

# When the Great Equalizer Shuts Down: Schools, Peers, and Parents in Pandemic Times

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# How Do School Closures Affect Educational Inequality?

- ▶ Already a lot of evidence that children's learning has slowed down during pandemic school closures.
- ▶ Online education is an imperfect substitute for in-person schooling.
- ▶ But children's learning does rely on schooling; **peers** and **parents** also matter.
- ▶ **How do influences of schools, peers, and parents combine to shape children's learning during the pandemic?**

# What We Do

- ▶ No well-documented comparable event to learn from—need theory for guidance.
- ▶ Build on model of skill acquisition with peers and parents, estimated using pre-pandemic data.
  - ▶ “It Takes a Village: The Economics of Parenting with Neighborhood and Peer Effects.”

# What We Do

- ▶ **Account for Different Channels through Which School Closures Affect Children**
  - ▶ Schooling becomes less efficient.
  - ▶ Peer effects are changed and parents react.
- ▶ **Combine Evidence from Before and During Pandemic to Quantify Channels**
  - ▶ Add Health Data for basic structure of the model.
  - ▶ Evidence on learning loss during the pandemic.
  - ▶ Evidence on parents' time constraints.
- ▶ **Assess Impact of Pandemic on Children from Rich and Poor Neighborhoods**

## Literature We Build On

- ▶ **Family Environment and Skill Formation:** Cunha and Heckman (2007); Cunha et al. (2010); Dahl and Lochner (2012); Løken et al. (2012); Del Boca et al. (2014); Attanasio (2015); Agostinelli and Wiswall (2016); Agostinelli and Sorrenti (2018); Attanasio et al. (2019); Mullins (2019), ...
- ▶ **Social Environment and Neighborhoods:** Cutler and Glaeser (1997); Brock and Durlauf (2001a, 2001b, 2007); Ioannides and Durlauf (2010); Chetty et al. (2016); Chetty and Hendren (2018a, 2018b); Agostinelli (2018); Altonji and Mansfield (2018); Eckert and Kleinberg (2019); Fogli and Guerrieri (2019); List, Momeni, and Zenou (2019), ...
- ▶ **Parenting Style:** Baumrind (1967); Doepke and Zilibotti (2017); Doepke and Zilibotti (2019); Doepke, Sorrenti, and Zilibotti (2019); Del Boca et al. (2019), ...

# Model of Parenting with Peer Effects

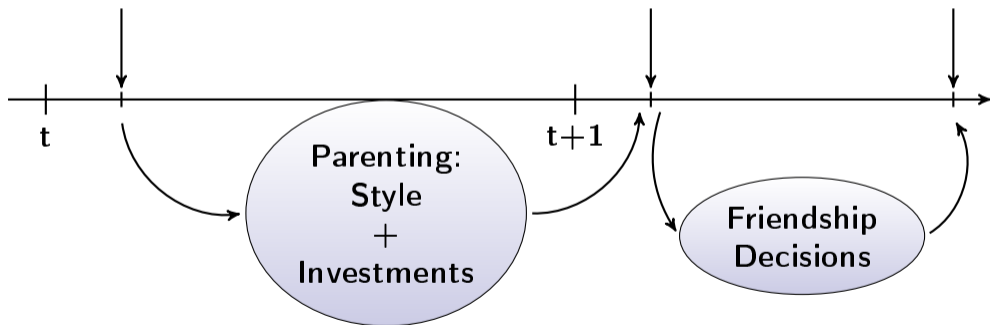
# Setting: Parenting through the High School Years

- ▶ Parents and children. Initial heterogeneity in child skills, varies across schools/neighborhoods
- ▶ **Parent** decides about:
  - ▶ **Authoritarian versus nonauthoritarian** parenting style
  - ▶ **Authoritative time investments** (continuous variable)
- ▶ **Child** decides about:
  - ▶ **Who to be friends with** ...
  - ▶ ...taking as given the parent's behavior

# Timeline

Skills of child ( $\theta_{i,t}$ ) and  
peers ( $\bar{\theta}_{i,t}$ ) realized

Child's skill ( $\theta_{i,t+1}$ ) realized    Peer group ( $\bar{\theta}_{i,t+1}$ ) realized





# Technology of Skill Formation

$$\theta_{i,t+1} = A(t, P) \cdot \left[ \alpha_{4,P} \theta_{i,t}^{\alpha_{6,P}} + \alpha_{5,P} \left[ \alpha_{1,P} \bar{\theta}_{i,t}^{\alpha_{3,P}} + \alpha_{2,P} I_{i,t}^{\alpha_{3,P}} \right]^{\frac{\alpha_{6,P}}{\alpha_{3,P}}} \right]^{\frac{1}{\alpha_{6,P}}}$$

- ▶ Next-period skill ( $\theta_{i,t+1}$ ) depends on:
  - ▶ Current stock of skills ( $\theta_{i,t}$ )
  - ▶ Peer effects ( $\bar{\theta}_{i,t}$ )
  - ▶ Parental investments ( $I_{i,t}$ )
  - ▶ Parenting style ( $P_{i,t} \in \{0, 1\}$ )
- ▶ Captures idea that authoritarian parenting may disrupt skill accumulation

# The Child's Problem: Forming Friendships

- ▶ The child's value function:

$$v_t^n(\theta_{i,t}, \bar{\theta}_{i,t}) = \max \{ E [ u(f_{i,t+1}) + b v_{t+1}^n(\theta_{i,t+1}, \bar{\theta}_{i,t+1}) ] \}$$

- ▶ Utility of potential new friendship of  $i$  and  $j$ :

$$f_{i,j,t+1} = g(\theta_{i,t+1}, \theta_{j,t+1}, P_{i,t}, \eta_{i,j,t+1})$$

- ▶ Friendship forms if there is mutual agreement:

$$f_{i,j,t+1} > 0 \quad \& \quad f_{j,i,t+1} > 0$$

- ▶ Total friendship utility:

$$f_{i,t+1} = \sum_{j \in \mathcal{X}_{i,t+1}} f_{i,j,t+1}$$

# The Child's Problem: Forming Friendships

- ▶ Functional form for friendship utility:

$$f_{i,j,t+1} = \gamma_0 + \gamma_1 \ln \theta_{i,t+1} + \gamma_2 \ln \theta_{j,t+1} + \gamma_3 (\ln \theta_{i,t+1} - \ln \theta_{j,t+1})^2 + \\ \gamma_4 \mathbb{1}(\theta_{j,t+1} < \theta_{i,t+1}) (\ln \theta_{i,t+1} - \ln \theta_{j,t+1})^2 P_{i,t} + \eta_{i,j,t+1}$$

- ▶ Allows for **homophily bias**: tendency to befriend similar kids
- ▶ Authoritarian parenting style **sanctions lower-skill peers**

# The Parent's Problem: Paternalism versus Altruism

- The parent's value function:

$$V_t^n(\theta_{i,t}, \bar{\theta}_{i,t}) = \max_{P_{i,t} \in \{0,1\}, I_{i,t} \geq 0} \left\{ E [U(I_{i,t}, P_{i,t}, \epsilon_{i,t}) + Z [\lambda \tilde{u}(\theta_{i,t}, P_{i,t}) + (1 - \lambda)u(f_{i,t+1})] + B \times V_{t+1}^n(\theta_{i,t+1}, \bar{\theta}_{i,t+1})] \right\}$$

- ▶ Cost of investing in skills:  $U_I(I_{i,t}, P_{i,t}, \epsilon_{i,t}) < 0$
- ▶ Cost of influencing friendships:  $U(I_{i,t}, 1, \epsilon_{i,t}) < U(I_{i,t}, 0, \epsilon_{i,t})$
- ▶ Final continuation utility:  $V_{T+1}^n = v_{T+1}^n(\theta_{i,T+1})$

# The Pandemic in the Model

- ▶ Grade specific productivity loss in the production function for skill (capturing online learning and peer disruption).
- ▶ Parents have to spend time  $\bar{T}$  to substitute teacher inputs:

$$H_p(\theta_{i,t}, \bar{\theta}_{i,t}, l_{i,t}) = \left[ \alpha_{1,p} \theta_{i,t}^{\alpha_{4,p}} + (1 - \alpha_{1,p}) \left[ \alpha_{2,p} \bar{\theta}_{i,t}^{\alpha_{3,p}} + (1 - \alpha_{2,p}) (l_{i,t} - \bar{T})^{\alpha_{3,p}} \right]^{\frac{\alpha_{4,p}}{\alpha_{3,p}}} \right]^{\frac{\alpha_{5,p}}{\alpha_{4,p}}}.$$

- ▶ Heterogeneous time endowment for parents (corresponding to ability to work from home):

$$T = T^{SC} \in \{\underline{T}^{SC}, \bar{T}^{SC}\}$$

- ▶ Peer effects take place at the level of neighborhood rather than school.

# Data and Descriptive Evidence

# Pre-Pandemic Evidence: National Longitudinal Study of Adolescent Health (Add Health)

- ▶ 144 public and private schools, representative for US in 1994
- ▶ In-school survey: 90,118 adolescents in grades 7-12
  - ▶ Friendship network within school
  - ▶ Core subject grades; Peabody Picture Vocabulary Test (PPVT)
- ▶ In-home survey: subsample of 20,745
  - ▶ Parental involvement [Details](#)
  - ▶ Parenting style

# Interaction of Peers and Parents

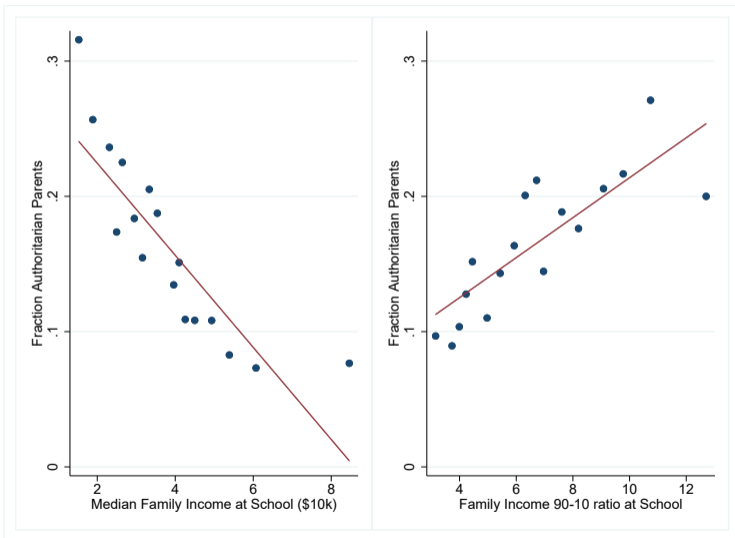
- ▶ Question in in-home survey:

*“Do your parents let you make your own decisions about the people you hang around with?”*

- ▶ No = Authoritarian about Friends
  - ▶ Yes = Nonauthoritarian about Friends
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- ▶ 16 percent of parents in AddHealth are Authoritarian about Friends



# Parenting Style and Peers Across Schools



# Parenting Style and Peers Within Schools

- ▶ School fixed effects
- ▶ Variation between quality of cohorts within the same school (Hoxby 2000)

	(1)	(2)	(3)	(4)	(5)	(6)
			Authoritarian about Friends			
Mean GPA within Grade	-0.114** (0.046)		-0.064 (0.047)	-0.059 (0.042)		-0.036 (0.043)
SD GPA within Grade		0.329*** (0.087)	0.269*** (0.087)		0.206** (0.087)	0.181** (0.089)
Obs	10057	10057	10057	10057	10057	10057
Clusters	63	63	63	63	63	63
Controls	No	No	No	Yes	Yes	Yes
School F.E.	Yes	Yes	Yes	Yes	Yes	Yes

# Parenting Style and Peers Within Schools

- ▶ Effect of authoritarian parenting style (conditional on current skills and peers):
  - ▶ **Positive effect on next period's mean GPA of peers**
    - ▶ Stronger in poor neighborhoods Peer Selection
  - ▶ **Positive effect on next period's mean GPA for the child**
    - ▶ Significant for intact families Skill Accumulation
    - ▶ No effect for single mothers

# Effect of Losing Peers

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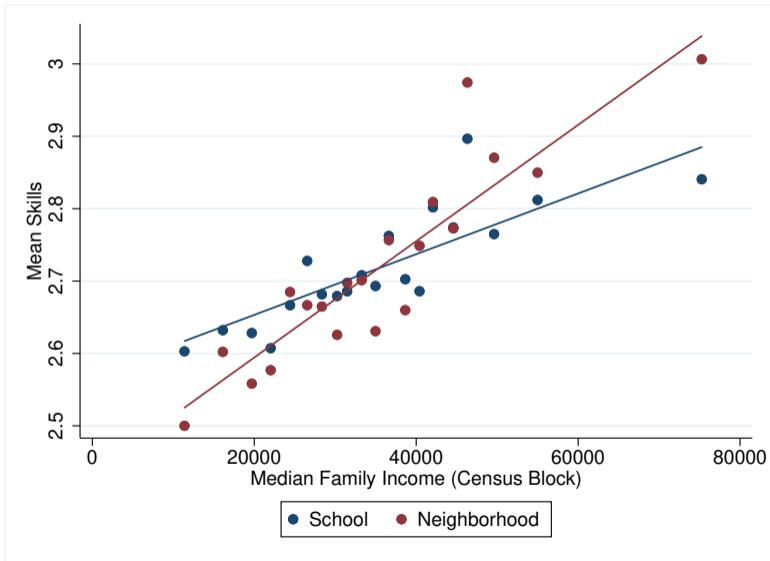
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	Change in GPA (from Grade 8 to Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
One or More Peers Left	-0.123** (0.051)	-0.112** (0.051)	-0.107* (0.054)			
N. of Peers who Left				-0.105** (0.040)	-0.096** (0.040)	-0.090** (0.043)
N	1235	1235	1235	1235	1235	1235
Controls	No	Yes	Yes	No	Yes	Yes
School F.E.	No	No	Yes	No	No	Yes

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# Peer Quality: School versus Neighborhood



## Pandemic Evidence: Learning Loss

- ▶ Maldonado and De Witte (2020): Belgian students experienced learning losses of 0.19 standard deviations in math and 0.29 s.d. in language during pandemic school closures.
- ▶ Similar magnitudes reported for the Netherlands and US projections based on summer learning loss.

# Pandemic Evidence: Parental Time Constraints

- ▶ Adams-Prassl et al. (2020a): Parents who can work from home spend much more time on parenting during the crisis.
- ▶ Adams-Prassl et al. (2020a), Mongey, Pilossoph, and Weinberg (2020): large differences in ability to work from home between rich and poor families.

# Estimating the Model



# Basic Model Estimation and Validation

- ▶ Simulated Method of Moments (SMM)
  - ▶ **Indirect inference** on regression coefficients (within school and grade) of:
    - ▶ Parenting style on child's and peers' skills **Reg 1**
    - ▶ Next-period skills on child's and peers' skills **Reg 2**
    - ▶ Next period peer quality on child's and peers' skills **Reg 3**
    - ▶ Investments on child's and peers' skills, by parenting style **Reg 4**
  - ▶ Additional moments: heterogeneous effects of authoritarian parenting style on the laws of motion of child and peers (8 coefficients)
- ▶ **Untargeted moments:** **Neighborhoods**
  - ▶ Replicating patterns of parenting styles across schools/neighborhoods

# Model Estimates

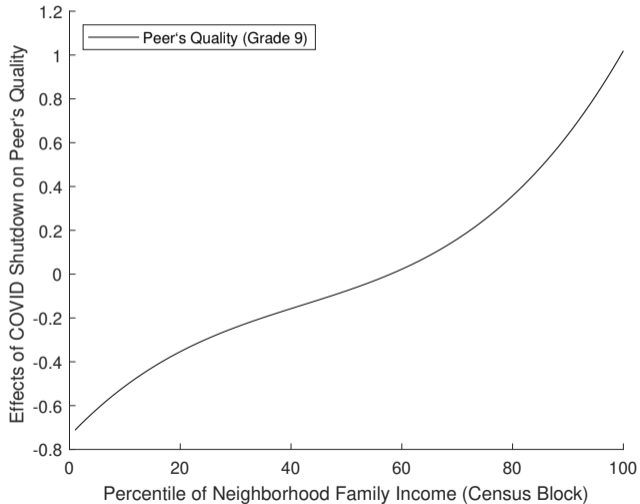
- Technology:
  - ▶ We find a Cobb-Douglas technology for authoritarian parents.
  - ▶ For permissive parents, we find that:
    - Peers and parents are substitute inputs.
    - Both parents and peers have high impact on skill formation.
- Peer Group Formation:
  - ▶ We find evidence of homophily w.r.t. skills.
  - ▶ Parenting style is effective in interfering with social interactions.
  - ▶ Two children in skills distribution: at mean and 1SD below the mean:
    - Probability of a link is reduced by 35% if parents are authoritarian.

# Quantifying the Pandemic

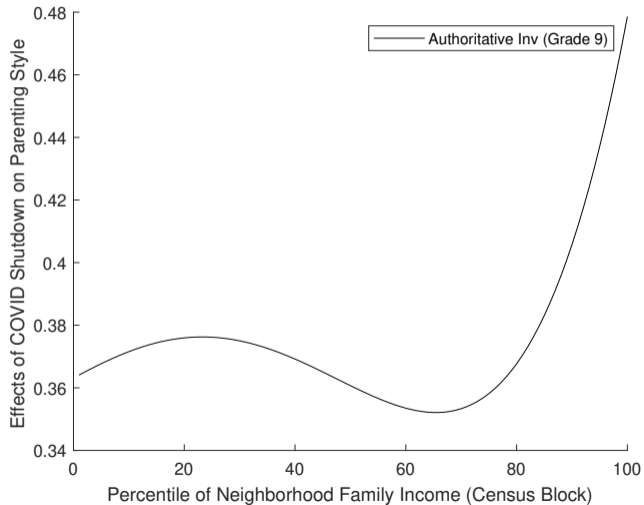
- ▶ **Covid learning shock  $\kappa^{SC}$** : Matches Maldonado and De Witte (2020): learning loss of 0.2 standard deviations.
- ▶ **Additional impact on freshmen  $\nu^{SC}$** : Matches AddHealth Evidence by GPA:  
 $\nu^{SC} = -0.314 + 0.086 \cdot Q(\theta)$ .
- ▶ **Change in peer environment**: Matches different slope in peer quality between schools and neighborhoods.
- ▶ **Overall increase in parenting needs  $\bar{T}$** : Matches increase in parental time from 1.26 hours/day before to 5.15 hours during pandemic (ATUS, Adams-Prassl et al. 2020a).
- ▶ **Heterogeneous time endowments  $\{\underline{T}^{SC}, \bar{T}^{SC}\}$** : Match changed slope in income-parental time relationship from before to during pandemic (ATUS, Adams-Prassl. et. al. including additional data from Covid Inequality Project).

## Effects of Pandemic in the Model

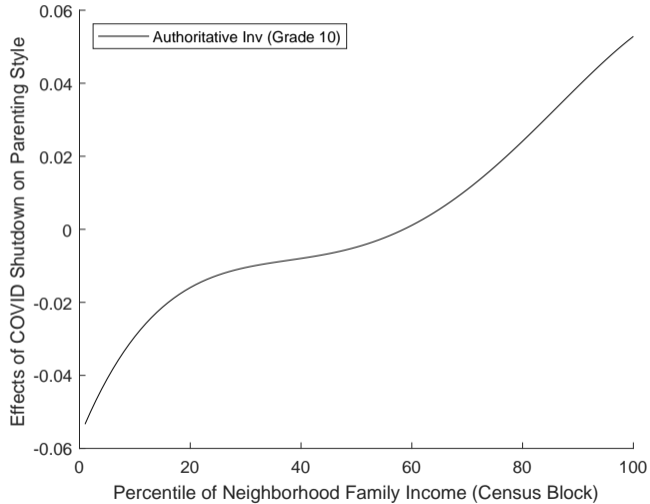
# Effect of Pandemic on Peer Effects



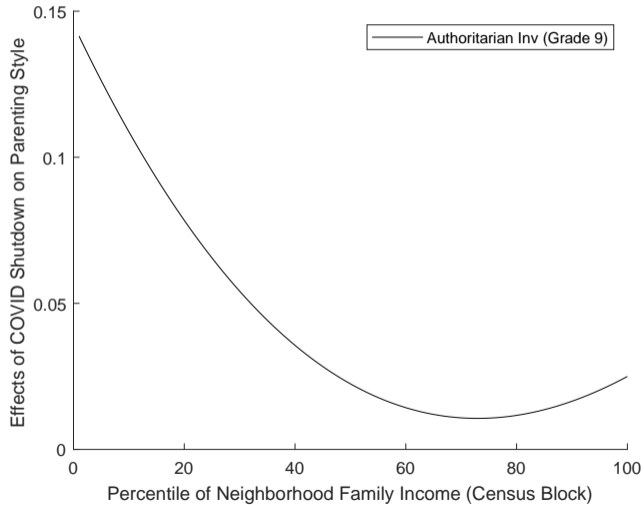
# Effect of Pandemic on Parental Investments (9th Grade)



# Post-Pandemic Effect on Parental Investments (10th Grade)

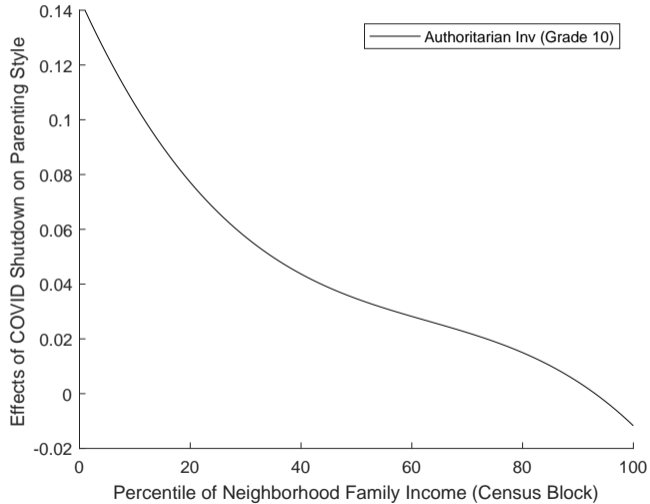


# Effect of Pandemic on Authoritarian Parenting (9th Grade)

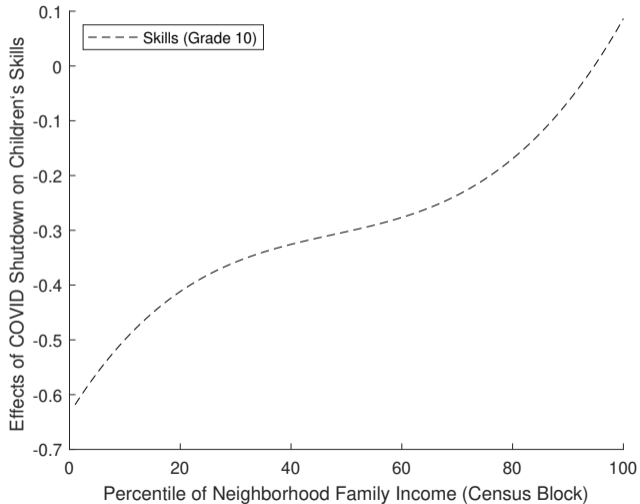




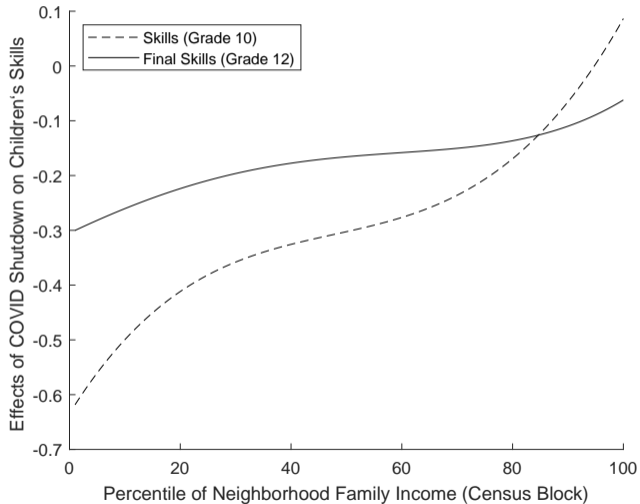
# Post-Pandemic Effect on Authoritarian Parenting (10th Grade)



# Effect of Pandemic on Children's Skills



# Effect of Pandemic on Children's Skills



## Channels Behind Educational Inequality

	No Learning Shock	No Peers Shock	No Extra Time Constraints
Inequality of Covid Effects by Income	-32.85%	-61.94%	-22.13%

# Conclusions

- ▶ We are only starting to learn about the impact of the pandemic on children's education, but clearly effects are large
- ▶ Effects running through schools, peers, and parents likely all contribute to rising educational inequality
- ▶ Findings can help inform policy choices

# Sample Fit

	Authoritarian	
	(1) Model	(2) Data
Child's Skills	-0.075	-0.016
Peer Skills	-0.021	-0.017
Mean Dep. Variable	0.135	0.140

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# Sample Fit

	Next-Period Skills					
	Pooled Sample		Authoritarian = 0		Authoritarian = 1	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model	Data	Model	Data	Model	Data
Child's Skills	0.889	0.823	0.917	0.835	0.776	0.650
Peer Skills	0.316	0.144	0.332	0.129	0.194	0.212
Authoritarian	-0.048	0.047				
Mean Child's Skills (Grade 9)	-0.039	-0.017				
Mean Child's Skills (Grade 10)	0.053	0.082				
Mean Child's Skills (Grade 11)	0.204	0.130				
Mean Child's Skills (Grade 12)	0.313	0.341				

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# Sample Fit

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	Next Period Peer Skills					
	Pooled Sample		Authoritarian = 0		Authoritarian = 1	
	(1)	(2)	(3)	(4)	(5)	(6)
	Model	Data	Model	Data	Model	Data
Child's Skills	0.283	0.223	0.277	0.223	0.321	0.152
Peer Skills	0.179	0.314	0.183	0.327	0.149	0.248
Authoritarian	0.070	0.012				
Mean Number of Friends	6.812	6.935				

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# Sample Fit

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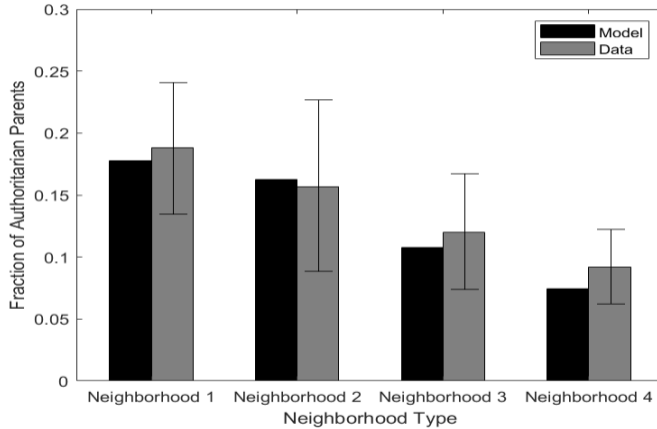
	Parental Investments			
	Authoritarian = 0		Authoritarian = 1	
	(1)	(2)	(3)	(4)
	Model	Data	Model	Data
Child's Skills	0.153	0.114	0.003	0.035
Peer Skills	-0.093	-0.065	0.002	0.028
Mean Dep. Variable	0.028	0.025	-0.178	-0.192

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# (Untargeted) Fit Across Neighborhoods



# Measures of Parental Involvement

- ▶ The current measures of parental involvement are related to specific activities that children can have done with their mothers in the previous 4 weeks:
  - ▶ Talking about life (e.g.: dating, social life)
  - ▶ Talking about personal problems
  - ▶ Worked on a school project

# Technology

	Cobb-Douglas (Authoritarian = 1)
Child's Skills ( $\alpha_{1,1}$ )	0.413 [0.321, 0.460]
Peer Skills ( $\alpha_{2,1}$ )	0.214 [0.168, 0.370]
Investments ( $\alpha_{3,1}$ )	0.073 [0.045, 0.095]
	CES (Authoritarian = 0)
Complementarity Parents vs. Peers ( $\alpha_{4,0}$ )	-0.784 [0.755, 0.801]
Share Self-Production ( $\alpha_{1,0}$ )	0.564 [0.558, 0.569]
Share Peer Skills ( $\alpha_{2,0}$ )	-0.395 [0.385, 0.404]
Complementarity Self-Production vs. Parents-Peers ( $\alpha_{3,0}$ )	-1.680 [-1.767, -1.587]
CES Returns to Scale ( $\alpha_{5,0}$ )	1.087 [1.046, 1.175]
	Total Factor Productivity
TFP Constant ( $\psi_0$ )	0.413 [0.389, 0.446]
TFP Age Trend ( $\psi_1$ )	0.025 [0.023, 0.030]
TFP Parenting Style ( $\psi_2$ )	-0.299 [-0.326, -0.280]

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## Parent's Preferences

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Disutility of Investment ( $\delta_1$ )	1 (Normalized) [-,-]
Disutility of Authoritarian ( $\delta_2$ )	-2.208 [-2.516,-2.084]
Child's Skills ( $\delta_3$ )	2.184 [2.049,2.336]
Authoritarian $\times$ Child's Skills ( $\delta_4$ )	-0.208 [-0.225,-0.173]

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## Child's Preferences

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Child $i$ 's Skills ( $\gamma_1$ )	$-0.184$ [-0.199, -0.173]
Child $j$ 's Skills ( $\gamma_2$ )	$-0.191$ [-0.201, -0.177]
Homophily ( $\gamma_3$ )	$-0.286$ [-0.320, -0.266]
Authoritarian ( $\gamma_4$ )	$-0.468$ [-0.502, -0.384]
Constant ( $\gamma_0$ )	$-1.484$ [-1.517, -1.438]

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# Initial Conditions

	Mean ( $\mu_e$ )	Standard Deviation ( $\sigma_e$ )	Population
Neighborhood 1	-0.55	0.87	269
Neighborhood 2	-0.28	0.98	307
Neighborhood 3	0.23	0.96	300
Neighborhood 4	0.59	0.84	210

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## Cross-Checking

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	(1)	(2)
	Authoritarian about Friends	
Best Friend is Bad Influence	0.066*** (0.022)	0.076*** (0.022)
Mean Dep	0.119	0.119
Obs	7942	7942
Clusters	63	63
School F.E.	No	Yes

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# NOT IN USE

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	<b>Next period peers quality</b>		
	(1)	(2)	(3)
	All	Single-Mother	Intact
Child's GPA	0.183*** (0.019)	0.131*** (0.039)	0.259*** (0.040)
Peers Skills	0.318*** (0.023)	0.279*** (0.052)	0.267*** (0.047)
Intensive about Friends	0.035 (0.039)	-0.063 (0.063)	<b>0.121*</b> (0.061)
Obs	8616	1276	2032
Clusters	113	101	104

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# Parenting Style and Skill Accumulation

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	Next period child's skills		
	(1)	(2)	(3)
	All	Single-Mother	Intact
Child's GPA	0.564*** (0.016)	0.516*** (0.017)	0.598*** (0.020)
Peers Skills	0.061*** (0.009)	0.064*** (0.014)	0.066*** (0.012)
Intensive about Friends	0.024 (0.015)	-0.008 (0.028)	<b>0.045**</b> (0.022)
Obs	9555	3292	4698
Clusters	114	110	113

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# Parenting Style and Selection of Friends

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	Next period peers quality			
	(1)	(2)	(3)	(4)
	Low-Income Neighborhood	Medium-Income Neighborhood	High-Income Neighborhood	All Neighb. Intact
Child's GPA	0.312*** (0.108)	0.246*** (0.049)	0.269*** (0.073)	0.259*** (0.040)
Peers Skills	0.144 (0.103)	0.322*** (0.049)	0.210** (0.095)	0.267*** (0.047)
Intensive about Friends	<b>0.299*</b> (0.162)	0.081 (0.063)	0.118 (0.161)	<b>0.121*</b> (0.061)
Obs	316	1134	582	2032
Clusters	33	43	71	104

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► All models include school fixed effects

# Other Counterfactuals

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Aggregate					
	Mean	90-10 Ratio	10th Percentile	Gini	Author Parenting	Time Inv
No Inequality	6.80%	-40.90%	43.33%	-0.11	-0.06	0.07
No Between-Neighb. Inequality	-4.23%	-12.32%	2.34%	-0.03	0.01	0.00
No Within-Neighb. Inequality	10.94%	-13.82%	27.33%	-0.03	-0.07	0.06
Truncate Local Distrib. at 10th percent	8.32%	-6.68%	13.89%	-0.01	-0.03	0.00
Halving Cost of Parental Investments	27.45%	10.39%	19.17%	0.02	-0.03	0.16
	Panel B: Low-Income Neighborhood					
	Mean	90-10 Ratio	10th Percentile	Gini	Author Parenting	Time Inv
No Inequality	29.63%	-33.95%	64.11%	-0.09	-0.11	0.05
No Between-Neighb. Inequality	15.91%	-0.38%	15.28%	-0.00	-0.03	-0.02
No Within-Neighb. Inequality	7.40%	-32.51%	34.18%	-0.09	-0.08	0.05
Truncate Local Distrib. at 10th percent	6.45%	-11.20%	14.96%	-0.03	-0.04	0.01
Halving Cost of Parental Investments	25.15%	9.69%	17.91%	0.02	-0.03	0.16
	Panel C: High-Income Neighborhood					
	Mean	90-10 Ratio	10th Percentile	Gini	Author Parenting	Time Inv
No Inequality	-15.96%	-19.29%	-6.01%	-0.05	0.00	0.09
No Between-Neighb. Inequality	-25.47%	19.28%	-33.32%	0.04	0.08	0.02
No Within-Neighb. Inequality	11.58%	-19.85%	25.19%	-0.05	-0.03	0.04
Truncate Local Distrib. at 10th percent	8.72%	-8.23%	14.63%	-0.02	-0.02	-0.01
Halving Cost of Parental Investments	29.42%	6.24%	23.93%	0.01	-0.02	0.17

# Other Counterfactuals

	(1)	(2)	(3)	(4)	(5)	(6)
	Aggregate					
	Mean	90-10 Ratio	10th Percentile	Gini	Authorit.	Time Inv
No Inequality	6.77%	-39.41%	39.79%	-0.11	-0.07	0.07
No Between-Neighb. Inequality	-4.77%	-13.62%	2.53%	-0.03	0.01	0.00
No Within-Neighb. Inequality	10.96%	-13.25%	26.90%	-0.03	-0.07	0.06
Truncate Local Distrib. at 10th percent	8.30%	-5.64%	13.04%	-0.01	-0.04	0.00
Halving Cost of Parental Investments	27.84%	10.31%	19.29%	0.02	-0.02	0.16

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# Other Counterfactuals

	(7)	(8)	(9)	(10)
	Low-Income Neighborhood		High-Income Neighborhood	
	Mean	10th Percentile	Mean	10th Percentile
No Inequality	26.76%	54.69%	-14.65%	-8.47%
No Between-Neighb. Inequality	12.23%	7.89%	-23.53%	-29.05%
No Within-Neighb. Inequality	6.47%	31.53%	9.95%	20.34%
Truncating Local Initial Distribution (at 10th percentile)	4.06%	11.95%	6.42%	13.02%
Reducing Cost of Parental Investments	24.26%	18.62%	27.18%	21.94%

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