Household choices in fragile families and their effects on children's cognitive and non-cognitive skills

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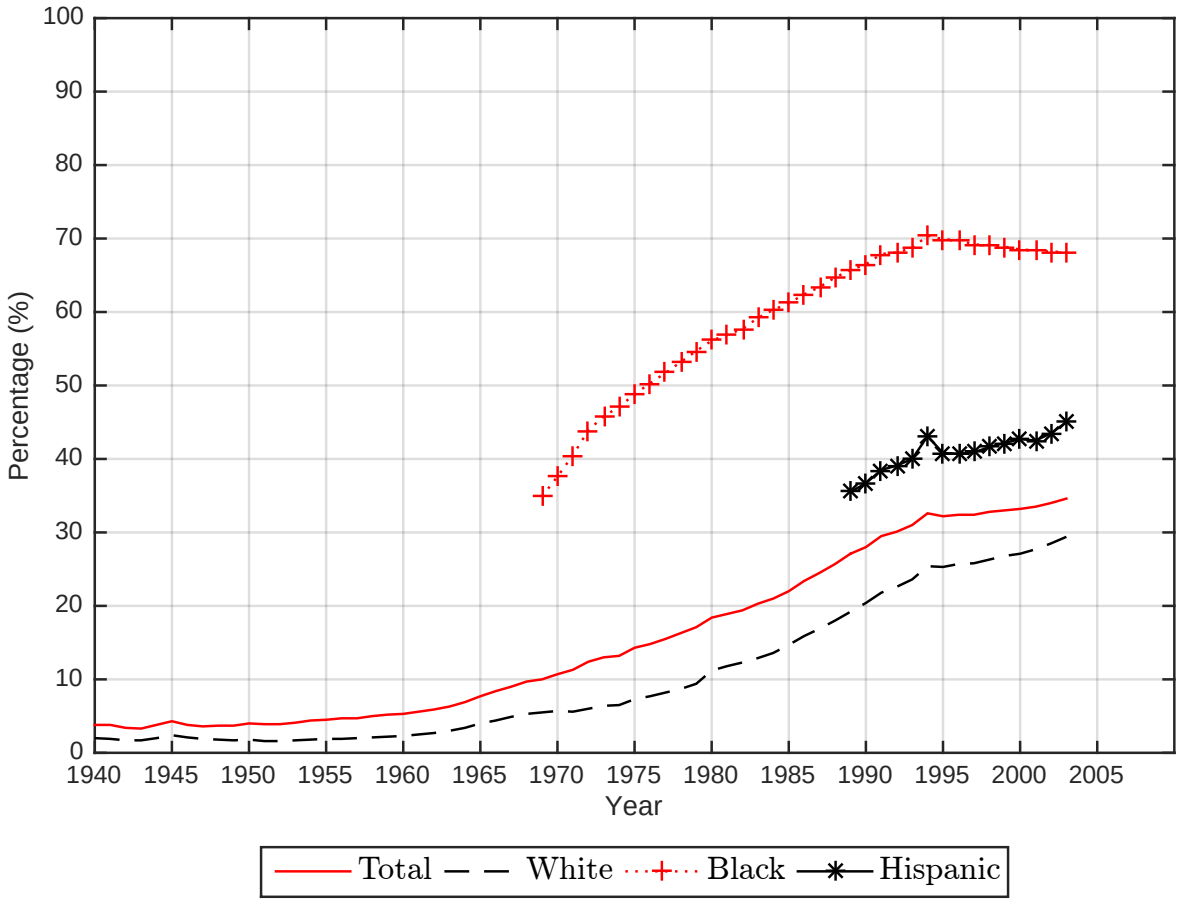

Figure: Unmarried Births as a Percent of All Births in the U.S.
Source: National Center for Health Statistics.

- **Becker and Tomes (1986)**, parents are utility-maximizing agents.
- They decide inputs for the production of child's cognitive ability (**Todd and Wolpin (2003)**).
- Parental care is a critical input in the child's development (**Cunha et al. (2006)**).
- **Almond and Currie (2011)**, parents' participation in the labor market.

Question:

- I focus on single mothers and their labor and child care decisions to assess how these choices affect their children's cognitive and non-cognitive ability.

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Model

- **Del Boca, Flinn, and Wiswall (2014)**.
- $t = 1, ..., T$.
- Choices: labor supply, time to dedicate to her child, formal and informal child care.
  - $k_{t+1} = (\tau_t)^{\delta_t^\tau} (\nu_t)^{\delta_t^\nu} (\pi_t)^{\delta_t^\pi} (\mathcal{E}^m)^{\delta_t^\mathcal{E}} (k_t)^{\delta_t^k}$.

In order to maximize her total utility

$$
\begin{aligned}
V_t(k_t, w_t, I_t) &= \max \alpha_1 \ln l_t + \alpha_2 \ln c_t + \alpha_3 \ln k_t + \beta \mathbb{E}_t V_{t+1}(k_{t+1}, w_{t+1}, I_{t+1}) \\
\text{s.t.} & \\
T^m &= l_t + h_t + \tau_t \\
w_t h_t + I_t &= c_t + p_\nu \nu_t + p_\pi \pi_t.
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Model Solution

As this model involves a dynamic programming problem with a terminal condition, the optimal solutions can be obtained by the application of **backward induction**.

I obtain analytic solutions:

$\boldsymbol{\Upsilon}_t^* = \left\{ h_t^*,\, l_t^*,\, \tau_t^*,\, \nu_t^*,\, \pi_t^*,\, c_t^* \right\}_{t=1}^{T}$ depending on:

$\boldsymbol{\Lambda}_t = (\alpha_1, \alpha_2, \alpha_3, \beta, \psi, \delta_t^{\tau}, \delta_t^{\nu}, \delta_t^{\pi}, \delta_t^{\mathcal{E}}, \delta_t^{k})$;
$\mathbf{P} = (p_\nu, p_\pi)$;
$\boldsymbol{\Phi}_t = (w_t, I_t, \mathcal{E}^m)$.

Data and Estimator

Fragile Families and Child Wellbeing Study:

- (1997-2003, 20 large cities in the US) follows a cohort of unwed new parents and their children.
- Baseline, Age 1, 3, 5.
- Variables:
  - Income,
  - time allocation,
  - child care,
  - Cognitive: Peabody Picture Vocabulary Test (PPVT).
  - Non-cognitive: Child Behavioral Checklist (CBCL). Externalizing and Internalizing problems.

Obtain moments: $\left\{h_t, l_t, \tau_t, \nu_t, \pi_t, c_t, k_t\right\} \rightarrow M_N$

Table: Summary statistics

	$t=0$		$t=1$		$t=3$		$t=5$	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Mother's education level								
Primary	0.30	0.46						
High School	0.35	0.48						
College	0.32	0.47						
Graduate	0.03	0..18						
Mother's ethnicity								
White	0.16	0.37						
Black	0.60	0.49						
Hispanic	0.23	0.42						
Mother's age			23.24	4.99	24.87	5.01	27.02	5.00
Annual income/$1,000			25.71	25.02	26.15	22.87	29.46	26.28
Weekly non-labour income			57.14	82.90	75.54	103.81	83.03	121.91
Outcome variables								
PPVT raw score					26.63	14.34	65.10	17.82
Externalizing score					30.06	7.69	46.45	7.86
Internalizing score					38.83	4.82	40.26	4.05
Endogenous variables								
Leisure, l_t					35.63	26.10	32.37	23.63
Working, h_t			36.38	10.81	36.08	10.03	36.48	9.56
Maternal care, τ_t					42.87	30.18	44.55	22.46
Formal care, ν_t					15.78	24.84	27.76	18.19
Informal care, π_t					29.14	27.31	15.84	20.99
Formal care options:								
Daycare, ν_t^D					15.78	24.84	4.35	11.82
Head-Start, ν_t^H							13.88	18.89
Kindergarten, ν_t^K							9.51	15.21

Data and Estimator, cont.

- Given $\tilde{k}_1$, I simulate paths of exogenous and endogenous variables over the development cycle: DGP

$$\left.\begin{array}{r} \alpha_1, \alpha_2, \alpha_3, \beta, \psi, \delta_t^{\tau}, \delta_t^{\nu}, \delta_t^{\pi}, \delta_t^{\mathcal{E}}, \delta_t^{k} \\ p_{\nu}, p_{\pi} \\ w_t, I_t, \mathcal{E}^m \end{array}\right\} \rightarrow \left\{\tilde{h}_t, \tilde{l}_t, \tilde{\tau}_t, \tilde{\nu}_t, \tilde{\pi}_t, \tilde{c}_t, \tilde{k}_t\right\} \rightarrow \tilde{M}_{SN}.$$

MSM: Primitive parameters contained in vector Θ.

$$\widehat{\Theta}_{SN} = \arg\min_{\Theta} \left\{M_N - \tilde{M}_{SN}\right\}' W \left\{M_N - \tilde{M}_{SN}\right\}.$$

Results: Child quality technology parameters

	Cognitive			Non-cognitive					
	PPVT			Externalizing			Internalizing		
	3	4	5	3	4	5	3	4	5
Maternal time, δ_t^τ	0.190	0.152	0.122	0.294	0.270	0.248	0.150	0.107	0.076
	(0.018)	(0.016)	(0.014)	(0.011)	(0.011)	(0.010)	(0.008)	(0.007)	(0.006)
Formal care, δ_t^ν	0.073	0.070	0.068	0.090	0.097	0.105	0.061	0.056	0.051
	(0.010)	(0.009)	(0.009)	(0.006)	(0.008)	(0.009)	(0.006)	(0.007)	(0.008)
Informal care, δ_t^π	0.041	0.028	0.020	0.091	0.072	0.058	0.050	0.033	0.021
	(0.009)	(0.006)	(0.005)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.006)
Mother's education, $\delta_t^\mathcal{E}$	0.219	0.151	0.105	0.219	0.149	0.102	0.620	0.489	0.385
	(0.056)	(0.041)	(0.032)	(0.022)	(0.016)	(0.013)	(0.022)	(0.024)	(0.025)
Current skill, δ_t^k	0.504	0.690	0.943	0.397	0.496	0.620	0.399	0.491	0.604
	(0.015)	(0.023)	(0.034)	(0.010)	(0.014)	(0.020)	(0.010)	(0.013)	(0.016)

Table: Counterfactual exercises, Transfers

	t	Baseline	Unconditional transfers			Subsidy
			$50	$100	$200	
Child's PPVT score, k_t	3	22.62	22.55	22.87	23.45	23.67
	5	68.86	68.21	70.17	73.96	75.15
Endogenous variables, (averages at $t = 5$)						
Mother's working hours, h_t		39.06	34.71	31.24	24.63	19.18
Maternal time, τ_t		44.64	47.34	49.47	53.57	63.11
Mother's leisure time, l_t		28.43	30.08	31.42	33.92	31.04
Consumption/1000, c_t		0.19	0.17	0.17	0.19	0.22
Household's utility/1000, u_t		0.06	0.06	0.06	0.07	0.06
Formal child care, ν_t		31.42	27.59	28.68	30.95	40.00
Informal care, π_t		26.29	23.08	24.00	25.90	19.77
Child's Externalizing score, k_t	3	29.77	29.61	30.23	31.41	29.33
	5	49.80	49.23	51.05	54.60	50.54
Child's Internalizing score, k_t	3	39.89	39.72	40.20	41.11	39.78
	5	40.98	40.65	41.32	42.60	41.77

Model extension

	$t=3$	$t=4$	$t=5$
π_t	✓	✓	✓
ν_t^D	✓	✓	-
ν_t^H	-	✓	✓
ν_t^K	-	-	✓

$$k_{t+1} = \begin{cases} (\tau_t)^{\delta_t^\tau} (\nu_t^D)^{\delta_t^D} (\pi_t)^{\delta_t^\pi} (\mathcal{E}^m)^{\delta_t^\mathcal{E}} (k_t)^{\delta_t^k} & \text{if } t \leq 3. \\ (\tau_t)^{\delta_t^\tau} (\nu_t^D)^{\delta_t^D} (\nu_t^H)^{\delta_t^H} (\pi_t)^{\delta_t^\pi} (\mathcal{E}^m)^{\delta_t^\mathcal{E}} (k_t)^{\delta_t^k} & \text{if } t = 4. \\ (\tau_t)^{\delta_t^\tau} (\nu_t^H)^{\delta_t^H} (\nu_t^K)^{\delta_t^K} (\pi_t)^{\delta_t^\pi} (\mathcal{E}^m)^{\delta_t^\mathcal{E}} (k_t)^{\delta_t^k} & \text{if } t = 5. \end{cases}$$

Table: Estimation results: productivity parameters, extended model

	Cognitive			Non-cognitive					
	PPVT			Externalizing			Internalizing		
	3	4	5	3	4	5	3	4	5
Maternal time, δ_t^τ	0.274	0.228	0.189	0.206	0.188	0.172	0.301	0.285	0.270
	(0.011)	(0.010)	(0.009)	(0.017)	(0.016)	(0.016)	(0.020)	(0.019)	(0.018)
Informal care, δ_t^π	0.043	0.028	0.018	0.034	0.020	0.012	0.053	0.036	0.025
	(0.006)	(0.006)	(0.005)	(0.010)	(0.010)	(0.009)	(0.014)	(0.016)	(0.018)
Mother's education, $\delta_t^\mathcal{E}$	0.106	0.065	0.040	0.391	0.371	0.352	0.311	0.184	0.109
	(0.024)	(0.018)	(0.013)	(0.029)	(0.031)	(0.033)	(0.034)	(0.028)	(0.023)
Current skill, δ_t^k	0.471	0.642	0.874	0.441	0.514	0.599	0.330	0.403	0.493
	(0.008)	(0.012)	(0.019)	(0.012)	(0.016)	(0.021)	(0.010)	(0.013)	(0.018)
Daycare, δ_t^D	0.142	0.066		0.089	0.024		0.174	0.096	
	(0.011)	(0.006)		(0.011)	(0.003)		(0.005)	(0.003)	
Head-Start, δ_t^H		0.019	0.010		0.035	0.021		0.099	0.080
		(0.006)	(0.004)		(0.011)	(0.008)		(0.009)	(0.006)
Kindergarten, δ_t^K			0.110			0.066			0.127
			(0.010)			(0.010)			(0.009)

Summary

- **Parental preferences and constraints** are important determinants of the child's development process.
- Preferences and technology parameters assumptions allow me to incorporate **different child care options** in the development process.
- I study **policies** to improve the child's PPVT.
- Among the institutional child care options, **Head-Start** is a relevant factor, but not the most productive of child's ability in single-mother households.

Section 1

More

DGP

Supplemental content.

$$
\begin{aligned}
\alpha_i &= \exp(\zeta_i)/(1+\exp(\zeta_1)+\exp(\zeta_2)), \text{ for } i=1,2,3 \\
\delta_t^j &= \exp(\gamma_0^j+\gamma_1^j\times t), \text{ for } j=\tau,\nu,\pi,\mathcal{E}^m,k \\
\ln\mu_{w,t} &= \mu_w^0+\mu_w^1\mathcal{E}^m+\mu_w^2 Age_t+\mu_w^3 Age_t^2+\epsilon_{w,t} \\
k_1 &= \exp\left(\vartheta_0+\vartheta_1\mathcal{E}^m+\vartheta_2\mathcal{E}^f+\vartheta_3 LBW\right) \\
I_t &= \max(0,\mu_I+\epsilon_{I,t}); \epsilon_{I,t}\sim\mathcal{N}(0,\sigma_I^2).
\end{aligned}
$$

Back to main.