Essays in Development Economics and Applied Microeconomics

A DISSERTATION
SUBMITTED TO THE FACULTY OF THE
UNIVERSITY OF MINNESOTA
BY

ANA MARÍA CUESTA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

PAUL GLEWWE

DECEMBER 2017

Acknowledgements

I am deeply grateful to my adviser Paul Glewwe, he advised and supported me on the decisions I made during these years, and had infinite patience improving this dissertation. I profoundly admire him as an expert in his field and as a professor. Thanks for going above and beyond on this journey and setting an example of how to be an outstanding development economist. I am also very thankful to Deborah Levison, she made me understand development economics holistically, and provided my thoughtful comments and suggestions that enriched this dissertation. She also gave me her full support and guidance me during challenging times.

I want to thank the rest of my committee, Janna Johnson and Jason Kerwin, for their insightful comments and fruitful discussions.

My sincere thanks also go to the wonderful IPUMS-International team (especially Lara Cleveland) and Dr. Samuel Myers Jr. They gave me the opportunity to be part of their multidisciplinary team, guide me, and help me in many more dimensions as a graduate student.

To the friend I made during graduate school, this was a great experience thanks to you. Specially Yoon Sun Hur and Yadira Peralta.

Lucas, Andrés, and JuanCa, thanks for being my Minnesota family during these years.

Finally, I want to thank mi Jesse for keeping up with my mood and frustrations, and for his unconditional support while finishing the graduate program and this dissertation. This long journey was remarkable thanks to you.

¡Gracias totales!

Dedication

To Jesse, Hector Jaime, Myriam, Mauricio, and Claudia. Thanks for all your love, patience, and support throughout this adventure.

Contents

List of Tables

List of Figures

Chapter 1

Introduction

Human capital is gained throughout a person's life. Most of those human capital investments are made in childhood, because the returns to these investments take time to materialize. There are different activities, conditions, and policies that can either boost or reduce human capital investments. Schooling is a fundamental dimension of human capital formation, and the activities that children perform during their school years yield consequences throughout their adult lives. School-age children residing in poor households in developing countries spend their time not only attending school, studying, and doing homework, but also performing additional activities such as work. The time devoted to work activities might have effects on these children's learning (negative or positive), and will affect their human capital accumulation.

The first two essays of this dissertation (Chapters 2 and 3) study two aspects of children's acquisition of human capital in Ethiopia.

Chapter 2 begins by exploring the effects of child work on academic achievement in Ethiopia. The goal of this chapter is to measure the effects of different types of work on test scores for children aged 8, 12, and 15 years old. Child work should be treated as endogenous in the process of human capital formation, so in Chapter 2, I propose to instrument child work with a set of variables related to sibling composition and household and environmental shocks faced by the child's household. This analysis is performed using three rounds of data from the Young Lives study for Ethiopia.

The Young Lives data are publicly available and well documented. This study has followed two cohorts of children since 2002. Since 2006 (Round 2 of the study), time use data have been collected as part of the survey, including the time spent in a typical day performing different activities that can be classified as domestic work or market work. In addition, the Young Lives study includes very detailed data on child, household, and community characteristics. The results of Chapter 2 show that child work negatively affects vocabulary test scores and that it has no effect on mathematics test scores.

Chapter 3 analyzes the urban-rural test score gap in Ethiopia. Currently, more than 80 percent of the population of Ethiopia resides in rural areas, and there is very little rural to urban migration. This chapter is the first study that decomposes this educational gap for Ethiopia. The decomposition of the test score gap follows the Blinder-Oaxaca decomposition method. This method allows one to decompose the test score gap into an explained portion (differences in endowments) and an unexplained portion (differences in coefficients). The main contributors to the explained portion of the test score gap are identified (hours of child work, parental education and socioeconomic status of the household). The chapter also presents some policies that could be implemented to increase the human capital accumulation process of the vast majority of the Ethiopian population that lives in rural areas.

The last chapter of this dissertation is quite different from the first two, although it continues to examine social sector policies in developing countries. More specifically, it explores the impact of gaining access to health insurance on different types on investments in Mexico. The program studied in Chapter 4 is Seguro Popular, a large subsidized health insurance program that currently covers more than 55 million persons. The study focuses on the impact of this program on human capital investment decisions. The chapter develops a model of consumption under uncertainty that is used to interpret the empirical results. It distinguishes between household expenditures that are liquid investments, which are useful for insurance purposes, and other, less liquid investments. The main hypothesis of the paper is that, upon obtaining access to public health

insurance, households will adjust their investment decisions. This analysis was performed using data from Mexico's ENIGH household survey from 2008 to 2012 and suggests that there is a statistically significant increase in the allocation of savings to illiquid, high return investments, relative to liquid, low return investments for households that gained access to *Seguro Popular* compared to uninsured Mexican households.

Chapter 2

Child Work and Academic Achievement: Evidence from Young Lives in Ethiopia

2.1 Introduction

Returns on human capital investments can take time to realize, so most human capital investments are made in the first stages of life. Schooling is crucial for human capital formation, and it is a human capital investment which mainly happens during childhood. As children grow, additional activities, such as work, start to gain importance in children's time allocation decisions. Spending a considerable amount of time doing such activities that are not related to schooling might have effects on children's learning processes (both negative or positive), with potential effects on their human capital accumulation. This Chapter studies the effect of child work on academic achievement in the context of Ethiopia.

Child work has been in the national and international agenda as a social issue for centuries. Bourdillon et al. (2010, chapter 3) summarize the history of regulation in child labor. The first labor laws that attempted to protect child workers were created in Britain: Act for the Better Regulation of Chimney Sweeper and their Apprentices (1788), Factory Health and Moral Act (1802),[1] Cotton Mill and Factories Act (1819) and the Factory Act (1833). Regulations have been incorporated in many other countries since the nineteenth

[1] For children working in textile mills.

century. In addition, international organizations, such as the International Labor Organization (ILO), have played a role mainly on minimum age conventions starting with industrial employment in 1929, and continuing with the 1973 Minimum Age Convention 138 and the 1999 Worst Forms of Child Labour Convention 182.

Bourdillon et al. (2010), in a recent seminal book, explain the importance of understanding child work holistically. While the work that children do is often seen as detrimental to their welfare, it may or may not interfere with school and schoolwork; it could be complementary in some cases, or it could provide the means to afford schooling. Some work activities could provide a different set of skills that prepare children for the economic environment in which they live. Therefore, child work can affect children's learning in both positive and negative ways.

The relationship between child work and schooling outcomes has been broadly studied by economists.[2] But this research can be divided into two categories: one that analyses time in school (enrolment, attendance, dropouts) and another one that analyses learning (school attainment, test scores). Although these measures capture an important aspect of children's development, they are somewhat limited. Other disciplines analyze complementary dimensions of child development, such as the psychological, physical and social.

Research related to time in school provides evidence that children who perform working activities are less likely to attend school (Ray and Lancaster, 2003; Ravallion and Wodon, 2000). But social programs, such as the conditional cash transfers in developing countries, have aimed to keep children in school and increase enrollment rates. Saavedra and Garcia (2012), found that these programs were more effective for secondary than primary enrollment rates.

[2] Edmonds (2007) provides a comprehensive review of the child work literature.

On the other hand, studies analyzing the effects of child labor on school attainment have concluded that working children complete fewer years of schooling or have lower schooling for age (Ray, 2002; Psacharopoulos, 1997; Khanam and Ross, 2008). Some authors have explored the relationship between child labor and school performance in Africa (as measured by test scores[3]); they conclude that children engaged in market activities[4] perform worse in school (Akabayashi and Psacharopoulos, 1999; Heady, 2003), while studies of Latin America provide mixed evidence. On one hand, Gunnarsson, Orazem, and Sánchez (2006) show that child labor lowers test scores, yet other studies find little or no effect (Binder and Scrogin, 1999; Patrinos and Psacharopoulos, 1997).

Child work and school attendance are jointly determined outcomes of an individual's time allocation within the household: this implies that estimation of the effect of child work on schooling outcomes may suffer from simultaneity bias. Several studies have acknowledged this endogeneity problem, others have not addressed this issue. Endogeneity could make estimation of the impact of child work on academic achievement challenging; endogeneity could be a result of simultaneity bias or measurement error.

Simultaneity in the context of this paper can come from omitted variables (which will be absorbed by the error term) or from endogeneity, the latter of which can be illustrated with an example. On the one hand, a child that works in his/her parents' business could gain numeracy skills that might increase his/her math test scores. In contrast, the household might decide that a child who performs poorly at school should allocate more time to household farm work rather than studying or attending school because the expected future returns on the child's human capital are low. Instrumental

[3] From the economics perspective, in the context of developing countries, analyzing test scores could provide information on later human capital outcomes. Hanushek and Woessmann (2008) showed that cognitive skills explain better than school attainment the impact of schooling on individual earnings, the distribution of income, and economic growth.

[4] These activities include farm activities and paid work, but do not include domestic work.

variables estimation has been the most commonly used empirical method to overcome endogeneity in the form of simultaneity (Orazem and Gunnarsson, 2004). Edmonds (2007) concludes that when instrumental variables are not used, the effect of child work on the education outcome will be underestimated.

Another source of bias comes from measurement error. In the context of this paper, it can come from measurement error of the right-hand side variables. The key variable in this Chapter is reported hours performing different types of child work. The data used for the empirical results uses hours of child work reported by an adult in the household. This measure is available for all children included in the sample, and it is the most comparable variable measured in the dataset. For the oldest children in the household, self-reported data on hours of child work is available, thus, Appendix 1 reports an alternative model specification using the self-reported data as the dependent variables. This allows one to verify if the coefficients of interest behave differently when using a different respondent for the same question.

Very few studies have examined the relationship between child work and academic achievement in Ethiopia. The few that have used data from the 1990s. The few studies that do exist do not analyze the impact of child work on academic achievement in the context of a production function for learning, or how child work affects the quantity of schooling that children obtain. Instead they study the determinants of child work and its relationship with current school attendance. For example, Alvi and Dendir (2011) show that the oldest child in the household has a larger probability of simultaneously attending school and participating in market work; with a larger probability for boys residing in urban areas. They also show that domestic work is mainly performed by girls. Haile and Haile (2012) study the determinants of work participation and school attendance of rural children aged 7 to 15; they find that the educational attainment (measured as grade for age) of working children decreases when they work long hours. Cockburn and Dostie (2007) analyze the relationship between asset accumulation, child work, and schooling; they find that household composition and a household's asset

profile are crucial determinants of the demand for child labor and conclude that households might be encouraged to withdraw their children from school when participating in asset accumulation-based poverty alleviation policies, such as a program that promote ownership of farm tools or adoption of perennial crops. Only one study includes test scores in the analysis: Cockburn (2002) shows that work activities do not prevent children from attending school, but the correlation between test scores and multiple work activities and weekend work hours is negative.

These studies on child work and schooling in Ethiopia provide evidence of a negative correlation between hours of work and education outcomes, but none of them addressed endogeneity and thus they are unlikely to estimate the causal effect of child work on test scores. This Chapter contributes in three distinct ways to the existing literature on understanding the dynamics of the relationship between child work and learning in the Ethiopian context. First, it uses a more recent dataset. Second, it examines the causal effects of child work on academic achievement by considering the potential for reverse causality, which has rarely been addressed in previous studies. It also includes tests score data for children that are not enrolled in school. Finally, it differentiates the effects of performing two different types of work (domestic work and market work) on learning (as measured by test scores).

This Chapter uses the term child work instead of child labor. The term child labor is usually associated with types of work that are harmful for children. But in this Chapter, I consider a broader range of work activities: i) paid work outside the household; ii) unpaid labor force work for the household; iii) domestic chores; and iv) time spent caring for other household members. Human capital formation is measured through vocabulary and mathematics test scores, which capture literacy and numeracy skills, which is just one aspect of children's development.

2.2 Child Work and Education in Ethiopia

Ethiopia has ratified the United Nations convention on the Rights of the Child, has signed the ILO convention on required minimum working age (Minimum Age Convention, 1973, No. 138), and has prohibited employing persons under 14 years of age (Proclamation No 42/1993, Chapter II, Section 89, (2)), but child work is still widespread in the country and has been a topic of interest in the national policy agenda.

Since 1993, Ethiopia has been implementing a series of educational reforms in order to provide better access to education, which include: i) Proclamation 41, in 1993; ii) the Education and Training Policy and the Education Sector Strategy adopted in 1994; iii) the Teacher's Career Structure was established in 1995 (Unesco, 2006). The Constitution was amended in 1995 to state that education should be provided without religious, political and cultural considerations, and that the state has the obligation to allocate resources to provide educational services. Primary school enrollment rates have increase dramatically since these reforms were implemented, but access to higher levels of education, the quality of education, and gender and urban-rural education gaps are still a serious problem. This section describes in more detail the most recent trends for child work and some education indicators in Ethiopia.

2.2.1 Child Work

This Chapter uses two different measures of child work: market work (which combines paid work outside the household with unpaid labor force work for the household) and domestic work (which includes domestic chores and time spent caring for other household members).

The most comprehensive survey of child work in Ethiopia, the Child Labor Survey, was carried out by the Central Statistical Authority of Ethiopia (CSA) in 2001.[5]

[5] The 2001 is the only national child labor survey that has been carried out in Ethiopia. The survey was funded by the International Labor Organization and the Government of Ethiopia.

The survey showed that 85 percent of the country's children aged 5 to 17 performed market or domestic (housekeeping) activities during the reference week. Boys were more likely to participate in market activities, while domestic activities were mainly performed by girls (CSA, 2002).

The report showed that most children started working at a very early age: 39.1 percent of the children started at or by the time they had reached 5 years of age and another 43.3 percent started between the ages of 6 and 7 years old (CSA, 2002).[6] Children participating in market activities were mainly unpaid family workers engaged in agriculture, which in the context of Proclamation No. 42/1993 is legal. More than one third of children aged 5 to 17 participating in market activities worked for 40 or more hours per week. They spent, on average, 32.8 hours a week in productive activities. In addition, the report shows that 77 percent of the children who were engaged in domestic activities spent more than 3 hours per day on these tasks. Girls spent more hours working on domestic activities than boys.

Using the 2013 (Round 4) data from the Young Lives study,[7] it is clear that Ethiopian children are still actively engaged in both market and domestic work activities, Figures 2.1a-c show the average number of hours worked in a typical day (including children that reported zero hours on any of these activities), first for all children living in households that were surveyed by the Young Lives study and then separately for boys and girls. On average, children aged 5 years old worked at least one hour per day. The number of hours worked per day rapidly increases for children between 5 to 8 years old, and stabilizes at around 4 hours of work per day when children reached 10 years of age. Consistent with the data from the 2001 Child Labor Survey, Figures 2.1b and 2.1c show that girls spend most of their working time on domestic chores, while boys spend most of their time on market work. At the time of the ILO survey, Ethiopian schools functioned

[6] The survey asked whether the child started to work when he/she was "5 or less years", so it is not possible to know how many children started to work at exactly age 5.
[7] The Young Lives data will be described in detail in section 2.3.

in 4-hour shifts (morning and afternoon groups of students), but in 2005 the government implemented a reform to lengthen the school day to 6 hours.

2.2.2 Education

In 1994, Ethiopia adopted a new Education and Training Policy, which introduced free primary education.8 Ethiopia's commitment to expand access to education is reflected by the increase in public expenditure on education as a percent of GDP, which almost doubled in 10 years from 2.4 percent of the GDP in 1993 to 4.5 percent in 2013. During these decades, the school aged population almost doubled, while the economy was growing at a faster rate (real GDP tripled during the same period).

Public expenditure on education represented 10.8 percent of total government expenditures in 1993 and 27 percent in 2013. This expenditure focused on primary schooling (75.8 percent in 2010). Some of the most recent policies include: increasing the number of primary schools from 6,958 in 2000 to 32,048 in 2013 (as a result of the government's effort to provide all children a primary school option within walking distance from their homes), providing instruction in each student's mother tongue (23 languages), and increasing the minimum qualifications to become a primary school teacher (Unesco, 2015).

Ethiopia's primary school enrollment rate is currently high. In 2013, according to UNESCO (2015), the gross primary school enrollment rate was 101.3 percent and varied widely by region, ranging from 74.4 percent in Afar to 154.6 in Addis Ababa.[9]. The gross primary enrollment rate for boys was slightly higher than that for girls (104.8 percent vs.

[8] Compulsory schooling in Ethiopia lasts for 8 years (from 7 to 14 years old) and comprises two cycles of primary education: 1st cycle (grades 1 to 4) and 2nd cycle (grades 5 to 8).
[9] This paper uses data from five regions of the country, while the UNESCO report presents data for 11 regions. The gross primary enrollment rates from the regions included in this paper are: Addis Ababa (154.6 percent), Amhara (106.7 percent), SSNPR (102 percent), Oromia (91.2 percent), and Tigray (106.2 percent).

97.8 percent). Historically, the gross secondary enrollment rate has been much lower, but it also increased from 10.5 percent in 1995 to 39.3 percent in 2013.[10]

In addition to low enrollment rates in higher grades, there are still disparities in educational attainment between girls and boys. Although the difference in the primary completion rate by gender has decreased, in 2014 there was still a small gap: 53.3 percent for girls and 54.0 percent for boys.[11] This education gender gap is much larger for older generations: in 2015, the youth literacy rate (ages 15-24) was 67.8 percent for young women and 71.1 percent of young men, while for adults 25 years or older the literacy rate was approximately 26.4 percent for women and 33.3 percent for men.[12]

A final problem is that, despite the government's efforts to improve education outcomes, the quality of education remains one of the main challenges in Ethiopia; the pupil-teacher ratio is 64.3 for primary education, and the percentage of trained teachers in primary education is low (56.8 percent in 2012), which are likely due to the rapid expansion of coverage of the primary level. A further sign of a reduction in education quality is that the National Learning Assessment (NLA) test scores fell from 2000 to 2008, and more than half of the grade 12 students (secondary education seniors) did not attain basic competencies (Joshi, 2012). Therefore, for upcoming generations, school enrollment does not seem to be the biggest challenge, but given the recent trends, school quality remains a challenge that has serious consequences for learning.

[10] Secondary education is composed of two cycles: general secondary education (grades 9-10) and preparatory classes (grades 11-12). At the end of grade 10, students take the Ethiopian General Secondary Education Certificate Examination in order to select students to continue on to the preparatory classes or to technical and vocational education (UNESCO, 2015).

[11] http://data.worldbank.org/data-catalog/world-development-indicators

[12] http://www.uis.unesco.org/das/Country/Literacy?code=ETH&regioncode=null&SPSlanguage=EN Retrieved in January 8, 2016.

2.3 Theoretical Framework and Empirical Strategy

This section presents the theoretical framework followed by this Chapter, which serves as a reference to the empirical strategy used to estimate the impact of child work on academic achievement.

2.3.1 Theoretical Framework

Academic achievement is assumed to be the result of a human capital production function, so it reflects how much a child learns and not only attendance or enrollment. I follow a model developed by Orazem and Gunnarson (2004) that shows the relationship between a child's time allocation and education outcomes.

Some children transition from school to the labor market only after they become adults, but most children go through a transition period during which they devote time to both school and work (performing different chores as children or teenagers). Orazem and Gunnarsson (2004) modelled a child's time allocation decision using a three-period model. The key assumptions of the model are: i) returns to years of schooling are positive, but are a decreasing function of the number of years of schooling; and ii) households decide how to allocate their child's time between labor (L) and school attendance (A) to maximize the present value of the child's lifetime earnings. The first assumption seems reasonable for the case of Ethiopia, in fact, Montenegro and Patrinos (2014) showed that Ethiopia is one of the countries with the highest returns to schooling in the world, especially for women. The second assumption need to be considered with caution; it assumes that households are altruistic and that even if the future is unknown for them, they are considering it when making time allocation decisions. Chuta (2017), in a recent study of young married women in Ethiopia, shows that the intra-household dynamics varied by area of residence (urban-rural) and by whether these women were living in their parents' house or with their husband. Urban women have more bargaining power in relation to education, work and education decisions when living with their parents; in the case of rural women, parents are the main decision makers, and sometimes

they do not consider the women's best interests when making decisions regarding education or work. Rural women also have less bargaining power than urban women when married; decisions regarding education and work are mainly made by their husbands. Taking into account Chuta's (2017) findings, it is likely that Orazem and Gunnarson's second assumption does not hold, especially for girls. In the case of Ethiopia parents might not maximize the present value of their child's lifetime earnings; parents might give a larger weight to the present and not maximize the lifetime earnings of each member of the household, but the overall household present welfare.

Orazem and Gunnarson's model includes two additional assumptions: households do not face any constraints to borrowing against future returns of schooling, and leisure time is ignored. Since 1994, public education is tuition fee-free in Ethiopia. [13] Recent data from the Living Standards Measurement Study (LSMS) household survey shows that more than 50 percent of the households spend less than 100 Birr on annual primary school expenses (CSA and World Bank, 2017).[14] Except for Addis Ababa, more than 90 percent on households spend less than 500 Birr on primary school expenses per year. In the case of secondary school education, school expenses are higher; the LSMS data show that more than 90 percent of the households spent more than 150 Birr on secondary school expenses per enrolled child in the academic year preceding the survey. Therefore, although returns for school are high in the country, households may face borrowing constraints to make investments in secondary and tertiary education, as fees increase for higher levels of education.

In the model, the time constraint for each period is given by: $A + L = 1$. During childhood (period 1), the child spends all his or her time in school: $A = 1$. Period 2 is the

[13] A consequence of the educational reform in Ethiopia in the 1990s, Proclamation No. 41 of 1993 and the Education Training Policy of 1994, is that education from grades 1 to 10 would be fee-free (Chicoine, 2016).
[14] One hundred Birr represent about 1 percent of Ethiopia's per capita income.

transition period in which the child divides her time between attending school and working: $0 < A < 1$. Finally, in period 3, adulthood, the child works full time: $A = 0$.[15]

The model is solved by considering the wage that the child can claim in periods 2 and 3, as a function of the total marketable skills accumulated (H), and the interest rate *r*. If the present value of the wage differential attributable to schooling exceeds the marginal cost of the child's time in school, the child will attend school. In this model, human capital accumulation (*H*) depends on years spent attending school, following the work of Mincer. Recent research has shown that cognitive skills explain better than school attainment the impact of schooling on individual earnings (Hanushek and Woessmann, 2008), especially in the context of a developing country. Thus, the human capital production function should include a measure of academic achievement, instead of a measure of school attendance. The structural relationship between child work and human capital is defined by the following production function:

$$H_{ij} = H(L_{ij}, X_{ij}, Z_j, H_{0ij}) \qquad (2.1)$$

where H_{ij} stands for a measure of academic achievement of child i in household j, child work (defined below) is captured by L_{ij}; X_{ij} is the child's characteristics, Z_j includes attributes of the parents and household, and H_{oij} is the past accumulation of human capital. The goal of this Chapter is to estimate the effect of child work (L_{ij}) on different measures of academic achievement.

This paper extends the framework presented in this section by making a clear distinction between the effect on school achievement of two types of child work: domestic work and market work. Thus, child work (*L*) is determined by the time spent on domestic activities and market work: $L = Dom + Mkt$.

[15] As mentioned in section 2.2.1, most children start working at young ages, even before going to school. Almost 40 percent of children started to work before they were 5 years old. Therefore, for the case of Ethiopia, period 1 of the model might not exist, the time constraint should start with period 2.

2.3.2 Effects of Child Work on Test Scores

Equation (2.2) shows a linear specification of equation (2.1). In this specification, the dependent variable is a test score

$$H_i = \alpha_0 + \beta_1 Mkt_i + \beta_2 Dom_i + \sum_{k=1}^{n} \rho_k X_{ki} + \sum_{l=1}^{n} \gamma_l Z_{li} + \theta H_{0i} + \tau_C + \varepsilon_i \qquad (2.2)$$

Test scores are a function of the daily hours allocated to market (*Mkt*) and domestic (*Dom*) work on a "typical" day,[16] a vector of child characteristics *X* (gender and age in months), a vector of parent/caregiver and household characteristics *Z* (whether a parent is the primary caregiver, educational attainment, absence of one or both parents, household size and composition, wealth quintile, and geographic location), and the child's past accumulation of human capital (H_{0i}). The variable τ_C allows for community-specific fixed effects and ε_I is an error term. Community-specific fixed effects represent the unobserved differences among communities that influence education, such as school and teacher quality. Equation (2) includes all the variables of the production function, thus the error term represents measurement error of the dependent or control variables, or omitted variables in the production function.

The coefficients of interest are β_1 and β_2, which capture the effects of an increase in the number of hours devoted to market or domestic work on academic performance. The sign of the coefficients is uncertain, when taking into consideration the existing literature. But one might expect that, given the differences in the type of activities performed by boys and girls and the time allocated to each of them, the coefficients for each type of child work will be different between boys and girls and those coefficients could also vary with age. Therefore, equation (2) will be estimated separately for boys and girls.

[16] The Young Lives data defines a typical day as follows: "***Typical day:*** *typical means 'usual', so it does not include something the child does irregularly, for example during festivals. Therefore, a typical day is a day from Monday to Friday, excluding holidays, festivals, days of rest during the weekend, etc*." Extract taken from the Fieldworker Manual, Ethiopia, Round 4, pg. 34.

2.3.3 Effects of Child Work on School Performance using 2SLS

The household's decision on the allocation of a child's time to different types of work could be influenced by the parents' observation of the child's performance in school. For example, a child performing poorly in school might have his/her hours of house work or work on the family business increased because of the parents' perception that the skills gained by performing these types of activities might yield higher returns in the future than those that come from schooling. Therefore, there is potential for reverse causality in the estimation of child work on schooling outcomes, which implies that OLS estimates of equation (2.2) may yield biased estimates. Endogeneity has been widely recognized in the child work literature, but not necessarily incorporated in the empirical analysis, mainly because of lack of valid instruments in most data sets. Previous analyses of the relationship between child work and schooling outcomes have used instrumental variables estimation to overcome endogeneity. Orazem and Gunnarsson (2004) provided examples of instruments that have been traditionally used: child wages and legal variation.[17] Additionally, they pointed out that when correcting for endogeneity of child work using instrumental variables, the estimated impact of child work on test scores usually might become more negative. Gunnarsson (2003) found larger child labor effects on test scores for 3rd and 4th graders in 10 countries of Latin America, Bezerra et al (2009) estimates on test scores for secondary school Brazilian children are larger after controlling for endogeneity, and Beegle et al. (2008) found larger effects of hours of work on schooling years after instrumenting child labor for children in a longitudinal data set in Tanzania.

Finding a valid instrument is the main challenge for an instrumental variables approach. As discussed above, daily hours allocated to market and domestic work are endogenous variables in equation (2.2), the equation for academic achievement. Thus, the time allocation decision is modeled using a first stage equation. The first stage has the

[17] Legal variation includes differences in school starting age, preschool programs in the country, as well as the capacity to enforce laws on child labor in the country. (Orazem and Gunnarsson, 2004, pp. 19)

same equation for both market and domestic work. I propose to instrument the time allocation decisions for the child with a set of variables included in a vector of sibling composition variables ($SiblingComp$), a vector of household shocks ($HhldShocks$), and a vector of environmental shocks ($EnvSchocks$). These instruments will be discussed in detail in subsection 2.4.2.

$$HrsWk_{icr}{}^{S} = \alpha_0 + \sum_{l=1}^{n} \varepsilon_l SiblingComp_{licr} + \sum_{l=1}^{n} \varphi_l HhldShocks_{licr}$$

$$+ \sum_{l=1}^{n} \mu_l EnvShocks_{licr} + \sum_{l=1}^{n} \rho_1 X_{licr} \sum_{l=1}^{n} \gamma_l Z_{li} + \tau_c + \varepsilon_{icr}, s \in \{Market, Domestic\} \quad (2.3)$$

The dependent variable, $HrsWk_{icr}$, indicates the daily hours allocated on a typical day to market or domestic (separately) work by child *i*, who resides in community *c*, in round *r*. The variables included in the set of sibling composition instruments are proportions of older sisters, older brothers, younger sisters, and younger brothers, relative to the total number of siblings. It is expected that the way these instruments affect domestic and market work will differ by the child's age and gender. Emerson and Souza (2002) show that, in Brazil, earlier-born boys and girls with younger siblings are more likely to work in the labor market (and family farm). This might be explained by the fact that when families cannot afford to send their oldest son/daughter to school, those children start to work. So, when families have more resources, they could start sending their youngest children to school. Edmonds (2006) shows that in Nepal, having a larger number of older sisters decreases the probability of domestic work for younger boys and girls. Other authors have shown that girls spend more hours on domestic work when there is a larger number of younger siblings (Edmonds, 2006; Parish and Willis, 1993).

The first set of shocks includes household shocks that could affect the household labor supply such as illness or death of a household member, or a new member of the household. These shocks could affect the time allocation of the children in different ways. On one hand, if a household member gets ill, the number of hours of domestic

work of other household members might increase (hours spent taking care of other household members).[18] Moreover, the effect could vary by gender and age of the child; girls are most likely to take over activities that are traditionally performed by women (cooking, cleaning), while boys are most likely to take over family farms or businesses. The second set of shocks include the following environmental shocks faced by the household in the past 4 years: drought, flood, frost, and death of livestock. The relationship between these types of shocks and child work relies on the fact that one of the dimensions of child work is that it can serve as a self-insurance strategy of the household. Kochar (1999) and Jacoby and Skoufias (1997) find that hours of market work increase when households in India face crop shocks. When households face these types of shocks, and they are credit constrained, it is difficult to borrow to mitigate the effect of the shock, but households can reallocate the time of their children to maintain the production levels in the farm or business affected by the shock.

Similar to equation (2.2), the first stage regression includes a vector of child characteristics X and a vector of parent and household characteristics Z, but the coefficients are different to those in equation (2.2).

The relevance assumption of the instruments is tested in section 2.5 by analyzing the first stage of the two-stage least squares (2SLS) specification. F-statistics of the first stage serve as a test for weak instruments, and the Hansen J-statistic is reported as an overidentification test of the exclusive restriction on the instruments.

[18] There is a direct effect that could happen if the person who dies or gets ill helps the child with his/her homework. Data on who helps the Young Lives child with homework is available for Round 4; it shows that children mainly rely on their older siblings (36 percent) if they need help with homework; followed by nobody (34 percent), father (10 percent), other family members (8.5 percent) and mother (5.3 percent). Thus, any bias in the IV estimates due to this direct effect is likely to be minor.

2.4 Data

2.4.1 The Young Lives Study in Ethiopia

This Chapter uses data from the Young Lives study,[19] a research program at Oxford University that studies childhood poverty in four developing countries.[20] The Young Lives study has implemented surveys of 12,000 children, their households, and their communities over a span of eleven years. Currently, four rounds of the survey data are available for Ethiopia (2002, 2006, 2009, and 2012). In each round, two cohorts were surveyed: children born in 2000/01 (the "younger cohort") and children born in 1994/95 (the "older cohort"). There are approximately 3,000 observations per country for each round: about 2,000 for the younger cohort and about 1,000 for the older cohort.

Data on time use for the Young Lives children and other children aged 5 to 17 in the household have been collected since the second round of the survey, thus this Chapter uses data from Round 2 (2006), Round 3 (2009), and Round 4 (2013). More specifically, this analysis uses the time use data from Rounds 3 and 4 for the younger cohort and from Rounds 2 and 3 for the older cohort. These children were surveyed when they were 8 years old (younger cohort, Round 3), 12 years old (younger cohort, Round 4 and older cohort, Round 2), and 15 years old (older cohort, Round 3). In Round 4, children from the older cohort were around 18 years old, as this study focuses on child work, they are excluded from the analysis. See Table 2.1, which summarizes the survey rounds and children included in this analysis.

The Young Lives study surveys children residing in five (out of nine) regions of Ethiopia: Addis Ababa; Amhara; Oromia; Tigray; and the Southern Nations, Nationalities, and People's Region (SSNP). [21] This is shown in Figure 2.2. When

[19] http://www.younglives.org.uk/
[20] Young Lives has similar data for India (state of Andhra Pradesh), Peru, and Vietnam; therefore, the analysis could be replicated for these countries.
[21] Some of the children interviewed in Round 4 had migrated to other regions of the country, as shown in Table 2.1b, they represent less than 1 percent of the sample.

surveying children in these regions, Young Lives intentionally oversampled the poor population in order to build a "*comprehensive picture of what poverty means for children in Ethiopia today.*"[22]

The Young Lives questionnaire includes different sections to be answered by the children and adults in the household. The child-level section includes demographic and educational variables of the child and his/her parents, test scores, and information on different types of activities, such as school, market work, and domestic work. The household section, answered by the caregiver or one of the adults present in the household, includes variables on household composition, dwelling infrastructure, and expenditure on different items, such as education. Very importantly for the purposes of this paper, the Young Lives data also include time use data for all children aged 5 to 17 residing in the household (as reported by the caregiver or one of the adults in the household).

For the younger cohort's empirical analysis, 1,875 children were interviewed in Round 4. Of those 1,875 children, 396 did not complete the vocabulary test (Peabody Picture Vocabulary Test, or PPVT) and 185 additional children did not complete the Mathematics test in Round 3 or 4. In addition, 86 children were dropped from the sample because of missing data on the control variables. Thus, the total number of children included in the younger cohort analysis is 1,208.[23] There is potential selection bias, due to the fact that a large percentage of children whose first language is one of the language minorities did not complete the vocabulary test (see Table 2.2). For example, in Round 4, more than 97% of the children whose first language is Hadiyigna or Sidamigna did not complete the PPVT test.

[22] http://www.younglives-ethiopia.org/

[23] For Round 3, 165 children did not complete the PPVT test and 211 children did not complete the mathematics test. For Round 4, 274 children did not complete the PPVT test and 291 children did not complete the mathematics test. The results for the PPVT test score use the sub-sample of children who took the vocabulary test (1,527 for Round 3 and 1,346 for Round 4) and the results for the Mathematics test score use another sub-sample of children who took the corresponding test (1,489 for Round 3 and 1,328 for Round 4).

From the 1,000 children included at the beginning of the study for the older cohort, 29 children were not interviewed in Rounds 2 and 3. Of the remaining 971 children in Round 3, 51 children did not take the Mathematics Achievement Test in either round and 35 did not took the PPVT test in either round. Finally, 103 children were dropped from the sample because of missing data on the control variables. Thus, the total number of children included in the older cohort analysis is 782.[24] Tables 2.3a-d report the summary statistics for the final samples by survey round, cohort, and child work category (domestic and market work). Columns 1 and 2 report the means and standard deviations of the all variables included in the analysis. For the purposes of the descriptive analysis, additional columns are reported on Tables 2.3a-d to show differences in the variables of interest between the whole sample and children who worked more than three hours per day or per each type of work. The statistical analysis is not restricted to these children. Columns 3 and 4 show the means and standard deviations for children working more than three hours per day.[25] Summary statistics for children engaged in market work for at least three hours per day are reported in columns 5 and 6,[26] and columns 7 and 8 show the means and standard deviations of the variables for children working more than three hours on domestic activities.[27]

[24] For Round 2, 26 children did not complete the PPVT test and 31 children did not complete the mathematics test. For Round 3, 10 children did not complete the PPVT test and 35 children did not complete the mathematics test. The results for the PPVT test score use the sub-sample of children who took the vocabulary test (826 for Round 3) and the results for the mathematics test score use another sub-sample of children who took the mathematics test (810 for Round 3).

[25] Which represent 60.3 percent of children aged 8 years, 69.4 percent of children aged 12 years of the younger cohort, 75.1 percent of children aged 12 years of the older cohort, and 82.5 percent of children aged 15 years.

[26] Which represent 27.5 percent of children aged 8 years, 31.7 percent of children aged 12 years of the younger cohort, 27 percent of children aged 12 years of the older cohort, and 28.3 percent of children aged 15 years.

[27] Which represent 34.8 percent of children aged 8 years, 38.5 percent of children aged 12 years of the younger cohort, 49.1 percent of children aged 12 years of the older cohort, and 60.4 percent of children aged 15 years.

2.4.1.1 Schooling Outcomes

Test scores are the academic achievement measure used in this analysis. More specifically, the analysis focuses on two of the cognitive tests administered as part of the Young Lives survey: the Peabody Picture Vocabulary Test (PPVT) and the Mathematics Achievement Test. This section describes the raw test scores; however, test scores were standardized for the statistical analysis; therefore, the estimated impacts of child work on academic achievement from the statistical analysis are measured in terms of the standard deviations of the test score variable.

The PPVT is a vocabulary test which was administered in all rounds to children in both cohorts. The test consists of selecting a picture that best represents the meaning of a word presented orally by the examiner. For Rounds 2 and 3 it included 204 words and for each correct answer the child received one point (Cueto and Leon, 2012). For the younger cohort in Round 3, the average test score was 84.9; for the older cohort, in Round 2 the average score was 77 and for Round 3, the average score was 152. For Round 4, the PPVT test that was administered to the younger cohort included only 55 words, and the average score was 39.3. In Ethiopia, this test could be taken in fifteen different languages.

The format of the Mathematics Achievement Test for the younger cohort in Round 3 included 29 items, divided into two sections. The first section included nine questions on basic quantitative and number notions, while the second section of 20 questions measured the ability to perform basic mathematics operations with numbers (see Cueto and Leon, 2012, for further details) The average test score for this cohort in Round 3 round was 7.4. The format of the test was similar in Round 4 but included 28 items divided into a first section that was comprised of 19 items dealing with addition, subtraction, multiplication, division, and square roots; the second section included 9 items on mathematics problem solving. The average test score for the younger cohort in Round 4 was 10.8. Columns 3, 5 and 7 of Tables 2.3a and 2.3b show that children who

worked more than 3 hours per day had much lower average mathematics test scores, but recall that this cannot be interpreted as a causal impact.

The format of the Mathematics Achievement Test for the older cohort differed from Round 2 to Round 3. In Round 2, the test consisted of 10 items evaluating topics of number and number sense (Cueto, Leon, and Munoz, 2009). The average test score for this round was 5. In Round 3, the test consisted of 30 items divided into two sections. The first section was comprised of 20 items dealing with addition, subtraction, multiplication, division, and square roots; the second section included 10 items on mathematics problem solving. (Cueto and Leon, 2012). [28] The average test score was 5.9.

2.4.1.2 Child Work

This Chapter uses direct measures of child work, distinguishing between market and domestic work. As mentioned before, most of the previous studies analyzing the relationship between child work and test scores have used market labor as the child work measure. Assad, Levison, and Zibani (2010) showed that lower school attendance of girls in Egypt is associated with the intensity of domestic work; thus, incorporating domestic work into the analysis of school performance could unmask some aspects of child work that were not captured in most previous studies.

In the Young Lives study, data on child work are reported in hours of work on a "typical" day for four different categories of work: i) paid work outside the household; ii) unpaid labor force work for the household (work on family farm, cattle herding, shepherding or other family business); iii) domestic chores (fetching water, firewood, cleaning, cooking, washing or shopping); and iv) time spent caring for other household members (younger siblings, elderly or ill household members).

[28] The last 10 questions of the Mathematics Achievement Test for the older cohort in Round 3 were multiple choice.

For the purposes of this analysis, child work is measured by two variables: market work (paid work outside the household and unpaid labor force work for the household) and domestic work (domestic chores and time spent caring for other household members). In the case of market work, the two types of activities included in the measure could have completely different working conditions, Orkin (2012) provides a clear description of these conditions for the children in the Young Lives older cohort residing in rural sites. Paid work usually involved planting or harvesting, with the condition of finishing the day's work to be paid or to be able to leave to attend school. In contrast, work in the family business had a more flexible and the task could be divided in small periods of time. The percentage of children reporting hours of work of paid work was less than 4 percent in the sample, therefore the sample size was too small to perform a statistical analysis of the different types market work separately.

Hours of work on a "typical" day were reported separately by one adult present in the household and by the Young Lives child participant. The main results reported in this Chapter used hours of work reported by the adult in order to have a comparable measure for children of different ages (different cohorts and different rounds), but data reported by the child were used to account for potential measurement error, given that older children might have a better idea on how they spend their time.[29] The measure of paid work outside the household might be underestimated given that the reference period was a typical day. As discussed by Orkin (2012), children involved in paid work usually engage in the activity during the weekends or school holidays.

Tables 2.3a-d report the average hours spent working on a typical day, overall and conditional on doing more than 3 hours of work. For all children aged 8 years old (including children that did not work), 92 percent of worked at least 1 hour per day, on average, and they spent 3.6 hours per day working, distributed between market work (1.4

[29] Although the answers might differ, the self-reported data is highly correlated with the data reported by an adult in the household. For the older cohort, Round 2, the correlation coefficient for domestic work is 0.756 and for market work is 0.807; for the older cohort, Round 3, the correlation coefficient is 0.888 for domestic work and 0.928 for market work.

hours) and domestic work (2.2 hours). As children grow, more of them work, and they work for more hours. Children of the younger cohort in Round 4 (12 years) spent 3.8 hours per day working, keeping the average hours of domestic work constant, but increasing their market work time to 1.6 hours. For the older cohort, Round 2 (12 years), 97 percent of the children worked at least one hour per day, and they spent 4.1 hours per day working, on average, distributed between market work (1.4 hours) and domestic work (2.7 hours). The oldest sample in the database is comprised of the older cohort in Round 3, when children were 15 years old. Ninety-nine percent of them worked at least one hour per day and the average number of hours increased to 4.8, distributed between market work (1.6 hours) and domestic work (3.2 hours).

For the purposes of the descriptive analysis, Tables 2.3a-d also report the variables of interest for children who spent more than three hours a day performing market and domestic activities. The percentage of boys engaged in market work for three or more hours per day ranges from 75 percent to 81 percent. In contrast, girls' engagement in market work (for three or more hours per day) ranges from 19 percent to 25 percent. The descriptive statistics in the case of domestic work show that girls are more engaged in this activity than boys. Girls' participation ranges between 65 percent to 70 percent and boys' participation represents 30 percent to 35 percent. This reaffirms the fact that the activities performed by boys and girls differed; domestic work is mainly performed by girls and market work is performed by boys (Assad, Levison and Zibani, 2010; Levison and Moe, 1998; Levison, Moe and Knaul 2001).

2.4.1.3 Child and Household Characteristics

The Young Lives data include detailed information about the child and his/her household and community. The empirical analysis includes, as additional controls, characteristics of the child (sex, age in months, and highest grade attained), characteristics of the child's parents (whether the caregiver is a parent, highest level of

education attained by either of the parents,[30] and absence of the parents in the household), household composition (number of household members), household classification according to its wealth quintile, and geographic location.

Edmonds (2007) emphasized the importance of analyzing urban-rural differences; children in rural areas tend to work more often, and for longer hours. As shown in Tables 2.3a-d, 55 percent of the younger cohort children resided in rural areas, while 59 percent of children of the older cohort were in rural areas. In addition, the region in which the child resides was included in the analysis, using Addis Ababa as the reference category.

2.4.2 Instrumental Variables

In addition to the education and child work variables, as well as other controls, a set of instrumental variables will be used to address the endogeneity issues discussed in the empirical strategy section. These instruments were selected taking into account that they should not belong to the academic achievement equation (equation 2), and at the same time they must have explanatory power regarding the hours spent on domestic and/or market work, (equation 3). The instruments can be grouped in the following categories: sibling composition, household shocks, and environmental shocks.

The sibling composition instruments reflect the proportion of co-resident older/younger sisters/brothers relative to the total number of siblings present in the household. The survey does not include information about siblings living elsewhere. Although many demographers may argue that family structure is endogenous, in this case the instrument "sibling composition" takes into account two aspects, one is the number of

[30] For children without data on the highest level of education attained by the parents, the information on the educational attainment of the caregiver was used. As shown in Tables 2.1a-d, sixteen percent of the children aged 8 years old had one parent absent and one percent had both parents absent from the household. In the case of children aged 12 years, for the younger cohort 22 percent of the children had one parent absent and five percent had both parents absent; for the older cohort 14 percent of the children had one parent absent and two percent had both parents absent from the household. Finally, 19 percent of the children aged 15 years old had one parent absent and two percent had both parents absent from the household. Only in Round 2, did the Young Lives questionnaire ask about the parental education when the parent is not present in the household.

brothers and sisters, and also the birth order of the Young Lives child. The importance of these variables relies on the fact that hours of domestic and market work could be affected by sibling composition. For example, a boy who has a large proportion of older sisters might be less likely to perform domestic chores, while a girl with a large proportion of older brothers might be less likely to take care of cattle in the fields. Table 2.3a-d reports the average number of older sisters, younger sisters, older brothers, and younger brothers for the different rounds and cohorts. The data reported in Tables 2.3a-d show that, in general, there is a smaller number of older brothers residing in the household, this could be explained by the practice of *Qenja*. *Qenja* is a practice in which only boys aged 8 to 18 years are involved. Boys are sent to either relatives or non-relatives to work in agricultural labor for a period of time after the child's family and the foster family develop an oral or written agreement. Kassa and Abebe (2016) studied the practice of *Qenja* in northern Ethiopia (Amhara region) and concluded that this practice also contributes to develop farming skills that children use later in life and allows children to save to either attend school or to use savings as a start-up capital later on.

The set of instruments related to household shocks includes dichotomous variables representing shocks faced by the household in the past 4 years that could affect the overall household's labor supply: illnesses of the mother, the father, or other household members, death of a household member, and births/new household members.[31] As seen in the bottom of Tables 2.3a-d (instruments section), most of the household shocks are related household members that that do not help with the homework,[32] therefore the test scores are unlikely to be directly impacted by these shocks. But the absence or inability to perform activities that these household members traditionally perform, might result on the reassigning tasks at home, and depending on the age and gender this could affect girls and boys differently. Chuta (2017, pp20) provides an example of how a household chore might be reallocated for a Young Lives girl whose

[31] This last shock includes birth of a household member or other people currently living in the household that were not living in the household in the previous round.
[32] See footnote 18.

mother was severely ill and this resulted on her dropping school and beginning to work in a stone crushing factory. Another way this could affect the child's time allocation of work is if the child's father gets ill: older boys might take over his duties in the field, while girls might have to take care of the father at home. The data reported on the instruments section of Tables 2.3a-d suggest that the children interviewed in Round 3 were affected by relatively few household shocks. For the younger cohort, the proportions of children living in households facing household shocks increased from Round 3 to Round 4. In contrast, the proportion of children living in household facing illnesses of a household member decreased from Round 2 to Round 3 for the older cohort.

The last set of instruments is the one that includes dichotomous variables representing environmental shocks faced by the household in the past 4 years. The bottom of Tables 2.3a-d reports the proportion of children facing environmental shocks. Environmental shocks can have an effect on the child's labor supply because most of the households included in the survey depend on agriculture. These types of shocks do not affect test scores directly, for example, when a drought happens it does not immediately have an impact on academic achievement, but it is through the reallocation of hours of work that it might influence test scores. Chuta (2017, pp20) provides an example that could illustrate this for another Young Lives girl: after a drought struck her village, the girl had to drop out of school and started to work at a stone crushing factory, do weeding at a farm, and sell cactus fruit. For all ages and rounds, the most common environmental shock is drought (ranging from 15 to 37 percent), followed by death of livestock (ranging from 18 to 30 percent), and flood (ranging from 7 to 12 percent).

2.5 Results

The estimates of the impact of child work on academic achievement for the Young Lives children in Ethiopia are presented in Tables 2.4-2.7. Each table summarizes the OLS and instrumental variables (IV) specifications using community fixed effects. Tables "a"

summarize results for the standardized Vocabulary (PPVT) test scores and tables "b" for standardized Mathematics test scores. [33] Estimations using self-reported child work data are reported in Appendix 1.

The tables provide estimates for each age-group of children, both overall and disaggregated by gender. Some additional control variables are not reported in the tables: some parent's characteristics, number of household members, wealth quintile, and the community-specific fixed effects. The discussion will focus on the IV specifications; in most cases the direction of the OLS estimates is the same but, as expected, the IV coefficients are larger. When the direction of the OLS and IV estimator are different, this will be mentioned in the discussion.

2.5.1 Results for children aged 8 years- Younger Cohort

Tables 2.4a-b summarize the results for children in the younger cohort who were 8 years old at the time of the survey. In general, the results do not provide evidence of the direction of the effects and most of them are not significant.

The results of the first stage regressions estimating the determinants of domestic and market work are summarized in Table A.1 of Appendix 1. Sibling composition (a larger proportion of younger sisters or brothers) is the main determinant of domestic work for girls, while environmental shocks, such as drought and frost, are the instruments that explain market work for girls. In the case of boys, having a larger proportion of younger brothers living in a household and having faced flood are the main determinants of domestic work for boys, while sibling composition (a larger proportion of younger sisters or brothers) and environmental shocks such as drought and death of livestock are key determinants of market work for boys.

[33] Estimates for the average test score were also computed. The results do not differ from the main conclusion of this Chapter. The average test score measure does not provide insights of the type of skills that children were improving or worsening because of hours of child work, it was computed as part of the the statistical analysis in order to gain power to have more variance in the dependent variable.

The Hansen J-Statistics and the F-tests reported in the bottom of Tables 2.4a-b show that, in general, the instruments are not weak and that there is little evidence that they violate the overidentification restriction. The F-statistic for domestic and market work is greater than 10 in most cases, therefore the instruments are not weak. The F-statistic for domestic work for boys ranges between 6.32 and 10.86, in which case the instruments for domestic work are weaker than those for market work. In addition, the p-value for the Hansen (overidentification) test is greater than 0.10 in most cases, which provides evidence that the instruments are valid. For the PPVT estimations for all children, and the mathematics estimations for all children and boys, the results fail the overidentification test at the 5 percent level, although not at the 1 percent level (see p-values for the Hansen test).

Table 2.4a reports the effect of child work on the vocabulary (PPVT) test score. The evidence shows that domestic work has a negative effect on the PPVT test scores for all children (-0.151 standard deviations, significant at the 5 percent level), which appears to be driven by girls' results (-0.144 standard deviations, significant at the 10 percent level). In contrast, the effects of market work are mostly small and always insignificant when using IVs. As hours of domestic work include taking care of smaller children, this could lead to slower language development for the children (mainly girls) that perform this chore.

Table 2.4b summarizes the results for the case of the Mathematics test score. The results provide weak evidence of a negative effect of additional hours of market or domestic work on mathematics skills for boys (and thus for all children). This could reflect low numeracy levels for children in Ethiopia at a young age. Looking closely at the IV results, an additional hour of domestic work lowers girls' mathematics test scores by 0.128 standard deviations (significant at the 10 percent level), which is a relatively moderate effect.

In all the specifications, a higher initial level of human capital and a higher educational level of the child and the parents translate into an increase in the child test scores. Also, children residing in rural areas have a lower academic performance than children residing in urban areas, perhaps due to lower school quality.

2.5.2 Results for children aged 12 years – Younger Cohort

The analysis of the impact of domestic and market work for the younger cohort when they were 12 years old is summarized in Tables 2.5a-b.

Tables 2.5a-b include a series of statistics that test the validity of the instruments used in the analysis. In the case of boys, the results show evidence of valid and non-weak instruments. The p-value of the Hansen (overidentification) test is large (greater than 0.10), which mean that the instruments are valid. The F-statistic for market work is greater than 10 in all cases, therefore the instruments for this type of work are not weak; but the F-statistic for domestic work in ranges between 4.11 and 8.19, in which case the instruments for domestic work are weaker than those for market work. The results for girls fail the overidentification test at the 5 percent level, although not at the 1 percent level (see p-values for the Hansen test) for the vocabulary test score estimates. The F-statistic for market work is greater than 10, therefore the instruments for this type of work are not weak, but the F-statistic for domestic work ranges between 3.15 and 3.21, so that the instruments for domestic work are weak.

In addition, when analyzing the first stage for hours of domestic and market work, (Table A.2 of Appendix 1) the results suggest that some instruments work for both boys and girls, while others are gender-specific. The key determinants of domestic work are related to sibling composition, such as the proportion of younger sisters or brothers, while the key determinants of market work are those related to environmental shocks faced by the household in the past 4 years, such as death of livestock and drought.

When analyzing the effect on the scores for the two different tests (Tables 2.5a and 2.5b), the magnitude of the child work effect when using IVs becomes larger in most

of the cases, perhaps as a result of correcting for attenuation bias. Table 2.5a shows that additional hours of market work have a negative and significant effect on vocabulary test scores. The IV results show that the effect for girls is -0.193 standard deviations (significant at the 5 percent level) and for boys is -0.370 standard deviations (significant at the 1 percent level). The effect of domestic work on the PPVT test score has different signs when using OLS and IVs, is not significant at the 10 percent level in all cases, and relatively small. When analyzing the effects of child work on the mathematics test scores, most of the effects when using IVs are insignificant, except for additional hours of market work for boys, which have a negative effect of -0.145 standard deviations (significant at the 10 percent level).

The IV results show that the negative effect of market work is larger for boys than for girls for both the PPVT and the Math test scores, although the differences are not statistically significant. In all the specifications, a higher initial level of human capital and a higher educational level of the parents translates into an increase in the child test scores. Children residing in rural areas have a lower academic performance than children residing in urban areas, maybe due to lower school quality. [34]

2.5.3 Results for children aged 12 years – Older Cohort

Tables 2.6a-b summarize the results for children of the older cohort who were 12 years old at the time of the Round 2 survey in 2006.

Tables 2.6a-b include a series of statistics that test the validity of the instruments used in the analysis. The p-value of the Hansen (overidentification) test is large (greater than 0.10) in most cases, which means that the instruments are valid. The exception to

[34] Young Lives has school level data available for Round 4. When analyzing the differences between urban and rural schools, the data show that teachers of urban schools have more experience teaching (12.3 vs 7.4 years), more experience teaching in the grade they currently teach (6.8 vs. 3.7), and, on average have a higher level of education (47.4 percent): 46.5 percent of rural teachers hold a post-secondary diploma and 0.9 percent of the rural teachers hold a university degree, compared to 64.8 of urban teachers that have a high level of education: 51.6 percent hold a post-secondary diploma and 13.0 percent hold a university degree.

this general rule are the results for girls for the vocabulary test score estimates; they fail the overidentification test at the 5 percent level but not at the 1 percent level (see p-values for the Hansen test). The older cohort estimations present weaker IVs than the younger cohort one; a possible explanation is a smaller sample size (see F-statistic values).

Table A.3.a, in Appendix 1, shows the first stage regression results for domestic and market work. The results suggest that, for all children, a larger proportion of older brothers or sisters will decrease the amount of domestic work per child, but the father's illness increases the hours of domestic work performed by the children residing in a household that faced that shock. On the other hand, the determinants of market work are: a larger proportion of younger sisters and environmental shocks such as drought, flood, frost or death of livestock.

Similar to the findings for children of the younger cohort at the same age, the results provide weak evidence that market work has negative effects on vocabulary skills (PPVT), but provide no evidence of effects of child work on mathematics test scores.

As shown in Table 2.6a, the results for the effect of child work on vocabulary skills provide evidence of a negative and significant effect of additional hours of market work on PPVT scores. The coefficients are stable among specifications and the effects of market work are significant at the 10 percent level for girls and boys separately. An additional hour of market work has a larger effect on PPVT for girls than for boys (-0.373 vs. -0.241). Note that the results for girls have to be interpreted with caution considering that the instrumental variables fail the overidentification test. Table 2.6b shows that there are no significant effects of additional hours of domestic or market work on the average test score or mathematics skills; except for additional hours of domestic work for boys and girls combined, which have a positive and significant effect of 0.173 standard deviations (significant at the 10 percent level). The evidence suggests that additional hours of domestic and market work could lead to higher mathematics test scores, when

using the instrumental variables approach, but as mentioned before, the results are not significant at the 10 percent level.

The Young Lives study for the older cohort includes self-reported data on the number of hours allocated to different types of work, school, and leisure activities; thus, these additional data are used to test for measurement error. Table A.3.b summarizes results for the OLS estimations using self-reported data on domestic and market work. The results for PPVT scores confirm the negative relationship between both domestic and market work and vocabulary skills, but they are not significant.

2.5.4 Results for children aged 15 years – Older Cohort

The last group of children included in the analysis is the one that includes 15-year-old youth at the time of the survey; these are children that have already reached the age where school is not compulsory in Ethiopia.[35] Tables 2.7a-b summarize the findings for this sample. Although most of the effects are not significant at the 10 percent level, the results suggest that there is a negative effect of additional hours of domestic and market work on academic achievement.

Tables 2.7a-b report a series of statistics that test the validity of the instruments used in the analysis. The p-value of the Hansen (overidentification) test is large (greater than 0.10) in the different specifications, which means that the instruments are valid. The F-statistics show that the instruments are weak for boys, especially for the case of domestic work, but for girls, the instruments are not weak when using a threshold of 5 for the F-statistic.

The results of the first stage regressions estimating the determinants of domestic and market work are summarized in Table A.4.a of Appendix 1. The key determinants of

[35] Data on marital status was not directly included in this survey. But some additional questions show that most likely, children surveyed in Round 4 were not married. Two questions related to migration show that just one child moved in the last three months because of marriage, and one question in relation to reasons for not attending school show that just two children were not attending school because of marriage.

domestic work for girls are a larger proportion of younger sisters, having an ill mother, and death of livestock. Similarly, the determinants of market work for boys include death of livestock and drought.

The results show that the relationship between hours of domestic work and the PPVT test score is negative and relatively small. For the case of girls, the effect of market work is large and significant (at the 1 percent level), an additional hour of market work lowers the PPVT test score by 0.323 standard deviations (Table 2.7a). The effects of child work on mathematics test scores are negative and significant when using the OLS approach, but the IV results are non-significant and in some cases the direction of the effect differs between OLS and IV estimations. As in all the other analyzed samples, the magnitude of the effect is larger when using an IV approach.

The estimations were also performed using self-reported data on time use, summarized in Table A.4.b. The effects are similar than those found using the adult reported data and are mainly not significant.

2.6 Conclusion

The statistical analysis confirms Orazem and Gunnarsson's (2004) statement in relation to correcting for endogeneity of child work by using instrumental variables. The estimated impacts of the different types of child work are more negative when using the instrumental variables approach, as shown in Figure 2.3 for the case of vocabulary test scores coefficients. In my estimates, the OLS specifications underestimated the effect of child work on school performance.

In the context of the Young Lives households in Ethiopia, the instrumental variables results presented in section 2.5 suggest that the negative effects of child work are mainly concentrated in vocabulary skills and there is weak evidence of effects of child work on mathematics test scores. Both domestic and market work have negative

effects on the vocabulary test scores for children at all ages, and the effects are larger for children aged 12 and 15.

Domestic work has statistically significant negative effects on vocabulary skills for the youngest and oldest girls in the Young Lives sample: -0.144 standard deviations for an additional hour of domestic work (significant at the 5 percent level) for 8-year-old girls, and -0.323 standard deviations for an additional hour of market work (significant at the 10 percent level) for 15-year-old girls. Market work has a large effect for 12-year-old boys and girls in both cohorts, with effects ranging from -0.193 to -0.373 standard deviations.

The direction of the effect of child work on the mathematics test scores was not as clear and statistically significant when compared to the effects on vocabulary skills. An additional hour of domestic work results in declines of 0.128 standard deviations (significant at the 10 percent level) for 8-year-old girls, and -0.145 standard deviations (significant at the 10 percent level) for 12-year-old boys from the younger cohort. The only positive and statistically significant effect in the analysis was found when pooling 12-year-old boys and girls of the older cohort: a 0.173 standard deviation increase for an additional hour of market work (significant at the 10 percent level). In this analysis, I included 36 different estimations, where 15 of them are statistically significant at least at the 10 percent level, and the evidence strongly suggest that the effect of child labor is generally negative; therefore, this could be a random significant effect.

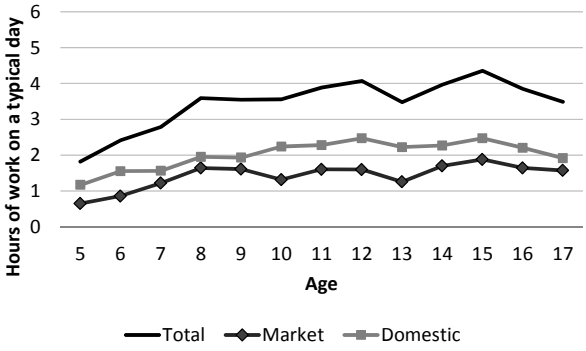
One possible explanation for the relative magnitudes of the effects when comparing 8-year-old children to older children could be related to school enrollment. In Ethiopia, children start working at young ages, but they start attending school relatively late at age 8. Children aged 12 years old attend school, but are also performing different types of working activities in the household, which compete with time in school and time for studying. This result is consistent with Cockburn's (2002) findings which showed that test scores appeared to be lower for children with multiple work activities.

The results are also in line with the conclusions from Akabayashi and Psacharopoulos (1999), Heady (2003) and Orazem and Gunnarsson (2006); children engaged in market activities perform worse in school. This Chapter presents new evidence that domestic work also has negative effects on learning, especially in vocabulary skills. The results also present evidence of the rural-urban gap on test scores, especially for children aged 8 to 12, which could reflect the differences in the quality of education.

Even if the results show that child work has negative effects in student academic achievement, test scores are just one dimension of the child's development. Suggesting policies prohibiting work for children in their school years could also be harmful for their future. On one hand, the activities that children perform outside of school can prepare them for the economic and cultural environment of their communities, and one the other hand, some children work in order to be able to attend school. A longer-term analysis of the effects of child work in the Ethiopian context is needed to propose policies that could enhance both student academic achievement and the acquisition of additional skills that will be useful in the future.

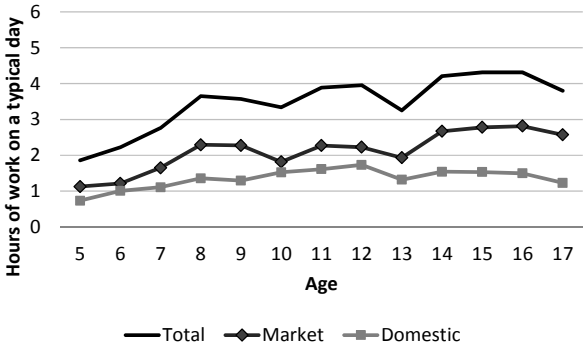
2.7 Figures

Figure 2.1a- All Children- Average number of hours worked in a typical day



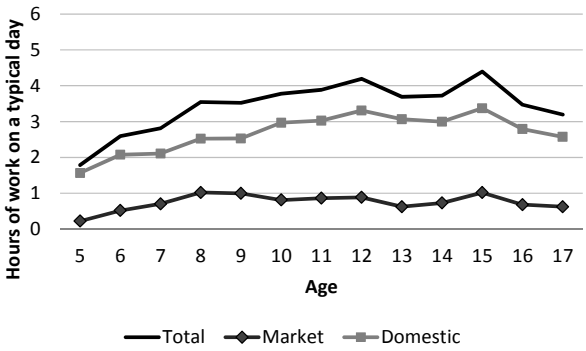
Source: Author's estimates using Young Lives, Round 4 (2013).

Figure 2.1b - Boys - Average number of hours worked in a typical day



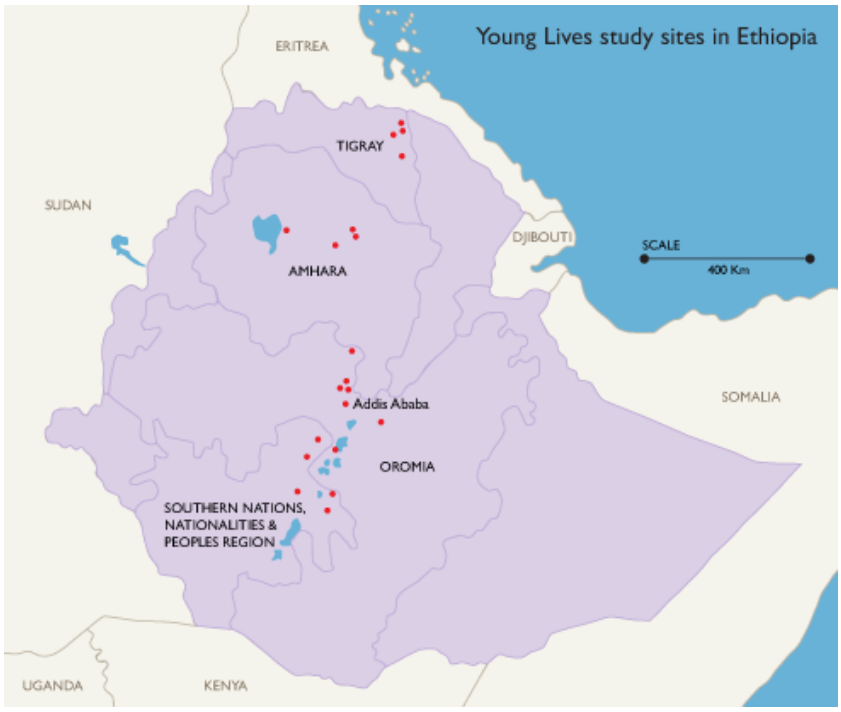
Source: Author's estimates using Young Lives, Round 4 (2013).

Figure 2.1c – Girls - Average number of hours worked in a typical day



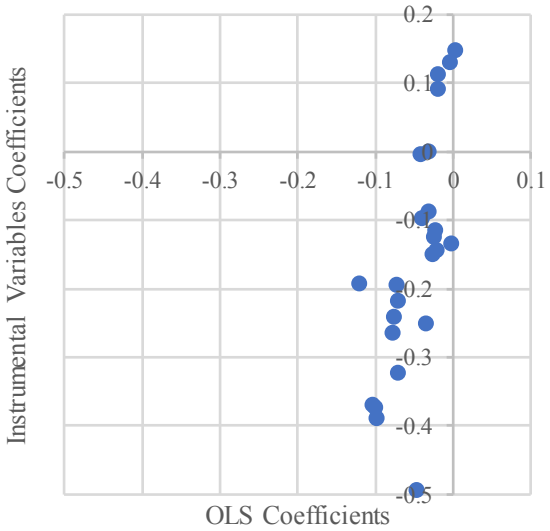
Source: Author's estimates using Young Lives, Round 4 (2013).

Figure 2.2 – Young Lives Study sites in Ethiopia



Source: Young Lives
Retrieved from: http://www.younglives.org.uk/where-we-work/ethiopia-1

Figure 2.3 OLS vs. IV child work coefficients for Vocabulary Test Scores



2.8 Tables

Table 2.1 – Young Lives Rounds and Cohorts

	Round 2 (2006)	Round 3 (2009)	Round 4 (2013)
Older Cohort			
Age	12	15	
Number of children in the survey	980	971	
Number of children in the PPVT analysis	782	826	
Number of children in the Math analysis	782	810	
Younger Cohort			
Age		8	12
Number of children in the survey		1,884	1,875
Number of children in the PPVT analysis		1,527	1,346
Number of children in the Math analysis		1,489	1,328

Table 2.2 – Child's First Language and PPVT Test Completion (Round 4)

	Number of children in the survey	Number of children NOT taking the PPVT test	Percentage of children that did not take the PPVT test
Afarigna	5		
Amarigna	804	4	0.5%
Guraghigna	93	2	2%
Hadiyigna	99	97	98%
Oromifa	302		
Sidamigna	94	91	97%
Siltigna	4		
Tigrigna	378	1	0.3%
Welayitegna	90	38	42%
Total	1869	233	12%

Table 2.3a – Round 3 (Children aged 8 years old) -Younger Cohort

	All		Work more than three hours per day		Market work more than three hours per day		Domestic work more than three hours per day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Schooling Outcomes								
Currently enrolled in school	0.87	0.34	0.83	0.37	0.80	0.40	0.81	0.40
PPVT Test score	84.87	45.39	70.35	37.84	61.67	31.24	74.90	40.29
Math Test score	7.37	5.39	5.73	4.65	4.90	4.03	6.05	4.97
Highest grade attained	2.31	1.21	2.12	1.26	2.05	1.30	2.05	1.29
Time in school (hours)*	2.25	3.34	0.78	2.08	0.27	1.19	1.02	2.41
Time studying at home (hours)*	0.30	0.58	0.10	0.40	0.02	0.15	0.15	0.49
Child Labor								
Works (total hours of work >= 1)	0.92	0.27	1.00	0.00	1.00	0.00	1.00	0.00
Total hours of work	3.61	2.47	5.19	1.85	5.97	1.88	5.19	1.97
Total hours of market work	1.40	2.10	2.30	2.29	4.44	1.54	0.96	1.62
Total hours of domestic work	2.21	1.80	2.89	1.95	1.53	1.40	4.23	1.38
Child's Characteristics								
Female	0.47	0.50	0.48	0.50	0.25	0.43	0.65	0.48
Male	0.53	0.50	0.52	0.50	0.75	0.43	0.35	0.48
Age in months	97.54	3.69	97.53	3.73	97.28	3.87	97.77	3.64
Parents' Characteristics								
Caregiver is one of the parents	0.93	0.25	0.95	0.22	0.97	0.18	0.94	0.23
Highest educational level of the parents (in years)	4.03	4.52	2.69	3.69	1.90	3.04	3.22	3.92
One parent absent	0.16	0.37	0.12	0.33	0.11	0.32	0.13	0.34
Both parents absent	0.01	0.10	0.01	0.10	0.01	0.08	0.01	0.08
Household Composition								
Number of household members	6.13	1.98	6.37	1.85	6.50	1.69	6.28	1.92
Wealth								
Household in the lowest urban quintile (reference)	0.08	0.27	0.04	0.20	0.01	0.11	0.06	0.24
Household in 2nd lowest urban quintile	0.08	0.27	0.04	0.21	0.01	0.09	0.07	0.26
Household in the top 3 urban quintile	0.29	0.45	0.12	0.32	0.03	0.16	0.18	0.38
Household in the lowest rural quintile (reference)	0.09	0.29	0.13	0.33	0.15	0.36	0.11	0.32
Household in 2nd lowest rural quintile	0.10	0.29	0.15	0.36	0.23	0.42	0.10	0.30
Household in the top 3 rural quintile	0.36	0.48	0.52	0.50	0.57	0.50	0.48	0.50
Geography								
Addis Ababa (reference)	0.18	0.38	0.03	0.17	0.00	0.00	0.05	0.23
Amhara	0.25	0.43	0.29	0.45	0.33	0.47	0.28	0.45
Oromia	0.22	0.42	0.27	0.44	0.21	0.41	0.30	0.46
Southern Nations, Nationalities, and Peoples' Region (SNNP)	0.11	0.31	0.09	0.29	0.04	0.19	0.15	0.35
Tigray	0.25	0.43	0.32	0.47	0.42	0.50	0.22	0.42
Rural	0.55	0.50	0.80	0.40	0.95	0.21	0.69	0.46
Instruments								
Sibling Composition								
Number of older sisters	1.07	1.20	1.19	1.24	1.31	1.27	1.10	1.17
Number of younger sisters	1.13	1.29	1.23	1.32	1.32	1.33	1.19	1.32
Number of older brothers	0.49	0.67	0.64	0.72	0.67	0.71	0.60	0.70
Number of younger brothers	0.50	0.67	0.66	0.72	0.67	0.69	0.70	0.73
Household Shocks								
Mom Ill past 4 years	0.21	0.41	0.22	0.42	0.26	0.44	0.22	0.42
Dad Ill past 4 years	0.13	0.34	0.16	0.36	0.19	0.40	0.14	0.35
Other Ill past 4 years	0.23	0.42	0.26	0.44	0.27	0.44	0.26	0.44
Death in the Household past 4 years	0.08	0.27	0.05	0.23	0.06	0.24	0.05	0.23
New Household Member past 4 years	0.15	0.36	0.20	0.40	0.25	0.43	0.19	0.39
Environmental Shocks								
Drought past 4 years	0.31	0.46	0.45	0.50	0.61	0.49	0.37	0.48
Flood past 4 years	0.11	0.32	0.17	0.38	0.20	0.40	0.17	0.38
Frost past 4 years	0.11	0.32	0.17	0.37	0.27	0.45	0.11	0.32
Death of Livestock past 4 years	0.30	0.46	0.41	0.49	0.51	0.50	0.34	0.47
Observations	1,208		729		332		420	

* For the time in school and time studying variables, 835 out of the 1,208 children reposponded these questions.

Table 2.3b – Round 4 (Children aged 12 years old) -Younger Cohort

	All		Work more than three hours per day		Market work more than three hours per day		Domestic work more than three hours per day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Schooling Outcomes								
Currently enrolled in school	0.97	0.16	0.96	0.19	0.94	0.24	0.97	0.18
PPVT Test score	39.34	8.15	37.04	8.08	34.67	7.70	38.27	8.17
Math Test score	10.84	5.94	9.47	5.47	8.53	4.81	9.95	5.70
Highest grade attained	4.82	1.67	4.56	1.75	4.34	1.95	4.60	1.70
Time in school (hours)	5.88	1.56	5.49	1.37	5.25	1.53	5.58	1.35
Time studying at home (hours)	1.58	0.92	1.46	0.88	1.32	0.88	1.53	0.85
Child Labor								
Works (total hours of work >= 1)	0.94	0.24	1.00	0.00	1.00	0.00	1.00	0.00
Total hours of work	3.76	2.17	4.87	1.59	5.63	1.68	4.78	1.60
Total hours of market work	1.55	2.05	2.20	2.15	4.15	1.52	0.89	1.50
Total hours of domestic work	2.21	1.61	2.67	1.66	1.48	1.21	3.89	1.02
Child's Characteristics								
Female	0.47	0.50	0.49	0.50	0.25	0.44	0.70	0.46
Male	0.53	0.50	0.51	0.50	0.75	0.44	0.30	0.46
Age in months	145.47	3.89	145.34	3.92	145.23	3.95	145.54	3.85
Parents' Characteristics								
Caregiver is one of the parents	0.93	0.25	0.95	0.21	0.97	0.18	0.94	0.23
Highest educational level of the parents (in years)	4.60	4.78	3.46	4.17	2.31	3.32	4.23	4.45
One parent absent	0.22	0.42	0.17	0.38	0.13	0.34	0.18	0.39
Both parents absent	0.05	0.22	0.04	0.19	0.03	0.16	0.04	0.20
Household Composition								
Number of household members	5.82	1.90	6.05	1.84	6.26	1.74	5.95	1.91
Wealth								
Household in the lowest urban quintile (reference)	0.08	0.28	0.07	0.25	0.03	0.16	0.10	0.30
Household in 2nd lowest urban quintile	0.09	0.29	0.05	0.23	0.03	0.16	0.08	0.26
Household in the top 3 urban quintile	0.29	0.45	0.17	0.37	0.06	0.24	0.22	0.42
Household in the lowest rural quintile (reference)	0.06	0.23	0.08	0.27	0.10	0.30	0.07	0.25
Household in 2nd lowest rural quintile	0.09	0.29	0.13	0.33	0.18	0.38	0.08	0.28
Household in the top 3 rural quintile	0.39	0.49	0.51	0.50	0.60	0.49	0.45	0.50
Geography								
Addis Ababa (reference)	0.18	0.38	0.04	0.19	0.00	0.00	0.07	0.25
Amhara	0.24	0.43	0.28	0.45	0.38	0.49	0.22	0.41
Oromia	0.23	0.42	0.28	0.45	0.20	0.40	0.32	0.47
Southern Nations, Nationalities, and Peoples' Region (SNNP)	0.11	0.31	0.11	0.31	0.03	0.16	0.17	0.38
Tigray	0.25	0.43	0.30	0.46	0.39	0.49	0.23	0.42
Other region	0.00	0.04	0.00	0.03	0.00	0.05	0.00	0.00
Rural	0.54	0.50	0.71	0.45	0.89	0.32	0.60	0.49
Instruments								
Sibling Composition								
Number of older sisters	1.08	1.20	1.18	1.24	1.34	1.28	1.04	1.18
Number of younger sisters	1.15	1.29	1.24	1.31	1.32	1.29	1.15	1.28
Number of older brothers	0.68	0.86	0.83	0.91	0.93	0.95	0.82	0.89
Number of younger brothers	0.70	0.85	0.82	0.89	0.85	0.86	0.83	0.91
Household Shocks								
Mom Ill past 4 years	0.10	0.31	0.10	0.29	0.08	0.28	0.11	0.31
Dad Ill past 4 years	0.07	0.26	0.07	0.26	0.07	0.26	0.08	0.27
Other Ill past 4 years	0.12	0.32	0.10	0.30	0.09	0.29	0.12	0.32
Death in the Household past 4 years	0.06	0.23	0.05	0.22	0.04	0.20	0.05	0.21
New Household Member past 4 years	0.03	0.16	0.03	0.16	0.03	0.16	0.04	0.19
Environmental Shocks								
Drought past 4 years	0.15	0.36	0.21	0.41	0.31	0.46	0.14	0.35
Flood past 4 years	0.07	0.26	0.10	0.30	0.13	0.33	0.08	0.27
Frost past 4 years	0.14	0.34	0.19	0.39	0.30	0.46	0.13	0.34
Death of Livestock past 4 years	0.18	0.39	0.24	0.43	0.31	0.46	0.20	0.40
Observations	1,208		838		383		465	

Table 2.3c – Round 2 (Children aged 12 years old) -Older Cohort

	All		Work more than three hours per day		Market work more than three hours per day		Domestic work more than three hours per day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Schooling Outcomes								
Currently enrolled in school	0.98	0.14	0.98	0.15	0.96	0.20	0.98	0.14
PPVT Test score	76.99	25.96	72.68	24.88	67.67	23.96	73.29	25.23
Math Test score	5.03	2.39	4.83	2.40	4.76	2.52	4.76	2.41
Time in school (hours)	5.64	1.54	5.42	1.47	5.21	1.60	5.41	1.45
Time studying at home (hours)	1.78	1.01	1.68	0.98	1.56	0.97	1.71	0.95
Child Labor								
Works (total hours of work >= 1)	0.97	0.17	1.00	0.00	1.00	0.00	1.00	0.00
Total hours of work	4.10	2.03	4.97	1.51	5.54	1.55	5.04	1.54
Total hours of market work	1.42	1.83	1.86	1.90	4.00	1.23	0.90	1.29
Total hours of domestic work	2.69	1.79	3.11	1.83	1.54	1.32	4.14	1.28
Child's Characteristics								
Female	0.50	0.50	0.52	0.50	0.22	0.42	0.69	0.46
Male	0.50	0.50	0.48	0.50	0.78	0.42	0.31	0.46
Age in months	145.19	3.73	145.28	3.77	145.15	3.76	145.33	3.81
Parents' Characteristics								
Caregiver is one of the parents	0.89	0.32	0.90	0.30	0.91	0.28	0.89	0.32
Highest educational level of the parents (in years)	3.43	4.16	2.94	3.85	1.99	2.97	3.28	3.99
One parent absent	0.14	0.35	0.12	0.33	0.10	0.31	0.13	0.34
Both parents absent	0.02	0.15	0.02	0.13	0.02	0.15	0.01	0.10
Household Composition								
Number of household members	6.59	2.04	6.73	2.00	7.03	1.86	6.51	2.03
Wealth								
Household in the lowest urban quintile (reference)	0.08	0.27	0.07	0.26	0.02	0.15	0.09	0.29
Household in 2nd lowest urban quintile	0.08	0.27	0.06	0.23	0.01	0.10	0.07	0.26
Household in the top 3 urban quintile	0.25	0.43	0.16	0.37	0.08	0.27	0.19	0.39
Household in the lowest rural quintile (reference)	0.11	0.31	0.13	0.34	0.13	0.33	0.13	0.33
Household in 2nd lowest rural quintile	0.12	0.32	0.14	0.35	0.14	0.35	0.14	0.35
Household in the top 3 rural quintile	0.36	0.48	0.43	0.50	0.62	0.49	0.37	0.48
Geography								
Addis Ababa (reference)	0.16	0.37	0.09	0.28	0.03	0.17	0.11	0.32
Amhara	0.18	0.38	0.21	0.41	0.21	0.41	0.22	0.41
Oromia	0.21	0.41	0.24	0.42	0.21	0.41	0.25	0.43
Southern Nations, Nationalities, and Peoples' Region (SNNP)	0.24	0.42	0.23	0.42	0.20	0.40	0.24	0.43
Tigray	0.21	0.41	0.24	0.43	0.34	0.48	0.18	0.38
Rural	0.59	0.49	0.71	0.45	0.89	0.31	0.64	0.48
Instruments								
Sibling Composition								
Number of older sisters	1.08	1.18	1.07	1.16	1.29	1.21	0.91	1.07
Number of younger sisters	0.81	0.93	0.90	0.97	0.96	1.00	0.85	0.89
Number of older brothers	1.10	1.18	1.09	1.18	1.20	1.18	1.04	1.16
Number of younger brothers	0.84	0.95	0.94	0.99	0.97	0.97	0.93	0.98
Household Shocks								
Mom Ill past 4 years	0.18	0.39	0.18	0.38	0.17	0.37	0.17	0.38
Dad Ill past 4 years	0.15	0.36	0.16	0.36	0.12	0.33	0.16	0.37
Other Ill past 4 years	0.19	0.39	0.19	0.39	0.15	0.35	0.20	0.40
Death in the Household past 4 years	0.13	0.33	0.13	0.34	0.12	0.33	0.15	0.36
New Household Member past 4 years	0.17	0.37	0.19	0.39	0.20	0.40	0.19	0.39
Environmental Shocks								
Drought past 4 years	0.30	0.46	0.36	0.48	0.47	0.50	0.32	0.47
Flood past 4 years	0.12	0.33	0.15	0.35	0.18	0.39	0.14	0.35
Frost past 4 years	0.07	0.26	0.09	0.28	0.13	0.33	0.06	0.24
Death of Livestock past 4 years	0.27	0.44	0.32	0.47	0.36	0.48	0.30	0.46
Observations	782		587		211		384	

Table 2.3d – Round 3 (Children aged 15 years old) -Older Cohort

	All		Work more than three hours per day		Market work more than three hours per day		Domestic work more than three hours per day	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Schooling Outcomes								
Currently enrolled in school	0.92	0.27	0.90	0.29	0.79	0.41	0.91	0.29
PPVT Test score	152.03	35.66	148.10	36.60	140.56	37.57	149.32	36.48
Math Test score	5.92	4.87	5.44	4.68	5.17	4.48	5.47	4.79
Time in school (hours)	5.69	2.08	5.40	2.05	4.51	2.46	5.49	2.02
Time studying at home (hours)	1.95	1.19	1.86	1.17	1.49	1.23	1.87	1.13
Child Labor								
Works (total hours of work >= 1)	0.99	0.12						
Total hours of work	4.76	2.47	5.44	2.15	6.76	2.55	5.43	2.17
Total hours of market work	1.61	2.34	1.92	2.45	4.79	1.98	1.03	1.91
Total hours of domestic work	3.15	1.95	3.52	1.93	1.96	1.63	4.40	1.40
Child's Characteristics								
Female	0.50	0.50	0.52	0.50	0.19	0.39	0.68	0.47
Male	0.50	0.50	0.48	0.50	0.81	0.39	0.32	0.47
Age in months	180.30	3.49	180.18	3.50	180.37	3.42	180.15	3.47
Parents' Characteristics								
Caregiver is one of the parents	0.90	0.31	0.91	0.29	0.93	0.25	0.90	0.30
Highest educational level of the parents (in years)	3.36	4.12	3.01	3.91	2.28	3.35	3.20	4.03
One parent absent	0.19	0.39	0.16	0.37	0.18	0.39	0.15	0.36
Both parents absent	0.02	0.13	0.01	0.11	0.01	0.12	0.01	0.12
Household Composition								
Number of household members	6.48	2.03	6.59	2.00	6.78	1.91	6.49	2.02
Wealth								
Household in the lowest urban quintile (reference)	0.08	0.28	0.06	0.24	0.04	0.19	0.07	0.26
Household in 2nd lowest urban quintile	0.08	0.27	0.07	0.25	0.04	0.19	0.07	0.26
Household in the top 3 urban quintile	0.24	0.43	0.19	0.39	0.10	0.30	0.21	0.41
Household in the lowest rural quintile (reference)	0.11	0.31	0.12	0.32	0.14	0.35	0.12	0.32
Household in 2nd lowest rural quintile	0.12	0.33	0.14	0.35	0.15	0.36	0.14	0.35
Household in the top 3 rural quintile	0.36	0.48	0.42	0.49	0.54	0.50	0.38	0.49
Geography								
Addis Ababa (reference)	0.16	0.37	0.07	0.26	0.03	0.16	0.08	0.28
Amhara	0.18	0.38	0.19	0.39	0.21	0.41	0.18	0.39
Oromia	0.21	0.41	0.24	0.43	0.28	0.45	0.23	0.42
Southern Nations, Nationalities, and Peoples' Region (SNNP)	0.24	0.43	0.27	0.44	0.19	0.39	0.29	0.46
Tigray	0.21	0.41	0.24	0.42	0.29	0.46	0.21	0.41
Rural	0.59	0.49	0.68	0.47	0.83	0.38	0.64	0.48
Instruments								
Sibling Composition								
Number of older sisters	1.19	1.21	1.22	1.18	1.30	1.23	1.18	1.15
Number of younger sisters	0.72	0.88	0.78	0.91	0.93	1.00	0.73	0.86
Number of older brothers	1.24	1.24	1.25	1.26	1.36	1.21	1.19	1.26
Number of younger brothers	0.71	0.85	0.78	0.87	0.89	0.96	0.75	0.84
Household Shocks								
Mom Ill past 4 years	0.22	0.41	0.23	0.42	0.22	0.41	0.24	0.43
Dad Ill past 4 years	0.15	0.36	0.17	0.37	0.14	0.35	0.17	0.38
Other Ill past 4 years	0.24	0.43	0.25	0.43	0.23	0.42	0.27	0.44
Death in the Household past 4 years	0.10	0.30	0.09	0.29	0.11	0.31	0.08	0.27
New Household Member past 4 years	0.08	0.27	0.09	0.28	0.09	0.29	0.09	0.29
Environmental Shocks								
Drought past 4 years	0.37	0.48	0.42	0.49	0.51	0.50	0.41	0.49
Flood past 4 years	0.12	0.33	0.14	0.35	0.19	0.39	0.13	0.34
Frost past 4 years	0.11	0.31	0.13	0.33	0.16	0.37	0.13	0.34
Death of Livestock past 4 years	0.29	0.46	0.34	0.48	0.39	0.49	0.33	0.47
Observations	782		645		221		472	

Table 2.4a – PPVT Test Score for children aged 8 years old (Round 3, younger cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.027*	-0.151**	-0.023	-0.144*	-0.026	-0.126
	(0.014)	*(0.069)*	*(0.014)*	*(0.074)*	*(0.021)*	*(0.095)*
Total hours of market work	-0.033**	-0.001	0.001	0.146	-0.043**	-0.005
	(0.011)	*(0.083)*	*(0.023)*	*(0.133)*	*(0.015)*	*(0.055)*
Cognitive Test Score Round 2	0.151***	0.151***	0.121***	0.149***	0.178***	0.217***
	-0.020	*-0.020*	*-0.028*	*-0.033*	*-0.023*	*-0.022*
Highest educational level of the parents	0.024**	0.023***	0.018	0.017	0.030***	0.029***
	(0.008)	*(0.007)*	*(0.011)*	*(0.011)*	*(0.007)*	*(0.008)*
Rural	-0.306	-0.340	-0.326	-0.598	-0.313	-0.405
	(0.340)	*(0.439)*	*(0.349)*	*(0.374)*	*(0.342)*	*(0.344)*
Constant	-4.718***	-4.982***	-4.379***	0.360*	-4.746***	0.273
	(0.691)	*(0.661)*	*(1.090)*	*(0.205)*	*(0.844)*	*(0.251)*
Observations	1,527	1,527	708	708	819	819
Hansen J-Stat		20.18		15.58		9.81
p-value		0.06		0.21		0.63
First Stage F-Stat - Domestic Work		19.91		19.18		6.32
First Stage F-Stat - Market Work		64.88		11.74		56.31
R-squared	0.469	0.417	0.44	0.303	0.512	0.448

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.4b – Mathematics Test Score for children aged 8 years old (Round 3, younger cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.031**	-0.057	-0.035***	-0.128*	-0.028	0.017
	(0.012)	*(0.054)*	*(0.012)*	*(0.065)*	*(0.024)*	*(0.109)*
Total hours of market work	-0.025	-0.006	-0.013	0.085	-0.027	-0.082
	(0.015)	*(0.071)*	*(0.027)*	*(0.115)*	*(0.017)*	*(0.085)*
Cognitive Test Score Round 2	0.094***	0.096***	0.105**	0.126**	0.074**	0.093***
	-0.025	*-0.025*	*-0.047*	*-0.049*	*-0.028*	*-0.029*
Highest educational level of the parents	0.026***	0.026***	0.033***	0.032***	0.018*	0.016
	(0.006)	*(0.006)*	*(0.009)*	*(0.009)*	*(0.010)*	*(0.010)*
Rural	-0.945***	-0.985***	-1.145***	-1.317***	-0.765***	-0.582*
	(0.208)	*(0.310)*	*(0.240)*	*(0.320)*	*(0.230)*	*(0.305)*
Constant	-1.561**	-1.608**	-1.467*	0.993***	-1.696**	0.639***
	(0.689)	*(0.650)*	*(0.832)*	*(0.170)*	*(0.795)*	*(0.175)*
Observations	1,489	1,489	690	690	799	799
Hansen J-Stat		19.72		10.66		21.97
p-value		0.07		0.56		0.04
First Stage F-Stat - Domestic Work		21.64		20.28		6.69
First Stage F-Stat - Market Work		124.10		19.46		58.19
R-squared	0.472	0.47	0.479	0.41	0.495	0.47

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.5a – PPVT Test Score for children aged 12 years old (Round 4, younger cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.020	0.090	-0.021	0.111	-0.005	0.130
	(0.023)	*(0.129)*	*(0.028)*	*(0.140)*	*(0.031)*	*(0.128)*
Total hours of market work	-0.100***	-0.390***	-0.121***	-0.193**	-0.104***	-0.370***
	(0.022)	*(0.083)*	*(0.026)*	*(0.091)*	*(0.025)*	*(0.105)*
CDA Score Round 2	0.142***	0.120***	0.107***	0.113***	0.175***	0.149***
	(0.0260)	*(0.0400)*	*(0.0310)*	*(0.0330)*	*(0.0350)*	*(0.0450)*
Highest educational level of the parents	0.021***	0.009**	0.024***	0.021***	0.020***	0.007
	(0.003)	*(0.005)*	*(0.006)*	*(0.007)*	*(0.005)*	*(0.009)*
Rural	-1.078***	-0.434*	-1.118***	-1.202***	-0.954**	0.013
	(0.307)	*(0.250)*	*(0.288)*	*(0.302)*	*(0.356)*	*(0.473)*
Constant	-1.155	-0.367	-0.492	0.156	-1.511	-1.537
	(0.950)	*(1.106)*	*(0.934)*	*(1.068)*	*(1.166)*	*(1.489)*
Observations	1,346	1,346	628	628	718	718
Hansen J-Stat		12.34		20.03		10.01
p-value		0.34		0.05		0.53
First Stage F-Stat - Domestic Work		5.05		3.15		8.19
First Stage F-Stat - Market Work		580.70		83.44		65.21
R-squared	0.556	0.239	0.574	0.512	0.56	0.301

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.5b – Mathematics Test Score for children aged 12 years old (Round 4, younger cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.037	0.057	-0.051*	-0.072	-0.007	0.007
	(0.022)	*(0.118)*	*(0.027)*	*(0.136)*	*(0.026)*	*(0.120)*
Total hours of market work	-0.056***	-0.09	-0.044*	-0.009	-0.071***	-0.145*
	(0.015)	*(0.082)*	*(0.024)*	*(0.116)*	*(0.022)*	*(0.086)*
CDA Score Round 2	0.115***	0.115***	0.104*	0.105**	0.127**	0.124***
	(0.0330)	*(0.0340)*	*(0.0540)*	*(0.0530)*	*(0.0470)*	*(0.0420)*
Highest educational level of the parents	0.036***	0.035***	0.038***	0.038***	0.034***	0.030***
	(0.006)	*(0.007)*	*(0.011)*	*(0.010)*	*(0.008)*	*(0.009)*
Rural	-0.721***	-0.652**	-0.774***	-0.798***	-0.644*	-0.444
	(0.214)	*(0.276)*	*(0.192)*	*(0.276)*	*(0.356)*	*(0.397)*
Constant	-1.065	-0.867	-0.587	-0.714	-1.541	-1.447
	(0.977)	*(1.068)*	*(1.633)*	*(1.616)*	*(1.374)*	*(1.336)*
Observations	1,328	1,328	622	622	706	706
Hansen J-Stat		6.61		16.74		13.70
p-value		0.83		0.12		0.25
First Stage F-Stat - Domestic Work		3.66		3.21		4.11
First Stage F-Stat - Market Work		98.25		46.85		52.69
R-squared	0.331	0.309	0.36	0.356	0.332	0.318

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.6a – PPVT Test Score for children aged 12 years old (Round 2, older cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.041**	-0.098	-0.024	-0.115	-0.073*	-0.196
	(0.020)	*(0.111)*	*(0.023)*	*(0.100)*	*(0.035)*	*(0.213)*
Total hours of market work	-0.079***	-0.265	-0.101***	-0.373*	-0.077**	-0.241*
	(0.025)	*(0.192)*	*(0.029)*	*(0.208)*	*(0.032)*	*(0.135)*
Highest educational level of the parents	0.023**	0.020*	0.017	0.01	0.027*	0.03
	(0.009)	*(0.010)*	*(0.014)*	*(0.014)*	*(0.014)*	*(0.021)*
Rural	-0.947***	-0.642	-1.228***	-0.833*	-0.685**	-0.295
	(0.230)	*(0.425)*	*(0.366)*	*(0.442)*	*(0.290)*	*(0.437)*
Constant	-3.091***	-3.466***	-1.486	-1.874	-4.406**	-4.584**
	(0.956)	*(1.065)*	*(1.535)*	*(1.773)*	*(1.709)*	*(1.830)*
Observations	782	781	391	391	391	390
Hansen J-Stat		11.47		24.28		10.80
p-value		0.49		0.02		0.55
First Stage F-Stat - Domestic Work		8.62		6.44		5.66
First Stage F-Stat - Market Work		9.47		4.75		6.64
R-squared	0.391	0.326	0.493	0.394	0.374	0.32

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.6b – Mathematics Test Score for children aged 12 years old (Round 2, older cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	0.003	0.173*	0.021	0.099	-0.024	0.121
	(0.024)	*(0.099)*	*(0.024)*	*(0.124)*	*(0.039)*	*(0.184)*
Total hours of market work	-0.019	0.071	0.02	0.28	-0.03	0.048
	(0.025)	*(0.159)*	*(0.040)*	*(0.233)*	*(0.025)*	*(0.151)*
Highest educational level of the parents	0.030***	0.029***	0.028**	0.035***	0.035**	0.028
	(0.008)	*(0.010)*	*(0.010)*	*(0.012)*	*(0.015)*	*(0.019)*
Rural	-0.776***	-1.108**	-0.982**	-1.341***	-0.470**	-0.716
	(0.262)	*(0.462)*	*(0.404)*	*(0.486)*	*(0.211)*	*(0.449)*
Constant	-1.518*	-1.449*	1.123	1.492	-3.808**	-3.980**
	(0.814)	*(0.771)*	*(1.782)*	*(1.802)*	*(1.508)*	*(1.625)*
Observations	782	781	391	391	391	390
Hansen J-Stat		11.56		10.58		11.09
p-value		0.48		0.57		0.52
First Stage F-Stat - Domestic Work		8.62		6.44		5.66
First Stage F-Stat - Market Work		9.47		4.75		6.64
R-squared	0.225	0.159	0.301	0.21	0.222	0.181

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.7a – PPVT Test Score for children aged 15 years old (Round 3, older cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.036**	-0.252	-0.072*	-0.218	-0.004	-0.134
	(0.016)	*(0.170)*	*(0.037)*	*(0.157)*	*(0.025)*	*(0.165)*
Total hours of market work	-0.048***	-0.494*	-0.072*	-0.323***	-0.032*	-0.088
	(0.014)	*(0.283)*	*(0.037)*	*(0.112)*	*(0.017)*	*(0.098)*
PPVT Test Score Round 2	0.234***	0.159*	0.218***	0.187**	0.233***	0.197***
	(0.045)	*(0.081)*	*(0.062)*	*(0.076)*	*(0.061)*	*(0.052)*
Highest educational levelof the parents	0.016**	0.007	0.012	0.003	0.015	0.015
	(0.007)	*(0.008)*	*(0.010)*	*(0.012)*	*(0.011)*	*(0.011)*
Rural	-0.859***	0.342	-0.795***	-0.153	-0.944***	-0.717***
	(0.162)	*(0.733)*	*(0.268)*	*(0.399)*	*(0.121)*	*(0.244)*
Constant	0.887	-2.692	4.321**	3.864**	-2.248	-3.333
	(1.194)	*(3.006)*	*(1.994)*	*(1.896)*	*(2.123)*	*(2.178)*
Observations	826	826	405	405	421	421
Hansen J-Stat		4.09		15.92		6.27
p-value		0.94		0.10		0.79
First Stage F-Stat - Domestic Work		6.45		8.12		3.90
First Stage F-Stat - Market Work		3.17		6.24		4.30
R-squared	0.431		0.449	0.273	0.472	0.435

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.7b – Mathematics Test Score for children aged 15 years old (Round 3, older cohort)

	All		Female		Male	
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Total hours of domestic work	-0.005	-0.164	-0.043*	-0.184	0.035	-0.023
	(0.017)	*(0.124)*	*(0.023)*	*(0.140)*	*(0.038)*	*(0.232)*
Total hours of market work	-0.036***	-0.254	-0.029*	0.054	-0.050**	-0.205
	(0.012)	*(0.283)*	*(0.014)*	*(0.153)*	*(0.023)*	*(0.170)*
Math Test Score Round 2	0.448***	0.394***	0.403***	0.400***	0.465***	0.432***
	(0.050)	*(0.073)*	*(0.044)*	*(0.058)*	*(0.065)*	*(0.076)*
Highest educational levelof the parents	0.008	0.002	0.008	0.005	0.007	0.003
	(0.008)	*(0.008)*	*(0.013)*	*(0.014)*	*(0.010)*	*(0.008)*
Rural	0.025	0.652	-0.205	-0.201	0.235	0.696
	(0.124)	*(0.718)*	*(0.195)*	*(0.483)*	*(0.261)*	*(0.615)*
Constant	-1.768	-3.153	-0.028	0.608	-3.929	-6.224*
	(1.547)	*(2.477)*	*(2.363)*	*(2.557)*	*(2.601)*	*(3.535)*
Observations	810	810	408	408	402	402
Hansen J-Stat		5.59		3.37		9.76
p-value		0.85		0.97		0.46
First Stage F-Stat - Domestic Work		5.90		6.04		2.48
First Stage F-Stat - Market Work		3.79		5.47		7.40
R-squared	0.412	0.229	0.457	0.364	0.416	0.332

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Chapter 3

Decomposing the Urban-Rural Schooling Gap in Ethiopia (2006-2013)

3.1 Introduction

In 1994 Ethiopia adopted a new constitution, and the following year the first multiparty elections were held. The new government was established after almost two decades of military government, two severe famines, and a civil war. When democracy was first established, the gross primary school enrollment was 25 percent and the adult literacy rate was 27 percent.[36] The new government took several steps toward providing better access to education: i) Proclamation 41, in 1993, defined the responsibilities of the central and regional governments, decentralizing the role of government in the provision of education services; ii) in 1994, the Education and Training Policy and the Education Sector Strategy were adopted; iii) in 1995, the Constitution stated that education should be provided without religious, political and cultural considerations, and that the state has the obligation to allocate resources to provide educational services; and iv) in 1995, the Teacher's Career Structure was established (Unesco, 2006). Twenty years later, in 2014, the gross primary school enrollment was above 100 percent and the adult literacy rate reached 49 percent.[37]

[36] Data from the World Development Indicators. http://data.worldbank.org/data-catalog/world-development-indicators
[37] Idem.

Since 1994, a new structure of the education system has been implemented. It changed the number of years of primary and secondary school education,[38] provided access to primary education in the student's mother tongue, and adopted a new structure of fiscal relations. The latter implied that each level of government would be responsible for providing different education services, for instance the *woredas*[39] are responsible of provision of primary education (World Bank, 2005). All these changes have resulted in an improvement in indicators of access to education.

Currently, more than 80 percent of the population resides in rural areas, and the country has a low level of rural-urban migration due to land tenure regulations. In addition, the average household size in rural areas in 5.2, while in urban areas it is 3.7. In rural areas, 46.4 percent of the population is between 0-14 years. In contrast, in urban areas that share is 29.4 (CSA and World Bank, 2017). Taking into account these factors, educational gaps between the urban and rural populations of the country should be analyzed, and the main contributors to those gaps should be identified in order to formulate policies that can benefit the vast majority of the population, particularly the rural population. This Chapter estimates the urban-rural schooling gap and decomposes it between the gap that can be explained by differences in endowments (explained portion) and differences due to the coefficients (unexplained portion).

The rest of this Chapter is organized as follows. Section 3.2 presents the urban-rural education differentials in Ethiopia. Section 3.3 provides a brief review of the literature. Section 3.4 describes the conceptual framework. In section 3.5, the data of used in the empirical analysis is described. Section 3.6 presents the main results of the empirical analysis, and section 3.7 concludes.

---

[38] From 1962 to 1994, the education system followed a 6-2-4 structure; with the implementation of the 1994 Education and Training Policy and Education Sector Strategy, the system was restructured to a 4-4-2-2 structure (two 4-year cycles of primary education and two 2-year cycles of secondary school education).

[39] Ethiopia is divided in nine regions; the regions are subdivided into 68 zones. A *woreda* is a smaller subdivision, followed by *kebele* which is the smallest geographical subdivision. There are 800 *woredas* and 15,000 *kebeles* (5,000 urban and 10,000 rural).
http://www.ethiopia.gov.et/regional-states

3.2 Urban-Rural Education Differentials in Ethiopia

Evidence on the urban-rural education gap in Ethiopia is scarce. Two reports that compiled different education indicators for 2000 and 2015 are summarized in Tables 3.1a-b (World Bank, 2005; CSA and World Bank, 2017). The data show that in 2000 there was a large education gap between rural and urban children. The first set of indicators included in Table 3.1a indicate the gross enrollment rate for rural and urban populations widens as the level of education increases. For instance, gross enrollment rates in grades 1-4 were 122.9 percent for urban areas and 65.3 percent for rural areas in 2000, while enrollment rates for secondary education were 76.3 percent in urban areas and 0.4 percent in rural areas. The low enrollment rates for secondary education in rural areas could reflect the lack of school facilities in rural areas. The Ministry of Education Annual Report (2015) reports that in 2013 the country had 32,048 primary schools (27,597 in rural areas) and 2,329 secondary schools (693 in rural areas).[40] Although the enrollment rates have increased, the secondary education enrollment rate is still low, and the urban-rural gap persists in 2015; as shown in Table 3.1b, enrollment in secondary school of children aged 7-18 for boys was only 2.7 percent in rural areas, compared to 22.5 percent in urban areas (large towns), and for girls they were 2.6 and 21.7, respectively. The Ministry of Education Annual Report (2015) reports that in 2013 out of the 1'969,576 students enrolled in secondary school, less than 20 percent were students enrolled in rural areas (368,918).[41]

In 2000, there was a significant difference in a set of student flow indicators reported in Table 3.1a. The percentage of the cohort ever enrolled in Grade 1 in rural areas was almost half of the one for urban areas (45.3 percent vs. 90 percent). Another indicator is related to distance to the nearest primary school: as the distance increases, enrollment decreases, but the differences between urban and rural areas are evident. For example, urban children living between 1-2 kms from the closest primary school have a

[40] The number of schools in the five regions included in the Young Lives survey were: had 29,291 primary schools (25,509 in rural areas) and 2,078 secondary schools (611 in rural areas).
[41] The gender disaggregation of the number of students enrolled in secondary school in 2013 is: 1,041,855 boys (196,262 in rural areas) and 927,721 girls (172,656 in rural areas). Tables 5.17.1 and 5.17.5.

school enrollment rate of 83.1 percent while the enrollment rate for children in rural areas living at the same distance to the closest primary school was 38.8 percent. Finally, the urban rural differences in enrollment are evident by the child's mother tongue group too.

Data for 2015 confirm that the urban-rural educational gap continues to persist. Table 3.1b shows that the youth and adult literacy rates have increased for the newer generations, but there are still large rural and urban differences. For example, 32.5 percent of children aged 7 to 18 years residing in rural areas are not enrolled in school, while this percentage drops to 19 in small towns and 16.4 in large towns.

Evidence on the urban-rural test score gap in Ethiopia is even more scarce. Using Young Lives data, Figures 3.1-3.8 show the distributions of language and mathematics test scores for children ranging from ages 8 to 15. Figures 3.1 and 3.2 show that both the distribution of the vocabulary (PPVT) and mathematics test scores of children residing in rural areas are skewed to the left (the same pattern is observed for the mathematics test score for children aged 12 years old and 15 years, as shown in Figures 3.4 and 3.8). Figure 3.1 shows that children residing in urban areas have a more uniform distribution of their test scores. For children aged 12 years old, vocabulary test scores distributions are shown in Figure 3.3 and 3.5, in both cases the distribution of test scores of children residing in rural areas seem to follow a normal distribution, while in the case of children residing in urban areas the distribution is skewed to the right. Section 3.5.2 describes the test score gap between urban and rural Ethiopian children.

3.3 Literature Review

School achievement disparities for children for different comparison groups have been studied in developed and developing countries. Most of these studies used the Blinder-Oaxaca decomposition (described in section 3.4). Ammermueller (2007) estimates the PISA test score gap between children in Germany and Finland. He finds that better performance of Finnish students is mainly explained by the differences in observable characteristics (which is often referred to as the explained portion). Additionally, he

concludes that the role of school types is ambiguous. Myers et al (2004) estimated the racial test score gap in Minnesota and concluded that school and student's characteristics do not explain most of the test score gap, therefore, the gap can be attributed to racial differences in coefficients (often referred to as the unexplained portion).

In developing countries, the educational attainment (measured by years of education) gender gap was studied in India by Kingdon (2002), who concluded that the main factors contributing to the gap were parental background, wealth, individual ability, age-at-marriage and quality of primary school attended. Twenty-five percent of the gender gap was explained by student, household and school characteristics, thus most of the gap is attributed to gender differences in coefficients. Nieto and Ramos (2014) decompose the PISA test score gaps by income groups[42] for 10 middle income and 2 high income countries. Their results suggest that the explained portion of the test score gap is around 50 percent. Within the explained portion of the gap, individual characteristics have lower explanatory power than school and teacher quality variables.

The educational gap between children residing in urban and rural areas has been studied in different developing countries. Hannum (1999) describes the trends in enrollment rates of the urban and rural populations of China between 1949 and 1990 and shows how the political context of the country was linked to the rural-urban education inequalities. The "Great Cultural Revolution" raised education levels in rural areas and narrowed the urban-rural educational differentials.[43] Note, however, that the reduction of the gap was not entirely driven by an increase of educational attainment in rural areas; it was also due to a decrease of educational attainment in urban areas. Lounkaew (2013) estimated the PISA test score urban-rural gap in Thailand. His estimations were calculated for different points on the achievement distributions, and he concluded that school characteristics explained a lower proportion of the gap (12-15 percent) for lower performing students than for higher performing students (61-69 percent of the gap). In

[42] They compared test scores for the top and bottom quartiles of the economic, social and cultural status index.
[43] Measured through number of schools, student enrollment and progression ratios.

addition, he found that the unexplained portion of the gap is higher for boys than for girls. Rural-urban decompositions estimated for test scores in Colombia and Zambia show that the explained portion of the gap is larger than the unexplained portion (Ramos et al., 2016; Burger, 2011). In the case of Colombia, Ramos et al. found that most of the differential is explained by family characteristics instead of school characteristics.

There are no studies decomposing the school achievement gap between urban and rural Ethiopian children. As discussed in section 3.1, with the vast majority of the population reside in rural areas, with some internal migration from rural to urban areas. Given that Ethiopia has one of the largest returns to education (as reported in Montenegro and Patrinos, 2014) it is important to investigate the main drivers of the urban-rural educational gap, to serve as a diagnosis for future education policies in the country. In addition, none of the studies referenced in this section have examined how the gap evolves over time for a specific cohort of children, which can be used to investigate whether urban-rural education disparities are narrowing or broadening in the country. Therefore, this Chapter contributes to the existing literature by estimating the school achievement gap between urban and rural children of Ethiopia for the first time, and it shows how this achievement gap changes over time for the same children.

3.4 Conceptual Framework

This section presents the empirical strategy used in this Chapter to decompose the urban-rural academic achievement gap in Ethiopia. As mentioned on Chapter 2, I follow Orazem and Gunnarson's (2004) model of the human capital production function. The structural relationship is given by the following production function:

$$H_{ij} = H(L_{ij}, X_{ij}, Z_j, H_{0ij}) \qquad (3.1)$$

where H_{ij} stands for a measure of academic achievement of child i in household j, child labor is captured by L_{ij}; X_{ij} is a vector with different child characteristics, Z_j includes attributes of the child's parents and household, and H_{0ij} is the past accumulation of

human capital. For this Chapter, the dependent variable H_{ij} is a test score. Equation (3.2) shows a linear specification of equation (3.1).

$$H_i = \alpha_0 + \beta_1 Mkt_i + \beta_2 Dom_i + \sum_{k=1}^{n} \rho_k X_{ki} + \sum_{l=1}^{n} \gamma_l Z_{li} + \theta H_{0i} + \tau_C + \varepsilon_i \qquad (3.2)$$

Test scores are a function of the daily hours allocated to market and domestic work ($Mrkt$ and Dom), a vector of child characteristics X (gender and age in months), a vector of parent and household characteristics Z (caregiver's educational attainment, absence of one or both parents and household composition), and past accumulation of human capital (H_{0i}). The variable τ_C allows for Region[44] fixed effects and ε_i is an error term. Region-specific fixed effects represent the unobserved differences among the different Regions of the country that influence education, such as school and teacher's quality. Equation (2) includes all the variables of the production function, thus the error term represents measurement error of the dependent or control variables. As discussed in Chapter 2, child work and school attendance are jointly determined outcomes of a child's time allocation within the household: this implies that estimation of the effect of child work could be endogenous. Building on the empirical strategy used in Chapter 2, the estimates presented in this Chapter will also use instrumental variables to correct for endogeneity.

The results presented in Chapter 2 showed a significant difference between urban and rural test scores for children. Therefore, the goal of this Chapter is to decompose the urban-rural academic achievement gap, and explore how much each factor contributes to the gap. The decomposition follows the Blinder-Oaxaca method which is explained in the following sub-section.

[44] Similar to Chapter 2, this Chapter includes five (out of nine) regions of Ethiopia: Addis Ababa; Amhara; Oromia; Tigray; and the Southern Nations, Nationalities, and People's Region (SSNP). These are the regions included in the Young Lives data, and the population of these regions represent approximately 90 percent of the country's population.

3.4.1 Blinder-Oaxaca Model

The Blinder-Oaxaca model has been widely used to analyze differences in labor market outcomes between two groups: male vs. female, white vs African Americans, etc. (Blinder, 1973; Darity and Mason, 1998; Ñopo, 2008; Oaxaca, 1973; Oaxaca and Ransom, 1994; O'Neill and O'Neill, 2006, Reimers, 1983). The method allows one to decompose group differences into an explained portion (differences in the magnitudes of the determinants) and an unexplained portion (differences in the effects of those determinants). For example, in the context of this Chapter, rural children could have a lower academic achievement not only because they spend more hours of their day working, but also because the effect of that time on academic achievement is larger.

In the context of the human capital production function described in equation (3.2), the differences between urban and rural outcomes can be expressed as follows:

$$H^U - H^R = \sum \beta_k^U x_k^U - \sum \beta_k^R x_k^R \qquad (3.3)$$

where H^U corresponds to the mean of the human capital outcome for children living in urban areas and H^R denotes the same outcome but for children residing in rural areas. In this case. the vectors of β parameters include intercepts and the vector of determinants x includes those groups of determinants included in equation (3.2): child work, child's characteristics, parent and household attributes, and past accumulation of human capital. Building on the model and empirical strategy followed in Chapter 2, the human capital production function is estimated using instrumental variables estimation to correct for endogeneity.[45]

To clearly show the different components of the Blinder-Oaxaca decomposition, equation (3.3) can be expressed as follows:

$$H^U - H^R = \sum \beta_k^U x_k^U - \sum \beta_k^U x_k^R - \sum \beta_k^R x_k^R + - \sum \beta_k^U x_k^R \qquad (3.4)$$

[45] For more detail on the model, see section 2.3 of Chapter 2. For a discussion of the instrumental variables see subsections 2.3.3 and 2.4.2 of Chapter 2.

$$H^U - H^R = \sum \beta_k^U \Delta x_k - \sum \Delta \beta_k x_k^R \qquad (3.5)$$

where

$$\Delta x_k = x_k^U - x_k^R \text{ and } \Delta \beta_k = \beta_k^U - \beta_k^R$$

Equation (3.5) corresponds to the gap in academic achievement, the first term on the right hand side of equation (3.5) corresponds to the portion of the gap is attributable to differences in the magnitudes of the determinants (x), the explained portion, and the second term on the right hand side of equation (3.5) corresponds to the portion of the gap that is attributable to differences in the parameters (β), the unexplained portion.[46]

In equation (3.5) the differences in the magnitudes of the determinants are weighted by the coefficients of the urban group, while the differences in coefficients are weighted by the x's of the rural group. Following O'Donnell et al. (2008, pp150), equation (3.5) is a special case of a more general decomposition:

$$H^U - H^R = \sum \beta_k^R \Delta x_k - \sum \Delta \beta_k x_k^R + \sum \Delta x \Delta \beta \qquad (3.6)$$

where

$$\sum \beta_k^R \Delta x_k = E$$

$$\sum \Delta \beta_k x_k^R = C$$

$$\sum \Delta x \Delta \beta = CE$$

Therefore, the gap could be decomposed into a gap in endowments (E), a gap in coefficients (C), and a gap that comes from the interaction between endowments and coefficients.

[46] There are some other ways to present this decomposition. This way to present it was chosen to emphasize the rural areas.

3.5 Data

3.5.1 The Young Lives Study in Ethiopia

This Chapter uses data from the Young Lives study,[47] a research program at Oxford University that studies childhood poverty. The Young Lives study follows 12,000 children since 2002 in four developing countries: Ethiopia, India (in the state of Andhra Pradesh), Perú, and Vietnam. Two cohorts have been followed in each country: a younger cohort (children born in 2000-01, approximately 2,000 children per country) and an older cohort (children born in 1994/95, approximately 1,000 children per country). Currently, four rounds of the survey data are available for Ethiopia (2002, 2006, 2009, and 2013). This Chapter uses data from both cohorts; data from Rounds 2 and 3 are used for the older cohort, and data from Rounds 3 and 4 is used for the younger cohort. These children were surveyed when they were 8 years old (younger cohort, Round 3), 12 years old (older cohort Round 2, and younger cohort, Round 4), and 15 years old (older cohort, Round 3).

By using different ages at different rounds off the survey, the analysis aims to understand the evolution of the urban-rural academic achievement gap. As mentioned in section 3.2, the urban-rural education gap becomes wider at higher levels of schooling, therefore it is expected that the test score gaps will be larger for older than for younger children.

The Young Lives study in Ethiopia surveyed children residing in five out of nine regions of the country, where more than 96 percent of the population lives: Amhara, Oromia, SNNP[48], and Tigray, plus the capital city Addis Ababa (see Figure 3.9). In each region, three to five *woredas* were selected for the sample. This selection process took into consideration having a balance of poor and less poor households and a balance of urban and rural areas. In addition, within the urban areas, there is a variety of urban site types: cities, intermediate cities and small urban areas. Twenty sentinel sites were

[47] http://www.younglives.org.uk/
[48] Southern Nations, Nationalities, and People's Region.

included in the sample. As the study focuses on poverty, the sentinel sites are in food deficit *woredas* and the households included in the study are poorer than the average Ethiopian household (Young Lives, 2014). Table 3.2 provides a detailed description of the different sentinel sites included in the Ethiopian Young Lives sample.

Tables 3.3a-d report the summary statistics for the final samples by survey round, cohort, and separately for children residing in urban and rural areas. Columns 1 and 2 report the means and standard deviations of the all variables included in the analysis. Columns 3 and 4 show the means and standard deviations for children residing in urban areas. Summary statistics for children residing in rural areas are reported in columns 5 and 6. As shown in Tables 3.3a-d, 61 percent of the younger cohort children resided in rural areas in 2009 (53 percent in 2013)[49], while 61 percent of children of the older cohort lived in rural areas when surveyed in 2006 (62 percent in 2009). These proportions do not reflect the reality of the country, where more than 80 percent of the population still resides in rural areas. The results have to be interpreted with caution, given that the Young Lives data oversamples the poor population, therefore the urban-rural gaps estimated in this Chapter are specific to the poor population of Ethiopia and are not representative of the country as a whole.

3.5.2 Schooling Outcomes

The data used for the empirical analysis of this chapter is the same as the data used for Chapter 2. The outcome of interest is academic achievement, which is measured by cognitive test scores: the Peabody Picture Vocabulary Test (PPVT) and the Mathematics Achievement Test. This section discusses the raw test scores, but the statistical analysis is performed using standardized test scores.

[49] The reduction in the percentage of children who lived in rural areas reflects a tendency for children who migrate to more urban areas. An analysis for the sample of 905 children that were surveyed in Rounds 3 and 4 of the younger cohort made by Gavonel (2017), shows that from the 298 children that reported moving to another location, 37 percent moved within the rural areas, 23 percent moved from rural to urban areas, 12 percent moved from urban to rural areas and the remaining 28 percent moved to within urban areas.

The PPVT is a vocabulary test which was administered in all rounds to children in both cohorts. The test consists of selecting a picture that best represents the meaning of a word presented orally by the examiner. For Rounds 2 and 3 it included 204 words and for each correct answer the child received one point (Cueto and Leon, 2012). As shown in Tables 3.3a-d, for the younger cohort in Round 3, the average test score was 79.7; for the older cohort, in Round 2 the average score was 75.5 and for Round 3, the average score was 149.9. For Round 4, the PPVT test that was administered to the younger cohort included only 55 words, and the average score was 39.3. For all Rounds and cohorts, the average test score for children residing in urban areas is higher than the average test scores of children living in rural areas. For example, the difference in test scores for children aged 8 years old is 44.75 points (107 urban vs. 62.25 rural). In Ethiopia, this test could be taken in fifteen different languages.

The format of the Mathematics Achievement Test for the younger cohort in Round 3 included 29 items, divided into two sections. The first section included nine questions on basic quantitative and number notions, while the second section used 20 questions to measure the ability to perform basic mathematics operations with numbers (see Cueto and Leon, 2012, for further details). The average test score for this cohort in Round 3 round was 6.5 (10.1 urban vs. 4.2 rural). The format of the test was similar in Round 4 but included 28 items divided into a first section that was comprised of 19 items dealing with addition, subtraction, multiplication, division, and square roots; the second section included 9 items on mathematics problem solving. The average test score for the younger cohort in Round 4 was 10.8. Columns 3 and 5 of Tables 3.3b show that children who lived in urban areas had higher average mathematics test scores (13.9 vs. 8.1).

For the older cohort, the format of the Mathematics Achievement Test differed from Round 2 to Round 3. In Round 2, the test consisted of 10 items evaluating topics of number and number sense (Cueto, Leon, and Munoz, 2009). The average test score for this round was 4.9 (5.7 urban vs. 4.4 rural). In Round 3, the test consisted of 30 items divided into two sections. The first section was comprised of 20 items dealing with addition, subtraction, multiplication, division, and square roots; the second section

included 10 items on mathematics problem solving. (Cueto and Leon, 2012).[50] The average test score was 5.9 (7.7 urban vs. 4.7 rural).

The test scores were standardized by round and cohort; therefore, the results of all estimations are presented in standard deviations.

3.5.3 Additional variables

The Young Lives data include detailed information about each child and his/her household and community. The empirical analysis includes a set of variables used as the determinants of the test scores. These variables are grouped into characteristics of the child (sex, age in months, and child work), characteristics of the parents (highest educational attainment of the parents[51] and absence of the parents from the household), household characteristics (number of household members, number of siblings, wealth index), and geographic location (Addis Ababa is the reference category).

In relation to the child work variables, Edmonds (2007) emphasized the importance of analyzing urban-rural differences; children in rural areas tend to work more often, and for longer hours. In this Chapter, child work is captured by hours performing domestic and market activities. For a detailed explanation of these variables, please refer to subsection 2.4.1.2 of Chapter 2. For the purposes of this analysis, child work is measured by two variables: market work (paid work outside the household and unpaid labor force work for the household) and domestic work (domestic chores and time spent caring for other household members). Building on the results and discussion of Chapter 2, I will instrument child work to control for bias due to reverse causality. The

[50] The last 10 questions of the Mathematics Achievement Test for the older cohort in Round 3 were multiple choice.

[51] For children without data on the highest level of education attained by the parents, the information on the educational attainment of the caregiver was used. Educational attainment is divided into four categories: parents with 0 years of education, parents with 1-3 years of education (corresponds to lower primary level not completed), parents with 4-7 years of education (corresponds upper primary level completed), parents with more than 8 years of education (corresponds to incomplete secondary education or more). Only in Round 2 the Young Lives questionnaire include a question on parental education for a parent is not present in the household.

selected instruments can be grouped in the following categories: sibling composition, household shocks, and environmental shocks.

Tables 3.3a-d show the descriptive statistics for these variables by cohort and Round. There are significant differences between urban and rural areas on the number of hours that children spend performing market work. For example, younger cohort children living in rural areas spend more than two additional hours on market work per day (i.e. for Round 3: 2.5 hours rural vs. 0.2 hours urban). For the older cohort, the difference is smaller, but still significant: children residing in rural areas spend at least 1.5 hours performing market work.

In addition, there are significant differences in parental education. For example, for the younger cohort in Round 3, 27 percent of urban parents had no years of education, but 62 percent of rural parents had no education. Moreover, 43 percent of urban parents had more than eight years of education, but just six percent of rural parents had the same level of education.

3.5.4 Resulting sample

For the younger cohort's empirical analysis, 1,875 children were interviewed in Round 4. Of those 1,875 children, 274 did not complete the PPVT test and 291 children did not complete the Mathematics test in Round 4. [52] For Round 3, 165 children did not complete the PPVT test and 211 children did not complete the mathematics test. In addition, 172 children were dropped from the Round 3 sample because of missing data on the control variables (201 for Round 4). As the PPVT and Mathematics estimations are performed separately, the total number of children included in the analysis ranges from 1,316 to 1,423.

From the 1,000 children included at the beginning of the study for the older cohort, 29 children were not interviewed in Rounds 2 and 3. Of the remaining 971

[52] For Round 4, 90 percent of the children that did not complete the tests could not read the language in which the test was administered.

children in Round 3, 35 children did not complete the Mathematics Achievement Test and 10 did not complete the PPVT test in either round. For Round 2, 26 children did not complete the PPVT test and 31 children did not complete the mathematics test. Finally, 96 children were dropped from the sample because of missing data on the control variables. As the PPVT and Mathematics estimations are performed separately, the total number of children included in the analysis ranges from 713 to 728.

3.6 Results

The urban-rural academic achievement gap decompositions for the Young Lives children in Ethiopia are presented in Tables 3.4-3.7. Each table corresponds to a test score for the younger or older cohort. The tables provide estimates for each age-group of children, both for all children and disaggregated by gender. In addition, each table reports results for both OLS and IV specifications of the model. Test scores were standardized; thus, the estimated impacts are measured in terms of the standard deviations of the test score variable.

Each table consists of two sections: section "a" presents the decomposition of the total academic achievement, reporting the explained and unexplained portions. In addition, section "a" of each table reports the contribution of each set of variables (child, parents, and household characteristics, and regional fixed effects) to the explained portion of the gap. Section "b" reports the contribution of each individual variable to the explained portion of the gap (differences in endowments).

The discussion will focus on the IV specifications for all children; in most of the cases the conclusions of the decompositions for the full sample is similar to the results for boys and girls separately. When there are gender differences, they will be highlighted in the discussion.

3.6.1 Tests Score Decomposition for the Younger Cohort

Table 3.4a summarizes the PPVT decomposition results for children in the younger cohort who were 8 and 12 years old at the time of the survey. The test score gap

was one standard deviation in Round 3 and 1.12 in Round 4. Most of the gap is explained due to differences in endowments (58.7 percent for Round 3 and 51.9 percent for Round 4). The child and household characteristics are the ones that contribute most to the explained portion of the gap, and in most cases the regional fixed effects contribution has a negative sign. Table 3.4b reports the variables with the largest magnitudes that significantly contribute to the differences in endowments are: the socioeconomic level of the household "wealth index" (0.18 in Round 3, 0.50 in Round 4), the proportion of parents that have more than eight years of education (0.10 in Round 3), hours of market work (0.24 in Round 3, 0.62 in Round 4), and hours of domestic work (-0.12 in Round 4); all of them are significant at least at the 10 percent level. These variables represent 88 percent of the explained portion of the test score gap in Round 3, and 172 percent in Round 4.[53] Although the results show that the PPVT test score gap widens for the same cohort as they get older, it important to be cautious with the interpretation given that the PPVT test differs from Round 3 to Round 4.

Table 3.4 also present results separately for boys and girls. The results are similar; the test score gap increases from age 8 to age 12, the main contributors to the explained portion are the child and household characteristic (regional fixed effects have a negative contribution), although the significance levels decrease for parental education and hours of market work.

The decomposition results for the mathematics test scores are summarized in Table 3.5a. In this case, the test score gap narrows from Round 3 to Round 4 (1.10 standard deviations in Round 3 to 0.97 in Round 4). The explained portion of the test score gap increases from Round 3 (49.6 percent) to Round 4 (60.2 percent). In the case of Round 4, similar to the PPVT results, child and household characteristics are the main contributors to the explained portion of the gap; while for Round 3 child, parent, and household characteristics contribute to the explained portion of the gap in similar proportions. Differences in the socioeconomic level "wealth index" (0.20 in Round 3 and

[53] In the case of Round 4, the region fixed effects contribute with -0.464 to the explained portion of the gap.

0.31 in Round 4), and the initial level of human capital (0.04 in Round 3 and 0.08 in Round 4), have a significant contribution to the explained portion of the test score gap in both rounds, and proportion of parents with more than 8 years of education (0.14 in Round 3), also has a significant contribution in Round 3. This set of variables represents 70 percent of the explained portion in Round 3 and 67 percent in Round 4.

The results for boys and girls are similar. The test score gap decreases from Round 3 to Round 4, the portion of the test score gap explained by differences in endowments increases for the case of girls (and slightly decreases for the case of boys), and the main contributors to the explained portion of the gap are the socioeconomic level and the proportion of parents with more than 8 years of education (this one for Round 3). In the case of boys, hours of market and domestic work and initial level of human capital also contribute to the explained portion of the test score gap.

In 2012, Young Lives added a school survey as part of its data collection. The school survey was conducted for a sub-sample of the younger-cohort children studying in Grades 4 and 5 in all the sentinel sites. The selected schools had to be located within the geographic boundary of the sentinel site. The survey included data about the Young Lives child, his/her peers (20 children per class), class teacher, head teacher and school.[54] While these school variables have the potential to provide additional information on urban-rural education gaps, they are available for only a small sub-sample of the children; analysis of the PPVT includes only 458 children and analysis of the mathematics score includes only 462 children. Some additional regressions, including teacher's characteristics,[55] were estimated for this sub-samples, but the results are generally insignificant due to the small sample size. Moreover, few significant results were somewhat unusual and may reflect random variation in the data. For example, having a teacher who specialized in language had a negative effect on the PPVT test score, but having a teacher who specialized in

[54] http://www.younglives.org.uk/content/ethiopia-school-survey

[55] The teacher's characteristics that were considered included gender, number of years teaching, whether the teacher is specialized on language/mathematics instruction and his/her educational attainment.

mathematics had a positive effect on the PPVT test score. Because of these difficulties, the exploratory regressions using the school survey are not included in this chapter.

3.6.2 Tests Score Decomposition for the Older Cohort

Table 3.6a summarizes the PPVT decomposition results for children in the older cohort who were 12 and 15 years old at the time of the survey. The test score gap was 0.96 standard deviations in Round 2 and 0.94 in Round 3. In both rounds, most of the gap is explained by differences in endowments (61.6 percent in Round 2 and 163.5 percent in Round 3). Hours in market work is the only variable that has a statistically significant contribution to the explained portion of the gap (0.51 in Round 2, significant at the 10 percent level; 1.42 in Round 3, significant at the 5 percent level). This represents 86.7 percent of the explained portion of the gap in Round 2 and 92.7 percent in Round 3. As shown in Table 3.3d, children residing in rural areas were working on average 5.7 hours per day and 86 percent were enrolled in school, in contrast to their urban counterparts who worked on average 3.6 hours per day and 99 percent were enrolled in school. Data from Round 3 show that the two main reasons why children do not attend school are: they were needed for domestic or agricultural work (21 percent), and they had to do paid work to earn money (17 percent).[56] Children aged 15 should be attending grades for which education is not free, so this could also be contributing to the differences in enrollment rates.

The PPVT decompositions for the older cohort boys and girls are also presented in Table 3.6a. The test score gap increases slightly from one round to another in the case of boys (0.89 in Round 2 and 0.91 in Round 3) and decreases slightly for the case of girls (1.02 in Round 2 and 0.97 in Round 3). The proportion of the test score explained by differences in endowments significantly increases for boys (66.4 percent to 127.8 percent) and girls (16.6 percent to 107.4 percent). Differences in hours spend on market work are significant for boys and girls and in both rounds, and in the case of girls, differences in hours of domestic work, also have a significant contribution in Round 3.

[56] This reason was reported by one of the parents or the main caregiver.

Table 3.7a summarizes the decomposition results for the mathematics test scores for the older cohort. The test score gap increases from Round 2 to Round 3 (0.48 standard deviations in Round 2 to 0.59 in Round 3). The explained portion of the test score gap increases from round to round, going from -6.7 percent of the test score gap in Round 2 to 84.6 percent in Round 3. Differences in the socioeconomic level "wealth index" have a significant contribution to the explained portion to the test score gap in Round 2 (0.29, significant at the 5 percent).

The results for boys and girls are similar to those for all children. The test score gap increases between rounds, and the portion of the test score gap explained by differences in endowments decreases (in Round 3 it is less than a third of the total gap). The main contributor to the explained portion of the test score gap for boys in Round 3 is hours of market work. For girls, the socioeconomic level is the main contributor to explained portion of the test score gap, which is off-set by a negative and significant effect of parental education in Round 3.

3.7 Conclusion

The results of this analysis show that there is a wide test score gap between children residing in urban and rural areas of Ethiopia. This test score gap widens as the children age. The test score gap is generally around one standard deviation, with the exception of the mathematics test score gap of the older cohort of children, which is 0.48 standard deviations in Round 2 and 0.59 standard deviations in Round 3.

The explained portion of the PPVT is always positive and contributes more than 50 percent of the test score gap. For the mathematics test score, the explained portion is mainly positive and contributes more than 40 percent of the test score gap, with the exception of the older cohort in Round 2, where the explained portion of the gap is -6.7 percent. In general, the explained portion of the gap is higher for boys than for girls.

The analysis included in this Chapter could not incorporate data on school and teacher's characteristics, i.e. school quality. Among the variables considered in the

analysis, the characteristics that consistently contribute to the explained portion of the gap are: hours of work, parental education and the socioeconomic status of the family, which is in line with the findings of Kingdon (2002) and Ramos et al. (2016), who concluded that child, parent, and household characteristics are the main determinants of the urban-rural educational gaps in India and Colombia, respectively.

Leaving aside policies that can improve the provision of educational services, such as construction of new schools to teacher training, policies that affect hours of work, parental education and socioeconomic status are needed. One example is short-term policies directing at decreasing child work, such as Conditional Cash Transfers programs, which would increase children's academic performance, especially in rural areas where children spend twice as much time as their urban counterparts performing domestic and market work. In fact, a recent evaluation of the Social Cash Transfer Pilot Programme in the Tigray region Berhane et al. (2015), found that this program increased the likelihood on enrollment by 13.3 percentage points and grade attainment by half of a grade. It also showed that the program helped reduce the hours that children spend on farm and family chores by over one hour per day. These effects could potentially translate into more time available for attending school and studying, which can contribute to higher test scores and educational attainment and thus reduce rural-urban education gaps.

3.8 Figures

Figure 3.1 – PPVT Score Distribution - Younger Cohort, Round 3 (8 years)

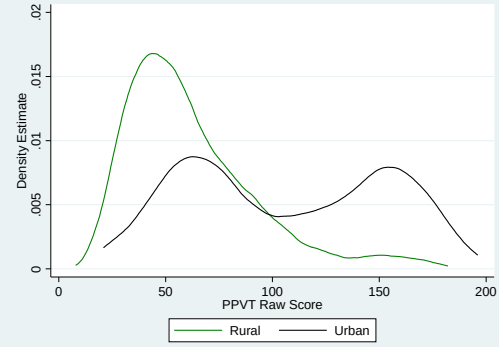


Figure 3.2 – Math Test Score Distribution Younger Cohort, Round 3 (8 years)

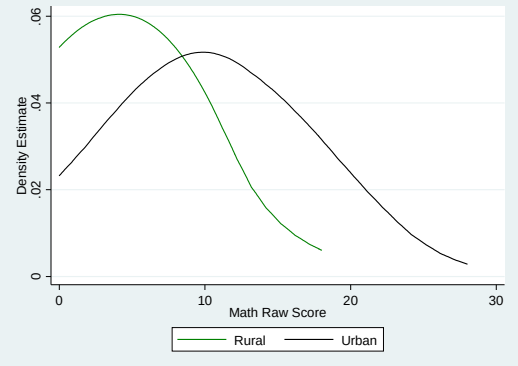


Figure 3.3 – PPVT Score Distribution- Younger Cohort, Round 4 (12 years)

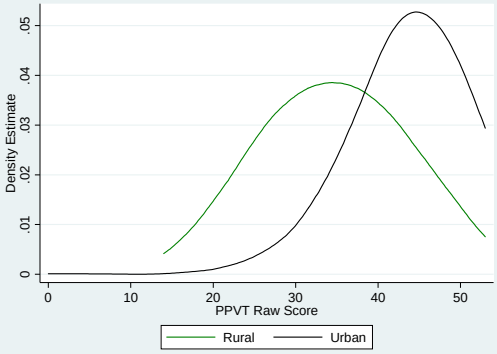


Figure 3.4 – Math Test Score Distribution Younger Cohort, Round 4 (12 years)

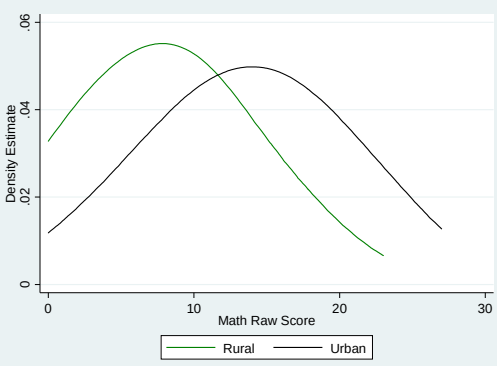


Figure 3.5 – PPVT Score Distribution Older Cohort, Round 2 (12 years)

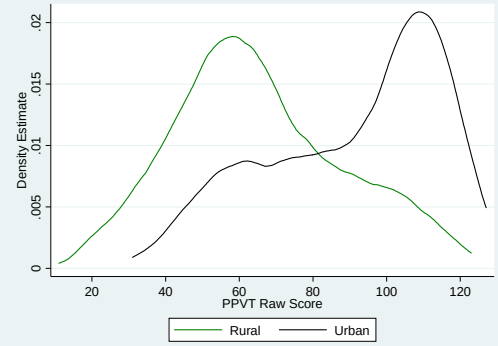


Figure 3.6 – Math Test Score Distribution Older Cohort, Round 2 (12 years)

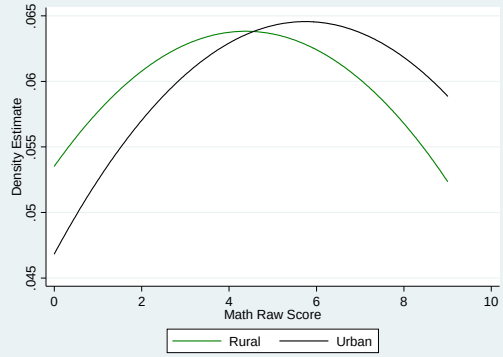


Figure 3.7 – PPVT Score Distribution Older Cohort, Round 3 (15 years)

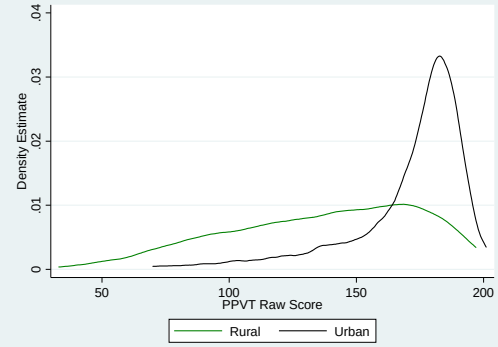


Figure 3.8 – Math Test Score Distribution Older Cohort, Round 3 (15 years)

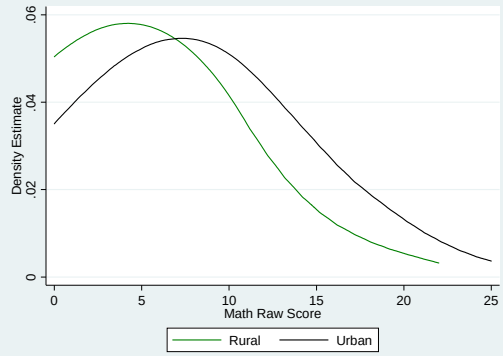
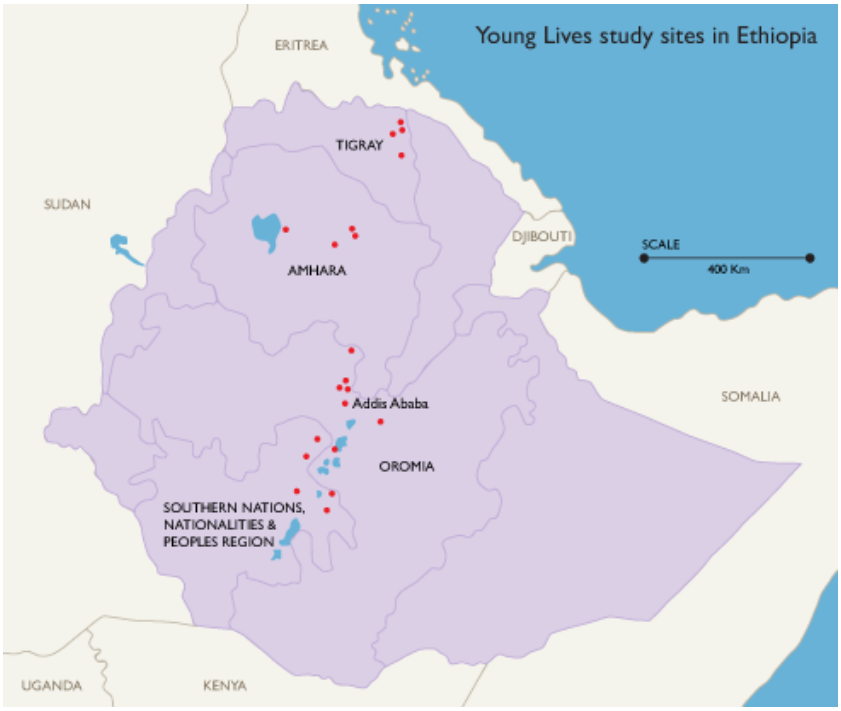


Figure 3.9 – Young Lives Study communities in Ethiopia



Source: Young Lives
Retrieved from: http://www.younglives.org.uk/where-we-work/ethiopia-1

3.9 Tables

Table 3.1a – Selected Education Indicators by Area of Residence -Ethiopia 2000

	Urban	Rural	Index (urban = 1)
Gross Enrollment Rates			
Primary Education			
Grades 1-8	111.6	46.2	0.41
Grades 1-4	122.9	65.3	0.53
Grades 5-8	101.1	22.0	0.22
Secondary Education			
Grades 9-12	76.3	0.4	0.01
Higher Education	3.7	0.02	0.01
Student Flow Indicators			
Percentage of cohort ever enrolled in grade 1	90.0	45.3	0.50
Composite cohort survival rate from grade 1			
To grade 4	76.9	55.3	0.72
To grade 8	79.8	19.7	0.25
School Participation Rates by Distance to Nearest Primary School			
Distance from home to nearest primary school			
Less than 1 km.	85.5	43.6	0.51
1-2 km.	83.1	38.8	0.47
3-4 km.	78.9	32.6	0.41
+5 km.	71.0	19.8	0.28
Percentage of Children Ages 7-14 Years registered for school, by mother's native language			
Amrigna	88.1	31.5	0.36
Ormigna	83.7	25.1	0.30
Tigrigna	85.5	24.8	0.29
Somaligna	35.7	11.4	0.32
Afarigna	-	12.9	-
Other	69.6	27.7	0.40

Source: World Bank (2005). Tables 4.2, 4.5, 4.9, and 4.10; using data from 1999-2000 Ethiopia Welfare Monitoring Survey, Ethiopia Household Income and Consumption Expenditure Survey, Education Management Information System Panel (Ministry of Education), and 2000 Demographic and Health Survey.

Table 3.1b – Selected Education Indicators by Area of Residence - Ethiopia 2015

	Rural	Small town (Urban)	Large town (Urban)
Literacy[A] Rates			
Males			
All	58.5	76.2	90.0
15-19	80.9	86.9	98.2
20-29	76.7	92.4	96.8
30+	51.1	73.1	90.9
Females			
All	39.0	62.1	79.7
15-19	77.5	90.0	95.8
20-29	45.9	77.4	92.6
30+	14.0	39.0	64.2
School Enrollment (ages 7-18)			
Males			
Not Enrolled	32.5	19.0	16.4
Primary	64.8	63.1	61.1
Secondary	2.7	18.0	22.5
Females			
Not Enrolled	33.0	16.4	17.7
Primary	64.4	68.9	60.7
Secondary	2.6	14.7	21.7
School Type			
Government	99.0	94.7	71.6
Non Government	1.0	5.3	28.4

Source: CSA and World Bank (2017). Tables 2.5, 2.6, and 2.7 ; using data from the Ethiopia Socioeconomic Survey 2015-2016.

A: Literacy is self-reported and is defined as the ability to read and write in any language.

Table 3.2 – Young Lives Sentinel Sites

Cluster ID	District	Anonymised name*	Short description
1	Addis Ababa	Bertukan	An overcrowded area in the centre of the capital city, Addis Ababa
2	Addis Ababa	Duba	An industrial area in the southern part of the city Addis Ababa
3	Addis Ababa	Menderin	A slum area in the capital city, Addis Ababa
4	Amhara	Kok	A tourist town in the Amhara region, with some extremely poor neighbourhoods
5	Amhara	Muz	A poor rural community in the Amhara region
6	Amhara	Enkoy	A rural area near Lake Tana in the Amhara region
7	Amhara	Tach-Meret	A rural food-insecure area in the Amhara region
8	Oromia	Leki	A rural area near lake Ziway in the Oromia region
9	Oromia	Loki	A drought-prone rural area in the Oromia region
10	Oromia	Ananas	A fast-growing town in the Oromia region
11	Oromia	Dinich	A relatively rich rural area in the outskirts of Debrezeit town in the Oromia region
12	SNNP	Timatim	A densely populated rural area growing enset (false banana) in the SNNP region
13	SNNP	Shenkurt	A densely populated town in the SNNP region
14	SNNP	Leku	A fast-growing business and tourist town in the SNNP region
15	SNNP	Buna	A coffee-growing rural area in the SNNP region
16	SNNP	Weyn	A poor and densely populated rural community in the SNNP region
17	Tigray	Zeytuni	A drought-prone rural area highly dependent on government support in the Tigray region
18	Tigray	Selata	An extremely poor rural area dependent on the Productive Safety Net Scheme and other government support in the Tigray region
19	Tigray	Gomen	A small, very poor town in the Tigray region
20	Tigray	Beles	A model rural area in the Tigray region known for its success in soil and water conservation

*Note: Pseudonyms are used for all site names in order to protect the children's anonymity.

Source : http://www.younglives-ethiopia.org/files/country-reports/ethiopia-r4-survey-design

Table 3.3a – Descriptive Statistics Younger Cohort Round 3 - (8-year-old)

	All Children		Urban		Rural	
	Mean	SD	Mean	SD	Mean	SD
Test Scores						
Currently enrolled in school	0.80	*0.40*	0.90	*0.30*	0.73	*0.44*
PPVT Test Score	79.70	*43.97*	107.00	*47.18*	62.25	*31.10*
Mathematics Test Score	6.54	*5.31*	10.14	*5.55*	4.24	*3.61*
Cognitive Test Score Round 2	-0.02	*1.00*	0.38	*0.94*	-0.27	*0.96*
Child's Characteristics						
Female	0.46	*0.50*	0.47	*0.50*	0.45	*0.50*
Age in Months	97.36	*3.70*	97.58	*3.62*	97.23	*3.75*
Total hours of domestic work per day	1.60	*2.24*	0.24	*0.82*	2.46	*2.42*
Total hours of market work per day	2.42	*1.92*	1.97	*1.63*	2.70	*2.04*
Parents' Characteristics						
Highest educational level of the parents:						
No education	0.48	*0.50*	0.27	*0.45*	0.62	*0.49*
1-3 years	0.14	*0.35*	0.09	*0.29*	0.17	*0.38*
4-8 years	0.17	*0.38*	0.21	*0.41*	0.15	*0.36*
More than 8 years	0.20	*0.40*	0.43	*0.50*	0.06	*0.23*
One Parent Absent	0.15	*0.36*	0.22	*0.42*	0.11	*0.31*
Both Parents Absent	0.01	*0.11*	0.01	*0.08*	0.02	*0.13*
Household Characteristics						
Number of household members	6.22	*1.96*	5.85	*2.07*	6.45	*1.85*
Number of siblings living at home	3.39	*2.13*	2.53	*2.03*	3.95	*2.01*
Wealth Index	0.33	*0.17*	0.47	*0.15*	0.24	*0.12*
Area of Residence						
Addis Ababa	0.14	*0.34*	0.35	*0.48*	0.00	*0.00*
Amhara	0.23	*0.42*	0.13	*0.33*	0.29	*0.45*
Oromia	0.21	*0.41*	0.15	*0.36*	0.25	*0.43*
SNNP	0.21	*0.41*	0.24	*0.43*	0.19	*0.40*
Tigray	0.21	*0.41*	0.13	*0.34*	0.27	*0.44*
Rural	0.61	*0.49*				
Observations	1300		507		793	

Table 3.3b – Descriptive Statistics Younger Cohort Round 4 - (12-year-old)

	All Children		Urban		Rural	
	Mean	SD	Mean	SD	Mean	SD
Test Scores						
Currently enrolled in school	0.97	*0.17*	0.99	*0.09*	0.95	*0.22*
PPVT Test Score	39.29	*8.32*	43.93	*6.01*	35.16	*7.91*
Mathematics Test Score	10.83	*6.01*	13.87	*5.74*	8.13	*4.84*
Cognitive Test Score Round 2	0.08	*0.98*	0.42	*0.93*	-0.22	*0.93*
Child's Characteristics						
Female	0.46	*0.50*	0.47	*0.50*	0.46	*0.50*
Age in Months	145.55	*3.90*	145.69	*3.82*	145.43	*3.97*
Total hours of domestic work per day	1.54	*2.10*	0.43	*1.16*	2.53	*2.25*
Total hours of market work per day	2.21	*1.61*	2.07	*1.53*	2.33	*1.66*
Parents' Characteristics						
Highest educational level of the parents:						
No education	0.39	*0.49*	0.21	*0.41*	0.56	*0.50*
1-3 years	0.13	*0.33*	0.08	*0.26*	0.18	*0.38*
4-8 years	0.17	*0.37*	0.19	*0.39*	0.14	*0.35*
More than 8 years	0.31	*0.46*	0.52	*0.50*	0.12	*0.33*
One Parent Absent	0.23	*0.42*	0.30	*0.46*	0.16	*0.37*
Both Parents Absent	0.09	*0.28*	0.13	*0.33*	0.06	*0.23*
Household Characteristics						
Number of household members	5.71	*1.90*	5.37	*1.95*	6.02	*1.81*
Number of siblings living at home	3.52	*2.21*	2.64	*2.01*	4.30	*2.08*
Wealth Index	0.40	*0.17*	0.50	*0.16*	0.30	*0.12*
Area of Residence						
Tigray	0.25	*0.43*	0.15	*0.36*	0.34	*0.47*
Amhara	0.24	*0.43*	0.14	*0.35*	0.32	*0.47*
Oromia	0.23	*0.42*	0.17	*0.38*	0.28	*0.45*
SNNP	0.11	*0.31*	0.17	*0.38*	0.06	*0.23*
Other	0.00	*0.04*	0.00	*0.06*	0.00	*0.00*
Addis Ababa	0.17	*0.38*	0.36	0.48	0.00	0.00
Rural	0.53	*0.50*				
Observations	1263		597		672	

Table 3.3c – Descriptive Statistics Older Cohort Round 2 - (12-year-old)

	All Children		Urban		Rural	
	Mean	SD	Mean	SD	Mean	SD
Test Scores						
Currently enrolled in school	0.97	*0.17*	0.98	*0.13*	0.96	*0.19*
PPVT Test Score	75.49	*25.82*	90.19	*23.69*	66.18	*22.61*
Mathematics Test Score	4.88	*2.42*	5.66	*2.17*	4.39	*2.45*
Child's Characteristics						
Female	0.50	*0.50*	0.51	*0.50*	0.49	*0.50*
Age in Months	145.21	*3.75*	145.29	*3.63*	145.15	*3.82*
Total hours of domestic work per day	1.52	*1.91*	0.49	*1.27*	2.17	*1.97*
Total hours of market work per day	2.70	*1.82*	2.70	*1.88*	2.69	*1.79*
Parents' Characteristics						
Highest educational level of the parents:						
No education	0.54	*0.50*	0.31	*0.46*	0.69	*0.46*
1-3 years	0.14	*0.35*	0.14	*0.35*	0.14	*0.35*
4-8 years	0.16	*0.37*	0.22	*0.41*	0.12	*0.33*
More than 8 years	0.16	*0.36*	0.33	*0.47*	0.05	*0.21*
One Parent Absent	0.15	*0.35*	0.20	*0.40*	0.11	*0.31*
Both Parents Absent	0.02	*0.14*	0.03	*0.17*	0.01	*0.12*
Household Characteristics						
Number of household members	6.55	*2.06*	6.03	*2.03*	6.89	*2.02*
Number of siblings living at home	3.84	*2.12*	3.10	*2.04*	4.30	*2.04*
Wealth Index	0.29	*0.17*	0.44	*0.14*	0.20	*0.11*
Area of Residence						
Addis Ababa	0.14	*0.35*	0.36	*0.48*	0.00	*0.00*
Amhara	0.18	*0.38*	0.12	*0.32*	0.21	*0.41*
Oromia	0.22	*0.41*	0.15	*0.35*	0.26	*0.44*
SNNP	0.24	*0.43*	0.26	*0.44*	0.23	*0.42*
Tigray	0.22	*0.42*	0.11	*0.32*	0.30	*0.46*
Rural	0.61	*0.49*				
Observations	707		274		433	

Table 3.3d – Descriptive Statistics Older Cohort Round 3 - (15-year-old)

	All Children		Urban		Rural	
	Mean	SD	Mean	SD	Mean	SD
Test Scores						
Currently enrolled in school	0.91	*0.29*	0.99	*0.12*	0.86	*0.35*
PPVT Test Score	149.86	*36.90*	170.87	*24.13*	137.02	*37.47*
Mathematics Test Score	5.85	*4.88*	7.68	*5.03*	4.72	*4.43*
Child's Characteristics						
Female	0.49	*0.50*	0.51	*0.50*	0.48	*0.50*
Age in Months	180.32	*3.48*	180.62	*3.38*	180.13	*3.53*
Total hours of domestic work per day	1.74	*2.48*	0.76	*1.77*	2.35	*2.65*
Total hours of market work per day	3.18	*1.96*	2.85	*1.62*	3.38	*2.12*
Parents' Characteristics						
Highest educational level of the parents:						
No education	0.56	*0.50*	0.31	*0.46*	0.71	*0.45*
1-3 years	0.13	*0.34*	0.13	*0.34*	0.13	*0.34*
4-8 years	0.16	*0.36*	0.22	*0.42*	0.12	*0.32*
More than 8 years	0.15	*0.36*	0.34	*0.47*	0.04	*0.20*
One Parent Absent	0.19	*0.40*	0.26	*0.44*	0.15	*0.36*
Both Parents Absent	0.01	*0.12*	0.02	*0.15*	0.01	*0.10*
Household Characteristics						
Number of household members	6.43	*2.02*	6.00	*2.06*	6.70	*1.95*
Number of siblings living at home	4.12	*2.17*	3.25	*2.05*	4.66	*2.07*
Wealth Index	0.34	*0.16*	0.48	*0.14*	0.26	*0.12*
Area of Residence						
Addis Ababa	0.14	*0.35*	0.37	*0.48*	0.00	*0.00*
Amhara	0.19	*0.39*	0.12	*0.32*	0.24	*0.42*
Oromia	0.22	*0.41*	0.14	*0.35*	0.26	*0.44*
SNNP	0.23	*0.42*	0.25	*0.44*	0.22	*0.42*
Tigray	0.22	*0.41*	0.12	*0.33*	0.28	*0.45*
Rural	0.62	*0.49*				
Observations	704		267		437	

Table 3.4a - PPVT Score Decomposition between Rural and Urban Children, Younger Cohort (Round 3 – 8-year-olds, Round 4 – 12-year-olds)

	All Children				Males				Females			
	OLS		IV		OLS		IV		OLS		IV	
	R3	R4	R3	R4	R3	R4	R3	R4	R3	R4	R3	R4
Decomposition:												
Mean Test Score (Urban)	0.612	0.609	0.612	0.609	0.646	0.62	0.646	0.620	0.573	0.597	0.573	0.597
Mean Test Score (Rural)	-0.391	-0.513	-0.391	-0.513	-0.413	-0.469	-0.413	-0.469	-0.364	-0.564	-0.364	-0.564
Raw differential (R) {Urban-Rural}:	1.003	1.122	1.003	1.122	1.059	1.089	1.059	1.089	0.937	1.161	0.937	1.161
- due to endowments (E):	0.692	0.595	0.589	0.583	0.713	0.688	0.638	0.839	0.398	0.522	0.327	0.702
- due to coefficients (C):	-0.127	0.397	0.099	0.555	-0.39	0.411	0.105	0.597	-0.017	0.448	0.032	0.533
- due to interaction (CE):	0.438	0.131	0.315	-0.016	0.737	-0.01	0.316	-0.347	0.557	0.191	0.578	-0.074
	0	0			0	0			0	0		
Unexplained (U){C+(1-D)CE}:	0.311	0.527	0.414	0.539	0.346	0.401	0.421	0.250	0.539	0.639	0.610	0.459
Explained (V) {E+D*CE}:	0.692	0.595	0.589	0.583	0.713	0.688	0.638	0.839	0.398	0.522	0.327	0.702
% unexplained {U/R}:	31.0	47.0	41.288	48.074	32.7	36.8	39.8	23.0	57.6	55.0	65.1	39.5
% explained (V/R):	69.0	53.0	58.712	51.926	67.3	63.2	60.2	77.0	42.4	45.0	34.9	60.5
Endowments:												
Child's Charactristics	0.194	0.269	0.317	0.549	0.262	0.349	0.395	0.624	0.142	0.174	-0.013	0.340
Parents' Characteristics	0.094	-0.078	0.091	-0.081	0.087	-0.062	0.079	-0.059	0.104	-0.097	0.115	-0.089
Household Characteristics	0.272	0.570	0.207	0.578	0.240	0.531	0.185	0.430	0.295	0.599	0.357	0.563
Region Fixed Effects	0.133	-0.166	-0.027	-0.464	0.078	-0.083	-0.021	-0.156	-0.144	-0.154	-0.131	-0.112
Observations	1349	1423	1349	1423	730	760	730	760	619	663	619	663

Notes :

R : Raw differential
E : Raw differential due to endowments
C: Raw differential due to coefficients
CE: Raw differential due to interaction
D: Matrix of weights. For the case presented here D = 0

Table 3.4b – Endowment Contributions to the PPVT Score Decomposition, Younger Cohort (Round 3 – 8-year-olds, Round 4 – 12-year-olds)

	All Children				Males				Females			
	OLS		IV		OLS		IV		OLS		IV	
	R3	R4	R3	R4	R3	R4	R3	R4	R3	R4	R3	R4
Endowments:												
Child's Charactristics												
Female	0.000	-0.003	-0.003	-0.017								
Age in Months	**0.022***	**0.010***	**0.022***	0.005	0.014	0.007	0.013	0.007	**0.035***	0.013	**0.032***	0.010
Cognitive Test Score Round 2	**0.055*****	**0.059*****	**0.058*****	**0.060****	**0.087*****	**0.072****	**0.092*****	**0.063****	0.032	0.045	0.029	**0.055***
Total hours of domestic work	0.012	0.004	0.003	**-0.117***	0.008	-0.003	0.024	-0.021	0.016	0.010	-0.026	-0.013
Total hours of market work	**0.104*****	**0.199*****	**0.237****	**0.618*****	**0.153*****	**0.273*****	**0.265****	**0.574***	**0.058***	**0.106*****	-0.047	**0.288****
Parents' Characteristics												
Parents Education: 1-3 years	-0.003	-0.011	-0.002	0.001	0.002	-0.011	0.002	-0.013	-0.011	-0.012	-0.012	-0.011
Parents Education: 4-8 years	0.001	0.001	0.001	-0.014	0.003	-0.001	0.003	0.000	-0.001	0.003	0.000	0.002
Parents Education: more than 8 years	**0.107*****	-0.048	**0.104****	-0.052	**0.114****	-0.031	**0.107****	-0.024	**0.106***	-0.068	**0.118***	-0.074
One Parent Absent	-0.011	-0.006	-0.012	-0.014	**-0.032****	0.003	**-0.033****	-0.007	0.012	-0.016	0.010	-0.003
Both Parents Absent	0.001	-0.014	0.000	-0.002	0.000	**-0.022***	0.000	-0.015	-0.001	-0.005	-0.001	-0.003
Household Characteristics												
Number of household members	0.008	**0.031****	0.007	0.026	0.008	0.012	0.006	0.004	0.003	**0.051****	0.003	0.040
Number of siblings living at home	0.030	**0.059****	0.020	0.049	0.031	**0.087****	0.025	**0.077***	0.030	0.035	0.044	0.035
Wealth Index	**0.234*****	**0.480*****	**0.181****	**0.503*****	**0.201*****	**0.433*****	**0.154****	**0.349*****	**0.262*****	**0.513*****	**0.311*****	**0.488*****
Observations	1349	1423	1349	1423	730	760	730	760	619	663	619	663

*** p<0.01, ** p<0.05, * p<0.1

Table 3.5a – Mathematics Test Score Decomposition between Rural and Urban Children, Younger Cohort (Round 3 – 8-year-olds, Round 4 – 12-year-olds)

	All Children				Males				Females			
	OLS		IV		OLS		IV		OLS		IV	
	R3	R4	R3	R4	R3	R4	R3	R4	R3	R4	R3	R4
Decomposition:												
Mean Test Score (Urban)	0.665	0.540	0.665	0.540	0.715	0.526	0.715	0.526	0.608	0.557	0.608	0.557
Mean Test Score (Rural)	-0.433	-0.428	-0.433	-0.428	-0.419	-0.416	-0.419	-0.416	-0.451	-0.443	-0.451	-0.443
Raw differential (R) {Urban-Rural}:	1.098	0.969	1.098	0.969	1.134	0.942	1.134	0.942	1.059	0.999	1.059	0.999
- due to endowments (E):	0.428	0.478	0.545	0.583	0.461	0.608	0.651	0.526	0.313	0.317	0.322	0.529
- due to coefficients (C):	0.163	0.336	0.305	0.443	-0.011	0.301	0.250	0.447	0.333	0.324	0.387	0.408
- due to interaction (CE):	0.507	0.155	0.249	-0.058	0.683	0.033	0.233	-0.032	0.413	0.359	0.351	0.062
Unexplained (U){C+(1-D)CE}:	0.670	0.491	0.553	0.385	0.672	0.334	0.482	0.416	0.746	0.683	0.738	0.470
Explained (V) {E+D*CE}:	0.428	0.478	0.545	0.583	0.461	0.608	0.651	0.526	0.313	0.317	0.322	0.529
% unexplained {U/R}:	61.0	50.7	50.4	39.8	59.3	35.4	42.5	44.1	70.4	68.3	69.6	47.1
% explained (V/R):	39.0	49.3	49.6	60.2	40.7	64.6	57.4	55.9	29.6	31.7	30.4	52.9
Endowments:												
Child's Charactristics	0.158	0.211	0.150	0.183	0.237	0.270	0.369	0.164	0.103	0.160	-0.037	0.264
Parents' Characteristics	0.122	0.037	0.129	0.038	0.135	0.032	0.138	0.031	0.117	0.025	0.125	0.026
Household Characteristics	0.199	0.280	0.188	0.322	0.138	0.342	0.064	0.381	0.242	0.200	0.301	0.191
Region Fixed Effects	-0.052	-0.050	0.079	0.040	-0.049	-0.035	0.080	-0.050	-0.148	-0.068	-0.067	0.048
Observations	1316	1388	1316	1388	714	747	714	747	602	641	602	641

Notes :

R : Raw differential
E : Raw differential due to endowments
C: Raw differential due to coefficients
CE: Raw differential due to interaction
D: Matrix of weights. For the case presented here D = 0

Table 3.5b – Endowment Contributions to the Mathematics Test Score Decomposition, Younger Cohort (Round 3 – 8-year-olds, Round 4 – 12-year-olds)

	All Children				Males				Females			
	OLS		IV		OLS		IV		OLS		IV	
	R3	R4	R3	R4	R3	R4	R3	R4	R3	R4	R3	R4
Endowments:												
Child's Charactristics												
Female	0.000	0.000	-0.002	-0.003								
Age in Months	0.007	0.005	0.007	0.004	0.002	0.003	0.002	0.003	0.015	0.006	0.013	0.005
Cognitive Test Score Round 2	**0.045*** **	**0.076*** **	**0.043** **	**0.080*** **	**0.074*** **	**0.083*** **	**0.078*** **	**0.084*** **	0.023	**0.070** **	0.021	**0.074** **
Total hours of domestic work	**0.033*** **	**0.014***	0.004	-0.059	**0.023** **	0.000	0.001	0.001	**0.039***	**0.044***	0.022	0.050
Total hours of market work	**0.074*** **	**0.116*** **	0.098	0.162	**0.137*** **	**0.185*** **	**0.288***	0.077	0.025	0.040	-0.093	0.135
Parents' Characteristics												
Parents Education: 1-3 years	0.003	-0.008	0.004	-0.003	0.004	-0.005	0.004	-0.004	0.001	-0.012	-0.002	-0.011
Parents Education: 4-8 years	-0.002	0.001	-0.002	0.000	-0.004	0.000	-0.002	-0.001	0.000	0.001	0.001	0.001
Parents Education: more than 8 years	**0.135*** **	0.053	**0.140*** **	0.053	**0.159*** **	0.049	**0.166*** **	0.045	**0.115***	0.049	**0.127** **	0.047
One Parent Absent	-0.011	-0.002	-0.011	-0.005	**-0.025***	-0.006	**-0.030** **	-0.001	0.006	-0.003	0.003	-0.001
Both Parents Absent	-0.002	-0.007	-0.002	-0.007	0.000	-0.005	0.000	-0.009	-0.005	-0.010	-0.005	-0.012
Household Characteristics												
Number of household members	0.015	0.003	0.016	0.008	0.013	0.002	0.009	0.006	0.014	0.004	0.012	-0.001
Number of siblings living at home	-0.022	0.002	-0.027	0.003	0.000	0.035	-0.009	0.038	-0.042	-0.041	-0.023	-0.038
Wealth Index	**0.206*** **	**0.275*** **	**0.198*** **	**0.311*** **	**0.125***	**0.305*** **	0.065	**0.337*** **	**0.270*** **	**0.236*** **	**0.313*** **	**0.230*** **
Observations	1316	1388	1316	1388	714	747	714	747	602	641	602	641

*** p<0.01, ** p<0.05, * p<0.1

Table 3.6a - PPVT Score Decomposition between Rural and Urban Children, Older Cohort (Round 2 – 12-year-olds, Round 3 – 15-year-olds)

	All Children				Males				Females			
	OLS		IV		OLS		IV		OLS		IV	
	R2	R3	R2	R3	R2	R3	R2	R3	R2	R3	R2	R3
Decomposition:												
Mean Test Score (Urban)	0.544	0.548	0.544	0.548	0.531	0.610	0.531	0.610	0.557	0.488	0.557	0.488
Mean Test Score (Rural)	-0.411	-0.389	-0.411	-0.389	-0.362	-0.300	-0.362	-0.300	-0.463	-0.487	-0.463	-0.487
Raw differential (R) {Urban-Rural}:	0.955	0.937	0.955	0.937	0.892	0.910	0.892	0.910	1.021	0.974	1.021	0.974
- due to endowments (E):	0.269	0.695	0.588	1.532	0.212	0.813	0.592	1.162	0.249	0.695	0.169	1.046
- due to coefficients (C):	0.289	0.521	0.330	0.524	0.371	0.533	0.422	0.539	0.337	0.541	0.332	0.552
- due to interaction (CE):	0.398	-0.279	0.038	-1.118	0.309	-0.436	-0.122	-0.792	0.434	-0.262	0.519	-0.625
Unexplained (U){C+(1-D)CE}:	0.686	0.242	0.367	-0.595	0.680	0.097	0.300	-0.253	0.771	0.279	0.851	-0.072
Explained (V) {E+D*CE}:	0.269	0.695	0.588	1.532	0.212	0.813	0.592	1.162	0.249	0.695	0.169	1.046
% unexplained {U/R}:	71.9	25.8	38.4	-63.5	76.2	10.6	33.6	-27.8	75.6	28.7	83.4	-7.4
% explained (V/R):	28.1	74.2	61.6	163.5	23.8	89.4	66.4	127.8	24.4	71.3	16.6	107.4
Endowments:												
Child's Charactristics	0.171	0.158	0.520	1.671	0.191	0.204	0.643	0.826	0.101	0.134	-0.028	0.636
Parents' Characteristics	0.045	0.180	0.061	0.247	-0.008	0.118	0.020	0.196	0.146	0.278	0.161	0.208
Household Characteristics	0.142	0.447	0.067	-0.095	0.030	0.492	-0.023	0.241	0.127	0.372	0.162	0.254
Region Fixed Effects	-0.089	-0.089	-0.060	-0.291	-0.001	-0.001	-0.047	-0.101	-0.124	-0.089	-0.126	-0.051
Observations	728	728	728	728	368	370	368	370	360	358	360	358

Notes :

R : Raw differential
E : Raw differential due to endowments
C: Raw differential due to coefficients
CE: Raw differential due to interaction
D: Matrix of weights. For the case presented here D = 0

Table 3.6b – Endowment Contributions to the PPVT Score Decomposition, Older Cohort (Round 2 – 12-year-olds, Round 3 – 15-year-olds)

	All Children				Males				Females			
	OLS		IV		OLS		IV		OLS		IV	
	R2	R3	R2	R3	R2	R3	R2	R3	R2	R3	R2	R3
Endowments:												
Child's Charactristics												
Female	-0.005	-0.009	-0.006	-0.037								
Age in Months	0.005	0.005	0.005	0.019	-0.010	0.007	-0.008	0.011	0.020	-0.017	0.020	-0.017
Total hours of domestic work	0.003	0.018	0.012	0.265	-0.020	0.000	-0.043	-0.005	-0.003	**0.094***	-0.019	**0.385***
Total hours of market work	**0.168*****	**0.144*****	**0.510***	**1.423****	**0.222*****	**0.197*****	**0.693****	**0.820****	**0.083****	**0.057****	-0.029	**0.268***
Parents' Characteristics												
Parents Education: 1-3 years	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.002	0.001	0.001	0.000
Parents Education: 4-8 years	0.007	**0.035****	0.015	0.037	-0.001	0.019	0.012	0.029	0.021	**0.053***	0.021	0.039
Parents Education: more than 8 years	0.043	**0.133****	0.043	0.153	0.015	0.079	0.021	0.106	0.131	0.213	0.151	0.145
One Parent Absent	0.003	0.019	0.009	0.057	0.013	0.037	0.012	0.053	-0.006	0.013	-0.010	0.027
Both Parents Absent	-0.008	-0.007	-0.007	0.001	-0.034	-0.018	-0.025	0.008	-0.002	-0.002	-0.002	-0.002
Household Characteristics												
Number of household members	-0.028	0.022	-0.042	-0.010	-0.072	0.031	**-0.113***	0.001	0.030	0.008	0.028	0.021
Number of siblings living at home	0.039	0.054	0.042	-0.007	0.089	0.077	**0.112***	0.061	-0.038	0.011	-0.027	-0.027
Wealth Index	0.130	**0.372*****	0.067	-0.078	0.014	**0.385*****	-0.022	0.179	0.135	**0.353****	0.161	0.260
Observations	728	728	728	728	368	370	368	370	360	358	360	358

*** p<0.01, ** p<0.05, * p<0.1

Table 3.7a – Mathematics Test Score Decomposition between Rural and Urban Children, Older Cohort (Round 2 – 12-year-olds, Round 3 – 15-year-olds)

	All Children				Males				Females			
	OLS		IV		OLS		IV		OLS		IV	
	R2	R3	R2	R3	R2	R3	R2	R3	R2	R3	R2	R3
Decomposition:												
Mean Test Score (Urban)	0.309	0.354	0.309	0.354	0.359	0.499	0.359	0.499	0.261	0.215	0.261	0.215
Mean Test Score (Rural)	-0.169	-0.236	-0.169	-0.236	-0.107	-0.082	-0.107	-0.082	-0.229	-0.389	-0.229	-0.389
Raw differential (R) {Urban-Rural}:	0.478	0.591	0.478	0.591	0.466	0.581	0.466	0.581	0.490	0.604	0.490	0.604
- due to endowments (E):	0.302	0.239	-0.032	0.499	0.364	0.091	0.344	0.413	0.239	0.173	0.232	0.199
- due to coefficients (C):	-0.152	0.020	-0.127	0.062	-0.022	0.097	-0.062	0.179	-0.419	-0.109	-0.283	-0.070
- due to interaction (CE):	0.328	0.332	0.637	0.029	0.125	0.393	0.185	-0.011	0.670	0.539	0.542	0.475
Unexplained (U){C+(1-D)CE}:	0.176	0.352	0.510	0.091	0.102	0.49	0.123	0.168	0.251	0.431	0.259	0.405
Explained (V) {E+D*CE}:	0.302	0.239	-0.032	0.499	0.364	0.091	0.344	0.413	0.239	0.173	0.232	0.199
% unexplained {U/R}:	36.8	59.6	106.7	15.4	22	84.3	26.3	28.9	51.2	71.4	52.8	67.1
% explained (V/R):	63.2	40.4	-6.7	84.6	78	15.7	73.7	71.1	48.8	28.6	47.2	32.9
Endowments:												
Child's Charactristics	0.032	0.148	-0.280	0.533	0.160	0.244	0.125	0.764	-0.067	0.070	-0.046	0.150
Parents' Characteristics	0.082	-0.021	0.009	-0.006	0.123	0.081	0.117	0.137	-0.015	-0.313	-0.022	-0.312
Household Characteristics	0.211	0.125	0.267	0.009	0.095	-0.131	0.100	-0.310	0.373	0.383	0.376	0.381
Region Fixed Effects	-0.022	-0.014	-0.028	-0.036	-0.014	-0.102	0.001	-0.177	-0.052	0.034	-0.076	-0.021
Observations	714	713	714	713	352	353	352	353	362	360	362	360

Notes :

R : Raw differential
E : Raw differential due to endowments
C: Raw differential due to coefficients
CE: Raw differential due to interaction
D: Matrix of weights. For the case presented here D = 0

Table 3.7b – Endowment Contributions to the Mathematics Test Score Decomposition, Older Cohort (Round 2 – 12-year-olds, Round 3 – 15-year-olds)

	All Children				Males				Females			
	OLS		IV		OLS		IV		OLS		IV	
	R2	R3	R2	R3	R2	R3	R2	R3	R2	R3	R2	R3
Endowments:												
Child's Charactristics												
Female	0.000	-0.002	-0.002	-0.004								
Age in Months	0.001	0.006	0.001	0.008	-0.006	0.002	-0.006	0.002	0.004	-0.006	0.003	-0.006
Total hours of domestic work	0.000	**0.028***	-0.007	0.093	-0.016	-0.004	-0.009	-0.011	-0.007	0.032	-0.020	0.111
Total hours of market work	0.031	**0.116*****	-0.272	0.435	**0.182***	**0.247*****	0.141	**0.772****	-0.064	**0.044****	-0.029	0.045
Parents' Characteristics												
Parents Education: 1-3 years	-0.001	0.000	-0.001	-0.001	0.001	0.002	0.001	0.002	-0.005	-0.002	-0.004	-0.002
Parents Education: 4-8 years	-0.005	-0.008	-0.027	-0.003	-0.007	-0.012	-0.009	0.005	0.000	0.002	-0.001	-0.005
Parents Education: more than 8 years	0.084	-0.014	0.029	-0.017	0.080	0.056	0.077	0.066	0.000	**-0.309****	-0.007	**-0.299****
One Parent Absent	0.012	0.011	0.009	0.026	0.048	0.035	0.049	**0.064***	-0.007	-0.002	-0.006	-0.002
Both Parents Absent	-0.008	-0.010	-0.002	-0.012	-	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.003
Household Characteristics												
Number of household members	-0.035	0.022	-0.036	0.021	-0.067	-0.013	-0.065	-0.029	-0.031	0.021	-0.031	0.026
Number of siblings living at home	0.030	-0.027	0.016	-0.052	0.062	0.028	0.061	-0.005	0.035	-0.037	0.029	-0.055
Wealth Index	**0.216****	0.130	**0.287****	0.041	0.100	-0.146	0.104	**-0.275***	**0.369****	**0.399****	**0.378****	**0.410*****
Observations	714	713	714	713	352	353	352	353	362	360	362	360

*** p<0.01, ** p<0.05, * p<0.1

Chapter 4

The Effects of Health Insurance on Investment Portfolios: Evidence from Seguro Popular in Mexico, 2008 to 2012[57]

4.1 Introduction

Health insurance and the public provision of health services have been important topics of study in the development economics literature. Improving the health status of the population and reducing the risks that it faces from health problems can potentially increase welfare, as well as productivity. In recent years, support for the expansion of universal health coverage has combined two main goals in the health provision agenda: provision of health services and financial protection from high out-of-pocket health care costs.

Research findings in this area suggest that the provision of public health services improves the overall health status of the population; and in particular, publicly funded health insurance reduces the risks faced by households (Escobar, Griffin and Shaw, 2011; Barros, 2008; Grogger et al., 2014). Other important findings in this area show that access to health insurance increases employment levels and wages in a developed country setting (Gruber and Hanratty, 1995), while public health insurance programs can

[57] This Chapter was written in collaboration with Santiago Bazdresch, Research Economist, Banco de México.

contribute to decrease informal employment in developing countries (Aterido et al., 2011; Bosch et al., 2010; Camacho et al., 2009).

The effects of public and private health insurance on savings have been extensively studied, framed into the precautionary savings literature.[58] Bai and Wu (2014) show that the implementation of the *New Cooperative Medical Scheme* in rural China increased the nonmedical-related consumption of the households by five percent. Chou et al. (2003) estimated that the *National Health Insurance Program* in Taiwan decreased household's savings by 8.6-13.7 percent.[59]. Kirdruang and Glewwe (2017) found no evidence of a decrease in savings with the introduction of the *Universal Healthcare Coverage Scheme* in Thailand. However, she estimated positive effects of the program on savings in the long run.

In a developed country setting, Starr-McCluer (1996) analyzed the impact of private health insurance in the U.S. on savings and found evidence that contradicted the argument that there is a decrease in savings when households have access to health insurance. She found a positive and significant relationship between wealth (measured as liquid or financial assets)[60] and insurance coverage.

While a large body of literature studies the impact of different health insurance systems on households' savings, this Chapter aims to look into the question of long term effects of these policies by studying changes in the investment behavior of households benefited from these programs. Intuitively, access to health insurance changes the profile

[58] In general, precautionary savings are defined to be the savings that an agent makes in order to smooth out the uncertainty around expected future income or expenditure. In standard economic theory, the agent engages in precautionary savings because he or she cannot directly buy insurance that will protect him or her from shocks at a reasonably low price. In these standard models, a reduction in the riskiness of net income, which would result from the introduction, *ceteris paribus,* of retirement insurance or health insurance, leads to a reduction in precautionary savings. Carroll and Kimball (2008) provided a recent summary of the state of the literature.
Theoretical studies on precautionary savings include Leland (1968), Kotlikoff (1989) and Kimball (1990), among others.
[59] The *National Health Insurance* Program in Taiwan is the only health insurance option in the country.
[60] The liquid assets measured include cash, checking accounts, savings accounts, and savings bonds, among others; the financial assets measured include liquid assets plus stocks, bonds, mutual funds, and retirement accounts, among others. The latter measure requires a well-developed financial market.

of risks that households face, and therefore changes how much savings they will need to self-insure and also what types of investments they allocate their savings to. In particular, access to insurance potentially allows households to allocate their savings to 'better' investments. To the extent that these investments have high returns such as investments in education, the provision of public health insurance can have a potentially large impact on long run economic development.

In particular, this Chapter estimates the effect on households of receiving access to a publically funded health insurance system on the type of investments they allocate their savings to. The Chapter characterizes a number of household's expenditures as being liquid investments, useful for insurance purposes, and other, less liquid investments. The main hypothesis of the Chapter is that, upon obtaining access to public health insurance, households will decrease(increase) the fraction of their savings that they allocate to liquid(illiquid) assets. Following the finance literature on liquidity, in this Chapter liquid assets correspond to low return assets and illiquid assets to high return assets.[61]

With this classification, this Chapter studies whether there is a measurable effect of the introduction of *Seguro Popular*, a large subsidized health insurance program, on the allocation of savings to different types of investment by using income and expenditure data from Mexico's ENIGH household survey from 2008 to 2012. This research has advantages and disadvantages. ENIGH includes tens of thousands of observations in each round, which allows parsing the sample in multiple ways. However, ENIGH is not a panel, therefore this Chapter uses logistic regressions to infer the household participation in different health insurance categories over time in order to apply a difference in differences empirical strategy. The results suggest that there is a statistically and economically significant change in the allocation of investment from liquid, low return investments to illiquid, high return investments (especially human

[61] For example, rates or return to investment in education are estimated to be on the order of 25 percent (Psacharopoulos and Patrinos, 2004) in some cases, while, considering inflation and the risk of theft or other physical loss imply that the return to savings in cash is likely to be a negative number.

capital investment) for households that enrolled in *Seguro Popular*, compared to uninsured households.

The rest of this Chapter proceeds as follows. Section 4.2 describes the *Seguro Popular* program in the context of Mexico's health care system. Section 4.3 develops a model of consumption under uncertainty that will be used to interpret the empirical results. Section 4.4 describes the bi-annual survey data used in the Chapter. Section 4.5 explains the empirical procedure, focusing in particular on how the change in status from non-participation to enrollment in *Seguro Popular* is inferred. Section 4.6 presents the results of the Chapter. Section 4.7 describes what can be concluded from the results of the study, and under which assumptions.

4.2 Background on Mexico's Health Care System

The right to receive medical treatment is guaranteed by the Mexican Constitution (Article 4),[62] and medical care is regulated by the *Ley General de la Salud* (General Health Law). Consequently, the Mexican population is entitled, by law, to have access to health services, and the state has to provide health care. In 2000, 58.6 percent of the Mexican population was uninsured. Two years later, in 2002, the government started a pilot program of a subsidized health insurance program called *Seguro Popular*. In 2004 the program was established as national policy and by 2006 the program was present in all Mexican states. By 2013, 45 percent of the population was covered by this universal health insurance program, while 21.5 percent remained uninsured.

In 2000, access to health care was unequal, not only geographically but also socioeconomically. In 2002, federal health spending was 45 percent of all health care spending in Mexico. Out-of-pocket payments accounted for an additional 52 percent of

[62] "*Every person has a right to receive medical treatment when deemed as necessary. The law shall not only define the guiding criteria regulating the access to health services but also establish concurrent activities to be carried out by the federation and the states in organizing public health services under article 73, paragraph XVI of this Constitution.*"
http://www.juridicas.unam.mx/infjur/leg/constmex/pdf/consting.pdf

health care spending; the remaining three percent came from private health insurance (Secretaría de Salud, 2005).

The World Health Report 2000 identified a major problem in Mexico regarding catastrophic health spending (Gakidou et al, 2006). In 2002, the out-of-pocket health payments of low income households averaged 6.8 percent of their income, while for high income households it represented 2.2 percent of their income (Secretaría de Salud, 2005). The lack of access to health care, the inequality of access, and the aim to protect the population against catastrophic health expenditures, led the government to establish the System for Social Protection in Health in November 2002 (*Sistema de Protección Social en Salud); Seguro Popular* is one of its components.

In 2002, *Seguro Popular* started as a pilot in 26 municipalities in five states: Aguascalientes, Campeche, Colima, Jalisco, and Tabasco. Through a reform of the General Health Law in 2004, *Seguro Popular* was established as a national policy. Geographic coverage across the country and the inclusion of different socioeconomic groups was gradually incorporated. By 2006, the program was present in all the Mexican states (1,584 out of 2,454 municipalities).

The goal of the program was to provide health insurance to the population that was not previously covered by the Social Security system by 2012. Coverage of *Seguro Popular* has increased dramatically over time (Figure 4.1). When the pilot program ended in December 2003, it covered 2.2 million people. By the end of 2013, as a national policy with voluntary enrollment, it covered 55.6 million people of all income levels (45 percent of the population). On the other hand, 21.5 percent of the population remained uninsured.

In order to be eligible for *Seguro Popular*, families cannot receive any other health insurance benefits provided by the Social Security system. Affiliation to *Seguro Popular* is requested by the head of the household and it is granted for one year to families in the highest income deciles, for the case of families from low income deciles, affiliation is granted for a three-year period (CONEVAL, 2014). In addition, *Seguro*

Popular has extended coverage of young adults and the elderly compared to other insurance programs provided by the Social Security system.[63]

Table 4.1 shows the annual fee that each household must pay to be enrolled in *Seguro Popular*. Fees are determined by the *Comisión Nacional de Protección en Salud,* based on socioeconomic information which is used to estimate the household income level. From 2008 to 2012, the annual fees were kept constant. The lowest four income deciles do not pay a fee, while the wealthier deciles pay annual fees that range from MX$2,075 (1.6 percent of the per capita GDP) to MX$11,374 (8.6 percent of the per capita GDP).

Since 2012, *Seguro Popular* has been the main source of health insurance for Mexican households. According to CONEVAL (2013), [64] from 2010 to 2012 the proportion of households covered by *Seguro Popular* increased from 30.5 to 40.8 percent, as shown in Figure 4.2.[65] The other health insurance sources available in Mexico are: IMSS, ISSSTE, PEMEX and private health insurance; ISSSTE, ISSSTE-Estatal and PEMEX are types of health insurance for public workers. Despite the effort of the government to make health insurance available to all Mexican households, as of 2012, 21.5 percent of the population was still not covered by any type of health insurance. [66]

According to the World Development Indicators, real health expenditure per capita in Mexico has increased by more than 80 percent in one decade, from US$ 584.2

[63] While the Social Security system covers children up to 16, or up to 25 if disabled or studying, *Seguro Popular*'s coverage extends to children under 18, or up to 25 if single, students, or economically dependent and living in the same dwelling. *Seguro Popular* also covers the parents (65 or older) of the head of the household or of his or her spouse if they are economically dependent and living in the same dwelling (Aterido et al., 2011)

[64]http://www.coneval.gob.mx/rw/resource/coneval/med_pobreza/Acceso_a_los_servicios_de_salud_Censo_2010/Carencia_a_los_servicios_de_salud_2010.pdf

[65] Measuring the proportion of the population covered by *Seguro Popular* varies by institutions. For the case of the number of persons and households participating in *Seguro Popular* reported in Figure 4.1, administrative records from *Seguro Popular* were used. On the other hand, CONEVAL measures enrollment using the section of socioeconomic characteristics of ENIGH.

[66] As discussed in the latest results report of the National Health and Nutrition Survey (ENSANUT), a new challenge will be to increase coverage targeting the young adults not attending school who have not been able to enter the formal labor market, given that they lose the right of coverage through their parents (Gutiérrez et al., 2012).

in 2002 to US$1,061.9 in 2012. [67] Total health expenditure is around six percent of the GDP, but public health expenditure as a proportion of total health expenditure has increased from 43.8 percent in 2002, to 51.8 percent in 2012. During this time, private health expenditure has remained constant at around 3.2 percent of the GDP. *Seguro Popular* currently represents 60 percent of the federal government's expenditure on health (around 0.5 percent of the GDP in 2014).

In summary, Mexico has spent a significant amount of resources to provide access to health care to the population that was uninsured before 2000. In 2002, the pilot of *Seguro Popular* was launched in five states; by 2005, the program was a national policy and was present in all states in Mexico. Since 2012, *Seguro Popular* has been the single largest source of health insurance in Mexico, with more than 55 million people affiliated.

4.3 Conceptual Framework

This Chapter studies the household's investment decisions subject to uncertainty, in terms of their choice to invest in liquid, low return assets, or illiquid, high return assets. This section describes a simple, two period model of consumption and investment that serves as a conceptual framework. The objective of this section is to present the problem of a risk averse, financially constrained agent who faces uncertainty about the shock he or she will face in the short run, i.e. period 1.

Our agent makes investment decisions in period 0 and consumes in two periods: period 1 which stands for the short run, and period 2 which stands for the long run. The agent is endowed with wealth W in period 0 and has access to two investment technologies to transfer this wealth into periods 1 and 2 for consumption. She invests A_L on a liquid type of investment (e.g. cash), which she can use for consumption in period 1. She invests the rest, $A_I = W - A_L$, in an illiquid type of investment (e.g. education), which she can use only in period 2. The liquid investment pays her returns $R_L=0$, the illiquid asset pays her higher returns $R_I > R_L$. Crucially, the agent is financially constrained, in the

[67] Values in constant 2005 international dollars.

sense that she cannot borrow in period 1 using her income from her A_I investment to pay back the loan (e.g. while she is a student, she cannot consume out of the returns of her investment in education).

The agent faces an income shock ξ in period 1 (eg. anything from a negative shock like a costly medical emergency to a positive shock like obtaining an improved treatment for a chronic condition). The shock has mean zero (0) and variance σ and we denote its distribution with F. When the shock is negative (ξ <0) the agent has more expenses than she expected. When the shock is positive (ξ >0) the agent has more wealth than she expected. Because the agent is credit constrained, her consumption in period 1 is limited by her investment in liquid assets plus the income shock: $C_1 \leq A_L + \xi$. For simplicity it is assumed that, in period 1, the agent consumes all the liquid assets available in that period, i.e. $C_1 = A_L + \xi$. (e.g. while she is a student, the agent doesn't save cash for the future).

Analytically, the agent's problem is to maximize the expected value of the sum of the first and second period utilities:

$$\max_{A_L, A_I} V = E_\xi[U(C_1) + \beta U(C_2)], \tag{4.1}$$

where it is assumed that U is strictly increasing and concave, and $0 < \beta < 1$ is the discount factor that reflects the passage of time. The agent maximizes this expected utility subject to the following constraints:

$$W = A_L + A_I \tag{4.2}$$

$$C_1 = A_L + \xi, \text{ with } \xi \sim F(0, \sigma) \tag{4.3}$$

$$C_2 = R_H * A_I \tag{4.4}$$

$$A_L \geq 0, A_I \geq 0 \tag{4.5}$$

The first constraint describes the fact that the agent has a limited amount of resources to invest for the future. She splits her wealth between the two possible

investments A_L and A_I. The second constraint describes the simplification that the agent's consumption in period 1 is equal to the sum of the liquid investment which she can dispose of and the income shock. The third row describes consumption in period 2 as the income that the agent receives from her illiquid investment, and the last constraint describes the idea that the agent cannot have a negative investment in any of the two periods.

To solve the model, we assume a Constant Absolute Risk Aversion (CARA) utility function, with $\gamma > 0$:

$$U(C) = -exp^{-\gamma C} \tag{4.6}$$

As the shock ξ is distributed as a normal with mean 0 and variance σ, the expected value of the agent's utility can be expressed as:

$$E[U(C_1)] = E\left[-exp^{-\gamma(A_L+\xi)}\right] \tag{4.7}$$

$$= -exp^{-\gamma A_L} exp^{-\gamma\mu+\frac{1}{2}\gamma^2\sigma^2}$$

Given that $U(C_2)$ does not depend on the shock, the initial budget constraint can be used to rewrite the agent's problem as:

$$\max_{A_L} V = -exp^{-\gamma A_L} exp^{+\frac{1}{2}\gamma^2\sigma^2} - \beta exp^{-\gamma(R_H(W-A_L))} \tag{4.8}$$

The first order condition with respect to A_L can be expressed as:

$$\frac{\partial U}{\partial A_L} = \gamma exp^{-\gamma A_L} exp^{+\frac{1}{2}\gamma^2\sigma^2} - \beta\gamma R_H exp^{-\gamma\left(R_H(W-A_L)\right)} = 0, \tag{4.9}$$

which is equivalent to:

$$-\gamma A_L + \frac{1}{2}\gamma^2\sigma^2 = ln(\beta R_H) - \gamma(R_H(W - A_L)) \tag{4.10}$$

Finally, the optimal level of investment in liquid assets (A_L^*) is given by:

$$A_L{}^* = \frac{\frac{1}{2}\gamma\sigma^2 - \frac{1}{\gamma}Ln(\beta R_H) + R_H W}{1+R_H} \qquad (4.11)$$

Our interest lies on the effect of the volatility of the shock on the fraction of income invested in the liquid assets $\alpha_L = A_L/W$. Intuitively, the agent will react to an increase in income risk in a period by allocating more savings for consumption in that period. We can show this by differentiating A_L^* with respect to σ^2, which gives us the direction of the effect:

$$\frac{\partial A_L}{\partial \sigma^2} = \frac{\frac{1}{2}\gamma}{W(1+R_H)} > 0 \qquad (4.12)$$

The agent's investment in liquid assets depends positively on the amount of risk she faces in period 1. Therefore, in response to higher period 1 volatility, the agent protects herself by allocating more of his consumption to that period, saving less at the high-return rate along the way.

The intuition is related to the precautionary savings motive. In this case it is a precautionary motive for liquidity as described originally by Keynes (1936)[68]. Utility functions that have the property that increased riskiness in a period's consumption leads the agent to increase the savings that she allocates to that period, are said to exhibit "prudence". It can be described analytically as a convex marginal utility, or equivalently as a positive third order derivative of utility. A convex marginal utility implies that the expected marginal utility of a risky consumption level is higher than the marginal utility of the expected consumption, and therefore in any setting where the agent is equalizing marginal utilities across periods, an increase in riskiness of consumption in a period will lead to an increase on the optimal allocation of consumption to that period.

[68] The original text reads that one of the motives for holding money is to "provide for contingencies requiring sudden expenditure and for unforeseen opportunities of advantageous purchases", (p.196).

The assumption of a utility function that displays prudence is relatively weak in the sense that both CARA and CRRA utility functions exhibit this property. Indeed, any increasing and concave utility function with decreasing absolute risk aversion displays prudence since $\frac{d\left(-\frac{u''}{u'}\right)}{dc} < 0 \Leftrightarrow -\frac{u'''}{u''} > -\frac{u''}{u'}$, but $-\frac{u''}{u'} > 0$ by assumption.

4.4 Data

4.4.1 Mexican National Household Income and Expenditure Surveys

This Chapter uses two rounds of the *Mexican National Household Income and Expenditure Surveys* (abbreviated as ENIGH for its name in Spanish), Mexico's main household survey of income and expenditure, which has been implemented since 1984 by the National Institute of Statistics and Geography (INEGI). The survey is conducted every two years and is representative at the national level. It includes three units of analysis: dwellings, households, and persons. The different sections of the questionnaire provide detailed information about household income and expenditure, dwelling characteristics, and demographic variables and information on income and social security contributions for each household member. See Appendix 2 for details and sections of the survey.

A new methodology for the ENIGH was introduced in 2008, which includes a health module for each household member. Questions regarding enrollment in *Seguro Popular* were introduced in 2006, but additional questions about other health insurance alternatives and medical attention were added in 2008. This analysis uses two rounds of ENIGH: 2008 and 2012. ENIGHs are repeated cross-sections rather than a panel, and the number of households surveyed varies from year to year: 24,468 households in 2008, and 9,002 in 2012. [69]

[69] The number of households surveyed in 2012 is smaller because in previous years the sample was expanded to make it representative at the state level. See Appendix 2 for more details.

4.4.2 Health Insurance Measures

Different measures of access to health insurance were computed from the ENIGH data. Enrollment in *Seguro Popular* is measured at the household level. For this purpose, the proportion of household members enrolled in *Seguro Popular* was computed. Then, to identify households with other types of health insurance, or uninsured households, we used the question regarding enrollment in another health care provider; the options included IMSS, ISSSTE, PEMEX, and others. This information was used to calculate the proportion of household members enrolled in other types of health insurance.

Then households were classified as beneficiaries of the program if more than half of the members of the household were enrolled in *Seguro Popular*. In contrast, when more than half of the household members were enrolled with any of the other health insurance providers, the household was considered as receiving other types of health insurance.

Table 4.2 shows the evolution of the proportion of households classified in the different types of health insurance by year and income level. From now on, low-income households are defined as those households in the first four expenditure deciles. This definition takes into account the fact that households in this group do not have to pay an annual fee to be enrolled in *Seguro Popular*. It is evident that *Seguro Popular* has expanded during the period. In 2008, 17.5 percent of the households were enrolled in *Seguro Popular*, while by 2012 that number reached 38.7 percent. In the case of low income households, the proportion of households enrolled in *Seguro Popular* increased form 27.2 percent in 2008 to 55.2 percent in 2012.

On the other hand, the proportion of households with different types of health insurance and uninsured households decreased during the 2008-2012 period. In 2008, households with other state-funded or private health insurance represented 43.5 percent, while by 2012 that number decreased to 37.4 percent. The proportion of low income households receiving other types of health insurance decreased from 25.6 percent in 2008 to 19.6 in 2012. From 2008 to 2012, the proportion of uninsured households of all income

levels decreased from 39.1 percent to 23.9 percent; the percentage of uninsured low-income households decreased from 47.2 percent to 25.2 percent in the same period.

4.4.3 Investment Measures

This section describes the assumptions about liquid/low return and illiquid/high return assets of households used in this Chapter. The expenditure variables included in the ENIGH could be reported daily, monthly, quarterly, semi-annually, or annually; for comparability purposes, all investment and savings measures were annualized.

Household expenditures on assets are classified as illiquid when the acquired assets cannot be easily transformed into cash. Investment in human capital, durable assets, and high return savings are included in this category. Human capital investment consists of expenditures on education, which includes expenses on tuition, fees, educational materials, education services, and uniforms. For example, this Chapter deems all human capital investments as illiquid. It is difficult to cash in a high-school degree or other education credentials to pay for an unexpected health event. Investment in durable assets includes mortgage payments and acquisition of vehicles; for these assets this Chapter assumes that it is difficult to transform construction improvements, past mortgage payments or small business investments into cash. Finally, high return savings consist of payments of debts and credit card debts.

On the other hand, household expenditures are classified as liquid by assessing which assets can be easily transformed into cash to pay for an unexpected health event. Consumer durable goods, expenses targeted to strengthen networks, and low return savings are included in this category. Consumer durable goods investment consists of expenses on a list of domestic appliances[70] that can be considered to be liquid assets, as they can be easily sold or given to a pawn shop. Different types of investments targeted to strengthen the household's network are included in the liquid investment category such

[70] Includes expenses on various items such as: fan, telephone, AC units, sewing machine, stove, refrigerator, blender, mixer, iron, juicer, microwave, washing machine, vacuum, water heater, lamps, toasters, beds, dining tables, chairs, carpets, rugs, book shelves, and bicycles, among others.

as expenditures on community events and gifts and loans to friends and family. A strong network could support the household in the eventuality of a medical emergency in different ways: company, taking care of children and elders, and lending money, among others. Expenditures in this category can also be thought of as a form of social insurance. Finally, low return savings includes deposits at formal and informal institutions.

The total level of investment is defined as the sum of all the investment and savings measures for each household. Our interest lies in how the proportion of different types of investment changes when households gain access to *Seguro Popular*. For this purpose, the proportion of each type of investment or savings relative to the total level of investment of each household is defined as:

$$PropInv_i = \frac{Inv_i}{\sum_{j=1}^{n} Inv_j} \tag{4.13}$$

where *i* refers to a specific type of investment and *j* stands for the different types of investments and savings.

Table 4.3 shows the evolution of the proportion of each type of investment or savings for the all households and for low income households. Regarding the illiquid investments, human capital is the main form of investment of Mexican households for all periods. It represents around 40 percent of total investment, and it represents a larger proportion of the total investment for low income households. Investment in durable assets, such as buying a house or a car, represents around five percent of the total investment for all households and less than two percent for low income households. The high return savings represents around eleven percent of the total level of investment for all households throughout the period, and fluctuates between 6.2 and 7.4 percent for low income households.

On the other hand, illiquid investment measures represented less than 48 percent in all periods and for both groups. The main form of investment in this category is strengthening the household network, which decreased from 17.9 percent in 2008 to 16.2 percent in 2012 for all households and from 22.1 percent to 18.6 percent for low income

households. The proportion of investment in consumer durable goods fluctuates around 11.5 percent for all households, while it represents around 14 percent of the total investment of low income households. Finally, the measure of low return savings increased for both groups during the analyzed period. It increased from 9.5 percent in 2008 to 15.9 percent in 2012 for all households and from 7.2 percent to 14.9 percent for low income households

4.4.4 Individual and Household Characteristics

Table 4.4 presents summary statistics of the household and individual variables used in the analysis. The first set of variables includes characteristics of the head of the household. In 2012, the household heads of households with *Seguro Popular* were the youngest and with the lowest levels of educational attainment, compared to uninsured households and households with other types of health insurance. In contrast, the largest proportion of female household heads was found in the uninsured group.

A second set of variables are related to the household characteristics, which include: composition of the household, geographic location, [71] labor markets, educational characteristics, and participation in *Oportunidades*.[72] The first group of variables is related to the composition of the household. In 2012, households enrolled in *Seguro Popular* were larger (4.56 members on average) and had more children under the age of 18 than households with other types of health insurance or uninsured households. In contrast, households with other types of health insurance had more household members aged 65 years or more, than households receiving *Seguro Popular* or uninsured households.

In 2012, most households with other types of health insurance, or uninsured resided in urban areas (93 and 84 percent, respectively), while just 63 percent of

[71] According to INEGI, a household is classified as urban if it resides in cities with more than 2,500 inhabitants; otherwise it is classified as rural.

[72] *Oportunidades* is the main anti-poverty program of the Mexican government. We identify households with *Oportunidades* through the education questions. The survey asked children who were enrolled in school, if the received a scholarship; if so, they identify which institution gave them the scholarship. *Oportunidades* was the main sponsor of education scholarships during the analyzed period.

households enrolled in *Seguro Popular* lived in urban areas. Households with other types of health insurance have the largest proportion of formal workers (52 percent), followed by uninsured households (16 percent) and households enrolled in *Seguro Popular* (9 percent).

The proportion of children enrolled in school was largest for households with other types of health insurance (76 percent) than for households enrolled with *Seguro Popular* (71 percent) and uninsured households (67 percent). In contrast, participation in *Oportunidades* differed between households receiving *Seguro Popular* (24 percent) and households with other types of health insurance (2 percent) or uninsured households (5 percent).

In addition to the head of the household and household characteristics, this Chapter used expenditure data for each year to classify each household into deciles.[73]

4.5 Empirical Strategy

To estimate the effect of *Seguro Popular* on household investment and savings decisions, the ideal dataset would be a panel with baseline data before the implementation of the program. A dataset with these characteristics allows for differences-in-differences analysis, and does not require strong assumptions regarding which households self-select into the program (selection on unobservable characteristics). Unfortunately, this type of data does not exist. [74]

As mentioned before, the most comprehensive income and expenditure household survey in Mexico is ENIGH. The question in this survey regarding affiliation with *Seguro Popular* was introduced in 2006, and the questions about other types of health insurance were introduced in 2008. Therefore, our analysis will be restricted to the period from

[73] The expenditure deciles were computed for each survey year using the total and per capita income and expenditure values.
[74] Another comprehensive dataset is the Mexican Family Life Survey (MXFLS) which has information of the demographic and socioeconomic characteristics of the Mexican families, as well as data on health, health insurance options, and expenditure. Unfortunately, it does not have detailed information regarding savings flows.

2008 to 2012. Although *Seguro Popular* was an existing and functional program in 2008, the number of persons enrolled in *Seguro Popular* doubled during the period of interest; increasing from 27.2 million persons enrolled in 2008 to 52.9 million persons in 2012.

4.5.1. Effects of Seguro Popular on Investment and Savings using Ordinary Least Squares Analysis

This Chapter first estimates the effect of *Seguro Popular* on different types of investment and savings. To do this, we use the following specification:

$$PropInv_{ijkt} = \vartheta_0 + \beta_1 PropSP_{jkt} + \beta_2 PropOHI_{jkt} + \sum_{l=1}^{n} \rho_1 X_{ljkt} + \tau_k + \varepsilon_{ijkt} \quad (4.14)$$

where *i* indexes the type of investment, *j* indexes the household, *k* indexes the geographic region, and *t* indexes the year.

The dependent variable, *PropInv,* corresponds to one of the *i* types of investment which are measured as a proportion of total investment. The $PropSP$ variable represents the proportion of household members enrolled in *Seguro Popular*. Similarly, *PropOHI* represents the proportion of household members receiving other types of health insurance; households without health insurance are the reference category. *X* is a vector of characteristics of the head of the household and of the household, such us gender, age, educational attainment and employment status of the head of the household, urban status of the household, number of household members, proportion of income earners who are informal workers, participation in *Oportunidades*, and dummy variables for the type of household: one-person household, nuclear family household, or extended family household. The variable τ_k allows for state-specific fixed effects and ε_{ijkt} is an error term.

The coefficient of interest is β_1, which captures the effect of an increase of the coverage of *Seguro Popular* on investment and savings (relative to households without insurance). The model developed in section 4.3 suggests that households facing less risk will allocate a smaller proportion of their investments into liquid assets (consumer durable goods, networks, and low return savings); while the effect for the case of high

return, illiquid assets is expected to be positive (human capital, durable assets, and high return savings).

4.5.2. Effects of Seguro Popular on Investment and Savings using Difference in Difference Analysis

The gradual introduction of *Seguro Popular* in Mexico allows one to exploit the variation of prior lacks health insurance to understand the immediate effects of this health policy on household investment and saving behaviors. For this purpose, the difference-in-differences (DID) framework is used.

We tested the parallel trends assumption using data from 2000, 2002, and 2004. The results suggest that there were no significant differences in the changes in investment and savings measures within uninsured groups of households before Seguro Popular was established. We excluded insured households, which correspond to those households whose head of the households or working-age adults had health insurance as one of the benefits from his/her job. The compared groups were: agricultural vs. non-agricultural workers, and self-employed vs. employed households. Traditionally, the agricultural sector lack of social security and health insurance. The investment measures used for this test are the same as the ones described in section 4.4.3. See Appendix 3 for a graphic representation of the process.

Changes in the behavior of the control group capture any systematic factors unrelated to the program, while changes in the treatment group capture both those some systematic factors and the impact of *Seguro Popular*. The following equation will be estimated for each *PropInv*:

$$PropInv_{ijkt} = \vartheta_0 + \beta_1 OHI_{jk} + \beta_2 SP_{jk} + \beta_3 NewSP_{jk} + \gamma T + \delta NewSP_{jkt} * T + \sum_{l=1}^{n} \rho_1 X_{ljkt} + \tau_k + \varepsilon_{ijkt} \quad (4.15)$$

where *i* indexes the type of investment, *j* indexes the household, *k* indexes the geographic region and *t* indexes the year. *OHI* is a dummy variable to identify households with other types of health insurance and *SP* is a dummy variable to identify households that

participated in *Seguro Popular* during the whole period. *NewSP* is a dummy variable that identifies households in the treatment group, those that were uninsured in 2008 and by 2012 were enrolled in *Seguro Popular*. Households that were uninsured during the 2008-2012 period are the reference category. A dummy variable for the year 2012 is represented by *T*. The dependent variable, *PropInv,* the additional controls (*X*) and the state fixed effects are described in subsection 4.5.1. ε_{ijkt} is an error term.

The interaction between *NewSP* and *T* captures the early impact of access to *Seguro Popular*. Thus, the coefficient of interest is δ, which captures the program effect. Following the results of the model developed in section 4.3, it is expected that δ would be negative when analyzing the low return investment measures. On the other hand, when analyzing the effects of access to *Seguro Popular* on human capital, durable assets, or high return savings, the sign of δ is expected to be positive.

4.5.3. Identification of the Treatment and Control Groups

In order to perform the DID analysis in equation (14), it is necessary to classify the households into treatment and control groups. This section describes the procedure carried out to classify households into these groups.

The first step performed was to classify the sample into two groups: households that were the potential target of *Seguro Popular* and those households that had other types of health insurance. This Chapter assumes that the quality of the other health insurance options available in Mexico was better than the quality of *Seguro Popular* services[75], thus it is not expected for households to switch from other types of health insurance to be enrolled with *Seguro Popular.*

In the ENIGH data, it is possible to observe whether each household was affiliated with *Seguro Popular,* other healthcare institutions, or was uninsured.

[75] A recent report from CONEVAL shows that although the number of beneficiaries of *Seguro Popular* has increased in the past years, the infrastructure, number of doctors and supplies has not increased at the same rate (see Table 7, pp34. in the report). In addition, the proportion of persons that did not get medical care when needed is higher for persons affiliated to *Seguro Popular* than for those with other types of health insurance (Figure 12, pp56.). (CONEVAL, 2014)

Households affiliated with *Seguro Popular* and uninsured households are defined as the potential targets of *Seguro Popular*, as shown in Figure 4.3a.

The second step was to classify households into permanently uninsured households (U), new to *Seguro Popular* (NewSP), and permanently affiliated to *Seguro Popular* (SP). This is a challenge in this setting because the data is not a panel. It does not follow households over time. Therefore, it is necessary to infer for the uninsured households in 2008, whether they were affiliated to *Seguro Popular* in 2012 (Figure 4.3b), and for households affiliated with *Seguro Popular* in 2012, whether they were uninsured in 2008 (Figure 4.3c).

To estimate the coefficients, we use logistic regressions which are described in detailed in the following sections.

4.5.3.1. Identification of Potential Participants in 2008

In order to identify the pool of potential participants in the 2008 sample, a logistic regression predicting the probability of participation in *Seguro Popular* in 2012 was estimated. Then, the predicted probabilities of participation for 2008 were used to classify the group of uninsured households in 2008 into: i) always uninsured and ii) new to *Seguro Popular*, as shown in Figure 4.3b.

Assuming that by 2012 all of the eligible households that wanted to participate in *Seguro Popular* were already affiliated, a logistic model was estimated to predict the probability of participation in *Seguro Popular* in 2012. In the sample, households with other types of health insurances were excluded. The set of control variables includes characteristics of the head of the household such as gender, age, educational attainment, and labor market characteristics (informality or self-employment) and household composition variables such as number of household members, women of childbearing age, household members (17 or 18 years old), number of children enrolled in school, proportion of informal workers in the household, participation in *Oportunidades*, a dichotomous variable identifying one-person households, and the proportion of

household members with other types of health insurance. The results of the logistic model are reported in Appendix 4, Table A.8.

$Prob(\widehat{Part._{SP}})$ is the predicted probability of enrollment in *Seguro Popular,* using the 2012 characteristics. Using this predicted probability in the 2008 sample of uninsured households, households were classified into two categories: households that were always uninsured, and households that were potential participants of *Seguro Popular*. The selected threshold value corresponds to the predicted probability that maintains a constant proportion of uninsured households in 2008 and 2012 (27.2 percent).

In summary, households in the 2008 sample were classified into three groups: i) households that always had *Seguro Popular* (households classified as been enrolled in Seguro Popular are the ones in this group), ii) potential participants in *Seguro Popular (*the group of households that were uninsured in 2008 but were probably enrolled in *Seguro Popular* by 2012), and iii) always uninsured households (the group of households that were uninsured in 2008 and probably remained uninsured in 2012). Households with other types of health insurance remained classified as such.

4.5.3.2. Identification of Permanent Participants of Seguro Popular in 2012

In order to identify the households enrolled in *Seguro Popular* during the whole period, a logistic regression predicting the probability of participation in *Seguro Popular* in 2008 was estimated. Then, the predicted probabilities of participation in the 2012 sample were used to classify households with *Seguro Popular* in 2012 into households with permanent access to *Seguro Popular* and households new to *Seguro Popular*.

This logistic regression was estimated for the group of households that from the results of the previous section were classified as potential participants and households enrolled in *Seguro Popular* in 2008, as shown in Figure 4.3c. The set of control variables used in the analysis is the same as the one described in section 4.5.3.1 in addition to state fixed effects (with Mexico City as the reference category). The results of the logistic regression are reported in Appendix 4, Table A.7.

$Prob(\widehat{Perm_{SP}})$ is the predicted probability of enrollment in *Seguro Popular,* using the 2008 characteristics. Using this predicted probability in the sample of households enrolled in *Seguro Popular* in 2012, households were classified into two categories: households with permanent affiliation with *Seguro Popular,* and households that entered *Seguro Popular* between 2008 and 2012. The selected threshold value corresponds to the predicted probability that let us maintain a constant proportion of households with permanent access to *Seguro Popular* in 2008 and 2012 (16.9 percent).

By using the logistic model, we were able to classify the households into three groups: i) households that always had *Seguro Popular* (the group of households that were probably enrolled in *Seguro Popular* in 2008 and remained enrolled in 2012) , ii) new participants in *Seguro Popular* (the group of households that were uninsured and potential participants in 2008 and were enrolled in *Seguro Popular* by 2012), and iii) always uninsured households (households classified as uninsured in 2012 are the ones in this group). Households with other types of health insurance remained classified as such.

In summary, these two logistic specifications allow us to classify households into four categories: i) households with other types of health insurance (OHI), ii) households that were uninsured throughout the period (U), iii) households affiliated with *Seguro Popular* throughout the period (SP), and iv) households that entered *Seguro Popular* between 2008 and 2012 (NewSP), as shown in Figure 4.3d.

The same procedure was implemented excluding households that participate in *Oportunidades,* given that most of those households are enrolled with *Seguro Popular* as part of the program benefits. The results of the logistic regression for this subsample are reported in Appendix 4, Tables A.6 and A.9, and column 2.[76]

[76] In order to perform sensitivity analysis, the same procedure was carried out but using an alternative definition of household enrollment to *Seguro Popular*. In this case the affiliation to *Seguro Popular*, other types of health insurance or uninsured was taken from the head of the household's health insurance affiliation status.

4.6 Results

The results suggest that households enrolled in *Seguro Popular* between 2008 and 2012 reduced the proportion of their investment in liquid, low return investments, compared to uninsured households. Low return investments include: consumer durable goods, expenses targeted to strengthen networks, and low return savings (which are described in detail in section 4.4.3). Additional estimation excluding households participating in *Oportunidades* were performed too, the results show that this decrease in liquid investment translates into a larger proportion of total investment in human capital. The empirical analysis is restricted to households whose head was between 25 to 65 years and had not yet retired.

4.6.1 OLS Estimates of the Effect of Enrollment in Seguro Popular on Investment and Savings

The OLS estimates of equation (13), which measure the effect of a change in the proportion of household members enrolled in *Seguro Popular* on the different investment and savings measures, are presented in Tables 4.5a.and 4.5b. The tables report the coefficients of the effect of increasing the proportion of the household members affiliated with *Seguro Popular* on the different types of investment, for three different groups: all households, low income households, and rural households. Table 4.5a summarizes the coefficients of interest for the whole sample, while the results summarized in Table 4.5b exclude households participating in *Oportunidades*.

The OLS estimates indicate that *Seguro Popular* negatively affects investment in liquid, low return assets. Moreover, the trade-off between low and high return assets is mainly explained by a decrease in the proportion of the investment allocated to social capital, low return savings or human capital. An increase in the proportion of household members enrolled in *Seguro Popular* decreases the proportion of the investment allocated to low return assets by 1.11 percent in both specifications. The effect is larger for low income and rural households, with an estimated significant decrease of 3.35 percent for

low income households in the whole sample and 4.38 percent for low income households excluding households participating in *Oportunidades*.

Investment in the household network and low return savings is negatively related to the proportion of members of the households enrolled in *Seguro Popular.* The effect in strengthening networks investment is negative and significant for low income households. The effect is larger when excluding households participating in *Oportunidades* (-2.12 percent vs. -1.79 percent). On the other hand, the effect of Seguro Popular on low return savings is negative and significant when analyzing all households. For this measure, the effect is also larger when excluding households participating in *Oportunidades* (-1.16 percent vs. -1.07 percent). The effect on consumer durable goods is ambiguous.

The effects on the illiquid, high return investments show a positive relationship between the proportion of household members enrolled in *Seguro Popular* and investment in human capital. Within the illiquid investments, the direction of the effect in investment in durable assets and high return savings is not the one expected, but the effect of *Seguro Popular* on human capital investment is positive and significant. An increase in the proportion of household members enrolled in *Seguro Popular* increases the proportion of the investment allocated to human capital by 2.55 percent for all households in the whole sample and 2.77 percent when excluding households participating in *Oportunidades*. The effect is larger for low income and rural households in both specifications. In the case of low income households the effect for the whole sample reflects an increase of 3.82 percent when increasing the proportion of household members with *Seguro Popular*, and when excluding households participating in *Oportunidades* the effect is 5.12 percent. For rural households the effect is 2.30 percent for the whole sample and 3.18 percent when excluding households participating in *Oportunidades.*

The results suggest that an increase in the proportion of household members enrolled in *Seguro Popular* has significant effects on the reallocation of liquid

investments to human capital. The results are robust to different specifications, and the effects are larger when excluding households participating in *Oportunidades.*

4.6.2 DID Estimates of the Effect of Access to Seguro Popular on Investment and Savings

The DID estimates of equation (14) measure the effect of beginning to receive *Seguro Popular* in the analyzed period (with respect to uninsured households) on the different investment and savings measures. The results are summarized in Tables 4.6a and 4.6b. As in the OLS specification, the results were estimated for all households, low income households and rural households. Table 4.6a summarizes the coefficients of interest for the whole sample, while the results summarized in Table 4.6b exclude households participating in *Oportunidades*.

The results for the whole sample show no significant evidence of an early effect *Seguro Popular* on most of the investment and savings measures, although the sign of the coefficient for liquid investments aggregate is negative. The only significant effect is found on high return savings measure for all households; gaining access to *Seguro Popular* increased the proportion of investment allocated into high return savings in 2.25 percent compared to uninsured households.

In contrast, when excluding households participating in *Oportunidades,* the results are in line with the OLS findings. As shown in Table 4.6b, the DID estimates indicate that *Seguro Popular* negatively affects investment in liquid, low return assets. Gaining access to *Seguro Popular* decreases the proportion of the investment allocated to low return assets in 2.88 for all households, as well as for low income and rural households (2.89 percent and 6.70 percent, respectively). The effect is significant for the aggregate level of liquid investments, but within the group of low return investments, the effect is not significant.

The effects on the illiquid, high return investments show a positive relationship between the gaining access to *Seguro Popular* and investment in human capital. Similar to the OLS results, within the illiquid investments, the direction of the effect in

investment in durable assets and high return savings is not the one expected, but the effect of *Seguro Popular* on human capital investment are positive and significant.

Gaining access to *Seguro Popular* increases the proportion of the investment allocated to human capital by 3.71 percent for all households and 3.62 percent for low income households. The effect is larger for rural households, with an increase of 8.56 percent when comparing households that are new to *Seguro Popular* and uninsured households.

The results suggest that households that were new to *Seguro Popular* and were not participating in *Oportunidades*, have significant effects on the reallocation of liquid investments to human capital.

4.7 Conclusion

The investment decisions of the households in an economy are potentially one of the most important determinants of its long-term growth. This Chapter studies the effect of access to public health benefits on the allocation of households' savings to different types of investment.

First, it shows in a simple model where a household faces financial constraints, the quantity of short term income risk affecting the household's optimal allocation of its savings into liquid assets. The larger the short-term risk that a household faces, the larger the savings that it will devote to liquid assets which can be used to face those risks. Second, using the introduction of a large public health system in Mexico, *Seguro Popular*, the Chapter estimates the effect of obtaining access to a public health on the investment allocations of households.

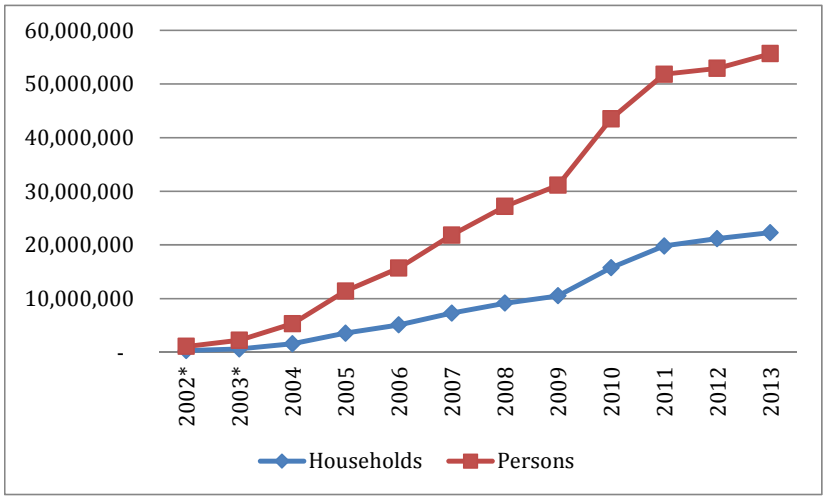
The estimations suggest that there is a statistically and economically significant change in the allocation of savings to illiquid, high return investments, relative to liquid, low return investments for households that obtain access to the *Seguro Popular* program compared to uninsured households. Households invest more of their savings in illiquid, high return assets than they did before. In particular, the results suggest that households

invested more of their savings in the development of their human capital than before. This result is in line with the findings of Alcaraz et al. (2016), that found that Seguro Popular had positive effects on school enrollment rates and on standardized test scores. These results are limited to the population that does not have alternative insurance nor participates in *Oportunidades*, and is subject to a set of assumptions, most importantly, that the logistic regressions that identify the treatment and control groups are accurate.

These results suggest that, beyond improving the health and welfare of the population, the provision of public health benefits or health insurance has the potential to increase the long-term growth of the economy by allowing credit constrained agents to invest their savings in high return assets.

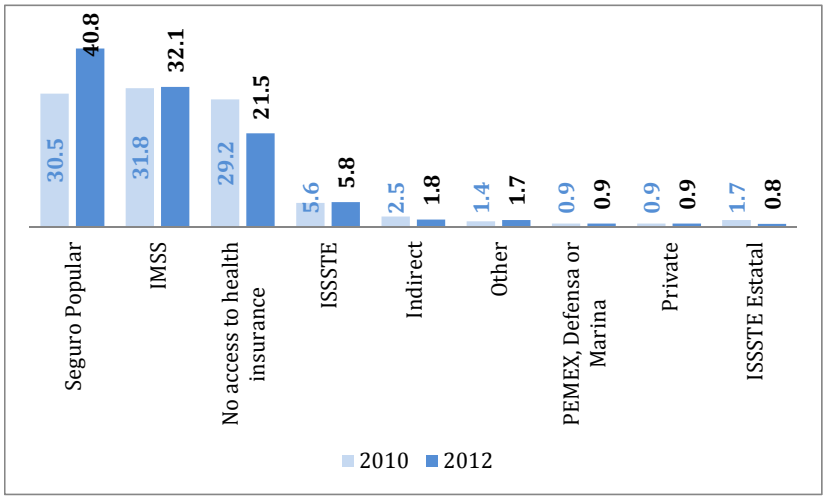
4.8 Figures

Figure 4.1 – Number of persons and households enrolled in Seguro Popular



Data: *Seguro Popular* administrative records
The years when the program was a pilot are marked with an asterisk *.

Figure 4.2 – Types of health insurance – Percentage of the population



Source: CONEVAL, 2013.

Figure 4.3a – Observed Health Insurance Categories in ENIGH

Figure 4.3b – Identification of Potential Participants in Seguro Popular in 2008

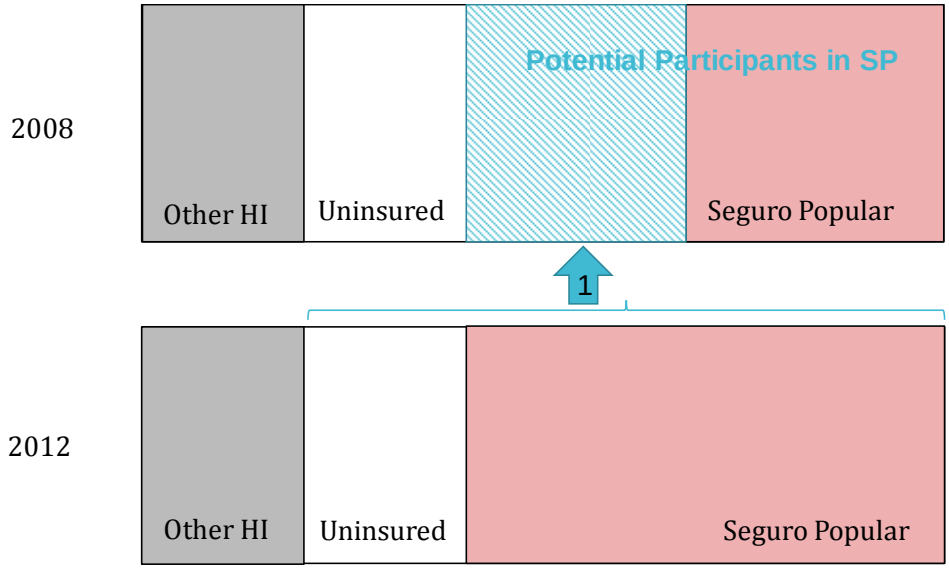


Figure 4.3c – Identification of Permanent Participants in Seguro Popular in 2012

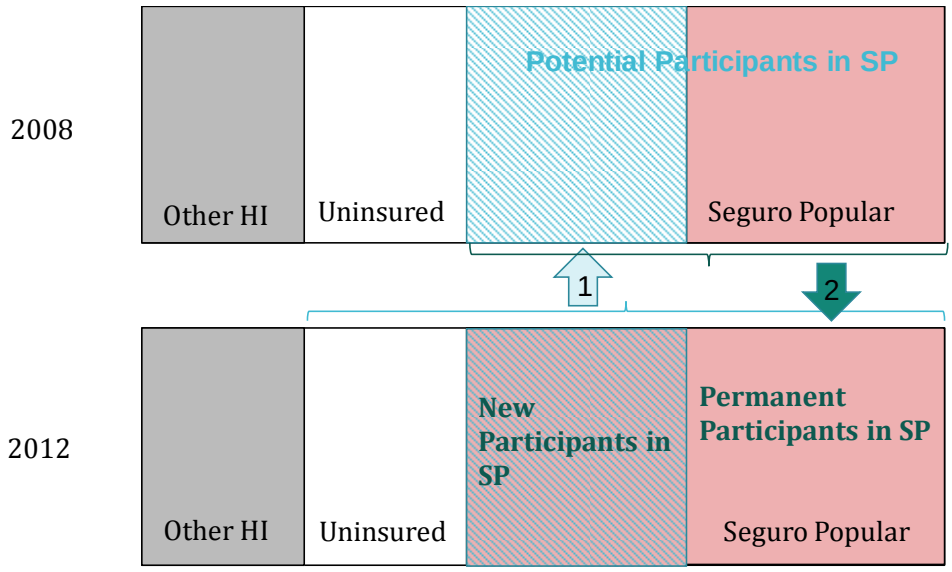
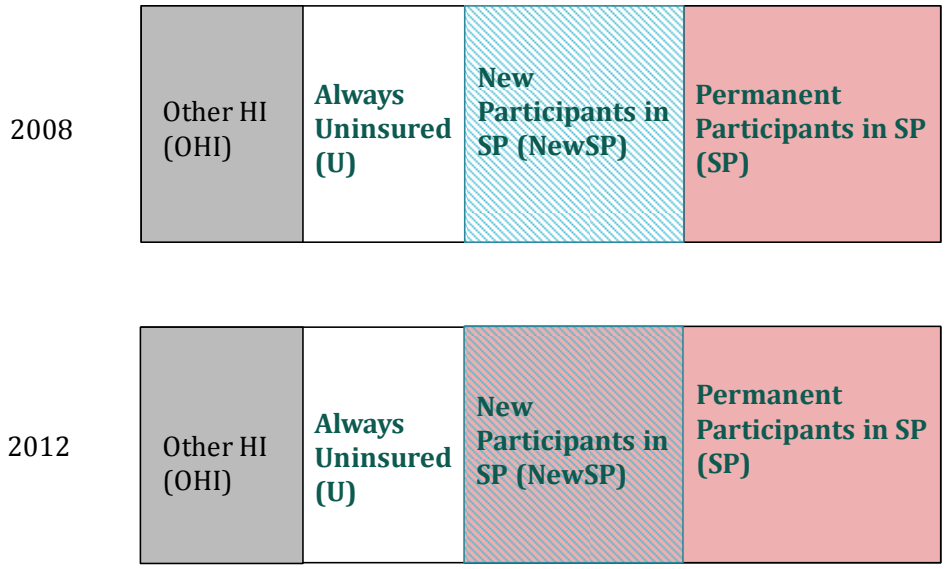


Figure 4.3d – Resulting Health Insurance Categories for the Statistical Analysis



4.9 Tables

Table 4.1 – Seguro Popular Annual Fee 2013

Income Decile	Annual Fee in Mexican Pesos	Annual Fee as a percentage of the GDP per capita
I, II, III, IV	-	-
V	$2,074.97	1.6%
VI	$2,833.56	2.2%
VII	$3,647.93	2.8%
VIII	$5,650.38	4.3%
IX	$7,518.97	5.7%
X	$11,378.86	8.6%

Source: Author's estimates based on Ley General de la Salud, Capitulo 5 and World Development Indicators.

Table 4.2 – Proportion of Households with Different Types of Health Insurance

	2008	2012
All Households		
Seguro Popular	17.5	38.7
Other Health Insurance	43.5	37.4
Uninsured	39.1	23.9
Low Income Households		
Seguro Popular	27.2	55.2
Other Health Insurance	25.6	19.6
Uninsured	47.2	25.2

Source: Authors' estimates using ENIGH.

Table 4.3 –Different Types of Investment as a Proportion of Total Investment

	All Households		Low Income Households	
	2008	2012	2008	2012
Human Capital	0.437	0.405	0.475	0.444
Durable Assets	0.051	0.049	0.018	0.013
Savings High Rtr.	0.117	0.109	0.062	0.064
Productive Capital	0.121	0.116	0.152	0.144
Social Capital	0.179	0.162	0.221	0.186
Savings Low Rtr.	0.095	0.159	0.072	0.149

Source: Authors' estimates using ENIGH.

Table 4.4 – Descriptive Statistics

	All Households				Households with Seguro Popular			
	2008		2012		2008		2012	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Head of the Household								
Age	46.28	14.41	46.91	14.90	43.76	13.71	44.96	14.73
Female	0.23	0.42	0.23	0.42	0.22	0.41	0.21	0.41
Educational Attaintment[A]	2.79	1.76	2.55	2.06	1.97	1.27	1.74	1.63
Household								
Number of household members	4.21	1.97	4.08	1.96	4.80	1.95	4.56	2.10
Children aged 0 to 5	0.47	0.73	0.44	0.70	0.68	0.84	0.57	0.77
Children aged 5 to 18	1.33	1.31	1.15	1.23	1.89	1.43	1.51	1.33
Adults 65+	0.20	0.50	0.22	0.53	0.16	0.44	0.20	0.51
Number of women of chilbearing age (15 to 49 years)	1.28	0.88	1.23	0.90	1.36	0.84	1.32	0.87
Live in urban area	0.81	0.39	0.80	0.40	0.53	0.50	0.63	0.48
Proportion of informal workers	0.29	0.38	0.27	0.38	0.07	0.20	0.09	0.22
Number of income earners	2.43	1.35	2.50	1.40	2.93	1.57	2.86	1.61
Maximun educational attaintnment	3.74	1.53	3.71	1.70	2.98	1.08	3.01	1.37
Proportion of children enrolled in school	0.72	0.37	0.71	0.39	0.73	0.35	0.71	0.37
Oportunidades	0.11	0.31	0.11	0.31	0.37	0.48	0.24	0.43

A: Educational Attaintment is classified into the following groups: 0 = No elementary Education 1 = Incomplete Elementary Education 2 = Complete Elementary Education 3 = Incomplete Secondary Education 4 = Complete Secondary Education 5 = Some Higher Education 6 = Complete Higher Education 7 = Post-Graduate Education

Table 4.4 – Descriptive Statistics, continued

	Households with Other Types of Health Insurance				Uninsured Households			
	2008		2012		2008		2012	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Head of the Household								
Age	46.91	14.40	48.37	15.06	46.63	14.59	47.49	14.61
Female	0.22	0.42	0.23	0.42	0.25	0.44	0.27	0.44
Educational Attaintment	3.40	1.79	3.37	2.09	2.44	1.65	2.50	2.09
Household								
Number of household members	3.90	1.73	3.68	1.71	4.32	2.16	4.01	1.98
Children aged 0 to 5	0.38	0.65	0.33	0.61	0.48	0.76	0.39	0.69
Children aged 5 to 18	1.09	1.12	0.89	1.06	1.37	1.38	1.02	1.18
Adults 65+	0.22	0.52	0.25	0.56	0.20	0.50	0.20	0.50
Number of women of chilbearing age (15 to 49 years)	1.22	0.84	1.14	0.89	1.31	0.93	1.23	0.95
Live in urban area	0.94	0.24	0.93	0.26	0.79	0.41	0.84	0.37
Proportion of informal workers	0.52	0.39	0.52	0.42	0.12	0.26	0.16	0.29
Number of income earners	2.27	1.18	2.25	1.15	2.40	1.38	2.36	1.30
Maximun educational attaintnment	4.27	1.55	4.36	1.72	3.46	1.46	3.71	1.70
Proportion of children enrolled in school	0.77	0.36	0.76	0.39	0.67	0.38	0.67	0.41
Oportunidades	0.02	0.14	0.02	0.13	0.09	0.29	0.05	0.22

A: Educational Attaintment is classified into the following groups: 0 = No elementary Education 1 = Incomplete Elementary Education 2 = Complete Elementary Education 3 = Incomplete Secondary Education 4 = Complete Secondary Education 5 = Some Higher Education 6 = Complete Higher Education 7 = Post-Graduate Education

Table 4.5a - – Summary of the Effects of Enrollment in Seguro Popular on Types of Investment (proportions) using OLS

Dependent variable:	All Households	Low Income Households	Rural Households
Liquid Assets - Aggregated[a]	-0.0115	-0.0335***	-0.0143
	(0.0077)	*(0.0119)*	*(0.0140)*
Consumer durable goods	0.0035	-0.0080	-0.0022
	(0.0056)	*(0.0085)*	*(0.0097)*
Networks	-0.0043	-0.0179*	-0.0082
	(0.0061)	*(0.0095)*	*(0.0121)*
Savings Low Rtr.	-0.0107**	-0.0075	-0.0039
	(0.0052)	*(0.0077)*	*(0.0091)*
Human Capital	0.0255***	0.0382***	0.0230*
	(0.0077)	*(0.0118)*	*(0.0139)*
Durable Assets	-0.0140***	-0.0047*	-0.0087**
	(0.0030)	*(0.0028)*	*(0.0036)*
Savings High Rtr.	0.0053	-0.0780	-0.0525
	(0.0877)	*(0.0921)*	*(0.1282)*
Observations	32,667	10,223	7,531

Robust standard errors clustered at the municipality level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

a: Liquid assets aggregated is the sum of investments in consumer durable goods, networks, and low return savings as the proportion of total investment.

Note: the sets of covariates include:

Characteristics of the Head of the Household: gender, age, educational attainment, and employment status.

Characteristics of the Household: urban status, number of household members, proportion of informal workers out of the income earners of the household, participation in *Oportunidades* , and dummy variables for the type of household: one-person household, single family household, and extended family household.

State fixed effects

Table 4.5b - – Summary of the Effects of Enrollment in Seguro Popular on Types of Investment (proportions) - Excluding households in the Oportunidades program using OLS

Dependent variable:	All Households	Low Income Households	Rural Households
Liquid Assets - Aggregated[a]	-0.0113	-0.0438***	-0.0183
	(0.0087)	*(0.0137)*	*(0.0170)*
Consumer durable goods	0.0025	-0.0116	-0.0055
	(0.0065)	*(0.0108)*	*(0.0136)*
Networks	-0.0022	-0.0212*	-0.0048
	(0.0069)	*(0.0111)*	*(0.0157)*
Savings Low Rtr.	-0.0116**	-0.0110	-0.0080
	(0.0057)	*(0.0089)*	*(0.0117)*
Human Capital	0.0277***	0.0512***	0.0318*
	(0.0085)	*(0.0135)*	*(0.0168)*
Durable Assets	-0.0164***	-0.0074**	-0.0135**
	(0.0036)	*(0.0037)*	*(0.0054)*
Savings High Rtr.	-0.0163	-0.1390	-0.1361
	(0.1093)	*(0.1173)*	*(0.1678)*
Observations	28,216	7,547	4,643

Robust standard errors clustered at the municipality level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

a: Liquid assets aggregated is the sum of investments in consumer durable goods, networks, and low return savings as the proportion of total investment.

Note: the sets of covariates include:

Characteristics of the Head of the Household: gender, age, educational attainment, and employment status.

Characteristics of the Household: urban status, number of household members, proportion of informal workers out of the income earners of the household, and dummy variables for the type of household: one-person household, single family household, and extended family household.

State fixed effects

Table 4.6a – Summary of the Effects of the Enrollment in Seguro Popular on Types of Investment (proportions) using Difference-in-Difference

Dependent variable:	All Households	Low Income Households	Rural Households
Liquid Assets - Aggregated[a]	-0.0098	-0.0083	-0.0261
	(0.0209)	*(0.0249)*	*(0.0332)*
Consumer durable goods	-0.0125	-0.0118	-0.0196
	(0.0091)	*(0.0157)*	*(0.0165)*
Networks	-0.0117	-0.0127	-0.0175
	(0.0129)	*(0.0217)*	*(0.0196)*
Savings Low Rtr.	0.0144	0.0162	0.0110
	(0.0177)	*(0.0218)*	*(0.0218)*
Human Capital	-0.0121	0.0020	0.0345
	(0.0229)	*(0.0279)*	*(0.0316)*
Durable Assets	-0.0006	-0.0011	0.0010
	(0.0055)	*(0.0065)*	*(0.0054)*
Savings High Rtr.	0.0225**	0.0074	-0.0094
	(0.0086)	*(0.0115)*	*(0.0152)*
Observations	23,681	7,206	5,572

Robust standard errors clustered at the municipality level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

a: Liquid assets aggregated is the sum of investments in consumer durable goods, networks, and low return savings as the proportion of total investment.

Note: the sets of covariates include:

Characteristics of the Head of the Household: gender, age, educational attainment, and employment status.

Characteristics of the Household: urban status, number of household members, proportion of informal workers out of the income earners of the household, participation in *Oportunidades* , and dummy variables for the type of household: one-person household, single family household, and extended family household.

State fixed effects

Table 4.6b – Summary of the Effects of Enrollment in Seguro Popular on Types of Investment (proportions) - Excluding households in the Oportunidades program using Difference-in-Difference

Dependent variable:	All Households	Low Income Households	Rural Households
Liquid Assets - Aggregated[a]	-0.0288*	-0.0289	-0.0670*
	(0.0154)	*(0.0406)*	*(0.0383)*
Consumer durable goods	-0.0096	-0.0045	-0.0004
	(0.0121)	*(0.0282)*	*(0.0289)*
Networks	-0.0198	0.0197	-0.0432
	(0.0153)	*(0.0345)*	*(0.0344)*
Savings Low Rtr.	0.0006	-0.0441	-0.0234
	(0.0150)	*(0.0287)*	*(0.0261)*
Human Capital	0.0371**	0.0362	0.0856**
	(0.0153)	*(0.0404)*	*(0.0384)*
Durable Assets	-0.0083	-0.0073	-0.0186
	(0.0076)	*(0.0088)*	*(0.0125)*
Savings High Rtr.	-0.2540	-0.0801	-0.0234
	(0.3450)	*(0.2932)*	*(0.0261)*
Observations	19,982	5,172	3,392

Robust standard errors clustered at the municipality level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

a: Liquid assets aggregated is the sum of investments in consumer durable goods, networks, and low return savings as the proportion of total investment.

Note: the sets of covariates include:

Characteristics of the Head of the Household: gender, age, educational attainment, and employment status.

Characteristics of the Household: urban status, number of household members, proportion of informal workers out of the income earners of the household, participation in *Oportunidades* , and dummy variables for the type of household: one-person household, single family household, and extended family household.

State fixed effects

Chapter 5

Conclusions

Human capital skills are gained throughout a person's life, and there are some activities, conditions, and policies that can either boost or reduce human capital investments. In this dissertation, I showed that for the context of poor households in Ethiopia, child work has a negative effect on academic achievement (measured as test scores) and that there is a wide test score gap between children residing in urban and rural areas of the country. In the case of Mexico, when households gain access to the *Seguro Popular* program, they adjust their investment decisions. Households invest more of their savings in illiquid, high return assets than they did before, especially human capital investments (schooling).

The results of Chapter 2 confirm that child work negatively affects vocabulary skills and that it has no effect on mathematics test scores. Child work was analyzed paying particular attention to two types of child work: domestic and market work. As children grow, the effects of child work on academic performance get larger. In the case of domestic work, I found negative and statistically significant effects for vocabulary skills for girls: -0.144 standard deviations for 8-year-old girls and -0.323 standard deviations for 15-year-old girls. Market work has a large effect for 12-year-old boys and girls in both cohorts, with effects ranging from -0.193 to -0.373 standard deviations.

The effect of the different types of child work on mathematics test scores was also explored in Chapter 2. But the direction of the effect of child work on the mathematics test scores was not as clear and exhibited less statistical significance when compared to the effects on vocabulary skills. An additional hour of domestic work results in declines

of -0.128 standard deviations for 8-year-old girls, and -0.145 standard deviations for 12-year-old boys, from the younger cohort. One positive and statistically significant effect was found in the analysis, an additional hour of market work increased the mathematics test score by 0.173 standard deviation for all 12-year-old children of the older cohort. The empirical analysis included in Chapter 2 had 36 different estimations, 15 of which are statistically significant at least at the 10 percent level, so the evidence strongly suggests that the effect of child labor is generally negative; therefore, finding one positive and significant effect out of 35 could be due to random chance.

Chapter 2 also contributes to the existing literature by presenting new evidence that domestic work can also have negative effects on learning, especially in vocabulary skills. It also confirms that when correcting for endogeneity in the child work variables, the estimated impacts are more negative when using instrumental variables; therefore, the OLS specifications appear to underestimate the effects of child work on school performance.

Chapter 3 first measures and then decomposes the test score gap between children residing in urban areas and children residing in rural areas of Ethiopia by using the Blinder-Oaxaca decomposition method, in combination with the instrumental variables approach developed in Chapter 2. The decomposition considered child, parent, and household characteristics. The test score gap is generally around one standard deviation, and it widens as children grow.

The explained portion (differences in endowments) of the vocabulary test score explains more than 50 percent of the test score gap. For the mathematics test score, the explained portion contributes more than 40 percent of the test score gap, with the exception for 12-year-olds in the older cohort, where the explained portion of the gap was -6.7 percent. In general, the explained portion of the gap is higher for boys than for girls. The variables that significantly contribute to the explained portion of the test score gap were: hours of child work, highest level of education attained by the parents, and the socioeconomic status of the family. Unfortunately, the analysis included in Chapter 3

could not incorporate school and teacher's characteristics given the small sub-sample of children that had the variables available; these variables could have helped to identify areas in which the education authorities might improve educational services in rural areas.

The results from Chapters 2 and 3 show that child work has negative effects on student academic achievement and that it significantly contributes to the urban-rural test score gap, but test scores are just one dimension of the child's development. It is also worth noting that policies prohibiting work for children during their school years could be harmful for those children's future. On one hand, the activities that children perform outside of school can prepare them for the economic and cultural environment of their communities, and on the other hand, some children work to be able to pay for the costs of attending school. A longer-term analysis of the effects of child work in the Ethiopian context is needed to propose policies that could enhance both student academic achievement and the acquisition of additional skills that will be useful for those children in the future. Policies such as Conditional Cash Transfers programs could reduce the number of child work hours, especially in rural areas where children spend twice as much time as their urban counterparts performing domestic and market work. In fact, a recent evaluation of the Social Cash Transfer Pilot Programme in the Tigray region (Berhane et al. 2015), found that this program increased the likelihood of enrollment by 13.3 percentage points and grade attainment by half of a grade.

Chapter 4 shows how households' investment decisions are affected by gaining access to public health insurance. First, a simple model where a household faces financial constraints was developed. The model shows the relationship between the magnitude of the short-term income risk and the household's optimal allocation of its savings into liquid assets. The larger the short-term risk faced by a household, the more its savings will be devoted to liquid assets (which could be used to mitigate the effects of those risks). Second, the effects of gaining access to health insurance on the investment allocations of households were estimated by using the expansion of a large public health system in Mexico, *Seguro Popular*.

The results of Chapter 4 suggest that there is a statistically significant change in the allocation of savings to illiquid, high return investments, relative to liquid, low return investments for households that gained access to *Seguro Popular* compared to uninsured households. Households invested more of their savings in illiquid, high return assets than they did before. The results suggest that households invested more of their savings in the development of their human capital than before. These results were limited to the Mexican population that does not have health insurance alternatives or does not participate in the Conditional Cash Transfer program, *Oportunidades*. These results suggest that, beyond improving the health and welfare of the population, the provision of publicly funded health insurance has the potential to increase the long-term outcomes by allowing credit constrained agents to invest their savings in high return assets.

The results in this dissertation show that in the context of poor households in Ethiopia some activities (child work) and conditions (residing in rural areas) have a negative effect on human capital formation for school-aged children. However, the results presented in this dissertation are only a small subset of the incidence of child work on human capital formation given that I analyzed the short-run effects on the academic achievement dimension. In addition, this dissertation also shows that policies targeted to improve other dimensions of well-being could have a positive impact on investments in human capital. In the context of Mexican households, gaining access to health insurance had a positive effect on their investment decisions and boosted household human capital investments.

Bibliography

Akabayashi, H., and Psacharopoulos, G. (1999). "The trade-off between child labour and human capital formation: A Tanzanian case study". *The Journal of Development Studies*, *35*(5), 120-140.

Alcaraz, C., Chiquiar, D., Orraca, M. J., and Salcedo, A. (2016). The effect of publicly provided health insurance on education outcomes in Mexico. *The World Bank Economic Review*, *30*(Supplement_1), S145-S156.

Alvi, E., and Dendir, S. (2011). "Sibling differences in school attendance and child labour in Ethiopia". *Oxford Development Studies*, *39*(3), 285-313.

Ammermueller, A. (2007). PISA: What makes the difference? *Empirical Economics*, *33*(2), 263-287.

Angrist, J.-D., and Pischke, J.-S. (2009) *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.

Assaad, R., Levison, D. and Zibani, N. (2010). "The Effect of Domestic Work on Girls' Schooling: Evidence from Egypt". *Feminist Economics*, 16(1). 79-128.

Aterido, R., M. Hallward-Driemeier and C. Pages (2011). Does Expanding Health Insurance beyond Formal-sector Workers Encourage Informality? Measuring the Impact of Mexico's Seguro Popular. *Policy Research Working Papers* 5785, The World Bank.

Attanasio, O.P., and Székely, M. (1998) Household Savings and Income Distribution in Mexico. *Documento de Trabajo #390*, Inter-American Development Bank.

Bai, C. E., and Wu, B. (2014). Health insurance and consumption: evidence from China's new cooperative medical scheme. *Journal of Comparative Economics*, 42(2), 450-469.

Barros, R. (2008) Wealthier but not much Healthier: Effects of a Health Insurance Program for the Poor in Mexico. Mimeo.

Beegle, K., Dehejia, R. H., and Gatti, R. (2006). "Child labor and agricultural shocks". *Journal of Development Economics*, *81*(1), 80-96.

Beegle, K., Dehejia, R. H., Gatti, R., and Krutikova, S. (2008). The consequences of child labor: evidence from longitudinal data in rural Tanzania. *Policy Research working paper*; no. WPS 4677. Washington, DC: World Bank Group.

Ben-Porath, Yoram. (1967) "The production of human capital and the life cycle of earnings." *The Journal of Political Economy*, 352-365.

Berhane et al. (2015). "Evaluation of the Social Cash Transfer Pilot Programme. Tigray Region, Ethiopia. Endline Report." Evaluation Report. https://www.unicef.org/evaldatabase/files/UNICEF_Tigray_Endline_Report_FINAL_Ethiopia_2015-051.pdf

Bezerra, M. E., Kassouf, A. L., and Arends-Kuenning, M. (2009). *The impact of child labor and school quality on academic achievement in Brazil.* IZA Discussion Paper No. 4062. Institute for the Study of Labor (IZA). Bonn, Germany.

Binder, M., and Scrogin, D. (1999). "Labor Force Participation and Household Work of Urban Schoolchildren in Mexico: Characteristics and Consequences". *Economic Development and Cultural Change*, *48*(1), 123-154.

Blinder, A. S. (1973). Wage Discrimination: Reduced Form and Structural Estimates. *Journal of Human Resources*, 436-455.

Bosch, M., Campos-Vásquez, M., and Knox, M. (2010) The Trade Offs in the Labor Market of Social Assistance Programs: the Case of Seguro Popular program in Mexico. Mimeo.

Bourdillon, M., D. Levison, W. Myers, and B. White. (2010). *Rights and Wrongs of Children's Work*. New Brunswick, NJ: Rutgers University Press.

Burger, R. (2011). School effectiveness in Zambia: The origins of differences between rural and urban outcomes. *Development Southern Africa*, *28*(2), 157-176.

Camacho, A., Conover, E., and Hoyos, a. (2014) Effects of Colombia's Social Protection System on Worker's Choice between Formal and Informal Employment. *The World Bank Economic Review,* 28(3), 446-466. Washington, D.C: World Bank.

Carroll, C. D., and Kimball, M. S. (2008). Precautionary Saving and Precautionary Wealth. *The New Palgrave Dictionary of Economics*, 6, 579-584.

Central Statistical Agency of Ethiopia (CSA) and World Bank (2017). "LSMS – Integrated Surveys of Agriculture Ethiopia Socioeconomic Survey (EES) 2015/2016". Survey Report. http://microdata.worldbank.org/index.php/catalog/2783/download/39555

Central Statistical Authority –CSA. (2002). *Ethiopia Child Labour Survey Report 2001*. Statistical Bulletin 262. Central Statistical Authority. Addis Ababa.

Chicoine, Luiz E. (2016). *Free Primary Education, Schooling, and Fertility: Evidence from Ethiopia.* IZA Discussion Paper No. 10387. Institute for the Study of Labor (IZA). Bonn, Germany.

Chou, S.-Y., Liu, J.-T., and Hammit, J. (2003) National Health Insurance and Precautionary Savings: Evidence from Taiwan. *Journal of Public Economics*, 87, 1873-1894.

Chuta, N. (2017). "Young Women's Household Bargaining Power in Marriage and Parenthood in Ethiopia". *Young Lives Working Paper, 166.*

Cockburn, J. (2002). *Income contributions of child work in rural Ethiopia*. University of Oxford, Centre for the Study of African Economies.

Cockburn, J., and Dostie, B. (2007). "Child work and schooling: The role of household asset profiles and poverty in rural Ethiopia". *Journal of African Economies*, *16*(4), 519-563. 2002

CONEVAL (2013) *Indicadores de Acceso y uso efectivo de los Servicios de Salud de Afiliados al Seguro Popular*. Consejo Nacional de Evaluación de la Política de Desarrollo Social. Mexico.

CONEVAL (2014) *Indicadores de Acceso y uso efectivo de los Servicios de Salud de Afiliados al Seguro Popular*. Consejo Nacional de Evaluación de la Política de Desarrollo Social. Mexico.

Cueto, S., and Leon, J. (2012). "Psychometric characteristics of cognitive development and achievement instruments in Round 3 of Young Lives". *Young Lives Technical Note, 25.*

Cueto, S., Leon, J., Guerrero, G., and Muñoz, I. (2009). "Psychometric characteristics of cognitive development and achievement instruments in Round 2 of Young Lives". *Young Lives Technical Note, 15.*

Darity Jr, W. A., and Mason, P. L. (2004). Evidence on discrimination in employment: Codes of color, codes of gender. In *African American Urban Experience: Perspectives from the Colonial Period to the Present* (pp. 156-186). Palgrave Macmillan US.

Deaton, A. (1990) Saving in Developing Countries: Theory and Review. *World Bank Economic Review* (suppl.1990), pp. 61-96.

Edmonds, E. V. (2006). "Understanding sibling differences in child labor". *Journal of Population Economics*, *19*(4), 795-821.

Edmonds, E. V. (2007). "Child labor". *Handbook of Development Economics*, *4*, 3607-3709.

Emerson, P. M., and Souza, A. P. (2002). "Birth order, child labor and school attendance in Brazil". *Nashville: Vanderbilt University, Department of Economics*.

Escobar, M. L., Griffin, C. C., and Shaw, R. P. (Eds.). (2011). *The Impact of Health Insurance in Low-and Middle-Income Countries*. Brookings Institution Press.

Gakidou, E., R. Lozano, E. Gonzalez-Pier, J. Abbott-Klafter, J. Barofsky, C. Bryson-Cahn, D. M. Feehan, D. K. Lee, H. Hernandez-Llamas and C. J. Murray. (2007) Assessing the Effect of the 2001-2006 Mexican Health Reform: An Interim Report Card. *The Lancet*, 368 (9550), pp. 1920-1935.

Gavonel, M. (2017) "Patterns and Drivers of Internal Migration Among Youth in Ethiopia, India, Peru and Vietnam". *Young Lives Working Paper, 169.*

Grogger, J., Arnold, T., León, A.S. and Ome, a. (2014) Heterogeneity in the effect of public health insurance on catastrophic out-of-pocket health expenditures: the case of Mexico. *Health Policy and Planning*. June 2014 (online). doi: 10.1093/heapol/czu037

Gruber, J., and Hanratty, M. (1995). The Labor-Marker Effects of Introducing National Health Insurance: Evidence from Canada. *Journal of Business and Economic Statistics*, 13(2), 163-173.

Gunnarsson, V., Orazem, P. F., and Sánchez, M. A. (2006). "Child Labor and School Achievement in Latin America". *The World Bank Economic Review*, *20*(1), 31-54.

Gunnarsson, Victoria. 2003. "Student level determinants of child labour and the impacts on test scores: A multinational study". Unpublished paper, Iowa State University

Gutiérrez, JP., Rivera-Dommarco, J., Shamah-Levy, T., Villalpando-Hernández, S., Franco, A., Cuevas-Nasu, L., Romero-Martínez, M., and Hernández-Ávila, M. (2012). *Encuesta Nacional de Salud y Nutrición 2012. Resultados Nacionales.* Cuernavaca, México: Instituto Nacional de Salud Pública.

Haile G, Haile B (2012) "Child labour and child schooling in rural Ethiopia: nature and trade-off". *Education Economics* 20(4): 365-385.

Hannum, E. (1999). Political change and the urban-rural gap in basic education in China, 1949-1990. *Comparative Education Review*, *43*(2), 193-211.

Hanushek, E. A., and Woessmann, L. (2008). "The Role of Cognitive Skills in Economic Development". *Journal of Economic Literature*, 607-668.

Heady, C. (2003). “The effect of child labor on learning achievement”. *World Development*, *31*(2), 385-398.

Jacoby, H. G., and Skoufias, E. (1997). “Risk, financial markets, and human capital in a developing country”. *The Review of Economic Studies*, *64*(3), 311-335.

Joshi, R.D. (2012). *Project Information Document (Concept Stage) - Ethiopia General Education Quality Improvement Project II - P129828*. Washington, D.C.: World Bank Group.

Kassa, S. C., and Abebe, T. (2016). Qenja: Child fostering and relocation practices in the Amhara region, Ethiopia. *Children's Geographies*, *14*(1), 46-62.

Keynes, J.M. (1936) *The General Theory of Unemployment, Interest and Money*. Harcourt, Brace and World, New York.

Khanam, R., and Ross, R. (2008). “Child work and other determinants of school attendance and school attainment in Bangladesh”. In *Proceedings of the 37th Australian Conference of Economists (ACE 2008)*. Economic Society of Australia (Queensland).

Khanam, Rasheda (2010) *“Child labour and schooling in developing countries: a review of the literature”. International Journal of Business Research,* 10 (3). pp. 137-142.

Kimball, M. S. (1990). Precautionary Savings: A Panel Study. *Review of Economics and Statistics*, 79 (2), 241-247.

Kimball, M. S. (1992). Precautionary motives for holding assets (No. w3586). *National Bureau of Economic Research.*

King, G., Gakidou, E., Ravishankar, N., Moore, R., Lakin, J., Vargas, M., Tellez-Rojo, M., Avila, J. Hernandez-Avila, M. and Hernandez-Llamas, H. (2007). A ‘Politically Robust’ Experimental Design for Public Policy Evaluation, with Application to the Mexican Universal Health Insurance Program. *Journal of Policy Analysis and Management*, 26(3), 479–506.

Kingdon, G. (2002). The gender gap in educational attainment in India: How much can be explained? *Journal of Development Studies*, *39*(2), 25-53.

Kirdruang, P., & Glewwe, P. (2017). The impact of universal health coverage on households’ consumption and savings in Thailand. *Journal of the Asia Pacific Economy*, 1-21.

Kochar, A. (1999). “Smoothing Consumption by Smoothing Income: Hours-of-work Responses to Idiosyncratic Agricultural Shocks in Rural India”. *Review of Economics and Statistics*, *81*(1), 50-61.

Kotlikoff, L. (1989). Health Insurance and Precautionary Savings. In L. Kotlikoff, *What Determines Savings?* (pp. 141-162). Cambridge: MIT Press.

Leland, H. E. (1968). Saving and uncertainty: The precautionary demand for saving. *The Quarterly Journal of Economics*, 465-473.

Levison, D., and Moe, K. S. (1998). “Household work as a deterrent to schooling: An analysis of adolescent girls in Peru”. *The Journal of Developing Areas*, 339-356.

Levison, D., Moe, K. S., and Knaul, F. M. (2001). “Youth education and work in Mexico”. *World Development*, *29*(1), 167-188.

Lloyd-Sherlock, P. (2006) When Social Health Insurance Goes Wrong: Lessons from Argentina and Mexico. *Social Policy and Administration,* 40 (4), 353-368.

Lounkaew, K. (2013). Explaining urban–rural differences in educational achievement in Thailand: Evidence from PISA literacy data. *Economics of Education Review*, *37*, 213-225.

Macías Santos, E., Moreno Padilla, j., Milanés García, S., Martínez Martínez Velasco, A., and Hazas Sánchez, A. (1993*). El Sistema de Pensiones en México dentro del Contexto Internacional,* Ed. Confederación Patronal de la República Mexicana. Instituto de Proposisiones Estratégicas, Themis, México.

Ministry of Education (2015). *Education Statistics Annual Abstract – 2006 E.C. (2013/2014)*. Education Management Information System and ICTDirectorate, Ministry of Education, Federal Democratic Republic of Ethiopia. Addis Ababa, Ethiopia.

Montenegro, C. E., and Patrinos, H. A. (2014). “Comparable estimates of returns to schooling around the world”. *Policy Research working paper*; no. WPS 7020. Washington, DC: World Bank Group.

Myers Jr, S. L., Kim, H., and Mandala, C. (2004). The Effect of School Poverty on Racial Gaps in Test Scores: The case of the Minnesota Basic Standards Tests. *Journal of Negro Education*, 81-98.

Nieto, S., and Ramos, R. (2014). Decomposition of Differences in PISA Results in Middle Income Countries. *IREA Institute of Applied Economics, Working Paper 2014/08, Regional Quantitative Analysis Research Group, Working Paper 2014/04.*

Ñopo, H. (2008). Matching as a Tool to Decompose Wage Gaps. *The Review of Economics and Statistics*, *90*(2), 290-299.

O'Donnell, O., Van Doorslaer, E., Wagstaff, A., and Lindelow, M. (2008). *Analyzing Health Equity Using Household Survey Data*. Washington, DC: World Bank.

O'Neill, J. E., and O'Neill, D. M. (2006). What do wage differentials tell about labor market discrimination? In *The Economics of Immigration and Social Diversity* (pp. 293-357). Emerald Group Publishing Limited.

Oaxaca, R. (1973). Male-female Wage Differentials in Urban Labor Markets. *International Economic Review*, 693-709.

Oaxaca, R. L., and Ransom, M. R. (1994). On Discrimination and the Decomposition of Wage Differentials. *Journal of Econometrics*, *61*(1), 5-21.

Orazem, P. F., and Gunnarsson, V. (2004). *Child Labor, School Attendance and Performance: A Review*. Iowa State University, Department of Economics.

Orkin, K. (2012) "Are Child Work and Schooling Competitive Activities? A Mixed Methods Study in Rural Ethiopia'. *Young Lives Working Paper, 77.*

Parish, W. L., and Willis, R. J. (1993). "Daughters, Education, and Family Budgets: Taiwan Experiences". *Journal of Human Resources*, 863-898.

Patrinos, H. A., and Psacharopoulos, G. (1997). "Family Size, Schooling and Child Labor in Peru–An Empirical Analysis". *Journal of Population Economics*, *10*(4), 387-405.

Psacharopoulos, G. (1997). "Child labor versus educational attainment. Some evidence from Latin America". *Journal of Population Economics*, *10*(4), 377-386.

Ramos Lobo, R., Duque, J. C., and Nieto, S. (2016). Decomposing the rural-urban differential in student achievement in Colombia using PISA microdata. *Estudios de Economía Aplicada, 2016, vol. 34, num. 2, p. 379-412*.

Ravallion, M. and Wodon, Q. (2000). "Does Child Labour Displace Schooling? Evidence on Behavioural Responses to an Enrollment Subsidy". *The Economic Journal*, 110 (462), 158– 175.

Ray, R. (2002). "The determinants of child labour and child schooling in Ghana". *Journal of African Economies*, 11(4), 561-590.

Ray, R., and Lancaster, G. J. (2003). *Does Child Labour Affect School Attendence and School Performance? Multi Country Evidence on SIMPOC Data*. Canberra: School of Economics, University of Tasmania.

Reimers, C. W. (1983). Labor Market Discrimination against Hispanic and Black Men. *The Review of Economics and Statistics*, 570-579.

Saavedra, J. E., and García, S. (2012). Impacts of conditional cash transfer programs on educational outcomes in developing countries: a meta-analysis. *RAND Labor and Population Working Paper Series, WR-921-1*.

Secretaría de Salud (2005). *Sistema de Protección Social en Salud: Elementos Conceptuales, Financieros y Operativos*. Secretaría de Salud, Mexico.

Secretaría de Salud. Informe de Resultados, various years.

Starr-McCluer, M. (1996). Health Insurance and Saving. *American Economic Review*, 86, 285-295.

UNESCO (2006). *World Data on Education.: Ethiopia.* 6th Edition.

UNESCO (2015). *Education for All 2015 National Review Report: Ethiopia.* Report prepared for the World Education Forum (Incheon, Republic of Korea, 19-22 May 2015).

United Nations Development Programme/World Health Organization (2009). *The Energy Access Situation in Developing Countries. A Review Focusing on the Least Developed Countries and Sub-Saharan Africa.* New York: UNDP and WHO.

World Bank (2005) *Education in Ethiopia: Strengthening the Foundation for Sustainable Progress*. World Bank Country Study. Washington, DC.

World Development Indicators. World Bank. http://data.worldbank.org/data-catalog/world-development-indicators

Young Lives. (2014). *Young Lives Survey Design and Sampling in Ethiopia. Preliminary Findings from the 2013 Young Lives Survey (Round 4).* University of Oxford.

Appendix 1

Table A.1 – First Stage Estimations for Children Aged 8 Years Old

	Hours of domestic work			Hours of market work		
VARIABLES	All	Female	Male	All	Female	Male
Proportion of Older Sisters	-0.815***	-1.447***	-0.365	-0.801***	-0.369**	-1.162***
	(0.217)	*(0.411)*	*(0.240)*	*(0.198)*	*(0.170)*	*(0.294)*
Proportion of Younger Sisters	0.507	0.601	0.321	-0.222	0.142	-0.597*
	(0.393)	*(0.389)*	*(0.400)*	*(0.280)*	*(0.330)*	*(0.338)*
Proportion of Older Brothers	-0.922***	-1.253***	-0.456*	-0.279	-0.458	-0.279
	(0.225)	*(0.333)*	*(0.222)*	*(0.282)*	*(0.343)*	*(0.362)*
Proportion of Younger Brothers	0.600**	0.340	0.695**	-0.381*	-0.426*	-0.242
	(0.234)	*(0.382)*	*(0.284)*	*(0.186)*	*(0.234)*	*(0.318)*
Mom Ill past 4 years	-0.032	-0.053	0.080	0.225	0.171	0.119
	(0.157)	*(0.277)*	*(0.130)*	*(0.198)*	*(0.223)*	*(0.254)*
Dad Ill past 4 years	0.036	-0.103	0.099	0.321**	0.278**	0.413
	(0.172)	*(0.246)*	*(0.186)*	*(0.139)*	*(0.131)*	*(0.248)*
Other Ill past 4 years	0.243*	0.336*	0.168	-0.115	-0.067	-0.141
	(0.126)	*(0.177)*	*(0.175)*	*(0.143)*	*(0.134)*	*(0.205)*
Death in the Household past 4 years	-0.370*	-0.374	-0.297	-0.071	0.055	-0.270
	(0.187)	*(0.237)*	*(0.194)*	*(0.191)*	*(0.192)*	*(0.373)*
New Household Member past 4 years	0.189	0.676*	-0.014	0.562***	0.067	0.766**
	(0.200)	*(0.341)*	*(0.229)*	*(0.166)*	*(0.204)*	*(0.304)*
Drought past 4 years	0.076	0.302	-0.154	1.235***	0.922***	1.565***
	(0.184)	*(0.215)*	*(0.215)*	*(0.302)*	*(0.262)*	*(0.388)*
Flood past 4 years	0.624***	0.580*	0.613**	0.109	-0.277	0.461
	(0.184)	*(0.306)*	*(0.230)*	*(0.268)*	*(0.245)*	*(0.269)*
Frost past 4 years	-0.231	-0.322	-0.055	0.743**	1.058***	0.460
	(0.239)	*(0.221)*	*(0.242)*	*(0.271)*	*(0.218)*	*(0.406)*
Death of Livestock past 4 years	0.157	0.474*	-0.108	0.857***	0.340**	1.253***
	(0.161)	*(0.256)*	*(0.173)*	*(0.184)*	*(0.134)*	*(0.309)*
Constant	2.121***	2.648***	1.633***	0.690**	0.378	1.024***
	(0.192)	*(0.284)*	*(0.173)*	*(0.278)*	*(0.247)*	*(0.346)*
Observations	1,208	563	645	1,208	563	645
R-squared	0.064	0.128	0.050	0.235	0.219	0.309
F-test	15.53	35.53	10.86	198.9	119.4	58.42

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.2 – First Stage Estimations for Children Aged 12 Years Old (Younger Cohort Round 4)

	Hours of domestic work			Hours of market work		
VARIABLES	All	Female	Male	All	Female	Male
Proportion of Older Sisters	-0.730**	-1.243**	-0.597*	-1.266***	-0.680***	-1.558**
	(0.321)	*(0.443)*	*(0.317)*	*(0.343)*	*(0.208)*	*(0.598)*
Proportion of Younger Sisters	0.345	0.033	0.654**	-0.910***	-0.200	-1.573***
	(0.223)	*(0.414)*	*(0.282)*	*(0.257)*	*(0.312)*	*(0.382)*
Proportion of Older Brothers	-0.838***	-0.484	-0.629***	-0.926***	-0.692*	-1.614***
	(0.212)	*(0.369)*	*(0.189)*	*(0.299)*	*(0.356)*	*(0.458)*
Proportion of Younger Brothers	0.054	-0.230	0.242	-0.643**	-0.185	-1.086**
	(0.268)	*(0.370)*	*(0.231)*	*(0.289)*	*(0.312)*	*(0.516)*
Mom Ill past 4 years	0.137	0.087	-0.044	-0.365*	-0.005	-0.525**
	(0.199)	*(0.206)*	*(0.198)*	*(0.183)*	*(0.148)*	*(0.244)*
Dad Ill past 4 years	0.045	-0.054	0.044	0.106	-0.191	0.439
	(0.267)	*(0.268)*	*(0.295)*	*(0.359)*	*(0.176)*	*(0.455)*
Other Ill past 4 years	0.008	-0.111	0.342	-0.360**	-0.202	-0.691**
	(0.207)	*(0.247)*	*(0.215)*	*(0.171)*	*(0.174)*	*(0.248)*
Death in the Household past 4 years	-0.328*	-0.407	-0.142	-0.185	0.159	-0.549*
	(0.170)	*(0.300)*	*(0.222)*	*(0.199)*	*(0.250)*	*(0.279)*
New Household Member past 4 years	0.277	0.193	0.241	-0.408	-0.047	-0.687*
	(0.289)	*(0.410)*	*(0.562)*	*(0.239)*	*(0.202)*	*(0.342)*
Drought past 4 years	-0.173	0.130	-0.278*	1.087***	0.544**	1.391**
	(0.238)	*(0.292)*	*(0.159)*	*(0.318)*	*(0.233)*	*(0.603)*
Flood past 4 years	0.315	0.227	0.136	0.380**	0.498**	0.471
	(0.209)	*(0.214)*	*(0.206)*	*(0.157)*	*(0.216)*	*(0.362)*
Frost past 4 years	-0.242	-0.170	-0.293**	1.174***	1.254***	1.085**
	(0.170)	*(0.278)*	*(0.120)*	*(0.237)*	*(0.276)*	*(0.392)*
Death of Livestock past 4 years	0.158	0.422	-0.235	0.758***	0.248	1.392***
	(0.244)	*(0.269)*	*(0.142)*	*(0.203)*	*(0.175)*	*(0.225)*
Constant	2.320***	3.036***	1.678***	1.479***	0.731***	2.174***
	(0.195)	*(0.273)*	*(0.154)*	*(0.318)*	*(0.224)*	*(0.445)*
Observations	1,208	571	637	1,208	571	637
R-squared	0.026	0.046	0.056	0.212	0.200	0.302
F-test	3.319	3.176	10.66	128.5	55.33	49.27

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.3.a – First Stage Estimations for Children Aged 12 Years Old (Older Cohort Round 2)

	Hours of domestic work			Hours of market work		
VARIABLES	All	Female	Male	All	Female	Male
Proportion of Older Sisters	-0.683*	-0.441	-0.185	0.675	-0.065	0.942
	(0.372)	*(0.389)*	*(0.497)*	*(0.407)*	*(0.339)*	*(0.626)*
Proportion of Younger Sisters	0.130	0.880	0.098	0.587**	0.246	0.633
	(0.459)	*(0.653)*	*(0.549)*	*(0.272)*	*(0.248)*	*(0.605)*
Proportion of Older Brothers	-0.706**	-0.510	-0.338	0.238	-0.233	0.431
	(0.294)	*(0.370)*	*(0.518)*	*(0.255)*	*(0.206)*	*(0.610)*
Proportion of Younger Brothers	0.345	0.876	0.420	0.215	-0.070	0.394
	(0.415)	*(0.519)*	*(0.681)*	*(0.344)*	*(0.459)*	*(0.641)*
Mom Ill past 4 years	0.047	0.231	0.056	-0.125	-0.267*	-0.178
	(0.152)	*(0.234)*	*(0.163)*	*(0.170)*	*(0.151)*	*(0.208)*
Dad Ill past 4 years	0.348**	0.139	0.244	-0.292**	-0.162	-0.137
	(0.154)	*(0.233)*	*(0.267)*	*(0.131)*	*(0.139)*	*(0.215)*
Other Ill past 4 years	0.089	-0.153	0.315*	-0.288	-0.188	-0.352
	(0.157)	*(0.200)*	*(0.154)*	*(0.202)*	*(0.161)*	*(0.327)*
Death in the Household past 4 years	0.223	-0.074	0.358	0.019	-0.180	0.261
	(0.220)	*(0.214)*	*(0.345)*	*(0.212)*	*(0.207)*	*(0.375)*
New Household Member past 4 years	0.173	0.036	0.312	0.046	-0.352	0.396
	(0.229)	*(0.266)*	*(0.250)*	*(0.274)*	*(0.244)*	*(0.345)*
Drought past 4 years	-0.168	-0.076	-0.422	0.805***	0.418	1.269***
	(0.272)	*(0.249)*	*(0.354)*	*(0.280)*	*(0.314)*	*(0.365)*
Flood past 4 years	0.211	0.218	0.066	0.433	0.004	0.998***
	(0.229)	*(0.271)*	*(0.323)*	*(0.282)*	*(0.281)*	*(0.340)*
Frost past 4 years	-0.452**	-0.067	-0.173	0.604**	0.307	0.320
	(0.210)	*(0.433)*	*(0.295)*	*(0.255)*	*(0.340)*	*(0.421)*
Death of Livestock past 4 years	0.183	0.329	-0.087	0.418***	0.418**	0.431**
	(0.176)	*(0.236)*	*(0.181)*	*(0.145)*	*(0.153)*	*(0.201)*
Constant	2.807***	3.142***	1.957***	0.680**	0.828**	0.795
	(0.322)	*(0.396)*	*(0.444)*	*(0.266)*	*(0.331)*	*(0.485)*
Observations	781	391	390	781	391	390
R-squared	0.051	0.083	0.057	0.104	0.068	0.191
F-test	8.615	6.435	5.664	9.466	4.749	6.641

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.3.b – Summary of Effects of Domestic and Market Work on Schooling Outcomes using Self-Reported Data for Children Aged 12 Years Old (Older Cohort Round 2)

	All		Female		Male	
	OLS	IV	OLS	IV	OLS	IV
PPVT Score						
Total hours of domestic work	-0.045***	-0.042	-0.036*	-0.102	-0.060**	-0.217
	(0.013)	*(0.083)*	*(0.019)*	*(0.086)*	*(0.028)*	*(0.157)*
Total hours of market work	-0.043*	-0.114	-0.042*	-0.18	-0.047	-0.169
	(0.023)	*(0.143)*	*(0.022)*	*(0.217)*	*(0.033)*	*(0.135)*
Mathematics Test Score						
Total hours of domestic work	-0.048*	0.027	-0.051*	-0.054	-0.054	0.133
	(0.027)	*(0.103)*	*(0.028)*	*(0.118)*	*(0.047)*	*(0.220)*
Total hours of market work	-0.019	-0.05	0.004	0.229	-0.025	0.105
	(0.025)	*(0.129)*	*(0.028)*	*(0.197)*	*(0.031)*	*(0.155)*
Observations	782	781	391	391	391	390

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.4.a – First Stage Estimations for Children Aged 15 Years Old

	Hours of domestic work			Hours of market work		
VARIABLES	All	Female	Male	All	Female	Male
Proportion of Younger Sisters	0.426	1.287***	-0.085	0.4	-0.429	1.04
	-0.341	*-0.294*	*-0.381*	*-0.489*	*-0.424*	*-0.664*
Proportion of Younger Brothers	0.385	0.416	0.091	0.028	-0.103	0.406
	-0.334	*-0.28*	*-0.454*	*-0.441*	*-0.34*	*-0.594*
Mom Ill past 4 years	0.316	0.620**	0.253	0.029	-0.057	-0.051
	-0.184	*-0.239*	*-0.253*	*-0.215*	*-0.19*	*-0.274*
Dad Ill past 4 years	0.092	-0.259	-0.005	-0.211	-0.089	0.033
	-0.237	*-0.235*	*-0.314*	*-0.219*	*-0.217*	*-0.347*
Other Ill past 4 years	0.013	-0.052	-0.131	-0.17	-0.199	0.016
	-0.16	*-0.158*	*-0.183*	*-0.165*	*-0.186*	*-0.275*
Death in the Household past 4 years	-0.412*	-0.405	-0.485*	0.209	-0.329	0.839
	-0.205	*-0.298*	*-0.235*	*-0.36*	*-0.205*	*-0.517*
New Household Member past 4 years	0.177	0.323	0.276	0.059	-0.51	0.224
	-0.22	*-0.331*	*-0.25*	*-0.428*	*-0.311*	*-0.489*
Drought past 4 years	0.208	0.411	-0.408	0.884**	0.760***	1.328***
	-0.223	*-0.266*	*-0.264*	*-0.314*	*-0.244*	*-0.444*
Flood past 4 years	-0.048	-0.450*	0.333	0.37	0.057	0.781
	-0.15	*-0.222*	*-0.298*	*-0.217*	*-0.211*	*-0.475*
Frost past 4 years	0.347	0.563*	0.172	0.184	0.148	0.129
	-0.264	*-0.308*	*-0.354*	*-0.197*	*-0.225*	*-0.32*
Death of Livestock past 4 years	0.385*	0.829***	0.065	0.466*	0.158	0.703**
	-0.211	*-0.265*	*-0.23*	*-0.241*	*-0.226*	*-0.318*
Constant	2.731***	3.422***	2.199***	1.048***	0.606***	1.353***
	-0.225	*-0.31*	*-0.18*	*-0.244*	*-0.202*	*-0.308*
Observations	782	391	391	782	391	391
R-squared	0.036	0.162	0.029	0.06	0.067	0.133
F-test	6.342	7.723	2.608	4.957	6.239	5.397

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.4.b – Summary of Effects of Domestic and Market Work on Schooling Outcomes using Self-Reported Data for Children Aged 15 Years Old

	All		Female		Male	
	OLS	IV	OLS	IV	OLS	IV
PPVT Score						
Total hours of domestic work	-0.031	-0.287	-0.078**	-0.336**	0.002	0.008
	(0.019)	*(0.189)*	*(0.033)*	*(0.170)*	*(0.033)*	*(0.157)*
Total hours of market work	-0.035**	-0.388	-0.053	-0.337	-0.024	0.026
	(0.016)	*(0.295)*	*(0.039)*	*(0.210)*	*(0.020)*	*(0.129)*
Mathematics Test Score						
Total hours of domestic work	-0.033*	-0.317	-0.044*	-0.288	-0.032	-0.105
	(0.018)	*(0.221)*	*(0.024)*	*(0.182)*	*(0.040)*	*(0.247)*
Total hours of market work	-0.048***	-0.579	-0.039**	-0.037	-0.064**	-0.302
	(0.014)	*(0.438)*	*(0.017)*	*(0.095)*	*(0.025)*	*(0.203)*
Observations	782	782	391	391	391	391

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 2

Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH)

The main objective of ENIGH is to provide information for the statistical analysis of the behavior of the households' income and expenditures. Data includes information on income and expenditure amounts, sources, and distribution; in addition to socio-demographic and labor occupational characteristics of the household members and dwelling infrastructure.[77] The households are surveyed during 7 consecutive days between August 21st and November 28th of the particular year.

The ENIGH is available for the following years: 1984, 1989, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2005, 2006, 2008, 2010, and 2012. The new methodology for the ENIGH was introduced in 2008, featuring a socioeconomic conditions section which was designed to provide estimates of a multidimensional measure of poverty.

The survey is representative at the national level, but for some particular years it is also representative at the state level for some particular States. The 2012 ENIGH has fewer observations than the 2008 and 2010 ENIGHs, and it is representative only at the national level. In 2008 the survey was designed to be representative at the national level and at the state level for: Distrito Federal, Guanajuato, Jalisco, México, Sonora, Querétaro and Yucatán. For the case of the 2010 survey, it was designed to be representative at the national level and at the state level for Distrito Federal, Chiapas, Guanajuato, México, and Yucatán.

Sections included in the New ENIGH

Six questionnaires are applied to each household surveyed in the ENIGH. We used information included on questionnaires 1, 3, 5, and 6. Table I.1 shows the sections within the different questionnaires included in our analysis and the use of the information in our analysis. For example, we used a particular question from the *"1. Household Expenditure*

[77] http://www.inegi.org.mx/est/contenidos/Proyectos/encuestas/hogares/regulares/enigh/

Questionnaire, Section I – Monthly Expenditures, Subsection1.3 – Education, Culture, and Recreation" to estimate the household annual investment on Education.

The new ENIGH features a health section for each household member (Questionnaires 5 and 6); the question regarding enrollment in *Seguro Popular* was introduced in 2006, but additional questions regarding other types of health insurance and medical attention were added in 2008.

Table A.5 – New ENIGH Questionnaires and Sections

Qustionnaire	Section	Subsection	Variables
1. Household Expenditure	I. Monthly Expenditures	1.3 Education, Culture, and Recreation 1.5 Dwelling and services	Investment on Education Mortgage
	III. Semi-annually Expenditures	3.1 Household Equipment and Dwelling Mainteinance	Household Productive Capital
		3.3 Transportation 3.4 Other Expeditures 3.5 Financial Expenditures	Vehicle Payments Social Capital Savings
2. Daily Expenses[a]			
3. Household and dwelling	III. Sociodemographic Characteristics		Relationship to the Head of the Household, Age, Gender, Educational Attainment , and Labor Force Participation for each member of the household
	VI. Time to the Closest Hospital		Time, in minutes, to the closest hospital
4. Household businesses[a]			
5. Persons aged 12 years old and above	X. Health		Affiliation with Seguro Popular or other Health Care Providers
6. Persons aged less than 12 years old	X. Health		Affiliation with Seguro Popular or other Health Care Providers

a: Questionnaire not inlcuded in this paper.

Appendix 3

Parallel Trends Tests for Agricultural Households: 2000 vs. 2002

In order to test the parallel trends assumption, the following equation was estimated for uninsured households. In this first estimation we compared agricultural vs. non-agricultural households.

$$PropInv = \vartheta_0 + \beta_1 AgriWrk + \gamma T + \boldsymbol{\delta AgriWrk * T} \quad \text{(A.1)}$$

The results suggest that there are no significant differences between the investments trends for agricultural and non-agricultural uninsured households. Table A.6 summarizes the coefficients for the interaction term of equation A.1, the standard error, and the t-statistic.

Table A.6– Parallel Trends Test: Agricultural vs. Non-Agricultural Unisured Households: 2000 vs. 2002

	Coeff	SE	t
<u>All households</u>			
Education	-0.033	0.025	**-1.324**
Durable Assets	-0.290	0.186	**-1.557**
Productive Capital	0.013	0.019	**0.655**
Social Capital	0.038	0.038	**0.997**
Savings	0.023	0.021	**1.096**
<u>Low Income Households</u>			
Education	0.036	0.030	**1.230**
Durable Assets	-0.081	0.276	**-0.294**
Productive Capital	0.005	0.024	**0.215**
Social Capital	0.017	0.051	**0.324**
Savings	-0.025	0.024	**-1.028**

Parallel Trends Tests for Self-Employed Households: 2000 vs. 2004

Additionally, another parallel trend test was estimated for another classification of the uninsured household. In this second estimation we compared self-employed vs. employed households.

$$PropInv = \vartheta_0 + \beta_1 SelfEmpWrk + \gamma T + \boldsymbol{\delta SelfEmpWrk * T} \quad \text{(A.2)}$$

The results suggest that there are no significant differences between the investments trends for self-employed and employed uninsured households, with the exception of investments in networks. Note that 2004 was a local election year, therefore part of this significant difference could relate to the context of the particular electoral year. Table A.7 summarizes the coefficients for the interaction term of equation A.1, the standard error, and the t-statistic.

Table A.7– Parallel Trends Test: Self-Employed vs. Employed Uninsured Households: 2000 vs. 2004

	Coeff	SE	t
All households			
Education	0.006	0.015	**0.373**
Durable Assets	-0.037	0.043	**-0.856**
Productive Capital	0.015	0.011	**1.297**
Social Capital	0.046	0.021	2.175
Savings	0.002	0.012	**0.163**
Low Income Households			
Education	0.024	0.022	**1.096**
Durable Assets	0.126	0.169	**0.744**
Productive Capital	0.030	0.017	**1.733**
Social Capital	0.122	0.036	3.370
Savings	-0.032	0.018	**-1.784**

Appendix 4

Logistic Regressions

A. 2012 – Potential Participants of Seguro Popular

Table A.8 shows the results for the logistic regression that estimates the probability of affiliation to *Seguro Popular* in 2012.

Table A.8– Logistic regression, Affiliation to Seguro Popular in 2012

Dependent variable: Household enrollment in Seguro Popular

	Whole Sample	Exluding households with Oportunidades
One person household	-0.7567***	-0.6409***
	(0.2142)	*(0.2140)*
Proportion of formal workers in the household	0.1627	0.2496
	(0.2517)	*(0.2846)*
Proportion of household members with other types of health insurance	-6.3124***	-6.2506***
	(0.2011)	*(0.1894)*
Formality status of the head of the household	0.4986*	0.3803
	(0.2723)	*(0.3075)*
Self-employed status of the head of the household	-0.1317	-0.2134
	(0.1367)	*(0.1398)*
Female head of the household	-0.174	-0.2099
	(0.1676)	*(0.1771)*
Age of the head of the household	-0.0079	-0.0078
	(0.0068)	*(0.0074)*
Educational attainment of the head of the household	-0.1617***	-0.1648***
	(0.0341)	*(0.0353)*
Number of household members	0.0404	0.0572
	(0.0427)	*(0.0444)*
Number of household members (5 to 25 years old) enrolled in school	0.1251**	0.1306**
	(0.0560)	*(0.0519)*
Number of household members (19 to 25 years old) enrolled in school	-0.4222***	-0.4424***
	(0.1540)	*(0.1564)*
Number of women of childbearing age (15 to 54 years old) in the household	0.0227	0.0202
	(0.0767)	*(0.0753)*
Number of household members (17 to 18 years old)	0.0965	0.1422
	(0.2061)	*(0.2216)*
Oportunidades	0.9484***	
	(0.1661)	
Size of the city	0.2512***	0.2978***
	(0.0515)	*(0.0515)*
Constant	0.4904	0.3426
	(0.4021)	*(0.4108)*
Observations	5,321	4,309
Pseudo - R^2	0.461	0.426

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

B. 2008 – Permanent Participants of Seguro Popular

Table A.9 shows the results for the logistic regression that estimates the probability of affiliation to *Seguro Popular* in 2008, for those households classified as potential participants of *Seguro Popular*.

Table A.9– Logistic regression, Affiliation to Seguro Popular for Potential Participants in 2008

Dependent variable: Household enrollment in Seguro Popular

	Whole Sample	Exluding households with Oportunidades
Proportion of formal workers in the household	-0.9162**	-0.9030**
	(0.3697)	*(0.3698)*
Proportion of household members with other types of health insurance	6.8353***	13.3263***
	(1.3270)	*(1.3924)*
Formality status of the head of the household	-0.1467	-0.4833*
	(0.2763)	*(0.2612)*
Self-employed status of the head of the household	0.1313	0.4432**
	(0.1190)	*(0.1857)*
Female head of the household	0.1357	0.4171***
	(0.1548)	*(0.1330)*
Age of the head of the household	0.0076	0.0127**
	(0.0051)	*(0.0059)*
Educational attainment of the head of the household	0.3366***	0.4566***
	(0.0362)	*(0.0570)*
Number of household members	-0.1864***	-0.1471***
	(0.0569)	*(0.0461)*
Number of household members (5 to 25 years old) enrolled in school	-0.0192	-0.2390***
	(0.0581)	*(0.0649)*
Number of household members (19 to 25 years old) enrolled in school	0.4994**	1.2378***
	(0.2530)	*(0.3076)*
Number of women of childbearing age (15 to 54 years old) in the household	0.1354	0.0928
	(0.1091)	*(0.0953)*
Number of household members (17 to 18 years old)	-0.1315	-0.4200***
	(0.1054)	*(0.1148)*
Number of household members (0 to 5 years old)	0.2804***	0.2425**
	(0.0891)	*(0.0984)*
Oportunidades	1.0672***	
	(0.1274)	
Expenditure decile	-0.0511**	-0.0992***
	(0.0210)	*(0.0225)*
Constant	0.8861***	1.2307***
	(0.2289)	*(0.3255)*
State Dummies	YES	YES
Observations	5,362	3,410
Pseudo - R^2	0.147	0.221

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1