Intra-Household Insurance and the Intergenerational Transmission of Income Risk

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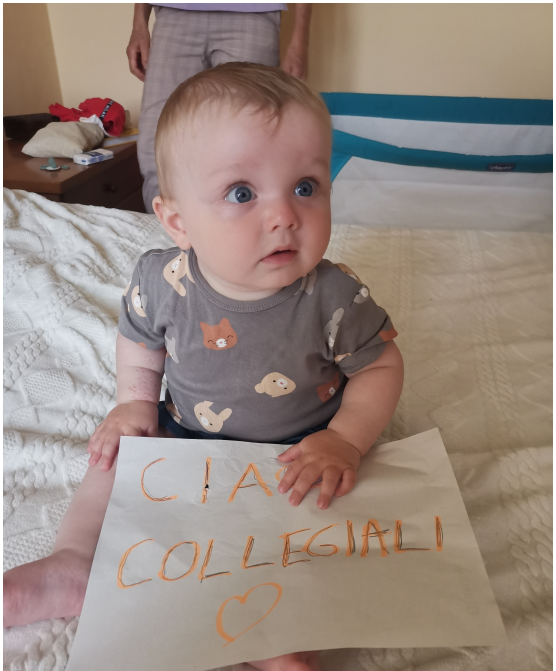
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Motivation

- Parental investments in early childhood are crucial for child development
- Parental income risk can alter time and resources allocation within the family
  - Temporary $\downarrow$ in earnings $\rightarrow \uparrow$ labor supply $\rightarrow \downarrow$ time investment...
- Life-cycle wage risk can pass through to children

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Uninsurable idiosyncratic risk can have a "scarring effect" that permanently reduces children's skill accumulation path

This Paper

1. We develop a two-parent life-cycle model of endogenous children's skill formation to study the intergenerational transmission of parental income risk
2. We estimate the model combining data from three different datasets
3. We study whether public policies can mitigate adverse consequences children

Preview of Results

- *Empirical Facts:*
  Adjustments in parental behavior in response to changes in parental income

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Preview of Results

- *Empirical Facts:*

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- *Model:*

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  2. Fathers' wage risk has a more significant adverse effect on skill levels
  3. Adverse effects are amplified if the shock hits both parents

- *Counterfactuals:*

  Public policies can mitigate adverse consequences for the younger generation

Data

1. **Consumer Expenditure Survey**
   - On US households' expenditures
   - Household-level dataset, four consecutive quarters
   - Child related expenditures and expenditures on non-durables

2. **American Time Use Survey**
   - US national time-diary samples
   - Ongoing monthly survey sponsored by the Bureau of Labor Statistics
   - We limit our sample of interest to households with one or more children

3. **NLSY79 + NLSY79-C**
   - Employment status, hours worked, earnings, PIAT...

Empirical Facts

Do changes in the tax system elicit responses in household child-related expenditures?

Parental Expenditures

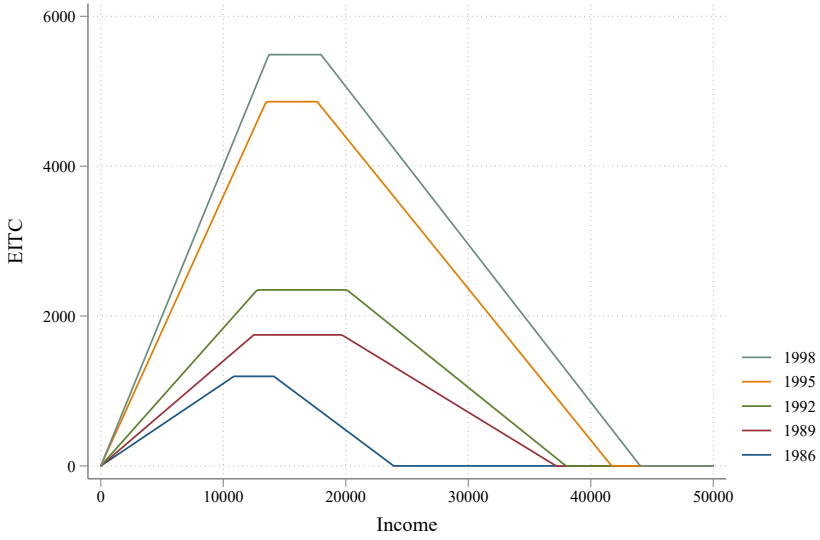
We focus on two types of expenditures:

- **Child-related expenditures**
  - Clothes
  - Childcare
  - Education
  - Toys

- **Expenditures on non-durables**
  - As in Blundell, Pistaferri, and Preston (2008)
  - Food, utilities, services, transportation, and personal care...

Parental Expenditures

- We focus on the reforms of the EITC program
- Identification challenge: nonrandom nature of eligibility for the program
- We leverage the quarterly nature of our data...
- ...and two features of the EITC program
  - EITC tax refunds are typically paid in the second quarter of the year
  - The EITC underwent substantial expansion starting in the early '90s


6000
4000
2000
0
EITC
0
10000
20000
30000
40000
50000
Income
1998
1995
1992
1989
1986

Parental Expenditures

- Empirical strategy based on a very simple idea
- Starting in the second quarter of a year,
  expenditures might increase due to the receipt of the tax credit
- We perform a **difference-in-differences** (DiD) analysis by comparing:
  - Individual treatment intensities based on the evolution of the program over time
  - Expenditures made in the first quarter versus in quarters two to four
    (before versus after receiving the tax credit)

$$Expenditure_{istq} = \alpha_0 + \alpha_1 MaxEITC_{ist} + \alpha_2 MaxEITC_{ist} \times Post_q + X_i'\gamma + \eta_q + \varepsilon_{itq}$$

- i is the household, s is the state of residence, t is the year
- $q \in [1, 2, 3, 4]$: quarter of the year
- $MaxEITC$: maximum tax credit by number of children, state, and year
- $Post$: one if the interview is in quarters two to four
- X: interactions and control variables (see table)
- η_q: fixed effects for quarters of the year

	(1) Child Expend.	(2) Child Expend.	(3) Child Expend.	(4) Non-durables	(5) Non-durables	(6) Non-durables
$MaxEITC_{ist} \times Post_q$	0.05***	0.04***	0.05***			
	(0.01)	(0.01)	(0.01)			
Observations	108,218	108,218	78,038			
Mean Dep.Var.	754	754	851			
Individual Controls	No	Yes	Yes			
Quarter FE	Yes	Yes	Yes			
Post*Year FE	Yes	Yes	Yes			
Post*Num.Children FE	Yes	Yes	Yes			
Sample	Whole	Whole	Married			

Intention-to-treat (ITT) interpretation of the effects

	(1) Child Expend.	(2) Child Expend.	(3) Child Expend.	(4) Non-durables	(5) Non-durables	(6) Non-durables
$MaxEITC_{ist} \times Post_q$	0.05***	0.04***	0.05***	0.03	0.02	0.04
	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)
Observations	108,218	108,218	78,038	108,218	108,218	78,038
Mean Dep.Var.	754	754	851	6728	6728	7280
Individual Controls	No	Yes	Yes	No	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Post*Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Post*Num.Children FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Whole	Whole	Married	Whole	Whole	Married

Intention-to-treat (ITT) interpretation of the effects

	(1)	(2)	(3)	(4)	(5)
	Childcare	Child Clothes	Education	Tuition	Toys
$MaxEITC_{ist} \times Post_q$	-0.01	0.02***	0.00	0.03***	0.01***
	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)
Observations	78,038	78,038	78,038	78,038	78,038
Mean Dep.Var.	335	231	42	165	78
Individual Controls	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Post*Year FE	Yes	Yes	Yes	Yes	Yes
Post*Num.Children FE	Yes	Yes	Yes	Yes	Yes
Sample	Married	Married	Married	Married	Married

Do changes in the tax system elicit responses in parental time use?

Parental Time Use

We group time use in three categories:

- **Work**
  - Paid jobs and paid activities
- **Childcare**
  - Care of infants, medical care, playing, supervising or assisting with homework...
- **Leisure**
  - Complement to 24 hours

Parental Time Use

- We focus on the reforms of the EITC program
- And adapt the identification strategy to consider the different (yearly) data
  1. We define and identify prominent program changes:
     - Any change in the maximum available EITC benefits by at least $200
     - Changes in the schedule at the state-year level for couples with two children
  2. We categorize sample units based on their exposure to the EITC program:
     - *High Exposure:* family income below 110% of the state-year income threshold
     - *Low Exposure:* remaining sample units
  3. We compare time usage before and after prominent EITC changes

$$TimeUse_{ist} = \alpha ProgramReform_{st} + \gamma X_i + \mu_s + \rho_t + \varepsilon_{ist}$$

- i is the parent, s is the state of residence, t is the year
- $TimeUse_{ist}$: daily minutes spent on a particular activity
- *ProgramReform*: indicator for a prominent EITC change
- *MaxEITC*: maximum tax credit by number of children, state, and year

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- $TimeUse_{ist}$: daily minutes spent on a particular activity
- *ProgramReform*: indicator for a prominent EITC change
- *MaxEITC*: maximum tax credit by number of children, state, and year
- All the analyses are by **level of exposure to policy changes**

	(1) Work	(2) Childcare	(3) Leisure	(4) Work	(5) Childcare	(6) Leisure
Program Reform	20.61***	-8.20**	-12.41			
	(7.62)	(3.91)	(7.78)			
Observations	16,829	16,829	16,829			
Mean Dep.Var.	167.91	80.11	1191.98			
Controls	Yes	Yes	Yes			
State FE	Yes	Yes	Yes			
Year FE	Yes	Yes	Yes			
Policy Exposure	High	High	High			
Sample	Whole	Whole	Whole			

	(1) Work	(2) Childcare	(3) Leisure	(4) Work	(5) Childcare	(6) Leisure
Program Reform	20.61***	-8.20**	-12.41	1.66	-1.28	-0.37
	(7.62)	(3.91)	(7.78)	(6.54)	(3.14)	(7.28)
Observations	16,829	16,829	16,829	29,472	29,472	29,472
Mean Dep.Var.	167.91	80.11	1191.98	203.8	87.31	1148.88
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Policy Exposure	High	High	High	Low	Low	Low
Sample	Whole	Whole	Whole	Whole	Whole	Whole

	(1) Work	(2) Childcare	(3) Leisure	(4) Work	(5) Childcare	(6) Leisure
Program Reform	24.62*	-11.11*	-13.52	-2.09	-0.38	2.47
	(12.55)	(6.16)	(14.00)	(7.84)	(3.67)	(8.62)
Observations	8,523	8,523	8,523	21,934	21,934	21,934
Mean Dep.Var.	186.35	94.61	1159.04	226.28	107.62	1106.1
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Policy Exposure	High	High	High	Low	Low	Low
Sample	Married	Married	Married	Married	Married	Married

Model

The Model (in a Nutshell)

- Two-parent household and one child
- Both parents decide whether to work short or long hours or not working at all
- Parents choose allocation of time and goods to the formation of child's skills
- The household makes such decisions in the face of the idiosyncratic risk
- Risk in form of shocks to wages and the technology of children's skill formation
- The model features a progressive tax-and-transfer system
  (useful for policy simulations)

Preferences

- We model parental decisions over T periods of the child's life (*childhood*)
- The child's age is denoted by t
- Each parent is endowed with one unit of time per period
- Time can be allocated to leisure, hours of work, and time spent with the child

Household's preferences over consumption, leisure, and child's skills:

$$\mathbb{E}_0 \left\{ \sum_{t=0}^{T} \beta^t u\left(c_t, l_{1t}, l_{2t}, \theta_t\right) + \beta^{T+1} v\left(\theta_{T+1}\right) \right\}$$

- $j = \{1, 2\}$
- u and v are increasing, concave, and twice continuously differentiable
- $\mathbb{E}_0$: expectation operator based on available information at childbirth (expectations wrt wage offers and shock of technology of skills formation)
- β: time discount factor

Budget Set

$$c_t + e_t = \mathcal{T}\left(\sum_{j=1}^{2} w_{jt} h_{jt}\right)$$

- c_t: consumption expenditures
- e_t: expenditures related to child's skill formation
- $\mathcal{T}$: tax-and-transfer system
- Labor supply of each parent:
  long-hours ($\overline{h}$) short-hours ($\underline{h} < \overline{h}$), not-working ($h = 0$)

Technology of Children Skill Formation

$$\theta_{t+1} = \exp(z_t)\, f(\theta_t, e_t, m_{1t}, m_{2t})$$

- m_{1t} and m_{2t}: parental time investments
- f is increasing and concave in each input $(\theta_t, e_t, m_{1t}, m_{2t})$

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- m_{1t} and m_{2t}: parental time investments
- f is increasing and concave in each input $(\theta_t, e_t, m_{1t}, m_{2t})$

To capture the inherent uncertainty in the process of skill accumulation:

$$z_{t+1} = \mu_z(1-\rho_z) + \rho_z z_t + \sigma_\eta \eta_{t+1}, \quad \text{with} \quad \eta_{t+1} \overset{iid}{\sim} \mathcal{N}(0,1)$$

- μ_z: unconditional mean of the shocks
- ρ_z governs the persistence of shocks
- σ_η: standard deviation of i.i.d. normal innovations η_t

θ_0 is random and potentially correlated with the wage offers of parents

Wage Processes

We assume that the log of the wage offered to parent $j \in \{1, 2\}$ at time t is:

$$\log w_{jt} = a_j + b_j t + \varepsilon_{jt}$$

- b_j: growth rate of the wage (in estimation we allow to vary by parent's gender)
- ε_{jt}: innovation that we assume to follow an AR(1) process:

$$\varepsilon_{jt} = \rho_j \varepsilon_{jt-1} + \sigma_{\nu j} \nu_{jt}, \quad \text{with} \quad \nu_{jt} \overset{iid}{\sim} \mathcal{N}(0, 1)$$

- ρ_j: persistence parameters
- $\sigma_{\nu j}$: standard deviations

The initial wage offers $\{w_{10}, w_{20}\}$ are random and drawn from a joint Normal distribution that allows for the offers of both parents to be correlated

Household's Problem

$$\max_{\left\{c_t, e_t, \left\{h_{jt}, l_{jt}, m_{jt}\right\}_{j=1,2}\right\}_{t=0}^{T}} \mathbb{E}_0 \left\{ \sum_{t=0}^{T} \beta^t u\left(c_t, l_{1t}, l_{2t}, \theta_t\right) + \beta^{T+1} v(\theta_{T+1}) \right\}$$

subject to

$$l_{jt} + h_{jt} + m_{jt} = 1,$$

$$c_t + e_t = \mathcal{T}\left(\sum_{j=1}^{2} w_{jt} h_{jt} \right),$$

$$\theta_{t+1} = \exp\left(z_t\right) f\left(\theta_t, e_t, m_{1t}, m_{2t}\right)$$

Bringing the Model to the Data

Functional forms (no time for details!):

- Preferences
- Technology:
  multi-layer nested constant-elasticity-of substitution (CES) production function
- Tax system: TAXSIM
- Child Skills' termination value: As in DFW (2014)

Estimation Procedure

Our estimation algorithm consists of two steps.

1. We set/estimate certain model's parameters directly outside the model (to reduce the computation burden of the estimation of the full model)

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1. We set/estimate certain model's parameters directly outside the model (to reduce the computation burden of the estimation of the full model)

2. We estimate the rest of the structural parameters via the SMM estimator

- **Step 1:**
  We exogenously set the value of the discount factor β
  We also estimate a subset of parameters for the tax system (χ_1, χ_2, and χ_3); and the initial distribution of skills at age 5

- **Step 2:**
  The structural parameters that we aim to estimate by SMM are:
  - Flow utility $u(c, l_1, l_2, \theta)$: $\gamma_c, \alpha_\theta, \gamma_\theta, \alpha_{l_1}, \gamma_{l_1}, \alpha_{l_2}, \gamma_{l_2}$
  - Terminal condition $V_{T+1}(\theta)$: $\tilde{\alpha}_\theta, \tilde{\gamma}_\theta$
  - Production function $f(\theta, e, m_1, m_2)$: $\omega_f, \omega_I, \omega_M, \sigma_f, \sigma_I, \sigma_M$
  - TFP process: $\mu_z, \rho_z, \sigma_\eta^2$
  - Wage process: $\left\{a_j, b_j, \rho_j, \sigma_{\nu j}^2\right\}_{j=1}^2$
  - Initial joint distribution of wages and skill: $\rho_{w_1,w_2}, \rho_{w_1,\theta}, \rho_{w_2,\theta}$.

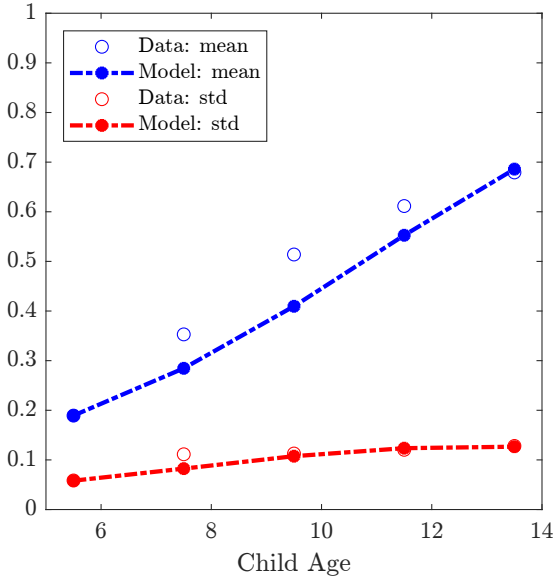
Moments

58 moments to identify 29 parameters.

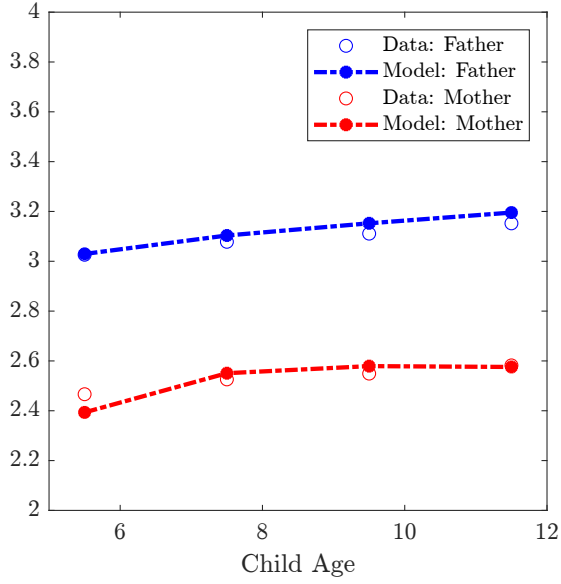
- 10 moments on the life-cycle profile of mean and standard deviation of skills
- 32 moments for the life-cycle profile of maternal and paternal hours worked, accepted wages, part-time and full-time employment rates
- 5 moments for the correlation between a child's skills and both spouses' accepted wages and earnings
- 10 moments for the distribution of spouses' joint labor supply decisions
- 2 moments from ATUS and CE which for the relative expenditure and time investments between mothers working full-time and other mothers

Symbol	Point Estimate	Standard Error	Symbol	Point Estimate	Standard Error
A. Preferences					
γ_c	2.5462	0.0232			
γ_θ	0.2267	0.0579	α_θ	4.7032	0.4113
γ_{l_1}	5.7242	0.0379	α_{l_1}	49.8411	2.6372
γ_{l_2}	5.7680	0.0575	α_{l_2}	64.1651	5.3799
$\tilde{\gamma}_\theta$	2.4733	0.6928	$\tilde{\alpha}_\theta$	18.3934	4.8688
B. Technology					
ω_f	0.9069	0.0031	σ_f	0.9902	0.0189
ω_I	0.1445	0.0054	σ_I	2.9109	0.1426
ω_M	0.5830	0.0175	σ_M	0.5883	0.0884
μ_z	0.4206	0.0087	ρ_z	0.4312	0.0195
σ_η	0.2255	0.0063			
C. Wage Process					
a_1	2.9400	0.0211	b_1	0.0576	0.0057
ρ_1	0.5345	0.0369	$\sigma_{\nu 1}$	0.6700	0.0371
a_2	1.7301	0.0337	b_2	0.1359	0.0063
ρ_2	0.6159	0.0294	$\sigma_{\nu 2}$	0.8744	0.0530
$\rho_{w_1,\theta}$	0.4508	0.0556	$\rho_{w_2,\theta}$	0.1931	0.0380
ρ_{w_1,w_2}	0.0519	0.0151			

Goodness of Fit: Skills (Mean and Standard Deviation)



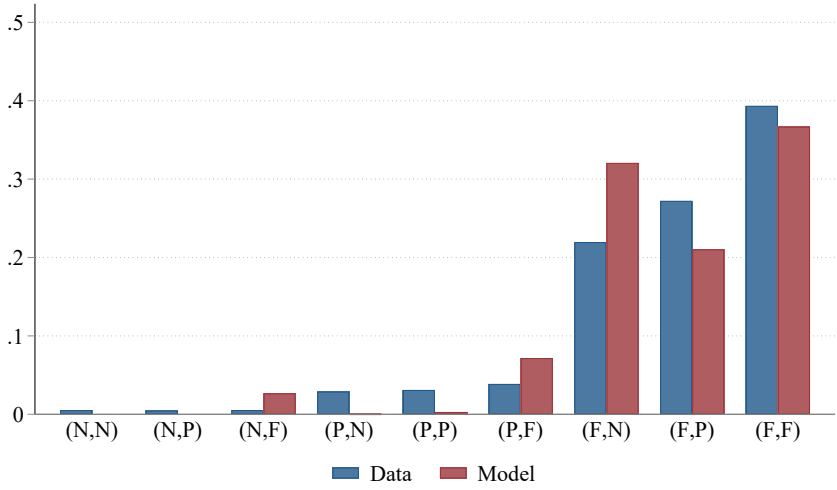
Goodness of Fit: Parents' Accepted Wages



Correlation Between Parent Wages and Child Skills

Moment	Data	Model
$\mathrm{corr}\left(\theta, w_1\right)$	0.1721	0.1845
$\mathrm{corr}\left(\theta, w_2\right)$	0.1080	0.0875
$\mathrm{corr}\left(\theta, y_1\right)$	0.1556	0.1719
$\mathrm{corr}\left(\theta, y_2\right)$	0.1324	0.1210
$\mathrm{corr}\left(w_1, w_2\right)$	0.2962	0.3552

Distribution (Frequency) of Joint Labor Supply



Wage Risk Shocks and Child Development

- We plot the distribution of skill changes
  (measured as the ratio of the SD of skills in the baseline)
- To a larger (50% more compared to the baseline) wage offer shock
- In all cases we increase the standard deviation of the wage *offer* distributions
- While keeping the mean wage offers fixed at their baseline level

Distributions of Skill Changes to a Mean-Preserving Spread in the Wage Offer Shocks

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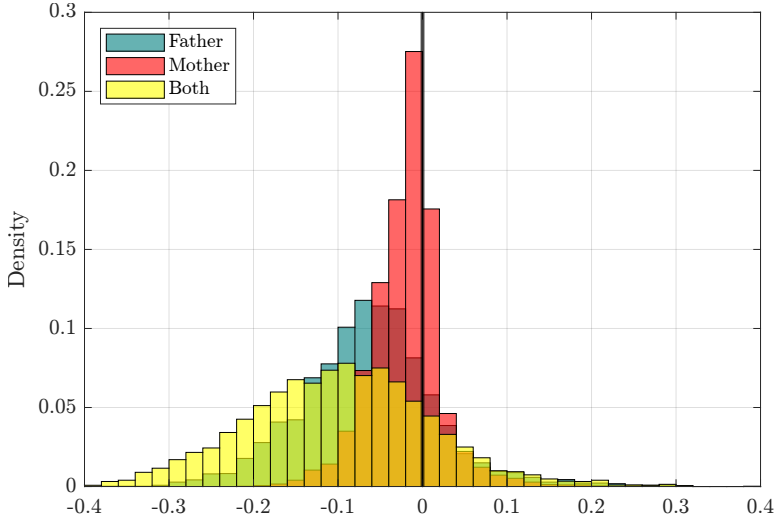

The Mean Effect of Wage Shock Dispersion

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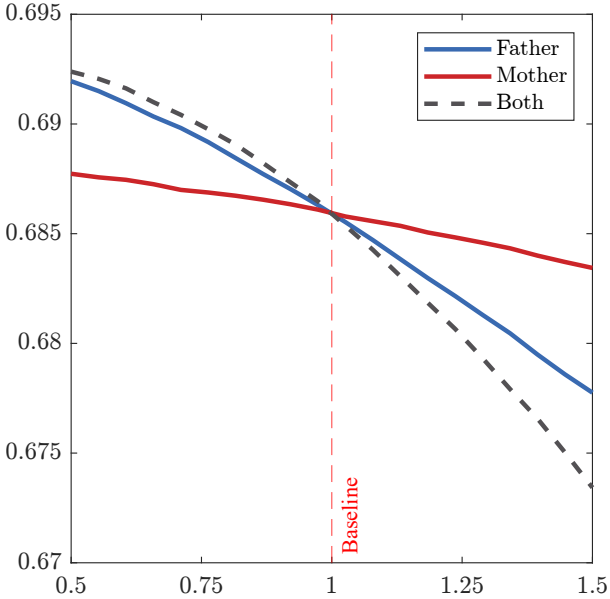

Inspecting the Transmission Mechanisms of Increased Wage Risk

After-Tax Income and Expenditures

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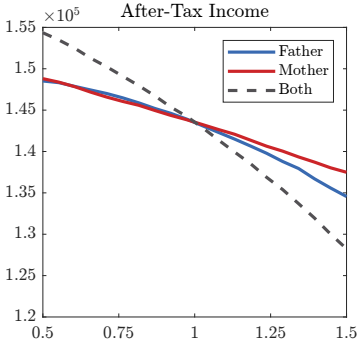

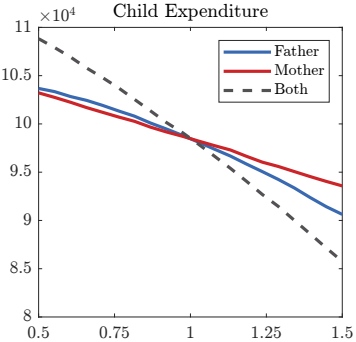

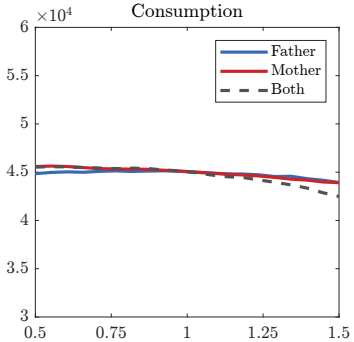

Inspecting the Transmission Mechanisms of Increased Wage Risk

Father's Time Allocation

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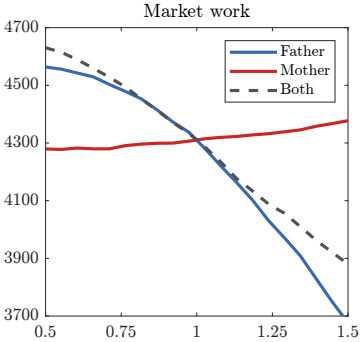

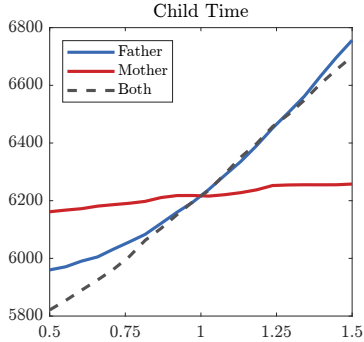

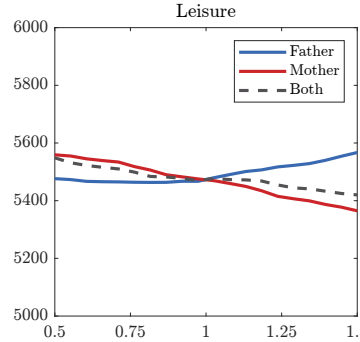

Inspecting the Transmission Mechanisms of Increased Wage Risk

Mother's Time Allocation

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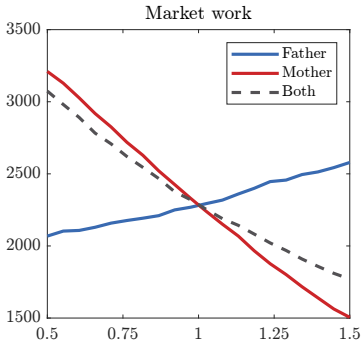

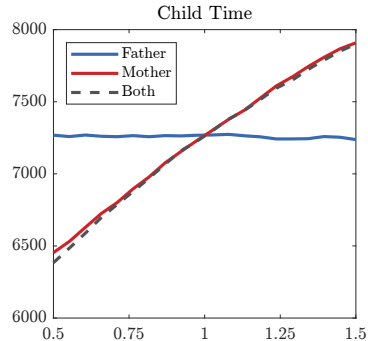

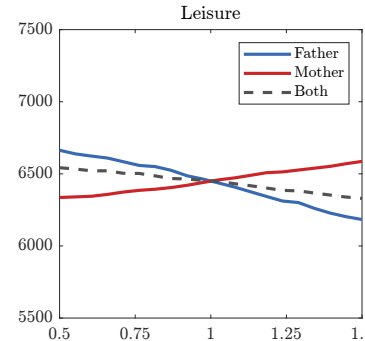

Can the Social Safety Net Mitigate Children Skill Losses?

Increasing Tax Progressivity

- We increase the tax progressivity index in the tax function
- Effective tax rate for the median household is unchanged

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Enhanced tax progressivity mitigates the transmission of wage risk across the board through the standard insurance effect of progressive taxation

Universal Basic Income (UBI)

- Andrew Yang's proposal of a universal basic income of $1,000 per month
- This amount to $24,000 a year for a two-parent household in our economy ($48,000 for two years, i.e. one model period)
- We keep the tax system unchanged

Skill Changes from Introducing UBI
(Skill Change vs. Income Level)

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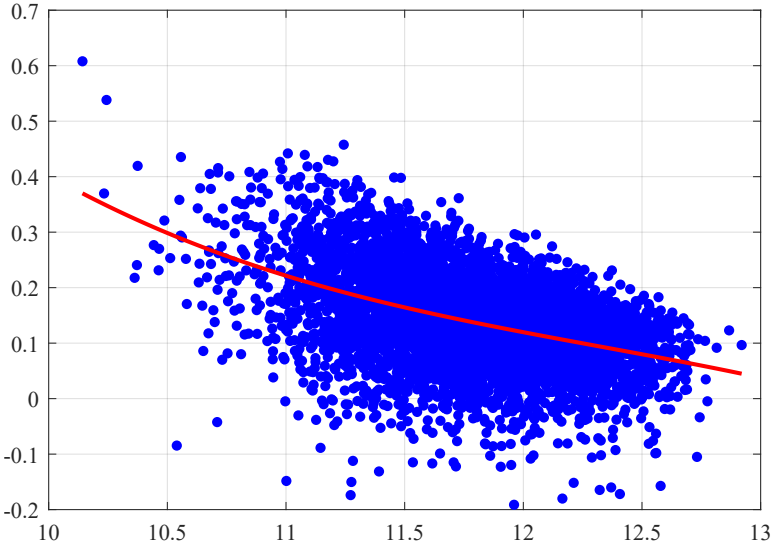

Conclusion

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- Income risk slows down skill accumulation, permanently lowering children skills
- Parents' wage risk has a scarring effect on children's skills
- Income risk affects more low-income households
  (due to limited ability to adjust labor supply)
- Certain policies can attenuate children's skill losses