Does Parenting Matter? Parental Cognitive Stimulation and Child Cognitive Competence

Whitney Schott, Population Studies Center, University of Pennsylvania

Background

- Parenting practices in early childhood can have lasting impacts on child development
  - Parenting practices in early childhood are associated with changes in brain size and brain development.[1-4]
  - Parental cognitive stimulation at early ages has been associated with higher cognitive scores at later ages in intervention studies.[5]
- There is a lack of evidence from large scale studies, possibly due to endogeneity issues: cognitive stimulation may be associated with a general parenting style that also influences cognitive performance; demonstrated cognitive ability may influence the amount of cognitive stimulation undertaken by parents[6]

Data

- *Encuesta Longitudinal de la Primera Infancia* (Longitudinal Survey of Early Childhood Development)
- The sample of 16,033 children was selected using a cluster-stratified, random-sampling strategy
- Collected in 2010 and 2012 as a nationally representative sample of children in Chile
- Data on children born 2005-2009 were collected in 2010; longitudinal data plus data on a refreshment sample of children born 2009-2011 were collected in 2012
- This analysis focuses on children ages 4-6 years in 2012
- **Cognitive tests (collected in 2012):**

Peabody Picture Vocabulary Test (PPVT) (Spanish version)
- measures receptive and oral vocabulary from 30-60 months
- has been used to represent child cognitive and intellectual ability in developing countries

Battelle Development Inventory
- measures a range of abilities from ages 6-23 months
- includes cognitive, adaptive, communication, motor, and social skills

Test of Learning and Child Development (TADI)
- a child development test that was developed in Chile
- only the cognitive component used here

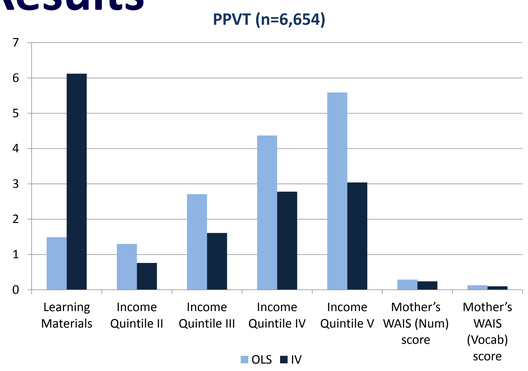
- **Parental Stimulation (in 2012)**

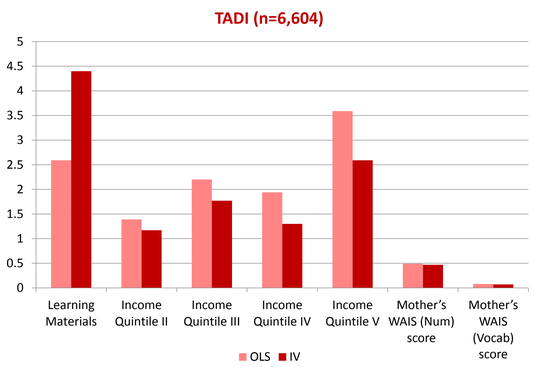
  First principal component (using principal components analysis) of 5 observations from the HOME score on l**earning materials**, such as availability of toys teaching shapes or colors, puzzles, children's books, learning games, etc.

Methods:

- Instrumental variables (IV) method allows us to untangle endogeneity problem
- IV must be a variable highly correlated with the endogenous variable of interest (cognitive stimulation) but not with the outcome variable (cognitive test scores): cov(instrument, endogenous variable)≠0 and cov(instrument, outcome) = 0
- Exploit information on participation in a large public program ***Chile Crece Contigo (CCCT)***, designed to improve early childhood development in Chile, which may provide some of the following to eligible families (based on means-testing): information packets, learning materials, books, crib, baby carrier, home visits, and parenting workshops. Other services, such as phone-an-expert, a radio program, and a website, are available to all.
- The three instruments used in this analysis are:
  1. Local awareness by community of the existence of CCCT
  2. Local participation by community in parenting workshops
  3. Local participation by community in the public health insurance program FONASA (note: FONASA is available to anyone but families with more income tend to chose private insurance[7])
- Higher local prevalence of CCCT participation is correlated with parental cognitive stimulation, but not cognitive scores

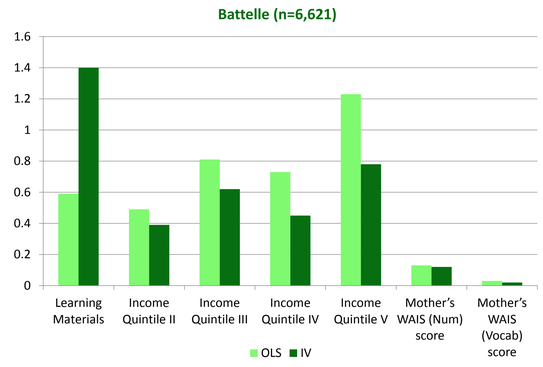
Results





Descriptive Statistics

	Mean/Percent	SD	N
PPVT	41.3	18.7	6,654
Battelle	170.6	19.5	6,621
TADI (Cognitive)	46.0	5.2	6,604
Learning materials	0.03	1.01	6,715
Emotional and verbal responsiveness	-0.04	1.02	6,715
Age (months)	63.0	9.1	6,715
Female	50.0		6,715
Father's completed schooling	11.8	3.5	6,715
Mother's age in 2010	32.3	7.1	6,715
Hours mother works per week	18.9	21.4	6,715
Household income per capita	129,015 CLP	119,680 CLP	6,715
Mother's WAIS (quantiative) score	8.8	2.0	6,715
Mother's WAIS (vocabulary) score	33.1	17.4	6,715
Local knowledge of Crece (by community)	73.0		6,715
Local participation in parenting workshops (by community)	9.7		6,715
Local participation in FONASA (by community)	84.4		6,715



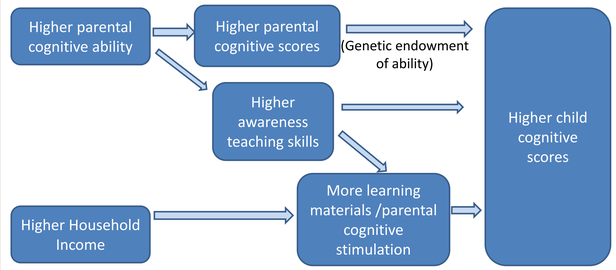
- Graphs show coefficient estimates of OLS and IV models, all estimates statistically significant (except for QII in IV model of PPVT and QIV in IV model of Battelle, though income quintiles jointly significant in models)
- Controls not shown include parental responsiveness, age in months and its square, child female, father's schooling, mother's age, and hours worked per week by the mother
- Learning materials (as estimated by instruments) is highly correlated with all three outcomes
- IV estimates show that OLS underestimates role of learning materials vis a vis financial resources

Why instrumental variables?

- Direct estimation of parental cognitive stimulation on cognitive outcomes

ignores potentially confounding factors, such as parental cognitive ability or income

Potential Confounding Relationships



IV Diagnostics

	TVIP	Battelle	TADI
First stage F statistic	F(14, 10038) = 975.42	F(14, 11735) = 3839.67	F(14, 11768) = 5617.74
Weak identification test			
Cragg-Donald Wald F-statistic	53.62	72.00	74.54
Stock-Yogo weak ID test critical value, 5% maximal IV relative bias	13.91	13.91	13.91
Underidentification test			
Anderson canon. corr. LM statistic	Chi-sq(3)=158.59	Chi-sq(3)=212.39	Chi-sq(3)=219.77
Weak-instrument-robust inference			
Anderson-Rubin Wald test	F(3,10036)= 5.77	F(3,11733)= 6.48	F(3,11766)= 12.03
Anderson-Rubin Wald test	Chi-sq(3)= 17.33	Chi-sq(3)= 19.47	Chi-sq(3)= 36.13
Stock-Wright LM S statistic	Chi-sq(3)= 17.30	Chi-sq(3)= 19.44	Chi-sq(3)= 36.02
Overidentification			
Sargan statistic	Chi-sq(2) P-val = 0.4413	Chi-sq(2) P-val = 0.7112	Chi-sq(2) P-val = 0.0050

- High first stage F-statistics (valid IV)
- Diagnostics suggest not weakly identified or under-identified; also suggest not overidentified (except for TADI)

Discussion

- Parental cognitive stimulation is significantly associated with child cognitive scores
- OLS estimates of parental cognitive stimulation are underestimated, while income effects are over-estimated due to endogeneity issues
- OLS erroneously attributes some of the "effect" of learning materials to income
- Mother's cognitive ability (WAIS) has surprisingly small association with cognitive scores for both OLS and IV models

Acknowledgements

- This project is supported by NICHD R01 HD065436-04

References

(1) Qiu A, Rifkin-Graboi A, Chen H, et al. Maternal anxiety and infants' hippocampal development: timing matters. Translational psychiatry 2013; 3(9): e306. **(2)** Luby JL, Barch DM, Belden A, et al. Maternal support in early childhood predicts larger hippocampal volumes at school age. Proceedings of the National Academy of Sciences 2012; 109(8): 2854-9. **(3)** Luby J, Belden A, Botteron K, et al. The effects of poverty on childhood brain development: the mediating effect of caregiving and stressful life events. JAMA pediatrics 2013; 167(12): 1135-42.

(4) Fox SE, Levitt P, Nelson III CA. How the timing and quality of early experiences influence the development of brain architecture. Child development 2010; 81(1): 28-40. **(5)** Walker SP, Wachs TD, Gardner JM, et al. Child development: risk factors for adverse outcomes in developing countries. The lancet 2007; 369(9556): 145-57. **(6)** Tucker-Drob EM, Harden KP. Early childhood cognitive development and parental cognitive stimulation: evidence for reciprocal gene–environment transactions. Developmental science 2012; 15(2): 250-9. **(7)** Pardo, Cristian, and Whitney Schott. "Health insurance selection in Chile: a cross-sectional and panel analysis." Health policy and planning (2013): czt017.