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Does greater household wealth make young children perform better? The case of Vietnam

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Abstract
Our study examines factors affecting children's cognitive ability in Vietnam for the period 2006–2016. We find that conditional wealth has a positive association with the cognitive capacity of 15-year-old children, manifested in all three methods of measurement: vocabulary points, math scores and reading comprehension scores in Vietnamese. Notably, the finding implies that improving household wealth after the children's first 1,000 days still plays an important role in the cognitive development of 5–12-year-olds. Also, it suggests that using conditional wealth enables us to capture the impact of economic shocks, thereby having a significant effect on the cognitive ability of children.

KEYWORDS
cognitive skills, conditional wealth, household wealth, the gender gap

INTRODUCTION

In the context of the rapid, comprehensive and extensive technological revolution, labour supply requirements in the labour market have also changed. Accordingly, workers must maintain their learning skills and pursue lifelong learning to be able to keep up with changing trends in the labour market. To acquire such skills, workers need to improve their cognitive ability, since they are at an early stage of development. According to Gottfredson (1997), cognitive ability is a general mental capacity, including reasoning, planning, abstract thinking, the ability to grasp general ideas, problem-solving and learning from experience. Schmidt and Hunter (1998) point out that the cognitive ability of a worker is generally considered the best predictor of his performance at work. The main channel through which cognitive ability influences job performance is job knowledge acquisition (Borman et al., 1993). Possession of high cognitive ability enables people to acquire the knowledge they need for the best performance in their work. Lachman (2004) also confirms that cognitive abilities play a vital role in helping workers not only to overcome job demands and challenges but also to acquire higher education and further advanced training, as well as meeting societal expectations.

Grantham-McGregor et al. (2007) show that the development of children in the first years of life plays a particularly important role in later development. Figure 1 shows that nutritional factors are very important in brain development during the first years of a child's life. Black et al. (2016) share this view when they demonstrate that the period from conception to the age of about 2 years (i.e., the first 1,000 days) is a time when nutrients have the most powerful influence on a child's development, cognitive ability and academic performance later. A study by Sudfield et al. (2015) confirmed that nutritional interventions after a child's second birthday had positive effects, even if such effects were significantly lower than those resulting from earlier interventions. In other words, the first 1,000-day period is considered the vital window of opportunity for interventions (Black et al., 2013). Accordingly, Crookston et al., (2010) suggest that in order to improve both the physical and intellectual development of children, policy-makers should put much effort into promoting catch-up growth and prevent the stunting of children in the first few years of life.

Crookston et al. (2014) measure cognitive competence through test results for math, vocabulary and language use, and reading comprehension. Numerical tests include addition, subtraction, multiplication, division, solving equations, measuring, interpreting data and basic geometry. The vocabulary test (PPVT) uses encouraging words with pictures or pictures alone to test vocabulary acquisition skills. The test of language skills and reading comprehension included 24 paragraphs of varying degrees of difficulty for children to read. Each paragraph consisted of sentences or short paragraphs that had one or several words missing. The child was then asked to identify the missing word and type it in the blank. Eventually, the child had to translate the complete sentence or paragraph into their native language. Based on the three types of test, the author calculated the results from each child's cognitive scores to include in the analysis of results of the child's nutritional condition.

Using data from more than 3,000 children from four countries (Ethiopia, India, Peru and Vietnam), Crookston et al. (2014) investigated the relationship between cognitive attainment and household economic conditions, education and nutritional factors to assess their influence on the development of children's cognitive ability. Their study showed a positive and statistically significant relationship between the individual factors, households and children's cognitive ability in all four countries.

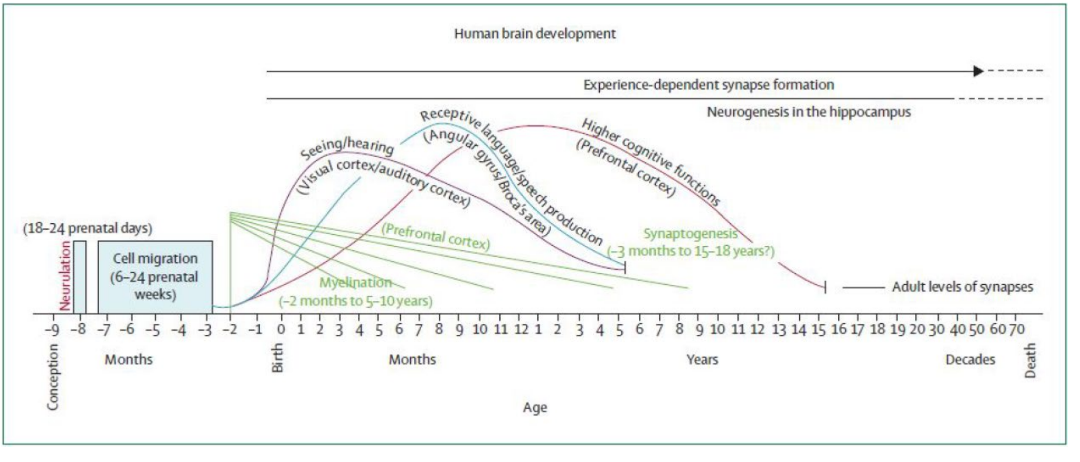

FIGURE 1 The development process of the human brain. Source: Grantham-McGregor et al., (2007)

Accordingly, if parents have received some education, if their household economic conditions improve, or if their children grow well, then their cognitive scores will increase over time. However, the method used by the authors did not control for a significant factor, namely the height of the mother (an element that is thought to have a significant effect on the height of the child. Thus, controlling for the mother's height and for the child's cognitive growth will overcome this deficiency of method.

Sepehri and Guliani (2015) find that, on average, children from better-off households will be taller than children from poorer households, but the difference decreases with children in the older age group. Thus, when a household's economic situation improves, the physical health of children also improves significantly, especially for children aged 0–3 years. Le (2011) studied the relationship between height and the cognitive development of Vietnamese children aged 5, using Young Lives data. Vocabulary awareness (PPVT) was used to measure a child's cognitive capacity. The results of the analysis showed that besides the matter of parental education and urban/rural factors that affect the development of 5-year-old children, additional factors directly related to a newborn's health, measured by preterm/full-term pregnancy, also play a vital role in a child's vocabulary test. However, the influence on cognitive ability of height or the number of months at birth of 5-year-old children is not statistically significant.

Using survey data for children, with nearly 1,000 observations for older children, Le and Tran (2015) have shown that the height factor in children at the age 8 and 15 has a positive influence on cognitive capacity. This means that adequate nutrition in the years after the first 1,000 days has a significant effect on the height and cognitive capacity of Vietnamese children. However, this study lacks necessary information about the characteristics of infants at birth, so it is not possible to assess the influence of birth factors and of the first 1,000 days on the cognitive capacity of children 15 years of age. A recent study by Duc and Behrman (2017) uses Young Lives data to assess the predictive ability of three nutritional indicators in the first year of life, including birth weight, increase in height and weight gain in the first year after birth. Their results indicate that although these three factors in the 12 months postpartum serve as anthropometric indicators for children at the age of 8, they are not statistically significant in predicting the cognitive ability of 8-year-old children, when measured by reading test scores, math test scores and vocabulary awareness (PPVT).

Several studies have examined factors affecting children's cognitive abilities in several developing countries. Using data for a group of children born in 2001–2002 in Peru in the Young Lives survey data set, Crookston et al. (2010) find that for cognitive vocabulary tests (PPVT), the influence of nutrition at 5 years of age is stronger than in early childhood (6–18 months). In contrast, there was no difference in math tests in the influence of nutrition on the cognitive ability of Peruvian children from early childhood to 5–6 years of age. This result is in line with that of Black et al., (2016) and provides additional evidence that interventions after the first 1,000 days still have a positive effect on the cognitive development of children. Cheung (2006) also supports this finding when he shows that the weight index of 12-month-old children has no effect on a child's cognitive test at 7 years of age. In contrast, the factor that has a positive effect on the cognitive abilities of 7-year-old children in Indonesia is the rate of weight gain between 1–7 years of age. Fink & Rockers, 2014; Bhargava, 2016; Georgiadis and Penny (2017) also provide supporting evidence for the association between cognitive achievement and growth acceleration in late childhood and adolescence. Furthermore, Mendez and Adair (1999) indicate that nearly one-third of children whose growth was stunted at the age of two or earlier had caught up with their peers by the age of 8. In addition, in quantitative test scores and vocabulary tests, children who had undergone catch-up growth achieved test results similar to their peers whose growth had not been affected (Crookston et al., 2010).

The aforementioned literature reveals that while numerous studies have investigated various factors affecting children' cognitive ability, no study thus far has examined the impact of family economic status on their children's cognitive ability in Vietnam. Household wealth helps children grow physically, but the benefit of physical growth for cognitive ability remains unexplored. Cognitive ability is a particularly important factor in career development as well as in other aspects of an adult's life and needs to be fostered and developed right from the first years of a child's life. Wealthier households provide better nutrition for children under 5, and many studies have confirmed that good nutrition for these children helps them gain better cognitive skills. Most studies reach the conclusion that investing in health and nutrition is most valuable for children before the age of 5, particularly in the 1,000-day period after birth. Our paper contributes to the literature by providing further evidence that changes in household welfare continue to have a positive effect on the cognitive development of children from 5 to 12 in a developing country.

Considering the importance of the research topic and the gap in the literature, the current study was conducted with the aim of examining the impact of household wealth on children's cognitive ability in late childhood in Vietnam. Our study provides empirical evidence that conditional wealth has a positive association with the cognitive capacity of 15-year-old children, manifested in all three methods of measurement: vocabulary points, math scores and reading comprehension scores in Vietnamese. Notably, the finding implies that improving household wealth after the children's first 1,000 days still plays an important role in their cognitive development from 5 to 12 years of age. Our finding also suggests that using the measure of conditional wealth enables us to capture the impact of economic shocks, which also can have a significant effect on the cognitive ability of children.

The paper is structured as follows. Data and method are outlined in Section 2, followed by results and discussion in Section 3. Section 4 concludes and suggests some policy implications.

DATA AND METHOD

Data

Young Lives is an international study of child poverty, conducted to contribute to raising our awareness of the causes and consequences of child poverty in developing countries. Young Lives was designed as a cohort study of the lives of 12,000 children in four low- and middle-income countries—Ethiopia, India (in Andhra Pradesh and Telangana), Peru and Vietnam, covering a span of over 15 years, beginning in 2002 through to the end of 2017. The sample in each country consists of two groups of children: one group of 2,000 millennials (born in 2001 and 2002) and an older group of 1,000 children, 7-year-olds born in 2000. The Vietnamese children were the first to benefit from their country's economic development achievements after the economic reform.

The Young Lives data were taken from a representative sample of the poor, in different geographical areas, and with a similar proportion of ethnic minorities represented in the national total. Including ages from infancy to adulthood, Young Lives not only monitors children's physical and social circumstances but also captures their views on life and their aspirations for the future. Five quantitative surveys of children, households and communities were conducted in Vietnam in 2002, 2006, 2009, 2013 and 2016 (Figure 2), collecting information on households as well as on children's views of their subjective well-being and perceptions of poverty. In parallel with the quantitative surveys, four qualitative survey rounds were conducted with a group of young children in the 2007–2014 period. Through in-depth interviews with children and parents, teachers, and friends, as well as local staff, qualitative surveys have provided the data for case studies investigating how

FIGURE 2 Five rounds of YL investigation in Vietnam

children's lives change, and how the environment and national or regional policies affect their lives.

Study indicators

Measure of cognitive skills

Many indicators reflect a child's cognitive ability, of which the three most common are math scores, reading comprehension and vocabulary (Peabody Picture Vocabulary Test—PPVT).

Math scores

In cycle 4, the math test for young children consisted of 34 questions. Each question asked the children to make a calculation, such as addition, subtraction, multiplication or division, with whole numbers, decimals, fractions or counting squares and triangles. Some questions require children to find the logical rule of a sequence and fill in the missing space in the sequence. In this test, there are also more complex problems, such as calculating the area, or analysing a prescription to calculate the amount of medicine to be taken. Later questions become more difficult than earlier ones. Each student takes the math test individually and is allowed 40 min to complete it. Math tests must be taken in a quiet place and, to ensure objectivity and avoid fatigue, are not performed before 7 a.m. or after 5 p.m.

Vietnamese score

The Vietnamese language test measures reading and comprehension at different levels of complexity (for example, single words, sentences, and paragraphs with multiple levels). For the Vietnamese test in cycle 4, a group of young children read five paragraphs or poems, and for each paragraph or poem had to answer six multiple choice questions. Children chose one of the answers given with information taken from a passage or verse that had been read. There were 30 questions in total to complete within 30 min. In cycle 5, the comprehension test had two paragraphs and one diagram. There were six questions after each paragraph or diagram, for a total of 18 questions.

Peabody Picture Vocabulary Test (PPVT)

To assess the cognitive capacity of children, vocabulary scores (PPVT) commonly used by previous studies in the Young Lives dataset include Blau (1999), McCulloch and Joshi (2002), Paxson and Schady (2007), Le (2011), Le and Tran (2015). In the PPVT test, children listened to a word read by the interviewer and then looked at four different images. Children would choose which image they thought best represented the meaning of the word that they had heard. The vocabulary test through flip-flops is not limited in time, but if children have not given an answer after about 15 min, the interviewer should encourage them to do so. The flipbook vocabulary test cannot be adapted for use in all languages, meaning that the test can only be performed in a predefined language. For the research group of children, the test was designed in Vietnamese. Translating the test into another language (for example, into the local language) will affect the accuracy of the results. Therefore, children who cannot speak Vietnamese do not take this test.

The number of questions in the fourth and fifth rounds is only one-third of the standard number in the second and third rounds, due to the alignment of Young Lives experts with specific principles (see more in Leon & Singh, 2017).

Measure of household wealth

Household wealth is measured by a wealth index, which is defined as the average of three components, including housing quality, access to services, and the availability of consumer durables. To be more specific, housing quality is measured by the average number of rooms per person and the quality of the materials used to construct house walls, roofs and floors. The second component—access to services—includes access to electricity, safe drinking water, non-polluting energy for cooking, and sanitation facilities. The last component comprises household items that members own, such as a TV, radio, motorbike, automobile, mobile phone, landline phone, bicycle, fan and refrigerator.

Controlling factors

The controlling variables for this study include a set of child characteristics, household characteristics and economic regions. Child characteristics consist of gender, height at birth, and ethnicity, while household characteristics include the mother's schooling, height, weight, father's schooling and household size. We also include urban/rural and economic region dummies to control for regional fixed effects.

Statistical methods

The literature review confirms that the household wealth of children at an older age is strongly correlated with household wealth when children are 5 years of age (Le, 2019). Thus, the effect of early childhood wealth on children's cognitive skills at the age of 5 may contribute to the link between household wealth and children's cognitive skills at the age of 15.

Conditional wealth

To investigate the link between the change in household wealth on children between 5 and 15 years, this study applies the conditional wealth formula introduced by Le (2019). The indicator is the residual term of the following ordinary least squares (OLS) regression:

$$\text{Wealth index}_4 = \beta_0 + \beta_1 \ \text{wealth index}_2 + C_{24} \tag{1}$$

where wealth index_2 and wealth index_4 are the wealth indexes in the second survey round (children 5 years of age) and in the fourth survey round (children 12 years of age). Conditional wealth, C_{24}, makes it possible to capture the impact of economic and environmental shocks that may occur during the period between survey cycle 2 and cycle 4 (Le, 2019). This conditional wealth is then entered in Equation (2) below. However, it is hard to interpret the estimated result of such a variable, so we standardise its value ($C_{24\_standardise}$) by dividing C_{24} by the standard deviation of the wealth index in the second survey round. The estimated value of standardised conditional wealth will be explained that when conditional wealth increases by 1 standard deviation when the child is 5 years old, by how many points will the cognitive skills score change at 15 years of age?

Modelling the effect of conditional wealth on cognitive skills

This study analyses the association between changes in household wealth and the cognitive skills of children at the age of 15. Standardised conditional wealth $C_{24\_standardise}$ serves as a proxy for change in household wealth between the point when a child turns 5, then later when he turns 12. Other controlling factors are given for 5-year-olds. The regression analysis follows Equation (2):

$$\text{Cognitive}_{5i} = \beta_0 + \beta_1 X_i + C_{24\_\text{standardise}} + u_i \tag{2}$$

where cognitive is measured by math's score, overall reading score, and the Peabody Picture Vocabulary Test score (PPVT) in the cycle 5 survey (children aged 15). Each of three outcome variables is estimated in separate models using a variety measures collected from survey rounds 2 to 5.

X_i represents (i) children's characteristics, such as gender, ethnicity, height for age (normalised to z scores); (ii) household characteristics, such as wealth index, household size, mother's height, mother's education, father's education; and (iii) characteristics of economic regions and urban/rural areas. u_i is an error term. The definition and measurement of included variables are given in Appendix 1.

RESULTS AND DISCUSSION

Table 1 reports the estimation results using the OLS method with the dependent variable being the PPVT, math and reading scores, respectively, for 15-year-old children, and does not control for changes in household wealth in the 2006–2013 period.

Measuring the cognitive ability of children aged 15 by the vocabulary scoring method (PPVT) shows that there is no difference between the sexes when the estimated coefficients are not statistically significant. In contrast, factors such as urban setting and infant height have a positive impact on the PPVT index of 15-year-old children. In the second cycle, factors such as ethnicity, household wealth index and geographical factors influence the vocabulary of 15-year-old children. Specifically, children with Kinh mothers and children living in households with a higher wealth index have higher vocabulary scores than do 15-year-olds of other ethnic groups.

By contrast, the more crowded the household, the lower the vocabulary ability of children aged 15. Generally, the likelihood of children interacting with their family members increases in a large household, and therefore vocabulary ability also increases. It is possible, however, that in a large household the adults may have to spread resources and care time, so there is less time to interact with children. Therefore, in order to be able to further analyse the influence of household size on a child's vocabulary, it is necessary to take into account the age of household members. Finally, compared to 15-year-old children in the Red River Delta, children in other economic regions, such as the Northern Uplands or Central Coast region, have lower vocabulary scores.

When measuring cognitive ability by math scores and reading comprehension, the results are significantly different from those obtained by testing PPVT vocabulary. Specifically, the results by gender show that 15-year-old boys have lower test scores than 15-year-old girls in both math and reading comprehension in Vietnamese. That the reading comprehension score of girls is higher than that of boys comes as no surprise because girls often have a higher language ability than boys. Math scores that are lower for 15-year-old boys than for girls of the same age need to be analysed more closely. Urban children scored higher in both math and reading tests than rural children.

Similarly, children living in households with a higher wealth index also have higher scores on math and reading tests. This difference can be explained in two ways. Firstly, children in urban areas and children living in better-off households are better cared for and enjoy better nutrition. Consequently, these children develop better physical strength, and their cognitive ability is also higher. Secondly, children in families with a higher wealth index and living in urban areas have greater opportunity to access extra courses, so they will have better test scores for reading and comprehension. While the factor of the mother's height made no difference to the reading comprehension score of 15-year-old children, this factor had a significant influence on the math test results. As expected, we find positive effects of parental education levels on the test scores using the three measurement methods. Finally, considering geographic areas, 15-year-old children living in the Northern Uplands and in the Mekong River Delta had higher reading comprehension scores than 15-year-old children in the Red Delta region.

We further examine factors affecting children's cognitive ability with additional control for conditional wealth. As already mentioned, this factor is measured by the residuals predicted from the regression model based on the household wealth index in 2006 and 2013. Results of detailed estimates are shown in Table 2. When controlling for this residual element of the household wealth changes between the two periods, the results reveal that growth in household wealth has a positive, significant association with children's cognitive development.

The increasing cognitive ability of 15-year-old children using all three measurement methods—PPVT, math and reading scores—is statistically significant. The regression results show that where

TABLE 1 Factors affecting the cognitive ability of 15-year-old children in 2016 (Without control for conditional wealth)

	PPVT	MATHS	READING
Male	−0.160	−0.922***	−1.609***
	(−0.40)	(−3.30)	(−7.38)
Urban	0.287	1.503***	1.434***
	(0.41)	(3.02)	(3.70)
Kinh	5.108***	0.619	1.422***
	(6.08)	(1.03)	(3.05)
Length/height-for-age *z*-score	0.362**	0.148	0.083
	(2.20)	(1.28)	(0.92)
Mother's height	0.009	0.067**	0.024
	(0.23)	(2.32)	(1.09)
Mother's weight	−0.015	−0.047**	−0.029*
	(−0.45)	(−2.03)	(−1.66)
Mother's education level	0.296***	0.315***	0.205***
	(3.79)	(5.74)	(4.78)
Father's education level	0.221***	0.264***	0.158***
	(2.96)	(5.00)	(3.85)
Wealth index in Round 2 (2006)	6.404***	4.491***	3.637***
	(3.90)	(3.90)	(4.04)
Household size	−0.148	−0.011	0.009
	(−1.31)	(−0.13)	(0.16)
Northern Uplands	−1.534*	−0.962*	1.337***
	(−1.94)	(−1.73)	(3.09)
Central Coastal	−5.764***	−0.439	0.288
	(−9.01)	(−0.98)	(0.82)
Mekong River Delta	0.074	0.387	1.614***
	(0.11)	(0.80)	(4.29)
Constant	51.240***	0.169	5.996*
	(8.81)	(0.04)	(1.88)
No. of Obs.	1,760	1,731	1,731
Adjusted R_2	0.235	0.238	0.202
F-Statistics	42	42	35
Prob > *F*	0.000	0.000	0.000

Note: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Sources: Author's calculation from YL data.

other factors remain unchanged, if conditional wealth increases by 1 standard deviation for 5-year-olds, the PPVT, math and reading scores of 15-year-old children will increase by 1.73, 0.99 and 0.75 points, respectively. The explanation may be that household economic improvement provides children with better nutrition and educational opportunities, which in turn increase their cognitive ability. Our

TABLE 2 Factors affecting the cognitive capacity of 15-year-old children, controlling for the residual wealth index from 2006 to 2013

	PPVT	MATHS	READING
Male	0.021	−0.764**	−1.473***
	(0.05)	(−2.58)	(−6.36)
Urban	0.174	2.049***	1.928***
	(0.23)	(3.86)	(4.66)
Kinh	5.819***	1.094*	1.781***
	(6.57)	(1.72)	(3.59)
Height-for-age *z*-score	0.340*	0.165	0.063
	(1.94)	(1.34)	(0.66)
Mother's height	0.018	0.057*	0.018
	(0.41)	(1.85)	(0.76)
Mother's weight	−0.009	−0.041*	−0.028
	(−0.29)	(−1.67)	(−1.47)
Mother's education level	0.369***	0.378***	0.239***
	(4.58)	(6.65)	(5.38)
Father's education level	0.277***	0.268***	0.190***
	(3.54)	(4.82)	(4.39)
Household size	−0.148	−0.029	−0.021
	(−1.23)	(−0.34)	(−0.31)
Northern Uplands	−1.959**	−1.618***	0.724
	(−2.42)	(−2.83)	(1.62)
Central Coastal	−5.691***	−0.747	−0.058
	(−8.54)	(−1.59)	(−0.16)
Mekong River Delta	−0.484	−0.330	1.031***
	(−0.70)	(−0.69)	(2.74)
Ehat_c24_stan	0.930**	0.572*	0.498**
	(2.22)	(1.94)	(2.16)
Constant	51.540***	3.328	8.293**
	(8.42)	(0.77)	(2.46)
No. of Obs.	1,556	1,531	1,531
Adjusted R_2	0.232	0.238	0.202
F-Statistics	37	38	31
Prob > F	0.000	0.000	0.000

Note: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.

Sources: Author's calculation from YL data.

research result is quite similar to the conclusion by Georgiadis and Penny (2017), that the economic development of households after the child has gone through the initial growth stage still has a positive influence on the child's cognitive development.

CONCLUSION AND POLICY IMPLICATION

Exploiting Young Lives data through four rounds of surveys from 2006 to 2016, carried out with 2,000 children in five provinces in Vietnam, we examine factors affecting the cognitive ability of 15-year-old children. Our regression model noted various important characteristics of children at birth as control variables, including household characteristics, height, mother's weight, economic region and, notably, economic development factors in the 2006–2013 period. As already discussed, it is important to control for household wealth changes when estimating factors affecting children's cognitive ability.

In our study, the conditional wealth factor is proxied by the residual of the regression equation of the wealth index in 2006 and 2013. Our research confirms that economic development through change in household wealth in the 2006–2013 period actually had a positive link with the cognitive capacity of 15-year-old children. This result was manifested by all three methods of measurement, according to vocabulary points, math scores and reading comprehension scores in Vietnamese, with a statistical significance of 5% for the vocabulary and 1% for the other two factors (math scores and reading comprehension). This finding once again confirms that late intervention after the first 1,000 days has a positive link with children's cognitive ability. Notably, our finding suggests that economic development plays a key role in enhancing the cognitive ability of children in Vietnam.

We acknowledge that our study has some certain limitations. First, attending additional classes is likely to be a key factor affecting children's test scores, because they may be taught similar content in such classes before taking the test. Accordingly, our econometric model tried to control for the average number of hours attending extra classes each week. Unfortunately, the data for this control variable contain many missing values, accounting for about 36% of the research sample. Consequently, this variable is not included in our analysis. However, we believe that this exclusion may not significantly affect the result, because children attend extra classes to prepare for national examinations, not for the Young Lives' test. Also, this drawback suggests that future research should account for this variable when information about additional class hours becomes available. Second, our study failed to account thoroughly for unobserved factors that may be associated with conditional wealth. This implies that such factors should be accounted for in future work.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this research. The data used in this study come from Young Lives, which is an international study of childhood poverty. Young Lives is core-funded by UK aid from the Department for International Development (DFID), co-funded from 2010 to 2014 by the Netherlands Ministry of Foreign Affairs, and from 2014 to 2015 by Irish Aid. Findings and conclusions in this article are those of the author and do not necessarily reflect positions or policies of NAFOSTED, Young Lives, DFID, or other funders.

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APPENDIX 1

Definition and measurement of included variables

Variable	Description of the variable	Obs	Mean	Std. Dev.	Min	Max
Ppvtr5	Vocabulary scores in round 5	1,865	59.483	9.536	0	75.000
Mathr5	Math scores in round 5	1,829	14.315	6.587	0	30.000
Readr5	Reading scores in round 5	1,832	14.008	5.038	0	25.000
Male	Gender of the children (1 = male; 0 = female)	1,871	0.516	0.500	0	1.000
Urban	Urban area (1 = urban; 0 = rural)	1,871	0.183	0.387	0	1.000
Ethnic	Ethnicity of children (1 = Kinh (majority); 0 = Minority	1,871	0.858	0.349	0	1.000

APPENDIX 1 (*Continued*)

Variable	Description of the variable	Obs	Mean	Std. Dev.	Min	Max
Zhfa	Length/height-for-age *z*-score of children	1,864	−1.123	1.328	- 7.150	9.370
Mother's height	Mother's height (cm)	1,851	52.148	5.905	108.850	178.550
Mother's weight	Mother's weight (kg)	1,851	48.742	7.132	31.200	90.200
Mother's edu	Years of formal schooling	1,854	6.858	3.904	0	16.000
Father's edu	Years of formal schooling	1,823	7.562	3.909	0	16.000
hhsize	Household size	1,871	4.896	1.837	2.000	14.000
Wealth_ ind ~ 2	Wealth index of households in survey round 2 (2006)	1,853	0.489	0.177	0.006	0.935
WEALTH_ ind ~ 4	Wealth index of households in survey round 4 (2013)	1,869	0.612	0.132	0.051	0.902
Region_1	Northern Uplands	1,871	0.199	0.399	0	1.000
Region_2	Red River Delta	1,871	0.207	0.405	0	1.000
Region_3	Central Coastal	1,871	0.390	0.488	0	1.000
Region_4	Mekong River Delta	1,871	0.205	0.404	0	1.000
Ehat_c24_ stan	Residual from wealth index from round 2 to round 4 divided by the standard deviation of wealth index in survey round 2	1,567	0.000	0.503	−2.609	1.976