

SERIE DE DOCUMENTOS DE TRABAJO

SDT 509

Socioeconomic Gradients in Child Development: Evidence from a Chilean Longitudinal Study 2010 – 2017

Autores:

Alejandra Abufhele Dante Contreras Esteban Puentes Amanda Telias Natalia Valdebenito

Santiago, Diciembre de 2020

sdt@econ.uchile.cl econ.uchile.cl/publicaciones

Socioeconomic Gradients in Child Development: Evidence from a Chilean Longitudinal Study 2010 – 2017

Alejandra Abufhele¹, Dante Contreras², Esteban Puentes², Amanda Telias¹, Natalia Valdebenito²

¹Centro Justicia Educacional, Pontificia Universidad Católica de Chile, Chile.

² Department of Economics, Universidad de Chile, Chile.

Abstract

Empirical evidence shows that lack of resources during infancy and the process of accumulating disadvantages throughout childhood have important consequences in cognitive and socio-emotional development. This paper examines socioeconomic gradients across cognitive and socio-emotional measures. Using longitudinal data from a 7 year - 3 wave panel data, we study the patterns of socioeconomic status and child development in Chile and estimate how much of the wealth gap can be explained by different mediators like maternal educational and skills, child attendance to preschool and school, possession of books, or violence indicators at home. We show strong associations between household wealth and child development, and as the child grows, the gap between the most extreme quintiles of the distribution, both in cognitive and socio-emotional skills remains, but decreases in magnitude. Taking advantage of the longitudinal nature of the data, we calculate a permanent skill for each child and each skill dimension in this 7-year period. The analysis for the permanent component shows that wealth gaps are important to determine cognitive ability but not socioemotional skills. While mediators account for some of the associations, there is still a large socioeconomic gap that persists in cognitive skills among children. By understanding the dynamism of social and cognitive vulnerability experienced during childhood and employing longitudinal data and methods, this study contributes to and extends the existing literature on socioeconomic gaps and child development in the context of Latin American.

Keywords: wealth gradients; early child development; mediators; cognitive skills; socioemotional skills.

Introduction

Studies have shown that socioeconomic gaps in children's cognitive and socio-emotional development unfold very early in the life course (Aughinbaugh and Gittleman, 2003; Blau, 1999; Rubio-Codina et al., 2015). Moreover, evidence indicates that experiencing lack of resources in critical periods during infancy, and the process of accumulation of disadvantages throughout childhood, has important consequences in different domains across the life course (Cunha and Heckman 2008; Kelly et al. 2011). These sharp differences in cognitive and socio-emotional development by socioeconomic status during childhood have been shown for different contexts. However, the evidence in Latin American countries is still scarce and mostly relies on cross-sectional data (Paxson and Schady 2007; Fernald et al. 2012; Schady et al. 2015).

This paper examines wealth gradients on children outcomes in Chile. The Chilean context resembles the conditions of Latin America as a whole: massive educational expansion and sustained socio-economic inequality. But Chile stands out because it has excelled in its relatively higher levels of economic development while the levels of inequality have remained relatively constant over time. Poverty levels decreased from 38.6 to 8.6 per cent between 1990 and 2017, but the Gini coefficient remain around 0.52 - 0.48 during this same period. This context makes Chile a suitable country to answer the question about the association between wealth gradients and children outcomes, and to contribute to unravel the mechanisms through which the socioeconomic status during infancy affects future cognitive and socio-emotional outcomes.

Empirical evidence that explores socioeconomic gradients in cognitive or non-cognitive outcomes area numerous (Aughinbaugh & Gittleman, 2003; Blau, 1999; Rubio-Codina et al., 2015; Bradley and Corwyn, 2002; Paxson and Schady, 2007; Guo and Harris, 2000; Taylor, Dearing, and McCartney, 2006; Berger, Paxson, and Waldfogel, 2009; Duncan and Brooks-Gunn, 1997; Bradbury, Waldfogel and Washbrook, 2018; Berlinski and Schady, 2015; Schady et al. 2015; Duncan y Magnuson 2011). Only a few have a longitudinal approach (Galasso, Weber and Fernald (2019); Lopez Boo (2016); Behrman, Contreras, Palma and

Puentes (2017); Kobrosly et al. 2011; Fernald, Marchman and Weisleder, 2013; Reynolds et al, 2017; Berger, Paxson, and Waldfogel, 2009). Furthermore, there are few longitudinal studies investigating wealth gradients in developing countries. Galasso, Weber and Fernald (2019) explore longitudinal patterns of child development and socioeconomic status in Madagascar, finding substantial gradients of wealth in receptive vocabulary, cognitive vocabulary, sustained attention and working memory. They show that wealth gradients are significant at ages 3-4, widen with age and flatten out by ages 9-10. Lopez Boo (2016) documents differences in cognitive development among children from households with high and low socioeconomic status in 4 developing countries: Peru, Ethiopia, India and Vietnam, focusing on mediators that reduce the gaps like urban residence, preschool attendance, early nutrition, caregiver education and primary school attendance. For Chile, there is one paper that resembles ours, using longitudinal data Behrman, Contreras, Palma and Puentes (2017) finds wealth disparities in cognitive abilities in favor of richer children at an early age and no disparities in socio-emotional skills, but they do not use a mediation analysis.

In this paper we look at the effect of wealth disparities in cognitive and socio-emotional skills in children between 18 months and 12 years of age in Chile, performing a cross-sectional and longitudinal analysis. In particular, we: (1) identify, using cross-sectional data, the existence of wealth gaps and their magnitude in cognitive and socio-emotional skills in infants, (2) show how these gaps change over time, (3) determine, through the longitudinal sample, the existence of wealth disparities for an unobserved and permanent component of the cognitive and socio-emotional skills and (4) establish which are the main mediators of the relationship between wealth and cognitive and socio-emotional ability for the longitudinal analysis.

The present research contributes to the existing literature in at least three ways. By using three rounds of the nationally representative Chilean Longitudinal Survey of Early Childhood (ELPI), an exceptional rich panel survey, we are the first to cover a seven-year period study the existence and magnitude of the wealth gradients in children outcomes for Chile. Using a novel two-step estimation of fixed unobservable characteristic, we are able to recover an individual and fixed component of cognitive and socio-emotional skills and study their relationship with wealth. Finally, we shed light on how much of the wealth gap can be

mediated by different factors - maternal education and skills, child attendance to preschool and school, and possession of books and violence indicators at home; which adds to the existing literature about potential drivers of the relationship between socioeconomic status and children outcomes.

We find strong cross-sectional associations between household wealth and child development outcomes, and as the child grows, the gap between the most extreme quintiles of the distribution, both in cognitive and socio-emotional skills remains over time but decreases in magnitude. The longitudinal analysis for the permanent component of the skills domains show that wealth gaps are important to determine cognitive ability but not socioemotional skills. Mediators associated to the mother - education and maternal skills - account for more than half of the associations for the permanent component of the cognitive skills and almost all the socioemotional skills, which translates into an intergenerational transmission of disadvantages. This perpetuation and deepening of the inequalities in the development of children have important consequences during the life course.

Data and Measures

Data

The data used in this paper come from the Chilean Longitudinal Survey of Early Childhood (ELPI), a nationwide representative survey. This face-to-face survey gathers two types of information: a socio-demographic survey applied to all mothers; and a battery of tests for evaluating cognitive, socio-emotional and anthropometric development in children and their mothers. The sample for the 2010 wave was randomly drawn from official administrative birth records of children born between January 2006 and August 2009. The sample size was approximately 15,000 children, between 6 months and 5 years old. The second wave was conducted in 2012. The target population for 2012 was the same sample interviewed in 2010 and an additional (refresher) sample of 3,000 children born between September 2009 and December 2011 (children between 6 months and 7 years old). The third wave was carried out in 2017. The target population for 2017 was the sample interviewed in the previous waves,

and a refresher sample of approximately 5,000 children born between January 2012 and December 2016 (children between 6 months and 12 years old). The sample includes different cohorts of children, differentiated by year of birth.

The ELPI contains various cognitive and socio-emotional tests. In this paper we use the two outcomes that were applied in all three rounds of the survey. For cognitive outcomes, we analyzed the Peabody Picture Vocabulary Test (PPVT). The PPVT evaluates receptive vocabulary and the acquisition of vocabulary and the verbal intelligence of the child for all children above 30 months old. To measure socio-emotional outcomes, we analyzed the Child Behavior Checklist (CBCL). This instrument evaluates several behavior and emotional problems in children and adolescents for all children above 18 months old.

The size of the analytical sample for the cross-sectional and longitudinal analysis are shown in Table 1. The cross-section sample includes the refreshment sample from each round of ELPI, and therefore they are different samples in each year, while in the longitudinal analysis we use the same children observed in the three rounds, that is, the sample is restricted to observations of children present in ELPI 2010, 2012 and 2017.

		2010	2012	2017
Cross-Section	PPVT	6.047	9.936	11.190
	CBCL	9.343	11.080	12.403
Panel	PPVT		3.009	
	CBCL		4.634	

Table 1: Analytical sample for cross section and longitudinal analysis

Measures

The dependent variables on our analysis to measure cognitive and socio-emotional abilities are the Peabody Picture Vocabulary Test (PPVT) and the Child Behavior Check List (CBCL) respectively. Both tests are standardized according to the age in months of the children, in order to have a direct interpretation of the final results with standard deviations. Usually, in the CBCL test, the lower the score, the better socio-emotional skills the child presents. In this

study, to simplify the interpretation and make it consistent with PPVT, the score is defined such that the higher the score, the better the result obtained.

The main explanatory variable, household wealth quintiles, was created by performing principal components analysis of three set of variables to obtain a unique index that reduces the dimensions of these variables to predict the first principal component which provides information on the socioeconomic status of the household in which the child lives. The variables included are: *housing*, which is a dummy that indicates home ownership; *assets*: a series of dummies that indicate if the home has appliances such as microwave, refrigerator, computer, television, washing machine, heating, cell phone and internet connection; and *occupation of the main householder*: dummies according to the occupation of the person who contributes the greatest amount of income to the household using the International Labour Organization (ILO) classification of occupations. With this information quintiles are created for each of the waves.

To obtain a robust effect of the wealth disparities in cognitive and socio-emotional skills, a series of controls and mediators are considered. In particular, the following are distinguished as controls: sex, age in months, weight and height at birth, year of birth, height of the mother, number of people in the household, if the selected child is the older sibling, if the biological father lives in the household and region of residence. As mediators we considered: mother's schooling, two indicators of maternal skill using WAIS (numerical ability and vocabulary) (WAIS¹), whether the mother had postpartum depression, if the child attends to school, if the child attended preschool, if there are more than 10 books in the home and if there is any type of violence². These last two mediators are part of the Home Observation Measurement of the Environment (HOME), which consists of a series of dichotomous questions aimed at assessing the emotional support and cognitive stimulation that children receive through their home environment, planned events and the family that surrounds them (Linver et al., 2004).

¹ Instrument applied to measure the cognitive abilities of individuals between 16 and 64 years. In ELPI it applies to the child's primary caregiver.

 $^{^2}$ Violence is constructed as a dummy that is 1 if any of the following scenarios are observed: mother or guardian yells at the child during the visit, mother or guardian shows hostility towards the child during the visit, mother or guardian hits the child during the visit and/or mother or guardian criticizes or scolds the child during the visit, and 0 otherwise.

It is important to consider that, theoretically and analytically, a distinction is made between controls and mediators. Controls are child and household characteristics that can affect developmental outcomes while the mediators are variables that affect the relationship between wealth and skills. For example, the sex of child could explain differences in the outcomes, but not explain the relationship between household wealth and test scores. However maternal schooling affects wealth and at the same time children outcomes: the more education, more wealth and greater child ability. The mediators contribute to explain the relationship between wealth quintiles and the child's cognitive and/or socio-emotional ability. We use both, control variables and mediations in our analysis, but focus on the role of the mediators.

	Obs 2010	Mean 2010	SD 2010	Obs 2012	Mean 2012	SD 2012	Obs 2017	Mean 2017	SD 2017
PPVT (raw score)	2010	104.61	15.00	2012	106.46	10.12	2017	2017	15.40
CBCL (raw score)	3009	104.61	15.33	3009	106.46	19.13	3009	96.59	15.49
	4634	59.80	9.71	4634	55.36	11.66	4634	51.22	10.62
Wealth quintiles	4634	3.05	1.38	4634	3.08	1.40	4634	3.05	1.39
Boy [ref. girl]	4634	0.50	0.50	4634	0.50	0.50	4634	0.50	0.50
Age in months	4634	34.92	10.22	4634	60.80	10.27	4634	129.06	10.43
Height at birth	4634	49.78	2.00	4634	49.78	2.00	4634	49.78	2.00
Weight at birth	4634	3.41	0.48	4634	3.41	0.48	4634	3.41	0.48
Year of birth	4634	2007	0.83	4634	2007	0.83	4634	2007	0.83
Mother's height	4634	1.58	0.06	4634	1.59	0.06	4634	1.58	0.06
Household size	4634	4.92	1.66	4634	4.83	1.59	4634	4.57	1.51
Older sibling	4634	0.90	0.31	4634	0.77	0.42	4634	0.58	0.49
Father present	4634	0.69	0.46	4634	0.68	0.47	4634	0.62	0.49
Region of residence	4634	9.43	3.83	4634	9.45	3.83	4634	9.39	3.83
Mother's schooling	4634	11.39	2.93	4634	11.77	2.88	4634	12.21	2.94
Mother's numerical WAIS	4634	6.95	2.76	4634	6.95	2.76	4634	6.95	2.76
Mother's vocabulary WAIS	4634	8.15	3.64	4634	8.15	3.64	4634	8.15	3.64
Mother's Postpartum depression	4634	0.12	0.32	4634	0.12	0.32	4634	0.12	0.32
School attendance	4634	0.50	0.50	4634	0.92	0.27	4634	1.00	0.06
Preschool attendance	4634	0.50	0.50	4634	0.66	0.48	4634	0.56	0.50
Books in household	4634	0.19	0.39	4634	0.33	0.47	4634	0.44	0.50
Violence in household	4634	0.22	0.41	4634	0.23	0.42	4634	0.15	0.36

Table 2: Means and standard deviation of longitudinal sample 2010, 2012 y 2017

Empirical Strategy

The empirical strategy consists of two set of analyzes. First, a cross-sectional analysis is performed for each wave of the ELPI, to determine the existence and magnitude of wealth disparities in the development of cognitive and socio-emotional skills in each cohort. This is a descriptive analysis and we do not claim the relationship is causal. It contributes to show how important these disparities are and what mediators are essential to explain this relationship. The second part corresponds to the longitudinal analysis, which determines the relevance of wealth disparities in the development of a permanent skill component calculated for cognitive and socio-emotional abilities for each child.

For the cross-sectional analysis, linear regression models are performed for each wave, as indicated in equation (1), where the dependent variable Y_{it} corresponds to the agestandardized scores obtained in the PPVT or CBCL tests by the child *i* in year *t* and the main independent variable are dummies by wealth quintiles *j* (Q_{ijt}), where the first quintile is omitted and therefore the interpretation of the coefficients is made in comparison to quintile 1, and controls (X_{it}) and mediators (M_{it}) as detailed in the previous section:

$$Y_{it} = \alpha_0 + \sum_{i=2}^{5} \beta_i Q_{ijt} + \delta X_{it} + \gamma M_{it} + \varepsilon_{it}$$
(1)

To exploit the richness of the longitudinal data, we calculate a permanent skill component for each child using a two-step estimation. First, a fixed effect model (equation 2) is performed, which considers as a dependent variable the standardized score in PPVT or CBCL tests, as regressors all time-variant controls $(X'_{it})^3$ and a child fixed effect (θ_i) :

$$Y_{it} = \theta_i + \delta X'_{it} + \epsilon_{1it} \tag{2}$$

We call this child effect a permanent and unobserved factor, which is inherently fixed for each child across their first 12 years of life. Doing this we are able to remove some noise or

³ Child's age in months, height of the main caregiver, number of people in the household, if the selected child is the older sibling in the household, if the biological father lives in the household.

measurement error in the tests, obtaining a measure of skills that controls for this noise. We estimate $\widehat{\theta_{11}}$ using the cognitive skills tests and $\widehat{\theta_{21}}$ using the socio-emotional skills tests.

Then, in a second step, we perform OLS estimations, where the dependent variable are the child fixed and unobserved components recovered from the first stage. In particular, equation (3) accounts for wealth disparities, through dummies per quintile, on the intrinsic unobservable characteristics to each child in the PPVT tests, while equation (4) gives us information regarding the gap when we consider as a dependent variable the unobservable characteristics of children in CBCL tests. In both cases, controls that do not vary over the years $(X_i'')^4$ and all mediators (M_{it}) detailed previously are considered⁵.

$$\widehat{\theta_{1\iota}} = \alpha_1 + \sum_{j=2}^5 \beta_j \, Q_{ijt} + \delta_1 X^{\prime\prime}{}_i + \gamma_1 M_{it} + \varepsilon_{1it} \quad (3)$$

$$\widehat{\theta_{2\iota}} = \alpha_2 + \sum_{z=2}^5 \beta_z \, Q_{izt} + \delta_2 X^{\prime\prime}{}_i + \gamma_2 M_{it} + \varepsilon_{2it} \quad (4)$$

There are two ways to carry out this last part: (1) to consider the wealth quintiles by year, and therefore, analyze the effect of socioeconomic status of year *t* on the unobservable skill factor of children, or (2) create a longitudinal quintile, which accounts for the socioeconomic status of the household in which the child lives considering all years (longitudinal quintiles). The first approach helps us to study at which stage of development, wealth is more relevant to explain skills gaps. The second specification has the advantage of using a more robust measure of wealth, which includes information for over 7 years. However, since we are more interested on finding the relationship of wealth on skill formation in critical periods of infancy, we only show the results of wealth quintiles by year and leave the longitudinal quintiles approach in the appendix.

⁴ Sex of the child, height at birth, weight at birth, year of birth, numerical WAIS of the mother and vocabulary WAIS of the mother.

⁵ This two-step procedure was estimated using bootstrap to consider that dependent variables in equations (3) and (4) are generated variables.

Results

To identify the existence of the wealth gap and their magnitude in cognitive and socioemotional skills in children, the first set of results (Fig 1 and Fig. 2) show the bivariate association between the wealth gradients and the children outcomes without any controls, to understand the unadjusted gap. Fig. 1 shows the means of the standardized test scores for children by wealth quintiles in each period, using the cross-sectional data, this means that in 2010 there are children between 6 months and 5 years, in 2012 between 6 months and 7 years and in 2017 between 11 months and 12 years. For both set of skills, the mean of the standardized scores increase as the wealth quintiles increase and this pattern is observed for the three periods. More specifically, in the PPVT score in 2010 there is a gap of 0.9 standard deviations among children belonging to the richest 20%, compared to children belonging to households of the poorest 20%. In 2017 this same gap decreases to approximately 0.4 standard deviations. For CBCL this gap amounts to 0.7 standard deviations in 2010 and falls to 0.4 standard deviations in 2017.

Fig. 1: Means of standardized cognitive (PPVT) and socio-emotional (CBCL) test scores by wealth quintiles.



Fig. 2 analyzes the evolution of the gap between the poorest and the richest quintile for the longitudinal sample over time. The gap between the poorest quintile and the richest quintile, without controls or mediators, decreases significantly between 2010 and 2017 in cognitive and socio-emotional skills. For cognitive skills, the gap in 2017 falls in 0.26 standard

deviations compared to the gap in 2010. For socio-emotional skills the reduction of the gap during the period corresponds to 0.18 standard deviations. When controls and mediators are considered the gap reduces in magnitude but remains being significant. For the cognitive skill the gap in 2017 decreases in 0.23 standard deviations from the gap in 2010. For the socio-emotional skill, the 2017 gap decreases by 0.17 standard deviations from the 2010 gap.

Fig. 2: Evolution of the gap between the poorest and the richest quintile of the standardized score obtained in the PPVT and CBCL test for the panel sample.



Figure 3 summarizes the information obtained in cross-sectional analysis for the cognitive and socio-emotional skills⁶. When adding controls and mediators, the estimations show that there are significant wealth disparities between the poorest and the richest wealth quintile for cognitive and socio-emotional outcomes, for all periods. More specifically, in 2010 children in the richest quintile have an average of 0.46 standard deviations more than children in the poorest quintile in the cognitive test. However, this gap decreases over time, being 0.11 standard deviations in 2017. For socio-emotional skills in 2010 the gap corresponds to 0.29 standard deviations and falls to 0.21 in 2017. Therefore, after controlling for child, mother and household characteristics, children belonging to households that are located at opposite end of the wealth distribution have gaps in cognitive and socio-emotional outcomes that goes from 0.08 standard deviations in socioemotional skills to 0.35 standard deviation in cognitive skills.

Fig. 3: Estimated coefficients and confidence intervals of quintiles, with respect to quintile I, obtained by performing cross-sectional analysis in PPVT and CBCL.



⁶ The result of the regression models can be found in the appendix.

The longitudinal analysis is presented in Fig. 4^7 . When using the fixed child component obtained in the two step procedure describe above, and controlling for child and maternal characteristics, the gap between the poorest and the richest wealth quintile is significant for the permanent unobserved component of the cognitive skill in each period, but not significant for the permanent unobserved component of the socio-emotional ability. Particularly when examining the wealth quintile when children are between 30 and 60 months old, the earliest period we observe, the gap for the permanent unobserved component of the cognitive skills, (blue lines in left panel of Fig. 4), corresponds to 0.36 standard deviations: that is, on average, children who belonged to the richest wealth quintile during early childhood obtain 0.36 standard deviations more in the test score than children belonging to the poorest quintile. When considering the wealth quintile when children are between 5 and 7 years old (red lines in left panel of Fig. 4), the gap slightly falls to 0.32. Children who belong to the richest quintile during the preadolescence period (10 to 12 years old) have 0.31 standard deviations more of the permanent component of the cognitive skills than preadolescents living in the poorest quintile during that period (green lines in left panel of Fig. 4). For the permanent component of socio-emotional skills, on average, children who belong to the richest wealth quintile, obtain 0.09, 0.07 and 0.04 standard deviations more than children belonging to the poorest quintile respectively in each period, however, these coefficients are not statistically different from zero (see right panel Fig. 4).

The results from Figures 1 to 4 indicate that the relationship between wealth and skills is robust to several measures of skills, weather we consider as dependent variables the skill test that vary by wave, or when we construct a fixed measure of skills, the gaps tend to appear early in life, though they decrease over time. Overall, the results indicate that in order to reduce wealth gaps, it is important to start as early as possible in the child development process.

Fig. 4: Estimated coefficients and confidence intervals of quintiles, with respect to quintile I, obtained by performing longitudinal analysis in PPVT and CBCL.

⁷ The models from the longitudinal analysis are in the appendix.



Table 3 and 4 show the particular effect that each of the mediators have on the association between quintiles and the permanent component of the cognitive and socio-emotional ability, respectively. Tables show only the coefficient from the richest quintile, compared to the poorest quintile, but results from the full models are shown in Appendix. In the first column of Table 3, are the results of the PPVT estimation only considering wealth quintiles, column two adds controls and the next columns adds each of the mediators, one by one. The last column includes all controls and mediators. From this exercise it can be concluded that, when we analyze the coefficient from the richest wealth quintile (compared to the poorest quintile) for the earliest period (when children are between 30 - 60 months old), the most relevant mediator is mother's schooling, which causes the gap to go from 0.76 (column 1) to 0.49 (column 3). The second mediator which makes the greatest contribution is WAIS, numerical and vocabulary ability of the mother, (column 4) which causes the gap to fall to 0.51 from the initial unadjusted gap (column 1). Then, given the results, it is possible to argue that maternal characteristics are the most important variables mediating the relationship between wealth and skills formation, while postpartum depression, attendance of the child to an educational establishment, attendance to preschool, and the presence of books and violence in the home, have no greater incidence in reducing the wealth gap from children belonging to the poorest households with respect to the richest households. However, this does not detract from the relevant effect of each mediator on the permanent component in cognitive skills. Subpanels from Table 3 show that when exploring the wealth quintiles children experienced in latest periods, the conclusions about mediators remain the same: maternal schooling and maternal ability are the most important explanatory variables to understand the wealth gaps in the permanent component of the cognitive skills.

	(1)	(2)	(2)	(4)	(5)	(6)	(7)	(9)	(0)
	(1) Only quintiles	(2) Fixed controls	(3) Mother's schooling	(4) Mother's WAIS	Mother's Postpartum depression	School attendance	(7) Preeschool attendance	Books and Violence (HOME)	All
Quintile V 2010	0,759***	0,758***	0,487***	0,507***	0,750***	0,745***	0,751***	0,728***	0,362***
	(0,075)	(0,075)	(0,082)	(0,073)	(0,075)	(0,074)	(0,074)	(0,075)	(0,079)
Constant	-0,387*** (0,050)	-1,012* (0,603)	-1,628** (0,611)	-1,487** (0,590)	-1,036* (0,607)	-1,117* (0,603)	-1,062* (0,602)	-1,106* (0,603)	-1,901*** (0,602)
Observations	3,009	3,009	3,009	3,009	3,009	3,009	3,009	3,009	3,009
Quintile V 2012	0,759***	0,751***	0,465***	0,496***	0,743***	0,750***	0,755***	0,710***	0,319***
	(0,072)	(0,071)	(0,081)	(0,066)	(0,071)	(0,072)	(0,071)	(0,070)	(0,075)
Constant	-0,413***	-1,013*	-1,697**	-1,487**	-1,041*	-1,044*	-0,987*	-1,123*	-1,792**
	(0,049)	(0,607)	(0,609)	(0,596)	(0,612)	(0,617)	(0,604)	(0,600)	(0,601)
Observations	3,009	3,009	3,009	3,009	3,009	3,009	3,009	3,009	3,009
Quintile V 2017	0,678***	0,674***	0,402***	0,448***	0,667***	0,673***	0,671***	0,647***	0,307***
	(0,075)	(0,074)	(0,079)	(0,070)	(0,074)	(0,074)	(0,074)	(0,074)	(0,077)
Constant	-0,360***	-0,770	-1,579**	-1,361**	-0,799	-0,769	-0,789	-0,865	-1,724**
	(0,052)	(0,614)	(0,614)	(0,595)	(0,618)	(0,741)	(0,616)	(0,615)	(0,709)
Observations	3,009	3,009	3,009	3,009	3,009	3,009	3,009	3,009	3,009

Table 3: Mediation analysis - wealth disparity (Q1 vs Q5) in each year of PPVT. Longitudinal analysis

Table 4 presents the particular effect that each of the mediators have on the association between quintiles and the permanent component of the socio-emotional skills. The unadjusted gap with wealth quintiles from the earliest period is 0.19, by including controls and all mediators, on average children who belong to the richest quintile obtain 0.09 standard deviations more in the permanent component of socio-emotional skills than children belonging to the poorest quintile, however this coefficient loses its significance. It is striking that is the mother's schooling (column 3) the mediator that captures the importance of the wealth gap on the permanent component of the socio-emotional skill: when adding maternal schooling the wealth gap reduces to a level that is not different from zero, and this is consistent when exploring the importance of the wealth gap in different periods during the life course of the child.

Table 4: Mediation analysis - wealth disparity (Q1 vs Q5) in each year of CBCL.

Longitudinal analysis.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Only quintiles	Fixed controls	Mother's schooling	Mother's WAIS	Mother's Postpartum depression	School attendance	Preeschool attendance	Books and Violence (HOME)	All
Quintile V 2010	0,191**	0,249***	0,076	0,226***	0,263***	0,267***	0,267***	0,227***	0,087
	(0,073)	(0,068)	(0,071)	(0,070)	(0,068)	(0,068)	(0,068)	(0,068)	(0,072)
Constant	-0,012 (0,049)	-0,388 (0,477)	-0,767 (0,485)	-0,472 (0,484)	-0,341 (0,482)	-0,210 (0,472)	-0,232 (0,475)	-0,410 (0,476)	-0,597 (0,482)
Observations	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634
Quintile V 2012	0,200***	0,237***	0,036	0,209***	0,250***	0,244***	0,237***	0,197***	0,071
	(0,070)	(0,067)	(0,074)	(0,064)	(0,067)	(0,067)	(0,067)	(0,067)	(0,073)
Constant	-0,033	-0,367	-0,790	-0,454	-0,315	-0,182	-0,365	-0,344	-0,524
	(0,045)	(0,472)	(0,484)	(0,480)	(0,476)	(0,479)	(0,474)	(0,480)	(0,496)
Observations	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634
Quintile V 2017	0,222***	0,215***	0,028	0,185***	0,226***	0,216***	0,224***	0,196***	0,042
	(0,071)	(0,066)	(0,073)	(0,061)	(0,066)	(0,067)	(0,066)	(0,067)	(0,070)
Constant	-0,059	-0,279	-0,793	-0,392	-0,226	0,065	-0,214	-0,323	-0,446
	0,050	0,483	0,494	0,492	0,489	0,559	0,483	0,490	0,583
Observations	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634

Discussion

This paper presents evidence of strong associations between household wealth and cognitive and socio-emotional outcomes during childhood. Using longitudinal data from Chile and using several methods and measures of skills, we show that there is an important socioeconomic gap that persists in cognitive and socio-emotional skills among children. In particular, in the cross-sectional analysis we find that there are significant inequalities in the score obtained by children who belong to households of high and low socioeconomic status, for both cognitive and socio-emotional skills abilities, and these gaps decrease over time. The longitudinal analysis, which estimates the permanent component of children abilities, confirm these results for the cognitive domain, however not for the socioemotional skills. Children who belonged to the wealthier quintile during their early infancy, have 0.36 standard deviations more in the permanent component of cognitive skills than children from the poorest quintile, and the influence of the wealth quintile they belong to, in periods after early childhood, at 5-7 and 10-12 years old, remain practically the same to explain the permanent component of the cognitive ability. Regarding the analysis of mediators, the more important factors in mediating the relationship between wealth and ability are the mother's schooling and her cognitive ability. This result supports previous literature (Contreras and Puentes, 2017; Behrman, et al., 2017) and emphasizes the intergenerational transmission of disadvantages: the wealth gaps in the permanent component of cognitive skills are reduced by half when considering maternal education and maternal skills and are reduced to zero for the permanent component of the socioemotional dimension.

It is also important to highlight that the gaps are greater for cognitive skills, than for socioemotional skills. This difference is accentuated in our longitudinal analysis, where we consider as an outcome the permanent component of cognitive and socio-emotional skills: the wealth gap for the socio-emotional component disappears. This is coherent with previous empirical evidence, that shows consistently weakest socioeconomic gaps for socio-emotional skills than for cognitive abilities. (Berlinski and Schady, 2015; Bradley and Corwyn, 2002). One possible explanation for this pattern is that parents' contributions have different effects at different stages of the child's life cycle, as documented by Cunha and Heckman (2008), in particular cognitive abilities are most affected at an early age and socio-emotional abilities in later ages. Also, the investments of the parents are generally more effective in increasing non-cognitive skills, which is correlated to our result that mother's schooling absorbs almost all of the socio-emotional skill gap.

The combined results about the sustained association between wealth gap and cognitive and socioemotional outcomes, and that the most important factors the mediate this relationship are inherited of maternal characteristics raises concern about social stratification in Chile. Given the sustained socio-economic inequality that prevails in Chile and how early in the life course these gaps are generated, there is an important concern about the perpetuation and deepening of the inequalities in children outcomes, that as the evidence shows, have an important effect in later life outcomes (Almond and Currie 2011; Gertler et al, 2014; Heckman, et al. 2006; Hoddinott et al. 2008).

Acknowledgments

Alejandra Abufhele and Amanda Telias acknowledges the financial support provided by ANID PIA CIE160007.

Dante Contreras acknowledges the financial support provided by the Center for Social Conflict and Cohesion Studies (ANID/FONDAP/15130009).

Dante Contreras, Esteban Puentes and Natalia Valdebenito acknowledges the financial support provided by ANID – Millennium Science Initiative Program – Code: NCS17_015.

References

Almond, D., & Currie, J. (2011). Human capital development before age five. In Handbook of Labor Economics (Vol. 4). <u>https://doi.org/10.1016/S0169-7218(11)02413-0</u>

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(2):416–40.

Behrman, J., Contreras, D., Palma, I., & Puentes, E. (2017). Wealth Disparities for Early Childhood Anthropometrics and Skills: Evidence from Chilean Longitudinal Data. Working Paper. SSRN Electronic Journal.

Berger, L. M., Paxson, C., & Waldfogel, J. (2009). Income and Child Development. *Children and youth services review*, *31*(9), 978–989. doi:10.1016/j.childyouth.2009.04.013

Berlinski, S., & Schady, N. (Eds.) (2015). The Early Years: Child Wellbeing and the Role of Public Policy. Development in the Americas Series. New York: Palgrave MacMillan, and Washington, DC: Inter-American Development Bank

Bradbury, B., Waldfogel, J. & Washbrook, E. (2019). Income-Related Gaps in Early Child Cognitive Development: Why Are They Larger in the United States Than in the United Kingdom, Australia, and Canada?. *Demography* **56**, 367–390. <u>https://doi.org/10.1007/s13524-018-0738-8</u>

Bradley, R., and Corwyn. (2002) "Socioeconomic Status and Child Development." *Annual Review of Psychology* 53, no. 1: 371–99. https://doi.org/10.1146/annurev.psych.53.100901.135233.

Blau M. D., (1999). "The Effect of Income on Child Development." Review of Economics and Statistics 81(2):261–76. doi:10.1162/003465399558067

Contreras, D., & Puentes, E. (2017). Inequality of Opportunities at Early Ages: Evidence from Chile. Journal of Development Studies, 53(10), 1748–1764. https://doi.org/10.1080/00220388.2016.1262025

Cunha, F., & Heckman, J. J. (2008). Formulating, identifying and estimating the technology of cognitive and noncognitive skill formation. Journal of Human Resources, 43(4), 738–782. https://doi.org/10.3368/jhr.43.4.738

Dearing, E., McCartney, K., & Taylor, B. A. (2006). Within-child associations between family income and externalizing and internalizing problems. *Developmental Psychology*, 42(2), 237–252. <u>https://doi.org/10.1037/0012-1649.42.2.237</u>

Duncan, G., & Brooks-Gunn, J. (2000). Family Poverty, Welfare Reform, and Child Development. *Child Development*, 71(1), 188-196. Retrieved February 6, 2020, from www.jstor.org/stable/1132232

Duncan, G., & Magnuson, K. (2011). The nature and impact of early achievement skills, attention skills, and behavior problems. *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances*, 47–69.

Fernald, L. C., Kariger, P., Hidrobo, M., & Gertler, P. J. (2012). Socioeconomic gradients in child development in very young children: Evidence from India, Indonesia, Peru, and Senegal. Proceedings of the National Academy of Sciences, 109(Supplement 2), 17273-17280

Fernald, A., Marchman, V. A., & Weisleder, A. (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental Science*, *16*(2), 234–248. https://doi.org/10.1111/desc.12019

Galasso, E., Weber, A., & Fernald, L. C. H. (2019). Dynamics of Child Development: Analysis of a Longitudinal Cohort in a Very Low Income Country. World Bank Economic Review, 33(1), 140–149. <u>https://doi.org/10.1093/wber/lhw065</u>

Garcia, E. 2015. *Inequalities at the Starting Gate: Cognitive and Noncognitive Skills Gaps between 2010–2011 Kindergarten Classmates*. Economic Policy Institute.

Gertler, P., Heckman, J., Pinto, R., Zanolini, A., Vermeersch, C., Walker, S., ... Grantham-Mcgregor, S. (2014). Labor Market Returns to an Early Childhood Stimulation Intervention in Jamaica. Science, 12(6).

Guo, G., Harris, K.M. (2000). "The mechanisms mediating the effects of poverty on children's intellectual development". *Demography* **37**, 431–447. https://doi.org/10.1353/dem.2000.0005

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(3), 55.

Hoddinott, J., Maluccio, J. A., Behrman, J. R., Flores, R., & Martorell, R. (2008). Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. Lancet (London, England), 371(9610), 411–416. https://doi.org/10.1016/S0140-6736(08)60205-6

Kobrosly, R., van Wijngaarden, E., Galea, S., Cory-Slechta, D., Love, T., Hong, C., Shamlaye, C., & Davidson, P. (2011). Socioeconomic Position and Cognitive Function in the Seychelles: A Life Course Analysis. *Neuroepidemiology*, *36*, 162–168. https://doi.org/10.1159/000325779

Kelly, Y., A. Sacker, E. Del Bono, M. Francesconi, & M. Marmot. (2011). "What role for the home learning environment and parenting in reducing the socioeconomic gradient in child development? Findings from the Millennium Cohort Study." Arch Dis Child 96 (9): 832–7.

Linver, M., Brooks-Gunn, J., & Cabrera, N. (2004). The Home Observation for Measuremente of the Environment (HOME) Inventory: The Derivation of Conceptually Designed Subscales. Parenting: Science and Practice, 4, 99.114

Lopez Boo, F. (2016). Socio-economic status and early childhood cognitive skills: A mediation analysis using the Young Lives panel. International Journal of Behavioral Development, 40(6), 500–508. <u>https://doi.org/10.1177/0165025416644689</u>

Paxson, C., & Schady, N., (2007), Cognitive Development among Young Children in Ecuador: The Roles of Wealth, Health, and Parenting, Journal of Human Resources, 42, issue 1, <u>https://EconPapers.repec.org/RePEc:uwp:jhriss:v:42:y:2007:i1:p49-84</u>.

Reynolds, S. A., Andersen, C., Behrman, J., Singh, A., Stein, A. D., Benny, L., Crookston, B. T., Cueto, S., Dearden, K., Georgiadis, A., Krutikova, S., & Fernald, L. C. H. (2017). Disparities in children's vocabulary and height in relation to household wealth and parental schooling: A longitudinal study in four low- and middle-income countries. *SSM - Population Health*, *3*, 767–786. https://doi.org/10.1016/j.ssmph.2017.08.008

Rubio-Codina, M., Attanasio, O., Meghir, C., Varela, N., & Grantham-McGregor, S. (2015). The socioeconomic gradient of child development: Cross-sectional evidence from children 6–42 months in Bogota. Journal of Human Resources, 50(2), 464-483.

Schady, N., Behrman, J., Araujo, M. C., Azuero, R., Bernal, R., Bravo, D., . . . Vakis, R. (2015). Wealth gradients in early childhood cognitive development in five Latin American countries. Journal of Human Resources, 50(2), 446–463.