Adolescent Schooling and Adult Labor Supply: Evidence from COVID-19 School Closures and Reopenings in Kenya

On-line Appendix

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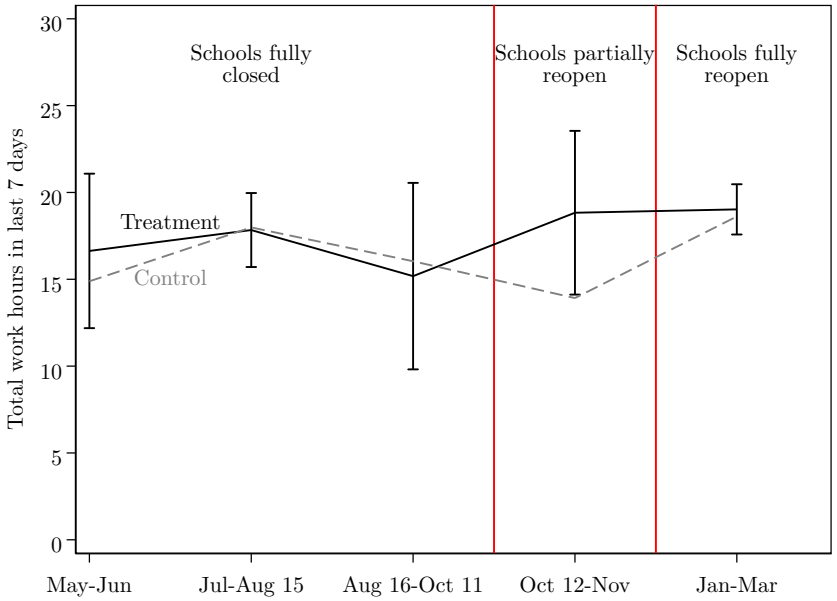
Appendix B: Robustness

Figure A5: Mean adult work hours by treatment group over time



Note: The figure shows mean total work hours in the last 7 days for adults in control households over time (dashed line), and in each period we add to this the estimated treatment effect with 95% confidence intervals using the results from Table A6. For the reference time period in that regression we show the treated group mean and 95% confidence interval. Data on February (pre-pandemic) working hours are not shown as they are only available for the respondent. Treated households have a child enrolled in grades 4 or 8, and control households have a child enrolled in grades 3, 5, 6, 7, or 9. Mixed households with children in both grade groups are not shown. The red bars indicate changes in Kenya's school closures policy. We fail to reject that the treated differences in the periods while schools are closed are jointly 0 ($p = 0.58$).

Table A5: Baseline balance by timing of round 3 interview

	Post-Oct 12 (N=1386) Mean (SD)	Pre-Oct 12 (N=204) Difference (SE)
Household characteristics		
Female household head	0.28	0.02
	(0.45)	(0.03)
Count adults	2.61	0.03
	(1.21)	(0.09)
Count of all kids age 0-17	3.10	0.18
	(1.60)	(0.12)
Any child age 0-4	0.36	0.11***
	(0.48)	(0.04)
Household wealth index	-0.04	-0.13*
	(0.92)	(0.07)
Urban	0.45	0.12***
	(0.50)	(0.04)
Any HH agriculture activity	0.81	-0.05
	(0.40)	(0.03)
Any child engaged in HH farm labor	0.40	-0.01
	(0.49)	(0.04)
Total child HH farm labor hours in last 7 days	4.75	0.05
	(11.99)	(0.89)
Any HH non-farm enterprise activity	0.24	0.07**
	(0.43)	(0.03)
Respondent characteristics		
Age	40.87	-2.45***
	(11.63)	(0.87)
Female	0.58	0.03
	(0.49)	(0.04)
Completed primary school	0.87	0.01
	(0.34)	(0.03)
Completed secondary school	0.46	0.01
	(0.50)	(0.04)
Married	0.76	-0.03
	(0.43)	(0.03)
Respondent labor supply		
Engaged in any work in last 7 days	0.68	-0.04
	(0.47)	(0.04)
Engaged in wage employment in last 7 days	0.11	-0.02
	(0.31)	(0.02)
Engaged in HH agriculture in last 7 days	0.56	-0.00
	(0.50)	(0.04)
Engaged in HH non-ag enterprise in last 7 days	0.10	-0.01
	(0.30)	(0.02)
Total work hours in last 7 days	20.72	-4.76***
	(21.99)	(1.63)
Wage employment hours in last 7 days	3.52	-1.38
	(12.21)	(0.89)
HH agriculture hours in last 7 days	13.70	-2.08*
	(17.01)	(1.26)
HH non-ag enterprise hours in last 7 days	3.68	-1.37
	(12.84)	(0.93)
Childcare hours in last 7 days	47.65	5.42
	(44.13)	(3.35)
Test of joint significance		$F = 2.26$
		$p < 0.001$

Note: The table presents means for analysis sample households surveyed during RRPS round 3 (late September-November) after schools partially reopened on October 12 and results from separate bivariate regressions of specific characteristics on a dummy for being surveyed before October 12. At the bottom of the table are results from a test of the joint significance of all characteristics in explaining round 3 survey timing.

Table A6: Impact of partial reopening on adult labor supply in the last 7 days, by time period

	(1) Engaged in any work in last 7 days	(2) Total work hours in last 7 days
Treat × May-Jun	0.02	1.75
	(0.06)	(2.27)
Treat × Aug 16-Oct 11	-0.05	-0.86
	(0.07)	(2.74)
Treat × Oct 12-Nov	0.07	4.91**
	(0.07)	(2.40)
Mixed × May-Jun	0.04	0.55
	(0.06)	(2.28)
Mixed × Aug 16-Oct 11	0.10	2.54
	(0.07)	(2.74)
Mixed × Oct 12-Nov	0.11*	1.83
	(0.06)	(2.31)
Observations	8694	8694
Mean, pre-reopen control	0.59	16.21
p-value, pre-reopening coefs jointly 0 for treament	0.58	0.49

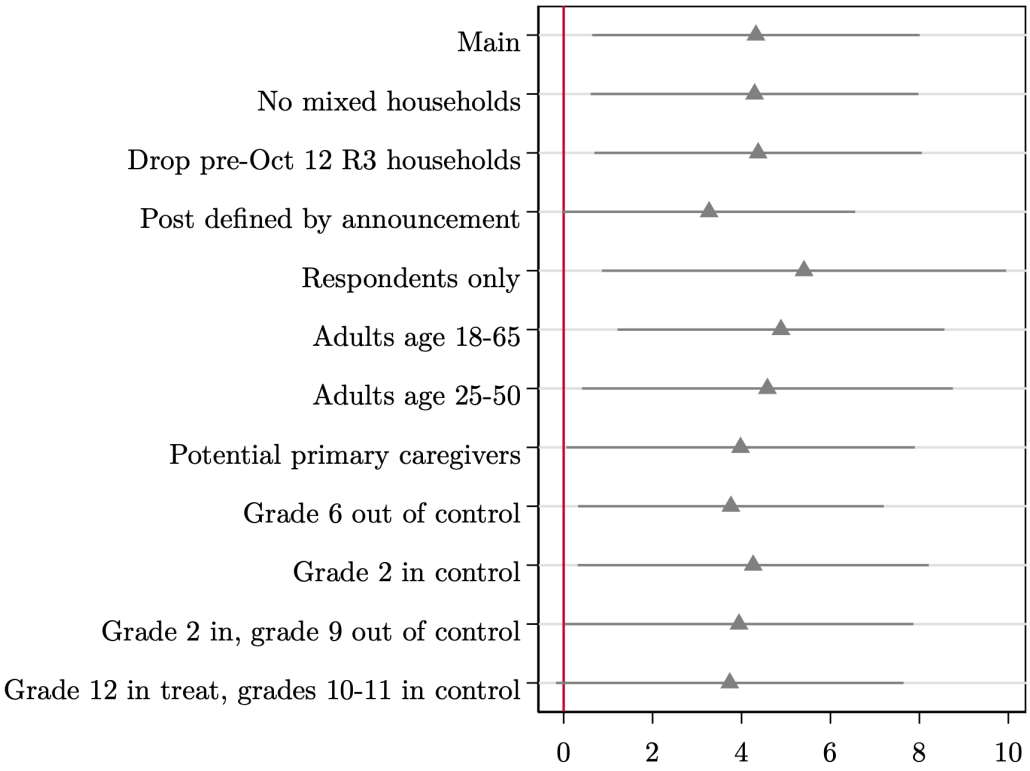
Note: This table presents estimates from Figure A5 of the interaction between *Treat* and time period from Equation 1, where *Post* is replaced with time period dummies, which also enter separately into the equation. The reference period is July-August 15, while schools were closed and before the partial reopening was announced. We show *p*-values from the F-test that the coefficients for May-June and Aug-Oct 11 are jointly 0 for treated households. Observations include data for all household adults (age 18+) from May to November 2020, and include treated households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'Mixed' households with both types of children. Regressions include household and month fixed effects. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Impacts of partial school reopening on total working hours, varying controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post		-3.28***				-2.26**	0.97
		(0.95)				(0.88)	(0.65)
Post x Treat	4.32**	4.39**	4.31**	4.19***	4.41**	2.34	2.81**
	(1.88)	(1.89)	(1.88)	(1.42)	(1.89)	(1.85)	(1.38)
Post x Mixed	0.93	0.92	0.92	0.29	0.95	0.97	-0.23
	(1.79)	(1.81)	(1.79)	(1.36)	(1.80)	(1.68)	(1.23)
Observations	8694	8694	8694	8694	7898	7898	7898
Mean, pre-reopen control	16.21	16.21	16.21	16.21	16.05	16.05	16.05
Household FE	Y	Y	Y	Y	N	N	N
Individual FE	N	N	N	N	Y	N	N
Month FE	Y	N	Y	Y	Y	N	N
Individual controls	N	N	Y	Y	N	N	Y
Household controls	N	N	N	Y	N	N	Y

Note: This table presents estimates of Equation 1 with varying controls. The dependent variable is total working hours over the last 7 days, taking a value of 0 for individuals not working. Observations include data from May to November 2020, and include treated households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'Mixed' households with both. 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Column 1 is the primary specification. Individual controls include sex, age, and household head status. Household controls include number of adults, young children (age 0-4), and school-age children (5-17) in the household, dummies for engagement in agriculture and in enterprise, and the sex of the survey respondent. The sample is smaller in columns 5-7 because some adults are only observed once. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure A6: Impacts of partial school reopening on adult work hours, varying sample



Note: The figure presents estimated coefficients and 95% confidence intervals for the effect of $Post \times Treat$ from Equation 1 for varying samples and treatment definitions. Only coefficients for treatment households are shown. The outcome is total work hours in the 7 days prior to the interview, taking a value of 0 for individuals not working.
We first test robustness to dropping mixed households and households surveyed in round 3 before the partial reopening (which do not inform identification of treatment effects) and to changing the definition of 'Post' to the date the reopening was announced (between survey rounds 2 and 3). The main sample includes adults ages 18+. We then test robustness to focusing on survey respondents, adults age 18-65, adults age 25-50, and adults identified as potential parents—between 14 and 55 years older than the oldest household child—or sole caregivers (the only household adult). We also test the robustness to varying the grades included in the treatment group definitions. Omitting grade 6 students from the control definition focuses just on students in grades immediately adjacent to those treated. Including grade 2 students in the control group mirrors the inclusion of grade 6 relative to grade 8. Omitting grade 9 students prevents comparing primary to secondary school students. Adding grade 12 students to the treatment definition and grade 10 and 11 students to the control definition expands the definition to include all grades eligible for the partial reopening. The definition of mixed households is updated accordingly in all cases.

Table A8: Correlates of adult childcare hours in last 7 days

	(1) Childcare hours, last 7 days
Female (=1)	12.26***
	(1.13)
Respondent (=1)	3.70***
	(0.84)
Household head (=1)	-0.23
	(0.99)
2 children in HH	0.07
	(2.04)
3 children in HH	-0.18
	(2.19)
4+ children in HH	1.03
	(2.38)
Female × 2 children	0.37
	(1.61)
Female × 3 children	2.94*
	(1.62)
Female × 4+ children	1.11
	(1.81)
Respondent × 2 children	1.15
	(1.16)
Respondent × 3 children	-0.67
	(1.20)
Respondent × 4+ children	1.35
	(1.26)
Household head × 2 children	-1.15
	(1.42)
Household head × 3 children	1.47
	(1.48)
Household head × 4+ children	0.38
	(1.64)
Observations	15328
Mean, Male non-resp non-head 0 kids	10.52

Note: The table presents correlates of childcare hours in the last 7 days for all adults (age 18+) in the RRPS in survey rounds 3 and 4 when data on childcare for all adults was collected. Standard errors are clustered at the household level.

Table A9: Heterogeneity in effects on adult total work hours in the last 7 days, by sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Interaction term Z:	Only 1 HH child		Any child age 0-4		Any girl in grades 3-9		Any child in grades 7-9		Any child in HH ag		Above mean HH wealth	
Sample:	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Post x Treat, Z=0	5.94**	3.05	4.20	3.33	9.64***	5.74**	2.83	3.74	2.37	1.51	11.86***	6.01**
	(2.67)	(2.13)	(3.19)	(2.73)	(2.96)	(2.75)	(3.18)	(2.75)	(2.57)	(2.47)	(3.59)	(3.02)
Post x Mixed, Z=0	1.30	0.58	0.50	0.16	2.77	-0.62	-0.68	-1.63	-0.68	-0.34	3.91	4.61
	(2.44)	(1.83)	(3.71)	(2.71)	(3.67)	(2.86)	(5.31)	(3.19)	(2.55)	(2.30)	(3.77)	(2.90)
Post x Treat, Z=1	4.02	4.65	6.34**	3.88	1.59	1.91	7.65**	3.96	8.99**	6.75**	0.97	1.91
	(4.23)	(3.92)	(3.17)	(2.78)	(3.31)	(2.62)	(3.25)	(2.73)	(3.81)	(3.03)	(2.80)	(2.49)
Post x Mixed, Z=1	1.30	0.58	2.38	1.04	-0.59	-0.08	2.99	2.14	3.67	2.39	-0.85	-2.21
	(2.44)	(1.83)	(2.97)	(2.34)	(2.85)	(2.12)	(2.85)	(2.27)	(3.57)	(2.70)	(2.85)	(2.20)
Observations	3887	4463	3887	4463	3887	4463	3887	4463	3887	4463	3887	4463
Mean, pre-reopen control	17.39	14.91	17.39	14.91	17.39	14.91	17.39	14.91	17.39	14.91	17.39	14.91
p-value Treated Z0=Z1	0.70	0.72	0.63	0.89	0.07	0.31	0.29	0.96	0.15	0.18	0.02	0.29
p-value Mixed Z0=Z1	.	.	0.69	0.81	0.47	0.88	0.54	0.34	0.32	0.44	0.32	0.06

Note: This table presents estimates of Equation 1 but interacting a characteristic Z with all right-hand side variables except the household fixed effects, separately for women and men. The dependent variable is total adult work hours over the last 7 days. Observations include data from May to November 2020, and include treated households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'Mixed' households with both. The total observations across women and men adds up to 8350 rather than 8694 as in the main analysis because some individuals only appear in their household in a subset of survey rounds. 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and month fixed effects. SEs clustered at household level.
The first columns show average effects for the full sample of households. In the following columns, coefficients with $Z = 1$ represent the sum of the $Post \times Treat$ and $Post \times Treat \times Z$ terms, and analogously for Mixed households, with standard errors calculated using the *xlincom* package in Stata. We include p-values for tests of whether the interaction term is equal to 0. The column labels indicate which characteristic Z is being used.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix C: Figure Tables

Table A10: Heterogeneity by individual characteristics in effects on adult work hours in the last 7 days

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Interaction term Z:	Female	Any work during closures	Any wage employmt during closures	Any HH ag work during closures	Any HH ent. work during closures	Ag HH	Urban location	Large urban location	Any child in private school
Post x Treat, Z=0	4.70**	-0.77	3.75*	0.26	4.58**	-0.49	3.61	4.54**	6.58***
	(2.11)	(2.16)	(1.92)	(2.30)	(1.89)	(3.20)	(2.75)	(2.04)	(2.10)
Post x Mixed, Z=0	0.88	-1.27	0.95	-2.59	1.81	-4.25	0.66	1.27	0.63
	(2.09)	(2.04)	(1.78)	(2.39)	(1.73)	(3.62)	(2.38)	(1.87)	(2.09)
Post x Treat, Z=1	3.99**	4.94**	8.79*	4.95**	5.63	5.03**	5.30**	1.70	-3.28
	(1.92)	(2.24)	(5.05)	(2.39)	(5.82)	(2.14)	(2.37)	(3.90)	(3.98)
Post x Mixed, Z=1	1.02	1.13	-0.75	2.51	-9.86*	1.66	1.65	-2.21	1.32
	(1.75)	(2.03)	(5.36)	(2.12)	(5.66)	(1.94)	(2.70)	(4.08)	(3.40)
Observations	8694	8281	8281	8281	8281	8694	8694	8694	8694
Mean, pre-reopen control	16.21	16.13	16.13	16.13	16.13	16.21	16.21	16.21	16.21
p-value Treated Z0=Z1	0.62	0.04	0.32	0.12	0.86	0.15	0.64	0.52	0.03
p-value Mixed Z0=Z1	0.92	0.35	0.75	0.09	0.03	0.15	0.78	0.44	0.86

Note: This table presents the results shown in Figure 4. The dependent variable is total working hours over the last 7 days, with individuals not working coded as working 0 hours. In each regression a characteristic Z is interacted with all right-hand side variables except the household fixed effects. Coefficients with $Z = 1$ represent the sum of the $Post \times Treat$ and $Post \times Treat \times Z$ terms, and analogously for Mixed households, with standard errors calculated using the *xlincom* package in Stata. We include p-values for tests of whether the interaction term is equal to 0. The column label indicates which characteristic Z is being used. Columns 1-5 interact treatment with individual characteristics, and columns 6-9 interact treatment with household characteristics. Closures work participation is based on any participation in a given sector from May-October 11 2020. Samples sizes for these analyses are lower because certain adults were not listed in household rosters during any baseline round surveys, leading to missing information on closures work engagement. 'Large urban' is a dummy for location in one of Kenya's largest urban areas (Nairobi, Mombasa, Nakuru, Kisumu, Kiambu) relative to any rural area, while 'Urban' is a dummy for location in any urban area. Private school enrollment is measured across all household children.
Observations include data from May to November 2020, and include adults age 18+ in treated households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'Mixed' households with both. 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and month fixed effects. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A11: Heterogeneity in effects on adult work hours in the last 7 days

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interaction term Z	None	Only 1 HH child	Any child age 0-4	Any girl in grades 3-9	Any child in grades 7-9	Any child in HH ag	Above mean HH wealth
Post x Treat	4.32**						
	(1.88)						
Post x Mixed	0.93						
	(1.79)						
Post x Treat, Z=0		4.46**	3.75	7.47***	3.34	1.81	8.82***
		(2.09)	(2.64)	(2.50)	(2.60)	(2.18)	(3.10)
Post x Treat, Z=1		4.25	4.93*	1.76	5.66**	7.80**	1.37
		(3.78)	(2.68)	(2.67)	(2.72)	(3.16)	(2.32)
Post x Mixed, Z=0		0.87	0.28	0.69	-1.41	-0.43	4.31
		(1.85)	(2.83)	(2.62)	(3.65)	(1.99)	(2.95)
Post x Mixed, Z=1		0.87	1.61	-0.35	2.47	2.93	-1.68
		(1.85)	(2.28)	(2.17)	(2.22)	(2.78)	(2.15)
Observations	8694	8694	8694	8694	8694	8694	8694
Mean, pre-reopen control	16.21	16.21	16.21	16.21	16.21	16.21	16.21
p-value Treated Z0=Z1		0.96	0.76	0.12	0.54	0.12	0.05
p-value Mixed Z0=Z1		.	0.71	0.76	0.36	0.33	0.10

Note: This table presents estimates of Equation 1 but interacting a characteristic Z with all right-hand side variables except the household fixed effects. The results are shown in Figure 5 and Figure 6. The dependent variable is total adult work hours over the last 7 days. Observations include data from May to November 2020, and include treated households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'Mixed' households with both. 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and month fixed effects. SEs clustered at household level.
The first column includes average effects for the full sample of households. In the following columns, coefficients with $Z = 1$ represent the sum of the $Post \times Treat$ and $Post \times Treat \times Z$ terms with standard errors calculated using the *xlincom* package in Stata, and equivalently for mixed households. At the bottom of the table are p-values for tests of whether the interaction terms are equal to 0. The column labels indicate which characteristic Z is being used. Children engagement in HH ag work is defined based on the period when schools were fully closed. 'Above mean wealth' is a dummy for whether an index of household wealth, based on housing and asset ownership before the pandemic, is above the sample mean.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A12: Heterogeneity in effects on respondent childcare hours in the last 7 days

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interaction term Z	None	Only 1 HH child	Any child age 0-4	Any girl in grades 3-9	Any child in grades 7-9	Any child in HH ag	Above mean HH wealth
Post x Treat	1.51						
	(5.13)						
Post x Mixed	0.74						
	(4.77)						
Post x Treat, Z=0		-0.46	-3.95	-2.72	2.04	1.92	1.79
		(6.13)	(6.52)	(6.71)	(7.77)	(5.79)	(6.32)
Post x Treat, Z=1		5.34	8.27	6.27	0.57	-2.10	1.61
		(9.37)	(8.18)	(7.94)	(6.92)	(10.42)	(8.59)
Post x Mixed, Z=0		1.29	0.83	3.16	-8.56	0.77	3.95
		(4.98)	(7.27)	(5.57)	(7.72)	(5.47)	(6.19)
Post x Mixed, Z=1		1.29	1.26	-14.98	1.35	-3.78	-3.88
		(4.98)	(6.39)	(9.92)	(6.23)	(9.31)	(7.54)
Observations	2997	2997	2997	2997	2997	2997	2997
Mean, pre-reopen control	52.88	52.88	52.88	52.88	52.88	52.88	52.88
p-value Treated Z0=Z1		0.60	0.24	0.39	0.89	0.74	0.99
p-value Mixed Z0=Z1		.	0.96	0.11	0.32	0.67	0.42

Note: This table replicates Table A11 but the dependent variable is respondent childcare hours over the last 7 days. The results are shown in Figure 5.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A13: Heterogeneity in effects on total child hours in household agriculture in the last 7 days

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interaction term Z	None	Only 1 HH child	Any child age 0-4	Any girl in grades 3-9	Any child in grades 7-9	Any child in HH ag	Above mean HH wealth
Post x Treat	-1.03						
	(0.94)						
Post x Mixed	-1.01						
	(1.10)						
Post x Treat, Z=0		-0.34	-0.68	-2.26*	-0.74	-0.48	-2.15*
		(1.10)	(1.24)	(1.36)	(1.15)	(0.89)	(1.15)
Post x Treat, Z=1		-2.87*	-1.57	0.44	-1.07	-3.67	0.96
		(1.68)	(1.45)	(1.29)	(1.48)	(2.56)	(1.62)
Post x Mixed, Z=0		-0.80	-1.12	-1.76	-1.31	0.22	-1.38
		(1.15)	(1.45)	(1.33)	(2.14)	(1.12)	(1.26)
Post x Mixed, Z=1		-0.80	-0.91	0.92	-0.38	-1.47	-0.23
		(1.15)	(1.61)	(1.56)	(1.40)	(2.55)	(1.96)
Observations	2997	2997	2997	2997	2997	2997	2997
Mean, pre-reopen control	3.89	3.89	3.89	3.89	3.89	3.89	3.89
p-value Treated Z0=Z1		0.21	0.64	0.15	0.86	0.24	0.12
p-value Mixed Z0=Z1		.	0.92	0.19	0.72	0.54	0.62

Note: This table replicates Table A11 but the dependent variable is total child hours in household agriculture over the last 7 days. The results are shown in Figure 6.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A14: Heterogeneity in effects on hiring any agricultural labor in the last 7 days

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interaction term Z	None	Only 1 HH child	Any child age 0-4	Any girl in grades 3-9	Any child in grades 7-9	Any child in HH ag	Above mean HH wealth
Post x Treat	0.05*						
	(0.03)						
Post x Mixed	0.02						
	(0.02)						
Post x Treat, Z=0		0.04	0.03	0.05	0.06	0.03	0.03
		(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)
Post x Treat, Z=1		0.07	0.07*	0.05	0.04	0.13	0.08**
		(0.06)	(0.04)	(0.04)	(0.04)	(0.09)	(0.04)
Post x Mixed, Z=0		0.02	0.05	0.02	-0.04	0.01	0.05
		(0.02)	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)
Post x Mixed, Z=1		0.02	-0.00	0.06	0.04	0.06	-0.02
		(0.02)	(0.03)	(0.05)	(0.03)	(0.04)	(0.03)
Observations	2997	2997	2997	2997	2997	2997	2997
Mean, pre-reopen control	0.07	0.07	0.07	0.07	0.07	0.07	0.07
p-value Treated Z0=Z1		0.71	0.49	0.92	0.82	0.27	0.36
p-value Mixed Z0=Z1		.	0.30	0.41	0.13	0.32	0.11

Note: This table replicates Table A11 but the dependent variable is a dummy variable for hiring any agricultural workers over the last 7 days. The results are shown in Figure 6.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A15: Heterogeneity in effects on adults hours outside household agriculture in the last 7 days

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interaction term Z	None	Only 1 HH child	Any child age 0-4	Any girl in grades 3-9	Any child in grades 7-9	Any child in HH ag	Above mean HH wealth
Post x Treat	0.49						
	(0.95)						
Post x Mixed	-0.29						
	(0.86)						
Post x Treat, Z=0		0.17	0.63	0.01	0.16	0.18	0.70
		(1.21)	(1.21)	(1.08)	(1.62)	(1.40)	(1.05)
Post x Treat, Z=1		1.27	0.16	0.84	0.80	0.84	0.18
		(1.54)	(1.54)	(1.46)	(1.10)	(1.29)	(1.40)
Post x Mixed, Z=0		-0.42	-0.31	0.22	0.16	-1.24	0.50
		(0.90)	(1.19)	(1.83)	(1.51)	(1.28)	(0.94)
Post x Mixed, Z=1		-0.42	-0.25	-0.68	-0.12	0.70	-0.89
		(0.90)	(1.24)	(1.05)	(1.11)	(1.12)	(1.35)
Observations	8694	8694	8694	8694	8694	8694	8694
Mean, pre-reopen control	4.08	4.08	4.08	4.08	4.08	4.08	4.08
p-value Treated Z0=Z1		0.58	0.81	0.64	0.74	0.73	0.77
p-value Mixed Z0=Z1		.	0.97	0.67	0.88	0.25	0.40

Note: This table replicates Table A11 but the dependent variable is adult hours of work outside household agriculture—in household non-farm enterprise or wage employment—over the last 7 days, with individuals not working coded as working 0 hours.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix D: Major Pandemic Policy Changes in Kenya

The following outline summarizes when major nation-wide pandemic-related policies were implemented and relaxed over the course of 2020 after the first COVID-19 cases in Kenya on March 13. The dates for the announcements of new restrictive policies are in *italics* and the dates when these policies were relaxed or ended are in **bold**. We also include announcements related to school closures, even though policies did not necessarily change with these announcements. Most policies were extended multiple times after first being imposed; we do not list the dates of policy extensions, except for school closures.

- *March 13-20*
  - Suspend all public gatherings, meetings, games, events
  - Ban on gatherings of more than 10 people
  - All schools closed
  - Recommend working from home where possible
  - Ban on foreigner entry; quarantine requirements for entry of nationals and visa holders
  - Public transport asked to reduce to 60% of capacity
- *March 24-27*
  - Ban on national and international flights
  - Closure of bars and restaurants for in-person service
  - Direct cash payments implemented for vulnerable citizens
  - Stay at home requirements imposed, except for 'essential' trips
  - Curfew imposed from 1700 to 0500 hours
  - Public transit closed between 'infected' and 'not infected' areas
- April 26: School closures extended to June 4
- **April 27**: Partial reopening of restaurants for take-out service
- June 6: School closures extended until further guidance from the Ministry of Health
- **June 7**: Nightly curfew revised to between 2100 and 0400 hours
- June 24: Announcement that school might reopen on September 1
- **July 7**
  - Phased reopening of religious gatherings
  - Up to 100 people permitted to attend weddings and funerals
  - Local air travel within Kenya to resume July 15
  - International air travel to resume August 1
- July 7: Announcement that schools will remain closed until January 2021, final exams are cancelled, and students would repeat the year; colleges and universities following strict guidelines might reopen in September
- ***July 27***
  - Restaurants reopened, must close by 1900 hours
  - Ban on sale of alcoholic drinks and beverages in eateries and restaurants
- **August 27**
  - Restaurants may remain open until 2000 hours
  - Ban on sale of secondhand clothing lifted
  - Licensed hotels may sell alcohol
- September 15: Ministry of Education releases guidelines for safe reopening of schools

- September 21: Ministry of Education calls all teachers to report back to schools by September 28
- **September 27**
  - Nightly curfew revised to between 2300 and 0400 hours
  - Bars may reopen; restaurants and eateries may sell alcohol; bars, restaurants, and eateries may remain open until 2200 hours
  - Religious gatherings may open for up to 1/3 of capacity
  - Up to 200 people may attend funerals and weddings
- October 6: Ministry of Education announces that students in examination grades (4, 8, and 12) shall return to classes on October 12
- **October 12**: Students in examination grades (4, 8, and 12) to return to classes
- *November 4*
  - Requests for government work to be done remotely when possible
  - Political gatherings suspended
  - Nightly curfew revised to between 2200 and 0400 hours
  - Bars, restaurants, and eateries must close by 2100 hours
- November 4: Announcement that schools to fully reopen in January 2021
- **January 4**: Schools fully reopen

Other policies were implemented that specifically affected certain parts of the country. For example, on April 6 the government instituted a 21 day movement ban/lockdown for Nairobi, Kilifi, Kwale, and Mombasa, and Mandera was added soon after. This lockdown was extended multiple times. These were the only counties affected. The lockdowns for Kilifi and Kwale ended on June 7 and those for Nairobi, Mombasa, and Mandera ended on July 8.

Sources: COVID-19 government response timeline for Kenya; Kenya COVID Tracker; Presidency of Kenya; Kenya Ministry of Education Twitter feed

Appendix E: Data

Data come from the Kenya COVID-19 Rapid Response Phone Surveys (RRPS), collected by the Kenya National Bureau of Statistics with support from the World Bank and the University of California at Berkeley. Pape et al. (2021) describe the survey methodology and implementation in detail.

The main RRPS sample is drawn from the nationally representative Kenya Integrated Household Budget Survey (KIHBS) conducted in 2015-2016: 9,009 households that were interviewed and provided a phone number served as the primary sampling frame for the RRPS. All households in the sample were targeted in each round regardless of whether they were reached in a previous round. By the fourth round of the RRPS, 5,499 KIHBS households had been successfully surveyed at least once. The KIHBS sample is supplemented by random digit dialing (RDD). From a sampling frame of 5,000 randomly selected numbers, of which 4,075 were active, 1,554 households had completed at least one survey by round four.

The sample is intended to be representative of the population of Kenya using cell phones. In the 2019 Kenya Continuous Household Survey 80% of households nationally report owning a mobile phone, though certain counties—notably in the northeast—have much lower mobile phone penetration. Pape et al. (2021) report that KIHBS households that provided a phone number and those that were successfully surveyed in the RRPS have better socioeconomic conditions—measured by housing materials and asset ownership—than households that did not provide a phone number or that did but were not reached for the RRPS. The RRPS data include household survey weights adjusting for selection and differential response rates across counties and rural/urban strata, attempting to recover national representativeness. We do not apply these household weights for our analyses.

We primarily use data from the first three rounds of the RRPS, covering May-November 2020, and also construct measures for February 2020, before the first COVID-19 cases in Kenya using recall questions from the first time a household was surveyed. We show data on household agricultural labor for later rounds of the RRPS covering January-October 2021 to show how outcomes evolved after schools fully reopened and for comparison with reports during the same months in 2020. Each round lasted approximately 2.5 months and covered a representative cross-section of households each week within each round. The order in which households were called was randomized in the first survey round and maintained in all subsequent rounds.

Due to a survey coding error, in round 1 women were requested as survey respondents whenever they were available leading to a higher share of female respondents. Subsequent rounds were conducted with the same respondent unless they could not be reached. The survey team attempted to reach the target respondent at least 5 times across several days and hours of the day before moving on to speak to any other knowledgeable household member in order to avoid replacing the respondent. Due to this non-random selection of respondents, household characteristics differ by whether the baseline respondent is female or male.

The surveys include information on household composition, assets and housing, labor outcomes for household adults, and child schooling and care, as well as more general household information and COVID-specific modules. Detailed questions on child care, schooling, labor, and other outcomes are included for a randomly selected child in each round.

Data on childcare arrangements for a randomly selected child include questions on which household member has primary responsibility for the child's care, which household member was with the child in the last 15 minutes, and where and in whose company the child stayed during the day

when out of school (from a set of general categories).[35] The surveys also ask respondents for their hours spent on childcare in the last 7 days.[36] Childcare hours from other household adults are measured starting in round 3, while childcare hours from all household children combined and all non-household members combined are included starting in round 4, after schools fully reopened.

In the first survey round, respondents are asked about their housing characteristics and ownership of selected assets before March 2020. We consider whether the dwelling has a primary floor material other than earth, dung, or palm and a primary wall material of cement, stone, bricks, adobe, or wood planks, and whether the household owned a radio, mattress, refrigerator, and mobile phone (the four most commonly reported assets). We normalize each of these components, sum them, and normalize the sum across the entire survey sample to construct our normalized wealth index.

Labor supply is captured using modules on household agricultural production, household enterprise, and wage employment. For both household agricultural production and for each household enterprise, respondents report all household adults engaged in those activities over the last 7 days and their hours of work. Wage employment is reported for each household adult. An individual not working in a given activity is coded as working 0 hours. Recall on labor supply for February 2020 is only available for survey respondents. The survey also includes data on total child hours spent working in household agriculture in the last 7 days in each round, and hours for a randomly selected child starting in round 3. Households also report whether they hired any outside workers to work on household agricultural activities.

Respondents report estimates of total household earnings from agricultural activities and from household enterprises over the last 14 days. For the few households with multiple enterprises, we sum earnings and profits across enterprises. Wage earnings in the last 14 days are reported for individual wage workers. For comparability with the measures of household agriculture and enterprise earnings, we aggregate wage earnings to the household level. Earnings data are limited—for all activities the 90th percentile of household earnings in the analysis sample is 0—in part due to a focus on the last 14 days, which does not accommodate seasonality or other variability in earnings.

We winsorize reported individual hours of work and household earnings across activities at the 99th percentile. We winsorize reported childcare hours at 140 per week.

35. Respondents are instructed to select all childcare arrangements used. Nevertheless, respondents might omit types of childcare that are used less frequently or that are seen as less socially acceptable (e.g., leaving a child at home by themselves).

36. The survey asks "In the last 7 days, how many hours did you spend doing childcare?" and does not distinguish between time actively spent caring for a child and time spent on other activities while responsible for a child. We topcode reported childcare hours at 140, or 20 hours a day. Over 15% of respondents in our analysis sample indicate spending at least this many hours on childcare.

Appendix F: A simple static partial equilibrium model of childcare and labor supply

We develop a simple model of adult labor supply and childcare decisions to generate predictions to take to the data. The model considers a static problem for adult household members with children. For simplicity, we assume that household adults take decisions jointly, and thus model the decision as that of a single person. We focus on a static, partial equilibrium labor supply decision, and set aside possible impacts of shocks to labor demand to focus on shocks to the adolescent school availability. Key aspects of the context that we aim to reflect in the model are the availability of child labor in household agriculture as well as childcare of younger children by older children. To reflect women's larger role in childcare in this setting, we assume that female adult household members have either a comparative advantage in childcare of younger children or, similarly, that social norms are such that the costs of refraining from childcare for women (or the cost of engaging in childcare for men) are exogenously larger. Moreover, in line with our data, we assume economies of scale in childcare provision, as well as the ability of the caregiver to combine some types of childcare with household production in agriculture.

Household adults get utility $U = U(C, L, \{Q_k\}_{k=1}^{N})$ from consumption, leisure, and the well-being of k household children. They can spend time on leisure, wage work for a fixed wage, home production[37], and childcare and face a time constraint $T = L + t_w + t_h + t_c$. Wage work earns a wage w. Home production $H = H(t_h, X, S)$ is a concave function satisfying the Inada conditions, which depends on the adult time input and other household characteristics X such as the availability of household agricultural land or existence of a household enterprise, as well as the availability of child labor (which is a function of the age distribution of children and school closure policy S). We normalize the price of consumption to 1 and assume that household production can be sold at this same price.

Adults provide childcare $CCM = \psi_g\big(t_c + \theta_h t_h\big)$, which includes "active" childcare time t_c focused on children as well as some portion θ of home production time that simultaneously provides passive childcare. ψ_g is a cost-shifter for childcare provision that takes on takes on smaller values for men than for women.[38] Adult childcare is a public good that all household children can access, reflecting the economies of scale we observe in this context.

Total childcare for child k is given by $CC_k = CCM + I_k$, adults' childcare provision plus any childcare provided by older children.[39] All children receive the same amount of care from household adults, but childcare from other children varies based on the age distribution of siblings. Total informal childcare available to the household $I = I(X, S)$ is a function of household characteristics (notably the presence of older siblings) and of school closures; older siblings provide more informal childcare when schools are closed. Child well-being $Q_k = Q_k(CC_k, \bar{CC}_k(age_k, S))$ is a concave function of childcare provided to the child and their minimum required care.[40] Minimum required care $\bar{CC}_k(age_k, S)$ decreases with age, and for school-age children it increases when schools are closed.

37. The key distinction this model makes is between a work sector which accommodates both simultaneous childcare and child labor contribution, and another work sector which does not. We therefore primarily think of the home production activity as being household agriculture, with household enterprise activities being a form of home production which has some of the same characteristics but less so.

38. This cost-shifter can be rationalized in multiple ways. It could be that women's childcare hours count for more relative to men's due to a social expectation of women to provide childcare, or a social stigma of childcare for men. This shifter is also isomorphic to a model where women are relatively more productive in childcare, and require fewer hours to achieve the same increase in child welfare.

39. Very few households in the data use non-household sources of childcare, so we abstract away from this possibility.

40. We can think of this as a Stone-Geary type of function.

Adults take as given household characteristics X such as presence of other adults and child composition, school closure policy S, and non-labor income Y. We model S as a binary variable taking a value of 1 if schools are closed and 0 otherwise.[41]

Adults' static optimization problem is

$$\max_{t_w, t_h, t_c} U(C, L, \{Q_k\}_{k=1}^N) \tag{2}$$

Subject to

$$C = wt_w + H(t_h, X, S) + Y \tag{3}$$

$$T = L + t_w + t_h + t_c \tag{4}$$

$$L \geq 0;\ t_w \geq 0;\ t_h \geq 0;\ t_c \geq 0 \tag{5}$$

$$CC_k = \psi_g\big(t_c + \theta_h t_h\big) + I_k \tag{6}$$

$$\sum_{k=1}^{N} I_k \leq I(X, S) \tag{7}$$

$$Q_k = Q_k(CC_k, \bar{CC}_k(age_k, S)) \tag{8}$$

Adults maximize their utility over choices of time use, subject to the following constraints: 1) the household budget constraint, 2) their time endowment, 3) non-negativity constraints on time use, 4) the childcare provision function, 5) availability of childcare from older siblings, and 6) the child well-being function. The budget constraint states that spending on consumption must equal the sum of wage income, the value of home production, and non-labor income.

We are interested in the impacts of changes in school closure policy S on adult labor supply t_w and t_h. S enters the model through childcare needs, the availability of sibling childcare, and household child labor availability. We expect $\bar{CC}_k(age_k, 1) > \bar{CC}_k(age_k, 0)$ for children enrolled in school, meaning schools being open decreases household childcare needs. On the other hand, $I(X, 1) > I(X, 0)$ for households with older children, as those children can provide more informal childcare when schools are closed. Moreover, $H(t_h, X, 1) > H(t_h, X, 0)$ as children may contribute more to home production when they are home from school.

Adults thus trade off their time among wage work, home production, childcare, and leisure, at an interior solution setting the marginal returns to each equal to each other:

$$u'_C w = u'_C H'_t(X, S) + \phi(\{age_k\}_{k=1}^N, S, \psi_g)\theta_h = \phi(\{age_k\}_{k=1}^N, S, \psi_g) = u'_L \tag{9}$$

where these terms are, respectively, the marginal utility of working one more hour for a wage w, the marginal utility of an additional hour in home production (providing both consumption and some child well-being value due to joint work and childcare), the marginal value to adults of an additional hour of childcare, and the marginal utility of an additional hour of leisure, and where we define

$$\phi = \sum_{k=1}^{N} u'_{Q_k} Q'_k(age_k, S)\psi_g \tag{10}$$

School reopening (moving from $S = 1$ to $S = 0$) affects the solution to adults' problem through two channels. First, it lowers child labor in home production, thus likely raising the marginal return of adults working in home production after school reopenings ($H'_t(X, 0) > H'_t(X, 1)$). Second,

41. S may vary by child, as in the case of the partial school reopening in Kenya, but we abstract from this point.

it changes the net demand (and thus net return) to childcare for the remaining children. When there are no other children present, the utility return to adult childcare hours decreases for sure ($\phi(K = 1, S = 1) < \phi(K = 1, S = 0)$, which also reduces the return to work in home production. But when there are other children present, the sign of this effect is ambiguous and depends on the age distribution of remaining children. When remaining children are very young, for instance, the marginal utility from adult childcare may actually *increase*, since the school reopening decreases sibling childcare ($I(X, 1) > I(X, 0)$) and changes the household childcare constraint.

The simple model thus allows us to generate several hypotheses for the effect of schools reopening to take to the data. First, in households where *all* children return to school, hours spent in childcare should decline while labor supply overall should increase. The decline in childcare should be greater for a younger child returning to school. Second, adults with young children will likely be providing a higher level of childcare on average when schools are open: sibling childcare falls as older siblings return to school, but childcare needs remain high since these are driven relatively more by younger children. Sibling childcare may be particularly affected by a girl child returning to school. Labor supply may therefore decrease in households with young children given the increased marginal utility from adult childcare.

Third, if women play a larger role in childcare (as is the case in our setting), either because children benefit more from female care, or because social norms and economic circumstances are such that men's social cost to childcare are larger, then $\psi_{female} > \psi_{male}$. This suggests that women should engage in more childcare overall, and that school closures should impact their childcare hours more. They will also be more likely to supply relatively more labor to home production, as this can be combined with childcare whereas wage work cannot. If, in addition, we suppose that childcare needs and norms for infants and young children are particularly gendered, then labor supply responses to school reopening when young children remain present in the household should be particularly muted (or even reversed) for women relative to men.

Finally, in households which used child labor for home production while schools were closed, adult labor supply in home production should increase after schools reopen to make up for lost child labor. This increase should be more pronounced in households which depend more on home production and which lack access to hired labor, such as poorer agricultural households. Households with better access to hired labor may respond to reduced child labor by increasing hired outside agricultural labor rather household adult agricultural labor, if the opportunity cost of household adult labor is greater than the cost of hired labor.