Wealth Gradients and Child Skills: Evidence from Chilean longitudinal data*

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Resumen

In this paper we study wealth gradients for the formation of cognitive and non-cognitive skills. We use sample of preschool and early school children in Chile. We improve on the previous literature by using longitudinal data, which allow us to study also the dynamics of skills formation. Also, we include information on mother and father's education and mother's cognitive ability. We find that even after controlling for many relevant variables, there are still important wealth gradients in the formation of cognitive skills, but there are no gradients in the formation of non-cognitive skills. Mother's education and cognitive ability are also main contributors of skill formation.

Very preliminary - Do not distribute

Keywords. Wealth, gradients.

JEL Classification: .

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1. Introduction

An increasing number of studies, primarily using cross-sectional data, show that significant parental wealth/income gradients for child cognitive skills start early in life, more in the early school ages but also in the preschool ages and more in high-income countries but increasingly in developing countries. The basic contribution of our study is to examine such gradients using longitudinal data within a dynamic framework for both preschool and early school ages in the context of Chile, a country characterized by fairly equal birth outcomes but high income inequality. We address the following questions: What are the extents of such gradients? Do significant wealth gradients persist with control for parental human capital including cognitive skills in addition to schooling attainment? Do more disaggregated wealth categories – deciles rather than quintiles – reveal interesting patterns? Do the patterns differ for the preschool and early school ages? How important are dynamic processes in the last two years and since birth? Are there gender differentials with respect to both parental human capital and child outcomes? Are the patterns similar for cognitive and behavioral outcomes?

This study contributes to the literature in four dimensions: First, we provide evidence using longitudinal data, which allow us to consider dynamics of the wealth gradient. Second, we use better control variables such as mothers' cognitive skills and child characteristics at birth, among others that allow better identifying the gradient relationship. Third, we explore gradients for for cognitive and non-cognitive skills of the child. Fourth, examining grades for Chile, an interesting case study because there are relatively few, though increasing, studies of gradients for developing countries and Chile is particularly interesting because of relative equality in birth outcomes but substantial inequalities later in the lifecycle.

To elaborate on the last point, Chile has relatively equal child birth outcomes by wealth: birth length and birth weight are practically the same along the wealth distribution (Figures 1 and 2). However, children's receptive vocabulary between ages three to six shows a significant gap between children coming from rich and poor households (Figure 3 and 4).

The high inequality that Chile exhibited is relevant to understand those patterns and consequences over time. Latin-American is a region of high income inequality and Chile

is high income country with one of the most unequal income distribution in the region. According to the World Bank, Chilean inequality is only surpassed by Brazil , Guatemala and Colombia. In addition, Chile is the most unequal economy in OECD countries. Our paper helps to understand when and where inequalities start and give some initial information on the interventions that could be implemented to reduce inequality.

Our results indicate that there are important wealth gradients for cognitive skills for preschool and early school children. Moreover, these gradients persist even after controlling for mother's cognitive skills and lags of the skills. At the same time, mother's education and mother's cognitive skills are highly related to the formation of cognitive skills of their children. For non-cognitive skills we find that gradients are less relevant, and mother's education and mother's cognitive skills are highly correlated with non-cognitive skills.

The paper is divided in seven sections. The first one is this introduction, the second one reviews the literature, the third one describes the data, the fourth one describes the tests used in the paper, the fifth one discusses the empirical methodology, the sixth one presents the results and the seventh concludes.

2. Literature

Gradients have been investigated for different types of countries and from different perspectives: Paxson and Schady (2007) found that in Ecuador household wealth and parental education were associated with higher scores, and that those associations were larger among older children. Child health and measures of parenting quality were associated with test performance, and account for a fraction, although not the majority, of the association between SES and cognitive development.

Fernald et al. (2011) found that in Madagascar, children whose families were in the top wealth quintile or whose mothers had secondary education performed significantly better across almost all measures of cognitive and language development and had better linear growth compared with children of women in the lowest wealth quintile or women with no education. The mean difference in the scores between children in the highest and lowest

socioeconomic status categories doubled between age 3 and age 6, and the biggest gaps across socioeconomic position by age 6 were in receptive language and sustained attention. Fernald et al. (2012) performed a score comparison among children whose mothers diferred in education and wealth for Peru, India, Indonesia and Senegal. Significant differences 0f 0.5 and 0.32 standard deviations where found for Peru and India, while no differences where found for the latter.

Behrman et al. (2015) found significant differences in child TVIP scores by mother schooling levels (incomplete primary or less, compared to complete secondary or more) in five latin american countries (Chile, Colombia, Ecuador, Peru and Nicaragua). The signicant association between wealth and child cognitive development is robust to the inclusion of additional covariates. With a longitudinal analysis for Ecuador, Peru and Nicaragua they conclude that there is no evidence of catch-up:the wealth gradients that are apparent among four and ve-year old children are also apparent as these children age.

Rubio-Codina et al. (2015) found significant gaps in test scores in cognition (0.53 SD), receptive language (0.42 SD) and expressive language (0.49 SD) between children in the top and bottom quartile of the household wealth distribution in Colombia. The SES gap is about half the size for fine motor and socioemotional development, and not significant in gross motor skills. The gaps persist after controlling for other factors likely correlated with wealth, including maternal education.

More recently, Boo (2016) conducted a mediators analyzing of gradients. She found that the SES gradient persists but is also significantly reduced when controlling for a large number of highly important variables in all countries, except India (age 5) and Vietnam (age 8) where the gradient disappears.Urban residence and caregiver's education are consistently the most important mediators across countries and ages.

Previous literature has not been able to draw causal inferences and cannot rule out the possibility that unobserved variables influencing both SEP, cognitive and language outcomes could bias the results or produce spurious correlation between child cognitive ability and SES.

3. Data

This study uses data from the first (2010) and second (2012) round of the *Early Childhood Longitudinal Survey* (Encuesta Longitudinal de Primera Infancia, ELPI). The survey is representative of the Chilean population and was created to gather information about children in the first few years of life for the purpose of designing and assessing different public policy programs.

The survey consisted of two information-gathering visits; on the first a sociodemographic survey was taken in the household of each child included in the survey. On the second visit, three instruments were applied to evaluate cognitive, socioemotional and physical aspects.

The survey was administered by psychologists with experience in infant evaluations and/or psychological tests. The TVIP test was then used to measure the child's cognitive abilities. It corresponds to an adaptation of the Peabody Picture Vocabulary Test that was designed for Spanish-speaking children. It is a measure of auditory vocabulary that is internally valid and consistent and has been used in several international studies (Dante and González, 2015; Coddington et al., 2014); Roy et al., 2011).

An important aspect of the survey is that it not only provides information required to characterize the family environment of the children studied. It also enables a profile of mothers to be built that includes prenatal care, cognitive ability, and employment status. Additionally, the survey enables the identification of factors that are important in the psychomotor development of children up to 5 years of age, such as preschool education, medical status, and the surrounding environment.

Because of its design, the ELPI can be used to analyze factors that are not considered by other surveys but that are relevant to children's physical and psychomotor development; these include medical factors during the mother's pregnancy and in the first few years of the child's life. By applying the Peabody Picture Vocabulary Test (TVIP), a measure of a child's cognitive status can be obtained. Child Behaviour Check List (CBCL) is a test that measures behavioral and socioemocional abilities of children, and allows to identify problems such as anxiety, autism, violent behaviours and atentional deficits children might have. In addition,

the application of the WAIS [1] digit span and vocabulary subtests provided a measure of the mother's cognitive ability. Using this information, it was possible to identify the effect, in terms of direction and magnitude, of the mother's cognitive development on the child's biopsychosocial development. The study was conducted with a sample of children whose mothers reported being the main caregiver.

Also, ELPI enables to built a measure of wealth using Principal Component Analysis in order to generate wealth quintiles.

ELPI 2012 was the second round of the inquiry and tried to find the children that were evaluated in 2010. Obviously, those kids where older in 2012. To achieve the goal of having a representative sample of children between the same ages, new younger kids where included in 2012, and this is known as the refreshment sample".

We take advantage of the first wave of data by including the child's first (2010) TVIP score as a way of controlling for the child's previous cognitive abilities.

The database for the final estimations was built merging 2010 and 2012 crosssectional ELPIs to follow children who took the tests on both years. The table below shows how the original databases statistics change when merging them. The first two columns shows statistics for the 2010 and 2012 crossectional data bases with valid TVIP and CBCL test scores, separately. The third column shows the longitudinal database with valid TVIP and CBCL Tests for both years.

It can be seen that 7828 children took TVIP test in 2010 and 12.231 did so in 2012. When mergin both databases we are able to follow 5.765 children that took TVIP test in both years.

With CBCL the story is a bit different: 11.193 children took CBCL in ELPI 2010. When they where reached to make the follow up in 2012 some of them were older than 72 months old, the limit age for CBCL test. For this reason, in 2012 there where two types of CBCL test: CBCL 1 for children under 72 months old, and CBCL 2 for children older than 72 months. In the table it can be seen that 7022 children took CBCL 1 in 2010 and 2012, while 1767 children took CBCL 1 in 2010 and CBCL 2 in 2012. In sum, 8789 children took CBCL test

[1] Test that measures the overall intelligence of individuals 16 to 64 years of age (Apfelbeck and Hermosilla, 2000).

in both years.

Cuadro 1: Database statistic

Variable	(1) ELPI 2010	(2) ELPI 2012	(3) ELPI 2010 y 2012
Panel A: TVIP Statistics			
Mean	103.76	102.69	105.66
SD	(15.43)	(17.82)	(19.15)
Obs TVIP	7282	12231	5765
Panel B: CBCL Statistics			
Mean CBCL 1	59.81	55.18	54.89
SD	(9.75)	(11.78)	(11.81)
Obs CBCL 1	11193	11573	7022
Mean CBCL 2		56.59	56.63
SD		(11.07)	(11.05)
Obs CBCL 2	0	1855	1767
Total Obs CBCL			8789
Total Obs	15175	16231	12898

Notes: Authors' calculations. Column 3 presents the average and SD of 2012 Tests scores for the longitudinal Sample.

In our estimation we present several specifications to observe how the magnitude and significance of the gradient changes when adding variables that are correlated to wealth and might affect test scores. The table below shows how the statistics change when changing the specification. Column 1 shows statistics for the original longitudinal sample with valid test scores. Column 2 shows statistics for the sample that has information for childs sex, a dummy indicating if he/she is the eldest son, childs age in months, region of residence, age difference among rounds, family size, wealth quintile, mothers WAIS, parents schoolling and childs height and weight at birth. It may be noted that while the observations fall, the average scores remain relatively stable.

Cuadro 2: Database statistic

Variable	(1) ELPI 2010 and 2012	(2) Restricted Sample
Panel A: TVIP Sample		
TVIP 2012	105.63	105.69
Childs Age	67.03	66.99
Childs Sex	0.5	0.5
Mothers Schoolling	11.32	11.36
Mothers Numeric WAIS	6.85	6.87
Mothers Vocabulary WAIS	8.05	8.1
Mothers Age	32.5	32.66
Wealth Quintile	2.99	3
N	5765	5186
Panel B: CBCL 1 Sample		
CBCL 1 2012	54.9	54.29
Childs Age in 2012	57.45	63.34
Childs Sex	0.5	0.5
Mothers Schoolling	11.36	11.37
Mothers Numeric WAIS	6.9	6.89
Mothers Vocabulary WAIS	7.8	8.07
Mothers Age in 2012	31.58	32.27
Wealth Quintile	2.97	2.98
N	7022	3582
Panel B: CBCL 2 Sample		
CBCL 2 2012	56.63	56.45
Childs Age in 2012	75.34	75.35
Childs Sex	0.49	0.49
Mothers Schoolling	11.29	11.31
Mothers Numeric WAIS	6.8	6.83
Mothers Vocabulary WAIS	8.13	8.17
Mothers Age in 2012	33.4	33.6
Wealth Quintile	3.02	3.06
N	1767	1564

Notes: Authors' calculations. 2010 characteristics include childs sex, a dummy indicating if he/she is the eldest son, childs age in months, region of residence, age difference among rounds, family size, wealth quintile, mothers WAIS, parents schoolling and childs height and weight at birth.

Table 3 shows the transition among wealth quintiles between 2010 and 2012. The diagonal shows the probability of being in the same quintile in both years: it can be noted that 58.5 % of people in quintile 1 in 2010 remained there in 2012 and that only 1.73 % moved to the fifth quintile. In the same period, 55 % of the sample remained in the fifth quintile. The fact that the diagonal has the highest row percentages it is a sign of low wealth mobility.

Cuadro 3: Matriz de Transición, Quintiles de Activos

Quintile 2012	1	2	3	4	5	Total
Quintile 2010						
1	58.49	26.17	10.05	3.55	1.73	100.00
2	23.49	31.50	26.94	13.86	4.22	100.00
3	11.32	22.19	29.74	25.70	11.05	100.00
4	4.55	12.53	22.23	33.65	27.04	100.00
5	2.47	6.36	10.95	25.27	54.95	100.00
Total	20.13	19.80	20.01	20.39	19.68	100.00

Notes: Authors' calculations. Sample that has data for both years on TVIP.

Figures 1 and 2 show that there is no significant difference in weight and height at birth among wealth quintiles. On the other side, Figure 3 and 4 show that there is significant differences in TVIP score between quintiles 1 and 5, and that these differences tend to change with age.

Figura 1: Height at birth and wealth Quintiles

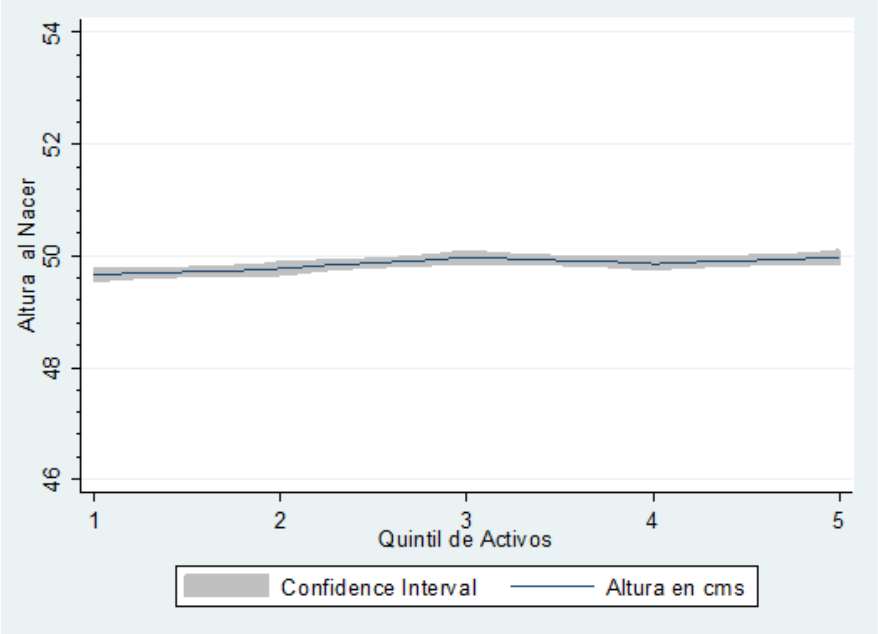


Figura 2: Weight at birth and wealth Quintiles

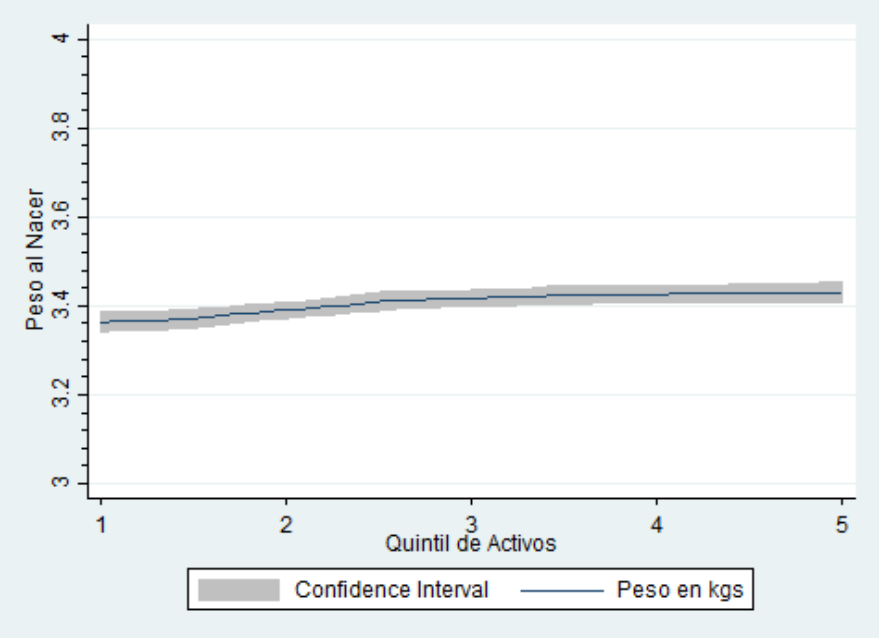


Figura 3: TVIP 2012 and age in months, Wealth Quintiles 1 and 5

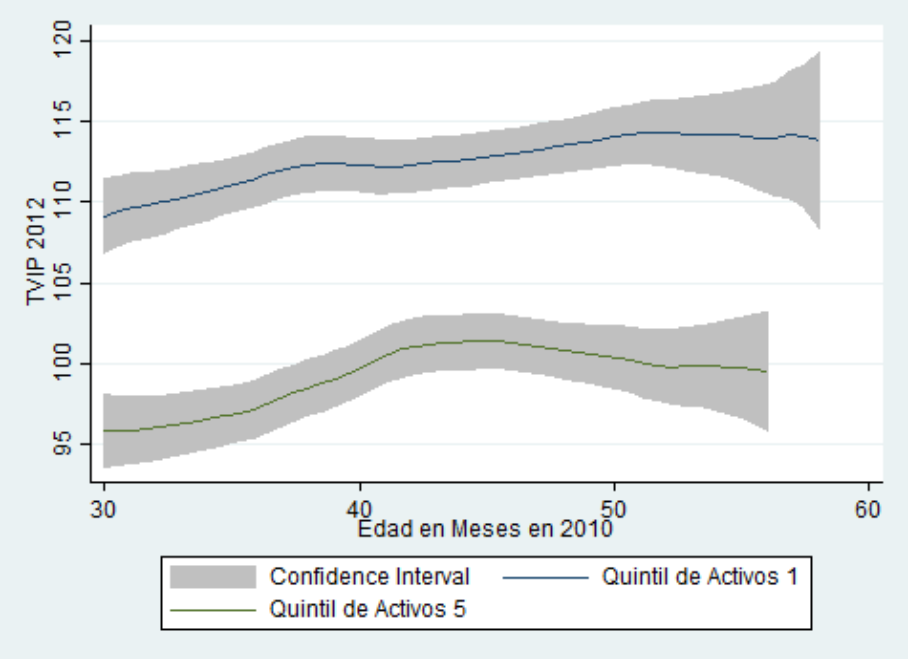
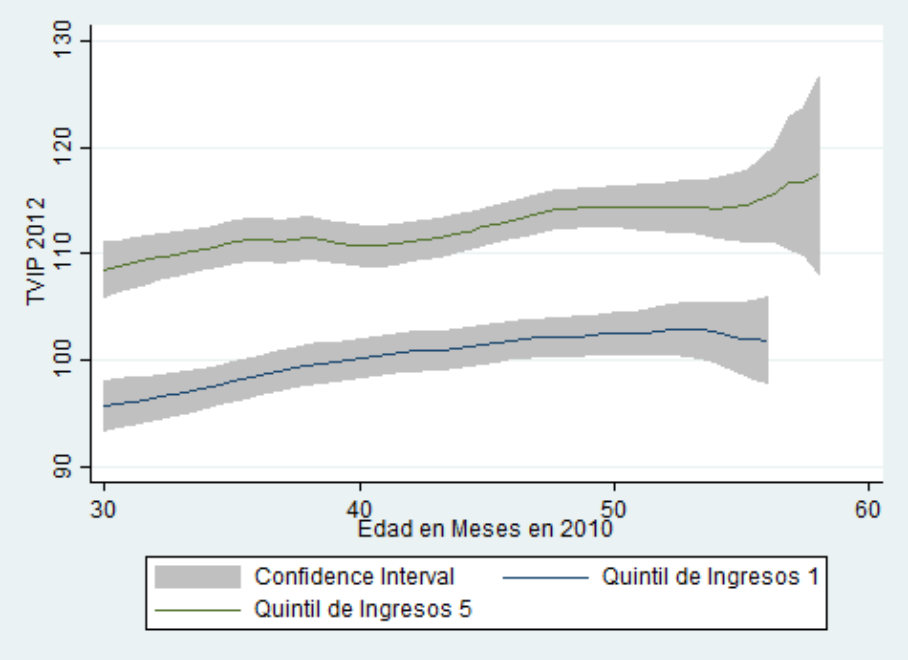


Figura 4: TVIP 2012 y and age in months, Income Quintiles 1 and 5



4. Test Description

Wechsler Adult Intelligence Scale (Adults) (WAIS)

The test of the two subscales of the Weschler Adults Intelligence Scale (WAIS) developed by Apfelbeck and Hermosilla (2000) involves vocabulary and digit retention, more commonly known as language and mathematics. This allows researcher to obtain the intellectual quotient, which is defined as the ratio of the achievement of the subject and the average achieved by the age group.

This test allows one to ascertain whether the skills evaluated are extremely low, borderline, low average, average, high average, superior or very superior. The test provides a gross score which is transformed into the standard results in order to conduct the aforementioned classifications. The abilities measured in each test are listed below:

Digit retention sub-scale: This is a two-part test and the sections are applied consecutively: digits in the same order and retention of digits in inverse order. It measures the performance of work or operational memory and the information processing speed. In addition, short-

terms auditory memory, sequencing, independence from distraction, facility with numbers and mental alertness are evaluated. A normal score indicates normal functioning in these areas and an excellent level implies rapid adaptation to stimulus and flexibility of cognitive adaptation. The test is standardized in seven levels and caregivers focus on three of these. The results show that 41.9 % of caregivers have a slightly diminished ability, 29.9 % have a normal ability and 17.5 % have a moderately diminished ability.15Furthermore, when we analyze the results by income, we find that a greater proportion of primary caregivers in the lower income quintiles have a lower level of development than their peers in the higher quintiles.

Vocabulary sub-scale: Evaluates the cultural level (especially in regard to the environment and education of the first years), education, capacity to receive new information, store it and use it correctly, receptivity of new ideas, associativity, classification and conceptualization. Our data show that 10.5 % of caregivers have a strongly diminished ability, 9.2 % moderately diminished, 13.9 % slightly diminished, 50.5 % normal, 10 % good level and the remainder are very good or excellent. When we analyze the data based on income, as occurred in the digits test, the higher the household income, the greater the development of primary caregivers' linguistic abilities.

The ELPI tests were both applied to all of the primary caregivers, noting that the average in digits was 7.016 (Low Average) and the average in vocabulary was 8.317 (average).

Child Behaviour Check List: CBCL

The Child Behaviour Check List (CBLC) assess behavior and socioemotional competencies of the child as reported by the parents, and can be used to identify problematic areas in child development: emotional reactivity, anxiety/depression, somatic complaints, autism, attention problems, aggressive behavior, and sleep problems. In addition to a total score which assess all seven areas simultaneously, each area can be studied separately. Finally, the first four areas (emotional reactivity, anxiety/depression, somatic complaints, and autism)

are grouped into an internalization category, and the next two (attention problems and aggressive behavior) into an externalization category. Thus, with these two tests we are able to study cognitive and non-cognitive (socioemotional) development of children.

Peabody Picture Vocabulary Test (TVIP)

The test corresponds to an adaptation of the Peabody Picture Vocabulary Test that was designed for Spanish-speaking children. It offers a measure of auditory vocabulary that is internally valid and consistent, and has been used in several international studies.

This psychometric test is intended to measure the auditory reception capacity of children 30 and 60 months old. It is easy to apply and as it requires no reading or writing skills it can be applied to preschool-aged children. The test contains 125 laminated sheets, each of which contains 4 pictures. The examiner shows the child each of the sheets and says a word out loud. After hearing the word, the child must select the image that best illustrates its meaning. The test is applied until it is possible to identify a basal and a ceiling in the responses obtained. The basal is the highest set and is established when a child has 8 consecutive correct responses, while the ceiling is the lowest set and is established when a child incorrectly identifies 6 out of 8 consecutive items. The results are then standardized according to the age group of those interviewed and the standards for Mexico or Puerto Rico. The standardized scale of the test ranges from 55 to 145 points, with scores ranging from extremely low toextremely high (Dunn et al. 1986).

5. Empirical Methodology

We begin our empirical analysis by estimating the effect that the assets of the familiy has on cognitive and no cognitive test scores. To do so, we estimate the following model:

$$Y_i = \alpha_0 + \sum_{j}^{4} \beta_j A_{ji} + \theta X_i + \epsilon_i \quad (1)$$

Where Y_i is the standarized test score of child i, $A_j i$ is a dummy that are 1 if the the familiy of child i have a asset quintile j and 0 if not[2], X_i is a vector of characteristics of child i and ϵ_i is the error term.

If equation (1) is estimated, the error will be correlated with omitted characteristics that may have to do with the characteristics of the family or with the characteristics of the student. For example, if in the first case, parents' schooling is omitted, and the schooling is positively correlatedd with a higher asset quintile and, in turn, with a higher test score, then a positive bias will be observed in the estimated parameters. If, in the second case, student characteristics that are related to performance are omitted but could also be related to the availability of assets, such as size and weight birth, then again the results will be biased.

Then, to equation (1) are added a vector of observable characteristics of child i (R_i) such as parental schooling, numerical and verbal wais test score, height at birth, birth weight. Additionally, is added the standarized test score of child at the past period to control by prior ability.

The estimated final equation is

$$Y_{it} = \alpha_0 + \sum_{j}^{4} \beta_j A_{ji} + \gamma Y_{i,t-1} + \theta X_i + \tau R_i + \epsilon_i \tag{2}$$

Thus, our approach consists in estimating a reduced-form linear regression models to account for the role of individual's characteristics, family background and other covariates on childs cognitive and non-cognitive outcomes. We place special attention to early endowments (weight and height at birth 2010) and its effects on skills.

One potential problem with the above specification is that several covariates may not be totally exogenous. In this case, wealthier families may take different choices to improve their children performance. If we fail to account for these types of factors, estimates from the reduced-form model would be biased. As we mentioned above, our identifying assumption consists in including different covariates accounting for individual and family background.

[2]the quintile 1 is ommited.

In addition, we included test scores at individual level (using the panel data set) in 2010 to proxy for individual's abilities that may be causing this potential selection bias.

All of our regressions analyses are based on variations of equation (2). Our goal is to reveal the contribution of wealth gradient on child outcomes.

6. Results

Results are presented in Tables 4-7. Tables 4 and 5 summarize outcomes for cognitive variables (TVIP), while Tables 6 and 7 shows non-cognitive outcomes (CBCL). Outcomes are presented for children over (below) 72 months, which is equivalent to first year in primary education. Access to formal education and social interaction may explain differences in outcomes since that age.

For cognitive skills the evidence suggests a significant gradient pattern for children over 72 months. There is a positive association between wealth and cognitive skill even controlling for family and individual characteristics. It is important to note that such effect remains after controlling for individual past test score. However, these effects are less stable for children under 6 years old.

In addition, the other covariates exhibit the expected coefficients. The larger mother and father education is related to better cognitive outcomes. The mothers Waiss vocabulary test scores also showed a positive association with cognitive skills.

On the other hand, the results for non-cognitive tests (CBCL)are less related to wealth gradients. Indeed, according to the evidence only for children below 72 months Q5 is significant. For the rest of the specification this relationship is not statistically significant.

Thus Chile exhibits little inequality in birth outcomes to large inequalities for preschool and beginning-primary age children. This large inequality is mostly transmitted in cognitive outcomes rather than non-cognitive ones. These results remain when longitudinal data is used to control for. The changes between 2010 and 2012 in anthropometrics and test scores are significantly related to 2010 wealth quintiles, thus perhaps suggesting increasing inequalities between the two years.

Cuadro 4: Regressions TVIP children under 72 months.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wealth Quintile = 2	0.161**	0.0906	0.127**	0.107*	0.153**	0.0744	0.0564
	(0.0613)	(0.0515)	(0.0553)	(0.0576)	(0.0627)	(0.0507)	(0.0523)
Wealth Quintile = 3	0.350***	0.209***	0.277***	0.218***	0.341***	0.181***	0.120**
	(0.0743)	(0.0598)	(0.0607)	(0.0586)	(0.0727)	(0.0541)	(0.0473)
Wealth Quintile = 4	0.372***	0.189***	0.282***	0.226***	0.364***	0.159***	0.101*
	(0.0668)	(0.0549)	(0.0582)	(0.0535)	(0.0676)	(0.0530)	(0.0500)
Wealth Quintile = 5	0.693***	0.362***	0.538***	0.419***	0.684***	0.318***	0.200***
	(0.0803)	(0.0587)	(0.0697)	(0.0670)	(0.0824)	(0.0557)	(0.0557)
Mothers Schooling		0.0543***				0.0420***	0.0329***
		(0.00374)				(0.00509)	(0.00646)
Fathers Schooling		0.0267***				0.0239***	0.0158***
		(0.00488)				(0.00475)	(0.00429)
Numeric WAIS			0.00957			0.00229	-0.00721
			(0.00897)			(0.00786)	(0.00522)
Vocabulary WAIS			0.0401***			0.0286***	0.0158**
			(0.00492)			(0.00533)	(0.00587)
Lagged TVIP 2010				0.384***			0.352***
				(0.0152)			(0.0129)
Height at birth					0.000878	0.00285	-0.000601
					(0.00715)	(0.00757)	(0.00716)
weight at birth					-0.0258	-0.0212	-0.0108
					(0.0346)	(0.0328)	(0.0352)
Constant	0.0288	-0.864**	-0.367	0.122	0.110	-0.983**	-0.412
	(0.332)	(0.363)	(0.305)	(0.393)	(0.428)	(0.451)	(0.450)
Observations	3,978	3,978	3,975	3,978	3,978	3,975	3,975
R-squared	0.095	0.125	0.116	0.206	0.097	0.135	0.222

Notes: Authors' calculations. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Cuadro 5: Regressions TVIP children over 72 months.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wealth Quintile = 2	0.239***	0.169*	0.193**	0.161*	0.243***	0.157*	0.120
	(0.0681)	(0.0840)	(0.0769)	(0.0784)	(0.0690)	(0.0846)	(0.0852)
Wealth Quintile = 3	0.349***	0.207***	0.269***	0.212***	0.353***	0.193***	0.134**
	(0.0452)	(0.0404)	(0.0435)	(0.0409)	(0.0466)	(0.0447)	(0.0466)
Wealth Quintile = 4	0.606***	0.404***	0.478***	0.371***	0.618***	0.382***	0.272***
	(0.0569)	(0.0469)	(0.0479)	(0.0413)	(0.0597)	(0.0497)	(0.0528)
Wealth Quintile = 5	0.714***	0.393***	0.508***	0.331***	0.732***	0.354***	0.175**
	(0.0636)	(0.0801)	(0.0646)	(0.0756)	(0.0601)	(0.0664)	(0.0750)
Mothers Schooling		0.0503***				0.0361***	0.0275**
		(0.00733)				(0.00833)	(0.00958)
Fathers Schooling		0.0279**				0.0220**	0.0102
		(0.00981)				(0.00982)	(0.00965)
Numeric WAIS			0.0220			0.0140	-0.000837
			(0.0126)			(0.0132)	(0.00960)
Vocabulary WAIS			0.0411***			0.0289***	0.0123**
			(0.00583)			(0.00680)	(0.00459)
Lagged TVIP 2010				0.362***			0.335***
				(0.0174)			(0.0169)
Height at birth					0.0196	0.0190	0.0193
					(0.0142)	(0.0125)	(0.0130)
weight at birth					0.0158	0.0175	0.00175
					(0.0706)	(0.0630)	(0.0585)
Constant	1.359***	0.409	0.717	1.231***	0.319	-0.791	-0.321
	(0.431)	(0.458)	(0.451)	(0.378)	(0.805)	(0.740)	(0.697)
Observations	1,757	1,757	1,755	1,757	1,757	1,755	1,755
R-squared	0.115	0.151	0.145	0.273	0.119	0.166	0.289

Notes: Authors' calculations. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Cuadro 6: Regressions CBLC child under 72 months.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wealth Quintile = 2	-0.0993**	-0.0501	-0.0628	-0.0704	-0.0984**	-0.0355	-0.0353
	(0.0429)	(0.0381)	(0.0410)	(0.0499)	(0.0428)	(0.0472)	(0.0472)
Wealth Quintile = 3	-0.228***	-0.118***	-0.160***	-0.121***	-0.226***	-0.0524	-0.0518
	(0.0319)	(0.0295)	(0.0332)	(0.0343)	(0.0322)	(0.0321)	(0.0327)
Wealth Quintiles = 4	-0.284***	-0.145***	-0.200***	-0.141***	-0.284***	-0.0554	-0.0558
	(0.0463)	(0.0381)	(0.0437)	(0.0455)	(0.0460)	(0.0402)	(0.0398)
Wealth Quintile = 5	-0.494***	-0.245***	-0.358***	-0.248***	-0.493***	-0.0992***	-0.0984***
	(0.0307)	(0.0202)	(0.0286)	(0.0365)	(0.0305)	(0.0309)	(0.0306)
Mothers Schooling		-0.0433***				-0.0198***	-0.0200***
		(0.00480)				(0.00543)	(0.00545)
Fathers Schooling		-0.0152**				-0.00472	-0.00465
		(0.00650)				(0.00543)	(0.00549)
Numeric WAIS			-0.0133***			-0.00248	-0.00221
			(0.00222)			(0.00221)	(0.00226)
Vocabulary WAIS			-0.0293***			-0.0128***	-0.0128***
			(0.00314)			(0.00296)	(0.00291)
CBCL1.				0.401***		0.383***	0.383***
				(0.0103)		(0.00964)	(0.00982)
Height at birth_1					-0.0182		-0.0169
					(0.0104)		(0.00961)
Weight at birth_1					0.0400		0.0465**
					(0.0229)		(0.0164)
Constant	2.137***	2.801***	2.476***	2.232***	2.897***	2.630***	3.308***
	(0.441)	(0.410)	(0.429)	(0.400)	(0.821)	(0.377)	(0.755)
Observations	6,973	6,973	6,971	6,973	6,973	6,971	6,971
R-squared	0.068	0.088	0.081	0.214	0.069	0.222	0.223

Notes: Authors' calculations. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Cuadro 7: Regressions CBLC child over 72 months.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wealth Quintile = 2	0.147	0.770	0.543	0.210	0.154	0.650	0.663
	(0.735)	(0.696)	(0.578)	(0.443)	(0.700)	(0.416)	(0.409)
Wealth Quintile = 3	-0.695	0.459	0.0821	-0.140	-0.683	0.611	0.615
	(1.117)	(1.080)	(0.964)	(0.952)	(1.071)	(0.937)	(0.918)
Wealth Quintile = 4	-2.389*	-0.569	-1.198	-1.180	-2.335*	-0.0201	0.0393
	(1.309)	(1.366)	(1.173)	(0.943)	(1.243)	(1.043)	(0.972)
Wealth Quintile = 5	-4.560***	-1.804	-2.562**	-2.602**	-4.492***	-0.761	-0.691
	(1.012)	(1.252)	(1.044)	(0.987)	(0.949)	(1.317)	(1.224)
Mothers Schooling		-0.441***				-0.144**	-0.138*
		(0.0704)				(0.0670)	(0.0667)
Fathers Schooling		-0.109				-0.0162	-0.0244
		(0.138)				(0.139)	(0.135)
Numeric WAIS			-0.0194			0.0866	0.0919
			(0.0743)			(0.0688)	(0.0678)
Vocabulary WAIS			-0.492***			-0.313***	-0.317***
			(0.0795)			(0.0804)	(0.0810)
CBCL1.				3.796***		3.559***	3.531***
				(0.309)		(0.315)	(0.315)
Height at birth_1					0.0401		-0.0284
					(0.130)		(0.126)
Weigth at birth_1					-0.0140		0.374
					(0.668)		(0.476)
Constant	81.15***	85.97***	85.83***	84.62***	78.66***	87.13***	86.61***
	(5.398)	(5.477)	(5.289)	(5.141)	(6.531)	(5.306)	(6.592)
Observations	1,756	1,756	1,755	1,756	1,756	1,755	1,755
R-squared	0.070	0.090	0.093	0.191	0.075	0.204	0.206

Notes: Authors' calculations. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

7. Conclusions

In this paper we use longitudinal data to study the relevance of wealth gradients in a dynamic model of skill formation. We find that wealth gradients are still important after controlling of a number of relevant variables in the formation of cognitive skills. However, wealth plays a little role in the formation of non-cognitive abilities. Our results also indicate that mother's schooling and cognitive ability are important contributors of skill formation. That both variables are significant indicate that there might be some genetic transmition of abilities, but also, higher education provides tools to mothers that help them to raise their children. Another key result is that initial conditions, measured as height and weight at birth do not affect skill formation, which in part occurs because there are no relevant differences on both variables by wealth and that on average children are born with similar anthropometric measures. Finally, we find that the lag of the tests is always significant on

all the specifications, which highlights the dynamic nature of skill formation, and that early differences on skill will tend to amplify with age.

8. Anexos

8.1. Decile

Cuadro 8: Regressions TVIP more than 72 months.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Decil de Activos = 2	0.199*	0.152	0.224**	0.163	0.207*	0.193*	0.162
	(0.110)	(0.105)	(0.0986)	(0.111)	(0.108)	(0.0996)	(0.106)
Decil de Activos = 3	0.325***	0.250**	0.311**	0.244**	0.337***	0.268**	0.212*
	(0.105)	(0.109)	(0.107)	(0.113)	(0.105)	(0.109)	(0.114)
Decil de Activos = 4	0.346***	0.243**	0.295***	0.239**	0.351***	0.242*	0.192
	(0.0797)	(0.106)	(0.0980)	(0.0901)	(0.0790)	(0.120)	(0.115)
Decil de Activos = 5	0.408***	0.256***	0.355***	0.275***	0.420***	0.273***	0.209**
	(0.0915)	(0.0775)	(0.0756)	(0.0781)	(0.0955)	(0.0789)	(0.0823)
Decil de Activos = 6	0.487***	0.319***	0.407***	0.311***	0.490***	0.313***	0.227**
	(0.0991)	(0.0983)	(0.0928)	(0.0920)	(0.0958)	(0.0964)	(0.0945)
Decil de Activos = 7	0.643***	0.459***	0.558***	0.448***	0.666***	0.475***	0.377***
	(0.0829)	(0.0743)	(0.0692)	(0.0622)	(0.0873)	(0.0790)	(0.0781)
Decil de Activos = 8	0.763***	0.514***	0.619***	0.455***	0.772***	0.492***	0.338***
	(0.109)	(0.100)	(0.0918)	(0.0813)	(0.111)	(0.0996)	(0.0926)
Decil de Activos = 9	0.718***	0.439***	0.559***	0.337***	0.740***	0.427***	0.217**
	(0.0601)	(0.0934)	(0.0677)	(0.0793)	(0.0553)	(0.0853)	(0.0849)
Decil de Activos = 10	0.892***	0.516***	0.673***	0.478***	0.913***	0.487***	0.306***
	(0.0440)	(0.0595)	(0.0540)	(0.0579)	(0.0479)	(0.0719)	(0.0828)
Escolaridad Madre		0.0492***				0.0350***	0.0266**
		(0.00782)				(0.00872)	(0.00983)
Escolaridad Padre		0.0257**				0.0200*	0.00818
		(0.00960)				(0.00985)	(0.00984)
Wais Numérico			0.0214			0.0141	-0.000446
			(0.0127)			(0.0133)	(0.00968)
Wais Vocabulario			0.0405***			0.0292***	0.0125**
			(0.00589)			(0.00677)	(0.00467)
Puntaje TVIP 2010				0.361***			0.335***
				(0.0175)			(0.0171)
altnacer_1					0.0202	0.0200	0.0201
					(0.0138)	(0.0124)	(0.0129)
pesonacer_1					0.0146	0.0152	0.00138
					(0.0709)	(0.0626)	(0.0573)
Constant	1.272**	0.386	0.637	1.155***	0.210	-0.872	-0.399
	(0.432)	(0.460)	(0.452)	(0.380)	(0.800)	(0.744)	(0.708)
Observations	1,757	1,757	1,755	1,757	1,757	1,755	1,755
R-squared	0.120	0.153	0.149	0.276	0.124	0.168	0.291

Notes: Authors' calculations. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Cuadro 9: Regressions TVIP less than 72 months.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Decil de Activos = 2	0.125	0.0840	0.105	0.114	0.126	0.0776	0.0820
	(0.0868)	(0.0858)	(0.0770)	(0.0695)	(0.0860)	(0.0784)	(0.0687)
Decil de Activos = 3	0.237**	0.159**	0.192**	0.176**	0.230**	0.137*	0.117*
	(0.0836)	(0.0726)	(0.0725)	(0.0700)	(0.0847)	(0.0679)	(0.0626)
Decil de Activos = 4	0.218***	0.116*	0.174***	0.159***	0.209***	0.0976*	0.0849
	(0.0613)	(0.0550)	(0.0519)	(0.0484)	(0.0634)	(0.0529)	(0.0504)
Decil de Activos = 5	0.371***	0.222**	0.297***	0.201**	0.360***	0.191**	0.0985
	(0.107)	(0.0964)	(0.0882)	(0.0747)	(0.106)	(0.0874)	(0.0677)
Decil de Activos = 6	0.457***	0.286***	0.369***	0.346***	0.450***	0.254***	0.225***
	(0.0864)	(0.0734)	(0.0637)	(0.0600)	(0.0839)	(0.0610)	(0.0489)
Decil de Activos = 7	0.432***	0.249***	0.337***	0.256***	0.426***	0.215***	0.129*
	(0.0820)	(0.0726)	(0.0701)	(0.0622)	(0.0826)	(0.0674)	(0.0607)
Decil de Activos = 8	0.445***	0.226**	0.344***	0.317***	0.436***	0.192**	0.162**
	(0.0882)	(0.0814)	(0.0675)	(0.0598)	(0.0882)	(0.0720)	(0.0600)
Decil de Activos = 9	0.658***	0.372***	0.524***	0.438***	0.650***	0.332***	0.245***
	(0.0885)	(0.0786)	(0.0720)	(0.0707)	(0.0892)	(0.0705)	(0.0651)
Decil de Activos = 10	0.851***	0.452***	0.664***	0.515***	0.843***	0.397***	0.249***
	(0.0950)	(0.0754)	(0.0776)	(0.0684)	(0.0961)	(0.0673)	(0.0623)
Escolaridad Madre		0.0536***				0.0415***	0.0325***
		(0.00388)				(0.00516)	(0.00648)
Escolaridad Padre		0.0254***				0.0229***	0.0152***
		(0.00481)				(0.00472)	(0.00430)
Wais Numérico			0.00912			0.00224	-0.00739
			(0.00897)			(0.00785)	(0.00520)
Wais Vocabulario			0.0391***			0.0283***	0.0156**
			(0.00484)			(0.00527)	(0.00573)
Puntaje TVIP 2010				0.384***			0.354***
				(0.0151)			(0.0128)
altnacer_1					0.000427	0.00256	-0.000235
					(0.00719)	(0.00765)	(0.00732)
pesonacer_1					-0.0212	-0.0190	-0.0122
					(0.0358)	(0.0333)	(0.0365)
Constant	-0.0348	-0.884**	-0.409	0.0676	0.0526	-0.995**	-0.448
	(0.327)	(0.349)	(0.301)	(0.388)	(0.400)	(0.431)	(0.437)
Observations	3,978	3,978	3,975	3,978	3,978	3,975	3,975
R-squared	0.098	0.126	0.118	0.208	0.100	0.135	0.223

Notes: Authors' calculations. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Cuadro 10: Regressions CBCL more than 72 months.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Decil de Activos = 2	0.110	0.137	0.0992	0.115	0.103	0.112	0.108
	(0.0763)	(0.0790)	(0.0801)	(0.0653)	(0.0756)	(0.0675)	(0.0663)
Decil de Activos = 3	0.271**	0.329***	0.291***	0.181**	0.271***	0.222***	0.224***
	(0.0940)	(0.0916)	(0.0870)	(0.0710)	(0.0890)	(0.0710)	(0.0678)
Decil de Activos = 4	-0.116	-0.0418	-0.0776	-0.0197	-0.121	0.0165	0.0139
	(0.124)	(0.121)	(0.0946)	(0.0899)	(0.120)	(0.0836)	(0.0808)
Decil de Activos = 5	0.0329	0.136	0.0793	0.0882	0.0304	0.141	0.140*
	(0.126)	(0.115)	(0.0999)	(0.0936)	(0.115)	(0.0819)	(0.0759)
Decil de Activos = 6	-0.0609	0.0627	0.0178	-0.0107	-0.0623	0.0691	0.0681
	(0.145)	(0.154)	(0.133)	(0.134)	(0.142)	(0.142)	(0.141)
Decil de Activos = 7	-0.0574	0.0923	0.0214	-0.00327	-0.0530	0.0866	0.0937
	(0.142)	(0.146)	(0.123)	(0.104)	(0.133)	(0.105)	(0.0949)
Decil de Activos = 8	-0.275*	-0.0841	-0.160	-0.107	-0.274*	0.00840	0.0101
	(0.150)	(0.157)	(0.126)	(0.117)	(0.144)	(0.121)	(0.115)
Decil de Activos = 9	-0.311*	-0.0942	-0.171	-0.158	-0.311*	-0.0210	-0.0183
	(0.155)	(0.173)	(0.147)	(0.160)	(0.145)	(0.178)	(0.166)
Decil de Activos = 10	-0.420***	-0.129	-0.223**	-0.214**	-0.411***	-0.0213	-0.0119
	(0.0894)	(0.106)	(0.0748)	(0.0734)	(0.0862)	(0.0866)	(0.0816)
Escolaridad Madre		-0.0388***				-0.0135**	-0.0130*
		(0.00602)				(0.00619)	(0.00618)
Escolaridad Padre		-0.00799				-0.00105	-0.00186
		(0.0124)				(0.0122)	(0.0119)
Wais Numérico			-0.000269			0.00836	0.00884
			(0.00687)			(0.00636)	(0.00624)
Wais Vocabulario			-0.0428***			-0.0275***	-0.0280***
			(0.00694)			(0.00706)	(0.00714)
CBCL1. Puntaje T Total				0.337***		0.316***	0.314***
				(0.0281)		(0.0285)	(0.0285)
altnacer_1					0.00517		-0.00143
					(0.0126)		(0.0117)
pesonacer_1					-0.00657		0.0306
					(0.0639)		(0.0454)
Constant	2.100***	2.502***	2.502***	2.444***	1.810**	2.664***	2.571***
	(0.511)	(0.524)	(0.504)	(0.483)	(0.626)	(0.502)	(0.617)
Observations	1,756	1,756	1,755	1,756	1,756	1,755	1,755
R-squared	0.081	0.099	0.101	0.194	0.086	0.207	0.209

Notes: Authors' calculations. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Cuadro 11: Regressions CBCL less than 72 months.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Decil de Activos = 2	-0.0825	-0.0394	-0.0628	-0.0678	-0.0848	-0.0405	-0.0419
	(0.0581)	(0.0529)	(0.0642)	(0.0549)	(0.0569)	(0.0545)	(0.0534)
Decil de Activos = 3	-0.143**	-0.0897*	-0.0996*	-0.107**	-0.143**	-0.0652	-0.0657
	(0.0503)	(0.0448)	(0.0515)	(0.0464)	(0.0500)	(0.0460)	(0.0461)
Decil de Activos = 4	-0.134*	-0.0514	-0.0882	-0.0991	-0.135*	-0.0454	-0.0458
	(0.0727)	(0.0687)	(0.0718)	(0.0752)	(0.0727)	(0.0725)	(0.0725)
Decil de Activos = 5	-0.287***	-0.169***	-0.218***	-0.171***	-0.286***	-0.0957*	-0.0955*
	(0.0531)	(0.0512)	(0.0583)	(0.0525)	(0.0528)	(0.0517)	(0.0516)
Decil de Activos = 6	-0.251***	-0.115**	-0.171**	-0.140**	-0.251***	-0.0521	-0.0524
	(0.0558)	(0.0504)	(0.0596)	(0.0532)	(0.0565)	(0.0519)	(0.0529)
Decil de Activos = 7	-0.319***	-0.176***	-0.231***	-0.156***	-0.319***	-0.0650	-0.0650
	(0.0498)	(0.0426)	(0.0490)	(0.0492)	(0.0496)	(0.0453)	(0.0452)
Decil de Activos = 8	-0.328***	-0.157**	-0.233***	-0.190***	-0.329***	-0.0831	-0.0853
	(0.0607)	(0.0552)	(0.0553)	(0.0541)	(0.0608)	(0.0493)	(0.0491)
Decil de Activos = 9	-0.448***	-0.237***	-0.333***	-0.252***	-0.448***	-0.121**	-0.121**
	(0.0662)	(0.0556)	(0.0690)	(0.0601)	(0.0653)	(0.0537)	(0.0530)
Decil de Activos = 10	-0.612***	-0.297***	-0.445***	-0.307***	-0.613***	-0.116**	-0.116**
	(0.0462)	(0.0375)	(0.0449)	(0.0504)	(0.0459)	(0.0477)	(0.0476)
Escolaridad Madre		-0.0429***				-0.0198***	-0.0201***
		(0.00475)				(0.00535)	(0.00537)
Escolaridad Padre		-0.0144*				-0.00470	-0.00462
		(0.00683)				(0.00583)	(0.00588)
Wais Numérico			-0.0130***			-0.00246	-0.00219
			(0.00212)			(0.00229)	(0.00234)
Wais Vocabulario			-0.0285***			-0.0128***	-0.0128***
			(0.00313)			(0.00290)	(0.00284)
CBCL1. Puntaje T Total				0.400***		0.383***	0.383***
				(0.0106)		(0.00978)	(0.00996)
altnacer_1					-0.0183		-0.0170*
					(0.0104)		(0.00966)
pesonacer_1					0.0391		0.0469**
					(0.0236)		(0.0168)
Constant	2.173***	2.804***	2.494***	2.259***	2.941***	2.645***	3.328***
	(0.432)	(0.401)	(0.419)	(0.391)	(0.804)	(0.363)	(0.734)
Observations	6,973	6,973	6,971	6,973	6,973	6,971	6,971
R-squared	0.070	0.089	0.082	0.214	0.071	0.222	0.223

Notes: Authors' calculations. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

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