The relationship of time-inputs on skills acquisition in Peru: a longitudinal analysis

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Summary

This working paper investigates the role of children's time use to produce one cognitive skill (i.e. a verbal score) and two psychosocial skills (i.e. a Self-Efficacy index and a Self-Esteem index). Following a dynamic human capital accumulation approach (Cunha & Heckman, 2008), I estimate linear production functions for both types of skills. Under this framework, I combine time inputs, current and past, and lagged outcomes to examine the relevance of time investments made at younger ages relative to present time investments to produce three different outcomes by the time children reach 15 years old. I also examine the trade-offs of child work among each alternative time input activity. Findings indicate time inputs effects are small for both types of skills, although daily time spent in educational activities is crucial for verbal development, specifically time spent studying and at school, leading to an increase of up to 0.077 standard deviations by age 15. For the Self-Esteem Index, current time (at age 15) spent in leisure and past (at age 8) and current time spent in child work is detrimental for this skill at age 15, decreasing this outcome between 0.057 and 0.63 standard deviations, respectively. I highlight concerns on measurement error for the Self-Efficacy Index, excluding

the results in the discussion. On the trade-off analysis of child work, I only find small detrimental effects for the verbal score of current time spent in paid work (at age 15), only when crowding-out time spent in educational activities; and no effects for the Self-Esteem Index.

1. Introduction

Skills give people the tools to shape their lives, to create new skills and to flourish (Kautz, Heckman, Diris, ter Weel, & Borghans, 2014). Questions like how to foster basic skills, when is the optimal time to invest in them (to yield the highest returns), what's the role of each actor into the skill development process, among others, have increasingly caught the attention of researchers and education practitioners alike. The term skill is entangled to the concept of human capital. According to Cunha and Heckman (2008), fostering and accumulation of human capital is a dynamic and symbiotic process developed throughout the life cycle. In short, we develop different skills through each life stage. These skills are the product of a variety of investments and inputs at each period, which in turn complement the future investments and stocks of distinct types of skills. They also argue that each life stage might represent a critical or sensitive period in the formation of skills. Sensitive periods are those periods where investment is especially productive; critical periods are those periods when investment is essential. Critical and sensitive periods differ across skills and investments should target those periods (Cunha, Heckman, & Schennach, 2010; J. Heckman & Mosso, 2014; Kautz et al., 2014).

The analysis on this chapter relates to the growing literature documenting the process of skill acquisition (human capital) and complements recent studies trying to assess the causal effect of child work on child's skill development within developing and mid-developing economies (Emerson, Ponczek, & Souza, 2017; Keane, Krutikova, & Neal, 2018). One first goal is to understand the role of children's time use to produce a cognitive skill, proxy by a vocabulary score, and psychosocial skills, proxy by two psychosocial measures, during three important and less documented life-stages in the child's development cycle, childhood (ages 6-9), early adolescence (ages 10-14) and transition to adolescence (age 15). A strand of studies has examined various factors as determinants of skill formation, including family income, parental education, parental investments, quality of home environment and school's inputs, childcare and early childhood programmes, and others (Garcia, Heckman, Leaf, & Prados, 2016; J. Heckman, Pinto, & Savelyev, 2013; P. Todd & Wolpin, 2007). As possible input or determinant for skill production, time allocation has received less attention. There are few empirical papers that study the role of time use on skill acquisition of children (Carneiro & Ginja, 2016; D. Del Boca, Flinn, & Wiswall, 2016; Del Bono, Francesconi, Kelly, & Sacker, 2016; Fiorini & Keane, 2014; Hsin & Felfe, 2014; Nicoletti, Monfardini, & Del Boca, 2017). They have primarily focused on parental time, rather than the child's own time, and in developed countries settings.

The second goal of this chapter is to investigate the trade-offs of child work among each alternative time input activity. Linked to time distribution, most of the research for developing countries investigate the causes and consequences of child work with emphasis on its link with schooling (e.g. attendance), rather than learning (Bourguignon, Ferreira, & Leite, 2003; Dumas, 2012; Emerson et al., 2017; Ravallion & Wodon, 2000). Most of these studies have only included market work as part of their definition of child labour. I consider a broader definition of child work, including the production and domestic work within the children's homes, a common situation in developing countries (Morrow & Boyden, 2018).

I estimate linear production functions of child cognitive and psychosocial skills following a dynamic human capital accumulation approach (Cunha & Heckman, 2008). Under this framework, I combine current and past time inputs and other factors to examine the relevance of earlier time inputs relative to later time inputs to produce three different "skills": the Peabody Picture, and Vocabulary Test (PPVT), the Self-Efficacy, and Self-Esteem indexes for Peru, a country with both high levels of inequality and rates of child work. I take advantage of rich time use measures collected from the child by Young Lives, an ongoing longitudinal study on childhood poverty. A major challenge when measuring skill production is dealing with endogeneity on inputs (e.g. adjusting time investments according to the realisation of previous outcomes), which may bias the estimates, resulting in spurious conclusions. I tackle endogeneity issues on time inputs by estimating a wide range of models, including standard OLS, cumulative, cumulative value-added, cumulative value-added-instrumental variables, and within-child fixed effects. All or some of these empirical strategies are applied in Borga (2018), Keane et al. (2018), Del Bono et al. (2016), Fiorini and Keane (2014), and Todd and Wolpin (2007). The works of Borga (2018) and Keane et al. (2018) are the two closest related contributions. Both studies estimate skill production functions using Young Lives data and children's own time but excluding the last round of survey data. Furthermore, Keane et al. (2018) focus on the impact of child work in two cognitive outcomes, while Borga (2018) excludes Peru from the analysis.

Results indicate that, overall, time inputs effects are marginal for both types of skills, but we document important differences in the type of activities influencing each outcome by age, confirming that the production functions for each skill are indeed different (Cunha & Heckman, 2008; Del Bono et al., 2016). We do find significant measurement error concerns in the Self-Efficacy Index which made us discard the estimates and focusing on discussing results on the verbal score and the Self-Esteem index. There are some key findings to summarise. First, daily time in educational activities, such as the time spent studying and at school during the school-age period and when transitioning into adolescence is crucial for verbal development, leading to an increase of up to 0.077 s.d. The same results indicate that an extra hour spent studying per day is slightly more productive than extra daily hours spent at school for the verbal score. Second, for the Self-Esteem Index, current time (at age 15) spent in leisure and past (at age 8) and current time spent in child work is detrimental for this skill at age 15, decreasing this outcome between 0.057 and 0.063 s.d, respectively. Third, on the trade-off analysis of child work, I only find small detrimental effects of current time spent in paid work (at age 15), particularly when it crowds-out time spent in educational activities for the PPVT score and no effects for the Self-Esteem Index. Fourth, outcome persistence (i.e. the effect of the lagged outcome) is strong for the PPVT score, accounting at least for 50% of current PPVT score (0.499 s.d.), and significantly less for the Self-Esteem index, only about 17% (0.168 s.d.). Fifth, the consistent detrimental effect of current time (age 15) spent in leisure is robust across different empirical strategies, when estimating alternative specifications to account for missing inputs, and when analysing the trade-off and contribution of each time input activity into each skill. Unfortunately, we are not able to disentangle which are the specific leisure activities driving the negative result, as opposed when we examined the trade-offs in child work. As discussed in Keane et al. (2018), the answer to the question whether child work is negative for skill development is dependent upon the alternative time inputs investments and which type of work is considered. For Peru, paid work at age 15 is the only child work activity with detrimental effects in the verbal score.

Altogether, the findings in this chapter contribute to the literature by 1) confirming the evidence with respect to the importance of time investments in education for cognitive skills and differences in malleability among each type of skills; 2) reveals key insights for the process of skill development for one psychosocial skill; 3) adds on to the limited literature documenting any outcome linked to leisure activities for aged-school children; 4) expands on the current studies using Young Lives data by including the latest survey round of data collection; and 5) have important implications in terms of data collection and policy design. There is still much scope to improve validation, collection, and measurement of psychosocial skills. This is crucial if we aim to document the causal processes and mechanisms for skill formation in these types of skills, and for the design of developmentally timed interventions to foster these skills. Likewise, policies aiming to increase human capital linked to time distribution should focus on allowing children to increase their time spent in school or studying (e.g. extended school-days) rather than focusing on reducing domestic child work. Policies aiming to remove children from the labour market should also aim to crowd-in time spent in educational activities, rather than just “freeing-up” child work time.

The chapter proceeds as follows. Section 3.2 expands on the related literature findings. Section 3.3 describes the data, outcomes, and sample characteristics. Section 3.4 presents the empirical strategies employed. Main results are discussed in Section 3.5, and further evidence is presented in Section 3.6. Finally, Section 3.7 concludes.

2. Related Literature

On the human capital literature, there is extensive evidence, that early childhood (from 0 to 5 years) is a sensitive period for child development and investments[1] made at this stage lead to higher rate of returns and positive long-term effects (Attanasio, 2015; Cunha, 2014; J. Heckman et al., 2013; Reynolds & Temple, 2008). The same literature documents that gaps in skills between individuals and across socioeconomic groups emerge at early ages and appear to be strongly linked to inequality of human capital investments (Attanasio, 2015; Cunha, 2014). Not until very recent, there has been a grow in studies documenting adolescence as another sensitive period for investment, particular in what concerns to development or malleability[2] of psychosocial skills (Duckworth, Almlund, & Kautz, 2011; Goodman, Joshi, Nasim, & Tyler, 2015; J. Heckman & Mosso, 2014; Kautz et al., 2014). Steinberg (2014, 2008) highlights adolescence as a development process that needs to be nurtured, and where it is possible to minimise risky behaviours by building up on resiliency factors. The neuroplasticity of the adolescent brain allows for learning and unlearning behaviours, as it is a period where new cellular circuits form as the prefrontal cortex (PFC) matures. Adolescents are very responsive to rewards and to reward-seeking behaviour and show reduced responsiveness to adverse stimuli such as punishment (Spear, 2013).

On time use, most of the empirical evidence has examined the time parents spend interacting with children, rather than how children themselves spend their time (Borga, 2018). A consistent finding in these studies is that maternal time is an important determinant of skill formation for children. Del Bono et al. (2016) estimate the relationship between maternal time inputs and early child development for UK children. They find the more time mothers spend with their children the higher cognitive and non-cognitive outcomes over ages 3–7. The magnitude of the effect is quantitatively large and corresponds to 20–40% of the magnitude of the effect of having a mother with a university degree as opposed to having a mother with no qualification. Carneiro and Ginja (2016) use parental time and other inputs to measure the response of parental investments in children in time and goods to permanent and transitory income shocks. Carneiro and Rodriguez (2009) find that more time with mothers leads children (particularly those aged three to six years) to perform better in cognitive tests. Fiorini and Keane (2014) analyse how Australian children aged between 1-9 years old allocate their time into several different activities (not just time with parents). They find that time spent in

[1]The most successful investments relate to high quality early childhood programmes, targeting socioeconomic disadvantaged families and children. Successful early childhood interventions scaffold children and supplement parenting. They generate positive and sustained parent-child interactions that last after the interventions end (J. Heckman & Mosso, 2014).

[2]Malleability (grade of plasticity) is set to describe the skill flexibility to change, adapt or improve through intervention or investments.

educational activities, mainly with parents, is the most productive input for cognitive skills, while non-cognitive skills are uncorrelated to different types of time allocations (Del Bono et al., 2016).

Few empirical exceptions documenting results on children's own time include Del Boca et al. (2014) and Caetano, Kinsler and Teng (2017), both using data from the Child Development Supplement of the Panel Study of Income Dynamics (PSID); and Borga (2018) and Keane et al. (2018), using Young Lives data. In their study, Del Boca et al. (2014) estimate adolescents production functions of cognitive skills. Their results point that child's own time investment is more influential than mother's time investment during adolescence, but maternal time inputs are more important when children are 6–10 years old. Caetano, Kinsler and Teng (2017) examine how time allocation affects children's skills accumulation by applying a test of exogeneity[3] to search for valid specifications. Their results indicate that active time with adult family members, such as parents and grandparents, is the most productive for cognitive skill formation. Borga (2018) estimates production functions for cognitive and psycho-social skills for three of four countries in the *Young Lives* study, Ethiopia, Vietnam, and India; and for the two cohorts of children, an Older Cohort, born in 1994-1995, and a Younger Cohort, born in 2001-2002. He finds that child involvement in work activities (paid or nonpaid) are associated with a reduction in both cognitive and non-cognitive achievements. Comparing the effect of young children's own time allocation with that of adolescents, he documents that the negative effect of time inputs in work in test scores is larger for the Younger Cohort than for the Older Cohort. Keane et al. (2018) focus on estimating cognitive ability production functions for a math and a verbal score, using the Younger Cohort data for the four countries. They document that leisure time is no more or less productive for child cognitive development than child work (including agricultural and paid work, as well as chores in the household).

On the consequences of child work, Bourdillon (2010) explains the importance of understanding child work holistically. While the work that children do is often seen as detrimental to their welfare, it may or may not interfere with school and schoolwork; it could be complementary in some cases, or it could provide the means to afford schooling. Some work activities could provide a different set of skills that prepare children for the economic environment in which they live. Therefore, child work can affect children's learning in both positive and negative ways. On this same vein, Vogler, Morrow and Woodhead (2009) argue that conceptualisation of child work as harmful often steams from normative idealised constructions of childhood that often do not reflect the local beliefs and values, and even less to the realities of children's lives and experiences, especially when applied to children in developing country contexts. Children engaging in low-intensive work and household

[3]See Caetano (2015) for a thorough discussion on the test.

production tasks is a widespread practice in developing countries and partly explains differences in their educational achievements (Seid & Gurmu, 2015). Cussianovich and Rojas (2014) report that for Peru, the incursion of rural children in household and work activities happens at an earlier age than in urban areas, yet school activities are the most valued by children and their families. More recently, Keane et al. (2018) show that both domestic chores and economic activities are detrimental to the development of cognitive skills (math and vocabulary), but only if they crowd out school time. The detrimental effect of work time is even greater if it crowds out time spent studying at home. Their finding holds for the four countries in the Young Lives study.

Also drawing on Young Lives data, Morrow and Boyden (2018) use descriptive information of children's working activities and qualitative experiences advocating for a more nuanced and comprehensive vision of child work. Likewise, Espinoza-Revollo and Porter (2018) offer a detail account of the evolving nature of time use during childhood and the influences that shape this process across the two Young Lives children cohorts.[4] Although failing to provide any causal explanation for child work (time use), they document important differences across countries, both in the amount of time children work and study. Gender matters for particular activities within the work aggregate. Girls do more housework and boys do more unpaid work in the household and paid work outside the household.

Haile and Haile (2012) study the determinants of work participation and school attendance of rural children aged 7 to 15; they find that the educational attainment (measured as grade for age) of working children decreases when they work long hours. Emerson, Ponczek and Souza (2017) find working while attending school translates up to a 13% decrease of a standard deviation in test scores for children in Brazil. The magnitude of the negative impact increases with student's ability, and lingering and cumulative negative effects persist from working while in school. Gunnarsson, Orazem and Sanchez (2006) use data from nine Latin American countries and find negative and significant effects of working on student test scores. As Emerson, Ponczek and Souza (2017) argue, the true nature of the connection between work and learning is one of substitutes or complements is still unclear. More empirical evidence is needed to examine this crucial relationship.

There is not much evidence on the effect of time spent in leisure for skills or learning. Using data from UK children between ages 3 to 5 years old (i.e. the Millenium Cohort Stud), Del Bono et al. (2016) document a positive relationship on recreational time in cognitive and non-cognitive skills. With Young Lives data, Borga (2018) finds a negative relationship (large and significant) for leisure activities and vocabulary ability for Ethiopia and leisure activities and Math score for India, when compared to time spent at school. Using time-use data for

[4]More information on the Young Lives data in chapter 1 and Section 3.3.

seven industrialised countries from the 1970s until 2000s, Gimenez-Nadal and Sevilla (2012) document a wide spread increase in leisure inequality in favour of lower educated adults. The relevance on this result is that these trends in leisure inequality mirror the general increase in income and earnings inequality experienced in most countries over this period, especially after the mid-1980s. Stiglitz, Sen and Fitoussi (2009) among others have recently proposed a broad range of measures of household economic activity to assess quality of life, including time spent in leisure activities.

3. Data and Descriptive Statistics

As stated in chapter 1, the analyses on this chapter and chapter's 4, is based on data of the Young Lives study, focusing in Peru and the Younger Cohort. In particular, this chapter uses data from the last three survey rounds[5], when children were, on average 8 (2009), 12 (2012), and 15 years old (2016). In Peru, the sampling of the 20 clusters selected was at random, using districts as the unit sample frame. Then, within each cluster, 100 households with a child aged between 6 and 18 months were selected at random to participate in the study, excluding the richest 5% districts[6] (Escobal & Flores, 2008; Lives, 2018; Sanchez, 2017). The attrition rate for Peru is low compared to other longitudinal studies, only 8.2% for the Younger Cohort from the first (2002) to the fifth (2016) round, for the unweighted panel (Espinoza-Revollo & Porter, 2018). Our focus on the three last rounds of data follows three motivations. The first is that, from ages 8 to 15, the child undergoes through a critical development and transitional period from childhood to adolescence[7] which in turns highlights the importance for the key allocation of resources and time use by both parents and children. Second, there is less understanding about the dynamics and the importance each input represents during this transitional period than for instance early childhood.[8] Time use decisions might be influential for skill development as Keane et al. (2018) and Borga (2018) document using also Young Lives data. And third, to complement Espinoza-Revollo and Porter (2018) and expanding on

[5]In practice, I retain information of key variables from the first two rounds such as mother's age, main caregiver years of education, place of residence, if child was underweighted, and if child attended pre-primary education before aged 4-years-old.
[6]Young Lives is not intended to be a national representative survey, yet a comparison with the Demographic and Health Survey (DHS) 2000 at Round 1, showed that Young Lives sample covers the diversity of children and families in Peru. For more details on the sample design see Young Lives (2018), Cueto, Escobal, Penny and Ames (2011), and Escobal and Flores (2008).
[7]It represents a period where the prefrontal cortex starts to mature. The neuroplasticity of the adolescent brain allows for learning and unlearning behaviours, relevant for fostering psychosocial skills (Cunha, Heckman, Lochner, & Masterov, 2006).
[8]See Del Bono et al. (2016), Del Boca et al. (2016), Fiorini and Keane (2014) documenting the role of early time inputs during early childhood.

Keane et al. (2018) and Borga (2018), I include time inputs from the last survey round (age 15) as part of the production functions for skill development.

Relevant information for the present analysis includes educational history on all household members, time use of household members aged 4 to 17 years old, child's cognitive tests, main caregiver and child's psychosocial measures, household socioeconomic circumstances (e.g. wealth index, information on economic shocks, food and non-food consumption and expenditure, etc.), health information of the child, and data on other measures (e.g. child's educational aspirations, parental expectations).

The unweighted Younger Cohort panel from Round 3 to Round 5 consists of 5670 children-data points. From this sample:

1) I retain children with complete information on the time inputs (n = 5544)
2) I retain children with complete information on the three outcomes (described in the following subsection), one cognitive skill and two psychosocial skills (n = 5423)
3) I kept children with no missing information on a set of background variables including: child's sex, child's language, child's ethnicity, child's religion, indicators on child's underweight, birth order, information on pre-primary attendance, type of are (urban/rural) where family lived at Round 1, mother's age, main caregiver years of education, sex of household's head, level of expenditure in food and education items, and a wealth index (n = 5134)

Finally, I retain children present at the last survey (Round 5), resulting in a period balanced sample of 5034 children (exactly three observations for each child). The paired sample is the main analytic sample which fluctuates according to the modelling strategy and represents 89% of the unweighted sample.[9] To account for missing data and the loss of observations after imposing these restrictions, I construct Inverse Probability Weights (IP) and include them in the main analysis. In the Appendix, Figure A1 plots the relationship between the IP weights and the time inputs (hours per day at school, hours per day studying outside school, hours per day in leisure, and hours per day in child work); while Tables A2 and A3 compares means of the PPVT score, Self-Efficacy and Self-Esteem outcomes with and without imposing weights and differences in means between the Young Lives unweighted sample and the paired analytic sample, respectively. In next section I report descriptive statistics for the three outcomes, the time use measures and the control variables.

[9]The 11% reduction in sample size is smaller than other studies using the Peruvian Younger Cohort (e.g. Creamer (2016): 53%, Cueto et al. (2016): 31%), and studies examining time inputs and early child outcomes (e.g. Del Bono et al. (2016): 56%, Fiorini and Keane (2014): 88% for the last wave).

3.1 Child Outcomes

a. Cognitive Outcome: The Peabody Picture and Vocabulary Test score (PPVT)

The cognitive outcome is assessed through the Peabody Picture, and Vocabulary Test (PPVT) score at ages 5, 8, 12, and 15. It is a widely used test of receptive vocabulary, in which the level of difficulty varies according to the child's age. The test is composed of up to 204 items (125 in the Hispanic version, which was used in Peru), arranged in order of increasing difficulty and only the items within the critical range of the specific child were administered to each child, selected by the interviewer (Keane et al., 2018; Sanchez, 2017). The task of the examiner is to show a set of four pictures and ask the child to select the image that best represents the word spoken by the examinee in their mother tongue (Cueto et al., 2016; Dunn, Padilla, Lugo, & Dunn, 1986). The PPVT was collected regardless of whether the child was attending school and also for a younger sibling.[10] I standardise scores to have mean zero and standard deviation of one for comparison.

b. Psychosocial Measures: Self-Efficacy and Self-Esteem Index

I use two different indicators to examine psychosocial abilities for children, the Self-Efficacy and Self-Esteem Indexes.[11] The Self-Efficacy and Self-Esteem index are constructs based on respondents' degree of agreement or disagreement with a set of statements, five for both measures. Items and definitions used for each psychosocial measure are listed in Table 1. The degree of agreement is measured on a 4-point Likert scale ranging from strong agreement to strong disagreement. Both indexes are based on existing scales, with proper adjustment for child relevancy.

The Self-Efficacy Index builds on the Rotter scale and measures aspects associated to agency or "locus of control," assessing child's beliefs about the link between their behaviour and its consequences (Rotter, 1966). Previous research on "locus of control" or Self-Efficacy, have found associations between these measures and people's life choices (e.g. career decisions, investment in skills and education, earnings, etc.) (Coleman & DeLeire, 2003; S. Dercon & Krishnan, 2009; Maddux, 1991).

The Self-Esteem Index builds on the Rosenberg Self-Esteem scale measuring aspects related to pride and shame. The Young Lives adaptation focus more on specific dimensions of children's living circumstances (e.g. housing, clothing, work, school) (S. Dercon & Sanchez,

[10]This is the main motivation on selecting the PPVT outcome as proxy for cognitive skill. In chapter 4 I take advantage of this information for the analysis.
[11]Young Lives also collected information for the child on the Life-satisfaction scale. I excluded it as part of the final analysis as a ceiling effect was consistently present on this outcome.

2013). The concept of Self-Esteem is also linked to a person's overall assessment of her own worth (Rosenberg, 1965).

The two psychosocial measures were asked for the first time in Round 3, when children were about 8 years old. To construct the Self-Efficacy and Self-Esteem indexes, all relevant questions are normalised to *z-scores* and then an average of the relevant *z-scores* is taken across the non-missing values of the questions.[12] To measure the internal validity of the statements in Self-efficacy and Self-esteem indexes, Cronbach's Alphas are calculated to examine the interrelatedness of the scales. This exercise is useful per se, as the reliability of the scales has not been closely examined for the Younger Cohort psychosocial measures up to the last survey round.[13] A valid Cronbach's alpha is generally above 0.70 (Bland & Altman, 1997). For the analytic sample, Cronbach's alpha for Self-Efficacy is very low, just about 0.43; while for Self-Esteem is 0.60 (see Tables A4 and A5 in the Appendix). In their analysis on the internal validity of the psychosocial measures for the Older Cohort, Dercon and Krishnan (2009) discuss that Peru, among the countries of the Young Lives study, is the one with the lowest reliability on these measures. Potential reasons for this low reliability are a possible lack of understanding of these concepts in the Peruvian culture or the underlying multidimensionality.

Table 1. Psychosocial indicators*

Measure	Question/Item
Self-efficacy index	If I try hard, I can improve my situation in life
	Other people in my family make all the decisions about how I spend my time [recoded to positive]
	I have no choice about the work I do—I must do this sort of work [recoded to positive]
	I like to make plans for my future studies and work
	If I study hard at school, I will be rewarded by a better job in the future
Self-esteem index	I am proud of my shoes or of having shoes.
	I am proud of my clothes
	I am never embarrassed because I do not have the right books, pencils or other equipment
	I am proud that I have the correct uniform
	I am proud of the work I have to do

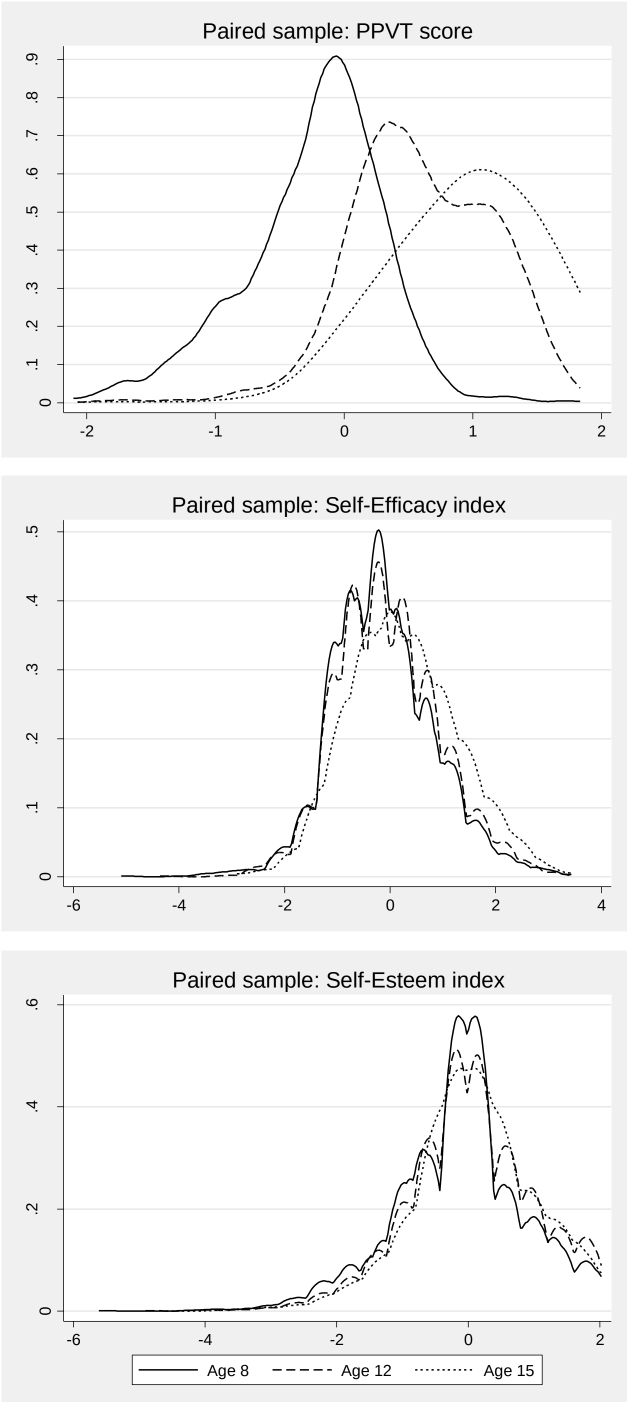
*Adapted from Dercon and Singh (2013).

[12] I follow the same approach as Creamer (2016), Dercon and Sanchez (2013), Dercon and Singh (2013), and Dercon and Krishnan (2009). This approach recognises the existence of a latent variable that cannot be directly measured and hence try to approximate by an index of different dimensions related to Self-Efficacy/Agency and Self-Esteem (S. Dercon & Krishnan, 2009).

[13] Except for Creamer (2016) up to Round 4. Dercon and Krishnan (2009) examined the internal validity of Self-efficacy and Self-esteem for the Older Cohort in the four countries of the Young Lives study. Self-esteem measure proved reliable in three of the four countries, with a Cronbach's alpha near to 0.70, except for Peru, with a value of 0.50. Self-efficacy Cronbach's alpha was closer to 0.50, while for Peru it was 0.28.

Figure 1 shows age-specific distributions of the standardised PPVT score, Self-Efficacy and Self-Esteem indexes, by each child's age. At age 8, the distribution of PPVT scores follows a normal distribution and as the child grows up, the distributions shift somewhat to the right. Distributions of Self-Efficacy Index are approximately normal across the three rounds, with longer tails in both sides. Regarding the Self-Esteem index, the distribution for the three rounds is slightly skewed to the right, with a longer tail in the left side of the distribution.

Figure 1. Distribution of Standardised Outcomes by child age



*Note: Kernel density graphs for the three outcomes in Round 3 (Age 8), Round 4 (Age 12) and Round 5 (Age 15), following a normal distribution and bandwidth 0.35.

3.2 Time inputs

The time inputs measures were collected for all household members aged four to 17 years old at the moment of the survey. The present analysis takes advantage that for the period of interest, information of time use is reported directly from the child. Compared to most studies from developing countries, the information obtained in Young Lives data report the actual number of hours the child spends on different activities (Seid & Gurmu, 2015). These are child-specific time use daily measures (i.e. continuous variables), thus are easier to interpret, relative to studies using broader measures of home environment inputs (e.g. aggregate indexes) or binary indicators for child activities (Del Bono et al., 2016).

Children report time allocation as the total number of hours they spend on eight different activities on a typical weekday (Monday-Friday) when school was in session (i.e. excluding holidays, festivals, days of rest over the weekend) for the 24-hour budget-time (Briones, 2018). For the analysis, I comprise time use inputs into three broad categories. In practice, I examine the relationship of four time-inputs (listed in Table 2) within the three broad categories: 1) hours spent at school, 2) hours spent studying at home or outside school (both under the education category), 3) hours spent in leisure activities, and 4) hours spent in child work (an aggregate category that comprise four specific activities related to domestic or market work), with respect to time spent sleeping as the omitted category.

Table 2. Description of Time-inputs*

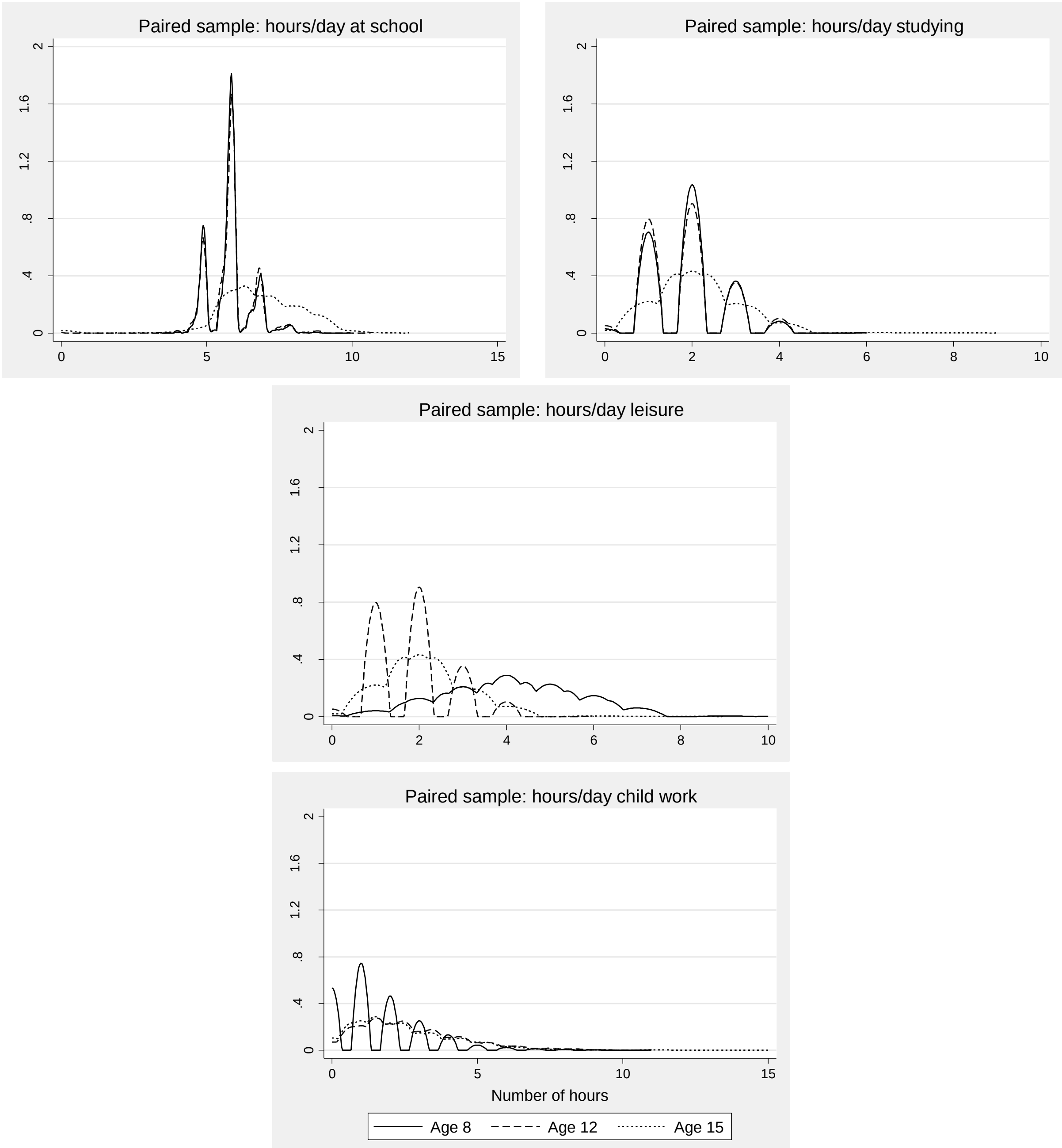
Category	Explanatory variable (Item)
Education	1. Number of hours per day the child spent at school (excluding travel time)
	2. Number of hours per day the child spent studying at home (including homework, extra classes, learning languages, and educational activities in general done outside the school)
Leisure	3. Number of hours per day the child spent in leisure activities (playing, seeing friends, using the internet, eating, drinking, bathing etc.)
Child work	4. Number of hours per day the child spent in child-working activities such as caring for others (caring for younger children or sick household members), 5. household chores (fetching water, cleaning, cooking, etc.), 6. domestic tasks (farming, herding, etc), and/or 7. Working outside household on paid activities.

*The omitted category is time spent sleeping. One restriction on the leisure time inputs is the impossibility to disentangle the time spent in each individual activity defined as "leisure" in the questionnaire. The questionnaire instructs the interviewer to consider a wide range of activities spanning from playing or having fun with friends to daily routine/basic needs activities as eating or showering. A closer translation to this term could be spare-time.

Figure 2 shows the distributions for the time inputs of interest by age. For time spent at school, when children were about 8-years-old and 12-years-old, the distributions overlap as most of the sample spent about 6 hours on school. When they reach 15, the time spent at school increases[14], but the distribution flattens as it is also by this age when children transition to upper secondary, where it has been shown a critical grade at which children leave school (Espinoza-Revollo & Porter, 2018). For hours spent studying outside of school, distributions at the three rounds are somewhat similar, where children seem to allocate about 2 hours to this activity. Children spent more time in leisure activities at a younger age (8-years-old), about 4 hours, and as they get older, distribution shifts to the left for both ages (12 and 15), seeming to allocate about 2 hours less than in the previous round. Distribution for time spent in child work is skewed to the left, signalling that most of the children spent only a few hours (or zero) in any child work-related activity. This is most notorious for Round 3, when children were about 8-years-old.

[14]The normative shift length in Peru for Secondary level, between ages 12-16 years old, is seven hours per day.

Figure 2. Distribution of Time Inputs by child age



*Note: Kernel density graphs for the four-time inputs in Round 3 (Age 8), Round 4 (Age 12) and Round 5 (Age 15), following a normal distribution and bandwidth 0.35

Table 3 reports the mean and standard deviations for all three outcomes (standardised) and the time inputs in the paired analytic sample. As reported for the distributions above, it is not surprising that there is an increase in the number of hours spent at school and a slight increase on the time spent studying outside school as the child gets older. Children aged 8 and 12 spent around 6 hours at school and an extra hour (about 7 hours) by the time when they reach 15.[15] Surprisingly for child work, 12-years-old is the age where children spent more

[15]The Ministry Education in Peru establishes mandatory full-time education for secondary level (ages 12 to 15/16) a shift of 35 weekly hours at school (seven hours of school per day).

time in this type of activities, about 2.6 daily hours (156 min), while at 15, the time spent in child work amounts to 2.4 daily hours (144 min). Children aged 8-year-old spend less time in child work, about 1.5 hours (90 min) per day, though it means that they could spend up to 7.5 hours a week involved in any child work related activity.

Table 3. Means and Standard Deviations of Outcomes and Time Inputs

	Age 8	*Age 12*	*Age 15*
Outcomes			
PPVT score	-0.237 (0.546)	0.604 (0.550)	0.949 (0.532)
Self-Efficacy index	-0.134 (0.976)	-0.036 (0.979)	0.240 (1.00)
Self-Esteem index	-0.106 (1.009)	0.060 (0.999)	0.109 (0.916)
Time inputs			
Educational			
Hours/day spent at school	5.808 (0.708)	5.841 (0.774)	6.822 (1.525)
Hours/day spent studying outside school	1.896 (0.826)	1.851 (0.893)	2.134 (1.001)
Recreational			
Hours/day spent in leisure	4.107 (1.542)	3.641 (1.399)	3.378 (1.375)
Child work (aggregate)			
Hours/day spent in child work	1.574 (1.470)	2.599 (1.805)	2.367 (1.823)
Observations (N)	1678	1678	1678

*Table reports means and standard deviations in parentheses for the standardised outcomes and each of time inputs by age for the paired analytic sample (n = 5034).

3.3.3 Other variables

The analysis includes a rich set of child, parental, and household controls, some time-invariant and other time-variant. The time-invariant variables include: child's sex, birth order[16], child language, ethnicity, a set of dummies indicating region and area of birth, religion, a binary indicator whether the child attended pre-primary education by age 4, a binary indicator if child was underweighted, mother's age, and main caregiver's years of education. The time-variant controls include child's age (in months) at each round, number of siblings living in household aged 0 to 5 and aged 6-12, a household wealth index[17], monthly expenditure in education

[16]Including all siblings living in the household by Round 5, regardless if half-siblings (born from the mother or father).

[17]The household wealth index is composed of three sub-indexes: a) housing quality index, b) access to services index, and c) consumer durables index, all of which have equal weights in the estimation of the wealth index. It ranges from 0 (poorest) to 1 (less poor). Each sub-index was estimated consistently across rounds and only variables common to the four rounds were included. The housing quality sub-index is the average of the following dummy indicators: crowding, main material of walls, main material

items[18], monthly household food expenditure[19], and an indicator if household head is female. Table 4 reports summary statistics for the control variables. The sample is balanced in terms of gender composition. More than 91 percent of the children is of Mestizo origin and profess Catholic faith (82%). Most of the children speak Spanish as the main language (87%) and lived in Urban areas (72%) at Round 1 of data collection. Also, only about 5% of the sample were underweight, while almost the full sample (95%) attended pre-primary education when they reached age 4. Mothers were on average 27 years old and main caregivers reported almost 8 years of education (equivalent to reaching eight-grade or having two years of secondary education) at Round 1.

Table 4. Summary Statistics of Control Variables[20]

	Mean	*SD*	*$SD_{between}$*	*SD_{within}*
Child Characteristics				
Age (in months)	138.941	34.94	4.996	34.659
Birth order (all siblings)	2.319	1.588	1.598	0.000
Female (prop.)	0.506	0.500	0.500	0.000
Children attended pre-primary (prop.)	0.949	0.219	0.227	0.000
Language is Spanish (prop.)	0.874	0.332	0.338	0.000
Religion is Catholic (prop.)	0.815	0.388	0.389	0.000
Other religion (prop.)	0.136	0.343	0.343	0.000
Ethnicity is Mestizo (prop.)	0.915	0.279	0.278	0.000
Ethnicity is White (prop.)	0.069	0.253	0.252	0.000
Child is underweight (prop.)	0.048	0.253	0.256	0.000
Household Characteristics				
Number of siblings aged 0-5 years old	0.534	0.724	0.54	0.486
Number of siblings aged 6-12 years old	0.592	0.752	0.551	0.513
Wealth index	0.619	0.194	0.179	0.077
Monthly expenditure in education items per capita	15.962	22.761	18.761	12.776

of roof, and main material of floor; the access to services sub-index is the averaged of the following dummy indicators: access to electricity, access to safe drinking water, access to sanitation, and access to adequate fuels for cooking: the consumer durables index is the average of a set of dummy variables denoting if a household member owns at least one of each consumer durable. The list of consumer durables included: radio, television, bicycle, motorbike, automobile, landline phone, mobile phone, refrigerators, stove, blender, iron, and record player (Azubuike & Briones, 2016; Briones, 2018).

[18]Education expenditure includes all money spent on school uniform for boys and girls, payments for tuition, fees or donations to school, books and stationary, and transport to school (Azubuike & Briones, 2016).

[19]Food expenditure represents the total monthly expenditure per capita in food consumption. It is constructed by aggregating all food items consumed in the last month from various sources: a) food purchased, b) food home-produced (own harvest), c) food items received as gifts or transfers, and d) food received from employers as payment in-kind for services rendered. The food reported as leftover was subtracted from the final aggregate (Azubuike & Briones, 2016).

[20]See Table A3 in the Appendix for summary statistics (difference in means) between the paired analytic sample and the observations excluded from the unweighted sample.

	Mean	*SD*	$SD_{between}$	SD_{within}
Monthly expenditure in food items per capita	137.929	71.357	54.294	46.191
Parental Characteristics				
Mom age (at birth)	27.322	6.71	6.761	0
Caregiver years of education (at birth)	7.952	4.726	4.756	0
Head of household is female (prop.)	0.211	0.408	0.355	0.202
Region Characteristics				
Child lives in Coast region (prop.)	0.362	0.481	0.48	0
Child lives in Mountain region (prop.)	0.525	0.499	0.5	0
Child lives in Jungle region (prop.)	0.113	0.317	0.318	0
Child lives in Urban area (prop.)	0.725	0.446	0.449	0
Observations (Children)	1678			
Observations (Children-Data points)	5034			

[1]Minority category includes Native of the Amazon, Negro & Asiatic. [2]Wealth index ranges from 0 (poorest) to 1 (less poor) and is the average of housing quality, access to services, and consumer durables sub-indexes. [3]Food expenditure per capita available from Round 2 onwards, average reported here is from Round 2.

4. Empirical Estimation

As stated previously, estimating the relationship of different time inputs in the production of cognitive and psychosocial skills is problematic given the endogeneity of time inputs and the difficulty of measuring all relevant inputs to child development. I follow the approach developed by Todd and Wolpin (2007) and applied in time use related studies (Borga, 2018; D. Del Boca, Flinn, & Wiswall, 2014; Del Bono et al., 2016; Fiorini & Keane, 2014; Keane et al., 2018). As in Cunha and Heckman (2007, 2008), all these studies, and the present one, recognise skill formation as a life-cycle and cumulative process. The latter assumption implies that current and past inputs are combined with child's genetic endowment (unobserved ability) to produce a cognitive or psychosocial outcome.[21] The approach relates to the value-added literature in economics of education, employed to measure the role of school-level determinants (e.g. teacher effectiveness, class size, school autonomy) on educational achievement as function of various inputs and a lagged outcome (Dearden, Ferri, & Meghir, 2002 ; Hanushek, Rivkin, & Taylor, 1996; Jackson, 2018; Kane, Rockoff, & Staiger, 2008; Rivkin, Hanushek, & Kain, 2005; Sass, Semykina, & Harris, 2014).

[21]Ben-Porath (1967) was the first to model formally the production function framework as an individual choosing the level of time and resources to determine human capital investments. Leibowitz (1974) was the first to extend this conception to home investments in children. Since then, the production function approach has been used extensively in the literature of skills acquisition in economics (P. Todd & Wolpin, 2007).

To explain the modelling strategy, I discuss the most general specification that nests other specifications in Equation (1). For simplification, I am assuming linearity in the production function for the skill Υ, i.e. PPVT score, Self-Efficacy or Self-Esteem index, of child i observed at age α. Eq (1) becomes:

$$\Upsilon_{i\alpha} = \sum_{k=0}^{\alpha} \beta_{\alpha-k} T_{i,\alpha-k} + \sum_{k=0}^{\alpha} \delta_{\alpha-k} P_{i,\alpha-k} + \lambda \Upsilon_{i,\alpha-k} + \epsilon_{i,\alpha} \quad (1)$$

Where i indexes the child, $T_{i,\alpha-k}$ represents the vector of educational, leisure and child work time inputs, $P_{i,\alpha}$ represents the vector of parental, child, and household characteristics[22] (see Section 3.3.4), and $\epsilon_{i,\alpha}$ is an error term capturing shocks in the child life-cycle, unobserved inputs (e.g. innate ability or endowments), and measurement error (e.g. in skill test or time inputs). $\beta_{\alpha-k}$ is our coefficient of interest. Eq (1) allows the full history of observed time inputs to affect child skills (including current and past time inputs). Moreover, including one-period lagged outcome ($\Upsilon_{i,\alpha-1}$) (e.g. past PPVT score/Self-Efficacy/Self-Esteem Index) captures self-productivity[23] or outcome persistence, and proxies for the stock of "all" previous inputs (observed and unobserved) into the production of cognitive and psychosocial outcomes (Del Bono et al., 2016; Fiorini & Keane, 2014; P. Todd & Wolpin, 2003). Eq (1) is known as the cumulative value-added (CVA) model[24] and comprises most of the common specifications found in the akin literature, including the ones employed in the present study. Thus, if $\lambda = 0$ and the influence of all past inputs is set to zero, $\Upsilon_{i\alpha}$ is assumed to depend exclusively on current (age α) time and observable inputs ($T_{i,\alpha}$ and $P_{i,\alpha}$), where $P_{i,\alpha}$ reduces omitted variable bias. Consistent estimates of β_{α} are only achieved if omitted factors are orthogonal to the time inputs included. The latter specification represents the contemporaneous model (CT) and I will use the estimates as benchmark to compare the "improvements" of the subsequent specifications. The main problem with CT is simultaneity or reverse causality, as both inputs and outcomes are measured at the same age of the child. The latter is of less concern in the present study as I am not using this specification to answer the main research question, comparing the relevance of earlier time inputs relative to later time inputs (e.g. two-period lagged time inputs($T_{i,\alpha-2}$) versus one-period lagged inputs ($T_{i,\alpha-1}$), or one-period lagged

[22]The vector of time-invariant predictors include child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and the vector of time variant predictors include child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female and village fixed effects.

[23]As defined by Cunha and Heckman (2007) as one of the skills properties in the technology of skill formation model.

[24]Using cross-validation methods, Todd and Wolpin (2007) selected this specification, among competing specifications, to study the sources of test score gaps (determinants of cognitive achievement) between black, white, and Hispanic children.

inputs ($T_{i,\alpha-1}$) versus contemporaneous time inputs ($T_{i,\alpha}$) into the production of current PPVT score and Self-Efficacy/Self-Esteem indexes ($Y_{i\alpha}$). The second specification relaxes the assumption that only current time inputs ($T_{i,\alpha}$) matter and includes the vector of observable lagged inputs ($T_{i,\alpha-k}$ and $P_{i,\alpha-k}$). As in CT, it holds the assumption that any omitted inputs and endowments are orthogonal to the time inputs included and does not consider the effect of past outcomes ($\lambda = 0$) (P. Todd & Wolpin, 2007). This specification is known as the cumulative model (CU) and I estimate two versions for the analysis. One including one-period lagged time inputs ($T_{i,\alpha-1}$); and a second one, extending the influence in outcomes of two-period lagged time inputs ($T_{i,\alpha-2}$).

Alternatively, if $\beta_{\alpha-k} = \beta_0 = 0$ and $\delta_{\alpha-k} = \delta_0 = 0$, then Eq (1) converts into the value-added model (VA).[25] It expands the CT specification by including one-period lagged outcome ($Y_{i,\alpha-1}$) as proxy for unobserved innate ability. The main assumptions in this case are that the effect of inputs (observed or unobserved) ($T_{i,\alpha-k}$ and $P_{i,\alpha-k}$) declines with age at the rate λ_α (assumed to be the same for each input); also, the impact of endowment (innate ability) declines at the same rate as input effects.[26] This assumption is relaxed in the cumulative value-added specification (CVA) when historical data of time inputs is included ($\beta_{\alpha-k} \neq 0$ and $\delta_{\alpha-k} \neq 0$), besides the lagged outcome ($\lambda \neq 0$). A common issue in VA and CVA modelling is that measurement error $\epsilon_{i,\alpha}$ diminishes λ, also affecting input coefficients (β and δ). A standard approach implemented under this framework, contingent on data availability, is instrumenting the one-period lagged outcome ($Y_{i,\alpha-1}$) with the two-period lagged outcome ($Y_{i,\alpha-2}$) (Anderson & Hsiao, 1981; Arellano & Bond, 1991; Del Bono et al., 2016). Then the CVA model transforms into the cumulative value-added instrumental variables model (CVA-IV) model.

As summarised in Del Bono, et al. (2016) and Fiorini and Keane (2014), the issue of endogeneity has three potential causes. One is omitted variable bias (including unobserved child endowments or unobserved inputs). An attempt to deal with this issue is to estimate several specifications with different assumptions (as discussed above) and using very rich longitudinal data (e.g. using CU, CVA and CVA-IV models). A second cause is reverse causality. To illustrate this issue, consider a child with innate cognitive ability who enjoys spending more time studying outside of school and achieving a higher test score; or a child with innate higher cognitive ability even if spending less time studying, still gets a higher test score than a child with less cognitive endowment and who spends more hours studying. A

[25]Excluded in the present analysis as effectively, two VA extended versions (CVA and CVA-IV) are included and the main interest is to examine the role of time inputs within the VA framework.

[26]For a more thorough discussion on the assumptions and restrictions in each model, see Todd and Wolpin (2007).

solution to this problem is to account for unobserved innate ability by including past skill test outcomes using the CVA specification and including additional proxies in vector $P_{i,\alpha}$ to help capture omitted inputs. Recent studies offer supportive evidence on the effectiveness of the lagged test score as a control for unobserved heterogeneity (Deming, Hastings, Kane, & Staiger, 2014; Guarino, Reckase, & Wooldridge, 2014). Moreover, as the CVA model might respond to feedback or adjustment effects (e.g. shifts on current parental decisions/investments respond to past outcomes), I implement the CVA-IV specification. A third cause of endogeneity is measurement error in both input measures and/or outcomes. An example of measurement error in inputs is if the parent or main caregiver does not know exactly how much time children spend in each specific activity. I address this concern by taking advantage of using own's child reports on how they allocate their time, although I do not argue the approach eliminates measurement error completely, given also the limitations of the time inputs measures, discussed in Section 3. The issue on measurement error in outcomes is more problematic. I partially address the problem of measurement error in one-period lagged outcome ($Y_{i,\alpha-1}$) using as instrument the two-period lagged outcome ($Y_{i,\alpha-2}$) in the CVA-IV model.[27] Yet, self-reported measures (including child's time inputs reports and the Self-Esteem and Self-Efficacy items) have a strong likelihood of inherent error component to them. The psychosocial measures deserve special attention given the observed low levels of Cronbach's alpha, particularly for the Self-Efficacy Index. In addition, there is a strong likelihood that $\epsilon_{i,\alpha}$ will be negatively correlated with the lagged skill test outcome ($Y_{i,\alpha-k}$) if the latter contains measurement error, biasing the λ estimate downwards and β_{α} in ambiguous directions (Keane et al., 2018). The potential impact of measurement error varies under different assumptions. For the present analysis, I only assume classical measurement error. If classical measurement error is only present in the variable of interest (e.g. time inputs), this will influence the size of the coefficients of interest (e.g. attenuation bias)[28]. Using CVA and CVA-IV specifications for the main analysis attempts to deal with this bias. Furthermore, as part of the robustness checks, I estimate *Hybrid* specifications of the production function and within child-fixed effects. Their advantages and limitations are discussed in Section 6.

[27]As part of the robustness exercises, I also instrument one-period lagged cognitive (psychosocial) outcome with a one-period or two-period lagged psychosocial (cognitive) outcomes (e.g. one-period lagged PPVT instrumented with one-period or two-period lagged Self-Efficacy or Self-Esteem).

[28]According to O'Neill and Sweetman (2012), non-classical measurement error might arise if there is a relationship between the reported measurement error and the true value of the variable of interest (time inputs); secondly, there may be a relationship between the reported measurement error and the residual in Eq (1). The latter situation is referred to as differential measurement error; in this case, time inputs contain information about our outcome of interest, and even after we condition on time inputs, none of the approaches will yield consistent estimates (Black, Berger, & Scott, 2000).

5. Results

This section compares estimates among the different specifications listed above: the CT, two CU models (using one-lagged and two-period lagged time inputs), the CVA, and the CVA-IV model. As the CVA-IV specification is the most time input intensive (extending the influence of all-period time inputs into the skill outcome) and dealing with measurement error for the one-period lagged outcome, we argue for now that this is our preferred specification. Time inputs coefficients are interpreted relative to time spent sleeping, the omitted category.

5.1 Cognitive Skill: The Peabody Picture Vocabulary Test (PPVT)

Table 5 below reports the time inputs coefficients for all model specifications derived from Eq (1), five regressions in total, and pooling all ages together. Hence, outcomes indicate the influence in PPVT score at age 15 as a function of current and past inputs. Column 1 shows estimates for the contemporaneous specification (CT), i.e. outcome regressed on the inputs and other controls at age 15, Columns 2 and 3 report coefficients for the cumulative specifications (CU), including time inputs at the same age and one (CU_{t-1}) or two-period lags (CU_{t-2}) of time inputs. Column 4 presents estimates from the cumulative value-added (CVA) model, where besides lagged time inputs, it includes one-period lagged PPVT score (dependent variable). Finally, Column 5 includes the CVA-IV model, instrumenting one-period lagged PPVT score (age 12) with two-period lagged PPVT score (age 8), dealing with measurement error concerns (Andrabi, Das, Khwaja, & Zajonc, 2011; Arellano & Bond, 1991; Del Bono et al., 2016).

In general, the influence of daily time inputs (current and historical) is small (CVA) or has no effect (CVA-IV) in the production of the PPVT score. The time inputs effects are stronger when not accounting for the past PPVT score. When considering the information on past time inputs (Columns 2 and 3), the influence of present and past time inputs becomes stronger, particularly for educational time inputs. This result suggests that excluding historical time inputs leads to an understatement of the immediate impact of a unit increase in time inputs (Del Bono et al., 2016). Time inputs effects diminish significantly or fade out when estimating the CVA and CVA-IV specifications. The specific results are as follow:

If only current inputs matter ($\lambda = 0$, $\beta_{\alpha-1} = 0$, $\beta_{\alpha-2} = 0$), an additional hour spent in educational activities (i.e. at school plus studying outside school) per day barely increases the PPVT score by 0.033[= *hours at school*: 0.024 (age 15) + *hours studying*: 0.009 (age 15)] of a standard deviation at age 15 (significant at the 5%). For Column 3 (CU_{t-2}), one hour increase in each lagged educational time input (hours spent at school and hours spent studying outside school) at ages 8 and 12, increases the PPVT score at age 15 by 0.119 s.d. [= *hours at school*:

0.024 (age 12) + 0.018 (age 8) + *hours studying* (0.040 (age 12) + 0.037 (age 8)]. In this case, both period-lagged educational inputs ($\beta_{\alpha-k}$), 0.064 s.d. for age 12 and 0.055 s.d. for age 8, have almost the same influence on current PPVT score. Although the effect of lagged hours spent studying is stronger than that of the number of hours spent at school. The results also show that spending one hour working at age 8 ($\beta_{\alpha-2}$), can lead to a decrease of the PPVT score of 0.020 s.d. by age 15; in contrast, spending time in leisure activities at ages 8 and 12, increases the PPVT score by 0.022 s.d. (joint effect).

If time inputs effects were already small, coefficients of all educational time inputs decline substantially for the CVA specification (Column 4) and fade out for the CVA-IV model (Column 5) when accounting for the lagged PPVT score. In both models, we can observe that the role of the past PPVT score is substantial in the prediction of the current PPVT score, ranging from 0.499 (Column 4) to 0.992 s.d (Column 5) when using two-period lagged PPVT score (age 8) as instrument. These results confirm the existence of outcome persistence, where past educational time inputs contribute on the subsequent production of the PPVT score. They are also consistent with the results obtained when inspecting the correlation of the PPVT score with time (in Table A6 in the Appendix) and when looking at the first-stage results for the CVA-IV model (in Table A10 in the Appendix). A differing result shows for time spent in leisure, being positive at age 8 (0.011 s.d.) for the CVA model and negative for current leisure time (-0.010 s.d.) in the CVA-IV model, but in both cases the magnitude of the time input coefficient is small. On child work time inputs, the relationship is negative (small in magnitude) and not significant for the CVA and CVA-IV models.

Besides using the two-period lagged PPVT score as instrument for the one-period lagged in the main results (Column 5), I follow previous studies (Del Bono et al., 2016) and conduct alternative CVA-IV specifications, instrumenting the one-period lagged PPVT score with one-period or two-period lagged Self-Efficacy and Self-Esteem Indexes, individually or both. Two-period lagged Self-Efficacy (age 8) alone proved not to be a valid instrument. When using all two-period lagged outcomes (Self-Efficacy, Self-Esteem, and PPVT score at age 8) as instruments, the negative coefficients in hours spent at school (age 8), current and one-period lagged time spent in leisure (ages 15 and 12), and current time spent in child work increase and become statistically significant. This result might be hinting into some complementary among the three skills to influence PPVT score at age 15. For the rest of the instruments checks, time inputs results are qualitatively similar, and the effect of the lagged outcome (after instrumenting) ranges from 1.171 to 0.832, all significant at 5% or 1% levels. First-stage results using the alternative instruments and estimates of time inputs are reported in Tables A11 and A14 in the Appendix.

Table 5. Time Inputs for PPVT score

	Benchmark (CT) (1)	CU_{t-1} (2)	CU_{t-2} (3)	CVA (4)	CVA-IV (5)
Education Time Inputs					
Hrs/day at school	0.024**	0.033***	0.032***	0.017***	0.002
	(0.011)	(0.006)	(0.007)	(0.006)	(0.007)
Hrs/day at school$_{t-1}$		0.017*	0.024*	0.008	-0.008
		(0.008)	(0.012)	(0.010)	(0.011)
Hrs/day at school$_{t-2}$			0.018***	0.014**	0.010
			(0.005)	(0.005)	(0.008)
Hrs/day studying outside school	0.009	0.029***	0.033***	0.020***	0.007
	(0.029)	(0.006)	(0.007)	(0.006)	(0.007)
Hrs/day studying outside school$_{t-1}$		0.040***	0.040***	0.026***	0.012
		(0.008)	(0.008)	(0.007)	(0.008)
Hrs/day studying outside school$_{t-2}$			0.037***	0.015	-0.007
			(0.010)	(0.009)	(0.011)
Leisure Time Inputs					
Hrs/day in leisure activities	-0.001	0.005	-0.001	-0.006	-0.010*
	(0.008)	(0.006)	(0.006)	(0.005)	(0.006)
Hrs/day in leisure activities$_{t-1}$		-0.000	0.010*	0.003	-0.003
		(0.004)	(0.006)	(0.005)	(0.006)
Hrs/day in leisure activities$_{t-2}$			0.012***	0.011**	0.010
			(0.004)	(0.005)	(0.006)
Child work Time Inputs					
Hrs/day in child work	-0.002	-0.001	-0.002	-0.002	-0.001
	(0.011)	(0.005)	(0.005)	(0.004)	(0.004)
Hrs/day in child work$_{t-1}$		-0.014***	-0.004	-0.007	-0.009
		(0.003)	(0.006)	(0.005)	(0.006)
Hrs/day in child work$_{t-2}$			-0.020***	-0.006	0.007
			(0.006)	(0.005)	(0.006)
PPVT score$_{t-1}$				0.499***	0.992***
				(0.031)	(0.042)
R-squared	0.717	0.700	0.477	0.601	0.480
p-value $H_0: \beta_n = \beta_{na-k} = 0$	0.426	0.098	0.028	0.069	0.106
Observations	6,503	4,826	3,044	3,044	3,044

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include (reported in Table A7 in the Appendix) time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

5.2 Psychosocial Skills: Self-Efficacy and Self-Esteem

I now turn to the main results for the psychosocial skills, reported in Table 6 for the Self-Efficacy Index and Table 7 for the Self-Esteem Index. For the Self-Efficacy Index, current time inputs in education and child work (age 15) and one-period lagged time inputs in education (age 8) matter and their influence is slightly larger than in the PPVT outcome. Moreover, controlling for the lagged Self-Efficacy outcome (age 12) in Column 4 (CVA), does not attenuate time inputs coefficients, in contrast to the PPVT results. When estimating the CVA-IV model (Column 5), we notice the estimate for the one-period lagged Self-Efficacy (after instrumenting with the two-period lagged outcome) is very imprecise (huge standard errors)[29] and all the time inputs effects dissipate. Investigating into the first-stage estimates (reported in Table A10, we notice poor explanatory power among all time inputs (exogenous variables) and the coefficient for the two-period lagged Self-Efficacy Index is positive, small in magnitude and not statistically significant. In this case, the CVA-IV model produces biased estimates and should not be considered. Turning then to the CVA estimates (Column 4), adding two extra hours in current educational time inputs, one hour spent at school and one hour spent studying at age 15, can lead to an increase in the Self-Efficacy Index of 0.115 s.d at the same age 15. This is independent of the influence of one-period lagged educational inputs (time spent at school and studying at age 12), which amounts to an increase of 0.136 of s.d. There is also a negative effect on time spent in child work at age 15, where any extra hour devoted to child work activities decreases the Self-Efficacy index by 0.052 s.d. The coefficient on the lagged Self-Efficacy index indicates mild outcome persistence, where one-unit increase in the Self-Efficacy index at age 12, leads to an increase in the Self-Efficacy index at age 15 by 0.177 s.d (not as large as in the PPVT score).

Several explanations of the source of bias when implementing CVA-IV include that estimates might be suffering from larger small-sample bias (Cameron & Trivedi, 2009), the twice-lagged Self-Efficacy Index (age 8) is not a valid instrument, and/or overall measurement error of this outcome (given the low Cronbach alpha observed and reported in Table A4). Further investigation on the extent of measurement error is needed. When checking for alternative instruments, the first-stage results indicate that only one (age 12) and two-period lagged (age 8) PPVT score have predictive power as instruments, being positive and statistically significant (see Table A12 in the Appendix)[30], but none of the time inputs coefficients have explanatory power. These results confirm that CVA-IV is not a valid specification to estimate the production function for the Self-Efficacy outcome and, more important, this outcome is likely to be plagued of measurement error since it was first collected. Even for the rest of the specifications, results should be taking cautiously. Time-inputs estimates for the CVA-IV model using the alternative instruments are reported in Table A15 in the Appendix.

[29]Notice also the R-squared is not possible to estimate under this model.
[30]There is also one specification largely imprecise, instrumenting one-period lagged Self-Efficacy with two-period lagged Self-Esteem.

Table 6. Time Inputs for Self-Efficacy index

	Benchmark (CT) (1)	CU_{t-1} (2)	CU_{t-2} (3)	CVA (4)	CVA-IV (5)
Education Time Inputs					
Hrs/day at school	0.044*** (0.015)	0.041*** (0.014)	0.036** (0.014)	0.034*** (0.012)	0.024 (0.036)
Hrs/day at school$_{t-1}$		0.017 (0.013)	0.068** (0.031)	0.059* (0.030)	-0.017 (0.129)
Hrs/day at school$_{t-2}$			-0.005 (0.029)	-0.009 (0.028)	-0.040 (0.085)
Hrs/day studying outside school	0.054** (0.019)	0.051** (0.020)	0.081*** (0.026)	0.081*** (0.024)	0.082 (0.058)
Hrs/day studying outside school$_{t-1}$		0.036** (0.016)	0.082*** (0.023)	0.077*** (0.023)	0.029 (0.096)
Hrs/day studying outside school$_{t-2}$			-0.009 (0.031)	-0.021 (0.027)	-0.132 (0.178)
Leisure Time Inputs					
Hrs/day in leisure activities	-0.003 (0.014)	-0.005 (0.014)	0.003 (0.020)	0.004 (0.020)	0.015 (0.036)
Hrs/day in leisure activities$_{t-1}$		0.022*** (0.007)	0.013 (0.018)	0.012 (0.020)	0.001 (0.042)
Hrs/day in leisure activities$_{t-2}$			0.022 (0.021)	0.014 (0.020)	-0.055 (0.113)
Child work Time Inputs					
Hrs/day in child work	-0.035*** (0.011)	-0.035*** (0.010)	-0.050*** (0.016)	-0.052*** (0.015)	-0.074 (0.051)
Hrs/day in child work$_{t-1}$		-0.011 (0.010)	-0.001 (0.017)	-0.000 (0.018)	0.009 (0.039)
Hrs/day in child work$_{t-2}$			-0.005 (0.018)	-0.003 (0.018)	0.015 (0.056)
Self-Efficacy$_{-1}$				0.181*** (0.014)	1.767 (2.684)
R-squared	0.131	0.133	0.168	0.195	N.A.
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.000	0.005	0.008	0.014	0.793
Observations	4,962	4,898	1,626	1,626	1,626

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include (reported in Table A8 in the Appendix) time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweight (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast. For column 5, R-squared is not reported (negative value) and cannot be recovered from estimation output.

For the Self-Esteem results (in Table 7), there is no effect on time inputs across all specifications, except for time spent in leisure activities at age 15 and time spent in child work at age 8. Any extra hour spent daily in leisure activities leads to a decrease of 0.059 s.d. in the Self-Esteem index at age 15, for both CVA (Column 4) and CVA-IV models (Column 5). There is also a negative relationship between Self-Esteem and time in child work at age 8, where one hour spent per day at that age leads to a decrease of more than 0.040 s.d. by age 15 for models in Columns 3 (CU), 4 (CVA) and 5 (CVA-IV). As with the Self-Efficacy results, controlling for the lagged Self-Esteem index does not affect the magnitude of time inputs coefficients. Furthermore, one unit increase in the past Self-Esteem index leads to an increase of the current Self-Esteem index of 0.182 s.d., only for the CVA (Column 4) model. The influence disappears when instrumenting the one-period lagged Self-Esteem (age 12) index with the two-period lagged (age 8) outcome, although the estimate is also very imprecise (i.e. large standard error). Inspecting into the first-stage results (see Table A10 in the Appendix), we notice the two-period lagged Self-Esteem index does not have explanatory power for the one-period Self-Esteem index (e.g. the coefficient is small in magnitude, positive, and not statistically significant), making it an invalid instrument. When investigating with alternative instruments, only one-period lagged Self-Efficacy index had statistical explanatory power; and most of the time inputs coefficients are insignificant except for time spent in leisure activities at age 15, which aligns with the main CVA-IV results in Column 5 (see Table A13 for first stage results and Table A16 for time inputs coefficients with alternative instruments in the Appendix).

Table 7. Time Inputs for Self-Esteem index

	Benchmark (CT) (1)	CU_{t-1} (2)	CU_{t-2} (3)	CVA (4)	CVA-IV (5)
Education Time Inputs					
Hrs/day at school	0.020	0.018	0.007	0.007	0.008
	(0.019)	(0.019)	(0.017)	(0.015)	(0.017)
Hrs/day at $school_{t-1}$		0.029**	0.022	0.020	0.022
		(0.012)	(0.037)	(0.036)	(0.036)
Hrs/day at $school_{t-2}$			0.013	0.005	0.013
			(0.040)	(0.041)	(0.057)
Hrs/day studying outside school	0.017	0.015	0.022	0.017	0.023
	(0.017)	(0.018)	(0.028)	(0.027)	(0.032)
Hrs/day studying outside $school_{t-1}$		0.018	0.024	0.028	0.024
		(0.020)	(0.027)	(0.026)	(0.032)
Hrs/day studying outside $school_{t-2}$			-0.031	-0.040	-0.030
			(0.034)	(0.033)	(0.061)
Leisure Time Inputs					
Hrs/day in leisure activities	-0.041***	-0.041***	-0.059***	-0.057***	-0.059***
	(0.014)	(0.014)	(0.018)	(0.018)	(0.019)
Hrs/day in leisure $activities_{t-1}$		-0.012	-0.001	0.007	-0.002
		(0.011)	(0.024)	(0.023)	(0.034)
Hrs/day in leisure $activities_{t-2}$			-0.011	-0.012	-0.011
			(0.018)	(0.018)	(0.019)
Child work Time Inputs					
Hrs/day in child work	-0.007	-0.008	-0.020	-0.023*	-0.020
	(0.012)	(0.012)	(0.013)	(0.012)	(0.013)
Hrs/day in child $work_{t-1}$		-0.008	-0.001	-0.001	-0.001
		(0.009)	(0.015)	(0.015)	(0.015)
Hrs/day in child $work_{t-2}$			-0.043**	-0.040**	-0.043*
			(0.018)	(0.017)	(0.022)
$Self\text{-}Esteem_{-1}$				0.168***	-0.018
				(0.023)	(0.724)
R-squared	0.080	0.083	0.090	0.120	0.083
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.003	0.352	0.047	0.038	0.004
Observations	4,963	4,899	1,626	1,626	1,626

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include (reported in Table A9 in the Appendix) time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

5.3 Discussion: Cognitive Skills vs. Psychosocial Skills

It is unclear to what extent the issue on measurement error regarding the Self-Efficacy Index is biasing the time inputs estimates. Hence, I will focus the discussion comparing the PPVT and Self-Efficacy results. Overall, time inputs effects are marginal for both types of skills with important differences in the type of activities influencing each outcome, hinting that the production functions for each skill are different. When comparing the coefficients, and excluding the CVA-IV estimates for now, results for time inputs coefficients are robust and fairly consistent across the different models for the PPVT score. Focusing on the CVA specification and relative to time spent sleeping, time inputs in educational activities, both past (i.e. time spent studying at age 12 and time at school at age 8) and present (age 15), are more productive for the PPVT score, leading to an increase of up to 0.077 s.d. [= *hours at school*: 0.017 (age 15) + 0.014 (age 8) + *hours studying*: 0.020 (age 15) + 0.026 (age 12)] by age 15. Any extra hour spent studying per day is slightly more productive than daily extra hours spent at school. There is no evidence that time spent in child work is harmful for the PPVT score.

For the Self-Esteem Index, current (age 15) and past (age 8) time spent in child work, and present (age 15) time spent in leisure, is detrimental for this skill at age 15, relative to time spent sleeping. Any extra hour spent in leisure and any extra hour spent in child work, decreases the Self-Esteem Index by 0.057 (age 15) and 0.063 s.d. [= *hours in child work*: 0.020 (age 15) + 0.043 (age8)], respectively. The negative result for leisure inputs may have two possible explanations. On the one hand, it might show that any additional extra hour spent in leisure activities is not enough to be satisfied with it, craving for more time on these activities, affecting Self-Esteem levels. On the other hand, it might indicate that time inputs captured under the "leisure" umbrella, are more related to routine activities such as eating, drinking, bathing, and these actions are being perceived as "obligations" rather than leisure time. Unfortunately, is impossible to disentangle the actual time distribution among each leisure activity.

A sizeable difference among both skills is the influence the lagged outcome (i.e. PPVT score or Self-Esteem index at age 12) has on the outcome of interest by age 15. When controlling for the past outcome, time inputs effects are considerable diminished or fade out for the PPVT score, while for the Self-Esteem Index are virtually unchanged. Though outcome persistence is strong for the PPVT score, accounting at least for 50% of current PPVT score (0.499 s.d.) in the CVA model[31], is significantly less for the Self-Esteem index, only about 17% (0.168 s.d.). This result is consistent with the notion of differences in malleability among types of skills and at different ages. Previous studies indicate that malleability is greater for cognitive skills at early ages (0 to 6 years-old) and then becomes stable. In contrast, malleability is higher for psychosocial skills during adolescence, where interventions have proved successful to influence behaviour (Cunha et al., 2006). Another aspect to consider is that, time inputs coefficients might be suffering of small-sample bias from the 2SLS estimator when implementing the CVA-IV approach, more evident for the Self-Esteem and Self-Efficacy Indexes (large standard errors) as having less observations for these indicators.

Although time inputs effects might seem small, it is important to not forget that coefficients represent incremental (diminishments) from any daily extra hour devoted to each activity in a regular school/working day. Transforming to weekly estimates, and assuming a constant behaviour on the reported daily time allocation, time inputs in present and past educational activities could increase the PPVT score at age 15 by 0.385 s.d. [= 0.077 x 5(1 hour per working day, Mon-Fri)]. For the Self-Esteem Index, the decrease of current time spent in leisure and past and present time in child work could amount to a decrease of 0.305 s.d. and 0.335 s.d., respectively. However, we are less confident on the Self-Esteem escalated weekly estimates, given the malleability property of this skill during this period and evident on the main results. The weekly time inputs are larger in magnitude to the ones observed for developed economies, as in Fiorini and Keane (2014).

6. Further Evidence

This section adds on the time inputs evidence as follows. First and given the policy interest on the negative consequences of chid work, I examine the trade-offs between child work and the rest of the time activities into the skills production function. Second, and probing on the robustness of the main results, I analyse the role of missed inputs on skills by estimating two hybrid production functions, adding inputs that were excluded from the main specification. One of the hybrid specifications examines the role of the main caregiver’s own psychosocial measures (Self-Esteem and Self-Efficacy) and whether the child is enrolled in a private school. The other hybrid specification investigates the role of income, controlling for the fact that the

[31]As expected, the lagged test score increases when we instrument for it (CVA-IV), reaching almost 100% (0.992 s.d) of the PPVT score value.

mother was working Full-time when the child was between 6-18 months to 5 years-old[32] and the incidence of monetary shocks related with mother or father illness. Finally, controlling for unobservable characteristics that are fixed over time (and exploiting variation that occurs within families), I estimate within child fixed-effects (FE) models. This is a popular approach used in the economics literature to purge of any time-invariant unobserved heterogeneity (alternative to the CVA specification that includes the lagged outcome to account for heterogeneity). Adding this empirical strategy serves to further check the robustness of the main results and model strategies.

6.1 Child work and skills

In this section, I expand the analysis on the role of time spent in child work and how it affects positively (negatively) the PPVT score and the Self-Esteem Index, using only the CVA and CVA-IV specifications.[33] I investigate if there is a trade-off between hours spent in child work and the rest of time inputs for a subsample of children that reported at least one hour per day spent in child work and that are currently enrolled in school (see Table A17 for the sample distribution). I do this by expanding the child work category into each of the specific child work tasks[34] and switching the omitted category in each regression, so the effect of child work (and the rest of the time input coefficients) can be interpreted as crowding-out time spent in the omitted time-input category in turn. As stated in Emerson, Ponczek and Souza (2017), the direction of the expected effect of child work on learning is still unclear. On the one hand, working requires time and energy that could curb the child's ability to learn. On the other hand, some of the child work related activities could involve tasks directly or indirectly related to learning. The recent study from Keane, Krutikova, and Neal (2018) using Young Lives data, finds that the negative influence on child work (paid activities) for cognitive outcomes only holds if it crowds-out time spent studying. Adding to these results using the last survey round from Young Lives, Tables 8 and 9 reports coefficients only for time inputs in child work for the PPVT score and the Self-Esteem Index, respectively. The rest of time inputs estimates are reported in Tables A18 and A19 in the Appendix.

For the PPVT score, the detrimental effects of time spent in child work are small in magnitude and vary by age and the specific task. Current time (age 15) spent in paid work exhibits a consistent negative influence in both CVA and CVA-IV specifications. The coefficient

[32] Age information available specifically for Round 1 and Round 2. Effectively, the indicator denoting Full-time working status was coded as 1 if at any of these two Rounds the mother reported to be in Full-time working.
[33] For the PPVT score I estimate both specifications. For the Self-Esteem, I only conduct the CVA one, given the small-sample bias concerns exposed in the previous section.
[34] Listed in Table 2: time spent in care activities, household chores, household tasks, and paid work activities.

is greater when it crowds-out time spent at school or time spent studying, decreasing the PPVT score between 0.030 s.d. and 0.037 s.d. in the CVA and CVA-IV specifications, respectively. Yet, there is also evidence of positive effects in time spent in paid work at age 12 and they are about the same size effect (0.025-0.031 s.d.). There is also mild evidence of the negative influence on hours spent in household chores at age 12, leading to a decrease in the verbal score of 0.020 s.d., but only for the CVA specification.

As in the main results, there is no trade-off effect of any of the child work activities for the Self-Esteem Index (i.e. outcome remains insensitive to time inputs). In contrast, there is evidence of detrimental effects if substituting current time (age 15) spent in leisure instead of studying or time at school. The decrease for the Self-Esteem Index for any extra hour spent in leisure oppose to any of the educational activities could amount up to 0.059 s.d. (See Table A19 in the Appendix).

Table 8. Child work trade-offs: PPVT score

		CVA			CVA-IV	
Omitted category:	Leisure (1)	School (2)	Study (3)	Leisure (4)	School (5	Study (6)
Child Work Time Inputs						
Hrs/day care activities	0.009	0.003	0.003	0.008	0.004	0.003
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Hrs/day care activities$_{t-1}$	-0.006	-0.006	-0.009	-0.006	-0.007	-0.009
	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
Hrs/day care activities$_{t-2}$	0.001	0.003	0.003	0.014	0.016	0.017
	(0.011)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)
Hrs/day household chores	-0.000	-0.007	-0.005	0.004	0.000	-0.001
	(0.009)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
Hrs/day household chores$_{t-1}$	-0.020*	-0.019*	-0.020*	-0.006	-0.007	-0.009
	(0.011)	(0.010)	(0.010)	(0.006)	(0.007)	(0.007)
Hrs/day household chores$_{t-2}$	-0.020*	-0.017	-0.016	-0.001	0.003	0.004
	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)	(0.012)
Hrs/day household tasks	0.005	-0.001	-0.000	0.016	0.012	0.011
	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)
Hrs/day household tasks$_{t-1}$	-0.015	-0.014	-0.019	-0.014	-0.014	-0.018
	(0.013)	(0.012)	(0.012)	(0.015)	(0.014)	(0.015)
Hrs/day household tasks$_{t-2}$	-0.023*	-0.020	-0.021	-0.007	-0.004	-0.002
	(0.013)	(0.013)	(0.013)	(0.014)	(0.015)	(0.014)
Hrs/day paid work	-0.024*	-0.032**	-0.030**	-0.033**	-0.036**	-0.037***
	(0.012)	(0.013)	(0.012)	(0.015)	(0.016)	(0.014)
Hrs/day paid work$_{t-1}$	0.031**	0.031**	0.025*	0.035***	0.034***	0.031***
	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)
Hrs/day paid work$_{t-2}$	0.070	0.073	0.061	0.042	0.047	0.040
	(0.063)	(0.064)	(0.058)	(0.059)	(0.059)	(0.056)
PPVT score$_{t-1}$	0.489***	0.493***	0.491***	0.994***	0.992***	0.989***
	(0.031)	(0.030)	(0.031)	(0.046)	(0.042)	(0.045)
R-squared	0.593	0.592	0.591	0.467	0.468	0.470
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.002	0.004	0.018	0.052	0.000	0.000
Observations	2,759	2,759	2,759	2,759	2,759	2,759

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, omitting the time input in the title and using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

Table 9. Child work trade-offs: Self-Esteem

		CVA	
Omitted category:	Leisure (1)	School (2)	Study (3)
Child Work Time Inputs			
Hrs/day care activities	-0.000	-0.024	-0.024
	(0.023)	(0.025)	(0.025)
Hrs/day care activities$_{t-1}$	-0.027	-0.029	-0.031
	(0.019)	(0.021)	(0.021)
Hrs/day care activities$_{t-2}$	-0.037	-0.035	-0.037
	(0.033)	(0.031)	(0.032)
Hrs/day household chores	0.022	-0.003	-0.001
	(0.028)	(0.028)	(0.028)
Hrs/day household chores$_{t-1}$	0.009	0.006	0.007
	(0.022)	(0.022)	(0.023)
Hrs/day household chores$_{t-2}$	-0.031	-0.029	-0.028
	(0.036)	(0.040)	(0.040)
Hrs/day household tasks	-0.019	-0.043	-0.043
	(0.025)	(0.025)	(0.029)
Hrs/day household tasks$_{t-1}$	0.010	0.010	0.005
	(0.020)	(0.023)	(0.022)
Hrs/day household tasks$_{t-2}$	0.005	0.006	0.003
	(0.024)	(0.025)	(0.022)
Hrs/day paid work	0.057	0.034	0.034
	(0.044)	(0.042)	(0.045)
Hrs/day paid work$_{t-1}$	-0.017	-0.020	-0.026
	(0.035)	(0.037)	(0.039)
Hrs/day paid work$_{t-2}$	0.164	0.154	0.141
	(0.484)	(0.474)	(0.476)
Self-Esteem$_{t-1}$	0.027	0.033	0.039
	(0.041)	(0.041)	(0.046)
R-squared	0.077	0.081	0.080
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.241	0.004	0.025
Observations	2,757	2,757	2,757

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, omitting the time input in the title and using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

6.2 Hybrid specifications

According to Todd and Wolpin (2007) and Del Bono et al. (2016), an option to adjust for missing inputs information is to substitute input demand equations in place of the unobserved inputs. In this case, missing inputs are functions of current and past family income, prices and preferences shocks. Variables related to family income and preferences, such as mother's employment status, main caregiver's psychosocial skills, shocks related to a family member illness, etc., are then included in the new estimation. A crucial assumption for the "hybrid" specification is to impose a non-zero correlation between observed included inputs and the unobservable drivers of child skill development, dealing with the potential issue that the "hybrid" specification might be picking-up preference parameters and not just the technology of child development (Del Bono et al., 2016; Ermisch & Francesconi, 2013). I proceed to estimate two hybrid production functions, that besides including the inputs from the main results, they encompass additional inputs excluded from Eq (1). For both "hybrid" estimations, I report CVA and CVA-IV specifications for the PPVT score and the CVA for the Self-Esteem index. The new variables added for the *Hybrid 1* function are the own psychosocial measures of the mother/main caregiver (Self-efficacy and Self-esteem indexes)—assuming main caregivers with a higher set of psychosocial skills have a technological advantage in the production of their child's skills—(Creamer, 2016; S. Dercon & Singh, 2013; P. Todd & Wolpin, 2007); and a binary indicator denoting if the child was enrolled in private versus public school. These extra inputs are all time-variant (to capture their cumulative effect and to allow for heterogeneity in how they affect each outcome with respect to the child's age). For the *Hybrid 2* function, I account for mother's working status[35] when the child was still young (between 6-18 months and 5 years-old) and the presence of monetary shocks related with mother or father illness throughout the life-cycle. The first additional input is time-invariant, while the second is time-variant. Table 10 below reports the summary statistics of the *Hybrid* controls for the paired sample. About 12% of the sample reported to suffer from a monetary shock, due to an illness of the mother or father.

Table 10. Summary Statistics of *Hybrid* controls

	Mean	*SD*	$SD_{between}$	SD_{within}
Main caregiver Self-Efficacy Index	0.002	1.009	0.572	0.834
Main caregiver Self-Esteem Index	0.014	0.989	0.626	0.769

[35]Information on mother working status was coded using a subsection for the main caregiver on working activities. The questionnaire asked for information related to the three main working activities. I created a binary indicator, coded 1 to denote Full-Time working status or 0 otherwise. For Round 2, I assigned Full-Time working status if the aggregate number of hours for one, two or the three activities together, added 8 or more hrs per day. For Round 1, I considered as Full-Time working status if in the original categorical variable of number of days worked per week, main caregiver answered 6 to 7 days a week.

	Mean	SD	$SD_{between}$	SD_{within}
Child enrolled in private school (prop.)	0.186	0.389	0.318	0.221
Household suffered monetary shock due to mother/father illness (prop.)	0.123	0.328	0.189	0.270
Main Caregiver Full-Time work (prop.)	0.545	0.498	0.498	0.000
Observations (Children)	1,147			
Observations (Children-Data points)	4,295			

*Note: After restricting the estimation to the paired sample, the number of observations for both *Hybrid* specifications is fewer than from the main results (Tables 5 and 7). For *Hybrid 1*-PPVT (CVA-IV), the total number of children-data points is 3,002 (42 observations less than in the main results). For *Hybrid 1*-Self-Esteem (CVA-IV), the total number of children-data points is 1,616 (only 10 observations less than in the main results). For Hybrid 2, the loss of observations is larger given the limited availability on working status data for the main caregiver in the initial two rounds. The total number of children-data points for Hybrid 2-PPVT (CVA-IV) is 2067, while for Hybrid 2-Self-Esteem (CVA-IV) is 1,111. Both sample sizes represent 68% of the paired analytic sample from the main results for their respective specification.

Overall, results for both *Hybrid* models confirm the robustness of the main results to the inclusion of additional inputs as coefficients remain virtually unchanged (Table 11).

For *Hybrid 1*, the positive influence of current and past educational inputs (Column 1) and the negative relationship with current time spent in leisure (Column 2) for the PPVT score remains the same. For the Self-Esteem Index, the detrimental effect of current time spent in leisure is attenuated but only by 0.006 s.d. (i.e. 0.055 s.d. instead of 0.061 s.d. from the main results).

For *Hybrid 2*, the effect of educational inputs for the PPVT score becomes stronger in the CVA model (Column 4) and even the coefficient of time spent studying at age 8 turns significant in the CVA-IV (Column 5), opposite to the main results. The negative effect of current time spent in leisure (age 15) is marginally enhanced for the PPVT outcome (Columns 4-5), while attenuated for the Self-Esteem Index (Column 6). Each difference only represents less than 0.014 s.d., being this value, the largest difference observed (i.e. for time spent studying at age 8 for the CVA-IV model). Furthermore, only the coefficient for the binary indicator on private school enrolment and the Self-Esteem index of the main caregiver are positive and significant for the PPVT score and the Self-Esteem Index, respectively.

Table 11. Hybrid Specifications[36]

	Hybrid 1			*Hybrid 2*		
	PPVT (CVA)	**PPVT (CVA-IV)**	**Self-Esteem (CVA)**	**PPVT (CVA)**	**PPVT (CVA-IV)**	**Self-Esteem (CVA)**
	(1)	(2)	(3)	(4)	(5)	(6)
<u>*Education Time Inputs*</u>						
Hrs/day at school	0.015**	0.000	0.010	0.015*	-0.005	0.010

[36] I matched the sample size of the paired analytic sample from the main results to the Hybrid sample to make valid comparisons. Even when not adjusting to the same number of observations, results remain qualitatively the same.

	Hybrid 1			*Hybrid 2*		
	PPVT (CVA)	**PPVT (CVA-IV)**	**Self-Esteem (CVA)**	**PPVT (CVA)**	**PPVT (CVA-IV)**	**Self-Esteem (CVA)**
	(1)	(2)	(3)	(4)	(5)	(6)
	(0.006)	(0.008)	(0.015)	(0.008)	(0.011)	(0.018)
Hrs/day at school$_{t-1}$	0.006	-0.007	0.026	0.021	0.001	0.023
	(0.010)	(0.011)	(0.038)	(0.013)	(0.015)	(0.043)
Hrs/day at school$_{t-2}$	0.014**	0.012	0.009	0.020***	0.014	-0.014
	(0.005)	(0.007)	(0.041)	(0.006)	(0.009)	(0.051)
Hrs/day studying outside school	0.019***	0.006	0.020	0.018*	0.002	-0.009
	(0.006)	(0.007)	(0.028)	(0.009)	(0.011)	(0.037)
Hrs/day studying outside school$_{t-1}$	0.025***	0.012	0.027	0.035***	0.026**	0.019
	(0.007)	(0.008)	(0.026)	(0.009)	(0.011)	(0.028)
Hrs/day studying outside school$_{t-2}$	0.013	-0.009	-0.038	0.002	-0.020	-0.031
	(0.010)	(0.012)	(0.034)	(0.010)	(0.013)	(0.036)
Leisure Time Inputs						
Hrs/day in leisure activities	-0.007	-0.012**	-0.055***	-0.012*	-0.016**	-0.047**
	(0.005)	(0.006)	(0.018)	(0.006)	(0.008)	(0.020)
Hrs/day in leisure activities$_{t-1}$	0.003	-0.003	0.009	0.006	0.001	-0.000
	(0.005)	(0.006)	(0.023)	(0.005)	(0.006)	(0.026)
Hrs/day in leisure activities$_{t-2}$	0.011**	0.010	-0.009	0.009	0.008	-0.030
	(0.005)	(0.006)	(0.019)	(0.006)	(0.008)	(0.023)
Child Work Time Inputs						
Hrs/day in child work	-0.003	-0.003	-0.020	-0.003	-0.003	-0.028
	(0.003)	(0.003)	(0.012)	(0.006)	(0.006)	(0.017)
Hrs/day in child work$_{t-1}$	-0.006	-0.009	-0.002	-0.004	-0.008	0.008
	(0.004)	(0.006)	(0.015)	(0.006)	(0.007)	(0.012)
Hrs/day in child work$_{t-2}$	-0.006	0.007	-0.040**	-0.008	0.004	-0.030
	(0.006)	(0.006)	(0.017)	(0.005)	(0.006)	(0.019)
Outcome$_{t-1}$	0.500***	0.985***	0.166***	0.475***	0.951***	0.135***
	(0.031)	(0.041)	(0.023)	(0.034)	(0.053)	(0.026)
R-squared	0.598	0.478	0.127	0.631	0.523	0.128
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.058	0.107	0.037	0.009	0.020	0.168
Observations	3,002	3,002	1,616	2,067	2,067	1,111

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. For Columns 3-4 and 7-8 controls are as in footnote of Tables 5 and 7. For Columns 1-2, besides main results controls, additional predictors include the Self-Efficacy and Self-Esteem indexes (z-scores) of main caregiver and if child was enrolled in private school. For Columns 5-6, besides main results controls, additional predictors include if main caregiver was working Full-Time for Round 1 and/or Round 2 of data collection, and if the family experienced any monetary shocks due to illness of the mother or father.

6.3 Fixed-Effects

A popular empirical approach to control for time-invariant unobserved heterogeneity is within child fixed-effects (FE). This specification exploits variation that occurs within families, in this case, within children across different ages. The FE estimator is feasible given the longitudinal nature of the Young Lives data (i.e. having multiple observations on outcomes and inputs for a given child at different ages). For this specification, one takes differences across time, as shown in Equation (2).

$$\Delta Y_{i\alpha} = \Delta \sum_{k=0}^{\alpha} T_i \beta + \Delta \sum_{k=0}^{\alpha} P_{i,\alpha} \delta + \Delta\lambda Y_{i,\alpha-1} + \Delta\epsilon_{i,\alpha} \quad (2)$$

To estimate consistent parameters of Equation (2), the main assumptions in this model include: (a) the impact of endowments on outcome of interest ($Y_{i\alpha}$) must be independent of age (differencing eliminates unobserved endowments from Eq (2)), (b) the choices on later inputs are invariant to prior child's outcomes, (c) the differenced inputs included in the estimation are orthogonal to the omitted differenced inputs and their effect is constant with age (hence eliminated by the differencing).

There are two disadvantages of this estimator. The first one relates to measurement error. If the data on outcomes is afflicted with measurement error (as we suspect at least for the Self-Efficacy Index), the issue on attenuation bias for lagged-outcomes increases. The second one is that the FE estimator does not allow to identify whether the effects of observed inputs change over the child's life cycle and whether past idiosyncratic individual shocks affect current input decisions (Del Bono et al., 2016). The latter limitation explains why the FE estimation is excluded from the main analysis section and used instead as a robustness check.

Table 12 reports results for the FE model. We notice FE estimates almost mirrors results obtained from the CVA specifications for all outcomes (Column 5 in Tables 5-7). For the PPVT score, the positive effect for current and past educational time inputs (i.e. current time spent at school and studying outside (age 15), and the two-period lagged time spent at school (age 8) remains the same. The negative effect of current time spent in child work (age 15) sustains for the Self-Efficacy index and extends to the one-period lagged estimate (age 12); while the detrimental effect of current time spent in leisure (age 15) for the Self-Esteem index albeit diminished, also prevails. Perhaps what stands out as the main difference is the opposite (and negative) relationship with the lagged outcome, while being positive for the main results. Nevertheless, FE estimates adds on to the robustness of the time inputs coefficients obtained in the CVA main results.

Table 12. Fixed-Effects

	PPVT (1)	Self-Efficacy (2)	Self-Esteem (3)
Education Time Inputs			
Hrs/day at school	0.015**	0.018	0.019
	(0.007)	(0.021)	(0.021)
Hrs/day at school$_{t-1}$	0.014	0.028	0.019
	(0.013)	(0.035)	(0.033)
Hrs/day at school$_{t-2}$	0.012*	-0.031*	0.026
	(0.006)	(0.018)	(0.020)
Hrs/day studying outside school	0.007	0.035	0.028
	(0.009)	(0.035)	(0.036)
Hrs/day studying outside school$_{t-1}$	0.020*	(0.035)	(0.034)
	(0.011)	(0.035)	(0.035)
Hrs/day studying outside school$_{t-2}$	0.022**	0.038	0.031

	PPVT	Self-Efficacy	Self-Esteem
	(1)	(2)	(3)
	(0.011)	(0.035)	(0.037)
Leisure Time Inputs			
Hrs/day in leisure activities	-0.006	0.011	-0.040**
	(0.007)	(0.021)	(0.020)
Hrs/day in leisure activities$_{t-1}$	-0.011	0.026	0.007
	(0.007)	(0.023)	(0.023)
Hrs/day in leisure activities$_{t-2}$	-0.004	0.020	0.006
	(0.005)	(0.016)	(0.016)
Child work Time Inputs			
Hrs/day in child work	-0.002	-0.055***	-0.017
	(0.006)	(0.018)	(0.017)
Hrs/day in child work$_{t-1}$	0.006	-0.068***	-0.008
	(0.007)	(0.022)	(0.021)
Hrs/day in child work$_{t-2}$	-0.004	-0.030	-0.028
	(0.007)	(0.020)	(0.020)
Outcome$_{t-1}$	-0.385***	-0.417***	-0.412***
	(0.040)	(0.022)	(0.022)
R-squared	0.540	0.284	0.239
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.328	0.006	0.083
Observations	3,146	3,146	3,146

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression. Controls include time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), an indicator if family head is female), village and child fixed effects.

6.4 Discussion: Further Evidence

This section started examining the trade-off of child work against the rest of the time inputs and how they influence the production of PPVT score and Self-Esteem outcomes. We find only small detrimental effects of current time spent in paid work (age 15), particularly when it crowds-out time spent in educational activities for the PPVT score; and no child work related effects for the Self-Esteem Index. We do confirm the negative effects of current time spent in leisure, specifically when it crowds-out time inputs on education. The magnitude of the effect is larger on decreasing the Self-Esteem Index (0.059 s.d.), than the one observed for paid work on decreasing the PPVT score (0.030 s.d.) (see Tables A18 and A19). This result has important implications when thinking about earlier studies claiming negative effects in child work. As pointed out by Keane, Krutikova and Neal (2018), it is essential to consider which is the actual counterfactual time activity that the child should reallocate her/his efforts that fosters the increase on cognitive and psychosocial skills. Having information for the full-time budget of the child (24 hours), gives us a comparative advantage to investigate the trade-off more accurately than in previous investigations. Furthermore, the disaggregated information on the different time inputs in child work allows us to identify which specific type of child work policies should target to enhance human capital accumulation in adolescence.

Evidence from the *Hybrid* specifications and the Fixed-effects strategy confirm the robustness of the estimates obtained in the main results. Accounting for missing inputs strengthens the positive effect of time spent in educational activities for the PPVT score, while marginally attenuating the detrimental effects of current time spent in leisure. Dealing with unobserved heterogeneity, the FE estimates mirror the main results obtained with the CVA specifications. They confirm the positive effect for current and past educational time inputs for the PPVT score; and for the Self-Esteem index, the negative effect of current time spent in child work (age 15), and the detrimental effect of current time spent in leisure (age 15). The main difference with this strategy is the negative relationship with the lagged outcome, while being positive for the main results (CVA). Likewise, it is unclear if attenuation bias worsens if the outcomes are measured with error. While we do not have concerns for the verbal score, we are not 100% sure for the Self-Esteem measure. Still, evidence into the causal mechanisms on how to foster psychosocial skills is very limited. The negative result of time spent in leisure for the Self-Esteem Index is consistent with the findings from Borga (2018) for the Older Cohort in Vietnam and Ethiopia (using the three previous rounds of data).

7. Conclusions

This study examined the relationship between children time inputs and the production functions of cognitive and psychosocial skills, employing rich longitudinal survey data from Peru, a country with persistent inequalities.

Overall, time inputs effects are marginal for both types of skills, but we document important differences in the type of activities influencing each outcome by age, confirming that the production functions for each skill are different, as established in previous studies (Cunha & Heckman, 2008; Del Bono et al., 2016).

Throughout different specifications (i.e. CVA, FE), our results show that time in educational activities, such as the time spent studying and at school during the school-age period and when transitioning into adolescence is crucial for verbal (cognitive) development. Relative to time spent sleeping, past (i.e. time studying at age 12 and time at school at age 8) and present time inputs in educational activities are more productive for the PPVT score at age 15, leading to an increase of up to 0.077 s.d. These same results indicate that an extra hour spent studying per day is slightly more productive than extra daily hours spent at school. When using the two-period lagged PPVT score (age 8) as an instrument to account for the potential measurement error in one-period lagged PPVT score (i.e. CVA-IV), time inputs effects in education fade out. However, when using alternative instruments, specifically when instrumenting the one-period lagged PPVT outcome with the Self-Efficacy, Self-Esteem, and PPVT score at age 8, findings show a negative coefficient in hours spent at school (age 8), current and one-period lagged time spent in leisure (ages 15 and 12), and current time spent in child work increase and become statistically significant. The latter might be hinting into some complementary among the three skills to influence PPVT score at age 15. On the trade-off analysis of child work, we only find small detrimental effects of current time spent in paid work (age 15), particularly when it crowds-out time spent in educational activities for the PPVT score.

For the Self-Esteem Index, current time spent in leisure and past (age 8) and present time spent in child work is detrimental for this skill at age 15, relative to time spent sleeping. The decrease amounts between 0.057 and 0.63 s.d, respectively. An important finding for the Self-Esteem index is the consistent detrimental effect of current time (age 15) spent in leisure across different empirical strategies (i.e. CVA, FE), when estimating alternative specifications to account for missing inputs, and when analysing the trade-off and contribution of each time input activity into each skill. Unfortunately, we are not able to disentangle which are the specific leisure activities driving the negative result, as opposed when we examined the trade-offs in child work. This is a relevant issue given the broad range of activities classified as "leisure" in the questionnaire, spanning from playing or having fun with friends to daily routine/basic needs activities as eating or showering. In turn, the negative result for leisure inputs might reflect two possible explanations. On the one hand, it might show that any additional extra hour spent in leisure activities is still not enough to be satisfied with it, craving for more time on these activities, affecting Self-Esteem levels. On the other hand, it might indicate that time inputs captured under the "leisure" umbrella, are more related to routine activities such as eating, drinking, bathing, and these actions are perceived as "obligations" rather than leisure time.

One difference among both skills is the influence of the lagged outcome when the child is in mid-adolescence by age 15. Controlling for the past outcome, time inputs are considerably diminished or fade out for the PPVT score, while for the Self-Esteem Index are virtually unchanged. This result is consistent with the notion of differences in malleability among types of skills and at different ages. Previous studies indicate that malleability is greater for cognitive skills at early ages (0 to 6 years old) and then becomes stable. In contrast, malleability is higher for psychosocial skills during adolescence, where interventions have proved successful in influencing behaviour (Cunha et al., 2006).

An important consideration relates to the measurement error evident on the Self-Efficacy Index, pushing us to exclude the estimates in the discussion; and the small-sample bias issue from the 2SLS estimator when implementing the CVA-IV strategy for the Self-Esteem Index, which in turn made us focus on the CVA estimates for this skill. Greater efforts should be implemented in studies validating, collecting and measuring psychosocial skills. This is crucial if we aim to document the causal processes and mechanisms for skill formation in these types of skills, and also relevant to the design of developmentally timed interventions. There are still a lot of unknown questions to be answered related to the development and malleability of psychosocial skills along the life-cycle, and how they interact and complement with cognitive skills. The latter implies a closer collaboration among disciplines, particularly the economics and psychology fields.

On a final note about the process of skill formation, returns on human capital investments can take time to realise, so most human capital investments are made in the first stages of life. We can only examine skill development if data is collected throughout different periods in time. Furthermore, recent evidence has also documented the fade out from early childhood interventions aiming to foster skills, though the analysis has focused mainly on developed economies (Bayley, Duncan, Odgers, & Winnie, 2017). We need comprehensive evidence analysing and identifying key features of child and adolescence interventions, as well as the characteristics and environments of their participants for mid-developing and developing countries. This will allow to document and identify characteristics that may explain persistence and fade-out of intervention effects over time, while providing valuable insights on the skill formation process.

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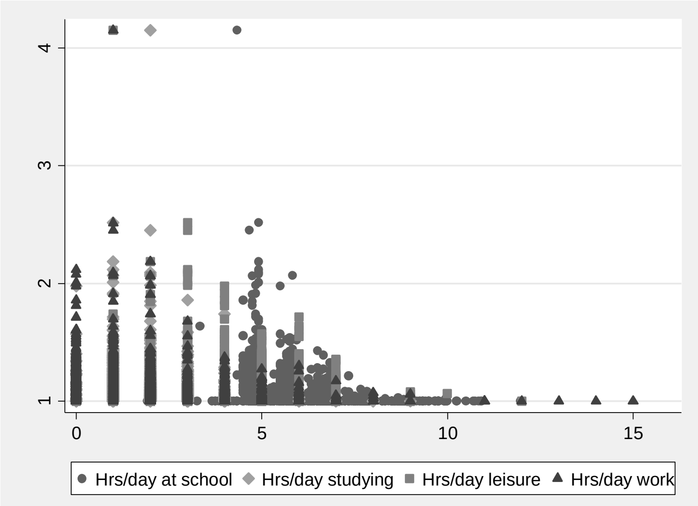
Appendix

Figure A1. Inverse Probability Weights and time inputs*



*Inverse probability weights ranged from 1 (1%) to 4.15 (99%), with an overall mean of 1.044 and standard deviation of 0.111.

Table A2. Difference in means with IPW and no weights

	IPW (1)	*No weights* (2)
PPVT score	0.451 (0.736)	0.450 (0.735)
Self-Efficacy index	0.023 (0.997)	0.021 (0.997)
Self-Esteem index	0.019 (0.979)	0.019 (0.979)

*Table reports means and standard deviations in parentheses applying the derived inverse probability weights (Column 1) and no weights (Column 2) for outcomes from the paired analytic sample (n= 5034).

Table A3. Difference in means Young Lives Unweighted Sample vs. Paired Analytic Sample

	Young Lives Unweighted Sample	*Paired Analytic Sample*	*Diff. in means*
Time inputs			
Hrs/day at school	5.478	6.385	-0.907***
Hrs/day studying outside school	1.588	1.961	-0.374***
Hrs/day in leisure activities	4.166	3.708	0.458***
Hrs/day in child work	2.682	2.180	0.502***
Child Characteristics			
Age (in months)	134.100	139.019	-4.919***
Birth order (all siblings)	2.549	2.368	0.181**
Female (prop.)	0.495	0.501	-0.006
Children attended pre-primary (prop.)	0.908	0.954	-0.046***
Language is Spanish (prop.)	0.652	0.866	-0.214***
Religion is Catholic (prop.)	0.799	0.813	-0.013
Other religion (prop.)	0.158	0.136	0.021*
Ethnicity is Mestizo (prop.)	0.890	0.923	-0.032***
Ethnicity is White (prop.)	0.061	0.056	0.005
Child is underweight (prop.)	0.188	0.064	0.125***
Household Characteristics			

	Young Lives Unweighted Sample	Paired Analytic Sample	Diff. in means
Number of siblings aged 0-5 years old	0.626	0.569	0.057*
Number of siblings aged 6-12 years old	0.795	0.652	0.143***
Wealth index	0.509	0.598	-0.089***
Monthly expenditure in education items per capita	9.948	13.714	-3.766***
Monthly expenditure in food items per capita	118.309	132.692	-14.383***
Parental Characteristics			
Mom age (at birth)	26.807	26.831	-0.024
Caregiver years of education (at birth)	6.185	7.259	-1.073***
Head of household is female (prop.)	0.159	0.164	-0.005
Region Characteristics			
Child lives in Coast region (prop.)	0.291	0.358	-0.066***
Child lives in Mountain region (prop.)	0.521	0.501	0.021
Child lives in Jungle region (prop.)	0.187	0.142	0.045***
Child lives in Urban area (prop.)	0.618	0.7	-0.083***
Observations (Children)	374	1678	
Observations (Children-Data points)	1122	5034	

***p<0.01, **p<0.05, *p<0.1. Compares difference in means between paired analytic sample and the excluded observations from the Young Lives unweighted sample from Round 3 to Round 5.

Table A4. Cronbach's alpha for Self-Efficacy

Item	Item-test correlation	Item-rest correlation	Average interitem correlation	Alpha	
(1) If I try hard, I can improve my situation in life	0.591	0.259	0.115	0.342	
(2) Other people in my family make all the decisions about how I spend my time [recoded to positive]	0.473	0.111	0.171	0.452	
(3) I have no choice about the work I do—I must do this sort of work [recoded to positive]	0.471	0.117	0.164	0.439	
(4) I like to make plans for my future studies and work	0.618	0.297	0.102	0.313	
(5) If I study hard at school, I will be rewarded by a better job in the future	0.624	0.308	0.098	0.303	
Test scale			0.1306	0.429	
Matrix Interitem correlations among items	(1)	(2)	(3)	(4)	(5)
(1)	1.000				
(2)	0.021	1.000			
(3)	0.011	0.193	1.000		
(4)	0.248	0.052	0.058	1.000	
(5)	0.309	0.043	0.024	0.311	1.000

Table A5. Cronbach's alpha for Self-Esteem

Item	Item-test correlation	Item-rest correlation	Average interitem correlation	Alpha
(1) If I try hard, I can improve my situation in life	0.703	0.461	0.192	0.488

Item	*Item-test correlation*	*Item-rest correlation*	*Average interitem correlation*	*Alpha*	
(2) Other people in my family make all the decisions about how I spend my time [recoded to positive]	0.648	0.383	0.222	0.532	
(3) I have no choice about the work I do—I must do this sort of work [recoded to positive]	0.540	0.238	0.282	0.611	
(4) I like to make plans for my future studies and work	0.656	0.395	0.218	0.527	
(5) If I study hard at school, I will be rewarded by a better job in the future	0.583	0.302	0.252	0.574	
Test scale			0.2334	0.6036	
Matrix Interitem correlations among items	(1)	(2)	(3)	(4)	(5)
(1)	1.000				
(2)	0.367	1.000			
(3)	0.223	0.106	1.000		
(4)	0.347	0.276	0.193	1.000	
(5)	0.221	0.253	0.128	0.198	1.000

Table A6. Correlation matrix for outcomes and time inputs with round

	PPVT score	*Self-Efficacy index*	*Self-Esteem index*	*Hrs/day at school*	*Hrs/day studying*	*Hrs/day in leisure*	*Hrs/day in child work*	*Round*
PPVT score	1.000							
Self-Efficacy index	0.274*	1.000						
Self-Esteem index	0.200*	0.245*	1.000					
Hrs/day at school	0.623*	0.133*	0.080*	1.000				
Hrs/day studying	0.397*	0.147*	0.0897*	0.332*	1.000			
Hrs/day in leisure	-0.116*	0.011	-0.038*	-0.291*	-0.217*	1.000		
Hrs/day in child work	0.217*	-0.124*	-0.048*	0.115*	-0.043*	-0.369*	1.000	
Round	0.819*	0.153*	0.090*	0.633*	0.316*	-0.161*	0.360*	1.000

*p<0.05. Correlation matrix for the paired analytic sample (n = 5034).

Table A7. Coefficients on Time Inputs for PPVT score (all controls)

	Benchmark (CT)	*CU_{t-1}*	*CU_{t-2}*	*CVA*	*CVA-IV*
	(1)	(2)	(3)	(4)	(5)
Child is female	-0.085***	-0.085***	-0.102***	-0.065***	-0.029***
	(0.027)	(0.018)	(0.020)	(0.012)	(0.009)
Child speaks Spanish	0.100	0.186***	0.205***	0.126***	0.049
	(0.093)	(0.039)	(0.048)	(0.038)	(0.036)
Child religion: Other	0.017	0.101***	0.099***	0.043**	-0.011
	(0.032)	(0.018)	(0.022)	(0.017)	(0.016)
Child religion: None	-0.008	0.030	-0.005	-0.028	-0.051**
	(0.071)	(0.036)	(0.041)	(0.027)	(0.021)
Child is moderately underweight	-0.144**	-0.121***	-0.154***	-0.101***	-0.048**
	(0.062)	(0.041)	(0.041)	(0.022)	(0.023)
Child severely underweight	0.219	-0.196*	-0.070	0.030	0.128**
	(0.186)	(0.104)	(0.117)	(0.073)	(0.065)
Child ethnicity is White	-0.172*	-0.047*	-0.051	-0.028	-0.005
	(0.095)	(0.027)	(0.035)	(0.021)	(0.016)
Child ethnicity is Minority	0.051	0.004	-0.063	-0.093**	-0.122***
	(0.064)	(0.052)	(0.056)	(0.036)	(0.020)
Child lived at Mountain	-0.080	0.162	0.112	-0.005	-0.120
	(0.093)	(0.122)	(0.134)	(0.125)	(0.122)
Child lived at Jungle	-0.440**	-0.098	-0.179	-0.238*	-0.297**
	(0.167)	(0.123)	(0.132)	(0.127)	(0.143)

	Benchmark (CT)	CU_{t-1}	CU_{t-2}	*CVA*	*CVA-IV*
	(1)	(2)	(3)	(4)	(5)
Child lived Rural area	-0.005 (0.029)	-0.107** (0.038)	-0.071* (0.039)	-0.011 (0.023)	0.048** (0.020)
Birth order: 2	0.046 (0.041)	-0.019 (0.019)	-0.013 (0.025)	-0.012 (0.018)	-0.011 (0.014)
Birth order: 3	0.071 (0.059)	-0.079*** (0.025)	-0.091*** (0.028)	-0.061*** (0.019)	-0.030** (0.015)
Birth order: 4	0.083* (0.048)	-0.094** (0.039)	-0.086* (0.045)	-0.038 (0.030)	0.009 (0.020)
Birth order: 5	0.106 (0.073)	-0.148*** (0.045)	-0.180*** (0.051)	-0.105*** (0.033)	-0.030 (0.031)
Birth order: 6	-0.060 (0.103)	-0.151** (0.063)	-0.196*** (0.059)	-0.113*** (0.034)	-0.031 (0.039)
Birth order: 7	0.062 (0.139)	-0.239** (0.088)	-0.246** (0.113)	-0.135 (0.084)	-0.026 (0.070)
Birth order: 8	0.010 (0.133)	-0.165 (0.106)	-0.187 (0.131)	0.014 (0.070)	0.213*** (0.045)
Birth order: 9	-0.163 (0.150)	-0.338*** (0.115)	-0.278** (0.132)	-0.083 (0.092)	0.110 (0.087)
Birth order: 10	0.072 (0.077)	-0.279 (0.283)	-0.333 (0.347)	-0.210 (0.269)	-0.088 (0.190)
Child attended pre-primary before 4 years-old	-0.010 (0.046)	0.096** (0.039)	0.082* (0.041)	0.027 (0.027)	-0.028 (0.026)
Mom age at Round 1 (YL child age: 6-18 months)	0.007** (0.003)	0.004** (0.002)	0.006** (0.002)	0.003* (0.001)	-0.000 (0.001)
Caregiver years of education = 1	0.047 (0.085)	0.086* (0.047)	0.055 (0.055)	0.015 (0.038)	-0.025 (0.032)
Caregiver years of education = 2	0.207*** (0.043)	0.110* (0.054)	0.113* (0.056)	0.021 (0.037)	-0.070** (0.035)
Caregiver years of education = 3	0.141*** (0.035)	0.068 (0.067)	0.076 (0.080)	0.026 (0.049)	-0.024 (0.027)
Caregiver years of education = 4	0.066 (0.046)	0.100** (0.041)	0.072 (0.061)	0.011 (0.046)	-0.050 (0.036)
Caregiver years of education = 5	0.096*** (0.028)	0.069** (0.033)	0.047 (0.049)	0.002 (0.040)	-0.043 (0.038)
Caregiver years of education = 6	0.191*** (0.044)	0.134*** (0.041)	0.122** (0.047)	0.040 (0.032)	-0.041* (0.023)
Caregiver years of education = 7	0.331*** (0.074)	0.143 (0.089)	0.109 (0.102)	0.014 (0.072)	-0.081 (0.056)
Caregiver years of education = 8	0.285** (0.118)	0.173*** (0.051)	0.140** (0.062)	0.039 (0.041)	-0.060** (0.028)
Caregiver years of education = 9	0.240*** (0.072)	0.136** (0.059)	0.092 (0.069)	0.018 (0.044)	-0.055* (0.031)
Caregiver years of education = 10	0.233** (0.083)	0.157* (0.083)	0.147 (0.100)	0.064 (0.065)	-0.018 (0.036)
Caregiver years of education = 11	0.358*** (0.081)	0.214*** (0.051)	0.185*** (0.059)	0.063 (0.039)	-0.058** (0.028)
Caregiver years of education = 12	0.666*** (0.081)	0.320*** (0.061)	0.276*** (0.070)	0.109** (0.046)	-0.057** (0.024)
Caregiver years of education = 13	0.402*** (0.118)	0.295*** (0.059)	0.279*** (0.070)	0.109** (0.047)	-0.060* (0.034)
Caregiver years of education = 14	0.618*** (0.088)	0.434*** (0.048)	0.381*** (0.060)	0.137*** (0.042)	-0.105*** (0.030)
Caregiver years of education = 15	0.819*** (0.107)	0.435*** (0.060)	0.340*** (0.069)	0.102* (0.053)	-0.134*** (0.046)
Head of household is female	-0.101 (0.062)	0.024 (0.019)	0.013 (0.021)	0.004 (0.016)	-0.005 (0.016)
Child's age (in months)	0.013*** (0.004)	0.014*** (0.002)	0.010*** (0.002)	0.002 (0.002)	-0.005*** (0.002)
Number of males aged 0-5	-0.068*** (0.022)	-0.016 (0.017)	0.005 (0.024)	0.005 (0.016)	0.005 (0.012)
Number of females aged 0-5	-0.024 (0.028)	-0.015 (0.014)	0.005 (0.015)	-0.005 (0.013)	-0.014 (0.016)

	Benchmark (CT)	*CU$_{t-1}$*	*CU$_{t-2}$*	*CVA*	*CVA-IV*
	(1)	(2)	(3)	(4)	(5)
Number of males aged 6-12	-0.027	0.009	0.013	0.012	0.012
	(0.025)	(0.011)	(0.012)	(0.009)	(0.009)
Number of females aged 6-12	-0.062***	-0.007	-0.003	0.003	0.008
	(0.018)	(0.013)	(0.018)	(0.013)	(0.011)
Wealth index	0.217	0.621***	0.540***	0.275***	0.014
	(0.200)	(0.088)	(0.092)	(0.073)	(0.066)
Monthly expenditure in education items per capita	0.009***	0.001**	0.001**	0.000	-0.000*
	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
Monthly expenditure in food items per capita	-0.001***	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-2.589***	-3.159***	-2.798***	-0.890**	0.996***
	(0.372)	(0.238)	(0.455)	(0.373)	(0.352)

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights.

Table A8. Coefficients on Time Inputs for Self-Efficacy Index (controls)

	Benchmark (CT)	*CU$_{t-1}$*	*CU$_{t-2}$*	*CVA*	*CVA-IV*
	(1)	(2)	(3)	(4)	(5)
Child is female	0.165***	0.166***	0.275***	0.250***	0.023
	(0.035)	(0.034)	(0.066)	(0.066)	(0.403)
Child speaks Spanish	0.122**	0.103**	-0.041	-0.071	-0.341
	(0.046)	(0.048)	(0.069)	(0.070)	(0.537)
Child religion: Other	0.051	0.071*	0.049	0.027	-0.162
	(0.040)	(0.040)	(0.064)	(0.062)	(0.335)
Child religion: None	-0.017	-0.024	-0.025	-0.053	-0.303
	(0.074)	(0.073)	(0.143)	(0.143)	(0.503)
Child is moderately underweight	-0.055	-0.062	-0.010	0.022	0.299
	(0.057)	(0.062)	(0.127)	(0.124)	(0.509)
Child severely underweight	-0.114	-0.122	-0.044	-0.004	0.342
	(0.156)	(0.155)	(0.195)	(0.196)	(0.715)
Child ethnicity is White	-0.022	-0.025	-0.073	-0.069	-0.036
	(0.083)	(0.084)	(0.092)	(0.088)	(0.165)
Child ethnicity is Minority	-0.143*	-0.153**	-0.068	-0.033	0.278
	(0.069)	(0.065)	(0.195)	(0.201)	(0.628)
Child lived at Mountain	0.060	0.066	0.067	0.083	0.224
	(0.594)	(0.594)	(0.625)	(0.607)	(0.671)
Child lived at Jungle	0.057	0.059	0.125	0.132	0.195
	(0.459)	(0.466)	(0.531)	(0.473)	(0.882)
Child lived Rural area	-0.163**	-0.162**	-0.069	-0.046	0.155
	(0.059)	(0.059)	(0.106)	(0.104)	(0.423)
Birth order: 2	-0.027	-0.027	0.135	0.147*	0.249
	(0.042)	(0.043)	(0.086)	(0.084)	(0.192)
Birth order: 3	-0.057	-0.068	-0.105	-0.100	-0.056
	(0.058)	(0.060)	(0.098)	(0.096)	(0.145)
Birth order: 4	-0.054	-0.070	-0.061	-0.050	0.045
	(0.084)	(0.085)	(0.107)	(0.096)	(0.211)
Birth order: 5	-0.051	-0.059	0.116	0.134	0.290
	(0.082)	(0.082)	(0.147)	(0.141)	(0.308)
Birth order: 6	0.022	0.000	0.183	0.196	0.311
	(0.086)	(0.088)	(0.121)	(0.117)	(0.264)
Birth order: 7	0.018	0.011	0.155	0.185	0.450
	(0.145)	(0.149)	(0.202)	(0.204)	(0.559)
Birth order: 8	-0.075	-0.081	-0.228	-0.234	-0.281
	(0.124)	(0.139)	(0.151)	(0.160)	(0.674)
Birth order: 9	-0.061	-0.045	-0.402	-0.411	-0.489
	(0.385)	(0.380)	(0.355)	(0.274)	(0.836)
Birth order: 10	0.116	0.140	0.265	0.251	0.125
	(0.368)	(0.366)	(0.508)	(0.441)	(0.403)
	-0.008	-0.007	0.065	0.075	0.166

	Benchmark (CT)	CU_{t-1}	CU_{t-2}	*CVA*	*CVA-IV*
	(1)	(2)	(3)	(4)	(5)
Child attended pre-primary before 4 years-old	(0.060)	(0.066)	(0.126)	(0.124)	(0.272)
Mom age at Round 1 (YL child age: 6-18 months)	0.010**	0.010**	0.010**	0.008*	-0.010
	(0.004)	(0.004)	(0.005)	(0.004)	(0.030)
Caregiver years of education = 1	0.138*	0.118	0.162	0.144	-0.012
	(0.076)	(0.077)	(0.189)	(0.171)	(0.243)
Caregiver years of education = 2	-0.003	-0.010	0.092	0.143	0.595
	(0.081)	(0.082)	(0.170)	(0.165)	(0.825)
Caregiver years of education = 3	0.155*	0.149*	0.207	0.225*	0.385
	(0.075)	(0.076)	(0.125)	(0.125)	(0.413)
Caregiver years of education = 4	0.173**	0.172**	0.159	0.124	-0.186
	(0.065)	(0.068)	(0.144)	(0.146)	(0.569)
Caregiver years of education = 5	0.163**	0.156**	0.232	0.222	0.136
	(0.064)	(0.064)	(0.152)	(0.154)	(0.295)
Caregiver years of education = 6	0.131***	0.128**	0.250*	0.245*	0.202
	(0.042)	(0.045)	(0.134)	(0.136)	(0.229)
Caregiver years of education = 7	0.168	0.168	0.365*	0.330	0.020
	(0.100)	(0.098)	(0.204)	(0.204)	(0.591)
Caregiver years of education = 8	0.081	0.074	0.184	0.182	0.160
	(0.091)	(0.090)	(0.161)	(0.163)	(0.318)
Caregiver years of education = 9	0.127	0.110	0.161	0.174	0.291
	(0.075)	(0.079)	(0.171)	(0.180)	(0.398)
Caregiver years of education = 10	0.306***	0.290**	0.479**	0.444**	0.135
	(0.103)	(0.105)	(0.171)	(0.169)	(0.544)
Caregiver years of education = 11	0.230***	0.213***	0.283*	0.250	-0.044
	(0.057)	(0.060)	(0.144)	(0.149)	(0.557)
Caregiver years of education = 12	0.248***	0.224***	0.227	0.209	0.048
	(0.063)	(0.063)	(0.165)	(0.167)	(0.364)
Caregiver years of education = 13	0.187*	0.176*	0.344*	0.324*	0.144
	(0.090)	(0.087)	(0.169)	(0.169)	(0.376)
Caregiver years of education = 14	0.493***	0.472***	0.698***	0.654***	0.272
	(0.100)	(0.099)	(0.181)	(0.178)	(0.767)
Caregiver years of education = 15	0.140	0.114	0.259	0.223	-0.099
	(0.113)	(0.114)	(0.223)	(0.226)	(0.570)
Head of household is female	0.079	0.083	0.065	0.052	-0.056
	(0.051)	(0.052)	(0.067)	(0.067)	(0.230)
Child's age (in months)	0.012***	0.012***	0.011	0.007	-0.023
	(0.003)	(0.004)	(0.006)	(0.006)	(0.051)
Number of males aged 0-5	0.047*	0.054**	0.083*	0.077	0.021
	(0.024)	(0.025)	(0.047)	(0.046)	(0.124)
Number of females aged 0-5	0.020	0.025	0.108	0.120*	0.229
	(0.025)	(0.026)	(0.066)	(0.064)	(0.204)
Number of males aged 6-12	-0.023	-0.021	0.007	0.011	0.049
	(0.025)	(0.025)	(0.043)	(0.039)	(0.095)
Number of females aged 6-12	-0.001	0.005	0.005	0.001	-0.036
	(0.024)	(0.024)	(0.047)	(0.050)	(0.119)
Wealth index	0.304**	0.260*	0.381**	0.348*	0.056
	(0.134)	(0.136)	(0.181)	(0.170)	(0.661)
Monthly expenditure in education items per capita	0.001	0.001	0.002*	0.002*	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Monthly expenditure in food items per capita	0.000	-0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Constant	-1.892***	-1.918***	-3.060**	-2.207	5.287
	(0.612)	(0.618)	(1.341)	(1.340)	(12.392)

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights.

Table A9. Coefficients on Time Inputs for Self-Esteem Index (all controls)

	Benchmark (CT)	CU_{t-1}	CU_{t-2}	*CVA*	*CVA-IV*
	(1)	(2)	(3)	(4)	(5)
Child is female	0.022	0.026	0.018	0.016	0.018
	(0.025)	(0.026)	(0.041)	(0.041)	(0.038)
Child speaks Spanish	0.136**	0.160***	0.051	0.020	0.055
	(0.052)	(0.052)	(0.092)	(0.092)	(0.129)
Child religion: Other	0.000	0.002	-0.010	0.006	-0.012
	(0.042)	(0.041)	(0.075)	(0.079)	(0.102)
Child religion: None	-0.119**	-0.109**	-0.116	-0.100	-0.117
	(0.053)	(0.052)	(0.075)	(0.077)	(0.106)
Child is moderately underweight	-0.118	-0.131	-0.284*	-0.241	-0.289
	(0.100)	(0.101)	(0.146)	(0.149)	(0.277)
Child severely underweight	-0.022	-0.013	0.085	0.175	0.075
	(0.065)	(0.057)	(0.124)	(0.123)	(0.382)
Child ethnicity is White	-0.013	-0.019	0.123	0.134	0.121
	(0.066)	(0.067)	(0.098)	(0.099)	(0.104)
Child ethnicity is Minority	0.218***	0.224***	0.087	0.012	0.095
	(0.066)	(0.068)	(0.149)	(0.140)	(0.352)
Child lived at Mountain	0.278	0.288	0.344	0.343	0.344
	(0.220)	(0.226)	(0.322)	(0.280)	(0.311)
Child lived at Jungle	-0.145	-0.136	-0.136	-0.092	-0.141
	(0.361)	(0.361)	(0.398)	(0.349)	(0.441)
Child lived Rural area	-0.112*	-0.113*	-0.031	-0.023	-0.032
	(0.058)	(0.057)	(0.097)	(0.103)	(0.105)
Birth order: 2	-0.111***	-0.108**	-0.059	-0.034	-0.061
	(0.037)	(0.039)	(0.054)	(0.053)	(0.129)
Birth order: 3	-0.165***	-0.160***	-0.113	-0.092	-0.115
	(0.052)	(0.054)	(0.074)	(0.070)	(0.109)
Birth order: 4	-0.203**	-0.200**	-0.035	0.004	-0.039
	(0.088)	(0.087)	(0.103)	(0.095)	(0.202)
Birth order: 5	-0.231***	-0.217***	-0.097	-0.061	-0.101
	(0.069)	(0.070)	(0.086)	(0.076)	(0.142)
Birth order: 6	-0.193	-0.175	-0.225**	-0.205**	-0.227*
	(0.135)	(0.133)	(0.104)	(0.091)	(0.138)
Birth order: 7	-0.087	-0.054	0.088	0.082	0.089
	(0.133)	(0.131)	(0.187)	(0.187)	(0.185)
Birth order: 8	-0.465**	-0.458**	-0.211	-0.126	-0.221
	(0.198)	(0.206)	(0.263)	(0.303)	(0.450)
Birth order: 9	-0.449*	-0.433*	0.093	0.155	0.086
	(0.240)	(0.250)	(0.230)	(0.237)	(0.338)
Birth order: 10	0.117	0.173	-0.632**	-0.784***	-0.616
	(0.318)	(0.298)	(0.231)	(0.170)	(0.777)
Child attended pre-primary before 4 years-old	0.051	0.014	-0.068	-0.089	-0.066
	(0.081)	(0.082)	(0.136)	(0.128)	(0.179)
Mom age at Round 1 (YL child age: 6-18 months)	0.004	0.004	-0.001	-0.002	-0.001
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)
Caregiver years of education = 1	0.083	0.076	0.148	0.135	0.150
	(0.067)	(0.066)	(0.160)	(0.163)	(0.158)
Caregiver years of education = 2	0.012	0.016	0.094	0.117	0.091
	(0.086)	(0.082)	(0.128)	(0.122)	(0.129)
Caregiver years of education = 3	-0.019	-0.011	0.067	0.118	0.062
	(0.063)	(0.057)	(0.080)	(0.087)	(0.254)
Caregiver years of education = 4	-0.022	-0.017	-0.039	-0.020	-0.041
	(0.079)	(0.076)	(0.126)	(0.127)	(0.164)
Caregiver years of education = 5	0.047	0.047	-0.016	0.009	-0.019
	(0.081)	(0.082)	(0.101)	(0.099)	(0.169)
Caregiver years of education = 6	0.022	0.017	0.040	0.061	0.038
	(0.057)	(0.057)	(0.070)	(0.074)	(0.105)
Caregiver years of education = 7	-0.100	-0.098	0.006	0.048	0.001
	(0.152)	(0.153)	(0.244)	(0.216)	(0.300)
Caregiver years of education = 8	0.055	0.050	0.060	0.071	0.059
	(0.094)	(0.093)	(0.170)	(0.169)	(0.174)
Caregiver years of education = 9	0.142*	0.129*	0.149*	0.176**	0.146
	(0.076)	(0.073)	(0.082)	(0.084)	(0.135)

	Benchmark (CT)	CU_{t-1}	CU_{t-2}	CVA	CVA-IV
	(1)	(2)	(3)	(4)	(5)
Caregiver years of education = 10	-0.040	-0.045	0.012	0.066	0.007
	(0.073)	(0.072)	(0.120)	(0.131)	(0.276)
Caregiver years of education = 11	0.076	0.069	0.122	0.145	0.120
	(0.070)	(0.070)	(0.097)	(0.101)	(0.129)
Caregiver years of education = 12	0.051	0.038	0.139	0.146	0.138
	(0.100)	(0.100)	(0.169)	(0.170)	(0.162)
Caregiver years of education = 13	0.036	0.033	0.062	0.079	0.061
	(0.087)	(0.084)	(0.150)	(0.152)	(0.169)
Caregiver years of education = 14	0.150	0.144	-0.191	-0.161	-0.194
	(0.102)	(0.102)	(0.152)	(0.147)	(0.187)
Caregiver years of education = 15	0.133	0.119	0.291	0.313	0.288
	(0.136)	(0.134)	(0.211)	(0.213)	(0.233)
Head of household is female	0.014	0.010	-0.014	-0.025	-0.013
	(0.046)	(0.048)	(0.076)	(0.070)	(0.076)
Child's age (in months)	-0.001	-0.003	-0.009	-0.011*	-0.009
	(0.004)	(0.004)	(0.006)	(0.006)	(0.011)
Number of males aged 0-5	-0.042	-0.038	-0.074	-0.078	-0.074
	(0.034)	(0.034)	(0.051)	(0.051)	(0.048)
Number of females aged 0-5	-0.081***	-0.080***	-0.043	-0.028	-0.045
	(0.026)	(0.027)	(0.063)	(0.064)	(0.071)
Number of males aged 6-12	-0.007	-0.002	-0.000	-0.010	0.000
	(0.027)	(0.026)	(0.046)	(0.046)	(0.059)
Number of females aged 6-12	-0.039	-0.037	-0.078*	-0.077*	-0.078**
	(0.029)	(0.030)	(0.039)	(0.040)	(0.037)
Wealth index	0.346**	0.300*	0.315	0.233	0.323
	(0.154)	(0.154)	(0.202)	(0.192)	(0.321)
Monthly expenditure in education	0.001	0.000	-0.000	-0.000	-0.000
items per capita	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Monthly expenditure in food items per	0.000**	0.000**	0.001**	0.000*	0.001
capita	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-1.089**	-0.984**	0.756	1.259	0.703
	(0.427)	(0.410)	(1.140)	(1.089)	(2.534)

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights.

Table A10. First-stage results of main results

CVA-IV	PPVT	Self-Efficacy	Self-Esteem
	(1)	(2)	(3)
Hrs/day at school	0.019**	0.005	0.003
	(0.006)	(0.023)	(0.019)
Hrs/day at school$_{t-1}$	0.024**	0.048	0.010
	(0.010)	(0.038)	(0.035)
Hrs/day at school$_{t-2}$	-0.005	0.020	0.041
	(0.008)	(0.038)	(0.042)
Hrs/day studying outside school	0.014**	-0.001	0.034
	(0.006)	(0.038)	(0.024)
Hrs/day studying outside school$_{t-1}$	0.027***	0.031	-0.022
	(0.008)	(0.027)	(0.029)
Hrs/day studying outside school$_{t-2}$	0.029**	0.070	0.055
	(0.009)	(0.037)	(0.036)
Hrs/day in leisure activities	0.011*	-0.007	-0.009
	(0.005)	(0.018)	(0.014)
Hrs/day in leisure activities$_{t-1}$	0.013*	0.008	-0.047
	(0.006)	(0.022)	(0.027)
Hrs/day in leisure activities$_{t-2}$	0.006	0.044	0.004
	(0.006)	(0.024)	(0.020)
Hrs/day in child work	0.001	0.014	0.012
	(0.004)	(0.019)	(0.014)
Hrs/day in child work$_{t-1}$	0.008	-0.006	0.003
	(0.007)	(0.016)	(0.019)

CVA-IV	*PPVT* (1)	*Self-Efficacy* (2)	*Self-Esteem* (3)
Hrs/day in child work$_{t-2}$	-0.030***	-0.010	-0.017
	(0.006)	(0.023)	(0.023)
Instruments: (1) PPVT score$_{t-2;}$ (2) Self-Efficacy score$_{t-2}$; (3) Self-Esteem$_{t-2}$;	0.419***	0.023	0.031
	(0.029)	(0.032)	(0.025)
R-squared	0.718	0.138	0.099
Observations	3,044	1,626	1626

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

Table A11. Alternative instruments: First-stage results for PPVT score

CVA-IV	*Instr: PPVT$_{t-3}$* (1)	*Instr: Self-Efficacy$_{t-1}$* (2)	*Instr: Self-Esteem$_{t-1}$* (3)	*Instr: Self-Efficacy$_{t-2}$* (4)	*Instr: Self-Esteem$_{t-2}$* (5)	*Instr: Self-Efficacy$_{t-2,}$ Self-Esteem$_{t-2}$ & PPVT$_{t-2}$* (6)
Hrs/day at school	0.018*	0.028***	0.031***	0.027***	0.027***	0.020***
	(0.010)	(0.006)	(0.007)	(0.008)	(0.008)	(0.008)
Hrs/day at school$_{t-1}$	0.025	0.031**	0.032**	0.051**	0.050**	0.026*
	(0.019)	(0.013)	(0.013)	(0.020)	(0.020)	(0.015)
Hrs/day at school$_{t-2}$	0.016	0.008	0.008	0.011	0.009	0.008
	(0.014)	(0.007)	(0.007)	(0.016)	(0.016)	(0.013)
Hrs/day studying outside school	0.019	0.026***	0.026***	0.031**	0.032**	0.018
	(0.013)	(0.007)	(0.007)	(0.014)	(0.014)	(0.015)
Hrs/day studying outside school$_{t-1}$	0.034**	0.027***	0.027***	0.041***	0.042***	0.029***
	(0.012)	(0.009)	(0.009)	(0.011)	(0.011)	(0.008)
Hrs/day studying outside school$_{t-2}$	0.045***	0.043***	0.043***	0.046***	0.044***	0.036**
	(0.013)	(0.010)	(0.010)	(0.016)	(0.016)	(0.014)
Hrs/day in leisure activities	0.003	0.010	0.014**	0.005	0.005	0.006
	(0.011)	(0.006)	(0.007)	(0.011)	(0.011)	(0.010)
Hrs/day in leisure activities$_{t-1}$	0.014	0.014**	0.014**	0.010	0.010	0.005
	(0.009)	(0.007)	(0.007)	(0.010)	(0.010)	(0.008)
Hrs/day in leisure activities$_{t-2}$	0.023**	0.001	0.001	0.025***	0.025***	0.016*
	(0.008)	(0.006)	(0.006)	(0.009)	(0.008)	(0.009)
Hrs/day in child work	-0.001	-0.001	0.000	0.001	0.001	0.004
	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
Hrs/day in child work$_{t-1}$	0.005	0.005	0.005	0.004	0.004	0.005
	(0.009)	(0.007)	(0.007)	(0.009)	(0.010)	(0.007)
Hrs/day in child work$_{t-2}$	-0.013*	-0.026***	-0.026***	-0.018***	-0.018**	-0.021***
	(0.007)	(0.005)	(0.004)	(0.007)	(0.007)	(0.009)
Instruments: (1) PPVT$_{t-3;}$ (2) Self-Efficacy$_{t-1}$; (3) Self-Esteem$_{t-1}$; (4) Self-Efficacy$_{t-2}$; (5) Self-Esteem$_{t-2}$; (6) PPVT$_{t-2}$	0.419***	0.019**	0.023***	-0.002	0.039***	0.464***
	(0.025)	(0.007)	(0.007)	(0.012)	(0.012)	(0.037)
Instruments: (6) Self-Efficacy$_{t-2}$						-0.007
						(0.011)
Instruments: (6) Self-Esteem$_{t-2}$;						0.019*
						(0.011)
R-squared	0.543	0.666	0.664	0.469	0.473	0.583
Observations	1510	3,039	3,040	1,553	1,553	1,553

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

Table A12. Alternative instruments: First-stage results for Self-Efficacy

CVA-IV	*Instr: $PPVT_{t-1}$*	*Instr: $PPVT_{t-2}$*	*Instr: Self-$Esteem_{t-1}$*	*Instr: Self-$Esteem_{t-2}$*	*Instr: Self-$Esteem_{t-2}$ & $PPVT_{t-2}$*	*Instr: Self-$Efficacy_{t-2}$, Self-$Esteem_{t-2}$ & $PPVT_{t-2}$*
	(1)	(2)	(3)	(4)	(5)	(6)
Hrs/day at school	0.001	0.011	0.006	0.007	0.011	0.009
	(0.023)	(0.022)	(0.023)	(0.023)	(0.022)	(0.022)
Hrs/day at $school_{t-1}$	0.041	0.041	0.046	0.048	0.040	0.040
	(0.038)	(0.039)	(0.038)	(0.038)	(0.039)	(0.040)
Hrs/day at $school_{t-2}$	0.020	0.008	0.012	0.020	0.016	0.016
	(0.036)	(0.007)	(0.035)	(0.038)	(0.038)	(0.038)
Hrs/day studying outside school	-0.009	0.003	-0.007	-0.001	0.003	0.002
	(0.038)	(0.040)	(0.036)	(0.038)	(0.014)	(0.039)
Hrs/day studying outside $school_{t-1}$	0.025	0.028	0.035	0.030	0.028	0.028
	(0.029)	(0.031)	(0.028)	(0.027)	(0.030)	(0.030)
Hrs/day studying outside $school_{t-2}$	0.059	0.056	0.060	0.070	0.056	0.056
	(0.039)	(0.042)	(0.041)	(0.038)	(0.042)	(0.041)
Hrs/day in leisure activities	-0.010	-0.004	-0.005	-0.007	-0.004	-0.004
	(0.017)	(0.018)	(0.019)	(0.018)	(0.018)	(0.018)
Hrs/day in leisure $activities_{t-1}$	0.006	0.003	0.016	0.007	0.003	0.004
	(0.021)	(0.021)	(0.022)	(0.022)	(0.021)	(0.022)
Hrs/day in leisure $activities_{t-2}$	0.041*	0.034	0.043	0.044	0.034	0.034
	(0.023)	(0.023)	(0.025)	(0.023)	(0.023)	(0.023)
Hrs/day in child work	0.012	0.023	0.012	0.014	0.023	0.023
	(0.019)	(0.017)	(0.018)	(0.019)	(0.017)	(0.018)
Hrs/day in child $work_{t-1}$	-0.005	-0.003	-0.006	-0.006	-0.003	-0.004
	(0.016)	(0.017)	(0.016)	(0.016)	(0.017)	(0.017)
Hrs/day in child $work_{t-2}$	-0.007	-0.018	-0.008	-0.012	-0.018	-0.016
	(0.023)	(0.024)	(0.025)	(0.023)	(0.024)	(0.025)
Instr: (1) $PPVT_{t-1}$; (2) $PPVT_{t-2}$; (3) Self-$Esteem_{t-1}$; (4) Self-$Esteem_{t-2}$; (5) & (6) $PPVT_{t-2}$	0.210***	0.129*	0.184	-0.002	0.130*	0.130*
	(0.051)	(0.069)	(0.026)	(0.024)	(0.067)	(0.067)
Instr: (5) & (6) Self-$Efficacy_{t-2}$					-0.003	0.023
					(0.024)	(0.036)
Instr: (6) Self-$Esteem_{t-2}$						-0.006
						(0.024)
R-squared	0.146	0.143	0.137	0.137	0.147	0.143
Observations	1620	1555	1,626	1,626	1,555	1,555

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

Table A13. Alternative instruments: First-stage results for Self-Esteem

CVA-IV	*Instr: $PPVT_{t-1}$* (1)	*Instr: $PPVT_{t-2}$* (2)	*Instr: Self-Efficacy$_{t-1}$* (3)	*Instr: Self-Efficacy$_{t-2}$* (4)	*Instr: Self-Efficacy$_{t-2}$ & $PPVT_{t-2}$* (5)	*Instr: Self-Efficacy$_{t-2,}$ Self-Esteem$_{t-2}$ & $PPVT_{t-2}$* (6)
Hrs/day at school	0.004	0.006	0.002	0.002	0.005	0.005
	(0.053)	(0.021)	(0.019)	(0.020)	(0.022)	(0.022)
Hrs/day at school$_{t-1}$	0.006	0.009	0.001	0.010	0.008	0.008
	(0.034)	(0.038)	(0.035)	(0.035)	(0.038)	(0.038)
Hrs/day at school$_{t-2}$	0.043	0.030	0.012	0.043	0.030	0.028
	(0.042)	(0.042)	(0.035)	(0.041)	(0.042)	(0.042)
Hrs/day studying outside school	0.032	0.042*	0.033	0.032	0.042	0.043
	(0.024)	(0.023)	(0.022)	(0.025)	(0.023)	(0.023)
Hrs/day studying outside school$_{t-1}$	-0.022	-0.027	-0.029	-0.023	-0.027	-0.025
	(0.030)	(0.030)	(0.030)	(0.029)	(0.030)	(0.030)
Hrs/day studying outside school$_{t-2}$	0.053	0.054	0.060	0.055	0.053	0.052
	(0.036)	(0.037)	(0.041)	(0.036)	(0.037)	(0.037)
Hrs/day in leisure activities	-0.009	-0.004	-0.008	-0.010	-0.004	-0.005
	(0.014)	(0.014)	(0.015)	(0.014)	(0.014)	(0.014)
Hrs/day in leisure activities$_{t-1}$	-0.049*	-0.047*	-0.049*	-0.047*	-0.047*	-0.046*
	(0.027)	(0.029)	(0.027)	(0.027)	(0.028)	(0.028)
Hrs/day in leisure activities$_{t-2}$	0.002	0.002	0.043	0.004	0.002	0.002
	(0.020)	(0.022)	(0.025)	(0.020)	(0.021)	(0.021)
Hrs/day in child work	0.011	0.021	0.009	0.012	0.020	0.020
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Hrs/day in child work$_{t-1}$	0.003	0.003	0.004	0.002	0.002	0.002
	(0.019)	(0.020)	(0.019)	(0.019)	(0.020)	(0.020)
Hrs/day in child work$_{t-2}$	-0.018	-0.017	-0.015	-0.016	-0.016	-0.015
	(0.024)	(0.027)	(0.026)	(0.024)	(0.027)	(0.026)
Instr: (1) $PPVT_{t-1;}$ (2) $PPVT_{t-2}$; (3) Self-Esteem$_{t-1}$; (4) Self-Esteem$_{t-2}$; (5) & (6) $PPVT_{t-2}$	0.016	-0.036	0.190***	0.030	-0.037	-0.045
	(0.053)	(0.064)	(0.028)	(0.030)	(0.064)	(0.064)
Instr: (5) & (6) Self-Efficacy$_{t-2}$					0.028	0.023
					(0.032)	(0.032)
Instr: (6) Self-Esteem$_{t-2}$						0.036
						(0.025)
R-squared	0.099	0.099	0.130	0.099	0.100	0.101
Observations	1,620	1,555	1,626	1,626	1,555	1,555

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

Table A14. Alternative instruments: Time Inputs for PPVT score

CVA-IV	*Instr: $PPVT_{t-3}$* (1)	*Instr: Self-Efficacy$_{t-1}$* (2)	*Instr: Self-Esteem$_{t-1}$* (3)	*Instr: Self-Efficacy$_{t-2}$* (4)	*Instr: Self-Esteem$_{t-2}$* (5)	*Instr: Self-Efficacy$_{t-2,}$ Self-Esteem$_{t-2}$ & $PPVT_{t-2}$* (6)
<u>*Education Time Inputs*</u>						
Hrs/day at school	-0.002	-0.003	0.006	0.250	-0.012	-0.005
	(0.010)	(0.016)	(0.013)	(1.103)	(0.012)	(0.009)
Hrs/day at school$_{t-1}$	-0.001	-0.013	-0.002	0.475	-0.016	-0.003
	(0.020)	(0.016)	(0.011)	(2.181)	(0.024)	(0.020)
Hrs/day at school$_{t-2}$	-0.036***	0.008	0.011*	0.069	-0.040***	-0.037***
	(0.011)	(0.009)	(0.006)	(0.519)	(0.012)	(0.011)

CVA-IV	Instr: $PPVT_{t-3}$	Instr: Self-Efficacy$_{t-1}$	Instr: Self-Esteem$_{t-1}$	Instr: Self-Efficacy$_{t-2}$	Instr: Self-Esteem$_{t-2}$	Instr: Self-Efficacy$_{t-2,}$ Self-Esteem$_{t-2}$ & $PPVT_{t-2}$
	(1)	(2)	(3)	(4)	(5)	(6)
Hrs/day studying outside school	0.002	0.002	0.011	0.290	-0.010	-0.002
	(0.012)	(0.016)	(0.009)	(1.329)	(0.017)	(0.013)
Hrs/day studying outside school$_{t-1}$	0.008	0.008	0.017*	0.390	-0.004	0.006
	(0.008)	(0.016)	(0.010)	(1.758)	(0.019)	(0.008)
Hrs/day studying outside school$_{t-2}$	-0.006	-0.014	0.001	0.425	-0.020	-0.008
	(0.011)	(0.030)	(0.021)	(1.996)	(0.018)	(0.013)
Leisure Time Inputs						
Hrs/day in leisure activities	-0.015	-0.012	-0.009	0.032	-0.020**	-0.019**
	(0.009)	(0.008)	(0.007)	(0.220)	(0.010)	(0.009)
Hrs/day in leisure activities$_{t-1}$	-0.014*	-0.005	-0.000	0.079	-0.016*	-0.014*
	(0.008)	(0.008)	(0.005)	(0.452)	(0.009)	(0.008)
Hrs/day in leisure activities$_{t-2}$	-0.007	0.010	0.011*	0.226	-0.016	-0.009
	(0.006)	(0.007)	(0.006)	(1.079)	(0.011)	(0.007)
Child work Time Inputs						
Hrs/day in child work	-0.009	-0.002	-0.002	-0.003	-0.011*	-0.011*
	(0.006)	(0.004)	(0.003)	(0.053)	(0.006)	(0.006)
Hrs/day in child work$_{t-1}$	-0.002	-0.010	-0.008	0.036	-0.003	-0.002
	(0.004)	(0.008)	(0.005)	(0.211)	(0.005)	(0.004)
Hrs/day in child work$_{t-2}$	-0.013	0.011	0.002	-0.186	-0.009	-0.013
	(0.009)	(0.014)	(0.011)	(0.757)	(0.012)	(0.009)
PPVT score$_{t-1}$	0.899***	1.171**	0.832**	-8.508	1.214***	0.961***
	(0.058)	(0.508)	(0.347)	(42.610)	(0.274)	(0.049)
R-squared	0.500	0.376	0.545	NA	0.333	0.487
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.009	0.417	0.118	1.000	0.293	0.010
Observations	1,510	3,039	3,040	1,553	1,553	1,553

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

Table A15. Alternative instruments: Time Inputs for Self-Efficacy index

CVA-IV	Instr: $PPVT_{t-1}$	Instr: $PPVT_{t-2}$	Instr: Self-Esteem$_{t-1}$	Instr: Self-Esteem$_{t-2}$	Instr: Self-Esteem$_{t-2}$ & $PPVT_{t-2}$	Instr: Self-Efficacy$_{t-2,}$ Self-Esteem$_{t-2}$ & $PPVT_{t-2}$
	(1)	(2)	(3)	(4)	(5)	(6)
Education Time Inputs						
Hrs/day at school	0.024	0.021	0.032***	-0.039	0.021	0.020
	(0.035)	(0.031)	(0.010)	(1.037)	(0.032)	(0.033)
Hrs/day at school$_{t-1}$	-0.030	-0.008	0.047*	-0.469	-0.009	-0.011
	(0.077)	(0.069)	(0.027)	(6.789)	(0.070)	(0.069)
Hrs/day at school$_{t-2}$	-0.047	-0.038	-0.013	-0.227	-0.038	-0.039
	(0.063)	(0.063)	(0.028)	(2.884)	(0.063)	(0.065)
Hrs/day studying outside school	0.085	0.085	0.080***	0.089	0.085	0.085
	(0.063)	(0.053)	(0.023)	(0.389)	(0.054)	(0.056)
Hrs/day studying outside school$_{t-1}$	0.017	0.035	0.069***	-0.255	0.035	0.033
	(0.058)	(0.060)	(0.023)	(4.212)	(0.059)	(0.060)
Hrs/day studying outside school$_{t-2}$	-0.137**	-0.095	-0.037	-0.788	-0.096	-0.099
	(0.065)	(0.070)	(0.025)	(10.027)	(0.071)	(0.068)
Leisure Time Inputs						
Hrs/day in leisure activities	0.021	0.015	0.006	0.076	0.015	0.015

CVA-IV	Instr: $PPVT_{t-1}$ (1)	Instr: $PPVT_{t-2}$ (2)	Instr: Self-$Esteem_{t-1}$ (3)	Instr: Self-$Esteem_{t-2}$ (4)	Instr: Self-$Esteem_{t-2}$ & $PPVT_{t-2}$ (5)	Instr: Self-$Efficacy_{t-2}$, Self-$Esteem_{t-2}$ & $PPVT_{t-2}$ (6)
	(0.034)	(0.031)	(0.019)	(0.965)	(0.032)	(0.032)
Hrs/day in leisure $activities_{t-1}$	-0.001	0.015	0.010	-0.068	0.014	0.014
	(0.047)	(0.041)	(0.021)	(1.072)	(0.041)	(0.042)
Hrs/day in leisure $activities_{t-2}$	-0.064	-0.031	0.004	-0.464	-0.031	-0.033
	(0.045)	(0.041)	(0.020)	(6.173)	(0.041)	(0.039)
<u>Child work Time Inputs</u>						
Hrs/day in child work	-0.073**	-0.082***	-0.055***	-0.203	-0.083***	-0.084***
	(0.033)	(0.030)	(0.015)	(2.033)	(0.030)	(0.031)
Hrs/day in child $work_{t-1}$	0.008	0.007	0.001	0.060	0.007	0.008
	(0.036)	(0.034)	(0.018)	(0.813)	(0.034)	(0.035)
Hrs/day in child $work_{t-2}$	0.016	0.033	-0.001	0.122	0.033	0.034
	(0.045)	(0.049)	(0.019)	(1.660)	(0.049)	(0.051)
Self-$Efficacy_{t-1}$ (after instrument)	1.917***	1.655*	0.405***	11.073	1.672*	1.727*
	(0.409)	(0.922)	(0.132)	(141.585)	(0.913)	(0.904)
R-squared	NA	NA	0.15	NA	NA	NA
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.011	0.396	0.002	1.000	0.393	0.393
Observations	1,620	1555	1626	1626	1555	1555

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

Table A16. Alternative instruments: Time Inputs for Self-Esteem index

CVA-IV	Instr: $PPVT_{t-1}$ (1)	Instr: $PPVT_{t-2}$ (2)	Instr: Self-$Efficacy_{t-1}$ (3)	Instr: Self-$Efficacy_{t-2}$ (4)	Instr: Self-$Esteem_{t-2}$ & $PPVT_{t-2}$ (5)	Instr: Self-$Efficacy_{t-2}$, Self-$Esteem_{t-2}$ & $PPVT_{t-2}$ (6)
<u>Education Time Inputs</u>						
Hrs/day at school	-0.016	0.023	0.007	0.003	0.008	0.012
	(0.132)	(0.042)	(0.015)	(0.027)	(0.022)	(0.018)
Hrs/day at $school_{t-1}$	-0.018	0.046	0.020	0.007	0.027	0.031
	(0.177)	(0.086)	(0.038)	(0.057)	(0.048)	(0.039)
Hrs/day at $school_{t-2}$	-0.233	0.069	-0.000	-0.051	-0.010	0.008
	(0.758)	(0.121)	(0.045)	(0.089)	(0.069)	(0.055)
Hrs/day studying outside school	-0.161	0.112	0.013	-0.026	0.004	0.029
	(0.581)	(0.162)	(0.025)	(0.070)	(0.057)	(0.035)
Hrs/day studying outside $school_{t-1}$	0.148	-0.013	0.033	0.061	0.060	0.043
	(0.378)	(0.078)	(0.027)	(0.057)	(0.038)	(0.028)
Hrs/day studying outside $school_{t-2}$	-0.339	0.050	-0.051	-0.117	-0.090	-0.058
	(0.952)	(0.225)	(0.034)	(0.112)	(0.080)	(0.052)
<u>Leisure Time Inputs</u>						
Hrs/day in leisure activities	-0.011	-0.063*	-0.060***	-0.049*	-0.053***	-0.055***
	(0.187)	(0.036)	(0.018)	(0.026)	(0.017)	(0.017)
Hrs/day in leisure $activities_{t-1}$	0.276	-0.070	0.014	0.071	0.055	0.026
	(0.937)	(0.196)	(0.023)	(0.075)	(0.045)	(0.026)
Hrs/day in leisure $activities_{t-2}$	-0.026	-0.017	-0.013	-0.017	-0.020	-0.019
	(0.107)	(0.042)	(0.018)	(0.031)	(0.024)	(0.019)
<u>Child work Time Inputs</u>						
Hrs/day in child work	-0.083	0.011	-0.026**	-0.040	-0.044*	-0.031*
	(0.197)	(0.092)	(0.012)	(0.029)	(0.026)	(0.016)
Hrs/day in child $work_{t-1}$	-0.016	0.006	-0.002	-0.005	-0.002	0.000

CVA-IV	*Instr: PPVT$_{t-1}$*	*Instr: PPVT$_{t-2}$*	*Instr: Self-Efficacy$_{t-1}$*	*Instr: Self-Efficacy$_{t-2}$*	*Instr: Self-Esteem$_{t-2}$ & PPVT$_{t-2}$*	*Instr: Self-Efficacy$_{t-2}$, Self-Esteem$_{t-2}$ & PPVT$_{t-2}$*
	(1)	(2)	(3)	(4)	(5)	(6)
	(0.097)	(0.038)	(0.016)	(0.032)	(0.024)	(0.017)
Hrs/day in child work$_{t-2}$	0.056	-0.080	-0.040**	-0.019	-0.034	-0.045**
	(0.363)	(0.084)	(0.016)	(0.044)	(0.030)	(0.019)
Self-Efficacy$_{t-1}$ (after instrument)	5.688	-1.645	0.317**	1.505	0.982	0.369
	(17.736)	(3.663)	(0.128)	(1.475)	(0.926)	(0.487)
R-squared	NA	NA	0.104	NA	NA	0.099
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.932	0.468	0.004	0.057	0.012	0.004
Observations	1,620	1,555	1,626	1,626	1,555	1,555

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights. Controls include time-invariant predictors (child's sex, birth order, child's language, ethnicity, region and area of residence at Round 1, religion, whether the child was severely or moderately underweight at Round 1, whether the child attended pre-primary education before aged 4, mother's age, main caregiver years of education; and time variant predictors (child's age in months, number of siblings living in household aged 0 to 12, a household wealth index, level of food and education expenditure per capita (in *Soles*), if family head is female) and village fixed effects. Reference categories: (Child's sex) Female, (Language) Other, (Birth order) First-born, (Underweight) Not underweighted (Ethnicity) Mestizo (includes Native of the Amazon, Negro & Asiatic), (Religion) Catholic, (Language) Other (Area) Urban, (Region) Coast.

Table A17. Sample distribution of children currently enrolled and at least one hr working

	Round 3 (Age 8)	*Round 4* (Age 12)	*Round 5* (Age 15)
Child currently enrolled (prop.)	0.759	0.921	0.891
Hrs/day in child work	2.067	2.806	2.657
	(1.341)	(1.688)	(1.721)
Observations	1273	1546	1495

*Sample of children from the paired analytic sample who reported currently being enrolled at least and working at least one hour daily.

Table A18. Child work trade-offs: PPVT score

	CVA				**CVA-IV**			
Omitted category:	*Leisure* (1)	*Work* (2)	*Study* (3)	*School* (4)	*Leisure* (5)	*Work* (6)	*Study* (5	*School* (6)
<u>Education Time Inputs</u>								
Hrs/day at school	0.015**	0.015**	0.009		0.004	0.001	-0.002	
	(0.005)	(0.006)	(0.006)		(0.006)	(0.009)	(0.007)	
Hrs/day at school$_{t-1}$	0.007	0.013	0.005		-0.006	-0.002	-0.008	
	(0.011)	(0.010)	(0.011)		(0.010)	(0.011)	(0.011)	
Hrs/day at school$_{t-2}$	0.006	0.011*	0.012*		0.003	0.006	0.006	
	(0.005)	(0.006)	(0.006)		(0.009)	(0.009)	(0.009)	
Hrs/day studying outside school	0.019**	0.018**		0.012	0.010	0.007		0.006
	(0.007)	(0.008)		(0.008)	(0.009)	(0.009)		(0.009)
Hrs/day studying outside school$_{t-1}$	0.026***	0.030***		0.027***	0.013	0.015		0.013
	(0.007)	(0.008)		(0.008)	(0.010)	(0.010)		(0.010)
Hrs/day studying outside school$_{t-2}$	0.011	0.017*		0.018*	-0.012	-0.008		-0.006
	(0.009)	(0.010)		(0.010)	(0.010)	(0.010)		(0.011)
<u>Leisure Time Inputs</u>								
Hrs/day in leisure activities		-0.005	-0.010*	-0.011*		-0.010*	-0.011**	-0.010*
		(0.005)	(0.005)	(0.006)		(0.006)	(0.005)	(0.005)
Hrs/day in leisure activities$_{t-1}$		0.009	-0.002	0.002		0.004	-0.004	-0.001
		(0.006)	(0.005)	(0.005)		(0.006)	(0.006)	(0.005)
Hrs/day in leisure activities$_{t-2}$		0.011**	0.005	0.005		0.007	0.009	0.007
		(0.005)	(0.005)	(0.005)		(0.006)	(0.007)	(0.007)
R-squared	0.593	0.591	0.591	0.592	0.467	0.470	0.470	0.468

Omitted category:	CVA				CVA-IV			
	Leisure (1)	*Work* (2)	*Study* (3)	*School* (4)	*Leisure* (5)	*Work* (6)	*Study* (5	*School* (6)
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.002	0.201	0.018	0.004	0.052	0.235	0.000	0.000
Observations	2759	2759	2759	2759	2759	2759	2759	2759

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights.

Table A19. Child work trade-offs: Self-Esteem

Omitted category:	CVA			
	Leisure (1)	*Work* (2)	*Study* (3)	*School* (4)
Education Time Inputs				
Hrs/day at school	0.031**	0.014	0.004	
	(0.012)	(0.015)	(0.018)	
Hrs/day at school$_{t-1}$	0.022	0.022	0.017	
	(0.031)	(0.028)	(0.029)	
Hrs/day at school$_{t-2}$	0.009	0.016	0.016	
	(0.016)	(0.016)	(0.015)	
Hrs/day studying outside school	0.039*	0.024		0.013
	(0.021)	(0.024)		(0.022)
Hrs/day studying outside school$_{t-1}$	0.029	0.033		0.029
	(0.022)	(0.022)		(0.023)
Hrs/day studying outside school$_{t-2}$	0.025	0.029		0.033
	(0.035)	(0.035)		(0.033)
Leisure Time Inputs				
Hrs/day in leisure activities		-0.044***	-0.059***	-0.058***
		(0.015)	(0.019)	(0.015)
Hrs/day in leisure activities$_{t-1}$		0.009	-0.003	0.000
		(0.013)	(0.016)	(0.017)
Hrs/day in leisure activities$_{t-2}$		0.014*	0.004	0.005
		(0.008)	(0.009)	(0.010)
R-squared	0.077	0.077	0.080	0.081
p-value $H_0: \beta_n = \beta_{n\alpha-k} = 0$	0.241	0.108	0.025	0.004
Observations	2,757	2,757	2,757	2,757

***p<0.01, **p<0.05, *p<0.1. Clustered robust standard errors in parentheses at the village level. Each column presents a separate regression, using inverse probability weights.