

# Childhood Circumstances and the Intergenerational Transmission of Socioeconomic Status

Leandro Carvalho

Published online: 3 July 2012  
© Population Association of America 2012

**Abstract** A large literature has documented the intergenerational transmission of socioeconomic status (SES). However, the mechanisms by which SES transmits across generations are still little understood. This article investigates whether characteristics determined in childhood play an important role in the intergenerational transmission. Using data from the Cebu Longitudinal Health and Nutrition Survey, I document the extent to which childhood human capital accounts for the intergenerational SES correlation. My results imply that childhood health and nutrition, cognitive and noncognitive abilities, and early schooling account for between one-third and one-half of the relationship between parents' SES and their offspring's SES.

**Keywords** Intergenerational transmission · Socioeconomic status · Human capital · Childhood · Early life circumstances

## Introduction

A large empirical literature has documented the transmission of socioeconomic status (SES) across generations, showing that children born in high-SES families are more likely to achieve high SES in adulthood (Behrman 1997; Solon 1999). Despite the attention given to the intergenerational transmission of SES, little is known about the mechanisms by which SES transmits across generations (Bowles and Gintis 2002; Solon 1999). Recent studies suggest that characteristics determined during childhood

---

**Electronic supplementary material** The online version of this article (doi:10.1007/s13524-012-0120-1) contains supplementary material, which is available to authorized users.

---

L. Carvalho (✉)  
RAND, 1776 Main Street, Santa Monica, CA 90401, USA  
e-mail: carvalho@rand.org

may play an important role in the intergenerational transmission of SES (Case et al. 2005; Currie 2009; Heckman 2006). The claim relies on consistent empirical evidence showing that (1) children born in higher-SES families are healthier (Case et al. 2002; Currie 2009) and perform better in cognitive and achievement tests (Grantham-McGregor 2007; Paxson and Schady 2007), and (2) these outcomes are important predictors of SES (Currie and Madrian 1999; Heckman et al. 2006; Smith 1999).

In this article, I assess the importance of characteristics that are determined during early childhood as channels for the intergenerational transmission of SES.<sup>1</sup> I use data from the Cebu Longitudinal Health and Nutrition Survey, a longitudinal survey that studies a cohort of Filipino children. The survey collected anthropometric measures (every 2 months for the first 24 months) and administered cognitive ability tests (at ages 8 and 11) and achievement tests (at age 11). The same data were collected for their siblings. Data were also collected on household income, children's schooling and parents' schooling. I first document that children born in higher-SES families accumulate more human capital, as measured by height, weight, cognitive ability, and achievement test scores. I then present evidence that these characteristics are highly predictive of SES in adulthood.

To quantify the importance of childhood circumstances, I present a simple framework that describes how parental SES determines children's human capital, which in turn determines children's SES in adulthood. I then estimate the relationship between parents' SES and their children's SES (henceforth, the intergenerational SES relationship). The association (partly) reflects that children born in higher-SES families accumulate a greater stock of human capital during childhood and are therefore more likely to be economically successful in adulthood. I investigate how much of the intergenerational SES correlation is accounted for by childhood human capital by reestimating the intergenerational SES relationship after adding children's outcome measures to the regression. The reduction in the intergenerational SES relationship provides an estimate of the importance of characteristics determined during early childhood as channels for the intergenerational transmission of SES.

My results suggest that between one-third and one-half of the intergenerational relationship can be accounted for by characteristics that are determined during childhood: namely, health, nutrition, cognitive and noncognitive abilities, and early schooling. They also indicate that channels that affect scores on the achievement test and cognitive test—presumably schooling and cognitive and noncognitive abilities—are more relevant to the intergenerational transmission than channels that affect nutrition and health. It is worth noting that the interpretation of my estimates as causal

---

<sup>1</sup> This article investigates how much of the intergenerational transmission of SES can be explained by the fact that children born to higher-SES parents accumulate more human capital during their early childhood. It is possible that SES may also transmit across generations through other channels; for example, children born to higher-SES parents may inherit nonhuman capital and family "connections." The analysis of these channels is beyond the scope of the current article.

require restrictive structural assumptions (the framework assumes linear human capital and SES production functions) and statistical assumptions. The estimates cannot be interpreted causally if, for example, there are omitted factors that are correlated with parental SES and with children's human capital (e.g., healthier parents may earn higher wages and have healthier children). The least-squares estimates are also biased if there are other factors that are correlated with children's human capital and with children's SES (e.g., children born in better-off families accumulate a greater stock of human capital but also inherit nonhuman capital and family "connections"). This problem can be solved using a fixed-effects approach if the omitted factor is constant across siblings. Using data on siblings, I present results from equations that are estimated with family fixed effects.

Other studies, using data from industrialized countries, have also estimated the contribution of schooling and cognitive ability to the intergenerational transmission of SES. Bowles and Nelson (1974) use U.S. data and find that from 40% to 67% of the covariation between parental SES and their children's income could be accounted for by years of schooling or IQ. Mulligan (1999) considered years of schooling, Armed Forces Qualification Test (AFQT) score, and measures of school quality as transmission mechanisms and found that they explain from one-half to three-fifths of the association between parental income and the log hourly wage of their children. Atkinson et al. (1983) found similar results for the United Kingdom. Eriksson et al. (2005) investigated how much health contributes to the intergenerational transmission using data from a cohort of Danes and their parents; they reported that the association between father's log earnings and offspring's log earnings falls by roughly 25% when health measures are included.

This article improves upon the existing literature in a number of ways. First, it focuses on transmission channels determined during early childhood. Second, the rich data allow me to look at a wide array of channels—health, nutrition, cognitive and non-cognitive abilities, and schooling—and to investigate which of them may be more relevant to the intergenerational transmission. Third, the work studies the topic in the context of poor families living in a developing country, a particularly interesting setting in which the transmission of SES may lead to poverty traps. Fourth, I use years of schooling as a measure of the offspring's SES. Past research has typically used children's income as a measure of SES, which is likely to be problematic because the evidence suggests that the intergenerational elasticity of income depends on the age at which the earnings of the offspring are measured (Solon 1999). Finally, this work improves on the existing literature by providing results that are robust to family-specific, time-invariant omitted heterogeneity.

This article is organized as follows. In the next section, I give an overview of the data and present summary statistics. The third section focuses on the relationship between family SES and children's outcomes. I discuss the estimating equations and the existing empirical evidence from the literature, and then present the estimates. The fourth section studies the intergenerational transmission of socioeconomic status. I present a framework that models how SES transmits across generations, and present the main results and robustness checks. The last section offers some conclusions.

## Data

In my analysis, I use data from the Cebu Longitudinal Health and Nutrition Survey (CEBU). The CEBU is a longitudinal survey that studies a cohort of Filipino children who were born between May 1, 1983 and April 30, 1984. The sample includes all children who were born in one of 33 randomly selected *barangays* in the Metropolitan Cebu area in the Philippines; a *barangay* is the smallest administrative division in the Philippines, corresponding to a village or district.<sup>2</sup> A baseline interview was conducted with 3,327 pregnant women during the sixth or seventh month of pregnancy. These women delivered a total of 3,073 nontwin live births. An interview was conducted immediately after birth, and follow-up interviews were conducted bimonthly for the child's first 24 months. Follow-up surveys were also conducted in 1991–1992, 1994–1995, 1998–1999, 2002 and 2005.

The survey collected extensive data on the cohort children and their families, including health, demographic, and socioeconomic data. Anthropometric data were collected bimonthly for the first 24 months and in the follow-up surveys. Approximately 2,600 children were followed for the first two years. Children were administered a cognitive ability test in the 1991–1992 and 1994–1995 survey rounds, when they were 8 and 11 years old, respectively.

The Philippines Nonverbal Intelligence Test was designed to assess analytic and reasoning skills and was developed specifically for the Philippines (Guthrie et al. 1977). The test is composed of a series of 100 cards, each card containing five different drawings. Children are asked to indicate the card that is different from the others.<sup>3</sup> In the 1994–1995 survey round, children took math, English, and Cebuano achievement tests.

The 1994–1995 survey round also collected anthropometric data and cognitive and achievement test scores for the younger siblings of the cohort children. The most recent follow-up survey for which data are available was conducted in 2005, when the individuals from the cohort were 21 years old. They responded to an extensive set of questions, providing information on their schooling, employment, and earnings. They also reported their siblings' schooling.

Summary statistics are presented in Table 1. The sample excludes multiple births. The first rows of the table show means for the variables that measure parental SES. The average annual household income for the sample is approximately 85,000 pesos in 2001 prices, which corresponds to 1,667 US dollars according to the exchange rate and to 4,250 US dollars according to the PPP exchange rate.<sup>4</sup> The average education of the father and the mother is 7.5 and 7.2 years of schooling, respectively. The next rows report means for children's outcomes. Children weighed, on average, 3 kilos when weighed at the interview immediately after birth. Less than 10% of children

---

<sup>2</sup>For budgetary reasons, the survey used a single-stage cluster sampling; 33 *barangays* (17 urban, 16 rural) were randomly selected among 243 *barangays*.

<sup>3</sup>Children are given no time limit to answer each question, and the difficulty of the questions increases throughout the test.

<sup>4</sup>These figures were converted using the 2007 World Development Indicators by the World Bank.

**Table 1** Descriptive statistics

	Boys		Girls	
	Mean	SD	Mean	SD
<b>Parental SES</b>				
ln (Household income)	10.8	(0.79)	10.8	(0.78)
Mother's education	7.2	(3.37)	7.1	(3.23)
Father's education	7.5	(3.57)	7.3	(3.40)
<b>Children's Outcomes</b>				
Birth weight (kilos)	3.0	(0.45)	3.0	(0.43)
Height at 24 months (cm)	79.9	(3.58)	78.3	(3.63)
Weight at 24 months (kilos)	10.1	(1.25)	9.4	(1.12)
Cognitive score at age 8 (out of 100)	50.9	(12.69)	52.0	(12.25)
English score at age 11 (out of 60)	25.3	(10.08)	29.6	(10.51)
Math score at age 11 (out of 60)	28.9	(10.68)	32.7	(10.90)
Years of schooling at age 21	9.8	(3.33)	11.1	(2.77)
Height at age 21 (m)	1.63	(0.06)	1.51	(0.06)
Self-reported health at age 21	2.1	(0.44)	2.1	(0.48)
Log earnings at age 21	6.8	(0.63)	6.6	(0.83)
<b>Control Variables</b>				
Mother's height	150.8	(5.15)	150.8	(5.07)
Mother's age at baseline	26.4	(6.02)	26.1	(5.89)
Urban	0.8	(0.42)	0.8	(0.43)
Household family size at baseline	6.6	(2.71)	6.6	(2.85)

*Notes:* The table reports means and standard deviations of variables for boys and girls from the cohort. The sample includes all children who were nontwins.

were wasted (not shown in the table).<sup>5</sup> At 2 years old, boys weighed, on average, 10.1 kilos and were 80 cm tall; girls weighed, on average, 9.4 kilos and measured 78.3 cm. At 24 months, 67.9% of children were stunted and 37.3% were wasted.

The table also reports means for information collected at the last survey round, when individuals from the cohort were 21 years old. At the time, men and women had, on average, 9.8 and 11.1 years of schooling, respectively. The weekly log earnings was 6.8 for men and 6.6 for women. Regarding self-reported health status, 7.3% assessed their health status as poor, 78.7% as good, and 14% as excellent. Finally, the last rows report the means for some of the control variables. Mothers were, on average, 26 years old at the 6th month of pregnancy and measured 150.8 cm. The average household size was 6.6, and 80% of households lived in urban barangays. The online supplement ([Online Resource 1](#)) includes a detailed description of how the variables used in the empirical analysis were constructed.

Finally, it is worth discussing the variables used in the empirical analysis to measure parental and children's SES. Because the accumulation of children's human capital (which is proxied in my analysis by height, weight-for-height, and scores on cognitive ability and achievement tests) that will ultimately determine children's SES is a continuous process over a number of years, long-run parental SES is presumably more important in affecting children's human capital than short-run parental SES. For this reason, I use as measures of parental (long-run) SES the following variables:

<sup>5</sup> Stunting and wasting were defined as a height-for-age and weight-for-age below 2 standard deviations based on the World Health Organization reference data.

mother's years of schooling, father's years of schooling, and log household income, where household income is calculated as the average of household income measured at the sixth month of pregnancy and when the child was 12 and 24 months old (the average is taken over all waves for each household with nonmissing income data). Later, I discuss results calculated using alternative measures of parental SES. I use two variables to measure children's SES: years of schooling and log earnings, both of which were measured at age 21. In an upcoming section, I discuss the appropriateness of these two measures.

## The Impact of Being Born in a Lower-SES Family

### The Relationships to Be Estimated

I start by documenting the association between parental SES and the following children's outcomes: birth weight, height-for-age, and weight-for-age at 24 months, the score on a cognitive test taken at age 8, and the scores on math and English achievement tests taken at age 11. These outcome measures are seen as determined by latent variables—namely, health, nutrition, cognitive and noncognitive abilities, and early schooling—which are potential mechanisms by which SES transmits across generations.

In this section, I present the equations to be estimated and discuss the existing evidence on the relationships of interest. The results are presented in the next section. As the discussion below makes clear, I explore the timing of the events to mitigate concerns about reverse causality biases. Nevertheless, there are concerns that the associations may reflect third-factor explanations. In this sense, the estimates presented are not meant to be interpreted as causal estimates. Evidence about causal relationships comes from the literature discussed in this section. The reduced-form estimates presented in the next section document the basic facts in the context of the article's sample.

The first equation shows the association between early childhood health and nutrition ( $h$ ) and parental socioeconomic status ( $SES$ ):

$$h_i = \gamma_0^h + SES_i \gamma_1^h + \varepsilon_i^h. \quad (1)$$

I use height and weight measured at 24 months as measures of childhood health and nutrition. Parental SES is measured by household long-term income and by father's and mother's education. By focusing on early childhood health, I rule out the channel running from cognitive ability and schooling to health.

Starting with Caldwell (1979), a large literature has shown a positive correlation between maternal education and children's health in developing countries (Glewwe 1999; Handa 1999; Thomas et al. 1991). Breierova and Duflo (2004) provided evidence that this relationship is causal. It has been suggested that educated mothers better protect their children's health because they (1) better diagnose and treat their children's health problems, (2) are more receptive to modern medical treatments, and/or (3) have better health care practices.

Evidence also suggests that children born in wealthier households are healthier. Case et al. (2002) documented an association between family income and children's health using U.S. data. Children born in wealthier households may be healthier than children born in poor households because wealthy parents can afford higher-quality medical care and better nutrition and because of a healthier disease environment. Then again, parental characteristics correlated with family income may determine children's health and therefore could potentially account for the association. Duflo (2000) provided evidence on the causal relationship between household income and children's health.

The second equation describes the relationship between childhood cognitive ability ( $\theta$ ), parental SES, and child health:

$$\theta_i = \gamma_0^\theta + SES_i \gamma_1^\theta + \gamma_2^\theta h_i + \varepsilon_i^\theta. \quad (2)$$

I use the score on a cognitive ability test administered at age 8 as a proxy for cognitive ability. I assume that early childhood cognitive ability does not depend on schooling. Otherwise, the coefficients on parental SES and child health may be positively biased because of an omitted variable bias.

Consistent evidence has shown a relationship between nutrition and cognitive development. Grantham-McGregor et al. (2007) reviewed the existing empirical evidence, which (for the causal relationship) comes from randomized nutrition interventions. They showed that undernourished children improved their cognitive scores after receiving nutrition supplements (Grantham-McGregor et al. 1991; Martorell et al. 2005).

The evidence also shows a positive (noncausal) relationship between parental socioeconomic status and children's cognitive ability. A large literature has investigated this relationship for children in the United States (Aughinbaugh and Gittleman 2003; Baum 2003; Guo and Harris 2000; Ruhm 2004; Smith et al. 1997; Taylor et al. 2004; Waldfogel et al. 2002). Paxson and Schady (2007) documented an association between family SES and cognitive development among poor children in Ecuador. Children born in high-SES families may have more resources available and may be more cognitively stimulated. It is also possible that parents' cognitive ability drives both children's cognitive ability and parental SES.

The next equation shows the relation between early schooling ( $s$ ), parental SES, health, and cognitive ability:

$$s_i = \gamma_0^s + SES_i \gamma_1^s + \gamma_2^s h_i + \gamma_3^s \theta_i + \varepsilon_i^s. \quad (3)$$

I use the scores on the math and English achievement tests administered at age 11 as measures of early schooling. Glewwe and Miguel (2008), in a review of the literature on the relationship between child health and educational outcomes, concluded that there is growing evidence of a causal effect of child health on education. Healthy children may learn more because they stay in school longer, because they have a higher attendance rate in school, or because they are more efficient in learning.

Finally, a large literature has documented a positive relationship between mother's education and her children's education in developing countries (Behrman 1997). Evidence also suggests an association between parents' income and wealth on the one hand and children's education on the other (Behrman and Knowles 1997; Filmer and

**Table 2** Health and parental socioeconomic status

	Birth	Height-for-Age			Weight-for-Age		
	Weight	at 24 Months			at 24 Months		
	All	All	Boys	Girls	All	Boys	Girls
ln (Household income)	0.0750** (0.03)	0.196** (0.03)	0.199** (0.04)	0.188** (0.05)	0.237** (0.03)	0.242** (0.04)	0.231** (0.05)
Mother's Education	0.0124† (0.01)	0.0515** (0.01)	0.0531** (0.01)	0.0499** (0.01)	0.0441** (0.01)	0.0443** (0.01)	0.0432** (0.01)
Father's Education	0.005 (0.01)	0.0392** (0.01)	0.0384** (0.01)	0.0409** (0.01)	0.0362** (0.01)	0.0331** (0.01)	0.0399** (0.01)
N	2,908	2,447	1,288	1,159	2,446	1,291	1,155

*Notes:* Numbers in parentheses are robust standard errors. Each regression includes mother's height, log of family size, an urban indicator, and a set of barangay indicator variables—all of which were collected during the baseline survey—as well as mother's age and mother's age squared at child's birth. The dependent variable in the first regression is the Z score of birth weight normalized within the sample. The dependent variables in the other regressions are the height and weight Z scores measured at 24 months, which were also normalized within the sample. *Household income* is the average of household income measured at baseline and in the 12-month and 24-month follow-ups (the controls include three indicators for whether household income was missing at any round). The sample is restricted to children who have nonmissing values for all the variables included in the regression and who are not twins. An indicator was created for fathers who did not cohabit with the mother during the baseline survey, and for these fathers, education was set equal to sample average education.

† $p < .10$ ; \*\* $p < .01$

Pritchett 1999). More recently, a number of articles have attempted to estimate causal effects of parents' SES on their children's schooling (Behrman and Rosenzweig 2002; Black et al. 2005b; Chevalier 2004; Plug 2004; Plug and Vijverberg 2005; Sacerdote 2007).

## Empirical Results

Table 2 estimates the relationship between childhood health/nutrition and parental SES (Eq. 1). The first column reports the results from a regression of birth weight Z score on parental SES. An increase in 10% in household income corresponds to an increase in birth weight by 0.75% of a standard deviation. One additional year of mother's education represents an increase by 1.2% of a standard deviation. However, the relationship between parental SES and children's health may change as children age (Case et al. 2002); thus, in the remaining columns of Table 2, I document the association between parental SES and children's height-for-age and weight-for-age at 24 months old.

Children born to higher-SES parents are healthier at age 2.<sup>6</sup> A 10% increase in household income corresponds to an increase in height and weight by 2% of a

<sup>6</sup>Height-for-age and weight-for-age at 24 months are strongly correlated with birth weight even after parental SES is controlled for (results not shown in the table).



standard deviation. One additional year of mother's or father's education represents an increase by 4% of a standard deviation.

As discussed earlier, the empirical evidence suggests that children born to wealthier parents may achieve higher SES because they also tend to have higher cognitive ability. Table 3 shows estimates of the association between children's cognitive ability and parental SES. The dependent variable is the normalized score on a cognitive test.

Children born in higher-SES families obtain higher scores in the cognitive test: a 10% increase in household income is associated with an increase in the cognitive test score by 1.3% of a standard deviation. Cognitive ability is also associated with birth weight: a 1 standard deviation increase in birth weight increases the cognitive test score by 9% of a standard deviation. Columns 3 and 4 investigate how the relationship between parental SES and children's cognitive ability changes when height-for-age and weight-for-height at 24 months are included in the regression. Taller children perform better on the cognitive test: an increase in height by 1 standard deviation corresponds to an increase in the cognitive test score by 18% of a standard deviation. Similarly, an increase by 1 standard deviation in weight-for-height is associated with an increase in the cognitive test score by 7% of a standard deviation. After the

**Table 3** Childhood cognitive ability and health and parental SES

	Standardized Cognitive Ability Score at Age 8					
	All	All	All	All	Boys	Girls
Weight-for-Height at 24 Months	--	--	--	0.0708** (0.02)	0.0603* (0.03)	0.0835* (0.04)
Height-for-Age at 24 Months	--	--	0.193** (0.02)	0.179** (0.02)	0.121** (0.03)	0.245** (0.03)
Birth Weight	--	0.0862** (0.02)	--	--	--	--
ln (Household income)	0.126** (0.03)	0.120** (0.03)	0.0945** (0.03)	0.0862** (0.03)	0.148** (0.04)	0.01 (0.05)
Mother's Education	0.0481** (0.01)	0.0464** (0.01)	0.0387** (0.01)	0.0386** (0.01)	0.0402** (0.01)	0.0381** (0.01)
Father's Education	0.0596** (0.01)	0.0598** (0.01)	0.0520** (0.01)	0.0512** (0.01)	0.0454** (0.01)	0.0565** (0.01)
<i>N</i>	2,096	2,094	2,096	2,096	1,113	983

*Notes:* Numbers in parentheses are robust standard errors. Each regression includes mother's height, log of family size, an urban indicator, and a set of barangay indicator variables—all of which were collected during the baseline survey—as well as mother age and mother age squared at child's birth date. The dependent variable is the score on a cognitive test administered at age 8, which is normalized within the sample. *Weight-for-height at 24 months* is the Z score of weight-for-height calculated based on WHO growth standards. *Height at 24 months* is height measured at 24 months normalized within the sample. *Birth weight* is birth weight normalized within the sample. *Household income* is the average of household income measured at baseline and in the 12-month and 24-month follow-ups (the controls include three indicators for whether household income was missing at any round). The sample is restricted to children who have nonmissing values for all of the variables included in the regression and who are not twins. An indicator was created for fathers who did not cohabit with the mother during the baseline survey, and for these fathers, education was set equal to sample average education.

\* $p < .05$ ; \*\* $p < .01$

anthropometric measures are included, the coefficients on household income and parental education reduce by 14% or more, suggesting that parental SES has an indirect effect on cognitive ability through childhood health. The last two columns report separate results for boys and girls.

Finally, children born in disadvantaged backgrounds may fare worse in the labor market because they achieve fewer years of schooling and the quality of the education they receive is lower. Table 4 presents estimates of the association between scores on achievement tests and parental SES. The scores are expected to reflect early schooling and cognitive and noncognitive abilities (Hansen et al. 2004).

As expected, parental SES and the scores are strongly related. A 10% increase in household income is associated with an increase in the math and English test scores by 1.2% of a standard deviation. In the remaining columns, anthropometric measures and the score on the cognitive test are added to the regression. The results suggest that healthier children with higher cognitive ability have higher early schooling: an increase by 1 standard deviation in the cognitive test score is associated with an increase by 47% of a standard deviation in the math score and 40% of a standard deviation in English score. The fourth and eighth columns illustrate that the effect of parental SES works, in part, indirectly through health, nutrition, and cognitive

**Table 4** Achievement tests, childhood health, cognitive ability, and parental SES

	Math at Age 11				English at Age 11			
Cognitive Ability at Age 8	--	--	--	0.471** (0.02)	--	--	--	0.402** (0.02)
Weight-for-Height at 24 Months	--	--	0.0604** (0.02)	0.0396* (0.02)	--	--	0.0547* (0.02)	0.0332† (0.02)
Height-for-Age at 24 Months	--	0.164** (0.02)	0.152** (0.02)	0.0688** (0.02)	--	0.188** (0.02)	0.177** (0.02)	0.105** (0.02)
ln (Household income)	0.117** (0.03)	0.0942** (0.03)	0.0867** (0.03)	0.0479† (0.03)	0.103** (0.03)	0.0755* (0.03)	0.0687* (0.03)	0.0335 (0.03)
Mother's Education	0.0637** (0.01)	0.0554** (0.01)	0.0550** (0.01)	0.0357** (0.01)	0.0785** (0.01)	0.0690** (0.01)	0.0686** (0.01)	0.0524** (0.01)
Father's Education	0.0623** (0.01)	0.0566** (0.01)	0.0563** (0.01)	0.0334** (0.01)	0.0625** (0.01)	0.0558** (0.01)	0.0554** (0.01)	0.0356** (0.01)
<i>N</i>	1,969	1,969	1,969	1,969	1,996	1,996	1,996	1,996

*Notes:* Numbers in parentheses are robust standard errors. Each regression includes mother's height, log of family size, an urban indicator, and a set of barangay indicator variables—all of which were collected during the baseline survey—as well as mother age and mother age squared at child's birth date. The dependent variables are the standardized scores on achievement tests on math and English administered at age 11. *Cognitive ability* is the score on a cognitive test administered at age 8, which is normalized within the sample. *Weight-for-height at 24 months* is the Z score of weight-for-height calculated based on WHO growth standards. *Height at 24 months* is height measured at 24 months normalized within the sample. *Household income* is the average of household income measured at baseline and in the 12-month and 24-month follow-ups (the controls include three indicators for whether household income was missing at any round). The sample is restricted to children who have nonmissing values for all of the variables included in the regression and who are not twins. An indicator was created for fathers who did not cohabit with the mother during the baseline survey, and for these fathers, education was set equal to sample average education.

†*p* < .10; \**p* < .05; \*\**p* < .01

ability. After the outcome measures are included, the coefficients on parental SES fall by roughly 50%.

### The Intergenerational Transmission of SES

My interest is in assessing the importance of characteristics determined in early childhood as channels for the intergenerational transmission of SES. The results in the previous section showed that children born in higher-SES families, on average, are healthier, have higher cognitive ability, and obtain higher scores in achievement tests. The upcoming empirical analysis in this section will provide evidence that these characteristics are highly predictive of SES in adulthood, hinting at the importance of childhood circumstances in transmitting SES. One key question, however, is how important these channels are. Quantifying the importance of childhood circumstances requires assumptions about the relationship between children’s human capital and their SES in adulthood and about the relationship between parental SES and children’s human capital. In the next subsection, I present the framework that is used to quantify the importance of childhood circumstances. The upcoming section on robustness investigates the sensitivity of the results to some of the framework’s assumptions.

#### The Model

The model posits that children born in higher-SES families accumulate more human capital and that children with a greater stock of human capital are more likely to be economically successful in adulthood. The SES of the cohort children as they reach adulthood is given by the following equation:

$$y_i^c = \alpha_0 + (x_i^c)' \alpha_1 + (y_i^p)' \alpha_2 + u_i^c, \tag{4}$$

where  $y_i^c$  is a measure of the SES in adulthood of the cohort child born to family  $i$ ,  $x_i^c$  is a column vector with measures of this child’s human capital in early childhood (i.e., health and nutrition, cognitive ability, noncognitive ability, and early schooling),  $y_i^p$  is a column vector with measures that reflect the SES of parents of family  $i$  (e.g., parents’ education and log household income), and  $u_i^c$  is an error term.

The model also postulates that childhood human capital depends on parental SES:

$$x_i^{k,c} = \beta_0^k + (\beta_1^k)' y_i^p + v_i^{k,c}, \tag{5}$$

where  $k$  indexes the different dimensions of human capital, and  $v_i^{k,c}$  is an error term. Substituting Eq. 5 into Eq. 4 yields:

$$y_i^c = \alpha_0 + \beta_0' \alpha_1 + (y_i^p)' (\beta_1' \alpha_1 + \alpha_2) + (v_i^c)' \alpha_1 + u_i^c, \tag{6}$$

where  $\beta_0$  is a column vector whose  $k$ th element is  $\beta_0^k$ , and  $\beta_1$  is a matrix whose  $k$ th row is the row vector  $\beta_1^{k'}$ .<sup>7</sup>

Equation 6 captures that the accumulation of childhood human capital is one channel through which SES transmits across generations. In the model,  $\beta_1' \alpha_1$  is the effect of parental SES on children’s SES working through childhood human capital. The goal of the empirical strategy is to estimate  $\beta_1' \alpha_1$ . I propose two alternative empirical strategies to estimate the parameter of interest.

The first strategy involves estimating the reduced-form equation (Eq. 6) and the structural equation (Eq. 4). Under standard assumptions—namely, that there is mean independence between  $v_i^c$  and  $y_{i,p}$  and that there is mean independence between  $u_i^c$ ,  $x_i^c$  and  $y_i^p$  (i.e., (A1)  $E[v_i^c | y_i^p] = 0$  and (A2)  $E[u_i^c | y_i^p, x_i^c] = 0$ )—the difference between the coefficients on  $y_i^p$  estimated from the reduced-form equation (Eq. 6) and from the structural equation (Eq. 4) provides an unbiased estimate of  $\beta_1' \alpha_1$ . Notice that the unbiasedness of this estimator requires that the OLS estimate of Eq. 4 is unbiased. The least squares estimate of Eq. 4 is biased, for example, if there is family-specific omitted heterogeneity that determines children’s SES in adulthood and is correlated with childhood human capital. In this particular case, one can still obtain an unbiased estimate of  $\beta_1' \alpha_1$  by using a fixed-effects approach.

The second empirical strategy uses within-family variation to estimate the parameter of interest. More formally, let us consider the case in which families have two children. Assume that  $u$  can be decomposed in the following way:

$$u_i^j = \mu_i + \varepsilon_i^j \text{ for } j \in \{c, s\}, \tag{9}$$

where  $\mu_i$  is a family fixed effect,  $u_i^c$  is the error term of the cohort child born to family  $i$ , and  $u_i^s$  is the error term of the sibling of the cohort child; I use the superscript  $s$  to index the sibling of the cohort child. Differencing out Eq. 4 across siblings yields the following equation:

$$y_i^c - y_i^s = (x_i^c - x_i^s) \alpha_1 + \varepsilon_i^c - \varepsilon_i^s. \tag{10}$$

Hence,  $\alpha_1$  can be consistently estimated as long as  $E[\varepsilon_i^j | x_i^l] = 0$  with  $j, l = \{c, s\}$ .

The estimation using the second empirical strategy involves two steps. Using data on the cohort children and their siblings, I first estimate the relationship between children’s SES in adulthood and childhood human capital using within-family variation (Eq. 10). In a second step, I estimate the association between childhood human capital and parental SES through OLS (Eq. 5). The estimator of  $\beta_1' \alpha_1$  is the

<sup>7</sup>The system of Eq. 5 can be rewritten in matrix form as follows:

$$x_i^c = \beta_0 + \beta_1 y_i^p + v_i^c, \tag{7}$$

where

$$x_i^c = \begin{pmatrix} x_i^{1,c} \\ \vdots \\ x_i^{K,c} \end{pmatrix}; \beta_0 = \begin{pmatrix} \beta_0^1 \\ \vdots \\ \beta_0^K \end{pmatrix}; \beta_1 = \begin{pmatrix} \beta_1^{1'} \\ \vdots \\ \beta_1^{K'} \end{pmatrix}; \text{ and } v_i^c = \begin{pmatrix} v_i^{1,c} \\ \vdots \\ v_i^{K,c} \end{pmatrix}. \tag{8}$$

product of these two estimates. More formally, it is equal to  $\widehat{\beta}'_1 \widehat{\alpha}_1$ , where  $\widehat{\beta}_1$  and  $\widehat{\alpha}_1$  are the estimates obtained from estimating Eqs. 5 and 10.

Finally, it is worth discussing the assumption that there is mean independence between  $\nu_i^c$  and  $y_{i,p}$ . This assumption is violated if there are omitted factors that are correlated with children’s human capital and with parental SES. The problem could be solved if there were an instrument for parental SES that was orthogonal to  $\nu$ , but no plausible instruments are available in this context. Therefore, I assume throughout the analysis that this assumption holds.

### Empirical Results

In this section, I investigate whether characteristics that are determined during early childhood are potential channels by which SES transmits across generations. The first exercise, shown in Tables 5, 6, and 7, consists of (1) estimating the reduced-form

**Table 5** Schooling, childhood cognitive ability and health, and parental SES

	Years of Schooling at Age 21						
	All	All	All	All	All	Boys	Girls
Math at Age 11	--	--	--	--	0.938** (0.10)	0.936** (0.14)	0.937** (0.15)
English at Age 11	--	--	--	--	0.469** (0.10)	0.492** (0.14)	0.478** (0.15)
Cognitive Ability at Age 8	--	--	--	0.760** (0.07)	0.168* (0.08)	0.259* (0.11)	0.04 (0.10)
Weight-for-Height at 24 Months	--	--	0.09 (0.07)	0.04 (0.07)	-0.02 (0.06)	0.04 (0.09)	-0.04 (0.09)
Height-for-Age at 24 Months	--	0.465** (0.07)	0.447** (0.07)	0.319** (0.07)	0.191** (0.07)	0.239* (0.10)	0.154† (0.09)
ln (Household income)	0.334** (0.10)	0.273** (0.10)	0.264* (0.10)	0.224* (0.10)	0.148† (0.09)	0.10 (0.12)	0.219† (0.13)
Mother’s Education	0.243** (0.03)	0.221** (0.02)	0.220** (0.02)	0.191** (0.02)	0.128** (0.02)	0.129** (0.03)	0.121** (0.03)
Father’s Education	0.195** (0.02)	0.180** (0.02)	0.179** (0.02)	0.140** (0.02)	0.0904** (0.02)	0.0981** (0.03)	0.0647* (0.03)
Incremental Contribution of Parental SES to Adjusted R <sup>2</sup>	0.1690	0.1260	0.1240	0.0797	0.0313	0.0283	0.0309
N	1,714	1,714	1,714	1,714	1,714	900	814

Notes: Numbers in parentheses are robust standard errors. The dependent variable is years of schooling at age 21. *Math* and *English* are the scores on achievement tests administered at age 11. *Cognitive ability* is the score on a cognitive test administered at age 8. *Weight-for-height at 24 months* is the Z score of weight-for-height calculated based on WHO growth standards. *Height at 24 months* is height measured at 24 months normalized within the sample. *Household income* is the average of household income measured at baseline and in the 12-month and 24-month follow-ups (the controls include three indicators for whether household income was missing at any round). The sample is restricted to children who have nonmissing values for all of the variables included in the regression and who are not twins. See the footnote to Table 2 for a description of the set of controls.

†  $p < .10$ ; \*  $p < .05$ ; \*\*  $p < .01$

**Table 6** Log earnings, schooling, childhood cognitive ability, and health

	Log Earnings at Age 21						
Schooling	--	--	--	--	--	0.0408** (0.01)	0.0350** (0.01)
Math	--	--	--	--	0.0968** (0.03)	--	0.0637† (0.03)
English	--	--	--	--	-0.001 (0.04)	--	-0.019 (0.04)
Cognitive Ability at Age 8	--	--	--	0.0809** (0.03)	0.039 (0.03)	0.0511† (0.03)	0.035 (0.03)
Weight-for-Height at 24 Months	--	--	0.020 (0.02)	0.013 (0.02)	0.010 (0.02)	0.011 (0.02)	0.009 (0.02)
Height-for-Age at 24 Months	--	0.0613** (0.02)	0.0573* (0.02)	0.0443† (0.02)	0.034 (0.02)	0.030 (0.02)	0.027 (0.02)
ln (Household income)	0.044 (0.03)	0.036 (0.03)	0.035 (0.03)	0.029 (0.03)	0.026 (0.03)	0.023 (0.03)	0.023 (0.03)
Mother's Education	0.0327** (0.01)	0.0301** (0.01)	0.0300** (0.01)	0.0275** (0.01)	0.0243** (0.01)	0.0197* (0.01)	0.0195* (0.01)
Father's Education	0.007 (0.01)	0.005 (0.01)	0.005 (0.01)	0.001 (0.01)	-0.003 (0.01)	-0.006 (0.01)	-0.007 (0.01)
Incremental Contribution of Parental SES to Adjusted R <sup>2</sup>	0.0233	0.0166	0.0163	0.0104	0.0061	0.0027	0.0026
N	1,250	1,250	1,250	1,250	1,250	1,250	1,250

Notes: Numbers in parentheses are robust standard errors. The dependent variable is log earnings at age 21. *Math* and *English* are scores on tests administered at age 11. *Cognitive ability* is the score on a cognitive test administered at age 8. *Weight-for-height at 24 months* is the Z score of weight-for-height calculated based on WHO growth standards. *Height at 24 months* is height measured at 24 months normalized within the sample. *Household income* is the average of household income measured at baseline and in the 12-month and 24-month follow-ups (the controls include three indicators for whether household income was missing at any round). The sample is restricted to children who have nonmissing values for all of the variables included in the regression and who are not twins. See the footnote to Table 2 for a description of the set of controls.

†*p* < .10; \**p* < .05; \*\**p* < .01

relationship between children’s SES and parental SES (Eq. 6) and (2) examining how this relationship changes once children’s outcome measures are added to the regression (Eq. 4). Two measures of SES for the youngest generation are used: years of schooling and log earnings measured at age 21.

Table 5 presents results for years of schooling. The first column estimates the association between parental SES and children’s schooling. A 10% increase in family income corresponds to a 0.03 increase in years of children’s schooling; a one-year increase in mother’s or father’s schooling is associated with roughly a 0.2 increase in years of children’s schooling. On the one hand, these associations reflect individual traits for which there is strong parent-offspring similarity (e.g., geographical location, race, and physical appearance). On the other hand, they reflect that children born to higher-SES parents accumulate more human capital and are, therefore, more likely to be economically successful. The penultimate row of the table reports the incremental contribution of parental SES to the adjusted R<sup>2</sup>: 0.17.

**Table 7** Health in early adulthood, childhood health, and parental SES

	Height-for-Age at 21		Self-reported Health			
Weight-for-Height at 24 Months	--	--	--	--	--	0.0901* (0.04)
Height-for-Age at 24 Months	--	--	--	--	0.0029 (0.04)	-0.0153 (0.04)
Birth Weight	--	0.248** (0.03)	--	0.0251 (0.03)	--	--
ln (Household income)	0.0364 (0.04)	0.0168 (0.04)	0.0550 (0.05)	0.0530 (0.05)	0.0546 (0.05)	0.0444 (0.05)
Mother's Education	0.0252* (0.01)	0.0211* (0.01)	0.0085 (0.01)	0.0080 (0.01)	0.0083 (0.01)	0.0081 (0.01)
Father's Education	0.0233* (0.01)	0.0228* (0.01)	0.0070 (0.01)	0.0069 (0.01)	0.0069 (0.01)	0.0059 (0.01)
Incremental Contribution of Parental SES to Adjusted R <sup>2</sup>	0.0178	0.0129	--	--	--	--
N	1,768	1,768	1,771	1,771	1,771	1,771

*Notes:* Numbers in parentheses are robust standard errors. The dependent variables measured at age 21 are height (normalized within the sample) and self-reported health (poor = 1; good = 2; excellent = 3). Each regression includes mother's height, log of family size, an urban indicator, and a set of barangay indicator variables—all of which were collected during the baseline survey—mother's age and mother's age squared at child's birth, dummy variables for sex, and an indicator for whether the woman was pregnant. *Weight-for-height at 24 months* is the Z score of weight-for-height calculated based on WHO growth standards. *Height-for-age at 24 months* is height measured at 24 months normalized within the sample. *Birth weight* is birth weight normalized within the sample. *Household income* is the average of household income measured at baseline and in the 12-month and 24-month follow-ups (the controls include three indicators for whether household income was missing at any round). The sample is restricted to children who have nonmissing values for all of the variables included in the regression and who are not twins. An indicator was created for fathers who did not cohabit with the mother during the baseline survey, and for these fathers, education was set equal to sample average education.

\**p* < .05; \*\**p* < .01

The results in Table 5 suggest that childhood health and nutrition, cognitive and noncognitive abilities, and early schooling are channels by which SES transmits across generations. When children's outcome measures are gradually included in the regression, the explanatory power of parental SES is reduced. In comparing the first and fifth columns, for example, the coefficient on log household income decreases from 0.33 to 0.15, and the coefficients on mother's and father's schooling decrease from 0.24 to 0.13 and from 0.20 to 0.09, respectively. Children born in higher-SES families are healthier and more fully develop their cognitive potential. As a consequence, they reach adulthood with a greater stock of human capital and are better positioned for socioeconomic success. Similarly, children born to higher-SES parents have better schooling and achieve higher SES themselves. When measures of early schooling (standardized scores on math and English achievement tests) are included in column 4, the estimated coefficients on parental SES decrease by half relative to the baseline (column 1). More importantly, the incremental contribution of parental SES to the adjusted R<sup>2</sup> declines from 0.17 to 0.03.

Table 6 uses log earnings as a measure of socioeconomic status. The first column shows the persistence in SES across generations. An additional year of mother's schooling corresponds to a 3% increase in log earnings. Household income and father's education are not statistically significant. The remaining columns include the children's outcome measures. Adult children with higher scores on the math test and with higher completed schooling earn higher wages.

The use of earnings at age 21 as a proxy for children's long-run SES is, however, not without its problems. First, selection into the labor market is an issue: some individuals may not join the labor force or may drop out of it to continue their studies or to have children. Second, data are missing for workers who are in the labor force but are unemployed. Third, earnings at age 21 may not be reflective of long-run SES if the earnings-age profile varies with SES. Indeed, the returns to schooling in our data are below 4%, which potentially could be explained by the fact that workers with lower levels of education join the labor market earlier and thus have more experience. The workers in our data are all of the same age, and the returns to experience are confounded with returns to education. For these reasons, years of schooling at age 21 seems to be a better proxy for children's long-run SES than log earnings at age 21. In what follows, I use years of schooling as the measure of children's SES.

Besides achieving higher SES, children born to higher-SES parents may enjoy higher welfare in adulthood because they are healthier (Becker et al. 2005). In Table 7, I study the relationship between parental SES and health in early adulthood. Two health outcome measures are used: height and self-reported health status (poor = 1, good = 2, excellent = 3).

Table 7 shows that there is a strong association between parental SES and children's height at age 21. However, there is no association between parental SES and children's self-reported health. In columns 5 and 6, I include measures of childhood health—height-for-age and weight-for-height at 24 months—in the regression. Only weight-for-height at 24 months is predictive of self-reported health.

The analysis shown so far suggests that childhood health, nutrition, cognitive and noncognitive abilities, and early schooling are important channels by which SES transmits across generations. There is, however, an alternative way to present the results that provides a measure of their importance for the intergenerational transmission. The first column of Table 8 reports the (partial) correlations between children's schooling on the one hand and log household income, mother's education, and father's education on the other: they are, respectively, 0.07, 0.27 and 0.2. These figures correspond to the normalized regression coefficients from a regression of children's years of schooling on the measures of parental SES. The remaining columns investigate how the intergenerational correlations change as children's outcome measures are added to the regression. Panel A presents results without controls, while panel B presents results with controls.

The results indicate that the proposed channels can explain as much as 50% of the intergenerational transmission of SES. The last column of panel A shows that, after all the children's outcome measures are included, the normalized coefficient on log household income declines from 0.07 to 0.04; the coefficient on mother's education decreases from 0.27 to 0.13. These findings are comparable to findings



**Table 8** The importance of childhood circumstances for transmission of SES: OLS

Variable	Baseline	Height and Weight	Cognitive Ability	English and Math	All	Baseline, All
Panel A. No Controls						
ln (Household income)	0.07	0.06	0.05	0.04	0.03	0.04
Mother's education	0.27	0.25	0.22	0.16	0.15	0.13
Father's education	0.20	0.18	0.14	0.09	0.08	0.12
Panel B. With Controls						
ln (Household income)	0.08	0.06	0.06	0.04	0.04	0.04
Mother's education	0.26	0.23	0.21	0.15	0.14	0.12
Father's education	0.21	0.20	0.16	0.11	0.10	0.11

*Notes:* The table reports normalized regression coefficients from regressions of cohort children's years of schooling at age 21 on measures of parental SES: namely, log household income and parental education. Each column corresponds to a separate regression. The first column reports the (unconditional) intergenerational correlation in SES. The remaining columns report the (conditional) intergenerational correlation in SES when anthropometric measures, the cognitive test score, or achievement test scores are controlled for. The last column includes all these measures simultaneously. Panel A reports results from regressions without controls, while Panel B reports results from regressions with controls. See the footnote to Table 2 for a description of the set of controls.

from other studies (Atkinson et al. 1983; Bowles and Nelson 1974; Mulligan 1999) that conducted similar exercises using years of schooling and IQ/AFQT scores as the offspring's outcome measures. They found that these measures account for from two-fifths to two-thirds of the covariation between parental SES and their children's income.

The work detailed here is distinct from previous studies in that it focuses on transmission channels determined in early childhood and uses years of schooling as a measure of the children's SES. Also, because the data contain different outcome measures, I can examine which of these outcomes are responsible for the largest reductions in the intergenerational correlation. Table 8 shows that the scores on the achievement tests correspond to the largest reduction, followed by the score on the cognitive test and the anthropometric measures. It is important to emphasize, however, that this particular finding may be the result of the variable I use as a proxy for children's SES. Notice that there are no noticeable differences between the results in panels A and B.

As discussed previously, the estimates presented in Tables 5–8 are biased if there is omitted heterogeneity in children's SES that is correlated with children's human capital. However, one can still obtain unbiased estimates by using a fixed-effects approach if the omitted heterogeneity is family-specific. Data on younger siblings of the cohort children (anthropometric measures and scores on cognitive ability and achievement tests) were collected in 1994, when siblings were aged 6 to 11. In addition, the cohort children were asked in 2005 to report the highest grade achieved by their siblings. I use anthropometric data and data on cognitive ability and achievement tests scores from the cohort children from the 1994 round, when they were roughly 11 years old, and information on years of schooling from the 2005 round. Height-for-age and weight-for-age Z scores were calculated using WHO and

CDC growth standards and children's outcome variables (height-for-age and weight-for-age  $Z$  scores, and grades on cognitive ability and achievement math and English tests) were normalized by running separate regressions by sex on a cubic function of age in months.<sup>8</sup>

The empirical strategy involves two steps: (1) estimate the association between children's outcomes and parental SES, and (2) estimate the relationship between children's SES in adulthood (i.e., years of schooling) and children's childhood outcomes using a fixed-effects approach. The estimator of interest is the product of the estimators from the first and second steps, which gives the effect of parental SES on children's SES working through the transmission channels (as explained in detail in the previous subsection on empirical strategy).

The results from this exercise are shown in Table 9. Panel A reports the results from the first step and shows a strong association between parental SES and children's outcomes. Children born to higher-SES parents have better scores on the cognitive and achievement tests; they are also taller and heavier. The sample includes the cohort children and their siblings, and is restricted to those cohort children whose siblings had been measured, weighed, and administered the exams. Panel B reports the results from the second step. The first and the third columns of panel B show estimates of the reduced-form equation (Eq. 6). It implies partial correlations between children's schooling on the one hand and log household income, mother's education, and father's education on the other: respectively, 0.05, 0.26, and 0.27 for the cohort children; and 0.06, 0.23, and 0.25 for the cohort children and their siblings (not shown in Table 9). These numbers are comparable to the partial correlations 0.07, 0.27, and 0.2 calculated for the full sample of cohort children (reported in the first column of panel B of Table 8).

The last column of panel B displays the results from the fixed-effects regression. For comparison, OLS results are presented in the second and fourth columns of the table. The OLS estimates in column 4, which use the sample of cohort children and their siblings, and the fixed-effects estimates in column 5 are somewhat similar. The exception is the coefficient on the height-for-age measure.<sup>9</sup> The OLS results suggest that children who were taller at age 2 achieve higher schooling in adulthood. However, I find no relationship between schooling and height at age 2 when including family fixed effects, which suggests that the OLS coefficient on height is biased because of some omitted heterogeneity common to siblings. For example, parents who better protect the health of their children may also give them an education conducive to higher SES in the future.

Panel C presents estimates of the extent to which the intergenerational correlation of SES can be accounted for by children's outcome measures. The estimates

---

<sup>8</sup>In Table 9, I use weight-for-age instead of weight-for-height because there are no weight-for-height standards to compute  $Z$  scores for children in this age range.

<sup>9</sup>One reason why height-for-age and weight-for-age may not be predictive of children's schooling is that these were measured when children were 6–11 years old, rendering them poor proxies for health because they reflect both the outcome of the first growth spurt as well as the timing and trajectory of the second. Unfortunately, no other information was collected both for the cohort members and their siblings that could be used as an alternative proxy for health.

**Table 9** The importance of childhood circumstances for SES transmission family fixed effects

	Math	English	Cognitive	Height	Weight
<b>Panel A. Children’s Outcomes and Parental SES</b>					
ln (Household income)	0.0670 <sup>†</sup> (0.04)	0.04 (0.04)	0.0785* (0.04)	0.157** (0.04)	0.149** (0.05)
Mother’s Education	0.0572** (0.01)	0.0743** (0.01)	0.0681** (0.01)	0.0455** (0.01)	0.0743** (0.01)
Father’s Education	0.0712** (0.01)	0.0615** (0.01)	0.0491** (0.01)	0.0339** (0.01)	0.0222 <sup>†</sup> (0.01)
<i>N</i>	1,712	1,712	1,712	1,712	1,712
<b>Panel B. Years of Schooling and Children’s Outcomes</b>					
	Cohort Children		All Children	Fixed Effects	
Math	--	0.580** (0.13)	--	0.560** (0.09)	0.449** (0.11)
English	--	0.475** (0.13)	--	0.505** (0.09)	0.397** (0.11)
Cognitive Ability	--	0.286* (0.12)	-- (0.07)	0.354** (0.11)	0.412**
Height-for-Age	--	0.18 (0.15)	--	0.181 <sup>†</sup> (0.09)	0.01 (0.12)
Weight-for-Age	--	-0.01 (0.12)	--	-0.04 (0.08)	-0.06 (0.10)
ln (Household income)	0.21 (0.13)	0.10 (0.12)	0.208* (0.10)	0.10 (0.09)	--
Mother’s Education	0.239** (0.03)	0.118** (0.03)	0.194** (0.03)	0.0954** (0.02)	--
Father’s Education	0.247** (0.03)	0.148** (0.03)	0.217** (0.02)	0.122** (0.02)	--
<i>N</i>	856	856	1,712	1,712	1,712
<b>Panel C. The Effects of Parental SES on Children’s Years of Schooling Working Through Childhood Human Capital</b>					
	Cohort Children		All	Fixed Effects	
ln (Household income)	0.03		0.03	0.02	
Mother’s Education	0.13		0.12	0.09	
Father’s Education	0.11		0.11	0.08	

*Notes:* Panel A reports results from regressions of children’s outcome measures on measures of parental SES. Robust standard errors are in parentheses. Panel B reports estimates of the relationship between children’s outcome measures and years of schooling at age 21. The columns labeled “Cohort children” show results for the cohort children, while the columns labeled “All children” report results for cohort children and their siblings. The last column shows estimates that include family fixed effects. Panel C reports estimates of how much of the intergenerational correlation of SES can be accounted for by children’s outcome measures. The first two columns display the reduction in the coefficients on parental SES measures after children’s outcome measures are included. The last column reports the estimate that is calculated from Panel A and the last column of Panel B (see the text for more details). The sample is restricted to families whose cohort child and his/her sibling have nonmissing values for all of the variables included in the regressions. See the footnote to Table 2 for a description of the set of controls.

<sup>†</sup> $p < .10$ ; \* $p < .05$ ; \*\* $p < .01$

correspond to the product of the normalized coefficients of the regression results shown in panels A and B.<sup>10</sup> The first two columns show results when the second step is estimated using OLS; the last column reports the fixed-effects estimate, which corrects for omitted heterogeneity that is constant across siblings. These figures can be compared with those shown in the last column of panel B in Table 8. A comparison of the first two columns of panel C in Table 9, which are estimated through OLS, with the last column of panel B in Table 8 shows that the estimates are robust to the sample restrictions. There is, however, one important caveat about the family fixed-effects approach. The regression results shown in panel B assume that within-family differences in children's outcomes are uncorrelated with any differences in unobservable determinants of children's SES (see Eq. 10). This assumption is violated, and hence the estimates are biased, if parents follow a compensating or reinforcing strategy (i.e., devoting more or less resources to the child with the greater endowment) when allocating their resources among their children (Becker and Tomes 1976; Behrman et al. 1982). Most prior literature suggests that parents engage in reinforcing behavior (see, e.g., Datar et al. 2010). In this case, fixed-effects estimates overestimate the relationship between childhood human capital and children's SES because the sibling with greater endowments tends to receive more parental investments.

In summary, the two empirical strategies proposed provide somewhat similar answers, which can be seen by comparing the last column of panel B in Table 8 with the last column of panel C in Table 9. The results from the first empirical strategy imply that characteristics that are determined in early childhood can explain as much as 50% of the intergenerational transmission of SES. The second empirical strategy suggests that, after family-specific omitted heterogeneity is taken into account, these characteristics can explain as much as one-third of the intergenerational correlation of SES.

## Robustness

This section summarizes several robustness checks I conducted to assess the sensitivity of the results to some of the main concerns about the empirical analysis. See the online supplement for a more detailed discussion.

### *Sample Attrition*

Sample attrition is a common concern in longitudinal studies. The Cebu study was carefully planned to minimize sample attrition of families living in the area of the study, metropolitan Cebu. The study, however, did not follow mothers or children who migrated to areas outside the study region, and that has been the leading cause of attrition in the study. Thus, the estimates presented earlier may be biased because of sample attrition.

---

<sup>10</sup>The normalized regression coefficients are not reported in the table.

**Table 10** Sample selection

	Height-for-Age 24 Months		Cognitive Ability Age 8		Math at Age 11				
	Missing Height	OLS	Heckman Two-Step	Missing IQ Score	OLS	Heckman Two-Step	Missing Math Score	OLS	Heckman Two-Step
Mother Born in this Barangay?	0.076 (0.15)	--	--	0.439** (0.07)	--	--	0.407** (0.07)	--	--
ln (Household income)	0.172† (0.10)	0.196** (0.03)	0.194** (0.03)	0.061 (0.05)	0.105** (0.03)	0.110** (0.03)	0.068 (0.05)	0.106** (0.03)	0.106** (0.03)
Mother's Education	-0.0605* (0.03)	0.0515** (0.01)	0.0525** (0.01)	0.0194† (0.01)	0.0541** (0.01)	0.0551** (0.01)	0.0219† (0.01)	0.0698** (0.01)	0.0699** (0.01)
Father's Education	-0.004 (0.02)	0.0392** (0.01)	0.0389** (0.01)	-0.0261* (0.01)	0.0578** (0.01)	0.0563** (0.01)	-0.0247* (0.01)	0.0605** (0.01)	0.0605** (0.01)
Lambda	--	--	-0.245 (0.23)	--	--	0.194 (0.22)	--	--	0.008 (0.22)
N	3,060	2,447	3,060	3,060	2,247	3,060	3,060	2,123	3,060

**Table 10** (continued)

	English at Age 11		Schooling at Age 21		Log Earnings at Age 21		Heckman Two-Step
	Missing English	OLS	Missing Schooling	OLS	Missing Log Wages	OLS	
Mother Born in this Barangay?	0.404** (0.07)	--	0.286** (0.06)	--	0.128* (0.05)	--	--
ln (Household income)	0.046 (0.05)	0.0932** (0.03)	0.032 (0.04)	0.350** (0.10)	-0.0378 (0.04)	0.0584† (0.03)	0.0677† (0.04)
Mother's Education	0.0196† (0.01)	0.0861** (0.01)	0.010 (0.01)	0.263** (0.02)	-0.0166† (0.01)	0.0307** (0.01)	0.0353** (0.01)
Father's Education	-0.0273* (0.01)	0.0617** (0.01)	-0.0264** (0.01)	0.191** (0.02)	-0.0329** (0.01)	0.0119 (0.01)	0.0199 (0.01)
Lambda	--	--	--	--	--	--	-0.404 (0.48)
N	3,060	2,155	3,060	1,884	3,060	1,370	3,060

Notes: Numbers in parentheses are robust standard errors. There are three regressions for each dependent variable of interest. The first column, labeled "Missing," estimates which characteristics predict whether the dependent variable of interest is missing. The second column, "OLS," estimates the ordinary least squares when the sample is restricted to children for which the dependent variable is nonmissing. The column "Heckman two-step" corrects for selection bias using an indicator for whether the mother was born in the barangay in which she was living at the time of the baseline interview as the variable that enters the selection equation but is excluded from the equation of interest. See the footnote to Table 2 for a description of the controls included in each regression.

†  $p < .10$ ; \*  $p < .05$ ; \*\*  $p < .01$

Table 10 shows estimates of the relationship between children's outcomes and parental SES, comparing results from OLS regression and a Heckman two-step estimator that corrects for selection bias. An indicator for whether the mother was born in the barangay in which she was living at the time of the baseline interview, which is assumed to be uncorrelated with the unobserved determinants of children's outcomes and children's SES in adulthood, predicts attrition and nonresponse (except for missing height-for-age at 24 months). The comparison of OLS and the Heckman two-step estimates, which are very similar, suggests that the attrition/nonresponse bias is small.

### *Functional Form Assumptions*

The model for the intergenerational transmission of SES presented earlier makes the following assumptions: (1) children's SES and children's human capital (which are proxied by anthropometric measures and scores on achievement and cognitive ability tests) are linear functions of log household (permanent) income and parents' years of schooling; (2) there are no complementarities between children's human capital and parental SES in producing children's SES; and (3) there are no complementarities between the different dimensions of children's human capital in producing children's SES. Because the assumptions are not warranted, the results may be sensitive to some of these assumptions.

Tables S1–S4 in the online supplement address these concerns. Table S1 looks at assumption (1) by presenting results when alternative measures of household income are used. Its results suggest that the overall conclusion that characteristics determined in childhood play an important role as channels by which SES transmits across generations is not sensitive to the choice of which income measure to use. The same conclusion holds if one instead uses parental education as a proxy for household long-term income (Table S2). Table S3 provides evidence that suggests that the relationship between children's childhood human capital and children's SES in adulthood does not depend on parental SES. Finally, by including interaction terms between the children's outcome measures (as shown in Table S4), I investigate the assumption that there are no complementarities between different dimensions of human capital. The omission from the main specification of the interactive terms does not overturn the result that characteristics determined in childhood play an important role as channels for the intergenerational transmission of SES.

### *Birth-Order Effects*

One concern about the family fixed-effects regressions presented in panel A of Table 9 is that they may be biased if there are birth-order effects (see, e.g., Black et al. 2005a, 2011). On the one hand, the older child may benefit from an "earlier start" advantage in competing with the younger child for scarce parental (financial and time) resources. On the other hand, the younger child may benefit from the lessons the parents learned from their experiences with the older child.

Table S8 in the online supplement examines the importance of birth-order effects. It presents estimates of (1) the association between children's outcomes and parental SES and (2) the relationship between children's SES (as measured by years of schooling) and children's outcomes separately for the cohort children (the older children) and their siblings (the younger children). The results suggest that overall, the relationships are similar for the cohort children and their siblings. It also shows the family fixed-effects estimators when they include and exclude an indicator for whether the child is the younger sibling. These results confirm that birth-order effects cannot account for my results.

## Conclusion

A large literature has documented the intergenerational transmission of SES. However, the mechanisms by which SES transmits across generations are still little understood. Recent research has suggested that characteristics determined in childhood may play an important role in the intergenerational transmission.

In this article, I investigated how important these characteristics are in explaining the intergenerational transmission. I find that height, weight, and scores on cognitive and achievement tests can account for one-third to one-half of the relationship between the SES of parents and their offspring. These results fit into a growing body of empirical research that underlies the support for early interventions that could remedy the effects of early adverse circumstances (Heckman and Masterov 2007). It is interesting that my estimates tend to be slightly lower than estimates of other studies that have used data from industrialized countries (Atkinson et al. 1983; Bowles and Nelson 1974; Mulligan 1999), which could be explained by two factors. First, I look only at the contribution of childhood characteristics. Second, my estimates correct for family-specific omitted heterogeneity. Indeed, there are reasons to believe that the contribution of these characteristics for the intergenerational transmission of SES may be higher in developing countries than in developed countries.

Although this work provides suggestive evidence that early circumstances matter for the intergenerational transmission of SES, additional questions remain. How does parental SES matter? And why are children born to higher SES parents healthier and have higher cognitive ability than other children? Future research should address these questions.

**Acknowledgements** I am grateful to Anne Case, David Lee, Chris Paxson, and Sam Schulhofer-Wohl for their advice and support. I am also indebted to Silvia Helena Barcellos, Deforest McDuff, Ashley Ruth Miller, Francisco Perez Arce Novaro, Heather Royer, Jim Smith, and seminar participants at Princeton University. All remaining errors are mine.

## References

- Atkinson, A., Maynard, A., & Trinder, C. (1983). *Parents and children: Incomes in two generations*. London, UK: Heinemann.



- Aughinbaugh, A., & Gittleman, M. (2003). Does money matter? A comparison of the effect of income on child development in the United States and Great Britain. *Journal of Human Resources*, 38, 416–440.
- Baum, C. L. (2003). Does early maternal employment harm child development? An analysis of the potential benefits of leave taking. *Journal of Labor Economics*, 21, 409–448.
- Becker, G. S., Philipson, T. J., & Soares, R. R. (2005). The quantity and quality of life and the evolution of world inequality. *American Economic Review*, 95, 277–291.
- Becker, G. S., & Tomes, N. (1976). Child endowments and the quantity and quality of children. *Journal of Political Economy*, 84, S143–S162.
- Behrman, J. (1997). *Mother's schooling and child education: A survey* (PIER Working Paper 97-25). Philadelphia, PA: Penn Institute for Economic Research.
- Behrman, J., & Knowles, J. C. (1997). *How strongly is child schooling associated with household income?* (PIER Working Paper 97-22). Philadelphia, PA: Penn Institute for Economic Research.
- Behrman, J. R., Pollak, R. A., & Taubman, P. (1982). Parental preferences and provision for progeny. *Journal of Political Economy*, 90, 52–73.
- Behrman, J. R., & Rosenzweig, M. R. (2002). Does increasing women's schooling raise the schooling of the next generation? *American Economic Review*, 92, 323–334.
- Black, S. E., Devereux, P. J., & Salvanes, K. G. (2005a). The more the merrier? The effect of family size and birth order on children's education. *Quarterly Journal of Economics*, 120, 669–700.
- Black, S. E., Devereux, P. J., & Salvanes, K. G. (2005b). Why the apple doesn't fall far: Understanding intergenerational transmission of human capital. *American Economic Review*, 95, 437–449.
- Black, S. E., Devereux, P. J., & Salvanes, K. G. (2011). Older and wiser? Birth order and IQ of young men. *CESifo Economic Studies*, 57, 103–120.
- Bowles, S., & Gintis, H. (2002). The inheritance of inequality. *The Journal of Economic Perspectives*, 16(3), 3–30.
- Bowles, S., & Nelson, V. I. (1974). The "inheritance of IQ" and the intergenerational reproduction of economic inequality. *Review of Economics and Statistics*, 56, 39–51.
- Breierova, L., & Duflo, E. (2004). *The impact of education on fertility and child mortality: Do fathers really matter less than mothers?* (NBER Working Papers 10513). Cambridge, MA: National Bureau of Economic Research.
- Caldwell, J. C. (1979). Education as a factor in mortality decline: An examination of Nigerian data. *Population Studies*, 33, 395–413.
- Case, A., Fertig, A., & Paxson, C. (2005). The lasting impact of childhood health and circumstance. *Journal of Health Economics*, 24, 365–389.
- Case, A., Lubotsky, D., & Paxson, C. (2002). Economic status and health in childhood: The origins of the gradient. *American Economic Review*, 92, 1308–1334.
- Chevalier, A. (2004). *Parental education and children's education: A natural experiment* (IZA Discussion Papers No. 1153). Bonn, Germany: Institute for the Study of Labor.
- Currie, J. (2009). Healthy, wealthy, and wise: Socioeconomic status, poor health in childhood, and human capital development. *Journal of Economic Literature*, 47, 87–122.
- Currie, J., & Madrian, B. C. (1999). Health, health insurance and the labor market. In O. Ashenfelter, & D. Card (Eds.), *Handbook of labor economics* (Vol. 3C, pp. 3309–3416). Amsterdam, The Netherlands: Elsevier.
- Datar, A., Kilburn, M. R., & Loughran, D. S. (2010). Endowments and parental investments in infancy and early childhood. *Demography*, 47, 145–162.
- Duflo, E. (2000). *Grandmothers and granddaughters: Old age pension and intra-household allocation in South Africa* (NBER Working Paper 8061). Cambridge, MA: National Bureau of Economic Research.
- Eriksson, T., Bratsberg, B., & Raau, O. (2005). *Earnings persistence across generations: Transmission through health?* (Memorandum 35/2005). Oslo, Norway: Oslo University, Department of Economics.
- Filmer, D., & Pritchett, L. (1999). The effect of household wealth on educational attainment: Evidence from 35 countries. *Population and Development Review*, 25, 85–120.
- Glewwe, P. (1999). Why does mother's schooling raise child health in developing countries? Evidence from Morocco. *Journal of Human Resources*, 34, 124–159.
- Glewwe, P., & Miguel, E. A. (2008). The impact of child health and nutrition on education in less developed countries. In T. P. Schultz, & J. Strauss (Eds.), *Handbook of development economics* (Vol. 4, pp. 3561–3606). Amsterdam, The Netherlands: Elsevier.
- Grantham-McGregor, S. (2007). Early child development in developing countries. *Lancet*, 369, 824.

- Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., & Strupp, B. (2007). Developmental potential in the first 5 years for children in developing countries. *Lancet*, *369*, 60–70.
- Grantham-McGregor, S. M., Powell, C. A., Walker, S. P., & Himes, J. H. (1991). Nutritional supplementation, psychosocial stimulation, and mental development of stunted children: The Jamaican Study. *Lancet*, *338*, 1–5.
- Guo, G., & Harris, K. M. (2000). The mechanisms mediating the effects of poverty on children's intellectual development. *Demography*, *37*, 431–447.
- Guthrie, G. M., Tayag, A. H., & Jacobs, P. J. (1977). The Philippine non-verbal intelligence test. *Journal of Social Psychology*, *102*, 3–11.
- Handa, S. (1999). Maternal education and child height. *Economic Development and Cultural Change*, *47*, 421–439.
- Hansen, K. T., Heckman, J. J., & Mullen, K. J. (2004). The effect of schooling and ability on achievement test scores. *Journal of Econometrics*, *121*(1–2), 39–98.
- Heckman, J. J. (2006). The skill formation and the economics of investing in disadvantaged children. *Science*, *312*, 1900–1902.
- Heckman, J. J., & Masterov, D. V. (2007). The productivity argument for investing in young children. *Review of Agricultural Economics*, *29*, 446–493.
- Heckman, J. J., Stixrud, J., & Urzua, S. (2006). The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics*, *24*, 411–482.
- Martorell, R., Behrman, J. R., Flores, R., & Stein, A. D. (2005). Rationale for a follow-up study focusing on economic productivity. *Food and Nutrition Bulletin*, *26*(2), S5–S14.
- Mulligan, C. B. (1999). Galton versus the human capital approach to inheritance. *Journal of Political Economy*, *107*, S184–S224.
- Paxson, C., & Schady, N. (2007). Cognitive development among young children in Ecuador: The roles of wealth, health, and parenting. *Journal of Human Resources*, *42*, 49–84.
- Plug, E. (2004). Estimating the effect of mother's schooling on children's schooling using a sample of adoptees. *American Economic Review*, *94*, 358–368.
- Plug, E., & Vijverberg, W. (2005). Does family income matter for schooling outcomes? Using adoptees as a natural experiment. *Economic Journal*, *115*, 879–906.
- Ruhm, C. J. (2004). Parental employment and child cognitive development. *Journal of Human Resources*, *39*, 155–192.
- Sacerdote, B. (2007). How large are the effects from changes in family environment? A study of Korean American adoptees. *Quarterly Journal of Economics*, *122*, 119–157.
- Smith, J. P. (1999). Healthy bodies and thick wallets: The dual relation between health and economic status. *Journal of Economic Perspectives*, *13*, 145–166.
- Smith, J. R., Brooks-Gunn, J., & Klebanov, P. (1997). Consequences of living in poverty for young children's cognitive and verbal ability and early school achievement. In G. J. Duncan, & J. Brooks-Gunn (Eds.), *Consequences of growing up poor* (pp. 132–189). New York: Russell Sage Foundation.
- Solon, G. (1999). Intergenerational mobility in the labor market. In O. Ashenfelter, & D. Card (Eds.), *Handbook of labor economics* (Vol. 3A, pp. 1761–1800). Amsterdam, The Netherlands: Elsevier.
- Taylor, B. A., Dearing, E., & McCartney, K. (2004). Incomes and outcomes in early childhood. *Journal of Human Resources*, *39*, 980–1007.
- Thomas, D., Strauss, J., & Henriques, M.-H. (1991). How does mother's education affect child height? *Journal of Human Resources*, *26*, 183–211.
- Waldfogel, J., Han, W.-J., & Brooks-Gunn, J. (2002). The effects of early maternal employment on child cognitive development. *Demography*, *39*, 369–392.