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First Come, First Served

An Analysis of Birth Order Effects on Children's Time Use and Human Capital Development in Four Developing Countries

Jennifer Drennan Olsen (41045)

Abstract: This thesis investigates whether, and to what extent, children's birth orders impact their human capital development and time use throughout their childhood, using data from a longitudinal cohort study of children from Ethiopia, India, Peru and Vietnam. Comparing children *across* households reveals significant birth order effects favouring first-born children's human capital development in all four countries. However, different dimensions of human capital are affected at different ages. Children's physical development is mainly affected by their birth order when they are aged five and eight, whereas children's cognitive development is mainly affected when they are twelve and fifteen. I also find cross-country evidence that first-born children spend more time taking care of others, and less time on leisure than other children at equivalent ages. Weaker evidence of these effects are provided when comparing children *within* households. No birth order effects are found on children's school attendance.

Keywords: Birth order, human capital development, cognition, anthropometrics, time use, enrolment

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1. Introduction

It has long been hypothesized that children with a low birth order, i.e. children born before their siblings, fare better than their younger brothers and sisters. The prevalence of such birth order effects can have a number of economic implications. From the perspective of human capital development, biased intra-household investments into children based on birth order could be an important source of aggregate inefficiencies in human capital investment (Behrman, 1997). It has also been pointed to as a source of inequality in both educational and labour market outcomes, leaving individuals on an unequal footing to their siblings throughout their childhood and into adulthood (Black, Devereux and Salvanes, 2005; Kantarevic and Mechoulan, 2006).

This thesis investigates whether and to what extent a child's birth order impacts their human capital development and time use throughout their childhood, using data from a longitudinal cohort study of children in four developing countries.

The longitudinal cohort study, Young Lives, has collected data on a cohort of 8000 children born in 2001/2 (hereby referred to as *index children*) from Ethiopia, India (in the state of Andhra Pradesh[1]), Peru and Vietnam. Five coordinated survey rounds have been administered across the four countries at regular intervals between 2002-2016, following the index children and their households through their first fifteen years of life. I use data on anthropometric z-scores[2] and cognitive test scores to capture birth order effects on children's human capital development across two dimensions: physical development and cognitive development. Furthermore, I use rich time use data to explore how children of different birth orders divide their time between education, work, leisure and care-giving activities once they are of school-going age. Complementary to this, I investigate whether birth order affects school enrolment.

I explore these outcomes through two different analyses. First, I perform OLS regressions, comparing human capital development, time use and school enrolment across index children at different stages of their childhood. Since index children are from different households, I refer to this as an *inter-household* analysis. Second, I use data on index children's siblings to perform an *intra-household* analysis, controlling for household-fixed-effects. The intra-household analysis captures any latent household characteristics that could bias the inter-household analysis, serving

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[1] It is should be noted that upon the official creation of the Indian state of Telanga in June 2014, Andhra Pradesh was split into two states: "New" Andhra Pradesh and Telanga. For the purpose of this study I refer to Andhra Pradesh as it was defined in 2001, at the start of the Young Lives project. This includes both the states of Telanga and Andhra Pradesh as defined in 2018.

[2] Anthropometric z-scores are defined by the World Health Organization (WHO), and capture how much a child's height or weight deviates from the typical height or weight of a healthy child of their age

as a robustness check. All analyses are conducted separately for each of the four developing countries. Analyses are also conducted separately for each survey round, since I do not expect birth order to have a constant effect on children throughout their lives.

The inter-household analysis finds significant birth order effects favouring first-born children's human capital development in all four countries. However, different aspects of human capital development are affected at different ages. Birth order effects on children's physical development appear stronger when children are between the ages of five and eight, whilst birth order effects on cognitive development appear stronger when children are aged twelve and fifteen.

The intra-household analysis of birth order effects on physical development only finds significant effects in Ethiopia. However, due to data restrictions I am unable to perform the intra-household analysis for the survey rounds in which the most significant effects are observed in the inter-household analysis. Meanwhile, the intra-household analysis on cognitive test scores confirms that there are significant birth order effects on cognitive development in Ethiopia and India, but not in Vietnam or Peru.

The analyses of birth order effects on time use suggest that first-born children spend more time dedicated to caring for others and less time on leisure than other children when they are young. Results from the intra-household analysis further suggest that first-born children spend more time studying than their younger siblings.

This study adds to the growing consensus in the empirical literature considering birth order effects on human capital development, concluding that birth order effects exist, and that they tend to favour first-born children. The previous literature in this field has largely used data from developed countries, and has tended to focus on effects on cognitive development (e.g. Black, Devereux and Salvanes, 2011; Hotz and Pantano, 2015; Pavan, 2016), although a few studies also consider non-cognitive development (e.g. Lehmann, Nuevo-Chiquero and Vidal-Fernandez, 2018). Meanwhile, the limited body of research from developing countries has tended to focus on physical development (Behrman, 1988; Horton, 1988; Jayachandran and Pande, 2017). To my knowledge, the only previous study to have explicitly analysed birth order effects on cognitive development in a developing country, is a recent paper by Calimeris and Peters (2017).

Birth order effects have also been considered by the substantial body of literature mapping children's likelihood of working as opposed to studying in developing countries. These studies find that first-born children are more likely to spend time on paid or unpaid work, while being less likely to attend school than other children of an equivalent age (Ejrnæs and Pörtner, 2004;

Emerson and Souza, 2008; Khanam and Rahman, 2007). This paper does not support this consensus, finding no evidence that first-born children are less likely to attend school. It does, however, confirm that first-born children work more, to the extent that care-giving is defined as a working activity.

This thesis contributes to the existing literature in five ways. First, it extends the limited body of research investigating birth order effects on the physical development of children. Second, it provides a contribution to the body of research considering birth order effects on cognitive development, by being the second study to have ever investigated these effects in a developing country. Third, it contributes to the literature exploring how birth order affects the trade-offs children face between education and responsibilities at home, by analysing effects of birth order on children's time use and school attendance. Fourth, by investigating birth order effects on equivalent measures of physical development, cognitive development and time use in four countries, it allows insight into how generally these effects apply across countries. Finally, it is the only study to consider all of these effects for the same sample of children at different ages, demonstrating how children's birth orders impact different aspects of their development throughout their childhood.

The paper proceeds as follows: Section two outlines some key facts and figures about each of the four countries considered in this study. Section three reviews both theoretical and empirical literature concerning birth order effects in developed and developing countries. Section four describes the Young Lives dataset in greater detail, outlining the key variables that are used in my analyses. Section five explains the methodology that has been applied in each of two analyses: An inter-household OLS analysis, and an intra-household analysis with household-fixed-effects. Subsequently, the results of the two analyses are presented in sections six and seven. These results are discussed in greater detail in section eight, which also outlines potential areas for future research. Section nine concludes.

2. Background

This section outlines some key facts and figures about the four developing countries that are considered in this study: Ethiopia, India (for the state of Andhra Pradesh), Peru and Vietnam. It also presents some of the main insights from previous research on the Young Lives cohort data[3] of relevance to the outcomes addressed in this study: physical development, cognitive development, time use and enrolment.

2.1 Economic Development and Growth

Table 1 displays inflation adjusted gross domestic product (GDP) per capita in Ethiopia, India, Peru and Vietnam for each of the five years in which Young Lives cohort data has been collected.

Table 1, GDP p.c. During Young Lives Survey Rounds

	GDP per Capita (2018 USD)				
	2002	**2006**	**2009**	**2013**	**2016**
Ethiopia	111	194	380	502	713
India	466	792	1090	1452	1718
Peru	2059	3171	4166	6583	6031
Vietnam	428	780	1211	1871	2171

Note: The table displays GDP per capita in current (2018) US dollars for each of the five years that Young Lives survey rounds have been administered.
Source: The World Bank (2018c)

Ethiopia, India, Peru and Vietnam all experienced substantial economic growth between 2002-2016. In fact, Peru, Vietnam and India changed their income status as defined by the World Bank during the course of the Young Lives project. Vietnam and India changed their status from low-income countries to lower-middle-income countries in 2009 and 2011 respectively, whilst Peru changed its status from a lower-middle-income country to an upper-middle-income country in 2010. Ethiopia has retained its status as a low-income country throughout the observed period, and is still classified as one of the world's least developed countries according to the UN, however it has also experienced substantial growth between 2002-2016 (The UN, 2018; The World Bank, 2018a).

This economic growth can also be seen reflected in the Young Lives data, where the average family has been getting wealthier over time in all four countries. Parallel to this, poverty has been reduced and living conditions have generally improved.

[3] The discussion in this section exclusively pertains to the cohort of index children born in 2001/2.

Still, many disadvantaged groups are left behind, remaining impoverished. In Ethiopia, these are typically rural households, with larger levels of dependency and lower levels of education among household members. In Andhra Pradesh, these are also typically households from rural areas, or from Scheduled Tribes and Castes. In Vietnam households that have remained poor have been geographically concentrated in the regions of the Northern Uplands, the Mekong Delta, and the Central Costal region. Vietnam also has a large income-divide between minority and majority ethnic groups, whereby 84% of the households at the bottom income tercile in 2016 were minorities. Meanwhile, in Peru, living conditions have generally been improving across socio-economic groups, but not necessarily across all dimensions. E.g. gaps in household water connections between different socio-economic groups increased between 2002-2016. (Cueto, Penny & Sanchez, 2018; Nguyen & Nguyen, 2018; Pankhurst, Woldehanna, Araya, Tafare, Rossiter, Tiumelizzan & Birhanu, 2018; Singh, Galab, Reddy and Benny, 2018).

2.2 Fertility and Household Size

As can be seen in table 2, the fertility rate varied greatly between Ethiopia, India, Peru and Vietnam in the year that the majority of the cohort of children considered in this study were born (2001). Whereas Ethiopia averaged 6.9 births per woman, Vietnam averaged only 2. Meanwhile, Andhra Pradesh averaged almost a whole birth less per woman than India as a whole. Thus, the average birth rate in Andhra Pradesh was lower than in Peru, despite India having a substantially higher fertility rate.

Table 2, Fertility Rate in 2001

	Fertility Rate (Births per Woman)
Ethiopia	6.9
India	3.2
Andhra Pradesh	2.3
Peru	2.9
Vietnam	2.0

Note: The table displays the average births per woman in the year that most index children were born (2001). *Source: The World Bank (2018b), National Institute for Transforming India (2018)*

Complementary to the relative fertility rates between the four surveyed regions, Young Lives data shows that index children from Ethiopia and Peru on average have more siblings, and are more likely to have higher birth orders, than index children from Andhra Pradesh and Vietnam. This will be discussed in more detail in section 4.2, which considers the birth order composition of index children in the Young Lives data.

2.3 Education

There are different national systems for education in Ethiopia, India, Peru and Vietnam, outlining national standards for school attendance and grade progression[4].

In Ethiopia children have the right to free primary education starting at the age of seven. With typical grade progression, children finish primary education at the age of 15, and have to take a national exam in order to progress to lower secondary education. After two years of lower secondary education, another exam determines whether children enter into upper secondary education, either preparing them for higher education or providing vocational training. With normal grade progression, children graduate from upper secondary education at the age of 19.

In India, primary education is compulsory for children aged 6-14. Upon completing primary education at the age of 14, children may enrol into lower secondary education, which typically lasts for two years, before progressing to upper secondary education. With normal grade progression, children graduate from upper secondary education at the age of 18.

In Peru access to education is mandatory from the age of three, when children enrol into pre-school, and remains mandatory throughout both primary education, which children typically attend between the ages of 6-11, and secondary education, which children typically attend between the ages of 12-17. All children who graduate from secondary education receive a certificate for entry into higher education.

In Vietnam, five years of primary education are compulsory. Children typically start primary education at the age of six, and following a normal grade progression they continue on to lower secondary education at the age of 11. At the age of 15 all children have to pass entrance exams in order to progress to secondary education, which prepares students for higher education. Among children who fail the entrance exams, many go on to do vocational training, or continue learning in local community centres (Cueto, Singh, Woldehanna and Duc, 2016).

2.4 Insights From Previous Young Lives Studies

The WHO (2018a) defines three different types of malnutrition that can be identified through physical measurements: Stunting, wasting and obesity. Children are defined as *stunted* if their height-for-age (HFA) is substantially lower than the average height for healthy children. *Wasting,* on the other hand, is when a child's weight-for-height is substantially lower than average. Stunting indicates long term malnutrition over a child's lifetime, whereas wasting indicates short

[4] All of the information for this section is sourced from Cueto, Singh, Woldehanna and Duc (2016).

term deficiencies in nutrition. Being underweight, i.e. having a low weight-for-age (WFA), could either indicate stunting or wasting, or both. Another form of malnutrition that is becoming increasingly important in developing countries is *obesity*. Children are defined as obese if their body mass index (BMI) exceeds healthy reference levels. In general terms, levels of stunting and wasting have been decreasing over time in all the surveyed countries (UNICEF, 2018ab). Meanwhile, levels of obesity are on the rise (UNICEF, 2018c).

Complementary to these national trends, previous research on Young Lives data[5] has found that the prevalence of stunting among index children has been diminishing over time (table 3). Meanwhile, levels of wasting have tended to vary more sporadically between different ages. This indicates that incidences of *long term* malnutrition have been diminishing over the index children's life-time, although periods of *short term* malnutrition have remained common. Meanwhile, obesity has been particularly problematic in Peru, where as many as 29% of index children were defined as overweight or obese at the age of 15 (in 2016). Incidences of obesity in Andhra Pradesh, Vietnam and Ethiopia are still fairly uncommon. Key household characteristics associated with persistent levels of malnutrition are low household wealth and low levels of maternal education. Children that are stunted, thin and underweight are also more likely to come from rural areas. Levels of obesity, on the other hand, are highly concentrated in urban areas (Benny, Boyden and Penny, 2018).

Table 3, The Level of Stunting Among Index Children

	Stunted Index Children (%)	
	2002 (Aged 1)	2016 (Aged 15)
Ethiopia	40	27
Andhra Pradesh	30	28
Peru	27	16
Vietnam	21	20

Note: The table displays incidences of stunting in Young Lives data. *Source: Benny, Boyden and Penny, 2018.*

The Young Lives research project has also administered a number of numeracy and literacy tests in order to assess children's cognitive skills (closer descriptions of these tests are outlined in section 4.3). A recent study into cross-country differences between index children's test scores when they were aged five and eight, ranks Vietnam first, Peru second, Andhra Pradesh third, and Ethiopia last at both ages (Singh, 2018). The cross-country gap was also larger for eight year-olds than for five year-olds. The study goes on to show that differences in these gaps can partly be

[5] For a summary of this research, see Benny, Boyden and Penny (2018)

explained by differences in school effectiveness, whereby schools are particularly productive in Vietnam.

Finally, a number of studies have used Young Lives time use- and enrolment- data to asses key drivers of drop out rates, as well as the dynamic interplay between work and education in children's lives. Studies into enrolment and drop out rates show that children in Ethiopia typically start school later than in the other countries, reflected in enrolment rates below 70% for Ethiopian index children at the age of eight. However, by the age of twelve more than 90% of Ethiopian children are enrolled in school (Cueto, Singh, Woldehanna and Duc, 2016). Meanwhile, drop-out rates at the age of fifteen are the largest in Andhra Pradesh and Vietnam. In Andhra Pradesh, girls are more likely to drop out of school, whilst in Vietnam drop-out rates are larger among boys (Sanchez and Singh, 2018).

Studies into children's time use show that although many children in all four countries work, most children combine work with school. However, school attendance is a large determinant of *how much* children work. Children out of school work as much as six to ten hours a day on average, compared to country averages ranging from ten minutes to four hours among children in school. Comparing across countries, index children in Ethiopia are more prone to work at younger ages and to work more while they are attending school than in other countries. Meanwhile, Peru displays the lowest average amount of hours worked among children out of school. Comparing across males and females, there is no clear gender gap in hours worked. There are, however, gender divides in the type of work children are engaged in, whereby girls are more prone to perform domestic chores, and boys are more prone to help with the family business or work for an external employer (Espinoza-Revollo and Porter, 2018).

3. Literature Review

This section summarizes some main takeaways from the theoretical literature explaining potential causal mechanisms of birth order effects. It also outlines key insights from empirical research mapping birth order effects on human capital development, education and labour in developed and developing countries.

3.1 Causal Channels of Birth Order Effects

The theoretical literature identifies several reasons why one might expect children's human capital development to vary with birth order. Broadly speaking, three causal channels of birth order effects have been identified: Parental characteristics, access to household resources and parental preferences.

Among theories focusing on *parental characteristics*, it has been hypothesised that children with lower birth orders tend to have younger and healthier parents. This could give children a biological advantage from birth, as well as the advantage of having more active parents growing up (Behrman and Taubman, 1986). Although early theoretical literature argued that these advantages could be outweighed by parental immaturity or inexperience (Blake, 1989), recent empirical evidence suggests that parents take more precautions when they are inexperienced, ultimately benefitting the development of their older children (Lehmann, Nuevo-Chiquero and Vidal-Fernandez, 2018).

Among theories focusing on *access to household resources*, the *resource depletion theory* proposes that older siblings deplete their parents' resources before their younger siblings are old enough to make use of them. However, it has been argued that the accumulation of family wealth and reduction of credit constraints over time typically outweigh effects from resource depletion, providing children of a higher birth order with richer parents (Parish and Willis, 1993). Some theories consider the presence of younger siblings to be a potential resource in itself, noting that older children who take care of their younger siblings get a chance to develop their own skills through teaching others. Meanwhile, the extra attention received by younger siblings can both favour and disfavour their development, as there are more older household members to turn to for help but also less opportunities to act independently. Younger siblings may also be affected negatively if they look to older siblings for guidance instead of their parents (Blake, 1989; Zajonc, 1976).

Among theories focusing on *parental preferences*, Behrman (1988) hypothesizes that parents are less inequality averse when they are strapped for resources, causing birth order biases to be particularly pronounced when families are more impoverished. This bias favours the older children in the household, who are more able to contribute to improving the family's income. Meanwhile, the *equity heuristic theory* proposes that even if parents are inequality averse intra-temporally (at a given point in time) they may give unequal shares of resources to their children inter-temporally (across time). Consistent with this theory, Lindert (1977) and Price (2008) find that first-born children, who have no siblings to contend with for resources before their younger siblings are born, receive a larger share of their parents available time over their lifetime. However, Lindert (1977) also finds that last-born children similarly benefit from being "only children" when older siblings move away from home. Hotz and Pantano (2015) observe that parents are less strict with their later-born children, and propose that this is due to parents facing a strategic trade-off between the costs and rewards of being strict. They present a model of strategic parenting in which disciplining a child has a *direct* effect on the child, as well as an *indirect reputational* effect on the child's younger siblings, who perceive their parents being strict. The indirect reputational effect is less relevant when a child has fewer younger siblings, lowering the incentive to discipline later-born children. Finally, Jayachandran and Pande (2017) note that parental preferences are likely to be culturally contingent, observing that parents are particularly prone to allocate more resources to first-born males in cultures that place a large legal- or ritual-importance on the eldest son.

3.2 Empirical Evidence from Developed Countries

Recent research from developed countries suggests that having a low birth order, and in particular being a first-born child, is related to better educational achievements and labour market outcomes (Black, Devereux and Salvanes, 2005; Kantarevic and Mechoulan, 2006). Complementary to this, studies into birth order effects on human capital development find that first-born children on average have higher IQ and better cognitive abilities than their younger siblings (Black, Devereux and Salvanes, 2011; Hotz and Pantano, 2015; Lehmann, Nuevo-Chiquero and Vidal-Fernandez, 2018; Pavan, 2016). Meanwhile, studies into intra-household allocations of resources, such as those of Price (2008) and Pavan (2016), find that investments of parental time and resources vary across different birth orders, favouring earlier born children.

However, in the field of psychology the empirical debate about the existence of a link between birth order and IQ is less clear-cut. In one corner are studies such as Armor (2001), Zajonc (2001) and Zajonc and Sulloway (2007), that find a significant negative relationship between higher birth orders and IQ scores. In the other corner are studies by Rodgers, Cleveland, van den Oord and Rowe (2001, 2000) and Whichman, Rodgers and McCallum (2007, 2006), presenting empirical evidence that no significant link exists. Each side criticises the other on methodological grounds, and there is no sign of a growing consensus (Pavan, 2016, p. 703).

3.3 Empirical Evidence from Developing Countries

In developing countries, studies considering birth order effects on human capital development have tended to focus on physical development, as opposed to cognitive development. These studies find that children of a higher birth order are more likely to be malnourished, impeding their physical development (Horton 1988; Jayachandran and Pande 2017). Complementary to this, studies into intra-household allocations of resources find that children of a lower birth order receive more food and vital nutrients than their younger siblings (Behrman, 1988; Calimeris and Peters, 2017)[6].

There is also large body of empirical evidence suggesting that childhood malnutrition leads to poor cognitive development[7], making it reasonable to suppose that observed birth order effects on physical development also entail effects on cognitive development. The only previous study that has explicitly considered birth order effects on cognition in a developing country, confirms that children with higher birth orders score worse on cognitive tests (Calimeris and Peters, 2017). However, this study fails to find that low levels of nutrition is a driving factor behind this effect, observing that the negative cognitive effect exists for later-born children even if they receive more nutrients than their older siblings.

Studies into the dynamics between birth order, child labour and school attendance find that first-born children are less likely to attend school and more likely to work than their younger siblings (Ejrnæs and Pörtner, 2004; Emerson and Souza, 2008; Khanam and Rahman, 2007; Seid and Gurmu, 2015). In other words, children of a lower birth order may benefit from a larger share of household resources, whilst at the same time being less prone to applying these resources to further their own education and development, instead applying them to activities securing the immediate well being of their family.

4. Data

This section outlines the Young Lives dataset, and defines key explanatory and dependent variables measuring birth order, physical development, cognitive development, time use and enrolment. It also outlines the balance of child- and household characteristics across different birth orders.

4.1 Young Lives

Young Lives is a collaborative research project coordinated by the Department of International Development at the University of Oxford. The Young Lives project has followed two cohorts of index children from Ethiopia, India (in the state of Andhra Pradesh), Peru and Vietnam over the course of 15 years. Data on the index children and their households have been collected over five survey rounds undertaken in 2002, 2006/7, 2009/10, 2013/14 and 2016. I use data on the

[6] The studies summarized in this section use data from India (Behrman, 1988), Indonesia (Calimeris and Peters, 2017) and the Philippines (Horton, 1988) – whilst Jayachandran and Pande (2017) compare differences in birth order effects between India and Sub-Saharan Africa, as well as between Indian states.

[7] For a review of this material, see Grantham-McGregor (1995)

younger cohort of index children, born in 2001/2, making them approximately one, five, eight, twelve and fifteen years old in the respective survey rounds. The younger cohort consists of 2000 index children from each of the surveyed countries, giving a total sample of 8000 children across all four countries[8].

From survey round three onwards, additional information has been collected on one of the index children's siblings, referred to as their *panel sibling*. The collected data includes Peabody Picture Vocabulary Test scores and anthropometric z-scores (these measures are outlined in greater detail in section 4.3). The age ranges of the panel siblings across the four countries are summarized in figures 1-4 in Appendix A. Time use data have also been collected on the index children's siblings through household surveys, capturing all children who have been living in the same household as the index child during any of the survey rounds.

Index children have been randomly selected from a range of so-called "sentinel sites", with each sentinel site representing a different sub-group of the population in the surveyed countries. Since the Young Lives project aims to shed light on the effects and drivers of childhood poverty, the sentinel sites chosen for the project represent poorer segments of the population. I.e. the selection of the sentinel sites has been non-random, geared towards poorer areas, whereas the selection of children within sentinel sites has been random. Besides over-sampling poorer households, the Young Lives data has been determined to represent the demographic diversity of the surveyed countries (or state, in the case of Andhra Pradesh). Field workers have been physically present at children's own homes to administer all surveys, even in the event of children moving from their original location. Consequently, rates of attrition have remained fairly low, and 95.1% of the sample has been retained throughout all five survey rounds (for a complete discussion of the sampling procedure in each country see Escobal and Flores, 2008; Kumra 2008; Nguyen 2008; Outes-Leon and Sanchez, 2008).

For the Indian data it is important to note that the Young Lives study has only surveyed children from one Indian state, Andhra Pradesh. For simplicity, I will simply refer to "India" when I am analysing the data from Andhra Pradesh throughout the rest of my analysis and tables.

4.2 Defining Birth Order

I define birth order by the number of children born to a child's mother up to and including the child itself. I.e. a child with birth order one is the first child born to their mother, a child with

[8] The Young Lives data sources are referenced under Boyden (2018, 2014a, 2014b), Boyden, Woldehanna, Galab, Sanchez, Penny and Duc (2018, 2016) and Huttly and Jones (2014) in section 10.

birth order two is the second child born to their mother, and so on. This has been the standard measure in much of the previous literature, where reported maternal births are often used as a means to deduce children's birth order (e.g. Black, Devereux and Salvanes, 2011; Calimeris and Peters, 2017; Lehmann, Nuevo-Chiquero and Vidal-Fernandez, 2018; Pavan 2016).

I have additionally grouped later birth orders together, so as to improve the statistical power of the analysis. Thus, the birth order categories used in this study are first-born, second-born and later-born.

Two methods have been used to calculate birth order. The first calculates *within-household birth order* by counting the number of older maternal siblings that are listed in the household survey. However, this disregards older siblings that have moved away from home before the first round of Young Lives surveys. The second method of calculation is based on responses to a question from the second survey round, which asks how many children the index child's mother has given birth to before the index child. This gives a simple and direct measure of the *true birth order* of the index child, capturing older siblings that have moved away from home.

I use the true birth order in analyses that only concern index children, i.e. in the inter-household analyses. However, the true birth order cannot be calculated for the index child's siblings. Thus, I use the within-household birth order in the intra-household analyses, which rely on sibling data. I will outline these analyses in greater detail in section 5 of the paper, concerning methodology.

Some children have been dropped from the analyses due to missing or erroneous reporting making me unable to infer the children's birth order. I have additionally dropped children with maternal siblings of the same age from the sample, as I am not able to distinguish the birth order of these siblings, or alternatively determine whether they are twins. The frequencies of dropped observations are summarized in table 32 in appendix D.

Table 4, Frequency of Birth Order Groups

	Ethiopia	**India**	**Peru**	**Vietnam**
First-born	466 (25.22%)	776 (40.82%)	768 (38.53%)	902 (45.62%)
Second-born	376 (20.35%)	733 (38.56%)	508 (25.49%)	726 (36.72%)
Later-born	1006 (54.44%)	392 (20.62%)	717 (35.98%)	349 (17.65%)
Total	1848	1901	1993	1977

Note: The table displays the number of children belonging to each birth order group in each of the four Young Lives countries. Percentage of total in parenthesis

Table 4 summarizes the frequency of the index children retained in my analysis belonging to each of the three birth order groups, using the children's *true birth order*. The table reflects the relative norms for family sizes across the four countries, as the proportion of later-born children is increasing in the countries' relative fertility rates. In Ethiopia, which has the highest rate of fertility, more than half of index children are later-born. Meanwhile in Vietnam, with the lowest rate of fertility, less than one fifth of index children are later-born. Peru shows the most equal distribution of index children across the three groups.

4.3 Outcomes

Table 5 summarizes the dependent variables that are used to measure each of three outcomes considered in this study: Physical development, cognitive development and time use and enrolment. It also shows the survey rounds for which each of the dependent variables are identified.

Table 5, Description of Dependent Variables Measured in Each Survey Round

Dependent Variables	**Description**	**Survey Rounds** 1	2	3	4	5
Physical Development						
WFA z-score	Weight-for-age (WFA) deviation from reference level	x	x	x		
HFA z-score	Height-for-age (HFA) deviation from reference level	x	x	x	x	x
Cognitive Development						
PPVT score	Normalised Peabody Picture Vocabulary Test scores		x	x	x	x
Numeracy test score	Normalised scores for numeracy tests		x	x	x	x
Literacy test score	Normalised scores for literacy tests			x	x	x
Time use and Enrolment						
Hours study	Hours spent studying in a typical day			x	x	x
Hours school	Hours spent at school in a typical day			x	x	x
Enrolled	Dummy variable = 1 if child is enrolled in school			x	x	x
Hours work	Hours spent on work or chores in a typical day			x	x	x
Hours care	Hours spent caring for household members in a typical day			x	x	x
Hours leisure	Hours of leisure in a typical day			x	x	x

Note: The table displays the dependent variables that are used to measure various outcomes in this study. Crosses indicate that outcomes are analysed in a given survey round

4.3.1 Physical Development

In order to measure physical development I use anthropometric data on the children's height and weight. Specifically, I use reported anthropometric z-scores to measure children's weight-for-age (WFA) and height-for-age (HFA).

Z-score reference levels are defined by the World Health Organization (WHO), and capture how much a child's height or weight deviates from the "normal" height or weight for a healthy child of their age. E.g. a z-score of -1 indicates that a child's height or weight is one standard deviation below the healthy norm. The WHO calculates these reference levels using measures of healthy children from a genetically diverse set of countries. A HFA z-score below -2, indicates that a child is stunted (WHO, 2018b).

Z-scores for WFA are only reported in survey rounds one through three, since WHO references for weight are not defined for children above the age of ten (Briones, 2018 p.9). Z-scores for HFA are reported in all survey rounds.[9]

4.3.2 Cognitive Development

The Young Lives study has administered several standardised tests in order to measure the development of children's basic cognitive skills.

The Peabody Picture Vocabulary Test (PPVT)[10] has been administered to all index children in survey rounds two through five. This test is designed to capture children's *receptive vocabulary* (their ability to understand words) and entails children matching verbally administered words with pictures. PPVT scores have been commonly used to proxy verbal intelligence and cognitive abilities in the psychological literature (Dunn and Dunn, 1997; Lubin, Larsen and Matarazzo, 1984).

In addition to the PPVT, children have undertaken standardized numeracy and literacy assessments in survey rounds three through five. Both the numeracy and the literacy tests were administered in local languages, and designed to increase in difficulty across survey rounds.

The numeracy test used in survey round two drew on elements from the standardised Cognitive Development Assessment (CDA). The assessment was orally administered, and aimed at capturing early quantitative skills (Singh, 2018). The numeracy tests applied in survey rounds 3-5 measured mathematic abilities, drawing on material from the internationally recognized

[9] Some children have been dropped from the anthropometric analyses due to their z-scores being flagged as biologically infeasible according to WHO reference levels (WHO 2018b). Dropped or missing z-scores are summarized in tables 33-36 in appendix D.

[10] The Young Lives project has applied the third version of this test, commonly referred to as PPVT III. PPVT III was originally developed in English, and had to be translated into appropriate local languages in Ethiopia, India and Vietnam. Peru applied a standardised Spanish version of the test, that had been developed prior to the Young Lives project (Leon, Miranda and Cueto, 2015).

Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) tests (Cueto and Leon, 2012).

The literacy assessment in survey round three was administered in form of an Early Grade Reading Assessment (EGRA). The EGRA is a standardised assessment that is orally administered, and designed to capture early literacy skills, such as knowing the letters of the alphabet and understanding simple sentences. More advanced literacy assessments, with components requiring both reading and writing, were administered in subsequent survey rounds (Cueto and Leon, 2012).

Since I am interested in the *relative* test performances between children, as opposed to their *absolute* test scores, I have normalised all raw test scores between index children from the same country so as to be normally distributed around a mean zero, with a standard deviation equal to one ($N \sim (0,1)$). This allows for a more meaningful discussion about the magnitude of captured birth order effects. It also allows for a more meaningful comparison of results across different tests in different survey rounds.

4.3.3 Time Use and Enrolment

Data on children's time use has been collected for all household members aged between five and seventeen in survey rounds two through five. However, since I am mainly interested in time use dynamics for children of school-going age, I choose to only perform the time use analysis for children above the age of seven.

The time use data represents how the members of the index children's households have spent their time in a typical day in the week preceding the survey, where a typical day is described as a week-day or a school-day (as opposed to a weekend or holiday). The time use data has been measured by giving survey respondents 24 beads representing an hour of time, which they are asked to place into each of eight different boxes representing different activities: caring for others, doing household chores (such as fetching water or cooking), performing household tasks that contribute to the family's income (such as herding or helping the family business), working for non-family members, attending school, studying, leisure (such as playing or eating) and sleeping (Briones, 2018). Time use data from survey round three is reported by the parents, whilst time use from rounds four and five are reported by the children themselves.

Some limitations arise from this method of collecting time use data. First, respondents are only allowed to report time use in discrete values of whole hours, limiting the precision of the time use measurements. Second, the same unit of time is only allowed to be allocated to one activity, meaning that it is not possible to allocate hours spent multi-tasking into more than one category (e.g. an hour spent doing homework while simultaneously baby-sitting younger siblings). Third, since household members are asked to represent a typical day in the week preceding the survey, seasonal variation is not captured or controlled for. However, the Young Lives project has attempted to mitigate this issue influencing differences by timing survey rounds to take place in roughly the same seasons as each other (Espinoza-Revollo and Porter, 2018).

Since I am mainly interested in the general dynamics between responsibilities at home, child labour, education and leisure, I choose to group responsibilities together in my analysis. Specifically, I create one time use variable for household chores, tasks and working for others. I choose to keep time spent caring for others as a separate variable, as I find it reasonable to suppose that this is more prone to be connected with birth order than other responsibilities (you are more likely to spend time taking care of your siblings if they are younger than you are). I also extend the scope of the leisure variable to include hours of sleep. Time spent caring for others, studying and attending school are as originally defined.

In addition to the time use data, I look at whether or not a child is enrolled in school. This is a dummy variable that has been collected for all children in all survey rounds, and will allow for a more meaningful interpretation of the factors driving any differences in time spent on school and studying.

4.4 Child- and Household Characteristics

Table 6 displays the balance of index children's child- and household characteristics across different birth order groups. The following characteristics are displayed:

- Child is female: A dummy variable = 1 if the child is female
- Child's age: The child's age at the time of the survey, measured in months
- Mother's age at birth: The age of the mother when the child was born, measured in years
- Mother's level of education: The highest attained level of maternal education (measured by completed grades)[11] when index children are aged five (survey round 2).
- Lives in rural area: A dummy variable = 1 if the child lives in a rural area
- Wealth index: An index variable constructed from a rich set of information on each household's assets and access to goods and services[12]
- Household size: The number of people living in the child's household
- Maternal siblings: The number of maternal siblings

[11] This is measured slightly differently from country to country, depending on their educational systems, making a cross-country comparison of maternal education difficult.
[12] For more details about the construction of the Young Lives wealth index, see Briones (2017)

Table 6, Balance of Index Child Characteristics Across Birth Order Groups

	First Born Mean	Second Born Mean	Later Born Mean	First - Second Difference	First - Later Difference
PANEL A: Ethiopia					
Fixed					
Child is female	0.50	0.47	0.46	0.03	0.03
Mother's age at birth	20.65	23.61	29.61	-2.96***	-8.96***
Mother's level of education	4.83	4.10	3.11	0.73*	1.73***
Contemporaneous					
Child's age (in months)	11.69	11.78	11.65	-0.08	0.05
Lives in a rural area	0.50	0.58	0.73	-0.08*	-0.23***
Wealth index	0.29	0.25	0.19	0.04*	0.10***
Household size	4.45	4.61	6.61	-0.17	-2.17***
Maternal siblings	0.01	0.83	3.23	-0.82***	-3.22***
Observations	428	368	1089	796	1517
PANEL B: India					
Fixed					
Child is female	0.47	0.47	0.43	0.01	0.04
Mother's age at birth	20.66	22.65	25.95	-1.99***	-5.29***
Mother's level of education	4.38	3.92	2.19	0.46	2.19***
Contemporaneous					
Child's age (in months)	11.79	11.98	11.57	-0.18	0.22
Lives in a rural area	0.73	0.74	0.80	-0.01	-0.07**
Wealth index	0.43	0.41	0.36	0.01	0.07***
Household size	5.34	5.07	5.88	0.27*	-0.54***
Maternal siblings	0.00	0.53	1.71	-0.53***	-1.71***
Observations	730	740	435	1470	1165
PANEL C: Peru					
Fixed					
Child is female	0.51	0.48	0.49	0.02	0.01
Mother's age at birth	20.98	25.13	30.76	-4.15***	-9.78***
Mother's level of education	8.98	8.13	5.43	0.85***	3.55***
Contemporaneous					
Child's age (in months)	11.39	11.54	11.66	-0.15	-0.27
Lives in a rural area	0.22	0.27	0.43	-0.05	-0.21***
Wealth index	0.49	0.45	0.35	0.03*	0.14***
Household size	5.38	5.05	6.41	0.33*	-1.03***
Maternal siblings	0.00	0.91	2.84	-0.90***	-2.84***
Observations	717	495	784	1212	1501
PANEL D: Vietnam					
Fixed					
Child is female	0.48	0.49	0.49	-0.01	-0.01
Mother's age at birth	23.04	27.36	31.65	-4.32***	-8.61***
Mother's level of education	6.43	6.40	4.69	0.03	1.74***
Contemporaneous					
Child's age (in months)	11.70	11.70	11.31	-0.00	0.39*
Lives in a rural area	0.81	0.79	0.80	0.03	0.01
Wealth index	0.45	0.46	0.41	-0.01	0.04**
Household size	4.67	4.70	5.82	-0.03	-1.15***
Maternal siblings	0.00	0.99	2.40	-0.98***	-2.40***
Observations	900	704	376	1604	1276

Note: Mean values of child and household characteristics across all survey rounds are reported in columns 1-3. Estimated differences in means between first-born children and subsequent birth order groups are reported in columns 4-5, where *p<0.05 **p<0.01 ***p<0.001.

The mother's age at birth, the child's sex and the mother's level of education are measured as fixed variables, staying constant over the index children's lives. The other characteristics vary over time, and are measured contemporaneously in each survey round. Since the distribution of the contemporaneous characteristics remains fairly balanced across rounds, I only report characteristics from survey round 1 in table 6. Means of contemporaneous characteristics in survey rounds two through five are reported in tables 16-19 (appendix A).

Children with higher birth orders tend to have older and less educated mothers, and to be from larger households. They are also overrepresented among less wealthy households, and in all countries except Vietnam they are more likely to live in rural areas.

Males and females appear evenly dispersed between the three birth order groups in all countries. Children's ages also appear evenly distributed across the three birth order groups, with a few exceptions for specific survey rounds: In the first survey round the average age is lower among later-born children in Vietnam, in survey round two the average age is lower among later-born children in Peru, and in survey round four the average age is lower among later-born children in Ethiopia and India, whilst being higher among later-born children in Peru.

Table 7 additionally displays the balance of child characteristics across different birth order groups for index children and their panel siblings in survey round four. As will be outlined in section 5.1., this sample of children is used to perform intra-household analyses on children's physical and cognitive development. Note that birth order in this case is defined as the *within household* birth order. The following characteristics are displayed:

- Child is female: A dummy variable = 1 if the child is female
- Child's age: The child's age at the time of the survey, measured in years

The table displays clear age distributions across the three birth order groups in all four countries, whereby the sample of first born children is substantially older than subsequent birth orders. The genders appear evenly balanced across birth order groups.

Finally, table 8 displays the balance of child characteristics across different birth orders for all household members that are included in the intra-household time use analysis, which will be outlined in greater detail in section 5.1. This table also displays clear age distributions across the three birth order groups, whereby first born children are older than subsequent birth orders. Genders are also evenly distributed across the three birth order groups except in India, where there are more females among first born children than later born children.

Table 7, Balance of Index Child and Panel Sibling Characteristics Across Birth Order Groups

	First Born Mean	**Second Born** Mean	**Later Born** Mean	**First - Second** Difference	**First - Later** Difference
PANEL A: Ethiopia					
Child is female	0.49	0.50	0.48	-0.00	0.02
Age	12.55	11.01	10.80	1.54***	1.76***
Observations	271	500	1623	771	1894
PANEL B: India					
Child is female	0.47	0.51	0.48	-0.04	-0.01
Age	13.30	11.17	11.00	2.13***	2.30***
Observations	1015	1353	746	2368	1761
PANEL C: Peru					
Child is female	0.52	0.51	0.52	0.00	-0.00
Age	11.52	9.88	9.90	1.64***	1.61***
Observations	216	342	511	558	727
PANEL D: Vietnam					
Fixed Controls					
Child is female	0.48	0.50	0.52	-0.02	-0.03
Age	14.36	11.48	11.51	2.88***	2.85***
Observations	725	950	491	1675	1216

Note: Mean values of index child and panel sibling characteristics in survey round 4 are reported in columns 1-3. Estimated differences in means between first-born children and subsequent birth order groups are reported in columns 4-5, where *p<0.05 **p<0.01 ***p<0.001.

Table 8, Balance of Household Member Characteristics Across Birth Order Groups

	First Born Mean	**Second Born** Mean	**Later Born** Mean	**First - Second** Difference	**First - Later** Difference
PANEL A: Ethiopia					
Child is female	0.51	0.51	0.49	0.02	0.02
Age	11.72	11.56	10.84	-0.69***	3.13***
Observations	1265	1089	2579	3053	6871
PANEL B: India					
Child is female	0.52	0.52	0.48	-0.00	0.04*
Age	10.48	9.23	9.14	2.37***	3.38***
Observations	1791	1193	708	3611	3176
PANEL C: Peru					
Child is female	0.49	0.49	0.51	0.00	-0.02
Age	11.17	8.67	7.54	2.51***	3.64***
Observations	1996	1795	3304	3791	5300
PANEL D: Vietnam					
Child is female	0.51	0.53	0.52	0.00	0.02
Age	10.39	9.33	9.55	2.48***	3.02***
Observations	1769	1010	537	3530	2941

Note: Mean values of child characteristics for household members aged 7-17 in survey round 3 are reported in columns 1-3. Estimated differences in means between first-born children and subsequent birth order groups are reported in columns 4-5, where *p<0.05 **p<0.01 ***p<0.001.

5. Method

5.1 Empirical Strategy

I perform two separate analyses in order to capture birth order effects on children's human capital development, time use and enrolment. The first analysis measures birth order effects across index children. Since no two index children are from the same household, this is essentially an *inter-household* analysis, measuring differences across different households. The second analysis uses panel sibling- and household member- data to perform an *intra-household* analysis, measuring birth order effects within households.

The inter-household analysis provides the benefit of capturing children from the same cohort at the same age within a given survey round. This allows for a dynamic analysis of how birth order has affected these children throughout their childhoods. Meanwhile, the intra-household analysis provides an analysis of how birth order affects siblings within the same families. By controlling for household-fixed-effects, the intra-household analysis can control for any latent household- and parental- characteristics that might be driving differences in the inter-household analysis, serving as a robustness check.

5.1.1 Regression Specification and Hypothesis Tests

I apply separate regression specifications for the inter- and intra-household analyses.

For the inter-household analysis, I perform ordinary least squares (OLS) regressions, estimating the following inter-household model:

$$Y_i = \beta_1 S_i + \beta_2 L_i + \gamma_1 C_i + \gamma_2 H_i + \varepsilon_i \qquad \text{(Inter-household)}$$

For the intra-household analysis, I perform fixed effects (FE) regressions. The FE regressions estimate the following intra-household model:

$$Y_{ih} = \beta_1 S_{ih} + \beta_2 L_{ih} + \gamma_1 C_{ih} + \alpha_h + \varepsilon_{ih} \qquad \text{(Intra-household)}$$

In both models, $\mathrm{Y_i}$ represents a single dependent variable in a single survey round for a single index child, i. In the intra-household model, subscripts for different households, h, are added, since the model captures several individuals from the same household.

S_i and L_i are dummy variables equalling one if index children are second-born or later-born respectively. C_i and H_i are vectors of control variables (these variables are outlined in section 5.2). Variables in C_i are child characteristics, whilst variables in H_i are household characteristics. Since each child in the inter-household model is from a different household, both C_i and H_i vary across all individuals. Meanwhile, in the intra-household analysis, all household characteristics are captured by the household-fixed-effects variable, α_h, which varies across households but not between individuals within households.

The FE regression estimation de-means all variables in the model, using mean values for members of the same household[13]. Since the household mean of α_h should be the same for all individuals within a given household, household fixed effects are removed from the regression estimates. In other words, the intra-household FE regression should control for all household characteristics. Thus, the vector of household characteristics (H_i) has not ben added to this analysis.

In each analysis, I am interested in testing the following two hypotheses:

H1: There is a difference in the average value of outcome variable Y between individuals who are first-born and individuals who are second-born.

H2: There is a difference in the average value of outcome variable Y between individuals who are first-born and individuals who are later-born.

In each analysis the "null hypotheses" (i.e. the hypotheses of *no* differences in average outcomes) are rejected if the estimated birth order coefficients are determined to be significantly different from zero, as summarised in table 9.

Table 9, Null Hypotheses

	Difference between first- and second-born **(H1)**	Difference between first- and later-born **(H2)**
H_0:	$\beta_1 = 0$	$\beta_2 = 0$
H_1:	$\beta_1 \neq 0$	$\beta_2 \neq 0$

Note: The table displays the null hypotheses tested in both the inter- and the intra-household analyses.

In order for the regressions to produce unbiased estimates, a key assumption is that the error term is uncorrelated with the independent variables. I.e. the error term has to fulfil the *zero conditional means assumption* (Wooldridge, 2008, p. 158).

$$E(\varepsilon_i | S_i, L_{i,} C_i, H_i) = 0 \qquad \text{(zero conditional mean, OLS)}$$

13 See Wooldridge, 2008, pp.481-482 for a formal explanation of this procedure, noting that *household characteristics* are held fixed across *individuals* in my analysis, whereas *individual characteristic*s are held fixed across *time* in Wooldridge.

Due to the FE estimation additionally depending on household means as well as individual characteristics, the *zero conditional means assumption* further requires an assumption of *strict exogeneity*. This assumption states that the error term of each household member is uncorrelated with all the independent variables of all household members (Wooldridge, 2008, p. 503).

$$E\left(\varepsilon_{ih} \middle| S_h, L_{h,} C_h, \alpha_h\right) = 0 \qquad \text{(zero conditional mean, FE)}$$

These assumptions only hold in the event of there being no omitted variables from the analyses that are correlated with both the independent and the dependent variables. I will discuss the potential for omitted variable bias in greater detail in sections 5.2 and 5.3.

In order to produce appropriate estimates of standard error (SE) terms, and correctly infer the significance of estimated coefficients, another key assumption for both models is that there are no correlations between error terms. I.e. for individual index children, i and j:

$$Corr\left(\varepsilon_i, \varepsilon_j\right) = 0 \quad for\ all\ j \neq i \qquad \text{(no correlation, normal SE)}$$

However, by way of representing specific population groups or areas, the Young Lives data has been collected from so-called "sentinel sites", with each site representing a different sub-group of the population. Given this survey design, it is reasonable to expect correlations between error terms within sentinel sites. Unless this correlation is accounted for, both models will underestimate the value of the standard errors, increasing the risk of type 1 errors (rejecting a true null hypothesis).

I therefore estimate both the OLS model and the FE model with *clustered standard errors* on the sentinel site level, using a so-called sandwich estimator (Rogers, 1993), which allows for correlation between index children within sentinel sites, but not across sentinel sites. This, in turn, ensures that inferences of significance levels are not distorted by correlations between error terms within sentinel sites. I continue to assume that error terms for children from different sentinel sites are uncorrelated. I.e. for individual index children, i and j, from sentinel sites, s and c:

$$Corr\left(\varepsilon_{is}, \varepsilon_{jc}\right) = 0 \quad for\ all\ j \neq i \ \ if \ \ c \neq s \qquad \text{(no correlation, clustered SE)}$$

5.1.2 Choice of Models

In both the inter- and intra-household analyses, I do not expect there to be a constant marginal difference in outcomes between different birth orders. Judging from the previous literature, the expectation is that first-born children are in a particularly advantageous position, whereas the difference between e.g. a third-born or a fourth-born child is less important. Therefore, I choose to discretely measure the effects of different birth orders, capturing the difference between being first-born and each subsequent birth order. I additionally group children with birth order three or above into one group of later-born children, so as to have a meaningful sample size of children in each birth order category.

In the *inter-household* analysis, separate OLS regressions are run for each dependent variable listed in table 5, in each survey round. This captures birth order effects across index children at different ages. I choose to run separate regressions for each survey round because I do not expect the relationship between birth order and the dependent variables to be constant across the index children's lifetime. Rather, I expect birth order to have a larger or smaller effect depending on age specific factors that vary non-linearly with age, e.g. whether the child is attending school. Performing independent OLS regressions for the five survey rounds captures the unique impact that a child's birth order may have for a given age.

Still, in the interpretation of the results it is important to note that all survey rounds capture birth order effects in a given year, as well as capturing the index children at a certain age. Thus round-specific effects may be due to conditions that are particular to the year of the survey round, as opposed to only being conditioned on the child's age.

For the *intra-household analysis on physical- and cognitive- development*, I use index child- and panel sibling- data from Ethiopia, Peru and Vietnam to run FE regressions on each of two dependent variables: HFA z-scores and PPVT test-scores. In India, the dependent variables are HFA z-scores and numeracy test-scores. The z-scores and test-scores are measured in the exact same way as in the inter-household regression, although it should be noted that cognitive test scores continue to be normalised using the scores of index children as a benchmark.

As discussed in the data section (section 4.1), panel sibling data has been collected in survey rounds three through five. However, the data from round three is lacking across several measures in different countries, and I therefore choose to restrict my analysis to survey rounds four and five. I perform separate analyses for the two survey rounds. Since the age range of panel siblings varies, panel sibling analyses in a given round do not capture birth order effects for a given age. However, by following the same siblings over two different rounds, the panel sibling analyses should give an image of how birth order effects between siblings may change over time.

For the *intra-household analysis on time use and enrolment*, I use collected data on all household members aged 7-17 to run FE regressions on each of six dependent variables: Hours worked, hours care, hours leisure, hours study, hours school and enrolment. All of these variables are as defined in table 5. By restricting the sample to this age group, I capture children of school-going age in all four countries.

With household data it makes less sense to measure effects across several survey rounds, since the full age range of children can be captured in a single round. Differences between survey rounds would also be difficult to interpret, since each round is likely to see new household members either leaving or joining the 7-17 age group. Thus, different survey rounds capture a different set of household members. I therefore choose to analyse intra-household time use from one survey round. Specifically, I use data from survey round three, as this is the round for which I have the most complete time use information for the desired age group.

5.2 Control Variables

5.2.1 Inter-Household Analysis

In the inter-household analysis, I control for a broad set of child- and household- characteristics in order to isolate birth order effects, and reduce the risk of omitted variables causing violations of the *zero conditional means* assumption. All characteristics are as defined in section 4.4.

The child characteristics I control for are the age (in months) of the child at the time of each survey, and the child's sex. I also control for the mother's age at birth, as is common practice in studies evaluating birth order effects. Since all index children are from the same cohort, this controls for both cohort- and age-specific maternal characteristics. However, it is worth noting that controlling for the mothers age at birth may eliminate a portion of birth order effects that could be explained by the optimality of the mother's age (Behrman and Taubman, 1986).

I also control for a number of household characteristics that give a good indication of the index children's socio-economic background. In line with much of the previous literature, I control for the mothers level of education (a fixed variable, measured in survey round two). I additionally control for household wealth, which is captured by a constructed index variable based on extensive information about the household's assets, and access to services and consumption goods. This provides a more thorough control of wealth than those typically included in previous studies, which tend to be restricted to controlling for household assets (e.g. Calimeris and Peters, 2017; Ejrnæs and Pörtner, 2004; Khanam and Rahman, 2007) or income and employment status (e.g. Behrman and Taubman, 1986; Kessler, 1991; Lehmann, Nuevo-Chiquero and Vidal-Fernandes, 2018). I also include a dummy control for whether the child lives in an urban or rural area.

Finally, in order to control for the fact that later-born children are more likely to come from larger households I have included a simple control for household size as well as discrete controls for the number of maternal siblings in the household (i.e. separate dummy variables for each possible number of maternal siblings contained in the sample).

5.2.2 Intra-Household Analysis

In the intra-household analysis I simply control for two child characteristics: age and sex. Previous studies performing household-FE regressions on birth order have also tended to include the mother's age at birth and cohort indicators as controls. However, children in this analysis are always compared at the same point in time. Consequently, differences in children's ages should be perfectly correlated with cohort differences and differences in the maternal age at birth. As summarized in section 5.1, all household characteristics are controlled for by estimating household-fixed-effects for all intra-household analyses.

Due to concerns about non-linear age effects, I choose to control for age discretely, including dummy variables for each age observed within the sibling sample (denominated in completed years).

5.3 Limitations of the Estimation Strategies

5.3.1 Inter-Household Analysis

The main limitations of the inter-household analysis arise from the fact that I am comparing children from different households. Thus, the analysis could be vulnerable to any omitted variable bias arising from unobserved household characteristics. There are in particular three household characteristics that I have been unable to control for, which have been identified by the previous literature as likely to systematically vary with birth order and the outcomes measured in this study. These characteristics are: Completed family size, birth spacing and separation or divorce.

Black, Devereux and Salvanes (2005, 2011) highlight that the potential of confounding effects of family structure and birth order effects is a common problem in the existing literature. Children of a higher birth order may be more likely to have divorced or separated parents at a given age since they are born later on in their parents marriage or partnership. This may in turn affect their development and education. This is not likely to present much of an issue in India, Peru and Vietnam where rates of divorce and separation are very low. However, in Ethiopia, where 6% of women were divorced or separated in 2016, this could be more problematic (Central Statistical Agency, 2016).[14]

Later-born children are also more likely to be born into families that are both larger when they are born, but also larger once their parents stop having children. Completed family size is, in turn, a variable that has been associated with particular parental behaviours and traits that could impact children's development (Blake, 1989). Although completed family size is likely to be highly correlated with current family size, the inclusion of this variable can be subject to endogeneity issues through so called *optimal stopping behaviours,* which entails parents stopping fertility once they have children with a desired set of characteristics (Behrman and Taubman, 1986; Zajonc, 1976).

Children with a higher birth order are also more likely to come from families with a shorter space of time between the births of their children. Shorter spaces between births may, in turn, place children at a biological disadvantage, or place particular pressures on the distribution of parental attention and other household resources (Zajonc, 1976). Since I do not know the ages of any siblings who have moved away from home, I am unable to reliably calculate birth spacing.

All of the above effects represent household characteristics, as opposed to child characteristics. Thus the intra-household FE regressions should serve as a robustness check by controlling for all unobserved household characteristics.

5.3.2 Intra-Household Analysis

The main limitations for the intra-household analysis arise from the fact that I am measuring differences between siblings at a given point in time, as opposed to measuring differences at an equivalent age.

First, this may limit the birth order effects that I am able to pick up. As proposed by the *equity heuristic theory,* birth order effects may be stronger inter-temporally than they are intra-temporally, with differences between birth orders becoming apparent when siblings are of equivalent ages, as opposed to being apparent at a given point in time.

Second, since differences between siblings at a given point in time are largely influenced by their relative ages, it is imperative to include appropriate controls for age. Including simple linear

[14] The rate of divorce or separation among women was 1.05% in Andhra Pradesh in 2006, 1.4% in Vietnam in 2009, and 0.04% in Peru in 2018 (Central Population and Housing Census Steering Committee, 2010; The Economist, 2018; Office of the Registrar General & Census Commissioner, 2006)

controls for age may be subject to bias if there are any non-linear "jumps" in z-scores, time use or cognitive abilities as children grow older. Thus, I choose to control for age discretely, i.e. including different dummy variables for each age that is observed within the sample[15]. However, by substituting one continuous age-variable with several dummy-variables I reduce the degrees of freedom in the FE regressions, constricting the statistical power of the intra-household analysis.

6. Results Section I: Inter-Household Analysis

This section presents the results of the inter-household OLS regressions, estimating birth order effects on physical development, cognitive development, time use and enrolment across index children.

6.1 Physical Development

Table 10 displays the results of the OLS regression on anthropometric z-scores in Ethiopia, India, Peru and Vietnam. It also reports mean anthropometrics z-scores across all index children in each country. For reported controls view tables 22-25, in appendix C.

6.1.1 Cross-Country Differences in the Sample Mean

As a general note, mean anthropometric z-scores are consistently negative throughout the index children's first fifteen years of life. Comparing across different ages, the average HFA is at its lowest when index children are around five years old in all countries except Ethiopia, where children have the shortest average HFA at the age of one. The average WFA decreases as index children get older in Ethiopia and Vietnam, whereas in Peru it is at its lowest when the index children are five. In India the average WFA is decreasing between the ages of one and five, and remains constant between the ages of five and eight.

Comparing across countries, Vietnam consistently has the tallest average HFA, whilst the highest average WFA is observed in Peru. The shortest average HFA is observed in Ethiopia when the children are young. However, Ethiopian children appear to outgrow Indian children as they get older, and by the age of 15 India displays the shortest average HFA out of the four countries. Children in India also have the lowest WFA at all ages.

15 I initially estimated the intra-household model with linear age effects, however results from several of these regressions estimated birth order effects of infeasible magnitudes, causing me to be concerned about results being driven by non-linear age effects. The original regressions with linear age effects have been included in appendix B.

Table 10, Effects on Anthropometric Z-Scores Across Index Children

PANEL A: HFA z-scores				
	Ethiopia (OLS)	**India** (OLS)	**Peru** (OLS)	**Vietnam** (OLS)
Aged 1				
Second Born	0.00 (0.17)	0.06 (0.08)	0.00 (0.18)	0.13 (0.36)
Later Born	-0.04 (0.23)	-0.17 (0.20)	-0.06 (0.20)	0.66 (0.47)
Mean	-1.51 (1.83)	-1.30 (1.47)	-1.30 (1.29)	-1.11 (1.25)
Observations	1704	1837	1888	1922
Aged 5				
Second Born	-0.32* (0.12)	-0.01 (0.05)	-0.23* (0.09)	-0.02 (0.06)
Later Born	-0.29* (0.14)	-0.19* (0.09)	-0.26 (0.13)	-0.00 (0.11)
Mean	-1.45 (1.12)	-1.66 (0.99)	-1.54 (1.11)	-1.35 (1.03)
Observations	1777	1858	1894	1904
Aged 8				
Second Born	-0.17 (0.13)	-0.07 (0.07)	-0.17* (0.06)	-0.12* (0.05)
Later Born	-0.24 (0.12)	-0.23* (0.09)	-0.22 (0.11)	0.02 (0.10)
Mean	-1.21 (1.13)	-1.45 (1.04)	-1.16 (1.05)	-1.10 (1.07)
Observations	1755	1832	1853	1879
Aged 12				
Second Born	-0.02 (0.11)	-0.04 (0.06)	-0.08 (0.07)	-0.06 (0.07)
Later Born	-0.05 (0.08)	-0.13 (0.07)	-0.05 (0.12)	-0.10 (0.10)
Mean	-1.46 (1.00)	-1.45 (1.03)	-1.04 (1.11)	-1.05 (1.15)
Observations	1747	1828	1804	1840
Aged 15				
Second Born	-0.10 (0.13)	-0.00 (0.06)	-0.08 (0.06)	0.02 (0.05)
Later Born	-0.03 (0.10)	-0.05 (0.11)	-0.01 (0.09)	0.03 (0.08)
Mean	-1.32 (1.10)	-1.46 (0.98)	-1.16 (0.89)	-1.01 (0.88)
Observations	1685	1808	1754	1893
PANEL B: WFA z-scores				
	Ethiopia (OLS)	**India** (OLS)	**Peru** (OLS)	**Vietnam** (OLS)
Aged 1				
Second Born	0.05 (0.11)	-0.02 (0.05)	0.16 (0.14)	0.30 (0.38)
Later Born	-0.15 (0.15)	-0.27* (0.13)	0.14 (0.18)	0.56 (0.51)
Mean	-1.38 (1.46)	-1.54 (1.12)	-0.20 (1.19)	-0.96 (1.08)
Observations	1640	1855	1892	1930
Aged 5				
Second Born	-0.18 (0.11)	-0.02 (0.05)	-0.22* (0.08)	-0.14 (0.08)
Later Born	-0.24* (0.09)	-0.13 (0.08)	-0.30* (0.12)	-0.34* (0.13)
Mean	-1.36 (0.92)	-1.87 (0.93)	-0.54 (1.03)	-1.06 (1.14)
Observations	1778	1864	1899	1910
Aged 8				
Second Born	-0.13 (0.08)	-0.04 (0.06)	-0.19* (0.08)	-0.22* (0.09)
Later Born	-0.15 (0.09)	-0.17 (0.10)	-0.30* (0.13)	-0.40* (0.15)
Mean	-1.64 (0.95)	-1.87 (1.06)	-0.34 (1.19)	-1.14 (1.28)
Observations	1757	1836	1852	1878

Note: The table displays OLS regression results, with clustered standard errors reported in parentheses. It also displays the sample means of the dependent variables, with standard deviations reported in parentheses. First-born is the omitted birth order category. All OLS regressions have used the full set of child- and household characteristics as controls, as outlined in section 5.2.
* p<0.05 **p<0.01 ***p<0.001.

6.1.2 Regression Results

Turning our attention to the results of the OLS regressions, estimated average HFA and WFA z-scores are generally lower for second- and later-born children, compared to first-born children, in all four countries. However, estimated effects vary in magnitude over the index children's life-time, and the null hypotheses tends to only be rejected at the 5% level of significance when the children are around five to eight years old.

In *Ethiopia,* differences in average z-scores between first-born children and subsequent birth orders are only significantly different from zero at the age of five. At this age, estimated gaps in the average HFA and WFA between first-born and later-born children exceed 0.2 z-score points, whilst the estimated HFA disadvantage for second-born children exceeds 0.3 z-score points. There is no significant gap in the average WFA between first- and second-born children.

In *India,* there are some significant gaps in z-scores between first- and later-born children from the age of one to the age of eight. Although there are also estimated differences between first- and second-born children, the magnitude of these differences are very small (0.07 z-score points at most), and results are not significantly different from zero in any of the survey rounds. Estimated birth order effects on HFA appear to follow a u-shaped pattern over the index children's life-time, reaching peak impact when the children are eight years old. However, it is important to note that the difference in estimates between survey rounds is not formally tested, and as such it is not known whether this estimated "u-shape" in effects over time is statistically significant. Meanwhile, the impact of being later-born on WFA appears strongest when the index children are around the age of one. At this age the average WFA z-score is 0.27 points lower for later-born children compared to first-born children.

In *Peru*, there is also suggestive evidence that birth order effects on anthropometric z-scores follow a u-shaped pattern over time, whereby the widest gaps between first-born children and subsequent birth orders are observed when the index children are aged five and eight. However, due to a larger standard error in the estimated HFA-gap between first- and later-born children, only second-born children display a statistically significant HFA disadvantage. The estimated magnitude of the WFA gap when children are five and eight is quite large and increasing in birth order. However, in the case of Peru, it should be noted that lower WFA scores among second- and later- born children may actually be considered an advantage as opposed to a disadvantage, to the extent that a higher average WFA among first-born children is driven by increased incidences of obesity in this birth order group.

In *Vietnam*, second- and later-born children appear particularly disadvantaged with regard to their weight at the ages of five and eight. The magnitudes of these effects are larger than what is observed in the other three countries, with an estimated average WFA z-score that is 0.4 points lower for later-born children than for first-born children at the age of eight. Meanwhile, the average HFA is not significantly lower for later-born children than for first-born children in any of the survey rounds. It is, however, significantly lower for second-born children compared to first-born children at the age of eight, albeit at a smaller magnitude than those observed in other countries.

6.2 Cognitive Development

Table 11 displays the results of the OLS regression on a series of normalised test-scores in Ethiopia, India, Peru and Vietnam. For reported controls view tables 26-29, in appendix C.

In *Ethiopia,* average test scores for second- and later-born children are significantly different to those of first-born children when the index children are 12. At this age, average PPVT scores for second- and later- born children are estimated at a little more than one tenth of a standard deviation below the average score for first-born children. For second-born children the magnitude of this effect remains almost identical when children are fifteen. Meanwhile, later-born children display an even larger disadvantage with regard to their numerical scores, with an average score disadvantage estimated at just a under one fifth of a standard deviation at the age of twelve. To put these magnitudes into perspective, Black, Devereux and Salvanes (2011, p.105) refer to one fifth of a standard deviation in average IQ scores as a large birth order effect, associated with a 2% decrease in annual earnings as an adult.

In *India*, second- and later-born children seem to be experiencing relatively consistent cognitive disadvantages, with lower estimated average test scores in all three test categories. Generally, gaps between later- and first-born children tend to be larger and more significant than gaps between second- and first- born children, indicating a cognitive disadvantage that is rising in birth order. There is already suggestive evidence that second- and later- born children score worse than first-born children at the age of eight, with this difference increasing in magnitude and significance as children get older.

In *Peru*, estimated average test scores are consistently higher for first-born children compared to second- and later-born children. The biggest gap in numeracy scores appears when the children are aged eight. At this age, average maths scores are estimated to be 0.16 standard deviations lower for second-born children than for first-born children. Meanwhile the gap between first-and later-born children is twice as large, at almost one third of a standard deviation. Literacy scores appear to become worse for later-born children as they get older, with literacy scores for later-born children consistently estimated to be around one fifth of a standard deviation lower than for first-born children at the ages of twelve and fifteen. Later-born children are similarly disadvantaged with regard to PPVT scores at these ages.

Table 11, Effects on Cognitive Test-Scores Across Index Children

	PANEL A: Ethiopia			PANEL B: India		
	PPVT (OLS)	**Numeracy** (OLS)	**Literacy** (OLS)	**PPVT** (OLS)	**Numeracy** (OLS)	**Literacy** (OLS)
Aged 5						
Second Born	0.06 (0.07)	0.07 (0.07)		0.11 (0.09)	-0.03 (0.06)	
Later Born	0.02 (0.09)	0.03 (0.10)		-0.03 (0.09)	-0.10 (0.05)	
Observations	1732	1758		1776	1848	
Aged 8						
Second Born	-0.01 (0.06)	0.04 (0.06)	-0.04 (0.05)	-0.03 (0.06)	-0.03 (0.07)	-0.07 (0.06)
Later Born	0.14 (0.09)	0.02 (0.05)	-0.00 (0.07)	-0.21 (0.11)	-0.16 (0.11)	-0.26* (0.09)
Observations	1734	1686	1754	1808	1811	1822
Aged 12						
Second Born	-0.12*(0.06)	-0.02 (0.06)	-0.09 (0.06)	-0.08 (0.05)	-0.06 (0.06)	-0.11 (0.07)
Later Born	-0.14*(0.05)	-0.19* (0.07)	-0.02 (0.06)	-0.21* (0.10)	-0.25* (0.09)	-0.19 (0.10)
Observations	1523	1511	1456	1821	1780	1777
Aged 15						
Second Born	-0.12 (0.06)	0.00 (0.08)	-0.11 (0.07)	-0.10**(0.03)	-0.09 (0.06)	-0.09 (0.08)
Later Born	-0.04 (0.06)	-0.08 (0.08)	-0.13 (0.07)	-0.15 (0.09)	-0.20* (0.08)	-0.19* (0.07)
Observations	1504	1596	1570	1800	1753	1744
	PANEL C: Peru			PANEL D: Vietnam		
	PPVT (OLS)	**Numeracy** (OLS)	**Literacy** (OLS)	**PPVT** (OLS)	**Numeracy** (OLS)	**Literacy** (OLS)
Aged 5						
Second Born	-0.00 (0.04)	-0.03 (0.05)		0.01 (0.06)	-0.03 (0.06)	
Later Born	-0.05 (0.07)	-0.08 (0.06)		-0.00 (0.11)	0.17 (0.10)	
Observations	1851	1894		1700	1856	
Aged 8						
Second Born	-0.08 (0.05)	-0.16* (0.06)	-0.03 (0.06)	-0.07 (0.06)	-0.11 (0.05)	-0.12 (0.06)
Later Born	-0.10 (0.07)	-0.32** (0.1)	-0.11 (0.10)	0.02 (0.11)	-0.02 (0.10)	0.02 (0.11)
Observations	1763	1802	1801	1786	1860	1888
Aged 12						
Second Born	-0.02 (0.06)	-0.06 (0.05)	-0.05 (0.06)	-0.16 (0.08)	-0.09 (0.06)	-0.08 (0.07)
Later Born	-0.21*(0.07)	-0.10 (0.08)	-0.20*(0.08)	-0.23 (0.16)	-0.27* (0.13)	-0.18 (0.13)
Observations	1785	1782	1782	1823	1777	1770
Aged 15						
Second Born	-0.08 (0.06)	-0.08 (0.06)	-0.05 (0.08)	-0.06 (0.05)	-0.13 (0.08)	-0.19**(0.07)
Later Born	-0.16*(0.07)	-0.10 (0.09)	-0.20*(0.08)	0.01 (0.07)	-0.25* (0.10)	-0.24* (0.09)
Observations	1731	1765	1718	1890	1849	1852

Note: The table displays OLS regression results, with clustered standard errors reported in parentheses. First-born is the omitted birth order category. All OLS regressions have used the full set of child- and household characteristics as controls, as outlined in section 5.2. * p<0.05 **p<0.01 ***p<0.001.

In *Vietnam*, there are no significant birth order effects on PPVT scores. However, later-born children score worse than first-born children on both numeracy- and literacy- tests as they get older. The estimated gap in average numeracy scores between first- and later-born children is particularly large in survey round four, and remains large, at one quarter of a standard deviation, in survey round five. Estimated gaps in average literacy scores are only significant at the age of fifteen, with estimated disadvantages of almost one fifth and one fourth of a standard deviation for second- and later-born children respectively.

6.3 Time Use

Table 12.1 displays the results of the OLS regressions on time use and enrolment in Ethiopia and India, whereas table 12.2 displays the results of the OLS regressions on time use and enrolment in Peru and Vietnam. The tables also display mean time use values for all index children at each surveyed age. The regression outputs for the control variables are reported in Appendix C (Tables 30-31). I will discuss the observed trends in time use and enrolment across all index children in the four countries, before presenting the results of the OLS regressions.

6.3.1 Cross-Country Differences in the Sample Means

First, viewing the mean time use values for all index children, there are some consistent trends across all four countries. Children tend to spend the largest share of their time on leisure at all ages, although they have less time for leisure as they grow older. Meanwhile, children spend the least amount of time caring for other household members. Children tend to work and study more as they get older, except in Vietnam where the average amount of time spent studying is highest when the index children are eight. The average amount of time spent attending school peaks at the age of twelve for children in all countries except Peru, where it is highest among fifteen-year-olds.

Comparing mean time-use values across countries, children tend to spend more time on care-giving in countries with higher fertility rates and larger household sizes (i.e. in Ethiopia and Peru) than in countries with lower fertility rates (i.e. in India and Vietnam). At all ages, children in Ethiopia work considerably more than in other countries, whilst children in India spend considerably longer hours at school than in other countries. In Vietnam school-days appear to be shorter than in other countries, although children partly make up for this by spending more time on independent study. Still, children in Vietnam have the most time for leisure out of the four countries.

Table 12.1, Effects on Time Use and Enrolment Across Index Children, Panels A & B

	Hours Worked (OLS)	**Hours Care** (OLS)	**Hours Leisure** (OLS)	**Hours Study** (OLS)	**Hours School** (OLS)	**Enrolled** (OLS)
PANEL A: Ethiopia						
Aged 8						
Second Born	-0.21 (0.16)	-0.31** (0.10)	0.45 (0.22)	0.10 (0.08)	-0.03 (0.15)	-0.06 (0.05)
Later Born	-0.15 (0.2)	-0.6*** (0.11)	0.74** (0.25)	0.11 (0.1)	-0.10 (0.21)	-0.04 (0.04)
Mean	3.16 (2.33)	0.82 (1.21)	14.11 (2.54)	1.00 (0.89)	4.91 (2.54)	0.66 (0.48)
Observations	1758	1759	1759	1759	1759	1744
Aged 12						
Second Born	0.09 (0.13)	0.05 (0.09)	0.12 (0.16)	-0.05 (0.05)	-0.21 (0.12)	-0.01 (0.02)
Later Born	0.22 (0.13)	-0.21* (0.09)	0.17 (0.15)	0.05 (0.08)	-0.22 (0.14)	-0.01 (0.01)
Mean	3.44 (2.16)	0.64 (0.94)	12.78 (1.97)	1.50 (0.94)	5.64 (1.77)	0.94 (0.24)
Observations	1742	1742	1742	1742	1742	1747
Aged 15						
Second Born	0.07 (0.15)	-0.10 (0.10)	0.50* (0.19)	-0.18 (0.13)	-0.28* (0.13)	-0.02 (0.02)
Later Born	0.17 (0.20)	-0.26 (0.14)	0.72***(0.15)	-0.16 (0.11)	-0.47* (0.17)	-0.05 (0.02)
Mean	4.03 (2.45)	0.52 (0.91)	12.27 (2.06)	1.84 (1.16)	5.34 (1.97)	0.91 (0.28)
Observations	1688	1689	1688	1688	1688	1692
PANEL B: India						
Aged 8						
Second Born	-0.01 (0.04)	-0.22*** (0.05)	0.19 (0.11)	0.06 (0.07)	-0.06 (0.06)	0.02 (0.01)
Later Born	-0.04 (0.08)	-0.4*** (0.07)	0.66** (0.2)	-0.08 (0.08)	-0.17 (0.11)	0.01 (0.02)
Mean	0.36 (0.69)	0.21 (0.52)	13.93 (1.68)	1.83 (1.09)	7.67 (1.14)	0.94 (0.25)
Observations	1838	1838	1838	1838	1838	1838
Aged 12						
Second Born	-0.09 (0.09)	-0.13*** (0.03)	0.01 (0.08)	0.09 (0.05)	0.12 (0.11)	0.01 (0.01)
Later Born	-0.17 (0.12)	-0.24*** (0.04)	0.18 (0.11)	-0.01 (0.07)	0.24 (0.14)	0.02 (0.01)
Mean	1.07 (1.44)	0.14 (0.49)	12.89 (1.71)	1.91 (1.16)	7.99 (1.76)	0.96 (0.19)
Observations	1827	1827	1827	1827	1827	1831
Aged 15						
Second Born	-0.09 (0.12)	-0.07* (0.03)	0.17 (0.12)	-0.06 (0.07)	0.04 (0.17)	-0.00 (0.02)
Later Born	-0.04 (0.25)	-0.10 (0.06)	0.47 (0.23)	-0.19 (0.13)	-0.14 (0.28)	-0.01 (0.03)
Mean	2.02 (2.86)	0.18 (0.59)	11.87 (2.0)	2.10 (1.39)	7.83 (3.01)	0.88 (0.33)
Observations	1807	1807	1807	1807	1807	1813

Note: The table displays OLS regression results, with clustered standard errors reported in parentheses. It also displays the sample means of the dependent variables, with standard deviations reported in parentheses. First-born is the omitted birth order category. All OLS regressions have used the full set of child- and household characteristics as controls, as outlined in section 5.2. * p<0.05 **p<0.01 ***p<0.001

Table 12.2, Effects on Time Use and Enrolment Across Index Children, Panels C & D

	Hours Worked	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrolled**
	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)
PANEL C: Peru						
Aged 8						
Second Born	0.00 (0.07)	-0.42*** (0.06)	0.25* (0.11)	-0.07 (0.05)	-0.02 (0.07)	0.01 (0.01)
Later Born	0.04 (0.12)	-0.67*** (0.07)	0.27 (0.17)	-0.10 (0.10)	-0.06 (0.10)	0.01 (0.01)
Mean	1.12 (1.06)	0.48 (0.88)	13.82 (1.81)	1.86 (0.84)	5.98 (1.01)	0.97 (0.18)
Observations	1852	1852	1853	1852	1853	1856
Aged 12						
Second Born	0.15 (0.09)	-0.30*** (0.07)	0.15 (0.13)	0.09 (0.05)	-0.09 (0.05)	0.00 (0.00)
Later Born	0.07 (0.09)	-0.60*** (0.09)	0.51* (0.18)	0.05 (0.07)	-0.12 (0.09)	-0.00 (0.01)
Mean	1.80 (1.36)	0.83 (1.02)	13.18 (1.70)	1.85 (0.91)	6.06 (0.87)	0.99 (0.09)
Observations	1792	1792	1792	1792	1792	1807
Aged 15						
Second Born	0.12 (0.09)	-0.28*** (0.05)	-0.01 (0.09)	-0.15 (0.09)	0.14 (0.11)	-0.00 (0.01)
Later Born	0.28 (0.14)	-0.57*** (0.12)	0.23 (0.17)	-0.04 (0.11)	0.21 (0.20)	0.00 (0.02)
Mean	1.85 (1.75)	0.69 (1.12)	12.16 (1.96)	2.07 (1.09)	6.85 (2.02)	0.97 (0.18)
Observations	1751	1751	1751	1751	1751	1765
PANEL D: Vietnam						
Aged 8						
Second Born	-0.00 (0.04)	-0.47*** (0.06)	0.44** (0.13)	0.08 (0.10)	-0.09 (0.10)	-0.01 (0.01)
Later Born	-0.19* (0.08)	-0.91*** (0.14)	0.74** (0.24)	0.38* (0.17)	-0.09 (0.22)	0.02 (0.03)
Mean	0.66 (0.89)	0.25 (0.68)	15.33 (1.86)	2.77 (1.51)	4.98 (1.42)	0.98 (0.14)
Observations	1876	1861	1880	1874	1880	1860
Aged 12						
Second Born	0.03 (0.08)	-0.48*** (0.06)	0.45** (0.12)	0.01 (0.09)	0.00 (0.08)	-0.02** (0.01)
Later Born	0.03 (0.19)	-0.87*** (0.08)	0.58* (0.24)	0.24 (0.15)	0.02 (0.23)	-0.02 (0.02)
Mean	1.58 (1.45)	0.43 (0.88)	13.97 (2.18)	2.63 (1.43)	5.38 (1.55)	0.97 (0.18)
Observations	1834	1834	1834	1834	1834	1818
Aged 15						
Second Born	0.42* (0.15)	-0.15 (0.07)	0.37 (0.21)	-0.23 (0.11)	-0.37 (0.22)	-0.05 (0.03)
Later Born	0.45 (0.31)	-0.42*** (0.10)	0.61 (0.32)	-0.26 (0.15)	-0.28 (0.29)	-0.05 (0.04)
Mean	2.83 (2.99)	0.34 (0.89)	13.19 (2.81)	2.57 (1.86)	5.00 (2.83)	0.81 (0.39)
Observations	1895	1895	1895	1895	1895	1882

Note: The table displays OLS regression results, with clustered standard errors reported in parentheses. It also displays the sample means of the dependent variables, with standard deviations reported in parentheses. First-born is the omitted birth order category. All OLS regressions have used the full set of child- and household characteristics as controls, as outlined in section 5.2. * $p<0.05$ ** $p<0.01$ *** $p<0.001$

The mean value of the enrolment dummy variable provides a direct measure of enrolment rates among index children at each surveyed age. This confirms the trends observed in previous studies on Young Lives data, as summarized in the background section. At the age of eight, enrolment rates are particularly low in Ethiopia, measured at 66%. Meanwhile, enrolment rates at the age of fifteen are lowest in India and Vietnam, dropping below 90% in both countries. Peru displays the highest rates of enrolment in every survey round, never dipping below 97%.

6.3.2 Regression Results

In *Ethiopia* a higher birth order is associated with less hours dedicated to care. However, these results are only significant at the 5% level when the children are young. By the age of fifteen there appears to be no birth order effect on time spent on care-giving activities. Complementary to this, a higher birth order is associated with more hours of leisure in all survey rounds, although results are only significant when children are aged eight and fifteen. At both these ages, later-born children on average have almost 45 minutes more time for leisure than first-born children. There is also a growing negative gradient in hours of school attendance for higher birth orders as children get older, which becomes statistically significant at the age of fifteen. Complementary to this, rates of enrolment for second- and later- born children are estimated to be lower than for first-born children throughout the observed survey rounds, although these result are statistically insignificant. As a whole, these results indicate that first-born children spend more hours dedicated to care early on in life, and more hours at school when they get older, at the cost of leisure.

In *India*, estimated birth order differences show that children with a higher birth order spend less time caring for other members of the household than first-born children - particularly at a younger age. For later-born children, the magnitude of these effects exceed the sample average amount of time spent on care in both survey rounds. Later-born children also have significantly more hours of leisure in survey round three. Although the estimated average time spent working is decreasing in birth order in all five survey rounds, none of these results are statistically significant. Similarly, there are no significant effects on any of the educational measures in any of the survey rounds.

In *Peru* later- and second-born children spend less hours caring for other household members than first-born children throughout their childhood. This gives later-born children an average of more than 34 minutes extra time for other activities, compared to first-born children at all ages. Second-born children also spend on average 25 minutes less caring for others than first-born children at the age of eight, although this reduces to around 15 minutes by the age of fifteen. There are some indications that second- and later-born children get more time for leisure, although this is only statistically significant for second-born children at the age of five and later-born children at the age of twelve. There are no significant results for any of the educational measures, or for hours worked. These results indicate that first-born children spend more time caring for others, at the cost of leisure.

As in the other countries, second and later-born children in *Vietnam* spend less hours caring for other household members than first-born children. For later-born children, this effect remains significant throughout the three survey rounds. There are also complementary trends for hours of care and hours of leisure, whereby second- and later-born children have significantly more hours of leisure compared to first-born children at the ages of eight and twelve. There are also some mixed, temporary, differences in hours worked between the different birth order groups. Specifically, later-born children work on average 11 minutes *less* than first-born children in survey round three, and second-born children work on average 25 minutes *more* than first-born children in survey round five. Again these results generally indicate that first-born children spend more time dedicated to caring for others, at the cost of leisure. There is also some indication that first- and second-born children work more than other children at certain ages.

6.4 Summary and Comments on Findings

The results of the OLS regressions of birth order on *anthropometric z-scores,* display similar trends across all four countries. The largest birth order effects are observed for five- and eight-year-olds, and magnitudes tend to be around 0.2-0.3 z-score points. Vietnam appears to be an outlier, with particularly large birth order effects observed for WFA of up to 0.4 z-score points, and particularly weak birth order effects observed for HFA, never exceeding 0.17 z-score points. Furthermore, in Vietnam and Peru there are only significant HFA effects on second-born children. Since HFA scores capture long term malnutrition, whilst WFA can be driven by short-term malnutrition, these results indicate that there may be more *consistent long term levels* of malnutrition among second-born children as opposed to later-born children in these countries. In Ethiopia, on the other hand, both second- and later-born children appear to be similarly disadvantaged in terms of average z-scores. In India, later-born children are consistently worse off than second-born children, indicating a disadvantage that is rising in birth order.

As a general note, birth order differences in physical development do not appear to last throughout the index children's lives. In fact, birth order appears to mainly affect children's anthropometric attributes when they are aged five and eight, and play a less important role as they grow older. There could be several competing explanations for why this trend is observed. Viewing parental preferences as a potential causal channel, children with a higher birth order may be more useful to their parents and be less likely to have older siblings still living at home as they grow older, thereby receiving larger shares of food allocations. Older children may also be more able to feed themselves, making them less vulnerable to parental allocations of food. However, as discussed in the methodology section, differences in birth order effects at different surveyed ages may also partly be driven by particular conditions in the years that these surveys took place. Thus a competing hypothesis could be that since poverty has been reduced in all surveyed countries as the index children have been getting older (as summarized in section 2.1), and birth order biases in nutrition have previously been found to be larger when families are impoverished (Behrman, 1988), the reduction in birth order effects could be explained by a reduction in poverty.

Second, comparing *cognitive test scores* across countries, Ethiopia shows the weakest signs of an association between birth order and cognitive test scores, although there are significant differences between first-born children and each subsequent birth order group at the age of twelve. In Vietnam, numeracy and literacy test scores are worse for higher birth orders when the children are twelve and fifteen. The magnitude of these differences are relatively large, at around one quarter of a standard deviation or more. In India and Peru there are significant effects across all test scores, although there are different trends for different ages in the two countries. In Peru numeracy gaps are largest when children are eight, for both second- and later-born children. The magnitude of these gaps are large, estimated at almost one third of a standard deviation for later-born children. In India, meanwhile, numeracy scores are particularly weak for later-born children at the ages of twelve and fifteen, with gaps ranging from one tenth to one quarter of a standard deviation. In terms of PPVT scores, India and Peru show very similar trends, whereby later-born children score between 0.15 and 0.21 standard deviations lower than first-born children when they are twelve and fifteen. A general insight from all four countries is that birth order differences in test scores appear to solidify at the age of twelve.

Finally, considering *time use and enrolment* across all four countries, a consistent narrative emerges: First-born children tend to spend more time caring for others at the cost of leisure, particularly at younger ages. There are also some signs that levels of school attendance, studying and enrolment may be lower among second- and later-born children as they get older, although these results are only significant for hours of school at the age of 15 in Ethiopia, and enrolment at the age of 12 in Vietnam. The data reveals no clear cross-country trends between different birth orders and hours worked.

A simple hypothesis explaining the observed cross-country trend in hours of care-giving among younger children, is that first-born children have no older siblings to help their family take care of their siblings when they are young. However, as they grow older, younger siblings are more able to take care of both themselves and others, reducing the family's reliance on the oldest sibling for care-giving.

Seen as a whole, these results indicate that birth order effects on physical development and cognition do not affect children contemporaneously. Rather, there appear to be physical birth order disadvantages for children when they are young, which are reduced after the age of eight. Conversely, cognitive disadvantages are less apparent when children are young, and grow wider until children reach the age of twelve, remaining large as children turn fifteen. The only exception to this rule is Peru, where both HFA-, WFA- and numerical test-gaps are largest when the children are eight, although it is important to note that this analysis does not determine whether cognitive and physical disadvantages are experienced by the same children.

Equally interesting, rates of school attendance and enrolment are very high among twelve-year-olds in all four countries, with no substantial schooling gaps between birth orders, whereas estimated birth order gaps in cognition between twelve-year-olds are considerable. Taken together, these results indicate that birth order differences in cognition are not being driven by differences in school attendance. However, since I do not explicitly look at interactions between school attendance and gaps in cognition, this evidence is only suggestive.

7. Results Section II: Intra-Household Analysis

This section discusses the results of the intra-household FE regressions, estimating birth order effects on physical development, cognitive development, time use and enrolment within households.

7.1 Panel Sibling Analysis on Physical Development

Table 13 presents the results of the intra-household analysis of birth order effects on HFA z-scores in Ethiopia, India, Peru and Vietnam. All regressions are estimated with household-fixed-effects. As previously discussed, I only have sufficient data on index children and their panel siblings to perform analyses for survey rounds four and five.

In *Ethiopia* results from the FE regressions confirm a negative birth order effect on anthropometric z-scores that is increasing in birth order. Although birth order effects of very similar magnitudes are estimated in survey rounds four and five, results are more statistically significant in the latter survey round, indicating that birth order differences between siblings have solidified over time. Contrastingly, birth order effects were strongest when the children were five years old in the inter-household analysis, diminishing with age.

In *India, Peru* and *Vietnam* the FE regressions find no evidence of a negative birth order effect on height. To the contrary, second- and later-born children appear to be taller than first-born children in India and Vietnam, although these results are insignificant at the 5% level. However, it should be noted that the vast majority of the measured children in all three countries are above the age of eight in both survey rounds (Figures 2-4, Appendix A). Thus these results are not necessarily inconsistent with the inter-household analysis, which finds no significant birth order effects on HFA for children above the age of eight.

Table 13, Effects on Anthropometric Z-Scores Between Siblings

	Ethiopia HFA z-score (FE)	**India** HFA z-score (FE)	**Peru** HFA z-score (FE)	**Vietnam** HFA z-score (FE)
Survey Round 4				
Second Born	-0.11 (0.11)	0.14 (0.13)	-0.10 (0.10)	0.15 (0.10)
Later Born	-0.28 (0.18)	0.14 (0.24)	-0.21 (0.19)	0.18 (0.22)
Child is female	0.02 (0.08)	-0.06 (0.06)	-0.20* (0.08)	0.03 (0.05)
Constant	-0.90** (0.28)	-1.29** (0.43)	-1.01* (0.40)	-1.62*** (0.36)
Age Dummies Included	YES	YES	YES	YES
Observations	2170	2982	1011	1759
Survey Round 5				
Second Born	-0.17* (0.07)	0.14 (0.11)	0.06 (0.08)	0.02 (0.14)
Later Born	-0.27* (0.13)	0.13 (0.19)	0.00 (0.17)	-0.15 (0.21)
Child is female	0.47*** (0.07)	-0.00 (0.05)	-0.22** (0.07)	0.02 (0.05)
Constant	-1.24*** (0.25)	-0.84* (0.32)	-0.20 (0.42)	-0.73 (0.56)
Age Dummies Included	YES	YES	YES	YES
Observations	2144	2517	1003	1522

Note: The table displays fixed effects estimates of birth order differences in HFA z-scores between index children and panel siblings. Clustered standard errors are reported in parentheses.
*p<0.05 **p<0.01 ***p<0.001

7.2 Panel Sibling Analysis on Cognitive development

As previously discussed, panel siblings undertook PPVT tests in Ethiopia, Peru and Vietnam, and numerical tests in India in survey rounds four and five. Table 14 presents an intra-household analysis of these cognitive test-scores. All regressions are estimated with household-fixed-effects.

In *Ethiopia* and *India,* the FE regressions on PPVT- and numerical- test scores estimate a negative birth order effect which is increasing in birth order. However, this difference is only statistically significant for second-born children in both countries, indicating that this birth order group is more consistently disadvantaged than others. The similarity of the estimated magnitude of these effects between survey rounds in Ethiopia is striking. These results appear fairly consistent with the inter-household analysis.

In *Peru* estimated differences in PPVT-scores between first-born children and subsequent birth orders are negative, indicating disadvantages to being second- and later-born of similar magnitudes to those estimated in the OLS regressions. However none of the results from the between-sibling analysis are statistically significant. Thus, I am unable to confirm a significant relationship between birth order and PPVT scores in Peru.

Table 14, Effects on Cognitive Test-Scores Between Siblings

	Ethiopia PPVT (FE)	**India** Numeracy (FE)	**Peru** PPVT (FE)	**Vietnam** PPVT (FE)
Survey Round 4				
Second Born	-0.17** (0.05)	-0.11 (0.07)	-0.11 (0.08)	-0.09 (0.14)
Later Born	-0.19 (0.11)	-0.12 (0.15)	-0.25 (0.18)	-0.26 (0.26)
Child is female	0.03 (0.04)	-0.01 (0.03)	-0.14* (0.05)	-0.06 (0.07)
Constant	-0.66* (0.24)	-2.57*** (0.14)	-0.81* (0.30)	-3.16** (0.99)
Age Dummies Included	YES	YES	YES	YES
Observations	2180	2930	1017	1890
Survey Round 5				
Second Born	-0.17* (0.07)	-0.15* (0.06)	-0.09 (0.09)	0.12 (0.12)
Later Born	-0.19 (0.14)	-0.21 (0.13)	-0.14 (0.18)	0.30 (0.30)
Child is female	-0.02 (0.04)	-0.11 (0.05)	-0.14*** (0.03)	-0.10 (0.06)
Constant	-0.92*** (0.18)	-0.74* (0.29)	-0.25 (0.30)	0.11 (0.81)
Age Dummies Included	YES	YES	YES	YES
Observations	2098	2543	989	1586

Note: The table displays fixed effects estimates of birth order differences in cognitive test-scores between index children and panel siblings. Test scores are normalised using test results of index children as a benchmark. Clustered standard errors are reported in parentheses. *p<0.05 **p<0.01 ***p<0.001

In *Vietnam* the FE regressions estimate no birth order effects on PPVT scores. However, the inter-household analysis similarly found no birth order differences in PPVT scores for Vietnam. What the inter-household analysis *did* find, was large and significant differences in numeracy and literacy test scores. Since panel siblings did not perform these tests I am unable to confirm that these results also apply within households.

7.3 Intra-Household Analysis on Time Use

Table 15 presents the results of the fixed-effects regressions on each of the five time use categories, as well as enrolment, for all household members aged 7-17. All of the data used in these regressions are sourced from survey round three.

Table 15, Effects on Time Use and Enrolment Between Siblings

	Hours Work	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrolled**
	(FE)	(FE)	(FE)	(FE)	(FE)	(FE)
PANEL A: Ethiopia						
Second Born	-0.14 (0.10)	0.07 (0.05)	0.18 (0.10)	-0.08* (0.03)	-0.01 (0.06)	0.00 (0.02)
Later Born	0.01 (0.14)	0.05 (0.06)	0.11 (0.15)	-0.17** (0.05)	-0.03 (0.11)	0.00 (0.03)
Child is Female	-0.56** (0.17)	0.68***(0.06)	-0.27* (0.13)	0.01 (0.05)	0.10 (0.11)	0.03 (0.02)
Constant	3.45***(0.23)	0.36** (0.11)	14.56***(0.2)	1.03***(0.09)	4.59***(0.21)	0.69***(0.05)
Age Dummies	YES	YES	YES	YES	YES	YES
Observations	4409	4409	4409	4409	4409	4417
PANEL B: India						
Second Born	0.09 (0.13)	-0.04 (0.03)	0.34** (0.10)	-0.13* (0.05)	-0.23 (0.12)	-0.02 (0.02)
Later Born	-0.26 (0.22)	-0.13* (0.06)	0.44 (0.21)	-0.06 (0.12)	0.06 (0.23)	0.02 (0.03)
Child is Female	0.53*** (0.13)	0.14*** (0.03)	-0.13 (0.07)	-0.13** (0.04)	-0.37** (0.12)	-0.01 (0.01)
Constant	0.19 (0.23)	0.22*** (0.06)	13.87*** (0.2)	1.78*** (0.11)	7.84*** (0.20)	0.95***(0.03)
Age Dummies	YES	YES	YES	YES	YES	YES
Observations	3493	3493	3493	3493	3493	3466
PANEL C: Peru						
Second Born	0.01 (0.10)	-0.18* (0.06)	0.19 (0.11)	-0.13* (0.05)	-0.09 (0.09)	0.01 (0.04)
Later Born	-0.21 (0.19)	-0.25* (0.10)	0.10 (0.22)	-0.10 (0.06)	-0.03 (0.18)	0.03 (0.07)
Child is Female	-0.01 (0.10)	0.36*** (0.04)	-0.31** (0.08)	0.07 (0.04)	0.06 (0.08)	0.01 (0.02)
Constant	1.32*** (0.15)	0.42*** (0.09)	14.05*** (0.2)	1.80*** (0.06)	5.95*** (0.13)	1.00*** (0.1)
Age Dummies	YES	YES	YES	YES	YES	YES
Observations	3673	3674	3675	3674	3675	1851
PANEL D: Vietnam						
Second Born	-0.11 (0.17)	0.06 (0.05)	0.63** (0.21)	-0.21 (0.10)	-0.25 (0.12)	-0.04 (0.02)
Later Born	-0.91** (0.27)	0.11 (0.12)	0.75* (0.35)	0.18 (0.19)	-0.10 (0.21)	0.02 (0.04)
Child is Female	0.09 (0.12)	0.08* (0.03)	-0.53*** (0.1)	0.23** (0.07)	0.20 (0.12)	0.04* (0.02)
Constant	0.80** (0.21)	0.10 (0.08)	15.11*** (0.3)	2.55*** (0.17)	5.10*** (0.22)	0.98***(0.03)
Age Dummies	YES	YES	YES	YES	YES	YES
Observations	3137	3137	3137	3137	3137	3158

Note: The table displays fixed effects estimates of birth order effects on time use for all household members aged 7-17. All data is sourced from survey round three. Clustered standard errors are reported in parentheses. *p<0.05 **p<0.01 ***p<0.001

Interestingly, in *Ethiopia* the intra-household analysis reveals no birth order dynamic on hours dedicated to care and leisure, such as was seen in the inter-household analysis. What it does capture, is a significant effect on hours spent studying. Second-born children spend on average five minutes less studying than their first-born siblings, whilst later-born children spend on average ten minutes less than their first-born siblings.

In *India* the FE regressions estimate that both second- and later-born children have in excess of twenty minutes more leisure than their first-born siblings, on average, with the estimated magnitude of this effect increasing in birth order. However estimates are only statistically significant for second-born children. Later-born children also spend an average of eight minutes less on care-giving than first-born children. As in Ethiopia, the intra-household analysis in India further reveals a negative relationship between birth order and hours spent studying, which is strongest for second-born children.

In *Peru* the FE regressions estimate a similar birth order effect on care as was seen in the inter-household analysis, whereby both second- and later-born children spend less hours on care than first-born children. There are also estimated birth order effects on hours of study for second-born children of an equivalent magnitude to effects observed in India. There is, however, no significant effect on time spent on leisure, as there was in the inter-household analysis

In *Vietnam* there is a strong birth order effect on leisure that is increasing in birth order. There is, however, no significant effect on time spent on care-giving, as there was in the inter-household analysis. There is also a strong birth order effect on hours worked among later-born children, who work on average 55 minutes less than their first-born siblings.

7.4 Summary and Comments on Findings

The results of the FE regressions of birth order on *anthropometric z-scores* only find significant effects in Ethiopia. I.e. the intra-household analysis does not confirm the presence of any birth order effects on HFA z-scores in India, Peru and Vietnam. However, this is not necessarily inconsistent with the findings of the inter-household analyses, which estimate no significant birth order effects on HFA for children above the age of eight. As discussed in section 6.3, insignificant results could be driven by the fact that index children and their panel siblings are older, and thereby less vulnerable to parental bias. Alternatively, the results could be consistent with the competing hypothesis of wealth related time-specific (as opposed to age-specific) effects, observing that families tend to be wealthier in survey rounds four and five than they were in the survey rounds for which birth order effects were observed in the inter-household analysis.

As a whole, results from the intra-household analysis on *cognitive development* appear fairly consistent with results from the inter-household analysis in Ethiopia, India and Vietnam. The household-FE regressions estimate birth order effects of similar magnitudes to those observed in the inter-household analysis in Ethiopia, India and Peru. However, results from the FE regressions on Peru are not statistically significant. Meanwhile in Vietnam, birth order gaps in PPVT scores are not observed in either of the intra- or inter-household regressions.

The FE regressions on *time use* find significant birth order effects on hours studied in Ethiopia, India and Peru, whereby first-born children study more that their siblings. In Ethiopia the estimated birth order gap is largest between first- and later-born children, while in India and Peru the effect is only significant between first- and second- born children. Interestingly, the strong cross-country evidence on care and leisure that was observed in the inter-household analysis appears less prominent in the intra-household analysis. India is the only country that displays significant birth order effects on both care and leisure, whereas Peru only displays significant birth order effects on hours dedicated to care, and Vietnam only displays significant birth order effects on hours of leisure. In Ethiopia neither of these activities appear to be significantly affected by birth order within families. The weaker evidence of birth order effects on care-giving could be partly due to the fact that the within-household analysis compares children of all ages between 7-17, whereas the inter-household analysis found that birth order only affected children's care-giving hours when they were young in all countries except Peru. Similarly the inter-household effects on leisure only affected children at younger ages in all countries except Ethiopia. However, weaker effects in the intra-household analysis could also indicate that results in the inter-household analysis are distorted by unobserved household characteristics.

Interestingly, birth order effects on hours worked are observed in both the inter- and the intra-household analyses for Vietnam, whereas no equivalent effects are observed in the other three countries. In the intra-household analysis later-born children work almost an hour less that first-born children. Similar results are found for eight year-olds in the inter-household analysis. However, it should also be noted that the inter-household analysis on 15-year-olds actually indicated that first-born children worked *less* than their younger siblings, showing significant estimates to this effect between first- and second-born siblings. Taken together, these results indicate that first-born children in Vietnam spend more time working than their later-born siblings when they are young, and less as they get older. Vietnam is also the only country where no birth order effects are found on hours studied.

8. Discussion

This section discusses key results and insights that can be drawn from the inter- and intra-household analyses, comparing results to those found in the previous literature. It also outlines some of the key limitations and benefits of this study, before discussing the potential role for future research.

8.1 Key Results and Insights

As summarised in section two, Ethiopia, India, Peru and Vietnam are characterised by wide disparities in their national incomes, fertility rates and education systems. Yet, despite these national differences, trends in birth order effects on physical development, cognitive development and time use and enrolment are surprisingly similar across the four countries.

In all four countries, the inter-household analysis estimates significant birth order effects on children's physical development around the ages of five and eight, favouring first-born children. At these ages, estimated birth order gaps in HFA typically range from 0.1-0.3 z-score points. Meanwhile, estimated birth order differences in WFA z-scores typically range from 0.2-0.4 points. These results are also fairly consistent with the findings of previous studies. E.g. Jayachandran and Pande (2017) similarly find birth order disadvantages for second- and later-born children ranging from 0.2-0.4 HFA z-score points, and 0.1-0.35 WFA z-score points in several Indian states. Meanwhile, Horton (1988) finds HFA disadvantages for last-born children ranging from 0.25-0.5 z-score points in her analysis of household data from the Philippines.

Also common for all four countries, is that birth order differences in HFA do not appear to last throughout children's lives. Instead, they fade with time, after children pass the age of eight. To my knowledge, this is the first study to have considered age-specific birth order effects on physical development. However, a previous study by Calimeris and Peters (2017, p.5530) measuring birth order effects on food allocations, similarly finds effects favouring first-born children that are only statistically significant for children under the age of 10.

Some significant birth order gaps in cognitive test scores favouring first-born children are also estimated in all four countries, with gaps in cognitive test scores typically ranging from 0.05-0.25 standard deviations when the children are aged 12-15. These effects are of a similar magnitude to those observed in studies on data from developed countries such as Lehmann, Nuevo-Chiquero and Vidal-Ferndanez (2018) and Black, Devereux and Salvanes (2011). Calimeris and Peters (2017) also find similar effects using Indonesian data. However, I only find significant cognitive gaps across certain test measures in certain survey rounds, and as such the conclusion that birth order affects children's cognition depends on which test score one focuses on. E.g. looking at PPVT scores there is no significant evidence of a birth order effect in Vietnam.

Birth order effects on cognitive development also tend to be stronger for 12-15 year olds than for 5-8 year-olds, in all four countries[16]. This is consistent with previous findings from Lehmann, Nuevo-Chiquero and Vidal-Ferndanez (2018), who find larger birth order effects on cognition for 11-14 year-olds than they do for 4-6 or 7-10 year-olds.

Birth order effects on time use vary somewhat from country to country, however there are some common trends. Notably, in all four countries, there is no evidence that first-born children spend less time on their education, or are less likely to attend school than children of higher birth orders. To the contrary, the intra-household analysis provides evidence that first-born children study more than their younger siblings in all countries except Vietnam. In the inter-household analysis there is also strong evidence of first-born children spending more time taking care of their siblings, with less time available for leisure compared to children of higher birth orders. However, this result is only confirmed across certain dimensions in certain countries in the intra-household analysis. Vietnam is the only country displaying any evidence of birth order effects on hours worked, whereby first-born children appear to work more than later-born children when they are young. Thus, despite this study finding some evidence that first-born children work more than other children, particularly if care-giving is defined as work, it finds no evidence to suggest that this negatively affects their education. This contradicts the former consensus in the literature considering birth order effects on child labour and school attendance, which has typically found significant negative birth order effects on first-born children's school attendance (e.g. Emerson and Sousa, 2008; Ejrnæs and Pörtner, 2004; Khanam and Rahman, 2007).

8.2 Benefits, Limitations and Room for Future Research

One of the limitations of this study is that it uses cohort survey data, and as such relies on a smaller sample than studies that have used national registry data, such as Black, Devereux and Salvanes (2005, 2011). Even comparing to other studies that use data from cohort studies, such as Pavan (2016) and Lehmann, Nuevo-Chiquero and Vidal-Ferndanez (2018), a sample size of 2000 children from each country is relatively modest. However, I have partly mitigated this issue by grouping birth orders together, ensuring that there are more than 300 children in each birth order group.

16 With the exception of the large birth order effects on numeracy test scores for eight-year-olds in Peru.

Another limitation specifically pertains to the time use analysis, since the time-use data is self-reported by either the parents (in survey round three) or the children themselves (in survey rounds four and five). By comparison, anthropometric z-scores and cognitive tests scores have been collected by professional field-workers, using standardised measurement procedures. Relying on self-reported data leaves room for concern about unobserved biases that arise from inaccurate reporting. E.g. parents may underreport the amount of time that they require their children to work if they fear being judged for making their children work too hard, whilst children may over-report the time they spend studying if they fear being judged for studying too little. However, this will only bias results if reports systematically vary across different birth orders.

A key benefit of this study, compared to the previous literature, is that it considers a variety of outcomes for the same children over a period of fifteen years. This provides a more complete picture of how birth order affects different aspects of people's development throughout their childhood than what has been available until now. A further benefit is provided by looking at results in four different countries, as this gives insight into how consistently these effects may be observed across country borders, strengthening the external validity of the results of this study. However, a downside of throwing such a "wide net", considering a variety of outcomes across different ages, is that it somewhat limits the depth of each analysis. Consequently, there could be a number of interesting follow-up studies that could deepen our understanding of the results presented in this paper.

For example, it would be interesting to get a deeper understanding of how birth order might interact with different household dynamics in developing countries, such as the gender compositions between siblings. Jayachandran and Pande (2017) have already done some research in this field, investigating interactions of birth order and the presence of older brothers on physical development. However, to my knowledge, there has been no equivalent research into combined effects of birth order and sibling compositions on cognitive development and time use in developing countries.

It would also be advantageous to gain a deeper understanding of how birth order affects the *dynamics* of human capital development throughout a person's childhood. E.g. based on the results of this study it would be interesting to see whether low anthropometric scores at young ages are *causing* cognitive disadvantages later on, or whether these trends are unrelated. Similarly, it could be interesting to see whether school attendance and grade progression mitigate birth order gaps in cognition later in life, given the suggestive evidence that cognitive gaps persist despite there being no birth order differences in school enrolment.

9. Conclusion

This thesis sets out to answer whether, and to what extent, a child's birth order affects their human capital development and time use. This question has been investigated through two separate analyses, comparing individuals *within* and *across* different households, using longitudinal cohort data on 8000 children and their households from Ethiopia, India, Peru and Vietnam. Significant birth order effects on both human capital development and time use are found in all four countries.

The analyses on human capital development estimate significant birth order effects on both physical- and cognitive development, favouring first-born children. These results are consistent with recent findings from both developed and developing countries (e.g. Black Devereux and Salvanes, 2011; Calimeris and Peters, 2017; Jayachandran and Pande, 2017; Lehman, Nuevo-Chiquero and Vidal-Fernandez, 2018). However, results are only statistically significant across certain measures at certain ages, indicating that birth order effects may be age- or time-specific. Meanwhile, the analyses on children's time use and enrolment find that first-born children spend more time taking care of other household members than other children, particularly when they are young, whereas second- and later-born children appear to have more time for leisure. The intra-household analyses further suggest that first-born children study more than other children. Unlike previous studies, which have typically found that first-born children are less likely to attend school and more likely to work than their siblings (e.g. Ejrnæs and Pörtner, 2004; Emerson and Sousa, 2008; Khanam and Rahman, 2007), I find no significant birth order effects on school attendance.

Three broad insights are gained from these results. *First*, a child's birth order affects different aspects of their human capital development at different stages of their childhood. Whereas physical development is mainly affected when children are young, gaps in cognitive development appear to solidify when children are around the age of twelve. *Second*, the education of first-born children in developing countries does not appear to suffer from any extra responsibilities at home. Unlike previous studies, this thesis finds no evidence that first-born children spend less time on their education than their younger siblings. *Finally*, birth order effects on physical development do not appear to last forever. Significant birth order gaps in anthropometric traits at the ages of five and eight appear to vanish as children get older. Meanwhile, cognitive gaps that solidify at the age of twelve typically prevail until the age of fifteen, suggesting that these effects may be more permanent. However, more research is needed in order to fully understand the dynamic impact that birth order may have on children at different stages of their development, disentangling key mechanisms explaining *why* these effects vary throughout people's lives.

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APPENDIX A: Descriptive Statistics

Table 16, Means of Contemporaneous Characteristics in Rounds 2-5, Ethiopia

	(1) **First-born** Mean	(2) **Second-born** Mean	(3) **Later-born** Mean	(4) **First – Second-born** Difference	(5) **First – Later-born** Difference
Round 2					
Child's age (in months)	62.00	61.94	61.76	0.05	0.23
Lives in a rural area	0.50	0.57	0.73	-0.06	-0.23***
Wealth index	0.36	0.34	0.27	0.03	0.09***
Household size	4.75	4.97	6.90	-0.23	-2.15***
Number of maternal siblings	0.59	1.54	3.98	-0.95***	-3.39***
Round 3					
Child's age (in months)	97.58	97.65	97.36	-0.07	0.22
Lives in a rural area	0.51	0.56	0.73	-0.05	-0.22***
Wealth index	0.40	0.38	0.32	0.02	0.08***
Household size	4.99	5.47	6.88	-0.48***	-1.89***
Number of maternal siblings	1.04	2.01	4.34	-0.97***	-3.30***
Round 4					
Child's age (in months)	145.74	145.76	145.29	-0.01	0.45*
Lives in a rural area	0.50	0.55	0.71	-0.04	-0.20***
Wealth index	0.43	0.41	0.37	0.02	0.06***
Household size	5.07	5.48	6.32	-0.41***	-1.25***
Number of maternal siblings	1.43	2.42	4.55	-0.99***	-3.12***
Round 5					
Child's age (in months)	181.09	181.19	180.91	-0.09	0.18
Lives in a rural area	0.51	0.55	0.71	-0.04	-0.20***
Wealth index	0.46	0.44	0.39	0.02	0.07***
Household size	5.26	5.46	6.07	-0.21	-0.81***
Number of maternal siblings	1.69	2.56	4.60	-0.87***	-2.91***
Observations	428	368	1089	796	1517

Note: Mean values of child and household characteristics across survey rounds 2-3 are reported in columns 1-3. Estimated difference in means between first-born children and subsequent birth order groups reported in columns 4-5, where *p<0.05 **p<0.01 ***p<0.001.

Table 17, Means of Contemporaneous Characteristics in Rounds 2-5, India

	(1) **First-born** Mean	(2) **Second-born** Mean	(3) **Later-born** Mean	(4) **First – Second-born** Difference	(5) **First – Later-born** Difference
Round 2					
Child's age (in months)	64.25	64.40	64.06	-0.15	0.18
Lives in a rural area	0.72	0.73	0.80	-0.00	-0.08**
Wealth index	0.48	0.47	0.41	0.00	0.07***
Household size	5.41	5.29	6.04	0.11	-0.63***
Number of maternal siblings	0.91	1.26	2.49	-0.35***	-1.57***
Round 3					
Child's age (in months)	95.44	95.57	95.06	-0.13	0.38
Lives in a rural area	0.72	0.73	0.80	-0.01	-0.08**
Wealth index	0.53	0.52	0.47	0.01	0.07***
Household size	5.30	5.21	5.98	0.09	-0.68***
Number of maternal siblings	1.07	1.31	2.58	-0.24***	-1.50***
Round 4					
Child's age (in months)	143.87	143.98	143.38	-0.11	0.49*
Lives in a rural area	0.69	0.71	0.78	-0.02	-0.10***
Wealth index	0.60	0.60	0.54	0.01	0.07***
Household size	4.76	4.74	5.28	0.02	-0.53***
Number of maternal siblings	1.14	1.31	2.56	-0.18***	-1.42***
Round 5					
Child's age (in months)	179.99	180.21	179.59	-0.22	0.40
Lives in a rural area	0.67	0.69	0.77	-0.02	-0.10***
Wealth index	0.65	0.65	0.59	-0.00	0.06***
Household size	4.77	4.61	5.06	0.16	-0.28**
Number of maternal siblings	1.15	1.30	2.50	-0.15***	-1.35***
Observations	730	740	435	1470	1165

Note: Mean values of child and household characteristics across survey rounds 2-3 are reported in columns 1-3. Estimated difference in means between first-born children and subsequent birth order groups reported in columns 4-5, where *p<0.05 **p<0.01 ***p<0.001.

Table 18, Means of Contemporaneous Characteristics in Rounds 2-5, Peru

	(1) **First-born** Mean	(2) **Second-born** Mean	(3) **Later-born** Mean	(4) **First – Second-born** Difference	(5) **First – Later-born** Difference
Round 2					
Child's age (in months)	64.15	63.84	62.61	0.30	1.53***
Lives in a rural area	0.20	0.26	0.44	-0.07**	-0.24***
Wealth index	0.52	0.51	0.40	0.02	0.12***
Household size	4.81	5.00	6.50	-0.19	-1.68***
Number of maternal siblings	0.51	1.35	3.38	-0.84***	-2.87***
Round 3					
Child's age (in months)	94.76	94.93	95.11	-0.17	-0.36
Lives in a rural area	0.20	0.24	0.40	-0.04	-0.20***
Wealth index	0.58	0.57	0.48	0.01	0.10***
Household size	4.78	5.07	6.25	-0.29**	-1.47***
Number of maternal siblings	0.77	1.52	2.88	-0.75***	-2.11***
Round 4					
Child's age (in months)	142.80	142.93	143.26	-0.13	-0.46*
Lives in a rural area	0.19	0.22	0.37	-0.03	-0.18***
Wealth index	0.63	0.62	0.54	0.01	0.09***
Household size	4.76	5.07	5.78	-0.31**	-1.02***
Number of maternal siblings	1.10	1.81	3.61	-0.70***	-2.51***
Round 5					
Child's age (in months)	179.04	179.26	179.41	-0.22	-0.38
Lives in a rural area	0.19	0.19	0.36	-0.01	-0.17***
Wealth index	0.66	0.66	0.58	0.00	0.08***
Household size	4.91	5.11	5.64	-0.20	-0.73***
Number of maternal siblings	1.28	1.94	3.68	-0.66***	-2.40***
Observations	717	495	784	1212	1501

Note: Mean values of child and household characteristics across survey rounds 2-3 are reported in columns 1-3. Estimated difference in means between first-born children and subsequent birth order groups reported in columns 4-5, where *p<0.05 **p<0.01 ***p<0.001.

Table 19, Means of Contemporaneous Characteristics in Rounds 2-5, Vietnam

	(1) **First-born** Mean	(2) **Second-born** Mean	(3) **Later-born** Mean	(4) **First – Second-born** Difference	(5) **First – Later-born** Difference
Round 2					
Child's age (in months)	63.16	63.09	62.74	0.07	0.43
Lives in a rural area	0.80	0.77	0.81	0.03	-0.01
Wealth index	0.52	0.54	0.48	-0.02	0.04***
Household size	4.29	4.62	5.72	-0.33***	-1.43***
Number of maternal siblings	0.48	1.19	2.57	-0.71***	-2.09***
Round 3					
Child's age (in months)	96.60	96.64	96.34	-0.04	0.25
Lives in a rural area	0.79	0.78	0.80	0.02	-0.00
Wealth index	0.61	0.63	0.56	-0.03**	0.04***
Household size	4.31	4.55	5.49	-0.25***	-1.18***
Number of maternal siblings	0.73	1.29	2.65	-0.56***	-1.92***
Round 4					
Child's age (in months)	146.35	146.52	146.16	-0.17	0.19
Lives in a rural area	0.80	0.78	0.80	0.02	0.00
Wealth index	0.67	0.68	0.63	-0.01	0.04***
Household size	4.35	4.48	5.14	-0.14*	-0.79***
Number of maternal siblings	0.91	1.34	2.71	-0.43***	-1.80***
Round 5					
Child's age (in months)	182.45	182.51	182.12	-0.06	0.33
Lives in a rural area	0.78	0.76	0.78	0.02	0.01
Wealth index	0.71	0.73	0.66	-0.01*	0.06***
Household size	4.31	4.20	4.72	0.11	-0.40***
Number of maternal siblings	0.96	1.37	2.66	-0.40***	-1.70***
Observations	900	704	376	1604	1276

Note: Mean values of child and household characteristics across survey rounds 2-3 are reported in columns 1-3. Estimated difference in means between first-born children and subsequent birth order groups reported in columns 4-5, where *p<0.05 **p<0.01 ***p<0.001.

Figures 1-2, Age Distribution of Panel Siblings in Ethiopia and India

FIGURE 1: Age Difference Between Panel Sibling and Index Child, Ethiopia

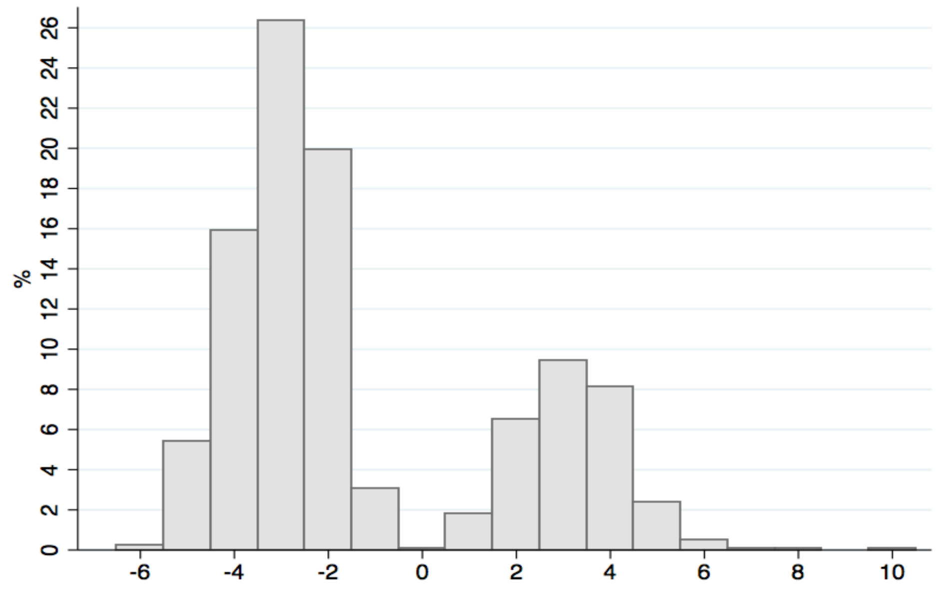
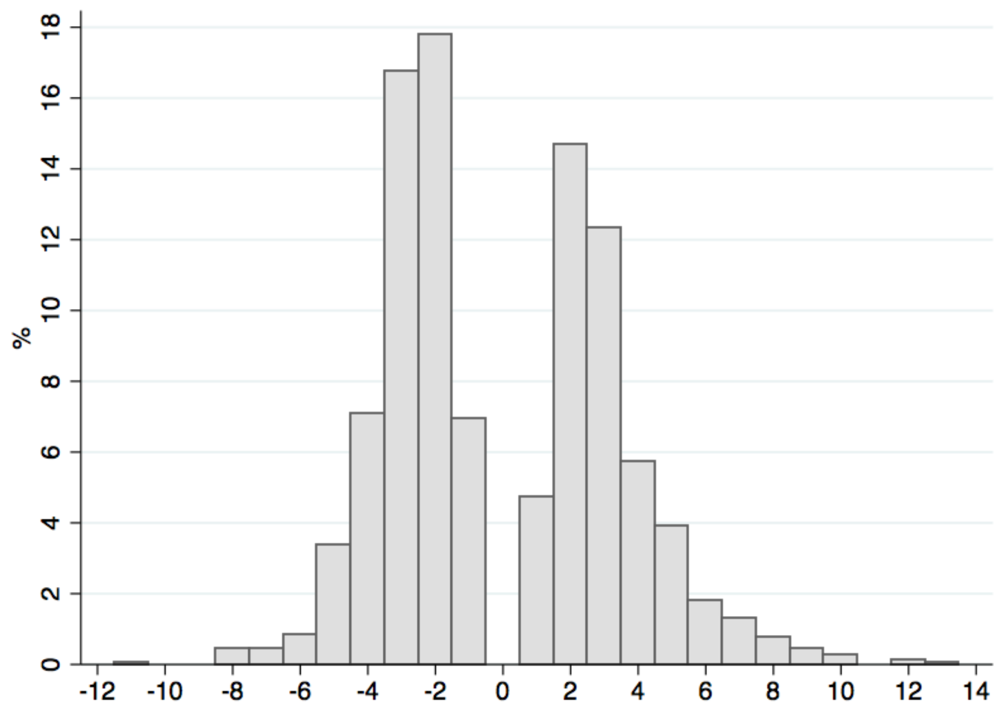


FIGURE 2: Age Difference Between Panel Sibling and Index Child, India



Note: The figures show the age differences between index children and their panel siblings, measured in completed years. A difference of zero would indicate that panel siblings were approximately 12 years old in survey round four, and 15 years old in survey round five.

Figures 3-4, Age Distribution of Panel Siblings in Peru and Vietnam

FIGURE 3: Age Difference Between Panel Sibling and Index Child, Peru

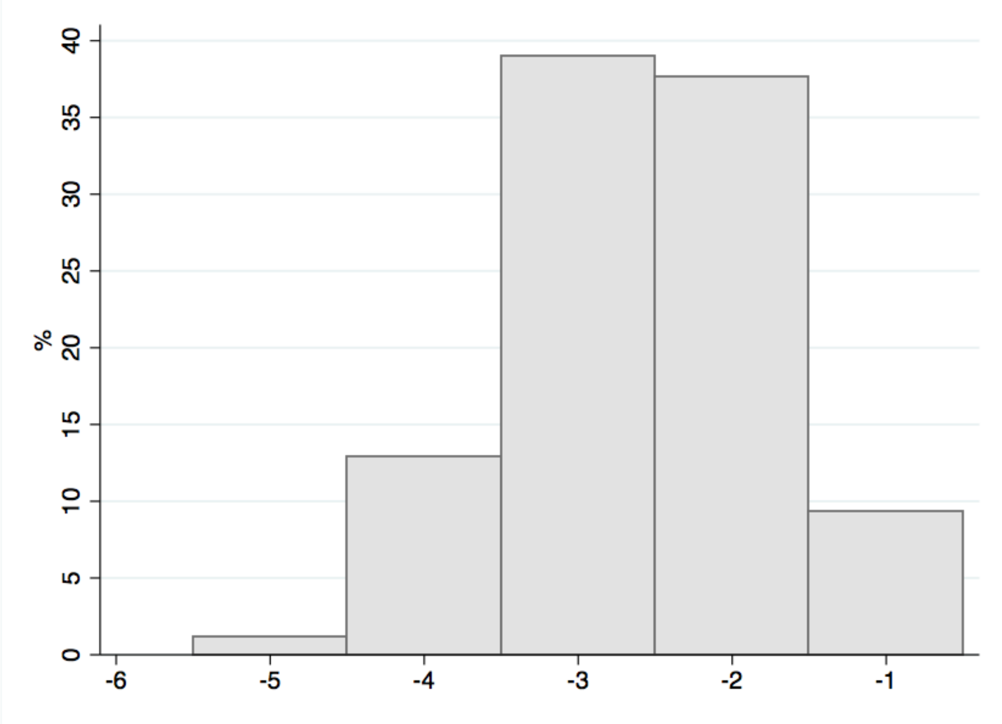
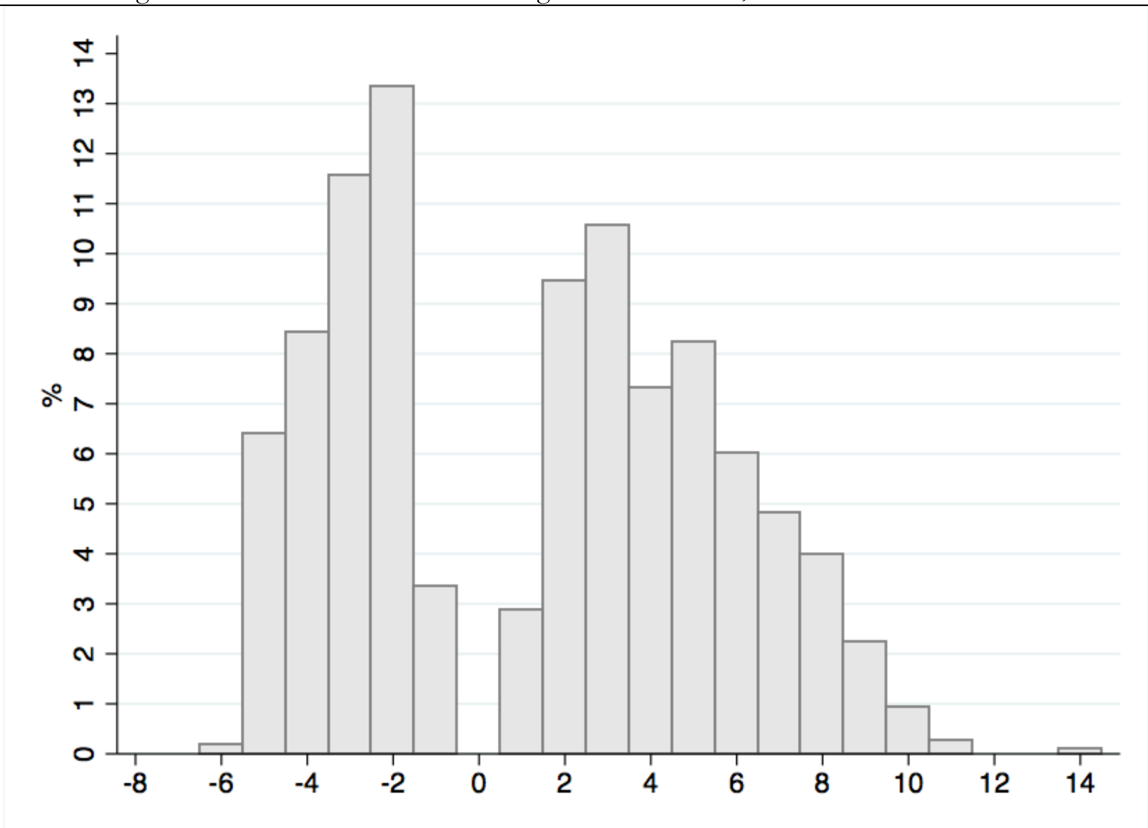


FIGURE 4: Age Difference Between Panel Sibling and Index Child, Vietnam



Note: The figures show the age differences between index children and their panel siblings, measured in completed years. A difference of zero would indicate that panel siblings were approximately 12 years old in survey round four, and 15 years old in survey round five.

APPENDIX B: Intra-Household Analysis with Linear Age Controls

Table 20, Effects on Anthropometric and Cognitive Scores Between Siblings with Linear Age

	Ethiopia	India	Peru	Vietnam
PANEL A: Physical Development				
	HFA z-score (FE)	HFA z-score (FE)	HFA z-score (FE)	HFA z-score (FE)
Survey Round 4				
Second Born	-0.09 (0.12)	0.10 (0.09)	-0.11 (0.08)	-0.05 (0.07)
Later Born	-0.25 (0.18)	0.07 (0.17)	-0.23 (0.16)	-0.20 (0.14)
Age (Completed Years)	-0.15*** (0.02)	-0.03 (0.03)	-0.05 (0.03)	-0.06*** (0.02)
Child is female	0.06 (0.08)	-0.06 (0.06)	-0.20* (0.08)	0.03 (0.06)
Constant	0.49 (0.33)	-1.12** (0.37)	-0.44 (0.37)	-0.41 (0.24)
Observations	2170	2982	1011	1759
Survey Round 5				
Second Born	-0.26** (0.07)	0.08 (0.08)	0.06 (0.08)	-0.08 (0.12)
Later Born	-0.43** (0.13)	0.02 (0.16)	0.00 (0.17)	-0.35 (0.20)
Age (Completed Years)	0.01 (0.02)	-0.01 (0.02)	-0.07* (0.03)	-0.10* (0.04)
Child is female	0.47*** (0.07)	-0.00 (0.05)	-0.22** (0.07)	0.01 (0.05)
Constant	-1.38*** (0.30)	-1.35** (0.41)	-0.20 (0.42)	0.41 (0.66)
Observations	2144	2517	1003	1522
PANEL B: Cognitive Development				
	PPVT (FE)	Quantitative (FE)	PPVT (FE)	PPVT (FE)
Survey Round 4				
Second Born	-0.19** (0.05)	-0.26*** (0.06)	-0.11 (0.08)	-0.38** (0.12)
Later Born	-0.24* (0.11)	-0.39** (0.12)	-0.25 (0.18)	-0.85*** (0.20)
Age (Completed Years)	0.12*** (0.01)	0.09*** (0.02)	-0.14* (0.05)	0.08** (0.02)
Child is female	0.02 (0.04)	-0.03 (0.04)	-0.81* (0.30)	-0.04 (0.08)
Constant	-1.34*** (0.19)	-1.02*** (0.26)	YES	-0.65 (0.33)
Observations	2180	2930	1017	1890
Survey Round 5				
Second Born	-0.18* (0.07)	-0.16** (0.06)	-0.09 (0.09)	-0.09 (0.07)
Later Born	-0.21 (0.13)	-0.23 (0.11)	-0.14 (0.18)	-0.14 (0.19)
Age (Completed Years)	0.07*** (0.02)	0.04* (0.02)	-0.14*** (0.03)	0.09** (0.02)
Child is female	-0.03 (0.04)	-0.12* (0.05)	-0.25 (0.30)	-0.09 (0.05)
Constant	-0.97** (0.29)	-0.52 (0.33)	YES	-1.26** (0.44)
Observations	2098	2543	989	1586

Note: The table displays fixed effects estimates of birth order differences in HFA z-scores and cognitive test-scores between index children and panel siblings. Clustered standard errors are reported in parentheses.
*p<0.05 **p<0.01 ***p<0.001

Table 21, Effects on Time Use and Enrolment Between Siblings with Linear Age

	Hours Work	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrolled**
PANEL A: Ethiopia						
Second Born	-0.16 (0.09)	0.07 (0.05)	0.22 (0.11)	-0.08* (0.04)	-0.03 (0.06)	-0.01 (0.02)
Later Born	0.01 (0.14)	0.06 (0.06)	0.09 (0.15)	-0.15** (0.05)	-0.00 (0.10)	0.01 (0.03)
Age (years)	0.14*** (0.03)	0.02 (0.01)	-0.37*** (0.03)	0.10*** (0.01)	0.09* (0.04)	0.02* (0.01)
Child is female	-0.56** (0.18)	0.68*** (0.06)	-0.30* (0.12)	0.01 (0.05)	0.11 (0.11)	0.03 (0.02)
Constant	2.57*** (0.40)	0.30* (0.13)	16.95*** (0.38)	0.31 (0.15)	4.07*** (0.40)	0.58*** (0.09)
Observations	4409	4409	4409	4409	4409	4417
PANEL B: India						
Second Born	0.45** (0.12)	-0.05 (0.03)	0.50*** (0.10)	-0.25*** (0.05)	-0.64*** (0.13)	-0.08*** (0.02)
Later Born	0.28 (0.18)	-0.15* (0.05)	0.68** (0.23)	-0.24 (0.12)	-0.55* (0.23)	-0.08* (0.03)
Age (years)	0.40*** (0.05)	0.05*** (0.01)	-0.12** (0.04)	-0.01 (0.02)	-0.31*** (0.04)	-0.04*** (0.00)
Child is female	0.49** (0.13)	0.14*** (0.03)	-0.15* (0.06)	-0.12* (0.04)	-0.33* (0.12)	-0.01 (0.01)
Constant	-3.34*** (0.52)	-0.19* (0.08)	14.50*** (0.42)	2.18*** (0.23)	10.81*** (0.43)	1.38*** (0.05)
Observations	3493	3493	3493	3493	3493	3466
PANEL C: Peru						
Second Born	0.13 (0.09)	-0.24** (0.07)	0.32** (0.10)	-0.19*** (0.05)	-0.23* (0.09)	-0.01 (0.04)
Later Born	-0.07 (0.18)	-0.33** (0.11)	0.26 (0.22)	-0.17** (0.06)	-0.18 (0.18)	0.04 (0.07)
Age (years)	0.22*** (0.02)	0.10*** (0.01)	-0.28*** (0.02)	0.01 (0.01)	-0.07** (0.02)	-0.05*** (0.01)
Child is female	-0.02 (0.10)	0.36*** (0.04)	-0.32*** (0.08)	0.07 (0.04)	0.07 (0.08)	0.02 (0.02)
Constant	-0.43 (0.23)	-0.16 (0.13)	15.78*** (0.34)	1.82*** (0.12)	6.62*** (0.26)	1.51*** (0.15)
Observations	3673	3674	3675	3674	3675	1851
PANEL D: Vietnam						
Second Born	0.07 (0.13)	-0.00 (0.05)	0.65*** (0.15)	-0.25* (0.09)	-0.47*** (0.11)	-0.08*** (0.02)
Later Born	-0.66** (0.22)	0.03 (0.11)	0.79** (0.25)	0.10 (0.19)	-0.39 (0.19)	-0.03 (0.03)
Age (years)	0.30*** (0.05)	0.02* (0.01)	-0.21*** (0.04)	0.02 (0.02)	-0.18*** (0.03)	-0.04*** (0.01)
Child is female	0.07 (0.12)	0.08* (0.03)	-0.52*** (0.12)	0.23** (0.08)	0.21 (0.12)	0.04* (0.02)
Constant	-1.51** (0.47)	0.05 (0.10)	16.76*** (0.48)	2.55*** (0.27)	6.58*** (0.33)	1.30*** (0.06)
Observations	3137	3137	3137	3137	3137	3158

Note: The table displays fixed effects estimates of birth order differences in time use and enrolment between all household members aged 7-17. Clustered standard errors are reported in parentheses.
*p<0.05 **p<0.01 ***p<0.001

APPENDIX C: Output with Reported Controls

Table 22, Effects on Anthropometric Z-Scores Across Index Children, Full Table, Ethiopia

PANEL A: HFA Z-Score					
	Aged 1	**Aged 5**	**Aged 8**	**Aged 12**	**Aged 15**
Second Born	0.00 (0.17)	-0.18 (0.11)	-0.13 (0.08)	-0.02 (0.11)	-0.10 (0.13)
Later Born	-0.04 (0.23)	-0.24* (0.09)	-0.15 (0.09)	-0.05 (0.08)	-0.03 (0.10)
Child is female	0.38*** (0.08)	-0.06 (0.05)	0.09 (0.05)	-0.01 (0.06)	0.82*** (0.07)
Mother's age at birth	-0.01 (0.01)	0.00 (0.00)	0.01 (0.00)	0.01 (0.00)	0.00 (0.00)
Mother's level of education	0.01 (0.01)	0.01* (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Child's age (in months)	-0.13*** (0.02)	-0.02** (0.00)	-0.01 (0.00)	-0.01* (0.01)	0.01* (0.01)
Lives in a rural area	0.20 (0.27)	0.12 (0.08)	0.09 (0.15)	-0.02 (0.12)	-0.22 (0.12)
Wealth index	1.93* (0.84)	1.44*** (0.19)	1.62*** (0.18)	1.12*** (0.23)	0.82** (0.25)
Household size	0.04 (0.04)	0.00 (0.01)	-0.01 (0.02)	0.00 (0.01)	0.01 (0.02)
Constant	-0.77 (0.43)	-0.97** (0.33)	-1.83*** (0.38)	-0.13 (0.82)	-4.55** (1.20)
Dummies For Number of Maternal Siblings	YES	YES	YES	YES	YES
Observations	1704	1778	1757	1747	1685
PANEL B: WFA Z-Score					
	Aged 1	**Aged 5**	**Aged 8**		
Second Born	0.05 (0.11)	-0.32* (0.12)	-0.17 (0.13)		
Later Born	-0.15 (0.15)	-0.29* (0.14)	-0.24 (0.12)		
Child is female	0.22** (0.07)	0.11* (0.05)	0.14* (0.05)		
Mother's age at birth	-0.00 (0.01)	0.01 (0.01)	0.01 (0.01)		
Mother's level of education	0.01* (0.01)	0.01 (0.00)	0.00 (0.00)		
Child's age (in months)	-0.08*** (0.02)	-0.02* (0.01)	-0.01 (0.01)		
Lives in a rural area	0.18 (0.19)	0.04 (0.20)	-0.02 (0.11)		
Wealth index	2.74*** (0.59)	1.41** (0.42)	1.46*** (0.18)		
Household size	0.01 (0.03)	0.02 (0.02)	-0.03 (0.02)		
Constant	-1.33*** (0.31)	-0.72 (0.68)	-0.94 (0.74)		
Dummies For Number of Maternal Siblings	YES	YES	YES		
Observations	1640	1777	1755		

Note: The table displays OLS regression results with reported child- and household- controls. First-born children, and children with no maternal siblings are omitted categories. Clustered standard errors in parentheses. * p<0.05 ** p<0.01 ***p<0.001

Table 23, Effects on Anthropometric Z-Scores Across Index Children, Full Table, India

PANEL A: HFA Z-Score					
	Aged 1	**Aged 5**	**Aged 8**	**Aged 12**	**Aged 15**
Second Born	0.06 (0.08)	-0.01 (0.05)	-0.07 (0.07)	-0.04 (0.06)	-0.00 (0.06)
Later Born	-0.17 (0.20)	-0.19* (0.09)	-0.23* (0.09)	-0.13 (0.07)	-0.05 (0.11)
Child is female	0.17* (0.06)	0.10* (0.04)	0.11* (0.04)	0.02 (0.04)	0.02 (0.05)
Mother's age at birth	0.05** (0.01)	0.02** (0.01)	0.02** (0.01)	0.01 (0.01)	0.01 (0.01)
Mother's level of education	0.04** (0.01)	0.01** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.01** (0.00)
Child's age (in months)	-0.07*** (0.01)	-0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Lives in a rural area	0.28 (0.17)	-0.07 (0.08)	-0.22* (0.09)	-0.20** (0.07)	-0.18*** (0.05)
Wealth index	1.21*** (0.19)	1.04*** (0.18)	1.28*** (0.22)	1.24*** (0.15)	1.11*** (0.14)
Household size	-0.01 (0.02)	0.02 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Constant	-2.35*** (0.38)	-2.66*** (0.48)	-1.89** (0.59)	-0.81 (0.83)	-1.30 (1.34)
Dummies For Number of Maternal Siblings	YES	YES	YES	YES	YES
Observations	1837	1858	1832	1828	1808

PANEL B: WFA Z-Score			
	Aged 1	**Aged 5**	**Aged 8**
Second Born	-0.02 (0.05)	-0.02 (0.05)	-0.04 (0.06)
Later Born	-0.27* (0.13)	-0.13 (0.08)	-0.17 (0.10)
Child is female	0.18*** (0.03)	0.02 (0.04)	0.20*** (0.05)
Mother's age at birth	0.02* (0.01)	0.02** (0.01)	0.02* (0.01)
Mother's level of education	0.02*** (0.01)	0.01** (0.00)	0.03*** (0.00)
Child's age (in months)	-0.04*** (0.01)	-0.03*** (0.01)	-0.02** (0.00)
Lives in a rural area	-0.03 (0.09)	-0.05 (0.08)	-0.28** (0.08)
Wealth index	0.84*** (0.17)	0.86*** (0.13)	1.13*** (0.15)
Household size	-0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Constant	-1.87*** (0.24)	-1.01* (0.38)	-1.28* (0.46)
Dummies For Number of Maternal Siblings	YES	YES	YES
Observations	1855	1864	1836

Note: The table displays OLS regression results with reported child- and household- controls. First-born children, and children with no maternal siblings are omitted categories. Clustered standard errors in parentheses. * $p<0.05$ ** $p<0.01$ *** $p<0.001$

Table 24, Effects on Anthropometric Z-Scores Across Index Children, Full Table, Peru

PANEL A: HFA Z-Score					
	Aged 1	**Aged 5**	**Aged 8**	**Aged 12**	**Aged 15**
Second Born	0.00 (0.18)	-0.23* (0.09)	-0.17* (0.06)	-0.08 (0.07)	-0.08 (0.06)
Later Born	-0.06 (0.20)	-0.26 (0.13)	-0.22 (0.11)	-0.05 (0.12)	-0.01 (0.09)
Child is female	0.22** (0.06)	-0.00 (0.04)	0.04 (0.05)	-0.05 (0.05)	-0.25*** (0.06)
Mother's age at birth	0.00 (0.01)	0.02** (0.01)	0.01* (0.00)	0.01 (0.01)	0.01** (0.00)
Mother's level of education	0.05** (0.02)	0.05*** (0.01)	0.05*** (0.01)	0.04*** (0.01)	0.04*** (0.01)
Child's age (in months)	-0.09*** (0.01)	0.02* (0.01)	-0.01 (0.01)	-0.02* (0.01)	-0.01 (0.01)
Lives in a rural area	-0.27 (0.17)	-0.24* (0.09)	-0.15* (0.06)	-0.09 (0.08)	-0.13 (0.07)
Wealth index	0.74* (0.35)	1.00*** (0.21)	1.20*** (0.22)	1.64*** (0.23)	0.66*** (0.14)
Household size	0.01 (0.01)	-0.03 (0.01)	-0.03 (0.02)	-0.02 (0.02)	0.01 (0.01)
Constant	-0.99*** (0.20)	-3.64*** (0.55)	-1.66* (0.73)	0.26 (0.99)	0.28 (1.31)
Dummies For Number of Maternal Siblings	YES	YES	YES	YES	YES
Observations	1888	1894	1853	1804	1754
PANEL B: WFA Z-Score					
	Aged 1	**Aged 5**	**Aged 8**		
Second Born	0.16 (0.14)	-0.22* (0.08)	-0.19* (0.08)		
Later Born	0.14 (0.18)	-0.30* (0.12)	-0.30* (0.13)		
Child is female	0.20*** (0.05)	-0.15** (0.04)	-0.08 (0.05)		
Mother's age at birth	0.01 (0.01)	0.02** (0.01)	0.02* (0.01)		
Mother's level of education	0.03* (0.01)	0.04*** (0.01)	0.05*** (0.01)		
Child's age (in months)	-0.06*** (0.01)	0.01 (0.01)	-0.01 (0.01)		
Lives in a rural area	-0.22 (0.11)	-0.03 (0.08)	-0.11 (0.08)		
Wealth index	1.00*** (0.24)	1.08*** (0.18)	1.51*** (0.22)		
Household size	0.01 (0.01)	-0.02 (0.01)	-0.02 (0.02)		
Constant	-0.38 (0.18)	-2.10*** (0.43)	-0.78 (0.71)		
Dummies For Number of Maternal Siblings	YES	YES	YES		
Observations	1892	1899	1852		

Note: The table displays OLS regression results with reported child- and household- controls. First-born children, and children with no maternal siblings are omitted categories. Clustered standard errors in parentheses. * p<0.05 ** p<0.01 ***p<0.001

Table 25, Effects on Anthropometric Z-Scores Across Index Children, Full Table, Vietnam

PANEL A: HFA Z-Score					
	Aged 1	**Aged 5**	**Aged 8**	**Aged 12**	**Aged 15**
Second Born	0.128 (0.36)	-0.02 (0.06)	-0.12* (0.05)	-0.06 (0.07)	0.02 (0.05)
Later Born	0.664 (0.47)	-0.00 (0.11)	0.02 (0.10)	-0.10 (0.10)	0.03 (0.08)
Child is female	0.209** (0.06)	0.01 (0.04)	0.08 (0.04)	0.03 (0.06)	-0.04 (0.06)
Mother's age at birth	0.027** (0.01)	0.02* (0.01)	0.01 (0.01)	0.01* (0.01)	-0.00 (0.00)
Mother's level of education	0.047*** (0.01)	0.06*** (0.01)	0.04*** (0.01)	0.05*** (0.01)	0.03*** (0.01)
Child's age (in months)	-0.058*** (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01* (0.01)	-0.01 (0.01)
Lives in a rural area	-0.124 (0.12)	-0.40** (0.11)	-0.31* (0.13)	-0.26* (0.11)	-0.13* (0.05)
Wealth index	0.886* (0.33)	0.69 (0.34)	1.22*** (0.27)	1.52** (0.45)	0.66* (0.27)
Household size	0.014 (0.01)	0.03 (0.02)	-0.00 (0.03)	0.01 (0.02)	-0.02 (0.01)
Constant	-1.749*** (0.33)	-1.53* (0.59)	-0.64 (0.82)	-0.27 (1.24)	0.13 (1.42)
Dummies For Number of Maternal Siblings	YES	YES	YES	YES	YES
Observations	1922	1904	1879	1840	1893

PANEL B: WFA Z-Score			
	Aged 1	**Aged 5**	**Aged 8**
Second Born	0.301 (0.38)	-0.14 (0.08)	-0.22* (0.09)
Later Born	0.562 (0.51)	-0.34* (0.13)	-0.40* (0.15)
Child is female	0.121** (0.04)	-0.14* (0.06)	-0.05 (0.07)
Mother's age at birth	0.004 (0.01)	0.01 (0.01)	0.02* (0.01)
Mother's level of education	0.046*** (0.01)	0.05** (0.01)	0.05*** (0.01)
Child's age (in months)	-0.043*** (0.01)	-0.02** (0.01)	-0.03** (0.01)
Lives in a rural area	-0.233 (0.13)	-0.77** (0.24)	-0.61* (0.26)
Wealth index	0.398 (0.27)	0.64* (0.23)	1.24*** (0.21)
Household size	0.017 (0.01)	0.05 (0.02)	0.02 (0.03)
Constant	-0.862** (0.27)	0.23 (0.60)	0.83 (1.05)
Dummies For Number of Maternal Siblings	YES	YES	YES
Observations	1930	1910	1878

Note: The table displays OLS regression results with reported child- and household- controls. First-born children, and children with no maternal siblings are omitted categories. Clustered standard errors in parentheses. * p<0.05 ** p<0.01 ***p<0.001

Table 26, Effects on Cognitive Test-Scores Across Index Children, Full Table, Ethiopia

	PANEL A: Aged 5			PANEL B: Aged 8		
	PPVT	**Numeracy**		**PPVT**	**Numeracy**	**Literacy**
Second Born	0.06 (0.07)	0.07 (0.07)		-0.01 (0.06)	0.04 (0.06)	-0.04 (0.05)
Later Born	0.02 (0.09)	0.03 (0.10)		0.14 (0.09)	0.02 (0.05)	-0.00 (0.07)
Child is female	-0.10** (0.03)	-0.00 (0.03)		0.01 (0.05)	-0.05 (0.05)	0.02 (0.05)
Mother's age at birth	0.01 (0.00)	0.00 (0.00)		0.01 (0.01)	0.00 (0.00)	0.00 (0.01)
Mother's education	0.01 (0.00)	0.01 (0.00)		-0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Child's age (months)	0.05*** (0.01)	0.03***(0.0)		0.05***(0.01)	0.03***(0.0)	0.01* (0.01)
Lives in a rural area	-0.20 (0.16)	-0.18 (0.16)		-0.49* (0.22)	-0.71**(0.2)	-0.56**(0.18)
Wealth index	1.55*** (0.28)	1.51***(0.2)		1.56***(0.38)	1.52***(0.3)	1.20***(0.3)
Household size	0.03 (0.03)	0.01 (0.02)		0.02 (0.02)	0.01 (0.02)	-0.02 (0.02)
Constant	-3.56*** (0.6)	-2.16***(0.5)		-5.21*** (0.8)	-3.17**(0.8)	-1.38 (0.7)
Dummies For Maternal Siblings	YES	YES		YES	YES	YES
Observations	1732	1758		1734	1686	1754

	PANEL C: Aged 12			PANEL D: Aged 15		
	PPVT	**Numeracy**	**Literacy**	**PPVT**	**Numeracy**	**Literacy**
Second Born	-0.12* (0.06)	-0.02 (0.06)	-0.09 (0.06)	-0.12 (0.06)	0.00 (0.08)	-0.11 (0.07)
Later Born	-0.14* (0.05)	-0.19*(0.07)	-0.02 (0.06)	-0.04 (0.06)	-0.08 (0.08)	-0.13 (0.07)
Child is female	-0.04 (0.04)	0.02 (0.05)	0.11 (0.06)	-0.03 (0.04)	-0.03 (0.05)	0.06 (0.05)
Mother's age at birth	0.00 (0.00)	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Mother's education	-0.00 (0.00)	0.00 (0.00)	0.00 (0.01)	0.00 (0.00)	0.00 (0.00)	0.01* (0.00)
Child's age (months)	0.01 (0.01)	0.02***(0.0)	0.02* (0.01)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
Lives in a rural area	-0.41* (0.19)	-0.5***(0.09)	-0.62***(0.1)	-0.43** (0.15)	-0.58**(0.2)	-0.64** (0.2)
Wealth index	2.47*** (0.39)	1.75***(0.2)	1.24***(0.2)	2.43*** (0.4)	1.27***(0.2)	1.18*** (0.3)
Household size	-0.03 (0.03)	-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.02)	-0.01 (0.02)	-0.00 (0.02)
Dummies For Maternal Siblings	YES	YES	YES	YES	YES	YES
Constant	-2.55 (1.24)	-3.62***(0.8)	-3.13* (1.4)	-2.61* (1.09)	-0.50 (1.24)	-1.42 (1.35)
Observations	1523	1511	1456	1504	1596	1570

Note: The table displays OLS regression results with reported child- and household- controls. First-born children, and children with no maternal siblings are omitted categories. Clustered standard errors in parentheses. * p<0.05 ** p<0.01 ***p<0.001

Table 27, Effects on Cognitive Test-Scores Across Index Children, Full Table, India

	PANEL A: Aged 5			PANEL B: Aged 8		
	PPVT	**Numeracy**		**PPVT**	**Numeracy**	**Literacy**
Second Born	0.11 (0.09)	-0.03 (0.06)		-0.03 (0.06)	-0.03 (0.07)	-0.07 (0.06)
Later Born	-0.03 (0.09)	-0.10 (0.05)		-0.21 (0.11)	-0.16 (0.11)	-0.26* (0.09)
Child is female	-0.03 (0.04)	-0.04 (0.05)		-0.18**(0.05)	0.02 (0.05)	0.06 (0.05)
Mother age at birth	0.01 (0.01)	0.02** (0.0)		0.02** (0.0)	0.02* (0.01)	0.02** (0.01)
Mother's education	0.04** (0.0)	0.03***(0.0)		0.02***(0.0)	0.04*** 0.0)	0.02** (0.01)
Child's age	0.04***(0.0)	0.04***(0.0)		0.02* (0.01)	0.05***(0.0)	0.03*** (0.0)
Lives in a rural area	-0.22 (0.24)	-0.10 (0.12)		-0.05 (0.17)	0.29* (0.14)	0.39* (0.16)
Wealth index	0.60** (0.21)	0.51* (0.20)		1.02***(0.2)	1.4***(0.25)	0.73** (0.22)
Household size	-0.01 (0.02)	0.02 (0.01)		-0.01 (0.01)	0.03**(0.01)	0.01 (0.02)
Constant	-2.75*** (0.60)	-3.47*** (0.47)		-2.9** (0.97)	-6.0*** (0.9)	-4.35*** (0.9)
Dummies for Maternal Siblings	YES	YES		YES	YES	YES
Observations	1776	1848		1808	1811	1822
	PANEL C: Aged 12			PANEL D: Aged 15		
	PPVT	**Numeracy**	**Literacy**	**PPVT**	**Numeracy**	**Literacy**
Second Born	-0.08 (0.05)	-0.06 (0.06)	-0.11 (0.07)	-0.1**(0.03)	-0.09 (0.06)	-0.09 (0.08)
Later Born	-0.21* (0.10)	-0.25* (0.09)	-0.19 (0.10)	-0.15 (0.09)	-0.20*(0.08)	-0.19* (0.07)
Child is female	-0.08 (0.04)	0.03 (0.04)	0.11* (0.04)	-0.11 (0.08)	-0.14**(0.1)	0.10* (0.1)
Mother age at birth	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)
Mother's education	0.02** (0.01)	0.03* (0.01)	0.03** (0.01)	0.02*** (0.0)	0.03** (0.01)	0.02* (0.01)
Child's age	0.02* (0.01)	0.01 (0.01)	0.02** (0.0)	0.01 (0.01)	0.02* (0.01)	0.01 (0.00)
Lives in a rural area	0.21 (0.16)	0.16 (0.11)	0.24 (0.14)	-0.00 (0.13)	0.03 (0.12)	0.06 (0.10)
Wealth index	1.57*** (0.21)	1.69*** (0.21)	1.43***(0.2)	0.83** (0.22)	1.54***(0.3)	1.61*** (0.2)
Household size	-0.04 (0.02)	0.02 (0.01)	-0.01 (0.01)	0.01 (0.02)	0.04* (0.02)	0.01 (0.01)
Constant	-3.66** (1.16)	-3.23** (1.06)	-4.27**(1.1)	-2.84 (1.48)	-4.23** (1.2)	-2.33* (0.90)
Dummies for Maternal Siblings	YES	YES	YES	YES	YES	YES
Observations	1821	1780	1777	1800	1753	1744

Note: The table displays OLS regression results with reported child- and household- controls. First-born children, and children with no maternal siblings are omitted categories. Clustered standard errors in parentheses. * p<0.05 ** p<0.01 ***p<0.001

Table 28, Effects on Cognitive Test-Scores Across Index Children, Full Table, Peru

	PANEL A: Aged 5			PANEL B: Aged 8		
	PPVT	**Numeracy**		**PPVT**	**Numeracy**	**Literacy**
Second Born	-0.00 (0.04)	-0.03 (0.05)		-0.08 (0.05)	-0.16* (0.06)	-0.03 (0.06)
Later Born	-0.05 (0.07)	-0.08 (0.06)		-0.10 (0.07)	-0.32** (0.10)	-0.11 (0.10)
Child is female	-0.02 (0.03)	0.06 (0.04)		-0.09* (0.04)	-0.14** (0.04)	-0.00 (0.03)
Mother age at birth	0.01* (0.00)	0.01* (0.00)		0.01 (0.00)	0.01* (0.01)	0.01 (0.00)
Mother's education	0.05*** (0.0)	0.03*** (0.0)		0.05*** (0.0)	0.05*** (0.0)	0.05*** (0.0)
Child's age	0.06*** (0.0)	0.05*** (0.0)		0.04*** (0.0)	0.06*** (0.0)	0.03*** (0.0)
Lives in rural area	-0.08 (0.08)	-0.01 (0.09)		-0.26** (0.09)	-0.18 (0.10)	-0.4*** (0.08)
Wealth index	1.47*** (0.21)	0.78*** (0.19)		1.51*** (0.17)	1.18*** (0.14)	0.85*** (0.16)
Household size	-0.03* (0.01)	-0.02 (0.01)		-0.00 (0.01)	-0.00 (0.01)	-0.02 (0.01)
Constant	-4.9*** (0.3)	-4.0*** (0.4)		-4.8*** (0.6)	-6.6*** (0.6)	-3.7*** (0.5)
Dummies for Maternal Siblings	YES	YES		YES	YES	YES
Observations	1851	1894		1763	1802	1801
	PANEL C: Aged 12			PANEL D: Aged 15		
	PPVT	**Numeracy**	**Literacy**	**PPVT**	**Numeracy**	**Literacy**
Second Born	-0.02 (0.06)	-0.06 (0.05)	-0.05 (0.06)	-0.08 (0.06)	-0.08 (0.06)	-0.05 (0.08)
Later Born	-0.21* (0.07)	-0.10 (0.08)	-0.20* (0.08)	-0.16* (0.07)	-0.10 (0.09)	-0.20* (0.08)
Child is female	-0.2***(0.05)	-0.05 (0.05)	0.04 (0.05)	-0.17***(0.03)	-0.2*** (0.04)	0.02 (0.05)
Mother age at birth	0.01* (0.00)	0.01* (0.01)	0.02** (0.00)	0.01* (0.00)	0.02* (0.01)	0.01** (0.00)
Mother's education	0.06*** (0.0)	0.07*** (0.01)	0.06*** (0.01)	0.06*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
Child's age	0.02*** (0.0)	0.02*** (0.0)	0.03***(0.01)	0.01* (0.00)	-0.00 (0.01)	0.01* (0.01)
Lives in rural area	-0.27**(0.08)	-0.22* (0.08)	-0.22** (0.07)	-0.26* (0.09)	-0.15 (0.08)	-0.25** (0.08)
Wealth index	1.4*** (0.12)	0.62** (0.22)	0.95*** (0.17)	1.32*** (0.16)	0.67*** (0.17)	0.72*** (0.14)
Household size	-0.03* (0.01)	-0.02 (0.01)	-0.01 (0.01)	-0.02 (0.01)	0.01 (0.02)	-0.01 (0.02)
Constant	-4.2*** (0.5)	-3.9*** (0.6)	-4.9*** (0.8)	-3.3** (0.9)	-1.0 (1.0)	-3.7** (1.2)
Dummies for Maternal Siblings	YES	YES	YES	YES	YES	YES
Observations	1785	1782	1782	1731	1765	1718

Note: The table displays OLS regression results with reported child- and household- controls. First-born children, and children with no maternal siblings are omitted categories. Clustered standard errors in parentheses. * p<0.05 ** p<0.01 ***p<0.001

Table 29, Effects on Cognitive Test-Scores Across Index Children, Full Table, Vietnam

	PANEL A: Aged 5			PANEL B: Aged 8		
	PPVT	**Numeracy**	**Literacy**	**PPVT**	**Numeracy**	**Literacy**
Second Born	0.01 (0.06)	-0.03 (0.06)		-0.07 (0.06)	-0.11 (0.05)	-0.12 (0.06)
Later Born	-0.00 (0.11)	0.17 (0.10)		0.02 (0.11)	-0.02 (0.10)	0.02 (0.11)
Child is female	-0.04 (0.05)	0.02 (0.05)		-0.00 (0.04)	0.06 (0.03)	0.14** (0.04)
Mother age at birth	-0.00 (0.01)	0.00 (0.01)		0.01 (0.01)	0.01 (0.00)	-0.00 (0.01)
Mother's education	0.05** (0.01)	0.04** (0.01)		0.08*** (0.01)	0.06*** (0.01)	0.04** (0.01)
Child's age	0.05*** (0.0)	0.05*** (0.01)		0.05*** (0.01)	0.08*** (0.01)	0.04*** (0.0)
Lives in rural area	-0.59** (0.2)	-0.15 (0.16)		-0.09 (0.22)	-0.13 (0.14)	-0.34 (0.18)
Wealth index	0.94* (0.37)	1.28** (0.40)		0.98** (0.29)	1.25** (0.33)	0.91* (0.34)
Household size	0.01 (0.02)	0.00 (0.02)		0.02 (0.03)	-0.00 (0.02)	-0.04 (0.02)
Constant	-3.3***(0.7)	-4.0*** (0.5)		-6.0*** (0.7)	-8.9*** (0.7)	-4.1*** (0.8)
Dummies for Maternal Siblings	YES	YES		YES	YES	YES
Observations	1700	1856		1786	1860	1888
	PANEL C: Aged 12			PANEL D: Aged 15		
	PPVT	**Numeracy**	**Literacy**	**PPVT**	**Numeracy**	**Literacy**
Second Born	-0.16 (0.08)	-0.09 (0.06)	-0.08 (0.07)	-0.06 (0.05)	-0.13 (0.08)	-0.19** (0.07)
Later Born	-0.23 (0.16)	-0.27* (0.13)	-0.18 (0.13)	0.01 (0.07)	-0.25* (0.10)	-0.24* (0.09)
Child is female	0.02 (0.04)	0.12** (0.03)	0.26*** (0.0)	0.07 (0.03)	0.16*** (0.04)	0.37** (0.04)
Mother age at birth	0.01 (0.01)	0.01 (0.01)	0.01* (0.01)	-0.00 (0.01)	0.02*** (0.01)	0.02** (0.01)
Mother's education	0.06***(0.0)	0.08*** (0.01)	0.07***(0.0)	0.06*** (0.01)	0.08*** (0.01)	0.06*** (0.0)
Child's age	0.01 (0.01)	0.02* (0.01)	0.02** (0.0)	0.00 (0.01)	0.01 (0.01)	-0.00 (0.01)
Lives in rural area	0.20 (0.20)	0.21 (0.19)	0.06 (0.14)	0.34* (0.16)	-0.13 (0.15)	-0.23* (0.10)
Wealth index	1.38* (0.58)	1.45** (0.48)	1.06* (0.45)	1.70** (0.54)	0.79* (0.35)	0.77* (0.27)
Household size	-0.02 (0.02)	0.00 (0.02)	0.01 (0.02)	-0.04 (0.03)	0.03 (0.02)	-0.01 (0.02)
Constant	-3.0* (1.3)	-5.1** (1.3)	-4.6***(1.1)	-2.3 (1.7)	-3.8* (1.6)	-1.2 (1.5)
Dummies for Maternal Siblings	YES	YES	YES	YES	YES	YES
Observations	1823	1777	1770	1890	1849	1852

Note: The table displays OLS regression results with reported child- and household- controls. First-born children, and children with no maternal siblings are omitted categories. Clustered standard errors in parentheses. * p<0.05 ** p<0.01 ***p<0.001

Table 30, Effects on Time Use and Enrolment Across Index Children, Full Table, Ethiopia and India

PANEL A: Ethiopia

	PANEL A.1: Aged 8						PANEL A.2: Aged 12						PANEL A.3: Aged 15					
	Hours Work	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**	**Hours Work**	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol.**	**Hours Work**	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**
Second Born	-0.21	-0.31**	0.45	0.10	-0.03	-0.06	0.09	0.05	0.12	-0.05	-0.21	-0.01	0.07	-0.10	0.50*	-0.18	-0.28*	-0.02
Later Born	-0.15	-0.6**	0.74**	0.11	-0.10	-0.04	0.22	-0.21*	0.17	0.05	-0.22	-0.01	0.17	-0.26	0.72**	-0.16	-0.47*	-0.05
Child is female	-0.63**	0.48**	0.06	-0.01	0.11	0.05	-0.48*	0.38**	-0.25	0.07	0.28**	0.04	-0.39*	0.31**	-0.34*	0.11	0.31	0.04
Mother age at birth	-0.01	-0.03**	0.03	0.01	0.00	0.00	-0.03*	-0.02**	0.02	0.01	0.02*	0.00	-0.01	-0.01	0.01	0.00	0.01	0.00
Mother's education	0.00	0.00	-0.00	-0.01	0.00	-0.00	-0.00	0.00	-0.01	0.00	0.01	0.00	-0.02	-0.00	0.01	0.01	0.00	0.00
Child's age	0.02	0.01	-0.05*	0.01	0.02	0.01	0.00	-0.00	0.01	0.00	-0.01	-0.00	0.01	-0.01	0.04*	-0.01	-0.03	-0.01*
Lives in rural area	1.50**	0.35**	-0.19	-0.45*	-1.21*	-0.24*	1.38**	0.04	-0.51	-0.34*	-0.57	-0.01	1.07**	-0.18	-0.09	0.09	-0.90*	-0.02
Wealth index	-3.2**	-0.70	0.07	0.58	3.25**	0.39	-3.1**	-0.25	0.47	0.87**	2.04**	0.2**	-2.9**	0.00	-0.18	1.8**	1.26	0.16*
Household size	-0.02	0.07**	-0.02	-0.02	-0.02	-0.02	-0.02	0.06**	-0.11**	0.03	0.05	0.01	-0.14*	0.05**	0.01	0.03	0.05	0.01*
Constant	1.94	-0.12	19.1**	0.31	2.78	0.03	4.46*	0.97	11.4**	0.74	6.47**	1.2**	3.29	1.84	6.25*	2.71*	9.9**	1.9**
Maternal Sib. Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1758	1759	1759	1759	1759	1744	1742	1742	1742	1742	1742	1747	1688	1689	1688	1688	1688	1692

PANEL B: India

	PANEL B.1: Aged 8						PANEL B.2: Aged 12						PANEL B.3: Aged 15					
	Hours Work	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**	**Hours Work**	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol.**	**Hours Work**	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**
Second Born	-0.01	-0.22**	0.19	0.06	-0.06	0.02	-0.09	-0.13**	0.01	0.09	0.12	0.01	-0.09	-0.07*	0.17	-0.06	0.04	-0.00
Later Born	-0.04	-0.40**	0.66**	-0.08	-0.17	0.01	-0.17	-0.24**	0.18	-0.01	0.24	0.02	-0.04	-0.10	0.47	-0.19	-0.14	-0.01
Child is female	0.20**	0.06	-0.27*	0.14*	-0.10	0.04*	0.27**	0.09**	-0.31**	0.05	-0.10	-0.00	0.17	0.13**	-0.24	0.17	-0.24	-0.03
Mother age at birth	0.00	-0.00	-0.01	0.00	0.00	0.00	0.01	-0.00	0.01	-0.01	-0.02	-0.00*	0.02	-0.00	0.02	-0.01	-0.03	-0.00*
Mother's education	-0.01	-0.01	-0.03**	0.04**	-0.00	0.00*	-0.01	-0.00	-0.02	0.01	0.02*	0.00**	-0.03	-0.01*	-0.03	0.03**	0.03	0.00
Child's age	0.01	0.00	-0.01	-0.00	0.01	0.01*	0.02	-0.01*	0.01	-0.02	-0.00	-0.00	0.06	0.00	0.00	-0.02	-0.05	-0.01
Lives in rural area	0.08	0.02	-0.40	0.26	0.10	-0.01	0.28*	0.02	-0.28	0.07	-0.08	0.01	0.19	0.05	-0.34	0.11	-0.01	0.02
Wealth index	-0.23	-0.10	-1.86**	0.81	1.47**	0.03	-0.51	-0.03	-1.67**	0.77*	1.44**	0.09*	-3.56**	-0.30	-1.92**	1.47**	4.30**	0.42**
Household size	-0.03**	-0.01	0.02	0.02	-0.00	0.00	0.02	0.02	-0.01	-0.05*	0.02	0.00	-0.03	0.02	-0.05	-0.01	0.06	0.00
Constant	-0.60	0.07	16.99**	1.26	6.22**	0.32	-1.41	1.07*	12.15**	4.38*	7.81**	1.24**	-6.84	-0.70	12.79**	4.91*	13.86**	1.61*
Maternal Sib. Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1838	1838	1838	1838	1838	1838	1827	1827	1827	1827	1827	1831	1807	1807	1807	1807	1807	1813

Note: Birth order one, and zero maternal siblings are omitted categories. Clustered standard errors are not reported. * $p<0.05$ ** $p<0.01$.

Table 31, Effects on Time Use and Enrolment Across Index Children, Full Table, Peru and Vietnam

PANEL C: PERU

	PANEL C.1: Aged 8						PANEL C.2: Aged 12						PANEL C.3: Aged 15					
	Hours Work	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**	**Hours Work**	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**	**Hours Work**	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**
Second Born	0.00	-0.42**	0.25*	-0.07	-0.02	0.01	0.15	-0.30**	0.15	0.09	-0.09	0.00	0.12	-0.28**	-0.01	-0.15	0.14	-0.00
Later Born	0.04	-0.67**	0.27	-0.10	-0.06	0.01	0.07	-0.60**	0.51*	0.05	-0.12	-0.00	0.28	-0.57**	0.23	-0.04	0.21	0.00
Child is female	-0.05	0.05	-0.18	0.09*	0.01	0.00	-0.07	0.09	-0.00	0.04	0.08	-0.00	-0.03	0.06	-0.29**	0.18**	0.22*	0.01
Mother age at birth	0.00	-0.01**	-0.00	0.01	-0.00	-0.00*	0.00	-0.02**	-0.01	0.01	0.00	-0.00	-0.00	-0.02**	0.00	0.02**	-0.02	-0.00
Mother's education	-0.04**	-0.01*	-0.01	0.02**	0.02**	0.00**	-0.04**	-0.03**	0.02	0.02	0.02*	0.00	-0.04**	-0.00	-0.03	0.01	0.05*	0.00*
Child's age	0.01	0.01*	-0.03**	0.00	-0.00	-0.00	0.01	-0.01	-0.03**	0.01	0.02**	-0.00**	0.02*	-0.00	0.00	-0.00	-0.02	-0.00
Lives in rural area	0.55**	0.07	-0.44*	-0.12	0.24**	0.01	0.74**	-0.08	-0.53**	-0.12*	0.06	0.00	0.25	-0.16	-0.26	0.01	0.17	0.01
Wealth index	-0.28	-0.20	-0.72	0.65**	0.13	0.00	-0.68*	-0.17	-0.66	0.48**	0.61**	0.01	-0.94*	-0.05	-0.48	0.84**	-0.00	0.07
Household size	-0.03*	-0.01	0.03	0.00	0.01	-0.00	0.01	0.06*	0.00	-0.05**	0.02	-0.00	0.00	0.03	0.02	0.00	-0.04	-0.00
Constant	0.36	-0.49	17.33**	1.22*	6.14**	1.07**	1.31	1.74	17.99**	0.02	1.88	1.24**	-0.99	0.94	12.71**	1.85*	10.61**	1.07**
Maternal Sib. Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1852	1852	1853	1852	1853	1856	1792	1792	1792	1792	1792	1807	1751	1751	1751	1751	1751	1765

PANEL D: VIETNAM

	PANEL D.1: Aged 8						PANEL D.2: Aged 12						PANEL D.3: Aged 15					
	Hours Work	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**	**Hours Work**	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**	**Hours Work**	**Hours Care**	**Hours Leisure**	**Hours Study**	**Hours School**	**Enrol**
Second Born	-0.00	-0.47**	0.44**	0.08	-0.09	-0.01	0.03	-0.48**	0.45**	0.01	0.00	-0.02**	0.42*	-0.15	0.37	-0.23	-0.37	-0.05
Later Born	-0.19*	-0.91**	0.74**	0.38*	-0.09	0.02	0.03	-0.87**	0.58*	0.24	0.02	-0.02	0.45	-0.42**	0.61	-0.26	-0.28	-0.05
Child is female	0.04	0.10**	-0.23*	0.08	-0.01	0.01*	0.16**	0.05	-0.60**	0.26**	0.14*	0.01*	-0.25	0.08	-0.99**	0.72**	0.48**	0.08**
Mother age at birth	-0.01	-0.01	0.03**	-0.04**	0.02	-0.00	-0.01	-0.00	0.00	0.01	-0.00	0.00	-0.04*	-0.00	-0.01	0.04**	0.01	0.00
Mother's education	-0.02	-0.00	-0.11**	0.11**	0.02*	0.00	-0.05**	-0.01	-0.05	0.08**	0.03	0.00*	-0.17**	-0.01	-0.15**	0.13**	0.20**	0.03**
Child's age	0.00	0.00	0.00	0.03	-0.04*	0.00	0.02	-0.01	-0.01	0.01	-0.01	0.00	0.09**	0.00	-0.02	-0.05**	-0.02	-0.01**
Lives in rural area	0.24*	0.08	0.27	0.64	-1.22**	0.02**	0.41**	0.05	-1.01**	-0.34	0.96**	0.03**	0.33	-0.04	-0.98*	-0.57**	1.27**	0.03
Wealth index	-0.76*	-0.23	-0.81	1.97**	-0.12	0.13**	-1.79**	-0.33	-1.35	2.49**	1.02	0.22**	-2.17**	-0.15	-1.91**	1.51**	2.54**	0.36**
Household size	-0.02	-0.01	0.09*	-0.06	0.00	-0.01	-0.01	0.07**	-0.04	0.02	-0.04	-0.00	-0.10	0.06*	0.00	-0.02	0.05	0.01
Constant	0.70	0.18	15.55**	-1.49	9.23**	0.86**	0.16	1.28	17.66**	-0.53	5.34**	0.56**	-9.94	0.24	20.59**	8.97**	4.34	1.99**
Maternal Sib. Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1876	1861	1880	1874	1880	1860	1834	1834	1834	1834	1834	1818	1895	1895	1895	1895	1895	1882

Note: Birth order one, and zero maternal siblings are omitted categories. Clustered standard errors are not reported. * p<0.05 ** p<0.01

APPENDIX D: Dropped Observations and Missing Values

Table 32, Dropped Observations

	Before drop	After drop	No. dropped
Ethiopia			
No index child on household roster	1999	1914	85
Same age sibling/Twins	1914	1905	9
Misreported maternal births	1905	1885	20
Total			**114**
India			
No index child on household roster	2011	1952	59
Same age sibling/Twins	1952	1949	3
Misreported maternal births	1949	1905	44
Total			**106**
Peru			
No index child on household roster	2052	1998	54
Same age sibling/Twins	1998	1997	1
Misreported maternal births	1997	1996	1
Total			**56**
Vietnam			
No index child on household roster	2000	1983	17
Same age sibling/Twins	1983	1983	0
Misreported maternal births	1983	1980	3
Total			**20**

Note: The table displays index children who were dropped from the analysis due to their birth order not being identified from the household surveys.

Table 33, Missing Values, Ethiopia

		Round 1		Round 2		Round 3		Round 4		Round 5	
	N	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing
Explanatory Variable											
Birth order group	1885	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Contemporaneous Controls											
Child's age (in months)	1885	0	0.00	2	0.11	31	1.64	43	2.28	98	5.20
Lives in a rural area	1885	0	0.00	2	0.11	29	1.54	40	2.12	92	4.88
Wealth index	1885	22	1.17	12	0.64	30	1.59	43	2.28	93	4.93
Number maternal siblings	1885	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Household size	1885	0	0.00	2	0.11	29	1.54	40	2.12	90	4.77
Fixed Controls											
Child is female	1885	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Mother's age at birth	1885	53	2.81	53	2.81	53	2.81	53	2.81	53	2.81
Mother's level of education	1885	62	3.29	62	3.29	62	3.29	62	3.29	62	3.29
Dependent Variables											
WFA (Z-score)	1885	138	7.32	5	0.27	34	1.80				
HFA (Z-score)	1885	73	3.87	6	0.32	36	1.91	43	2.28	105	5.57
PPVT Score	1885			52	2.76	57	3.02	**272**	**14.43**	**287**	**15.23**
Numeracy Score	1885			25	1.33	105	5.57	**287**	**15.23**	**198**	**10.50**
Literacy Score	1885					35	1.86	**343**	**18.20**	**227**	**12.04**
Hours worked	1885			**574**	**30.45**	31	1.64	46	2.44	102	5.41
Hours care	1885			**573**	**30.40**	30	1.59	46	2.44	101	5.36
Hours leisure	1885			**573**	**30.40**	30	1.59	46	2.44	101	5.36
Hours study	1885			**573**	**30.40**	30	1.59	46	2.44	102	5.41
Hours school	1885			**573**	**30.40**	30	1.59	46	2.44	102	5.41
Enrolment	1885	40	2.12	40	2.12	40	2.12	35	1.86	98	5.20

Note: The table displays missing observations for all variables used in the inter-household analysis across all survey rounds. Missing values that exceed 10% of the sample are marked in bold

Table 34, Missing Values, India

	N	Round 1 # Missing	Round 1 % Missing	Round 2 # Missing	Round 2 % Missing	Round 3 # Missing	Round 3 % Missing	Round 4 # Missing	Round 4 % Missing	Round 5 # Missing	Round 5 % Missing
Explanatory Variable											
Birth order group	1905	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Contemporaneous Controls											
Child's age (in months)	1905	0	0.00	2	0.10	21	1.10	41	2.15	51	2.68
Lives in a rural area	1905	0	0.00	6	0.31	39	2.05	42	2.20	55	2.89
Wealth index	1905	5	0.26	4	0.21	23	1.21	36	1.89	41	2.15
Number maternal siblings	1905	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Household size	1905	0	0.00	2	0.10	21	1.10	36	1.89	41	2.15
Fixed Controls											
Child is female	1905	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Mother's age at birth	1905	16	0.84	16	0.84	16	0.84	16	0.84	16	0.84
Mother's level of education	1905	20	1.05	20	1.05	20	1.05	20	1.05	20	1.05
Dependent Variables											
WFA (Z-score)	1905	16	0.84	8	0.42	23	1.21				
HFA (Z-score)	1905	36	1.89	14	0.73	28	1.47	44	2.31	56	2.94
PPVT Score	1905			97	5.09	51	2.68	48	2.52	60	3.15
Numeracy Score	1905			24	1.26	48	2.52	91	4.78	108	5.67
Literacy Score	1905					37	1.94	92	4.83	117	6.14
Hours worked	1905			**196**	**10.29**	21	1.10	41	2.15	57	2.99
Hours care	1905			**196**	**10.29**	21	1.10	41	2.15	57	2.99
Hours leisure	1905			**196**	**10.29**	21	1.10	41	2.15	57	2.99
Hours study	1905			**195**	**10.24**	21	1.10	41	2.15	57	2.99
Hours school	1905			**195**	**10.24**	21	1.10	41	2.15	57	2.99
Enrolment	1905	87	4.57	21	1.10	21	1.10	31	1.63	50	2.62

Note: The table displays missing observations for all variables used in the inter-household analysis across all survey rounds. Missing values that exceed 10% of the sample are marked in bold

Table 35, Missing Values, Peru

		Round 1		Round 2		Round 3		Round 4		Round 5	
	N	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing
Explanatory Variable											
Birth order group	1996	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Contemporaneous Controls											
Child's age (in months)	1996	0	0.00	35	1.75	56	2.81	119	5.96	140	7.01
Lives in a rural area	1996	0	0.00	35	1.75	55	2.76	96	4.81	138	6.91
Wealth index	1996	5	0.25	35	1.75	63	3.16	105	5.26	163	8.17
Number maternal siblings	1996	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Household size	1996	0	0.00	35	1.75	55	2.76	105	5.26	138	6.91
Fixed Controls											
Child is female	1996	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Mother's age at birth	1996	15	0.75	15	0.75	15	0.75	15	0.75	15	0.75
Mother's level of education	1996	82	4.11	82	4.11	82	4.11	82	4.11	82	4.11
Dependent Variables											
WFA (Z-score)	1996	13	0.65	43	2.15	62	3.11				
HFA (Z-score)	1996	17	0.85	48	2.40	61	3.06	122	6.11	155	7.77
PPVT Score	1996			94	4.71	155	7.77	123	6.16	176	8.82
Numeracy Score	1996			49	2.45	114	5.71	127	6.36	138	6.91
Literacy Score	1996					115	5.76	127	6.36	192	9.62
Hours worked	1996			37	1.85	64	3.21	116	5.81	154	7.72
Hours care	1996			37	1.85	64	3.21	116	5.81	154	7.72
Hours leisure	1996			37	1.85	64	3.21	116	5.81	154	7.72
Hours study	1996			37	1.85	64	3.21	116	5.81	154	7.72
Hours school	1996			38	1.90	63	3.16	116	5.81	154	7.72
Enrolment	1996	65	3.26	0	0.00	0	0.00	72	3.61	138	6.91

Note: The table displays missing observations for all variables used in the inter-household analysis across all survey rounds. Missing values that exceed 10% of the sample are marked in bold

Table 36, Missing Values, Vietnam

		Round 1		Round 2		Round 3		Round 4		Round 5	
	N	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing	# Missing	% Missing
Explanatory Variable											
Birth order group	1980	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Contemporaneous Controls											
Child's age (in months)	1980	0	0.00	13	0.66	32	1.62	82	4.14	42	2.12
Lives in a rural area	1980	0	0.00	13	0.66	22	1.11	82	4.14	42	2.12
Wealth index	1980	0	0.00	34	1.72	48	2.42	57	2.88	44	2.22
Number maternal siblings	1980	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Household size	1980	0	0.00	13	0.66	22	1.11	52	2.63	43	2.17
Fixed Controls											
Child is female	1980	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Mother's age at birth	1980	6	0.30	6	0.30	6	0.30	6	0.30	6	0.30
Mother's level of education	1980	40	2.02	40	2.02	40	2.02	40	2.02	40	2.02
Dependent Variables											
WFA (Z-score)	1980	8	0.40	20	1.01	51	2.58				
HFA (Z-score)	1980	16	0.81	27	1.36	49	2.47	83	4.19	46	2.32
PPVT Score	1980			**236**	**11.92**	135	6.82	74	3.74	50	2.53
Numeracy Score	1980			77	3.89	60	3.03	119	6.01	95	4.80
Literacy Score	1980					31	1.57	127	6.41	91	4.60
Hours worked	1980			181	9.14	44	2.22	59	2.98	45	2.27
Hours care	1980			195	9.85	61	3.08	59	2.98	45	2.27
Hours leisure	1980			195	9.85	61	3.08	59	2.98	45	2.27
Hours study	1980			183	9.24	47	2.37	59	2.98	45	2.27
Hours school	1980			181	9.14	41	2.07	59	2.98	45	2.27
Enrolment	1980	1980	100.00	72	3.64	72	3.64	70	3.54	70	3.54

Note: The table displays missing observations for all variables used in the inter-household analysis across all survey rounds. Missing values that exceed 10% of the sample are marked in bold