

Household Choices and Child Development

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MAIN QUESTION

- ▶ What is the relationship between parental time allocation, household expenditure patterns and child quality outcomes?
- ▶ Estimate dynamic child quality production function, with (potentially) observed factors of production such as (active and passive) **parental time** and **expenditures on children**.
 - ▶ How do the factor loadings change as the child grows up?
 - ▶ Do different age children benefit more from different inputs?
- ▶ What is the effect of parental employment on child quality?
 - ▶ Comparative statics exercise with wage increase

MODEL

- ▶ Single children families: child's age = t
- ▶ Household's life begins with the birth of a child, infinitely lived.
- ▶ Child quality investment decisions at $t = 1, \dots, T$:
 - ▶ active ($\tau_{it}, i = 1, 2$) and passive ($z_{it}, i = 1, 2$) childcare time for each parent, and expenditures (e_t) on child.
- ▶ Household utility function:

$$u(l_{1t}, l_{2t}, c_t, k_t) = \alpha_1 \ln l_{1t} + \alpha_2 \ln l_{2t} + \alpha_3 \ln c_t + \alpha_4 \ln k_t$$

- ▶ where $l_{it}, i = 1, 2$ are leisure for mother and father, c_t is consumption and k_t is latent child quality at time t .
- ▶ Child quality production function:

$$k_{t+1} = f(k_t, \tau_{1t}, \tau_{2t}, z_{1t}, z_{2t}, e_t) = R_t \tau_{1t}^{\delta_{1t}} \tau_{2t}^{\delta_{2t}} z_{1t}^{\delta_{3t}} z_{2t}^{\delta_{4t}} e_t^{\delta_{5t}} k_t^{\delta_{6t}}$$

DYNAMIC PROBLEM

$$V_t(S_t) = \max_{l_{1t}, \tau_{1t}, l_{2t}, \tau_{2t}, z_{1t}, z_{2t}, e_t} u(l_{1t}, l_{2t}, c_t, k_t) + \beta \mathbb{E}_t V_{t+1}(S_{t+1})$$

$$s.t. \quad TT = l_{it} + h_{it} + \tau_{it} + z_{it}, \quad i = 1, 2$$

$$c_t + e_t = w_{1t}h_{1t} + w_{2t}h_{2t} + I_t$$

- ▶ where h_{it} denotes market hours, w_{it} denote wages, and I_t is non-labor income.
- ▶ The state vector $S_t = (k_t, w_{1t}, w_{2t}, I_t)$
- ▶ No Saving or Borrowing!

TERMINAL VALUE

- ▶ Let $\tilde{S}_t = (w_{1,t}, w_{2,t}, I_t)$
- ▶ Terminal level of child quality $\equiv k_{T+1}$

$$V_{T+1}(\tilde{S}_{T+1}; k_{T+1}) = V_{T+1}^{static}(\tilde{S}_{T+1}) + \psi \alpha_4 \ln k_{T+1}$$

- ▶ where

$$V_{\tau}^{static}(\tilde{S}_{\tau}) = \max_{l_{1\tau}, l_{2\tau}} \alpha_1 \ln l_{1\tau} + \alpha_2 \ln l_{2\tau} \\ + \alpha_3 \ln[w_{1\tau}(TT - l_{1\tau}) + w_{2\tau}(TT - l_{2\tau}) + I_{\tau}]$$

$$\forall \tau = T + 1, T + 2, \dots$$

ECONOMETRIC SPECIFICATION

- ▶ **Heterogeneity:** HH preference parameters $(\alpha_1 \alpha_2 \alpha_3)$ distributed $G(\alpha; \theta)$ in the population
- ▶ Child quality production function parameters

$$\delta_{jt} = \exp(\gamma_{j0} + \gamma_{j1}t), \quad j = 1, \dots, 6; \quad t = 1, \dots, T$$

- ▶ Latent non-labor income: $I_t^* = \mu_I + \epsilon_{It}$, $\epsilon_{It} \sim^{iid} N(0, \sigma_I^2)$, thus

$$I_t = \max(0, I_t^*), \quad \forall t$$

- ▶ Wage process:

$$\ln w_{it} = \mu_{it} + \epsilon_{it}, \quad i = 1, 2$$

$$\epsilon_t \sim^{iid} N(0, \Sigma_w), \quad \epsilon_t = (\epsilon_{1t}, \epsilon_{2t})'$$

$$\mu_{it} = \mu_i^0 + \mu_i^1 \text{edu}_i + \mu_i^2 \text{age}_{it} + \mu_i^3 \text{age}_{it}^2, \quad i = 1, 2$$

MEASURING CHILD QUALITY

- ▶ Child with latent quality k_t , with measured k_t^* correct answers
- ▶ Probability of answering *each* question right on a test:

$$p(k_t) = \frac{k_t}{1 + k_t}$$

- ▶ $k_t^* \sim \text{Binomial}(\bar{k}, p(k_t))$, \bar{k} = total number of questions
- ▶ k_0 not observed. Prior for $p_0 \sim \text{Beta}(1, 1)$ i.e. $U[0, 1]$
 - ▶ k_0^* is observed, update \Rightarrow posterior is $\text{Beta}(1 + k_0^*, (\bar{k} - k_0^*) + 1)$
 - ▶ Draw \tilde{p} from that posterior $\Rightarrow \tilde{k} = \frac{\tilde{p}}{1 - \tilde{p}} \equiv k_0$
 - ▶ Construct $\{k_t\}$ sequence from k_0 , using the HH inputs
- ▶ k_{2002}^* is observed at age t' for that child
- ▶ k_{2002}^* drawn from $\text{Binomial}(\bar{k}, p(k_{t'}))$

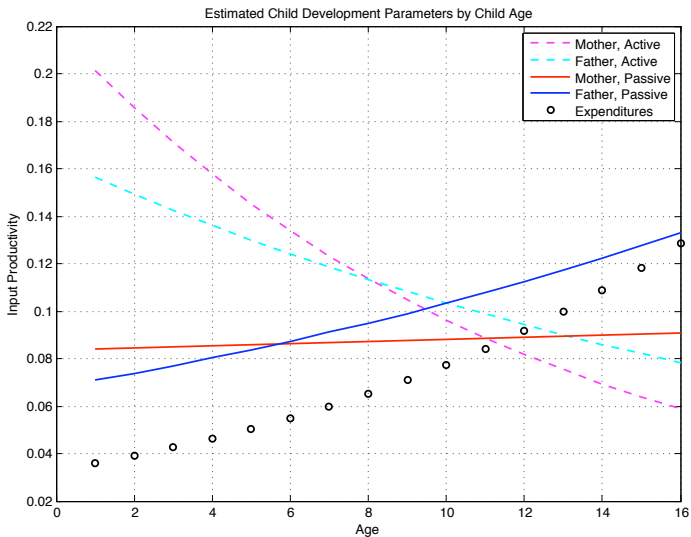
DATA AND ESTIMATOR

- ▶ PSID-CDS 1997:
 - ▶ 3500 children in 2400 HHs who are part of the PSID sample
 - ▶ Data collected for up to 2 children < 13 years old, per HH
 - ▶ Follow up in 2002-2003
 - ▶ **Time diaries** and **letter word test results**
 - ▶ **Restrict to:** HHs with both biological parents in both waves, and with only one child

- ▶ Labor supply, wage and demographic variables from PSID (1997, 1999, 2001).

- ▶ Estimate using Method of Simulated Moments

CHILD QUALITY TECHNOLOGY PARAMETERS



COMPARATIVE STATICS: WAGE CHANGES

For each period t , increase the wage draws of mothers and fathers:

▶ **A 1% increase in the mother's wage:**

- ▶ Mother's time with child ↓
- ▶ Father's time with child ↑
- ▶ Expenditures ↑

Measured and latent child quality ↑ by 0.0005 and 0.0049

▶ **A 1% increase in the father's wage:**

- ▶ Mother's time with child ↑
- ▶ Father's time with child ↓
- ▶ Expenditures ↑ (by more than previous case)

Measured and latent child quality ↑ by 0.0007 and 0.0068

APPENDIX

Table 2: Parent's Time with Child by Child Age

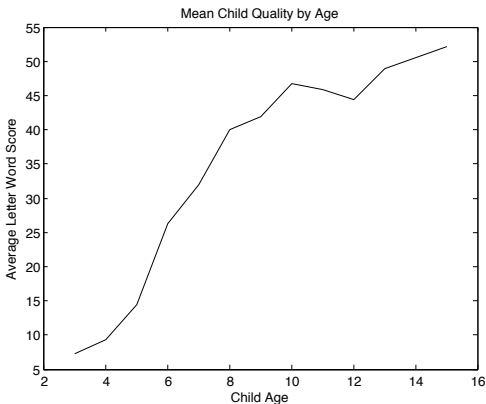
Child Age	Mother	Father
	Active Time (Avg.)	
3-5	32.65	17.91
6-8	20.86	15.59
9-11	19.45	12.59
12-15	16.12	12.55
	Passive Time (Avg.)	
3-5	16.40	7.90
6-8	12.65	10.25
9-11	13.83	10.45
12-15	17.99	15.25

Table 3: Parent's Labor Supply by Child Age

Child Age	Mother	Father
	Fraction Working > 0 Hours	
3-5	0.831	0.985
6-8	0.829	0.991
9-11	0.862	0.977
12-15	0.794	0.985
	Average Hours Working	
3-5	30.67	45.13
6-8	35.91	44.98
9-11	36.63	45.12
12-15	34.67	43.89

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Figure 1: Average Letter Word Score by Child Age



Notes: Sample of intact households (mother and father present in household) with one child.

Source: PSID-CDS combined sample from 1997 and 2002 interviews and 1997, 1999, 2001, 2003 PSID core data.

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Table 4: Preference Parameter Estimates

	Estimate	SE
Mean of α_1	0.130	(0.0067)
Mean of α_2	0.169	(0.0050)
Mean of α_3	0.329	(0.0101)
Mean of α_4	0.373	(0.0054)
Std. of α_1	0.104	(0.0105)
Std. of α_2	0.081	(0.0044)
Std. of α_3	0.092	(0.0074)
Std. of α_4	0.205	(0.0101)
Correlation of α_1 and α_2	0.492	(0.109)
Correlation of α_1 and α_3	-0.254	(0.089)
Correlation of α_2 and α_3	0.403	(0.088)
ψ (Terminal Payoff to Child Quality)	43.67	(29.13)

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Table 9: Comparative Statics

	Level at	Increase	Increase
		in Mother's Wage	in Father's Wage
	Baseline	Elasticity	
Mean Measured Child Quality (Age 16)	51.99	0.0005	0.0007
Mean Latent Child Quality (Age 16)	11.15	0.0052	0.0068
Mean Hours Work (Mother)	33.02	1.052	-1.023
Mean Hours Work (Father)	43.32	-0.59	0.59
Mean Active Time w/ Child (Mother)	19.39	-0.49	0.49
Mean Active Time w/ Child (Father)	15.76	0.39	-0.39
Mean Passive Time w/ Child (Mother)	16.76	-0.49	0.49
Mean Passive Time w/ Child (Father)	15.43	0.39	-0.39
Mean Leisure (Mother)	42.84	-0.40	0.38
Mean Leisure (Father)	37.49	0.36	-0.36
Mean Child Expenditures	241.25	0.40	0.57
Mean Household Consumption	1,325	0.39	0.59
Mean Utility	-	0.13	0.19

Notes: This table reports elasticity estimates from an increase in mother's (2) and father's wage offer (3). Mean Measured Child Quality (Age 16) is the average level of measured child quality (test score on scale of 0 to 57) at the end of age 16 or the start of period $t = 17$, k_{17}^* . Mean Latent Child Quality (Age 16) is the latent value of child quality at the end of age 16 or the start of period $t = 17$, k_{17} .