COVID-19 and Educational Inequality: How School Closures Affect Low- and High-Achieving Students

Elisabeth Grewenig, Philipp Lergetporer, Katharina Werner, Ludger Woessmann, and Larissa Zierow

ifo INSTITUTE
Leibniz Institute for Economic Research
at the University of Munich

How School Closures Affect Low- and High-Achieving Students

- Many have argued: School closures increase inequality between children from different **family backgrounds** (e.g., UNESCO, 2020; European Commission, 2020)
- We argue: Another dimension of inequality: **low- vs high-achieving students**
  - Low-achieving students particularly affected by lack of educator support during closures
- Educational production perspective
  - School closures induced sharp decline in **support of trained teachers** (defining feature)
  - Our data: Direct contact with teachers evaporated during school closures
- Out-of-school learning implies large amount of **self-regulated learning**
  - Children must independently acquire and understand academic content
  - May be feasible for high-achieving students, but esp. challenging for low-achieving students
  - Skill formation as process of dynamic complementarities

This Paper

SETTING

- 3 months of nation-wide school closures in Germany due to COVID-19 pandemic
- Almost no digital learning experience, no master plan of school ministries

DATA & RESEARCH DESIGN

- Detailed **time-use** information on school children **during** and **before** closures
- Survey of 1,099 parents of school children in Germany
- June 2020 (part of representative *ifo Education Survey*)
- + Elicitation of parental support and schools' distance-teaching activities

RESULTS

- Learning time reduced by about half (from 7.4 to 3.6 hours per day)
- Reduction significantly larger for low- than for high-achieving students
- Replaced mainly by detrimental (gaming) rather than conducive activities
- Learning gap not compensated by parents or schools
- No difference in reduction by parental education; but larger for boys than for girls

Institutional Background: COVID-19 School Closures in Germany

- **March 13**: All federal states **close all educational institutions** throughout Germany
  - Emergency services in schools for children of parents in "system-relevant" occupations
- Many students **lost up to 12 weeks** (1/3 of entire school year) of in-person classroom learning
- **No state- or nation-wide concepts** to implement online school operations
  - Decisions on distance-teaching activities left to schools' and teachers' discretion
- **Late April:** education ministers decided to **gradually re-open** schools
  - Partial return in daily or weekly shifts, starting with graduation classes
  - Successively expanded to other grades in **May** and **June**
    → Most students had a few weeks of in-person teaching before summer break
- **August/September**: Schools **opened for all students** after summer break
  - Still no clear guidelines on how to continue school operations through distance teaching in case of future school closures

Data and Research Design

- Our annual **representative** opinion **survey**: ifo Education Survey 2020
  - Fielded by Respondi in online access panels from June 3 – July 1, 2020
  - Total sample: 10,338 respondents representative of population aged 18-69
- This study: subsample of **1,099 parents of school children**
  - Asked about youngest child in school
  - Convenience sample, but provides very good fit for students in Germany
- **Survey items** on
  1. Children's **time use** during and before corona-induced school closures
     - What activities did your child do on a typical workday during [before] the several weeks of Corona-related school closures?
  2. Children's school **grades** in math and German before school closures
     - Low- versus high-achievers: students with average grade in math/German below vs at-or-above median of respective school type
  3. **Parental** involvement in children's activities
  4. Parental beliefs on benefits of activities for child development
  5. General information about family environment
  6. How **schools** organized teaching during school closures

Sample Characteristics

	Full sample (1)	Low-achievers (2)	High-achievers (3)	Difference high-low (4)
Child characteristics				
School type				
Elementary school	0.361	0.240	0.341	0.100***
Gymnasium	0.301	0.368	0.308	-0.061**
Other secondary school	0.338	0.391	0.352	-0.040
Age	12.48	13.57	12.45	-1.12***
Girl	0.484	0.471	0.501	0.030
Single child	0.383	0.382	0.381	-0.001
Parent characteristics				
Female	0.490	0.522	0.462	-0.060*
University degree	0.273	0.227	0.306	0.079***
Single parent	0.166	0.181	0.159	-0.022
Parent in home office+	0.342	0.268	0.405	0.136***
Work hours	29.108	29.155	29.596	0.441
Partner at home++	0.185	0.178	0.194	0.016
Household income	3370.4	3171.7	3529.3	357.6***
West Germany	0.795	0.822	0.778	-0.043*
Observations	1,099	437	546	

Notes: Sample characteristics. Low- versus high-achievers: students with an average grade in German and mathematics below versus at-or-above the median for their respective school type. Significance levels: *** $p<0.01$, ** $p<0.5$, * $p<0.1$. Data source: ifo Education Survey 2020.

+ Parent in home office: responding parent reports a positive number of hours working from home during the period of school closures.

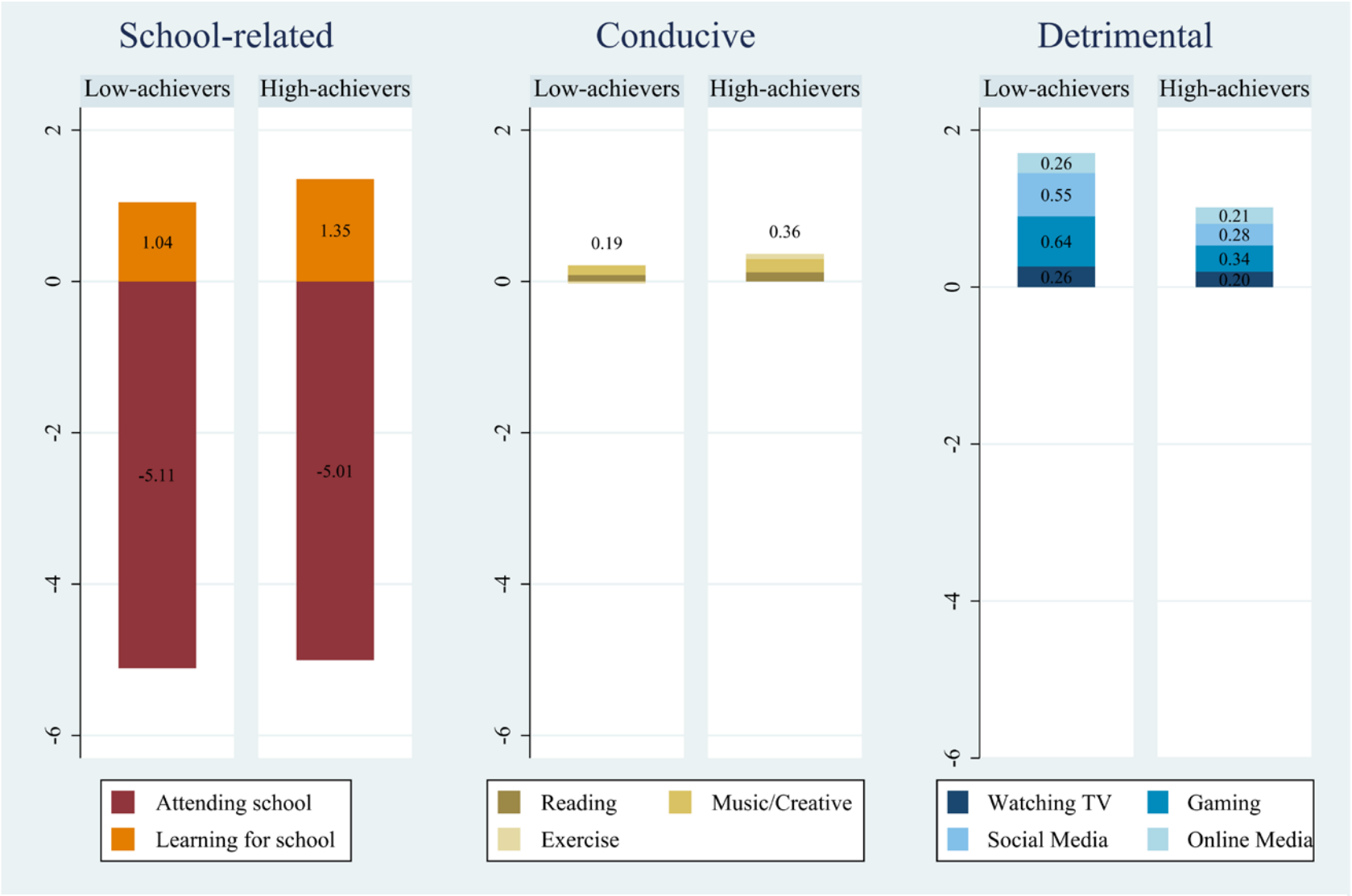
++ Partner at home: dummy=1 if additional adult in household who works less than 20 hours per week during period of school closures, 0 otherwise.

Activities of Low- and High-Achievers before and during School Closures

	During Corona				Before Corona				Difference during-before			
	Low-achievers	High-achievers	Gap	Std. err.	Low-achievers	High-achievers	Gap	Std. err.	Low-achievers	High-achievers	Gap	Std. err.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
School activities												
Aggregate	3.36	3.85	0.496	*(0.151)****	7.42	7.50	0.079	*(0.130)*	-4.07	-3.65	0.416	*(0.180)***
Attending school	0.82	0.92	0.103	*(0.133)*	5.93	5.93	-0.003	*(0.116)*	-5.11	-5.01	0.105	*(0.177)*
Learning for school	2.54	2.93	0.393	*(0.102)****	1.49	1.58	0.082	*(0.067)*	1.04	1.35	0.311	*(0.108)****
Conducive activities												
Aggregate	2.79	3.37	0.580	*(0.128)****	2.61	3.01	0.403	*(0.107)****	0.19	0.36	0.177	*(0.107)**
Reading	0.63	0.86	0.237	*(0.046)****	0.54	0.74	0.201	*(0.039)****	0.09	0.12	0.036	*(0.041)*
Music and creative work	0.66	0.82	0.164	*(0.061)****	0.53	0.65	0.117	*(0.046)***	0.13	0.17	0.047	*(0.047)*
Physical exercise	1.51	1.69	0.179	*(0.080)***	1.53	1.62	0.085	*(0.067)*	-0.03	0.07	0.094	*(0.077)*
Detrimental activities												
Aggregate	6.29	4.84	-1.452	*(0.210)****	4.58	3.82	-0.762	*(0.156)****	1.71	1.02	-0.691	*(0.146)****
Watching TV	1.50	1.37	-0.126	*(0.070)**	1.24	1.18	-0.059	*(0.058)*	0.26	0.20	-0.067	*(0.051)*
Gaming	1.87	1.32	-0.550	*(0.101)****	1.23	0.99	-0.244	*(0.068)****	0.64	0.34	-0.306	*(0.068)****
Social media	1.77	1.18	-0.593	*(0.097)****	1.22	0.90	-0.321	*(0.067)****	0.55	0.28	-0.272	*(0.067)****
Online media	1.15	0.97	-0.184	*(0.067)****	0.89	0.76	-0.137	*(0.047)****	0.26	0.21	-0.046	*(0.056)*

Notes: Average hours spent on different activities on a typical workday. Outliers are top-coded at 12 hours. "During Corona" refers to the period of school closures due to COVID-19, "Before Corona" refers to the period before the school closures. Low- versus high-achievers: students with an average grade in German and mathematics below versus at-or-above the median for their respective school type. "Std. err.": standard errors stemming from regressions of hours spent on each activity on a high-achievers indicator. Significance levels: *** $p<0.01$, ** $p<0.5$, * $p<0.1$. Data source: ifo Education Survey 2020.

During-before Differences in Time Use for Low- and High-Achievers



Notes: Differences between average hours spent on different activities on a typical workday before and during the period of school closures due to COVID-19. Low- versus high-achievers: students with an average grade in German and mathematics below versus at-or-above the median for their respective school type. See Table 2 for details. Data source: ifo Education Survey 2020.

Robustness of Gap in School-related Activities during School Closures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
High-achiever	0.478***	0.474***	0.417***	0.455***	0.478***	0.460***	0.463***	0.498***	0.460***	0.478***	0.475***	0.492***	0.461***	0.385**
	(0.149)	*(0.149)*	*(0.151)*	*(0.148)*	*(0.149)*	*(0.149)*	*(0.149)*	*(0.153)*	*(0.150)*	*(0.149)*	*(0.149)*	*(0.149)*	*(0.149)*	*(0.155)*
School activities before Corona	0.224***	0.218***	0.244***	0.219***	0.224***	0.229***	0.222***	0.222***	0.227***	0.224***	0.224***	0.232***	0.219***	0.245***
	(0.036)	*(0.037)*	*(0.037)*	*(0.036)*	*(0.036)*	*(0.036)*	*(0.036)*	*(0.038)*	*(0.036)*	*(0.037)*	*(0.036)*	*(0.037)*	*(0.036)*	*(0.040)*
Gymnasium		0.120												0.702***
		(0.191)												*(0.258)*
Other secondary school		-0.286												0.301
		(0.183)												*(0.238)*
Age			-0.053**											-0.109***
			(0.023)											*(0.033)*
Girl				0.477***										0.503***
				(0.147)										*(0.151)*
Single child					-0.062									-0.097
					(0.152)									*(0.158)*
Parent female						-0.286*								-0.286*
						(0.148)								*(0.163)*
Parent has university degree							0.185							0.174
							(0.167)							*(0.192)*
Single parent								-0.088						-0.049
								(0.203)						*(0.221)*
Parent in home office									0.183					0.146
									(0.157)					*(0.179)*
Parent work hours										0.000				-0.002
										(0.004)				*(0.005)*
Partner at home											0.172			0.091
											(0.189)			*(0.198)*
Household income												-0.001*		-0.001**
												(0.000)		*(0.000)*
West Germany													-0.399**	-0.291
													(0.184)	*(0.190)*
Constant	1.692	1.805	2.260	1.504	1.719	1.809	1.665	1.710	1.616	1.692	1.662	1.881	2.058	3.163
Observations	983	983	983	982	983	983	983	915	982	983	983	980	983	910
R^2	0.0476	0.0530	0.0527	0.0570	0.0477	0.0512	0.0488	0.0471	0.0501	0.0476	0.0484	0.0504	0.0521	0.0874

Notes: Dependent variable: average hours spent on "attending school" and "learning for school" on a typical workday during the period of school closures due to COVID-19. "Before Corona" refers to the period before the school closures. Outliers are top-coded at 12 hours. Low- versus high-achievers: students with an average grade in German and mathematics below versus at-or-above the median for their respective school type. Significance levels: *** $p<0.01$, ** $p<0.5$, * $p<0.1$. Data source: ifo Education Survey 2020.

Parental Involvement in Activities of Low- and High-Achievers

	During Corona				Before Corona				Difference during-before			
	Low-achievers	High-achievers	Gap	Std. err.	Low-achievers	High-achievers	Gap	Std. err.	Low-achievers	High-achievers	Gap	Std. err.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
School activities												
Aggregate	0.89	1.20	0.311	*(0.079)****	0.42	0.62	0.193	*(0.044)****	0.47	0.59	0.118	*(0.069)**
Conducive activities												
Aggregate	1.07	1.47	0.398	*(0.099)****	0.78	1.11	0.325	*(0.087)****	0.29	0.36	0.073	*(0.077)*
Reading	0.22	0.34	0.121	*(0.033)****	0.18	0.30	0.124	*(0.030)****	0.04	0.04	-0.002	*(0.026)*
Music and creative work	0.20	0.28	0.086	*(0.033)****	0.17	0.23	0.060	*(0.028)***	0.03	0.06	0.026	*(0.030)*
Physical exercise	0.66	0.85	0.191	*(0.063)****	0.44	0.58	0.142	*(0.050)****	0.22	0.27	0.050	*(0.057)*
Detrimental activities												
Aggregate	1.36	1.45	0.094	*(0.132)*	1.03	1.23	0.200	*(0.109)**	0.32	0.22	-0.106	*(0.090)*
Watching TV	0.68	0.73	0.047	*(0.058)*	0.52	0.62	0.101	*(0.049)***	0.16	0.11	-0.053	*(0.047)*
Gaming	0.23	0.24	0.003	*(0.044)*	0.18	0.22	0.037	*(0.035)*	0.05	0.02	-0.035	*(0.033)*
Social media	0.24	0.24	-0.005	*(0.053)*	0.18	0.20	0.016	*(0.040)*	0.06	0.04	-0.021	*(0.039)*
Online media	0.19	0.24	0.049	*(0.034)*	0.15	0.19	0.046	*(0.028)*	0.05	0.05	0.003	*(0.030)*

Notes: Average hours parents spent with their child on different activities on a typical workday. Outliers are top-coded at 12 hours. "During Corona" refers to the period of school closures due to COVID-19, "Before Corona" refers to the period before the school closures. Low- versus high-achievers: students with an average grade in German and mathematics below versus at-or-above the median for their respective school type. "Std. err.": standard errors stemming from regressions of hours spent on each activity on a high-achievers indicator. Significance levels: *** $p<0.01$, ** $p<0.5$, * $p<0.1$. Data source: ifo Education Survey 2020.

Schools' Distance-teaching Activities during School Closures

				Unconditional gap		Conditional gap	
	Average	Low-achievers	High-achievers	Gap	Std. err.	Gap	Std. err.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Shared lessons (e.g., by video call)	0.29	0.24	0.37	0.131	*(0.029)***	0.131	*(0.031)***
Individual discussions with the teacher	0.17	0.13	0.23	0.102	*(0.025)***	0.081	*(0.026)***
Teaching videos or texts	0.53	0.47	0.59	0.118	*(0.032)***	0.115	*(0.034)***
Teaching software	0.43	0.40	0.47	0.078	*(0.032)***	0.068	*(0.034)***
Child received exercises	0.87	0.84	0.89	0.049	*(0.022)***	0.042	*(0.023)**
Child submit exercises	0.51	0.51	0.55	0.033	*(0.032)*	0.054	*(0.033)*
Child received feedback on exercises	0.37	0.34	0.42	0.078	*(0.031)***	0.096	*(0.033)***

Notes: Probability that the respective activity was conducted "daily" or "several times a week". Low- versus high-achievers: students with an average grade in German and mathematics below versus at-or-above the median for their respective school type. "Std. err.": standard errors stemming from regressions of an indicator that the respective activity was conducted at least several times a week on a high-achievers indicator. Conditional gap: see Table 1 for controls. Significance levels: *** $p<0.01$, ** $p<0.5$, * $p<0.1$. Data source: ifo Education Survey 2020.

Parental Education and Child's University Access

Parental Education and Child's Activities before and during School Closures

	During Corona				Before Corona				Difference during-before			
	Low (1)	High (2)	Gap (3)	Std. err. (4)	Low (5)	High (6)	Gap (7)	Std. err. (8)	Low (9)	High (10)	Gap (11)	Std. err. (12)
School activities												
Aggregate	3.55	3.82	0.275	*(0.162)**	7.37	7.55	0.178	*(0.136)*	-3.83	-3.73	0.097	*(0.189)*
Attending school	0.85	1.04	0.190	*(0.143)*	5.91	5.92	0.013	*(0.122)*	-5.06	-4.88	0.177	*(0.185)*
Learning for school	2.70	2.78	0.085	*(0.107)*	1.46	1.63	0.165	*(0.070)***	1.23	1.15	-0.080	*(0.114)*
Conducive activities												
Aggregate	3.10	3.48	0.380	*(0.138)****	2.86	2.98	0.122	*(0.114)*	0.24	0.50	0.258	*(0.113)***
Reading	0.73	0.87	0.141	*(0.048)****	0.63	0.76	0.128	*(0.042)****	0.10	0.11	0.013	*(0.043)*
Music and creative work	0.70	0.95	0.249	*(0.064)****	0.57	0.73	0.161	*(0.048)****	0.13	0.22	0.088	*(0.051)**
Physical exercise	1.67	1.66	-0.010	*(0.088)*	1.66	1.50	-0.166	*(0.072)***	0.01	0.16	0.156	*(0.083)**
Detrimental activities												
Aggregate	5.48	4.54	-0.934	*(0.223)****	4.17	3.41	-0.759	*(0.164)****	1.31	1.13	-0.175	*(0.150)*
Watching TV	1.48	1.25	-0.237	*(0.072)****	1.26	1.04	-0.221	*(0.060)****	0.23	0.21	-0.016	*(0.053)*
Gaming	1.55	1.33	-0.225	*(0.106)***	1.10	0.91	-0.189	*(0.070)****	0.46	0.42	-0.036	*(0.070)*
Social media	1.42	1.01	-0.409	*(0.102)****	1.04	0.72	-0.318	*(0.070)****	0.38	0.29	-0.092	*(0.068)*
Online media	1.02	0.96	-0.062	*(0.070)*	0.78	0.75	-0.031	*(0.050)*	0.24	0.21	-0.031	*(0.057)*

Notes: Average hours spent on different activities on a typical workday. Outliers are top-coded at 12 hours. "During Corona" refers to the period of school closures due to COVID-19, "Before Corona" refers to the period before the school closures. Low: parents without a university degree. High: parents with a university degree. "Std. err.": standard errors stemming from regressions of hours spent on each activity on a high-indicator. Significance levels: *** $p<0.01$, ** $p<0.5$, * $p<0.1$. Data source: ifo Education Survey 2020.

Child Activities before and during School Closures by Child's Gender

	During Corona				Before Corona				Difference during-before			
	Boy (1)	Girl (2)	Gap (3)	Std. err. (4)	Boy (5)	Girl (6)	Gap (7)	Std. err. (8)	Boy (9)	Girl (10)	Gap (11)	Std. err. (12)
School activities												
Aggregate	3.36	3.89	0.525	*(0.143)****	7.40	7.44	0.039	*(0.121)*	-4.04	-3.55	0.486	*(0.168)****
Attending school	0.88	0.91	0.026	*(0.127)*	5.91	5.92	0.016	*(0.109)*	-5.02	-5.01	0.010	*(0.164)*
Learning for school	2.48	2.98	0.499	*(0.094)****	1.50	1.52	0.022	*(0.063)*	0.98	1.46	0.476	*(0.100)****
Conducive activities												
Aggregate	3.08	3.34	0.260	*(0.123)***	2.85	2.94	0.087	*(0.102)*	0.23	0.40	0.173	*(0.101)**
Reading	0.72	0.82	0.102	*(0.043)***	0.65	0.68	0.032	*(0.038)*	0.07	0.14	0.071	*(0.038)**
Music and creative work	0.65	0.90	0.253	*(0.057)****	0.55	0.68	0.128	*(0.043)****	0.10	0.22	0.125	*(0.046)****
Physical exercise	1.71	1.62	-0.096	*(0.079)*	1.65	1.58	-0.073	*(0.064)*	0.06	0.04	-0.023	*(0.075)*
Detrimental activities												
Aggregate	5.57	4.85	-0.716	*(0.199)****	4.19	3.72	-0.477	*(0.147)****	1.38	1.14	-0.239	*(0.134)**
Watching TV	1.41	1.43	0.013	*(0.065)*	1.20	1.19	-0.008	*(0.054)*	0.21	0.23	0.021	*(0.048)*
Gaming	1.97	0.98	-0.987	*(0.090)****	1.34	0.73	-0.611	*(0.060)****	0.63	0.25	-0.376	*(0.062)****
Social media	1.19	1.44	0.254	*(0.091)****	0.87	1.03	0.162	*(0.062)****	0.32	0.41	0.092	*(0.061)*
Online media	1.00	1.00	0.004	*(0.063)*	0.78	0.76	-0.020	*(0.044)*	0.22	0.24	0.024	*(0.051)*

Notes: Average hours spent on different activities on a typical workday. Outliers are top-coded at 12 hours. "During Corona" refers to the period of school closures due to COVID-19, "Before Corona" refers to the period before the school closures. "Std. err.": standard errors stemming from regressions of hours spent on each activity on a female indicator. Significance levels: *** $p<0.01$, ** $p<0.5$, * $p<0.1$. Data source: ifo Education Survey 2020.

Further Analyses

- Results by school type
- Parental assessment of whether activities are beneficial for child development
- Parental assessment of home environment and child's learning
  - Psychological burden for child: 0.39 vs 0.36 for low- vs high-achievers (not significant)
  - Psychological burden for parent: 0.39 vs 0.36 (not significant)
  - Argued more with child: 0.30 vs. 0.24 (marginally significant)

Discussion

- We measure learning time, not acquired knowledge and skills
  - Likely lower bound, as high-achievers arguably more effective time users
- Survey-specific challenges
  - Social desirability bias
    - Yet: fewer learning, more TV and gaming
  - Recall bias
    - Yet: retrospective reports on hours of schooling before closures correspond to curricula
  - Parents' knowledge of child's activities
    - Yet: only 21% of respondents/partners away from home for work for at least half a day
  - Survey fatigue
    - Yet: 500 of 1,099 respondents filled in open field in time-use battery

How School Closures Affect Low- and High-Achieving Students

- Important dimension of **inequality** during closures: Low- vs high-achieving students
  - Low-achievers particularly hurt by lack of educator support during school closures
  - Self-regulated learning (too) challenging
- **Low-achievers** reduced learning time significantly more than high-achievers
  - Replaced mainly by **detrimental (gaming)** rather than conducive activities
- Learning gap **not compensated** by **parents** or **schools**
- Educational **inequality** likely to **increase** (along this dimension)
  - Need for binding distance-teaching concepts particularly targeted at low-achievers

THANK YOU
FOR YOUR ATTENTION!

Comments and questions are very welcome

woessmann@ifo.de

@Woessmann

sites.google.com/view/woessmann-e