The Fiscal and Welfare Effects of Policy Responses to the COVID-19 School Closures

Nicola Fuchs-Schündeln Dirk Krueger André Kurmann
Etienne Lalé Alexander Ludwig Irina Popova

Goethe University Frankfurt, CEPR and NBER
University of Pennsylvania, CEPR, CFS, NBER and Netspar
Drexel University
Universit du Qubec Montral, CIRANO and IZA
Goethe University Frankfurt, ICIR and CEPR
Goethe University Frankfurt

IMF 22nd Jacques Polak Annual Research Conference
Toward an Inclusive and Resilient Recovery

November 4-5, 2021

Motivation: School Closures in the U.S.

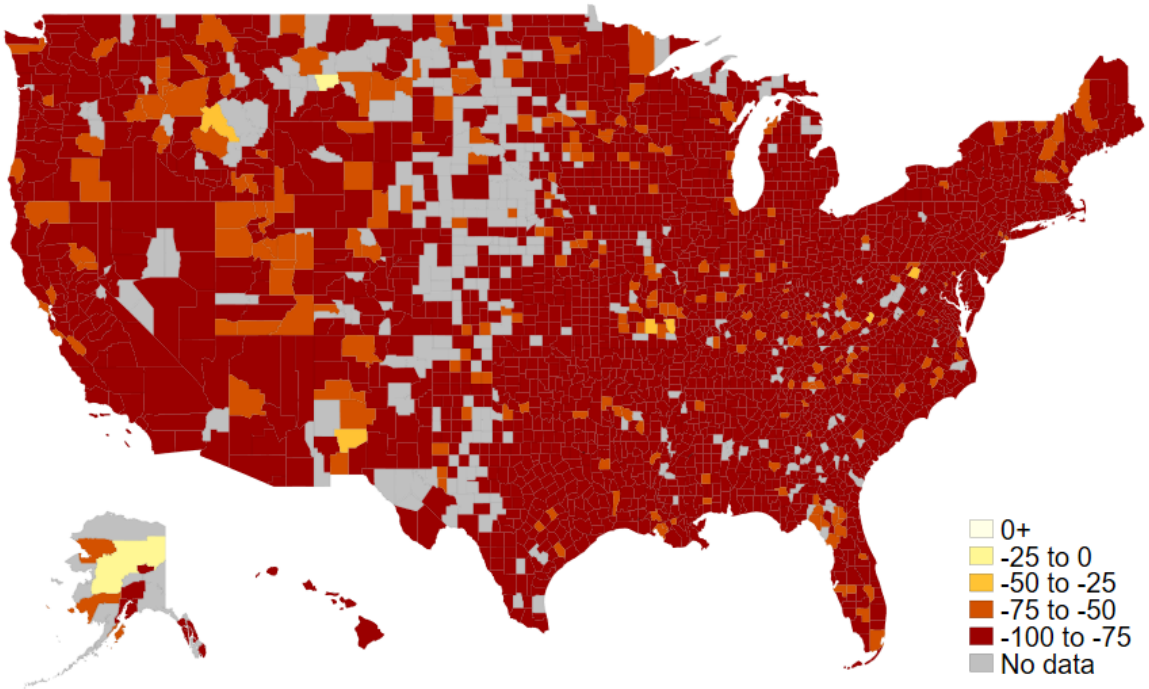


Figure: Avg. change (from 2019) in school visits by county: March-May 2020

- Most schools closed in spring of 2020
- Massive loss of instructional time

Motivation and Research Questions

- Covid-19 Pandemic: Policy responses
  - Lockdown of the economy: Large academic literature
  - School closures: Initially less of a focus (since main costs only accrue in the long run?)
- Our research questions:
  - What are the long-run effects of school closures on
    - ★ School children? Average future earnings, welfare. Distributions?
    - ★ Public finances?
  - Desirable schooling policy responses?

Research Approach

- Data: Use cell phone data on school visits (Safegraph) and school closures (Burbio) to estimate effective schooling time in 2020-21
  - Data at the school level: public/private, elementary/secondary, schools in poor/rich counties.
- Model: Feed empirical school closure measures into life cycle model with endogenous child human capital accumulation:
  - Child human capital production depends on schooling inputs, parental time and monetary investments.
  - Human capital at age 16, parental transfers determine higher education choice, future earnings.
  - Covid-19: temporary reduction in schooling input (heterogeneous by school type, age of child, income of parents)
  - Model predicts average losses and its distribution in PDV of earnings, welfare from Covid-19 school closures.
- Policy Experiment: Keep schools open during next summers

Related Literature

- Very large literature on the economic and health impacts of COVID-19 lockdowns...
  - Studies on optimal lockdown policies (but school closures $\notin$ lockdown): Argente et al.(2020), Acemoglu et al. (2020), Glover et al. (2021), Brotherhood et al. (2020)
- Literature on structural modeling of human capital accumulation following Cunha et al. (2006), Cunha and Heckman (2007), Cunha et al. (2010)
  - Applications to the COVID-19 school closures: Agostinelli, Doepke, Sorrenti and Zilibotti (2020), Jang and Yum (2021)
- Studies using Safegraph data on school visits (but focus on spread of COVID-19): Chernozhukov et al. (2021), Bravata et al. (2021)

Data

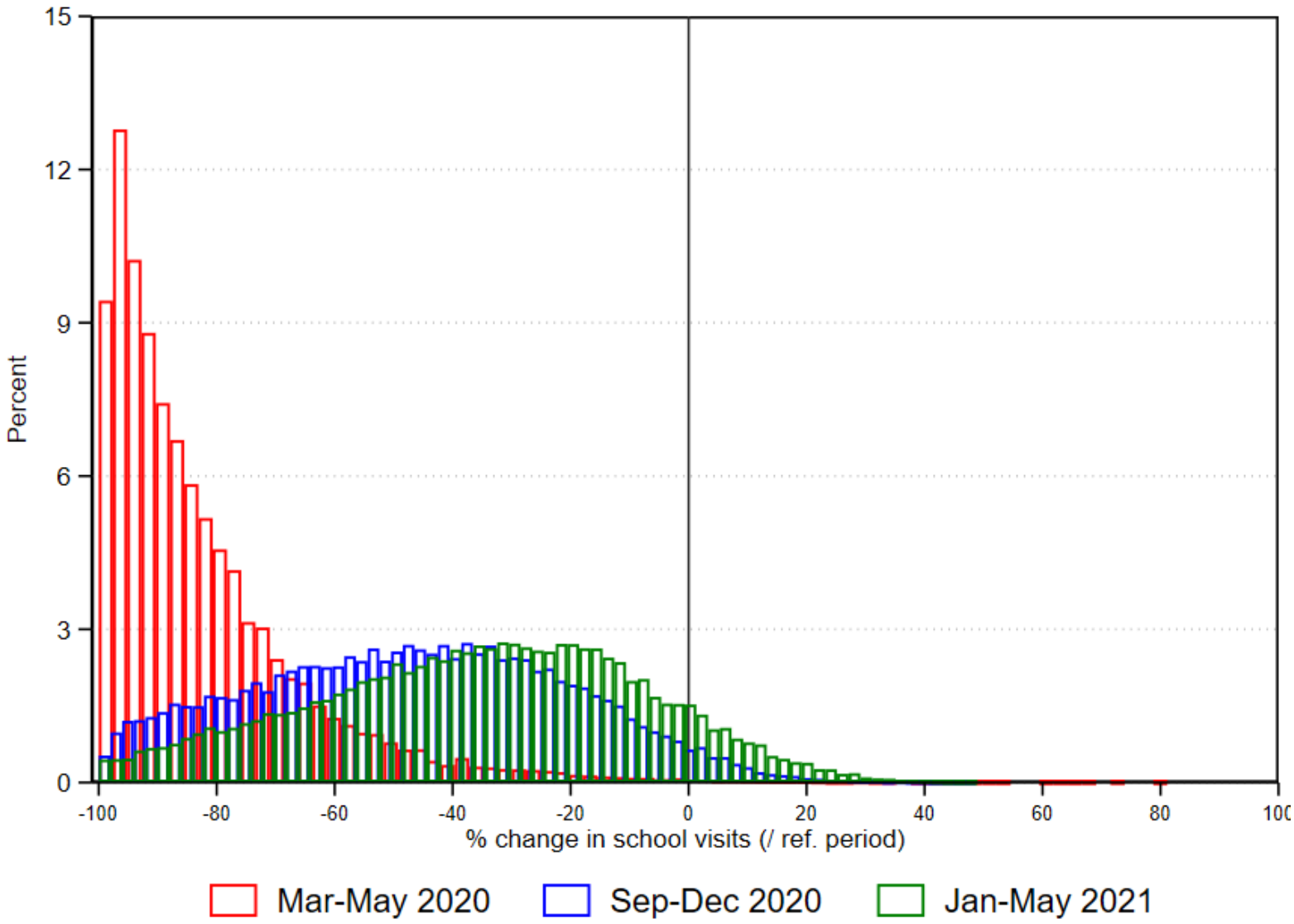
Measuring Extent and Distribution of School Closures

- Weekly visits constructed from cell phone data from Safegraph to elementary and secondary Schools $\sim$ 125K locations
- Match to National Center for Education Statistics data $\Rightarrow$ (Universe of the $\sim$ 100K public schools) and Private School Survey $\Rightarrow$ (representative survey of the $\sim$ 30K private & religious schools).
- Final data set is representative of the full set of elementary and secondary schools in the U.S.
- Measure change in school j visits relative to pre-Covid average:

$$d_{j,t} = \frac{v_{j,t} - \overline{v}_{j,0}}{\overline{v}_{j,0}} \times 100$$

  - $v_{j,t}$ = counts of visits to school j during week t (norm. by county-level counts of Safegraph devices)
  - $\overline{v}_{j,0}$ = average of $v_{j,t}$ from November 2019 through February 2020

Distribution of Changes in School Visits (Rel. to 2019)



School Closures in the U.S. in 2020

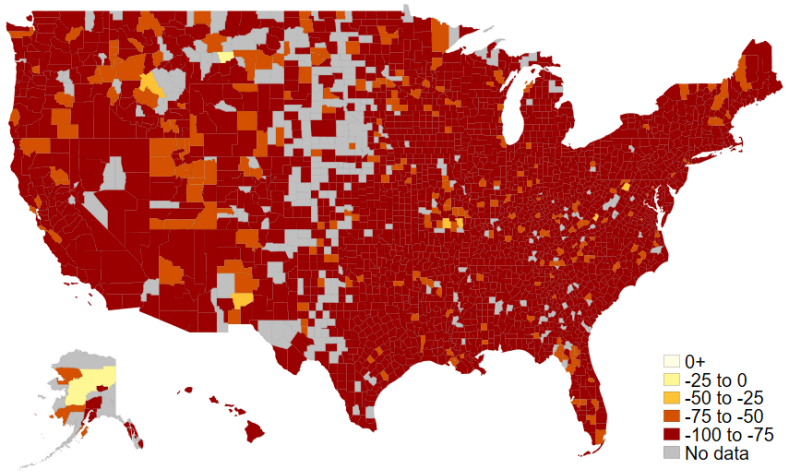


Figure: Avg. change (from 2019) in school visits by county: March-May 2020

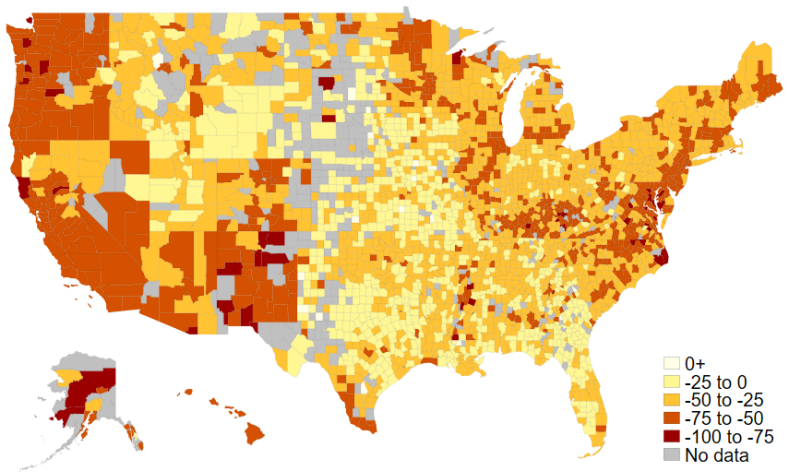


Figure: Avg. change (from 2019) in school visits by county: Sept.-Dec. 2020

Estimates of Effective Schooling Time (Share of Total, over 2 School Years)

	Without virtual learning		
	All	**Elementary**	**Secondary**
All	**59.2**	**62.2**	**52.3**
Public schools	**58.5**	62.0	51.7
Private schools	**65.9**	66.2	62.1
	All	**Elementary**	**Secondary**
Top 25% inc.	**54.5**	58.0	46.8
Bot. 25% inc.	**63.9**	66.6	58.2

- If virtual instruction is 50% as effective as in-person, similar qualitative patterns but differences become smaller.

Quantitative Model

Based on Fuchs-Schündeln, Krueger, Ludwig and Popova (2021)

Economic Model: Overview

- One parent generation and one child generation, living through full life cycle in partial equilibrium
- When children are part of the household, parents make all economic decisions, including
  - Whether to send child to public or private school
  - Private resource and time investment into school children
  - Inter-vivos transfers
- Child human capital accumulation depends on parental and schooling inputs
- Equipped with human capital and inter-vivos transfers an adolescent decides on higher education (high-school, college)
- Covid-19 school closures: decline in school input measured in data

Model in a Nutshell (I): Life-Cycle of Parents

Initial Distribution

$\Phi(m,e,a)$

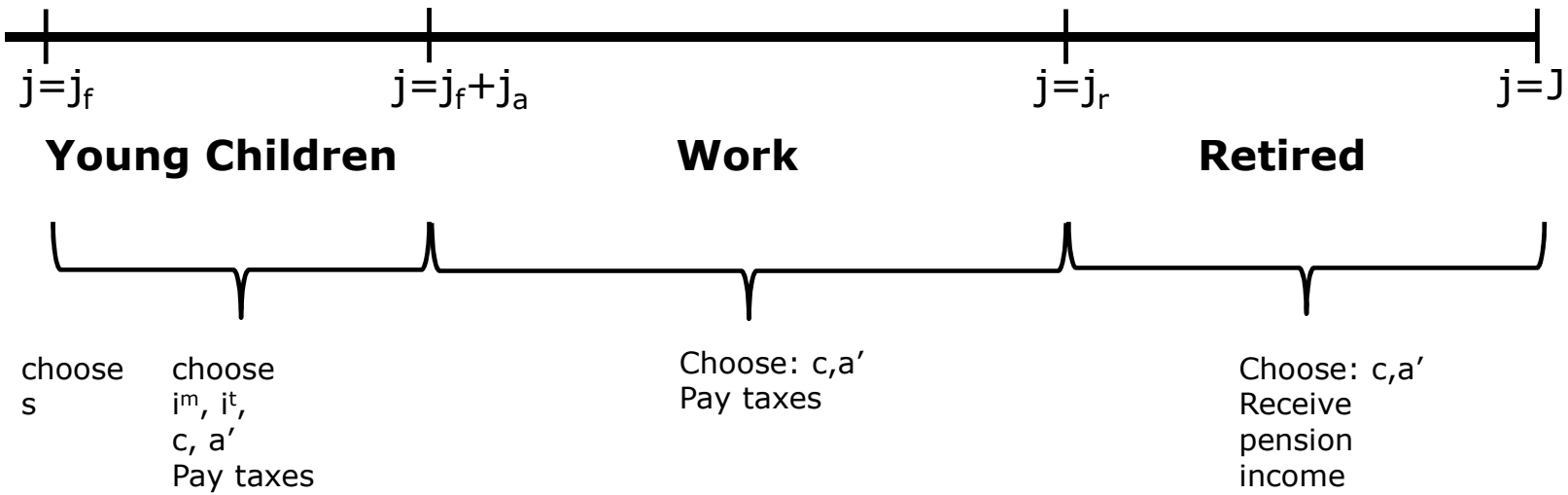
Children Leave Household

Pay inter-vivos transfers b

Earnings while Working

wage w ϵ η ε until retirement
working time l(m) depends on marital status

ϵ = age and educ. specific wage profile
η = persistent productivity shock, 2-state Markov
ε = transitory productivity shock



Model in a Nutshell (II): Life-Cycle of Children

Birth

Innate ability: $h = h_0(m_p, e_p)$

Higher Education?

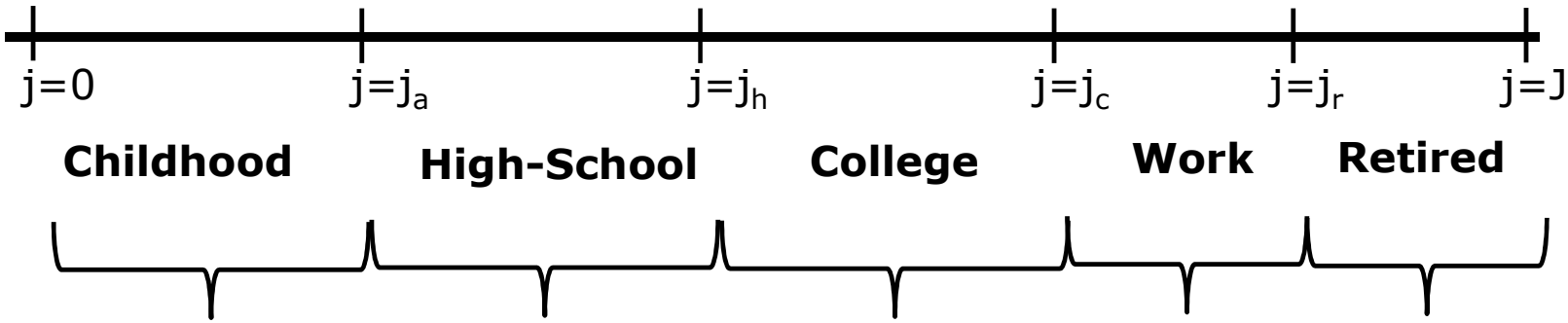
At age j_a given h
i) parents pay inter-vivos transfers
ii) children make higher education decision, with psychological costs $p(s,e,h,e_p)$

Choice: e=(no,hs,co)?

Earnings while Working

wage w γ(h) ϵ η ε until retirement
working time l(s) after completed education
reduced working time during education

γ(h) = fixed effect
ϵ = age and educ. specific wage profile
η = persistent productivity shock, 2-state Markov
ε = transitory productivity shock



Main Results

Aggregate Outcomes

	Baseline	Average Change
		Change in %p
frac $s = no$	12.16%	**1.55**
frac $s = hs$	54.60	0.36
frac $s = co$	33.24%	**-1.91**
		Change in %
av HK	1.00	-2.77
PDV gross y	\$845,149	**-1.73**
PDV net y	\$695,548	-1.39
child CEV	-	**-0.99**

- +13% high school dropouts, -6% college graduates
- -2.77% reduction in average human capital
- Decline of **-1.73%** in earnings, **-0.99%** in welfare
- Larger losses for children in secondary school

Heterogeneity: Age, Public vs. Private Schools

Table: Present Discounted Value of Gross Lifetime Earnings

	baseline	%-Change, Child Age at Covid-19 Shock				
		average	6	8	10	12	14
public	821,404	**-1.77**	-2.01	-1.79	-2.09	-1.82	-1.54
private	1,034,791	**-1.49**	-1.72	-1.78	-1.75	-1.48	-1.24

Table: Welfare (CEV)

	average	6	8	10	12	14
public	**-1.04%**	-1.19%	-1.05%	-1.22%	-1.06%	-0.90%
private	**-0.64%**	-0.75%	-0.71%	-0.73%	-0.64%	-0.55%

- Larger earnings and welfare losses for children going to public school

Heterogeneity: Income-Rich vs. Income-Poor Parents

Table: Welfare (CEV): Bottom, Top Income Quartile, Same School Closures

	average	6	8	10	12	14
bottom	**-1.30%**	-1.49%	-1.31%	-1.51%	-1.30%	-1.10%
top	**-0.53%**	-0.59%	-0.54%	-0.63%	-0.57%	-0.52%

Table: Welfare (CEV): Bottom, Top Income Quartile, Diff. School Closures

	average	6	8	10	12	14
bottom	**-1.11%**	-1.29%	-1.13%	-1.27%	-1.10%	-0.93%
top	**-0.57%**	-0.61%	-0.57%	-0.69%	-0.63%	-0.58%

- Welfare losses larger for children from poorer parents, but...
- Difference ameliorated by 1/3 by difference in length of school closures between income-rich and income-poor counties

National Schooling Expansion

- Expansion of school for 3 months starting from 2022 (e.g., 6 weeks in the summer of 2022 and 2023)

Table: NPV of Schooling Intervention (Net of Cost)

	Abs Change for Children of Biological Age					
	average	6	8	10	12	14
NPV (in $)	**1,018**	1,347	1,170	948	726	428

Table: Welfare Effects (CEV) of Schooling Intervention

	average	6	8	10	12	14
CEV	**0.21%**	0.26%	0.22%	0.19%	0.16%	0.14%

- Reform generates welfare gains and pays for itself: NPV for government approximately zero.

Who Should Get Extra Schooling?

Table: NET Child CEV

	Avg.
Bottom Quartile	0.28%
Top Quartile	0.09%

Table: NPV Government (in $)

	Avg.
Bottom Quartile	$129
Top Quartile	$196

- Most welfare gains for children from poor families
- Largest boost in tax revenues if applied to high parental income children.

Concluding Remarks

- What we have found:
  - Long-run losses from school closures:

    -1.73% gross earnings, -0.99% CEV
  - Substantial Socio-economic gradient in welfare losses
  - Expansion of school in next two summers increases welfare

    (especially of income-poor children) and roughly pays for itself.
- Caution: not a cost-benefit analysis of school closures. It ignores:
  - Potential health benefits from school closures
  - Loss of social contacts in school
  - Psychological stress for parents and children

THANK YOU FOR ATTENDING AND LISTENING