Early Child Development Programs in a Developing Economy: Evidence from Chile

Jere Behrman, David Bravo and Sergio Urzúa

UPenn, UChile, Northwestern

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Research and Public Policy Agenda

Placing high-quality early education as a top priority for long-term development and growth

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1. **Motivation**: Increasing body of literature showing the long term effects of early childhood development (ECD) (economics, developmental psychology, etc.) and massive increment in the number of child-care centers.
2. **Objectives**: To evaluate and understand the role of early education on ECD from a multi-dimensional perspective and to provide insights for the design of public policies.
3. **The components**: New and better data, experiments, econometric/identification challenges.
4. **Preliminary Evidence**: Coming from a pilot study (IABD)

Human Development

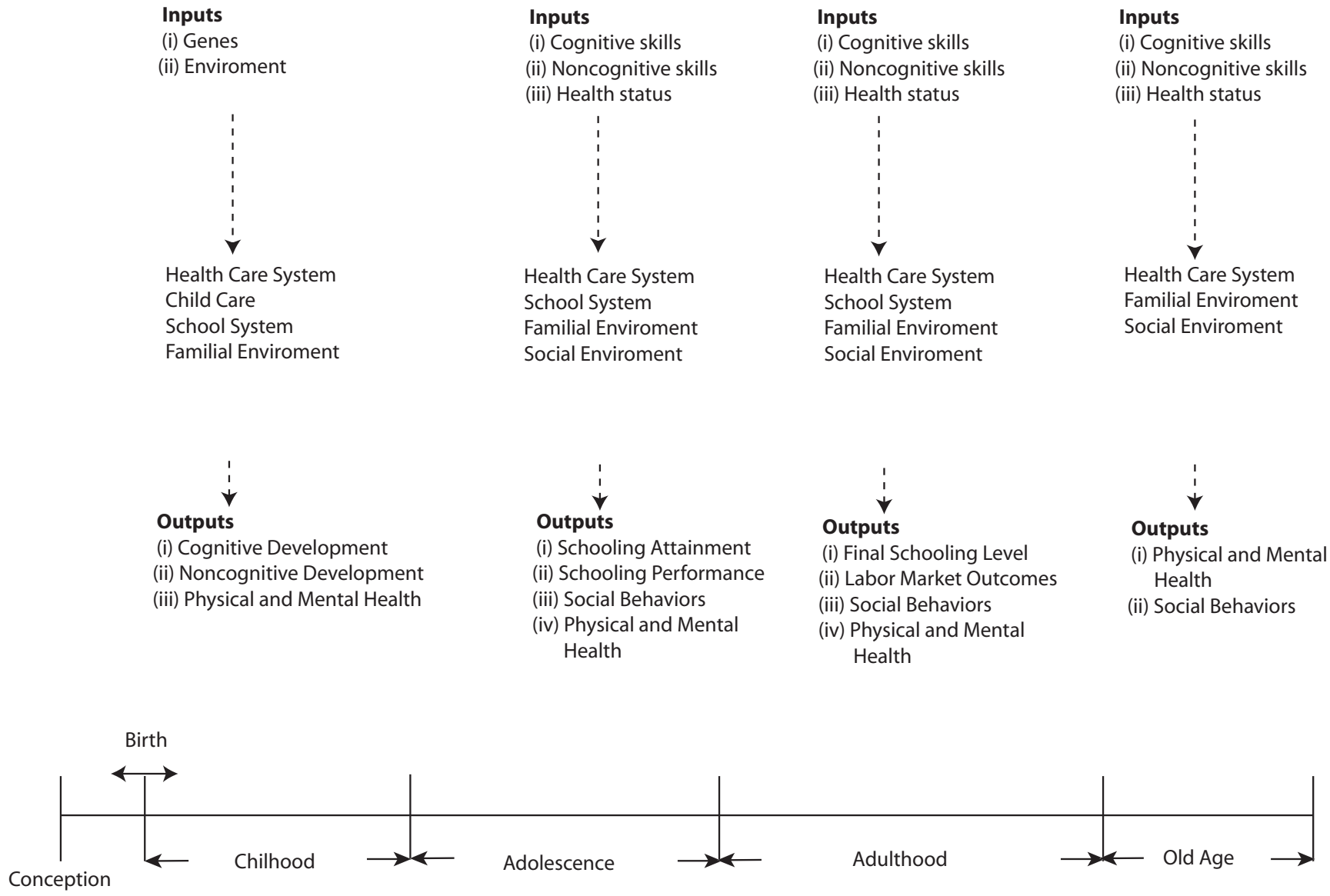

Figure 2. Human Development at Each Stage (inputs/ouputs)

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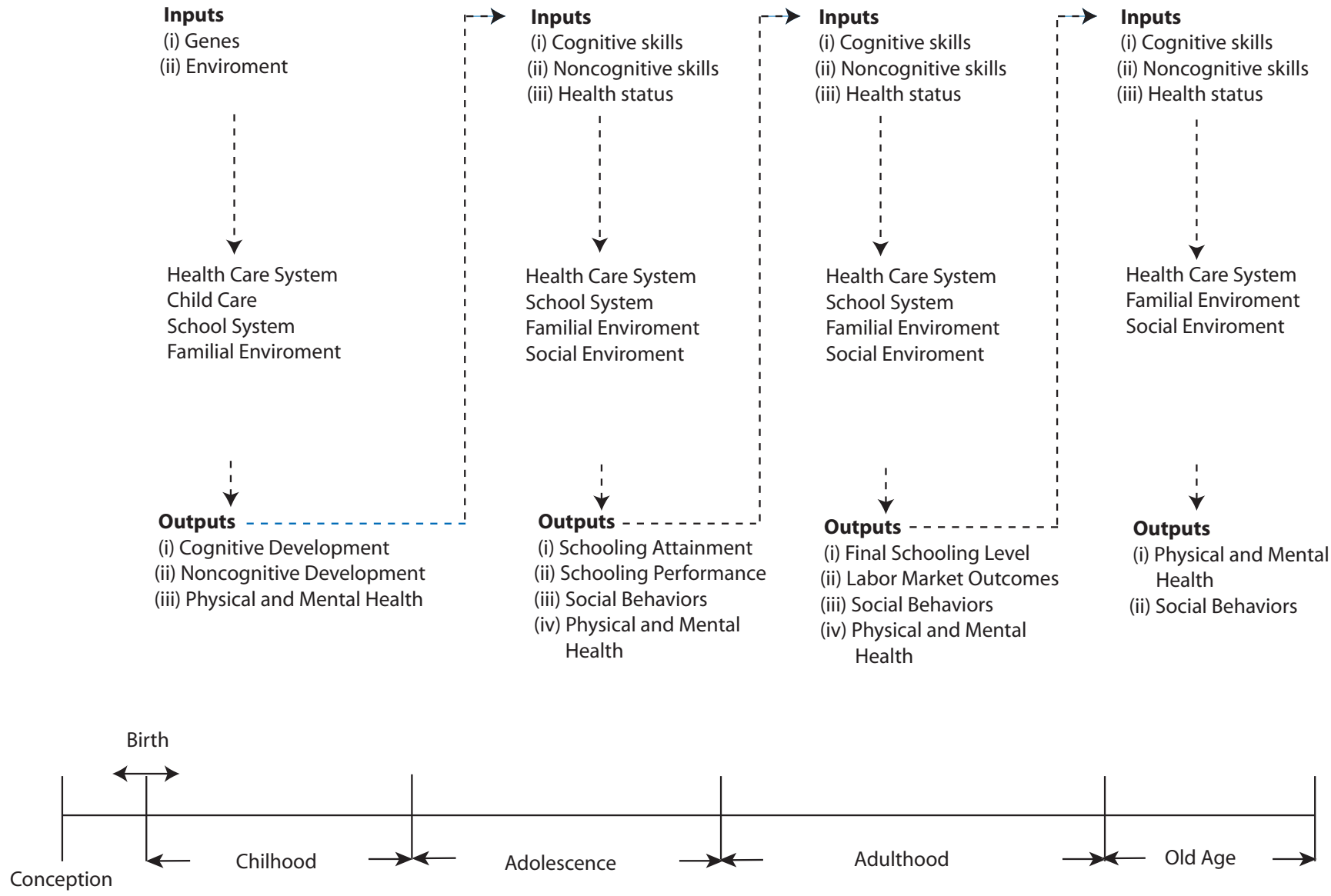

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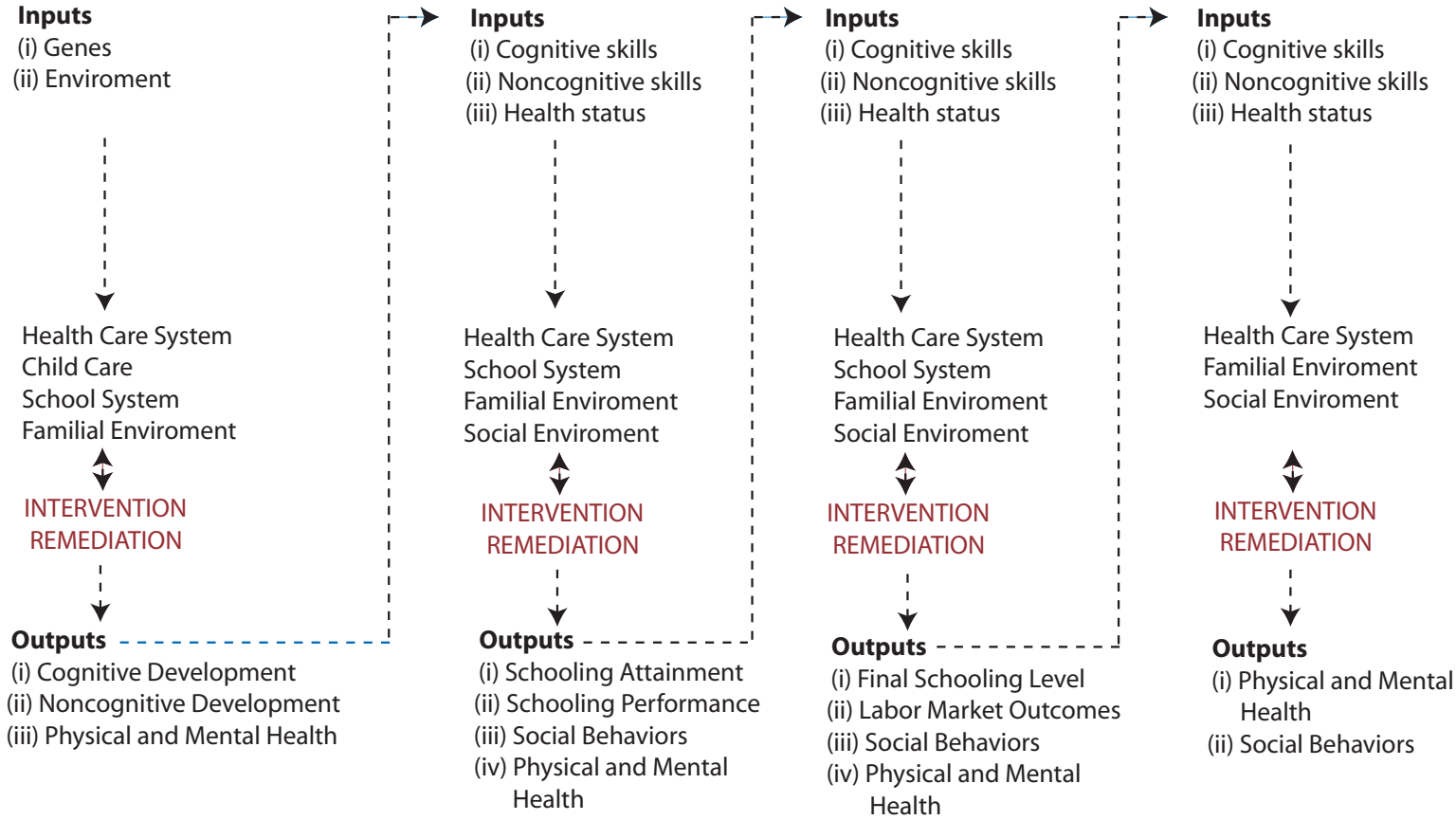

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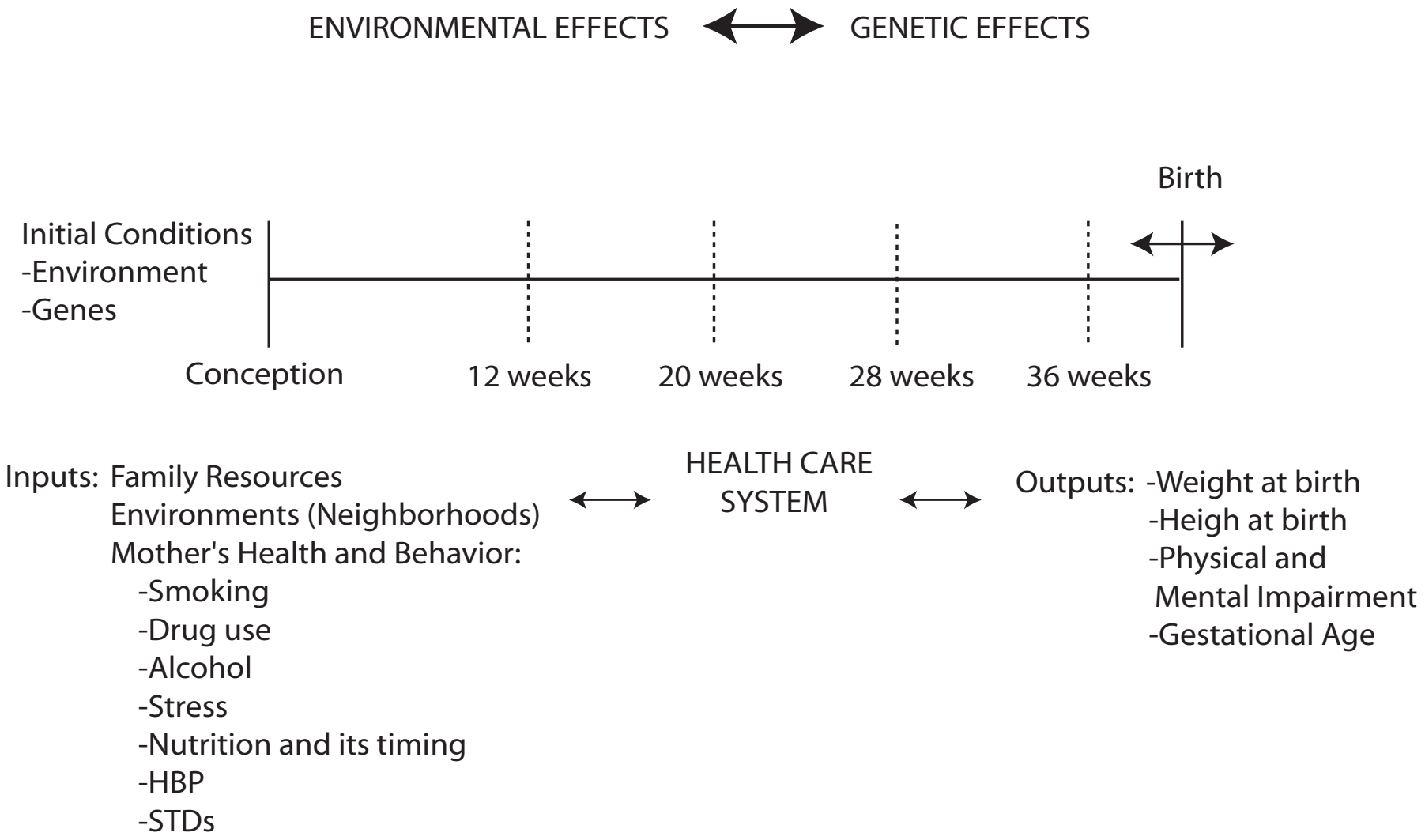

Figure 1. Enviroment and Genetic Effects from Conception to Birth

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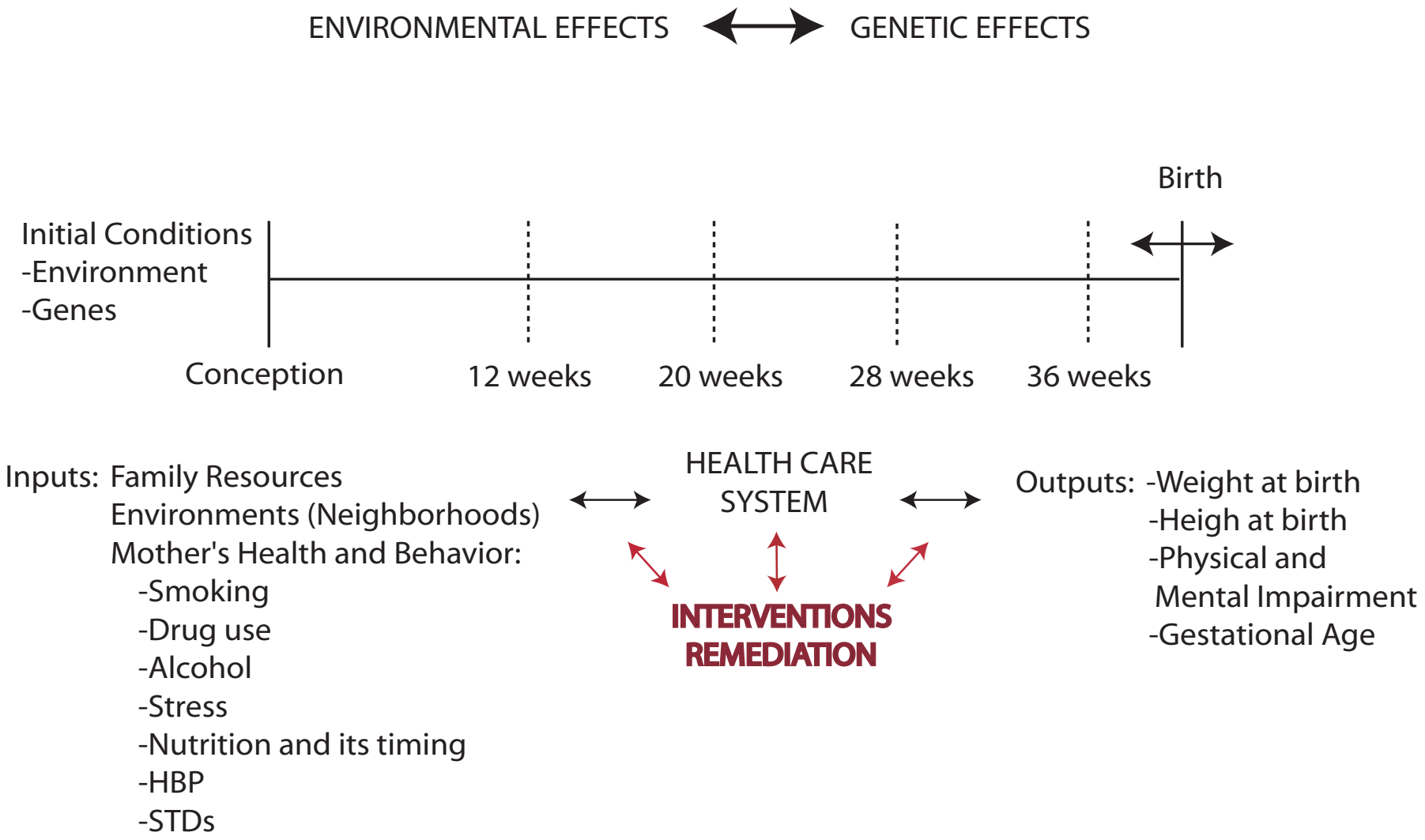

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ECD Programs around the World

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Bangladesh, Cape Verde, Guinea, India, Nepal, Turkey, Philippines, Uganda, Vietnam, and many others.

Cost/Benefit?

- Abecederian Project: 4.10 dollars per dollar invested (Masse & Barnett, 2002)
- Nurse Family Partnership: 5.70 dollars per dollar invested (Karoly et al, 2005)
- Perry Preschool: 9.2-6.6 dollars per dollar invested (Heckman et al, 2009)

ECD Programs

País (Programa)	Características y Beneficiarios	Impacto sobre Resultados Escolares	Impacto Antropométrico y Nutricional	Impacto sobre Habilidades
Bolivia (PIDI)	Servicios educacionales y nutricionales Niños entre 6 y 72 meses Zonas Urbanas y Pobres	Aumento de 3-4% en resultados de pruebas (edades 37-58 meses con tratamiento de a lo menos 7 meses)	Resultados no concluyentes	Mejora habilidades motoras, psico-sociales, y lenguaje (37 meses + 1 año tratado)
Colombia (Hogares Comunitarios)	Madres seleccionadas actúan como parvularias Suplementos nutricionales Infantes hasta 6 años	20% mas probabilidad de asistencia escolar (13-17 años)	Tratados son 3.8 centímetros mas altos que no tratados (72 meses de edad)	n.d.
Guatemala (Hogares Comunitarios)	Similar a Colombia	n.d.	Efectos positivos sobre niveles de calorías, hierro, vitaminas y proteínas.	n.d.
Argentina (Construcción de Jardines Infantiles)	Gran expansión de Jardines Infantiles	Aumento de matricula pre-escolar (noción de falta de oferta) Aumento en pruebas de matemáticas y español	n.d.	Mejora habilidades no-cognitivas (disciplina, atención en clase, participativo)

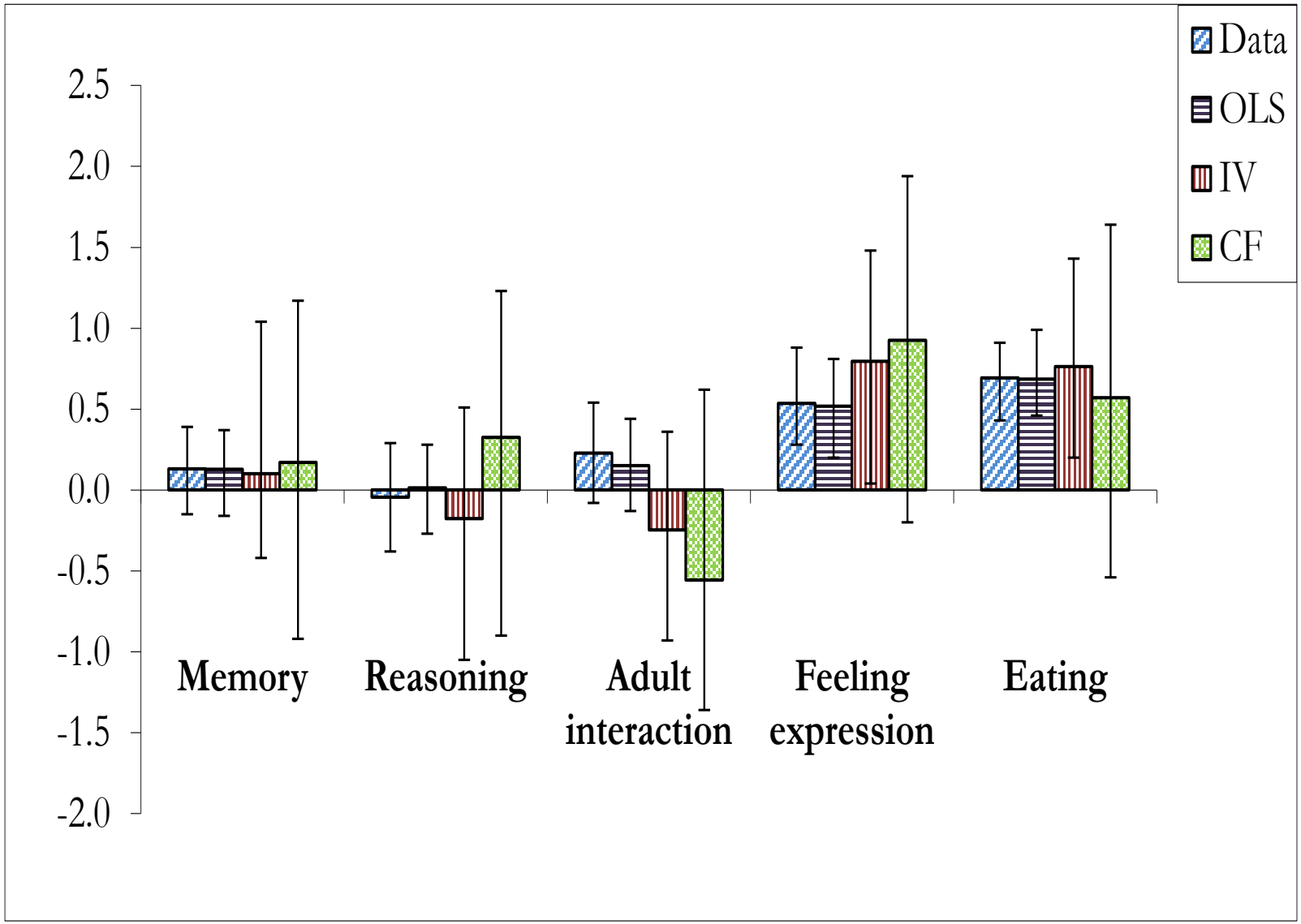
Fuente: Bouillon y Tejerina (2007) y Schady (2006). Fuentes originales: Behrman, Cheng y Todd (2004), Berlinski y Galiani (2005), Behrman, Yingmei y Todd (2004), Attanasio y Vera-Hernández (2004), Ruel et.a. (2002).

Programs Improving Nutrition

Tipo de Programa	País	Características y Beneficiarios	Impacto Nutricional	Habilidades	Impacto Asistencia Escolar
Intervención a Pequeña Escala	Colombia	Suplemento vitamínico para embarazadas e hijos Estimulación sicológica 6 meses desde concepción - 3 años hogares con deficiencias nutricionales	Δ+ del peso del bebé Δ+ peso madre y recién nacido (hombre)	n.d.	n.d
	Guatemala	Suplemento de alto contenido proteico Niños tratados hasta 7 años	Δ+ del peso del bebé	Δ+ en test cognitivos (Mujeres) Δ+ en pruebas de desempeño escolar (hombres)	Mayor nivel educacional en mujeres
	Jamaica	Suplemento vitamínico Estimulación sicológica Niños 9 y 24 meses - Pequeños al nacer	Δ+ del peso y tamaño del bebé Mejoramiento de fenotipo (físico)	Δ+ en Desarrollo Mental pero sostenido solo para quienes recibieron estimulación	n.d.
Desayunos Escolares	Jamaica	Niños en 3er y 4to grado	Δ+ del peso del bebé	Δ+ puntajes para niños inicialmente desnutridos	Mejor asistencia y menor deserción escolar
	Perú	Niños 3 y 14 años en áreas rurales	Resultados poco concluyentes	Resultados poco concluyentes	Mejor asistencia
	Perú (Vaso de Leche)	Niños 2 y 11 años en Lima	No Impacto	n.d.	n.d.

Fuente: Bouillon y Tejerina (2006). Fuentes originales: Mora et.al (1981a,b), Schroeder, Kaplowitz, y Motorel (1992), Maluccio et.al (2005), Walker et.al (1991), Grantham-McGregor, Chang y Walker (1998), Pllit, Jacoby y Cueto (2002), Cueto y Chinen (2001), Gajate y Iturritegui (2003), Stifel y Alderman (2003).

El Efecto de Sala Cuna Sobre el Desarrollo Infantil: Chile (Noboa y Urzúa, 2010)



From the literature

- International evidence suggests *positive effects* (Engle et al 2007; Bouillon and Tejerina, 2007; Schady, 2006; Behrman et al 2004; Noboa and Urzua, 2010; Heckman, 2010),

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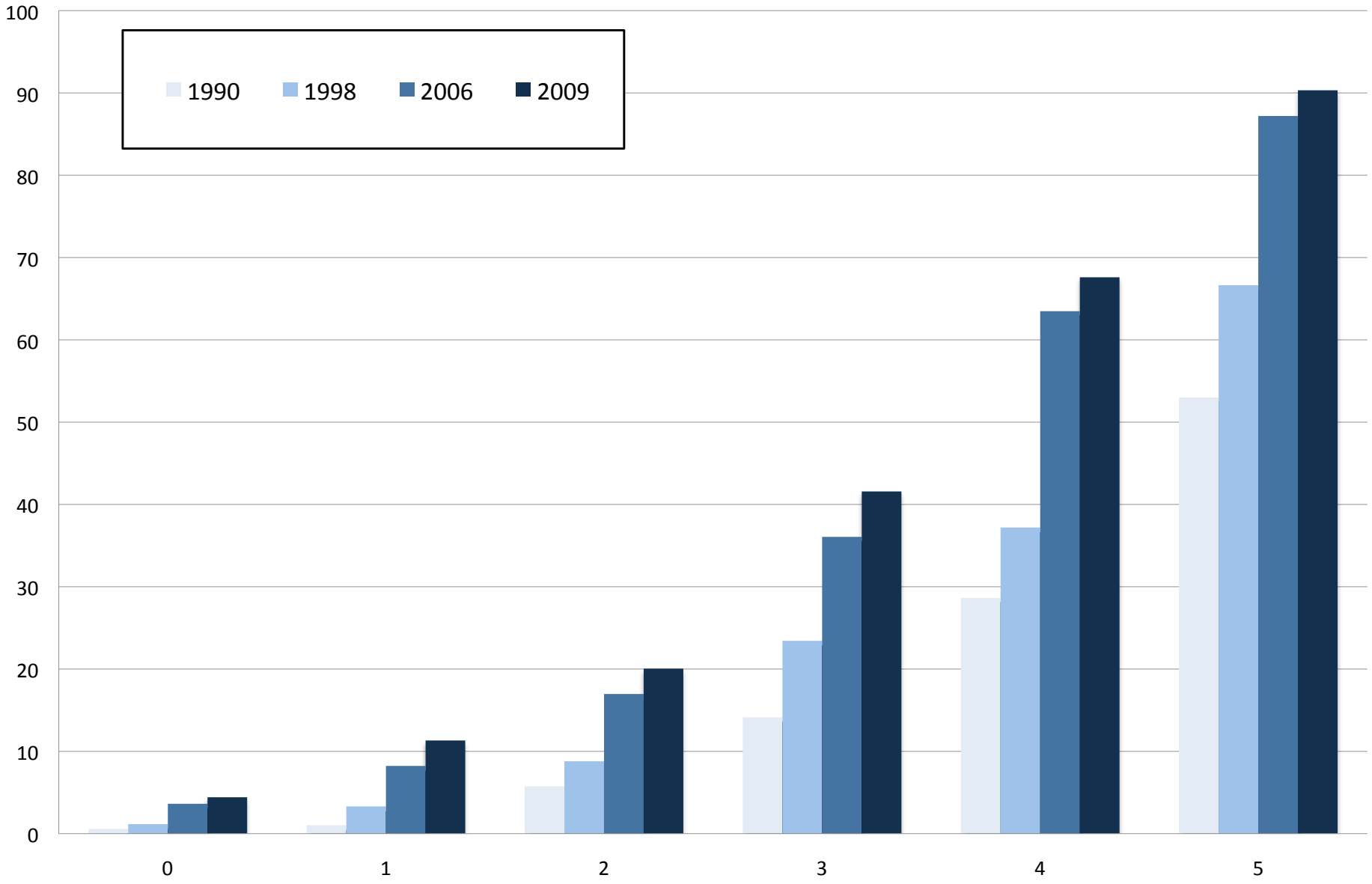
- International evidence suggests *positive effects* (Engle et al 2007; Bouillon and Tejerina, 2007; Schady, 2006; Behrman et al 2004; Noboa and Urzua, 2010; Heckman, 2010), but **can we extrapolate?**
- We are just learning about the *underlying mechanisms* (is it trough cognitive or/and socio-emotional traits?, parents?, quality?, how to intervene? when? for how long?).
- Extra limitations: Small samples not nationally representative, usually static models, ECD programs limited in scale, correlation vs. causality, few studies looking at cost/benefit analysis.

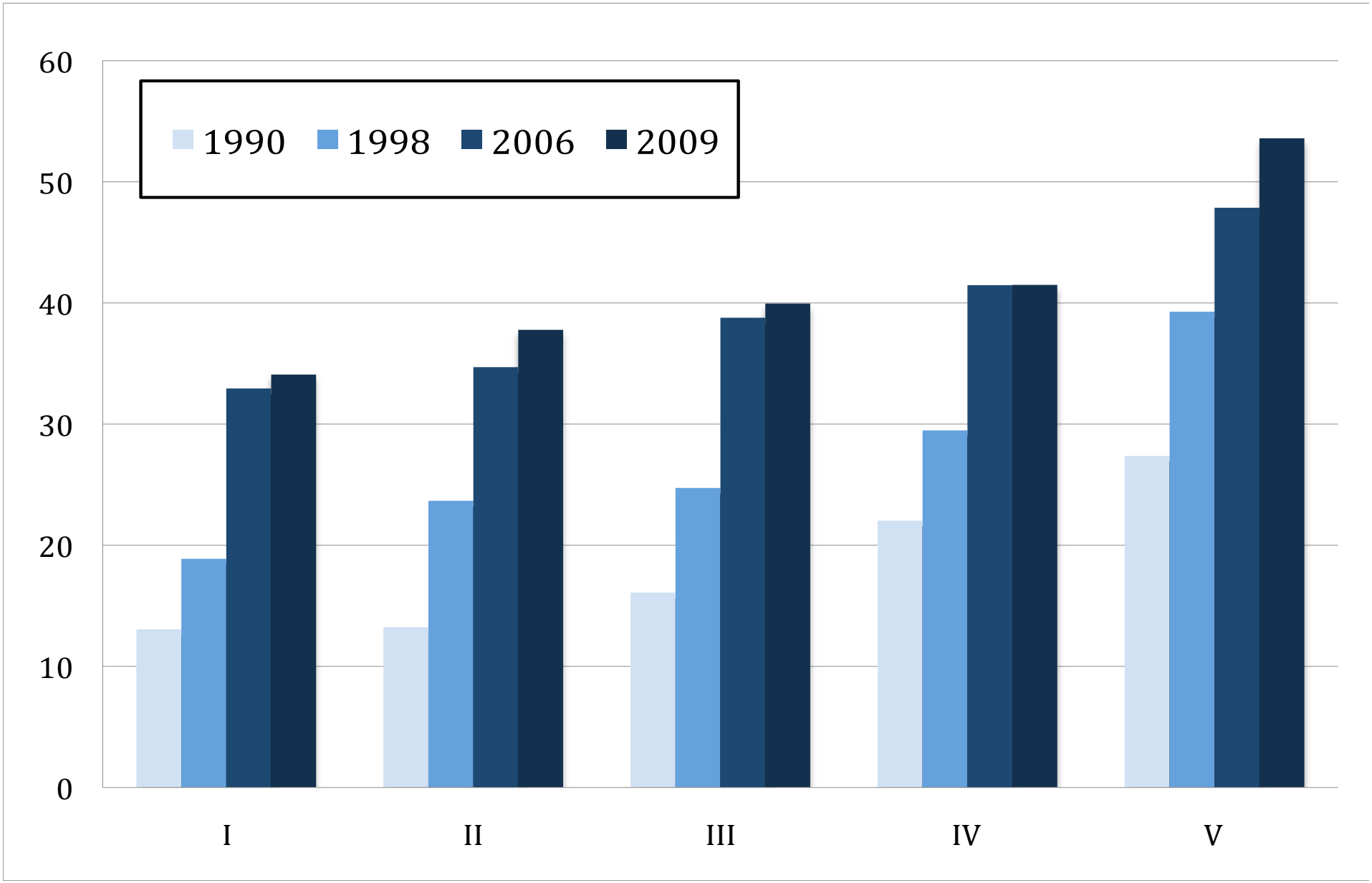
Why Chile?

- Chile has taken serious steps to improve the situation of young children, particularly the most vulnerable.
- National ECD policy established in 2006 (Chile Growths with You/Chile Crece Contigo).
- Coverage by public providers nearly tripled between 2005-2007 and continue increasing (500% between 2006-2009). Quality?

Enrollment Rates by Age



Enrollment Rates by Income



Research and Public Policy Agenda

To generate a substantial increase in critical knowledge of ECD in Chile (but also in the world), we need:

- **Data**: A well designed collection of data
- **Econometrics/Identification Strategy**: To take advantage of ECD programs already implemented and recent developments, we need a clear identification strategy: using quasi-experimental methods and modeling explicitly endogenous choices and potential outcomes (but we need policy variations and good data)
- **Experiments**: To develop some random controlled experiments providing some useful variation for policy design (Information, Curriculum, Staff Incentives, Vouchers, Extra Staff).

Data Collection: What do we need?

- An individual longitudinal data set:
  - Nationally representative of children;
  - Family background information;
  - Cognitive; non-cognitive; physical health measurements on children and mothers
  - Longitudinal dimension
- This data set is the Encuesta Longitudinal de la Primera Infancia (ELPI) designed by the Microdata Center for the Ministry of Education.

Data Collection: ELPI

- First round of Data: 2010.
- First results to be released in 3 weeks.
- Sample Size: 15,000 0-5 ys old representative children (born between 1/I/2006 and 31/VIII/2009)
- Other relevant ingredients:
  - Information on the supply side of centers (physical capital, human capital, distance, location, competition)
  - Information on costs.

Data collection: ELPI

Household Surveys

- Collect data in household with children $\leq$ 5 years
- HH surveys include:
  - Household composition
  - Each member's education
  - Health care status
  - Labor participation status
  - Household income
  - Type and size of home
  - Detailed questions on pre-natal and post-natal care
  - Newborn data and health history
  - Detailed retrospective history of child-care
  - Vaccination records
  - Available resources for children
- Psychologists return to home to apply instruments on abilities and health

Data collection: ELPI

Psychologists measure abilities and health of mother and children

- Recent graduates specializing in child psychology
- Must take 3-day training in 13 instruments and pass exam
- Setup appointment to meet mothers and children after HH interview
- Measure cognitive, socioemotional, and health traits

Instruments for mothers

Cognitive Tests

- WAIS - Vocabulary Scale (language)
- WAIS - Digit Scale (working memory)

Socio-emotional Tests

- Big Five Inventory

Health

- weight and height (BMI)

Instruments for Children

- Cognitive: EEDP (6-23 months), TEPSI (24-60 months), PPVT (24-60 months), Batelle (6-23 months)
- Socio-emotional: ASQ (6-17 months), CBCL (18-60 months).
- Physical: Weight, height, Crane circumference (6-60 months)

The Pilot Study

1. **Taking advantage of social programs**: Large increase in supply (500% between 2006-2009) + Chile Crece Contigo
2. **Data**: New data set of 650 children from Santiago. Comprehensive set of controls and tests.
3. **Model**:
   - Reduced-form: OLS and IV estimates of the effect of enrollment in child-care center. We use local supply of centers as source of instruments
   - Structural model: Explicit model of enrollment and model of counterfactual outcomes. Unobserved traits and heterogenous treatment effects.

OLS and IV

Let D_{ij} denote enrollment of child i in household j and Y_{ij} the outcome of interest.

- Thus,

$$Y_{ij} = \alpha + \beta D_{ij} + \gamma X_{ij} + \epsilon_{ij}$$

  where X_{ij} includes a number of controls (eg: mother's cognitive and socio-emotional traits).
- We allow for Corr(D_{ij},ϵ_{ij})$\neq$ 0 (endogeneity) .
- IV: Distance from home to closest public child-care center and the average number of children per center at the municipality level (measured at the year and month of

Model of Endogenous Enrollment and Heterogenous Effects

Outline:

- The unit of analysis is a household (two parents and one child)
- At $t = 0$ parents decide whether or not to enroll their child into a child-care center.
- At $t = 1$, outcomes associated with development of children are observed.

This delivers an obvious selection problem: We observe outcomes conditional on the "treatment" status

Defining the *Effects* of Child-care Centers

- $\left(Y_{ij}^0, Y_{ij}^1\right)$ denote the potential outcomes for child j in household i.
- We observe: Y_{ij}^1 or Y_{ij}^0, not both.
- But we need: $Y_{ij}^1 - Y_{ij}^0$ (or a version of this)
- Our model generates the counterfactual outcomes controlling for selection:

$$\Delta^{ATE} \equiv E(Y^1 - Y^0 | X = x)$$

$$\Delta^{TT} \equiv E(Y^1 - Y^0 | X = x, D = 1)$$

All in all:

- Endogenous Parents' Decisions: Parents decide based on their socio-economic status, potential gains for children, availability of ECD centers, and unobserved endowments.
- Children Outcomes: Conditional on enrollment status, cognitive/socio-emotional/health outcomes depend on age, gender, and unobserved endowments.
- Unobserved endowments are linked to cognitive and socio-emotional abilities.
- We allow unobserved endowments to be correlated: Cognitive and socio-emotional + intergenerational transmission of endowments.

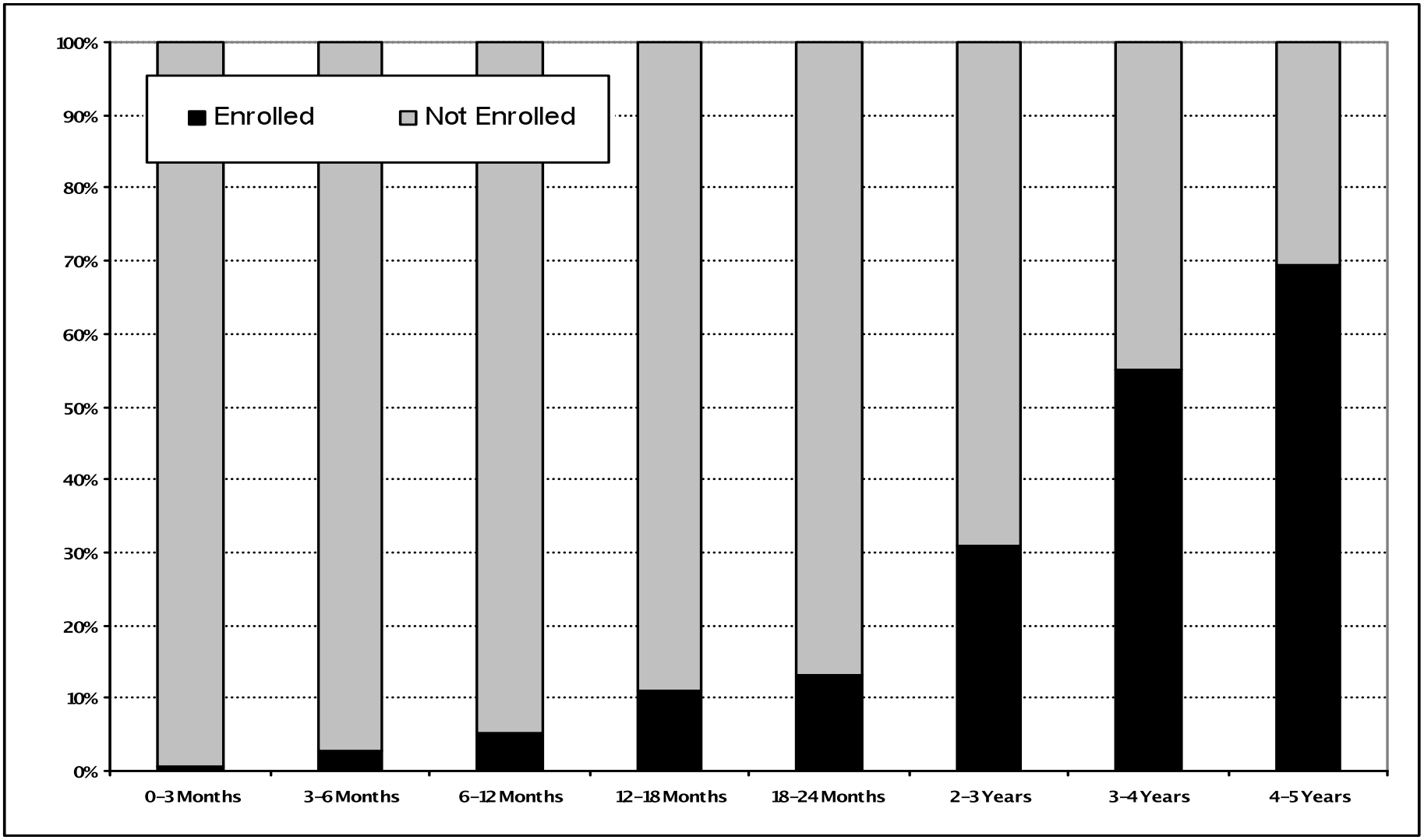
Results

1. Summary Statistics
2. Correlations of Cognitive and Socio-emotional traits (not today)
3. Demand for Childcare centers
4. Reduced Form Results
5. Structural Model

Table 2. Number of Children by date of birth (mm/yyyy)

Month\Year	2004	2005	2006	2007	2008	2009	*Total*
January	0	14	13	10	15	13	*65*
February	0	4	9	12	11	12	*48*
March	0	11	13	7	7	7	*45*
April	0	11	12	25	20	5	*73*
May	0	13	12	13	14	0	*52*
June	0	12	10	9	9	0	*40*
July	0	8	9	18	19	0	*54*
August	0	10	8	16	11	0	*45*
September	2	14	9	12	13	0	*50*
October	7	11	9	18	9	0	*54*
November	9	19	10	18	12	0	*68*
December	8	10	8	20	10	0	*56*
Total	*26*	*137*	*122*	*178*	*150*	*37*	*650*

Figure 5. Enrollment Rates by Age



REDUCED FORM MODEL

Table 20: Probit Model of Children's Attendance to Public and Private Childcare Centers (Older than 2 years)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Gender (Female=1)	-0.042	-0.059	-0.067	-0.062	-0.078
	(-0.152 , 0.068)	(-0.173 , 0.054)	(-0.182 , 0.048)	(-0.177 , 0.053)	(-0.195 , 0.038)
Age	0.017***	0.017***	0.017***	0.017***	0.017***
	(0.012 , 0.022)	(0.012 , 0.023)	(0.012 , 0.023)	(0.011 , 0.022)	(0.011 , 0.022)
Total People in the Household	-0.055***	-0.051***	-0.052***	-0.051***	-0.05***
	(-0.085 , -0.025)	(-0.082 , -0.021)	(-0.084 , -0.021)	(-0.083 , -0.02)	(-0.082 , -0.019)
Mother's Education		0.019	0.012	0.012	0.009
		(-0.005 , 0.043)	(-0.015 , 0.038)	(-0.015 , 0.038)	(-0.018 , 0.036)
Father's Education		0.011	0.012	0.012	0.013
		(-0.01 , 0.031)	(-0.01 , 0.033)	(-0.009 , 0.034)	(-0.008 , 0.035)
Father Absent		-0.13	-0.103	-0.106	-0.118
		(-0.365 , 0.106)	(-0.351 , 0.144)	(-0.354 , 0.141)	(-0.365 , 0.129)
Numerical IQ (Mother)			0.026*	0.026*	0.03*
			(-0.005 , 0.056)	(-0.004 , 0.057)	(-0.001 , 0.061)
Verbal IQ (Mother)			-0.001	-0.001	-0.001
			(-0.005 , 0.003)	(-0.005 , 0.003)	(-0.005 , 0.003)
Extraversion (Mother)			0.089**	0.092**	0.095**
			(0.013 , 0.166)	(0.015 , 0.169)	(0.017 , 0.173)
Conscientiousness (Mother)			-0.067	-0.069	-0.056
			(-0.156 , 0.021)	(-0.158 , 0.02)	(-0.147 , 0.034)
Distance to Childcare Center				-0.0002*	-0.0002*
				(-0.001 , 0.00004)	(-0.001 , 0.00005)
Avg. # of Children Per Center					-0.0047**
					(-0.009 , -0.00032)
Observations	349	340	340	340	338

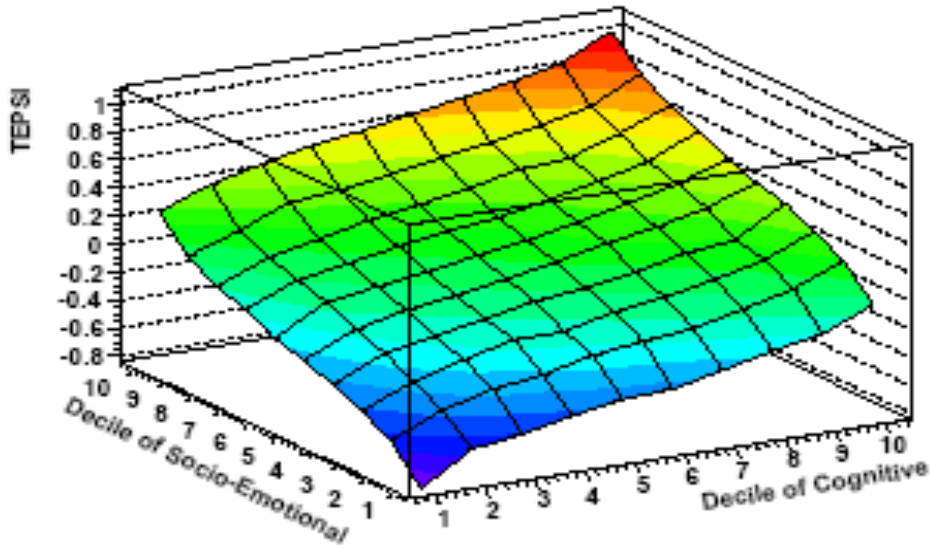
Robust 95% confidence intervals in parentheses. *P< .10, **P< .05, ***P< .01

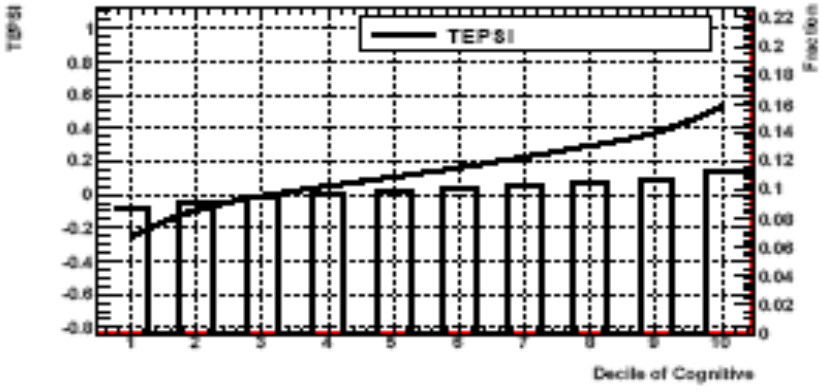
STRUCTURAL MODEL

STRUCTURAL MODEL

- We allow endowments to be correlated, but the correlation is small (0.02) and non-significant.
- Unobserved endowments (jointly with education and age) determine observed mother's test scores.
- Unobserved endowments (socio-emotional) determine mother's enrollment decision.
- Unobserved endowments are strong predictors of children's cognitive and socio-emotional test scores.

FigurE 8. Average TEPSI score for Children that Enrolled in Childcare (Treatment Group) as a Function of Mother's cognitive and socio-emotional unobserved abilities.





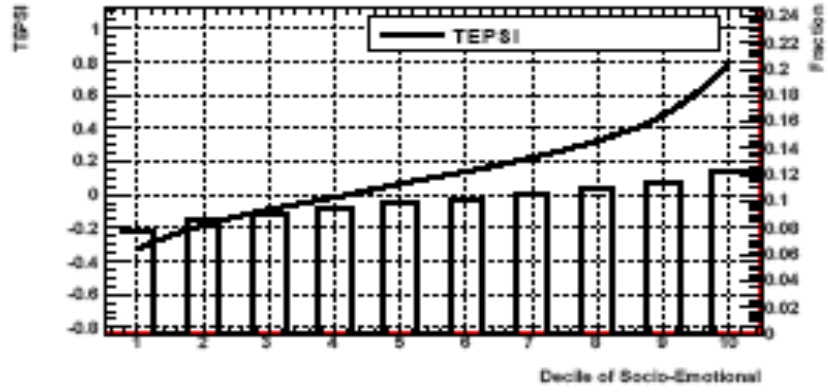


Table 33: Treatment Effect Estimates of Attendance to Childcare Centers from Structural Model

	ATE	TT	TUT	AMTE
TEPSI	0.302	0.324	0.281	0.414
	(0.034,0.586)	(0.063,0.604)	(-0.028, 0.617)	(0.011, 0.733)
CBCL	0.191	0.142	0.240	0.342
	(-0.147,0.610)	(-0.241,0.550)	(-0.164,0726)	(-0.095,0.748)
CBQ-surgency	-0.254	-0.326	-0.180	-0.130
	(-0.764,0.269)	(-0.866,0.154)	(-0.897,0.463)	(-0.852,0.457)
CBQ- Negative Affect	0.101	0.018	0.187	0.027
	(-0.388,0.498)	(-0.463,0.448)	(-0.356,0.642)	(-0.478,0.544)
CBQ- Control	-0.141	-0.144	-0.138	0.004
	(-0.670,0.304)	(-0.677,0.376)	(-0.685,0.384)	(-0.721,0.443)
Weight (klg)	-0.023	-0.001	-0..045	0.144
	(-0.577,0.478)	(-0.635,0.590)	(-0.654,0.481)	(-0.610,0.717)
Height (cm)	0.665	0.265	1.074	0.753
	(-0.834,2.057)	(-1.056,1.707)	(-0.800,2.662)	(-0.810,2.792)

Note: For cognitive and socio-emotional test scores we report the standardized treatment effects (% of std. deviations). The numbers in this table are obtained using the estimates from our structural model and simulations based on our original data. The number in brackets represent the confidence interval (5%,95%) obtained using bootstrapping .

Finally Ingredient:Experiments

- **ECD Program Information**: Information on ECD center availability and their specific programs.
- **ECD Program Curriculum**: An innovative US initiative (Tools of the Mind) centered in changes in the curriculum (40 ECD centers would be needed).
- **ECD Center/Staff Incentives Treatment**: Incentives based on high levels and high improvements in child outcomes.
- **Provision of vouchers**: In contrast with primary and secondary education, mainly public supply of ECD (Junji/Integra). Competition?
- **Provision of extra staff for ECD Centers**: Additional staff should be randomly assigned to a subset of ECD centers to assess if ECD quality is enhanced.

Conclusions

We **MUST** place high-quality early education as a top priority for long-term development and growth

1. **Motivation**: Increasing body of literature showing the long term effects of early childhood development (ECD) (economics, developmental psychology, etc.) and massive increment in the number of child-care centers.
2. **Objectives**: To evaluate the impact of early education on ECD from a multi-dimensional perspective and to provide insights for the design of public policies.
3. **The components**: New and better data, experiments, econometric/identification challenges.
4. **Preliminary Evidence**: Suggests some positive impact on ECD.