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Balancing Work and Childcare

Evidence from COVID-19 School Closures and Reopenings in Kenya

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Abstract

This paper identifies the impact of childcare responsibilities on adult labor supply in the context of COVID-19-related school closures in Kenya. It compares changes in parents' labor participation after schools partly reopened in October 2020 for households with children in a grade eligible to return against households with children in adjacent grades. Using nationally-representative panel data from World Bank phone surveys in 2020–21, the findings show that the partial reopening increases affected adults' weekly labor hours by 22 percent, with increases concentrated in household agriculture. The results suggest that school closures account for over 30 percent of the fall in average work hours in the first few months after COVID-19 cases were detected. The effects are driven by changes in household childcare burdens and child agricultural labor when a student returns to school. The impacts are not significantly different by sex of the adult. Although both women and men increased hours spent on childcare during the pandemic, women benefited more than men from reductions in childcare needs, but took on more of the childcare burden when the returning student was a net childcare provider. The results highlight the importance of siblings in household childcare and suggest that policies that increase childcare availability and affordability could increase adult labor supply in Kenya.

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Balancing Work and Childcare: Evidence from COVID-19 School Closures and Reopenings in Kenya

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1 Introduction

The availability and cost of childcare have been shown to significantly affect adult labor supply in high-income countries, particularly for women. But there is less evidence on this relationship in low- and middle-income countries (LMICs), particularly in Sub-Saharan Africa (Halim, Perova, and Reynolds 2021). Yet, a historical perspective highlights the important role of women's labor supply in driving economic development. Understanding how childcare and adult labor supply interact is therefore crucial in these settings.

Sub-Saharan African countries differ from more frequently studied high-income countries in many ways relevant to this question. Households have more children on average but also more commonly have additional adults (UN 2020). Formal early childhood care availability is increasing, but from a low base and there are concerns around quality and cost (Samman et al. 2016). Older siblings play an important role in household childcare (Jakiela et al. 2020). Female labor participation is higher in Sub-Saharan Africa than any other region, but it is concentrated in informal household activities; this region also has the world's highest gender gap in wage employment (ILO 2017). Households are more likely to engage in family farm or non-farm enterprises, which may be more accommodating of childcare needs than wage employment. It is not clear *a priori* how these differences would affect the relationship between childcare needs and labor participation.

An important factor influencing household childcare needs is the availability of low- or no-cost schooling. In response to the COVID-19 pandemic, countries around the world closed schools in an effort to limit virus transmission. This paper leverages pandemic school closure policies in Kenya as exogenous shocks to household childcare burdens to provide empirical estimates of the impact of childcare responsibilities on adult labor supply in an LMIC setting in Africa.

Kenya closed all schools nationwide soon after its first COVID-19 cases in March 2020 and partially reopened schools for specific grades in October 2020, prior to fully reopening in January 2021. School closures increased household childcare needs—more so for households without young children already at home due to economies of scale—creating trade-offs in adults' time allocation across childcare, work in different sectors, and leisure. We exploit the quasi-random variation in the timing that children enrolled in different grades were eligible to return to school and use data from the nationally-representative panel Kenyan Rapid Response Phone Survey to implement a difference-in-differences analysis comparing changes in labor supply after the partial reopening for adults in 'treatment' households with children in grades 4 or 8—eligible to return (99% did return)—against those with children in adjacent grades.

Having a child eligible to return to school increases adults' labor supply in the weeks after reopening. Labor supply effects of the partial reopening are concentrated on the intensive margin: total work hours in the past 7 days increase by 3.6 (22%), driven by a 26% increase in household agriculture hours. We find no effects on labor participation or on wage employment or household enterprise hours, which may take longer to adjust.[1] Household agriculture is likely more flexible

1. Analysis of longer-term impacts is complicated by the fact that schools fully reopened in January 2021, meaning our comparison group also becomes 'treated.'

in allowing adults to adjust working hours after a change in the childcare burden; participation in household agriculture was also less affected by the pandemic.

Agricultural households drive average labor impacts. Poorer households—based on an index of housing and assets—increase work hours by more than wealthy ones but not significantly so. They are more likely to be engaged in agriculture and may have had fewer resources to deal with increased childcare needs during closures. We observe no differences in impacts between rural and urban locations. Relatively high participation in agriculture even in 'urban' areas and low participation in wage employment or take-up of paid childcare in our sample mean that key differences that could affect how changes in childcare burdens affect labor supply by location are not present in this context.

Surprisingly, the impacts are not significantly different by sex, contrasting with evidence of more negative impacts of the COVID-19 pandemic on mothers' labor hours in high-income contexts (Alon et al. 2021; Amuedo-Dorantes et al. 2020; Collins et al. 2021; Hansen, Sabia, and Schaller 2022; Heggeness 2020) and expectations based on women's role as primary caregivers in most Kenyan households. One reason for the lack of difference is that in our sample, both women and men contribute to childcare and increased childcare hours during school closures. A second reason is that in this setting, school-age children are both *recipients* of childcare and *contributors* to household productive activities, including childcare to siblings and household agriculture. We find that women's labor supply responds relatively more to changes in childcare burdens while men respond more to changes in child agricultural labor, leading to offsetting impacts.

The effects of the partial school reopening on adult childcare and work hours vary with household composition—in particular, the presence of below-school-age children—consistent with evidence of economies of scale in childcare and of an important role of siblings in childcare (Jakiela et al. 2020). Whether the returning student is a net provider or recipient of childcare in the household determines whether the reopening is a negative or positive childcare shock. Increases in work hours are driven by households without below-school-age children, where the student's return to school decreases adults'—and particularly women's—childcare burdens. A second mechanism for the impacts we observe is participation of school-age-children in household agriculture. Child agriculture hours decrease in treated households by approximately one-quarter of the total increase in adult agriculture hours, suggesting some of this increase substituted for child labor during Kenya's main harvest season.

This paper explores a new dimension of the relationship between childcare and labor supply (e.g., Browning 1992; Connelly 1992; Ribar 1992) by considering how formal childcare for school-age children (through schooling) affects households through changes in both childcare burdens and availability of child labor. The current literature largely studies childcare for below-school-age children and treats children solely as childcare recipients, while focusing on settings dominated by wage employment. These characteristics do not generalize to many LMIC contexts. Among studies of childcare and labor supply in African LMICs (Bjorvatn et al. 2021; Clark et al. 2019; Delecourt and Fitzpatrick 2021; Heath 2017; Lokshin, Glinskaya, and Garcia 2000; Martinez, Naudeau, and

Pereira 2012; Quisumbing, Hallman, and Ruel 2007), causal identification is limited, only two include rural areas, and none consider the role of children as household labor providers. This paper estimates causal impacts of a change in childcare needs using a natural experiment with a nationally-representative sample of households in an African LMIC with most engaged in household farm and non-farm enterprise rather than wage work. Analyzing a shock affecting formal care provision for school-age children further allows us to shed light on the role of child household labor in the relationship between childcare needs and adult labor supply.

We also contribute to understanding labor impacts of pandemics and pandemic-related policies. A growing number of studies analyzes the gendered effects of the COVID-19 pandemic on childcare and labor supply (see e.g., Alon et al. 2021; Amuedo-Dorantes et al. 2020; Collins et al. 2021; Del Boca et al. 2020; Furman, Kearney, and Powell 2021; Grantham et al. 2021; Hansen, Sabia, and Schaller 2022; Heggeness 2020; Prados and Zamarro 2021; Zamarro and Prados 2021). Though descriptive evidence from COVID-19 in India (Chauhan 2020; Deshpande 2020) and South Africa (Casale and Posel 2020) and from Ebola in Sierra Leone and Liberia (Wenham et al. 2020), along with one causally-identified study on COVID-19 in Shaanxi province, China (Ma, Sun, and Xue 2020), suggests that women increase domestic work and reduce their labor during pandemics more than men in LMICs, causal estimates of impacts of changes to household childcare needs during a pandemic on adults' labor supply in an LMIC are currently lacking.

The impact of partial reopening on adult work hours corresponds to over 30% of the fall in average hours after the first COVID-19 cases in Kenya. A back-of-the-envelope calculation indicates that school closures decreased work hours across Kenya by 2.1 billion in 2020—at the average hourly income in the data a cost of USD 3 billion (3.1% of 2019 GDP). More generally, we demonstrate that reducing household childcare burdens can broadly increase adults' labor participation, and provide new evidence of the importance of siblings in household childcare in an African LMIC context.

2 Context and Data

This section summarizes Kenyan COVID-19 school closure policies, the data we use to analyze their impacts on labor supply, and information on childcare arrangements.

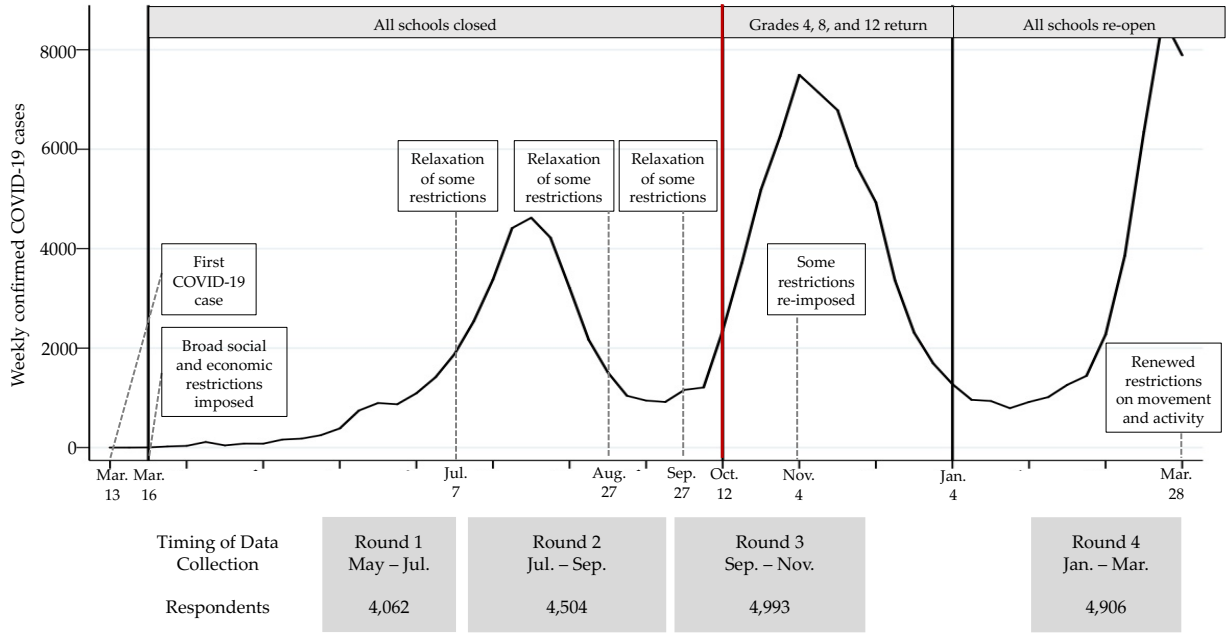
2.1 Kenyan School System and COVID-19 Closure Policies

Public primary and secondary education in Kenya is free for all children starting around age 6, and education is compulsory for the first nine years. Pre-primary education has also become broadly available for children ages 4 and 5. Though public education is nominally free, households pay for a variety of school-related costs such as materials, meals, and examinations. These costs are typically in the range of 25-75 USD per year for primary schools (Zuilkowski et al. 2018) and 100-500 USD per year for secondary schools (Bonds 2021), with higher costs for private and boarding schools. Academic years in Kenya begin in January and end in late October, and consist of three terms.

Schools in Kenya closed on March 16, 2020, days after the first reported COVID-19 cases, as

part of a broad set of national restrictions to reduce the risk of disease transmission. The rest of academic Term 1 was cancelled. Figure 1 shows a timeline of school closures and reopenings, other key pandemic-related policy changes, and weekly confirmed COVID-19 cases in Kenya.[2] Pandemic school closure policy in Kenya was decided nationally. Top-down changes in policies thus represent exogenous shocks to households, unrelated to local economic or health conditions.

Figure 1: Kenya COVID-19 cases, pandemic policy, and data collection timeline



The figure shows the evolution of weekly confirmed COVID-19 cases in Kenya over time, along with the timing of key pandemic policy changes. The red bar indicates the partial school reopening on 12 October, the focus of the analysis. 'Relaxation of some restrictions' indicates that one or more of the initial pandemic constraints were at least partially reduced. Specific policy changes are outlined in Appendix C. Sources: COVID-19 government response timeline for Kenya; Kenya COVID Tracker; Presidency of Kenya; Kenya Ministry of Education Twitter feed; COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University

On September 15, the Ministry of Education released guidelines for safe reopening of schools, but the timing and nature of reopening remained uncertain until October 6, when the Ministry announced that students in grades 8 and 12—those sitting national exams—along with students in grade 4 should return to school on October 12 for Term 2 of 2020. This announcement was presented in the media as "a shocking move that caught parents and candidates off guard" (The Star 2020). On November 4, the President announced that schools would reopen fully for all students on January 4, 2021 to complete the 2020 school year. There were no additional fees incurred when school reopened, but some parents may have been asked to pay outstanding bills from before the school closures and others may have paid for new materials or extra lessons.[3]

2. An overview of specific pandemic-related policies is presented in Appendix C.

3. There are some additional costs associated with national exams, but these were paid by the government for all candidates at the time of the exams in spring 2021.

Students in grades 4, 8, and 12 returned for Term 3 from January-March 2021 while other students returned for Term 2; their Term 3 was shifted to May-July 2021. Grade 8 and 12 students sat national exams in March-April. 2021 Term 1 for all students began in late July 2021. Terms and breaks for the 2021-2023 academic calendars were shortened to allow a gradual return to the standard pre-pandemic term schedule (running from January-October) in time for the 2024 academic year.

We focus on the impacts of the partial school reopening for several reasons. First, unlike initial school closures, the partial reopening did not coincide with other pandemic-related policies, allowing for cleaner identification. Second, we can exploit discontinuities in the timing that children enrolled in different grades were eligible to return to school to isolate the effect of the childcare shock. Further, because households vary in whether the students eligible for the partial reopening are net suppliers or demanders of childcare—depending on the presence of younger siblings—this shock sheds light on the importance of sibling-provided childcare.

2.2 Data

Data come from the Kenya COVID-19 Rapid Response Phone Survey (RRPS) panel, collected by the World Bank in collaboration with the Kenya National Bureau of Statistics and the University of California at Berkeley (Pape 2021).[4] The main sample ($\sim$ 80%) is drawn from the nationally-representative Kenya Integrated Household Budget Survey conducted in 2015-2016, and this sample is supplemented by random digit dialing. The sample is intended to be representative of the population of Kenya using cell phones—80% of households nationally report owning a mobile phone, and these have better socioeconomic conditions on average than households that do not (Pape et al. 2021). We use data from the first four survey rounds, covering May 2020-March 2021. In addition, we construct measures for February 2020, before the first COVID-19 cases in Kenya, using recall questions from the first round.

The outcomes of interest are measures of labor supply.[5] The extensive margin is measured by participation in the last 7 days in three activities: employed/wage labor, household non-farm enterprise, and household agriculture. The intensive margin is captured using hours of work by activity in the last 7 days; an individual not working in a given activity is coded as working 0 hours. The survey also includes data on total child hours spent working in household agriculture.

Information on what grades children were enrolled in prior to the initial closures allows us to identify households affected by the partial reopening. We define 'treatment' households as those with children enrolled in grades 4 or 8 prior to the pandemic (eligible for the partial reopening)[6] while 'control' households have children in grades 3, 5, 6, 7, or 9, but not in grade 4 or 8.[7] We

4. See Appendix D for more detail.

5. We use the term labor 'supply' to refer to equilibrium outcomes, acknowledging that individuals may have been willing to supply additional labor but faced limited demand.

6. Few households report any children in grade 12; we test robustness of our results to including them.

7. Results are robust to including households with children in grade 2 as controls and to excluding households with children in grade 9 (in secondary school) or in grade 6 (to focus only on immediately adjacent grades).

separate 'mixed' households with children in both grade groups from 'treatment' households as they might experience different effects when not all of their children in the relevant grade range return to school. The main analysis sample includes 335 treatment, 361 mixed, and 948 control households.

Prior to the partial reopening, 98.5% of sample households stated that their children would return to school after schools reopened, despite possible concerns about the pandemic or conditions leading some children to drop out. Close to 99% of eligible students are reported to have returned to school after October 12, 2020.[8] Across all grades, 97% of children enrolled prior to the pandemic closures returned to school after the full reopening in January 2021.

Finally, the data include questions on household childcare arrangements, including respondent childcare hours.[9]

2.3 Childcare Arrangements

At least 93% of children at each age from 6-16 in the RRPS are reported to have been enrolled in school in February 2020. After the March closures these children were all home requiring care and supervision during the working day, representing a large and unexpected shock to household childcare needs. Children primarily stayed at home with a parent during the closures (Figure A1), including situations where parents were simultaneously working. Almost no households report their children spending time with childcare providers outside the home or with a maid/domestic helper at home, and this does not vary by rural/urban setting or change as pandemic restrictions were relaxed and case numbers fluctuated. Adults with schoolchildren at home will have faced trade-offs in their allocation of time across childcare, work in different sectors, and other activities given a limited time budget to accommodate increased childcare burdens.

Figure 2 Panel A presents how hours of childcare from different providers (excluding schools) vary with the number of household children, using data from after schools fully reopened.

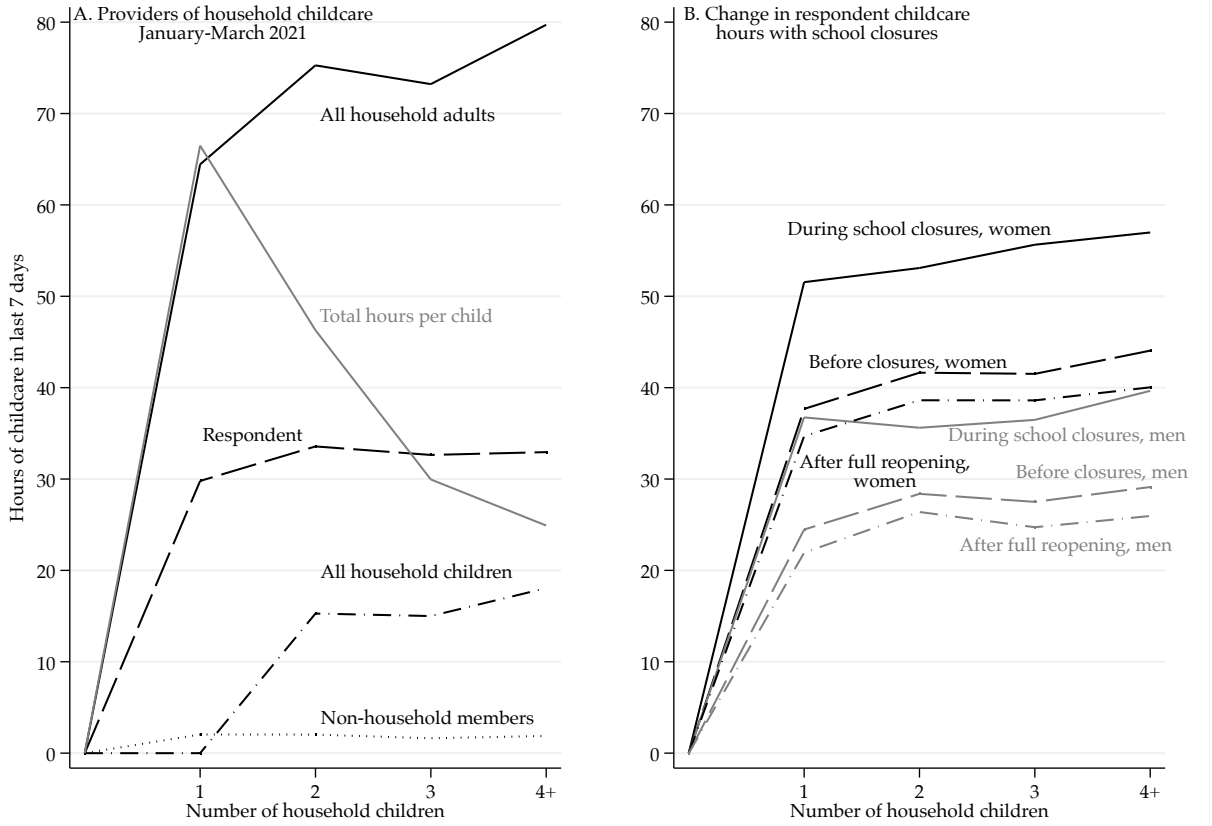
Non-household members provide very little childcare on average—86% of households with children report 0 hours of care from non-household members in the last 7 days. While childcare availability has been increasing in Kenya (particularly in urban areas), affordability remains a challenge for most households (Clark et al. 2021; Murungi 2013).

Other adults besides the parents are present in 37% of households with children, and on average provide around 10 hours per week of childcare. Siblings also play an important role in childcare (Jakiela et al. 2020). In households with at least 2 children 55% of children provided childcare to siblings in the last 7 days, for 15-20 hours on average in total, demonstrating how childcare burdens can also fall on household children. Sibling childcare hours may have been higher during school closures as school-age children were at home, but we only measure sibling childcare after the full

8. This may be overstated but is consistent with data from a survey of 3,000 grade 8 students in Busia County, Kenya, which shows that 97% of these students reported back to school after the partial reopening in October (Bonds 2021).

9. The survey asks about time spent on childcare in the last 7 days, but 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.

Figure 2: Count of children and childcare hours in the last 7 days, by provider of care and school closure status



The figures show mean childcare hours in the last 7 days by number of household children (ages 0-17). Panel A presents data from RRPS round 4 (January-March 2021) which asks about childcare hours for each household adult, for all children in total, and for all non-household members in total. Previous rounds only ask about childcare hours for the respondent. The hours for 'all household adults' include the respondent's hours. Total hours per child is the sum of all childcare hours divided by the number of children.
Panel B presents data for female (black) and male (gray) *respondent* childcare hours before school closures (dashed lines, recall data from RRPS round 4 about January-early March 2020), during school closures (solid lines, RRPS rounds 1-3 covering May-November 2020), and after schools fully reopened (dash-dot lines, RRPS round 4 covering January-March 2021). Data on childcare hours before and during the school closures period for other care providers are not available.

reopening.

Respondents provide 30-35 hours a week of childcare. Figure 2 Panel B shows that while female respondents provide around 10-15 hours more than men, men still contribute around 25 hours on average. This contrasts with the image of fathers in African countries as primarily providing economic support and little childcare, but is consistent with recent evidence (Clark, Cotton, and Marteleto 2015; Kah 2012). The gender gap in childcare hours per week increased during school closures—women's hours increased by 13.4 on average compared to 9.8 for men—but the burden increased significantly for both. This pattern is similar to findings of increases in domestic work

during the pandemic for both men and women, but larger for women, in India (Deshpande 2020), South Africa (Casale and Posel 2020), and many higher-income countries (see e.g., Andrew et al. 2020; Del Boca et al. 2020; Farré et al. 2020; İlkkaracan and Memiş 2021). After schools fully reopened, respondent childcare hours returned to slightly below pre-pandemic levels.

Figure 2 indicates that there are significant economies of scale in childcare hours in Kenya: respondent childcare hours increase very little after the first child, with total childcare hours likely determined by the child that requires the most care. Sibling childcare provision may also contribute to these economies of scale. Households with below-school-age children might thus have been less affected by school closures as their existing childcare time allocation could absorb some additional childcare needs. Adults in these households might have even had a smaller childcare burden as school-age siblings provided more childcare while out of school. The importance of sibling childcare suggests that a student returning to school might increase rather than decrease parents' childcare burden, in situations where they were net childcare providers while at home.

3 Empirical Approach

We identify the effect of partial school reopenings through a difference-in-differences analysis comparing outcomes before and after the reopening between households with and without eligible children. We estimate regressions of the form

$$y_{iht} = \alpha + \beta_1 \cdot Post_t \times Treat_h + \beta_2 \cdot Post_t + \mu_h + County_h \times \tau_t + X_{iht} + \epsilon_{iht} \quad (1)$$

y_{iht} are labor supply outcomes for adult (age 18-64) i in household h at time t. $Post_t$ is an indicator for observations after the partial reopening on 12 October 2020. We include observations from May-November, omitting data from after schools fully reopened. $Treat_h$ indicates whether all household children in grades 3-9 were eligible to return to school (treatment), none were eligible (control), or some were eligible and others not (mixed). Household fixed effects μ_h absorb time invariant characteristics of households which may affect labor supply outcomes. County-by-month fixed effects control for common shocks affecting households across locations and over time. Finally, X_{iht} is a vector of individual- and household-level controls. We include individual sex, age, and household head status, the number of adults, young children (age 0-4), and school-age children (5-17) in the household (as household composition sometimes varies across rounds), and household dummies for engagement in agriculture and engagement in enterprise. We cluster standard errors at the household level.

We exploit quasi-random discontinuities in which households are affected by the partial reopening by restricting our control group to households with children in grades adjacent to those eligible to return to school. Identification is based on the argument that unobserved factors that could affect outcomes are continuous around the thresholds of children being in adjacent grades of school. Respondent and household characteristics and labor participation are similar for treatment and control households during the full school closures period (Table A1). Mixed households look different

in terms of household composition by construction as they must have one additional child on average.We focus our analysis on the comparison between control and treatment households. Though we also test for impacts of partial reopening mixed households relative to control, differences in household composition may affect impacts of the partial reopening.[10]

Mean work hours trend almost identically for adults in treatment and control households from February until the partial school reopening in October, and differences after the partial reopening are eliminated after schools fully reopen in January—when all households become 'treated' (Figure A2). Figure 3 shows further evidence of parallel trends in labor participation on the intensive and extensive margins while schools were closed for both women and men. There are no significant impacts of being in a treatment household in the periods prior to the partial reopening while schools were fully closed for women or men, and there is no evidence of anticipation effects in the period from September to October 11.

Our main analyses pool women and men as both contribute to childcare and increased childcare hours during school closures in our sample, though we also test for different impacts by sex, as well as by particular household characteristics.

4 Results

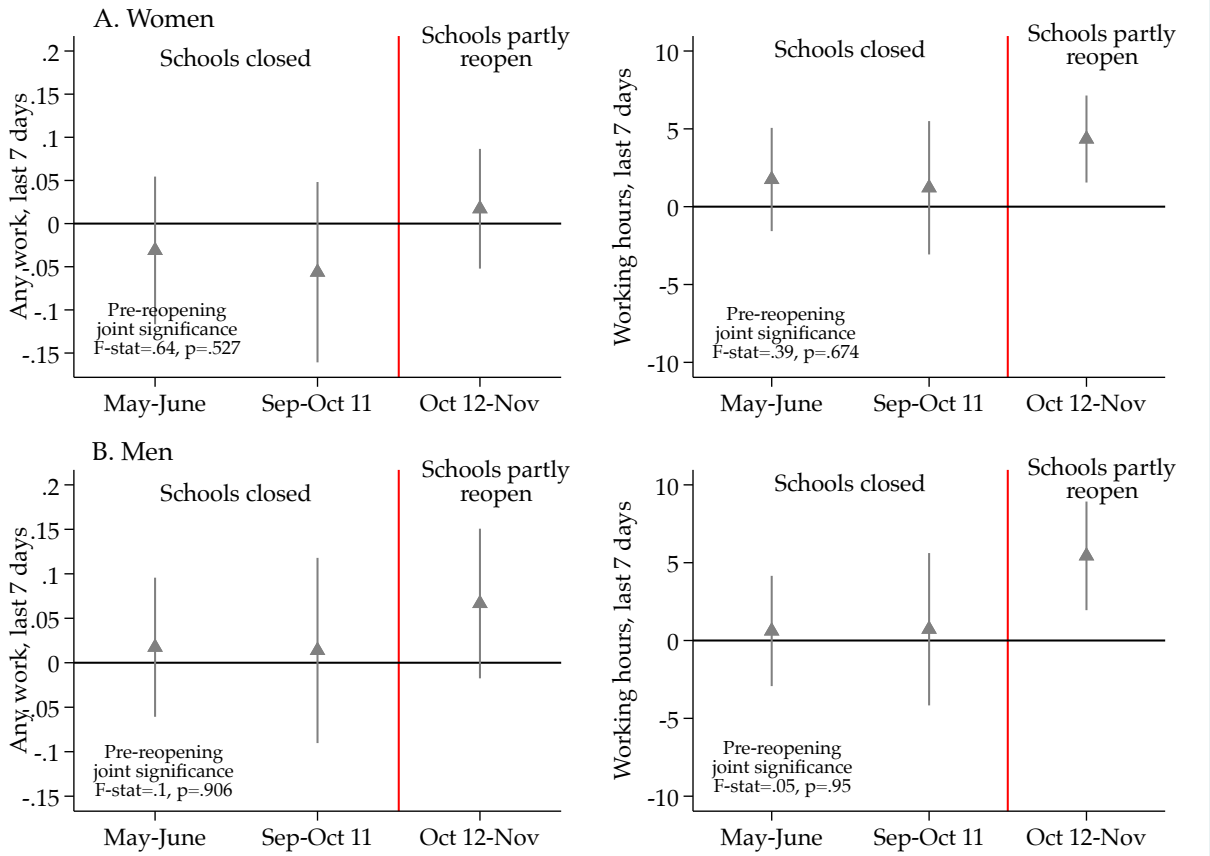
Table 1 presents results for the impacts of partial reopening on labor supply by activity at the individual level. Just 59% of adults ages 18-64 among control households were working in the last 7 days during the school closures period. Mean work hours of 16.4 reflect this large share of adults not working. Work is concentrated in household agriculture, despite 46% of the sample being classified as 'urban'—urban locations include city peripheries, where agriculture remains common. Labor supply does not change in control households after schools partly reopen. This suggests that general labor conditions were not changing, consistent with no major simultaneous pandemic policy changes.

We find no effects of treatment on the extensive margin of labor supply but a large impact on the intensive margin. Work hours in the last 7 days increase by 3.6 (23.2%) relative to adults in control households before schools reopened, driven by a 26.0% increase in household agriculture hours. Greater impacts on household agricultural hours than in wage work or in work participation are not surprising given that we estimate short-term impacts in the weeks following the partial reopening, and household agricultural work is likely more flexible. Changing wage work participation is dependent on employers so may be more constrained in the short term. Increased agricultural work may also be a response to reduced child labor.

Non-significant impacts on household agriculture engagement indicate hours increased primarily among those already engaged in agriculture during school closures. Household agriculture engagement was likely affected less by school closures and other pandemic restrictions than other work activities. Adults may have been more likely to pause their engagement in enterprise—more ex-

10. Results are robust to dropping mixed households from the analysis.

Figure 3: Impact of treatment on labor participation in the last 7 days, by time period



The figures show estimated coefficients and 95% confidence intervals for the interaction between *Treat* and time period from Equation 1 for treatment households, where *Post* is replaced with time period dummies, separately for women (panel A) and men (panel B). Outcomes are any work engagement (left) and total work hours (right) in the 7 days prior to the interview. Treatment 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. We do not show coefficients for mixed households with children in both grade groups. The reference period is July-August, while schools were closed and before the partial reopening was announced. The red bars indicate the timing of Kenya's partial school reopening.

posed to infections and pandemic restrictions as well as potentially more challenging to combine with childcare—and slower to resume these activities.

'Mixed' households with children eligible to return to school as well as children in adjacent grades experience no labor supply impacts of the partial reopening. This is not surprising given what we observe about economies of scale in childcare hours in Kenya: one child returning while another of a similar age stays home is unlikely to decrease adult childcare hours in this context.

Impacts across treatment households are driven more by households with a grade 8 student eligible to return than those with a grade 4 student (Table A3). Though grade 4 children likely require more care than grade 8 children, they also likely contribute less to household agriculture and are more likely to have young siblings, mechanisms we explore in subsection 4.2. Impacts on work hours are smaller in magnitude if we expand our treatment definition to include grade 12 students

Table 1: Impacts of partial school reopening on adult labor supply

	N	Control Mean (SD)	Post (SE)	Post x Treat (SE)	Post x Mixed (SE)
Engaged in any work in last 7 days	8538	0.587	-0.003	0.041	0.030
		(0.492)	(0.031)	(0.026)	(0.026)
Engaged in wage employment in last 7 days	8538	0.062	-0.006	0.011	-0.006
		(0.241)	(0.018)	(0.013)	(0.013)
Engaged in HH agriculture in last 7 days	8538	0.510	0.015	0.037	0.006
		(0.500)	(0.027)	(0.027)	(0.023)
Engaged in HH non-ag enterprise in last 7 days	8538	0.072	-0.007	0.015	0.019
		(0.259)	(0.019)	(0.016)	(0.015)
Total work hours, last 7 days	8538	16.434	0.074	3.630***	-0.569
		(20.027)	(1.806)	(1.365)	(1.413)
Wage hours, last 7 days	8538	1.986	0.053	0.395	-0.367
		(9.374)	(0.731)	(0.565)	(0.582)
Ag hours, last 7 days	8538	11.895	0.575	3.090***	-0.564
		(15.403)	(1.362)	(1.091)	(1.125)
Enterprise hours, last 7 days	8538	2.434	-0.178	0.281	0.036
		(10.023)	(0.681)	(0.625)	(0.630)

This table presents estimates of Equation 1 for individual labor supply. Individuals not working in a given sector are coded as working 0 hours. From left to right, the columns show the dependent variable, number of observations, the control mean prior to the partial reopening, and the impacts of being in the partial reopening period for control households (Post), treatment households (Post x Treat), and mixed households (Post x Mixed). Control households have a child in grades 3, 5, 6, 7, or 9, treatment households have a child in grades 4 or 8, and mixed households have both. 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and county by month fixed effects and controls for household and individual characteristics. Standard errors are clustered at the household level. Data include observations for adults age 18-64 from May to November 2020. Significant treatment impacts on total and agricultural work hours are robust to multiple testing adjustment using FDR q-values.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

also eligible to return to school (Table A3). This result is not surprising as grade 12 students are net providers of household childcare and increase rather than decrease childcare burdens when returning to school.

We conduct a variety of robustness tests (Table A2). Results are unchanged when using individual rather than household fixed effects, when focusing on sub-samples of adults more likely to be parent caregivers and engaged in work, and when defining *Post* not by the date schools reopened but by the date the potential reopening was announced.

4.1 Heterogeneity

We test for heterogeneity in impacts by adult sex and different household characteristics by estimating Equation 1 and fully interacting a characteristic Z with all right-hand side variables other than the household fixed effects, focusing on total working hours (Table 2).[11] Figure 4 displays estimated effects from regressions for sub-samples with particular characteristics.

Impacts of schools reopening on work hours are not significantly different for women (54% of the sample) relative to men. This contrasts with evidence from high-income countries during the pandemic (e.g., Alon et al. (2021) and Collins et al. (2021)), which consistently report larger effects

11. Results are very similar if we consider agricultural hours (Table A4). We note any exceptions in our discussion below.

Table 2: Heterogeneity in impacts of partial school reopening on working hours by individual/-household characteristics

Interaction term Z	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Female	Ag HH	Urban	Large Urban	Above Mean Wealth	Any Kids Aged 0-4	>2 HH Adults
Post	-1.516	-1.047	0.994	0.994	-1.319	-1.322	-4.799*
	(2.330)	(2.222)	(3.214)	(3.227)	(2.644)	(2.737)	(2.710)
Post × Treat	3.793**	1.756	3.337	3.337	6.095**	5.035***	2.598
	(1.785)	(1.820)	(2.127)	(2.136)	(2.590)	(1.945)	(2.086)
Post × Z=1	1.570	-0.591	-1.100	0.698	1.056	-1.526	6.723*
	(1.739)	(3.738)	(4.117)	(5.162)	(3.705)	(3.696)	(3.732)
Post × Treat × Z=1	-0.687	5.485*	-0.280	-1.238	-4.209	-3.376	1.065
	(1.629)	(3.204)	(2.940)	(4.108)	(3.108)	(3.080)	(2.858)
Observations	8538	8538	8538	5172	8538	8538	8538
Mean, pre-reopen control	16.475	16.475	16.475	16.475	16.475	16.475	16.475

This table presents estimates of Equation 1 but interacting a characteristic Z with all right-hand side variables except the household fixed effects. The column label indicates which characteristic Z is being used. Values for household characteristics are from the first time they are observed in the data. '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. 'Above Mean Wealth' is a dummy for whether and index of household wealth, based on housing and asset ownership, is above the sample mean.
The dependent variable is total working hours over the last 7 days, with individuals not working coded as working 0 hours. Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'mixed' households with both (results not shown). 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

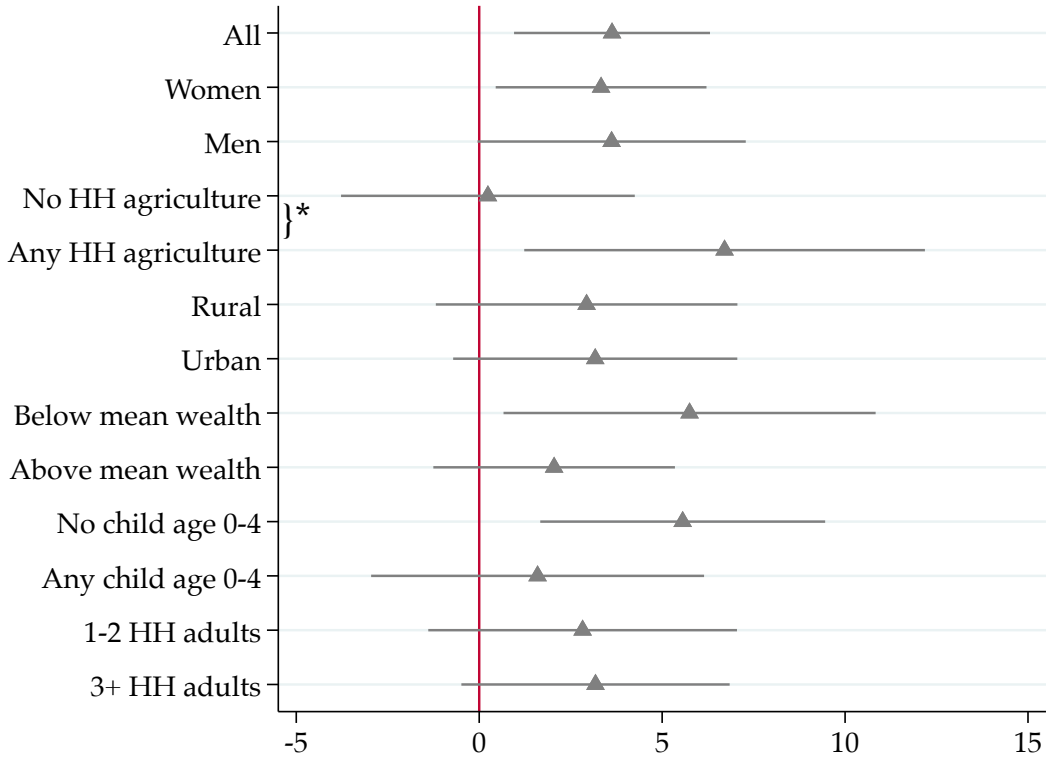
of the pandemic on mothers' labor supply relative to fathers' and other women's, pointing to school closures as the mechanism. But this result aligns with the data on childcare hours in Kenya: responsibilities prior to the pandemic were less gendered than expected prior to the pandemic and both women's and men's hours increase by over one-third during school closures, though women's hours increase by more in absolute terms. A childcare shock in this context could thus affect both parents' labor participation. Different mechanisms may also underlie the similar increases for women and men, which we discuss further in subsection 4.2.

The impact of partial reopening on work hours is over four times as large for adults in agricultural households (61%), defined as households with any agricultural activity. This is consistent with effects on total hours driven largely by household agriculture.[12] Adults in non-agricultural households do not significantly increase work hours, likely reflecting constraints on increase wage or enterprise labor supply in the short term.

We observe no differences in impacts between urban (46%) and rural households. The definition of 'urban' in the data includes many peri-urban areas; over 35% of household classified as urban

12. The difference is larger and significant when considering impacts on agricultural hours (Table A4).

Figure 4: Heterogeneity in impacts of partial school reopening on adult work hours



The figure summarizes estimated coefficients and 95% confidence intervals for the effect of $Post * Treat$ from Equation 1 for sub-samples with specified characteristics. Only coefficients for treatment households are shown. The outcome is total work hours in the 7 days prior to the interview. Results are reported in Table 2. Brackets indicate significant differences between pairs of characteristics. Data include observations from May-November 2020. Household characteristics are from the first time they are observed. Wealth is measured by an index based on housing and asset ownership.

are engaged in agriculture.[13] The sample may also not be representative of all rural households with schoolchildren: sample households must have a mobile phone and are on average better off than the population (Pape et al. 2021). This may further blur the urban/rural distinction in these data. Low take-up of formal childcare services and low wage employment in the data may also limit heterogeneity by urban location.

Adults in poor households increase work hours by more than those in wealthy households, measuring wealth by an index based on housing and asset ownership, though the difference is not significant. Below-mean-wealth households in the analysis sample are around 30 percent more likely to engage in agriculture than wealthier households and so may have been better able to increase work in the short term after the partial reopening, but differences in agricultural hours do not fully explain the difference (Table A4). Wealthier households may also have had resources to better absorb increased childcare burdens during school closures and thus been less affected by the reopening.

We also consider differences by household composition. Households with below-school-age chil-

13. The difference remains insignificant when restricting urban households to those in counties with the largest cities in Kenya (Column 4), though even there 25% of 'urban' households engage in agriculture.

dren aged 0-4 (41%) likely face *increased* childcare burdens when an older sibling returns to school as the role of siblings in childcare may be particularly important in the context of high needs of very young children, while households without below-school-age children may benefit from reduced childcare needs after the partial reopening. Indeed, we observe that the increase in work hours is 3 times larger and only significant in households with no children ages 0-4, consistent with differences in the nature of the childcare shock with reopening by household composition.

Changes in work hours do not differ by whether the household has more than two adults (45%), perhaps due to two competing mechanisms. Households with more adults may have spread out the increased childcare burden during school closures more than households with 1-2 adults. Conversely, they would also better absorb any reduction sibling-provided childcare after the reopening. The competing mechanisms may explain the lack of significant difference.

Different types of work may also be more or less affected by a childcare shock; we consider differences in impacts by individual work participation by sector prior to the pandemic and during the school closures period (Table A5). Increased work hours are driven by adults that were engaged in agriculture in February 2020, consistent with overall impacts driven by agriculture hours. Similarly, works hours only increase after the partial reopening for treated adults that were working at some point during the school closures, reflecting how impacts are concentrated on the intensive rather than the extensive margin of labor supply. Treated adults working for a wage or in household enterprise during school closures do not increase hours after the partial reopening, which again may reflect constraints in increasing hours in these activities in the weeks we observe after reopening.

4.2 Mechanisms

Adults must allocate their limited time across work in different sectors, childcare, other activities, and leisure. Changes in household childcare burdens after the partial school reopening may therefore affect adults' time allocation. The differences in impacts by household composition indicate that positive labor supply effects of the partial reopening are driven by households for whom the childcare shock was likely to be positive. As a proxy for childcare burdens, we directly test for impacts of the partial school reopening on childcare hours using Equation 1, though childcare data are only available for respondents in these survey rounds so we cannot fully capture household-level changes.

Table 3 column 1 shows that respondent childcare hours in the last 7 days do not change significantly for treatment households after the partial school reopening. This is not surprising as most households have multiple children and we observe significant economies of scale in household childcare hours by number of children. Point estimates are negative for treated households with a grade 4 student and positive and larger for the return of older students (Table A3), consistent with older students more likely being net providers of childcare on average. The average impact of treatment on childcare is negative but not significantly different for female respondents.[14]

Household children provide 15-20 hours of childcare per week to their siblings in the period after

14. The positive point estimate on *Post* for women may be due to increased burden of childcare on women during the harvest period.

Table 3: Impacts of partial school reopening on respondent childcare hours and child agricultural labor

	Respondent Childcare Hours						Child Ag. Hours	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	0.253	6.414	-6.786	-10.657	1.995	5.817	0.829	0.744
	(6.443)	(9.764)	(9.798)	(13.736)	(12.157)	(17.687)	(1.084)	(2.862)
Post × Treat	0.461	-0.575	-5.972	-11.648	-3.170	-6.997	-1.480**	-2.635
	(5.032)	(6.922)	(6.960)	(10.601)	(9.311)	(16.262)	(0.739)	(1.758)
Post × Any child age 0-4			17.426	49.104**				
			(13.770)	(23.043)				
Post × Treat × Any child age 0-4			8.394	39.520**				
			(11.204)	(19.482)				
Post × Any child age 0-8					0.670	5.050		-0.636
					(14.686)	(23.237)		(3.125)
Post × Treat × Any child age 0-8					5.729	9.185		1.715
					(11.563)	(18.999)		(1.992)
Observations	3073	1722	3073	1722	3073	1722	3077	3077
Control Mean	52.743	59.905	52.743	59.905	52.743	59.905	3.848	3.848
Adult Sex	Both	Women	Both	Women	Both	Women	-	-

This table presents estimates of Equation 1 for respondent childcare hours (columns 1-6) and total household child agriculture hours (columns 7-8). Dependent variables are defined over the last 7 days. Childcare hours are not measured for household adults besides the respondent in these survey rounds. Households not engaged in agriculture are coded as having 0 child agriculture hours. Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'mixed' households with both (results not shown). 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

schools fully reopen (Figure 2) and likely provided more during school closures. Though childcare needs could fall after the partial reopening in households without younger children in the home still requiring large amounts of care, if the sibling returning to school was a net provider of childcare this could increase adult childcare hours. Given what we observe about the role of siblings and economies of scale in childcare in the sample, children in grades 4 and 8 (typically around age 9 and 13) are likely net providers of childcare when home from school in households with younger children. Their return to school would thus *increase* the childcare burden on adults. In households without younger children, the return to school of these students would instead decrease that burden.

Columns 3-6 of Table 3 support this, showing increased childcare hours for treated adults with young children and decreases for those without.[15] Differences are more pronounced by the presence of below-school-age children (ages 0-4) than by the presence of younger children more generally (ages 0-8), consistent with much higher childcare needs of very young children.

Labor supply effects of the partial school reopening by presence of below-school-age children are consistent with these childcare differences: positive impacts of the partial school reopening are

15. Control adults—particularly women—with young children also increase childcare hours following reopening. We suspect this reflects a general household reallocation of childcare responsibilities toward women during the harvest period which coincides with the reopening.

driven by households without below-school-age children (Table 2). Adults increase their work hours when the partial reopening constitutes a positive childcare shock (the student returning to school is a net childcare recipient) but not when it is a negative shock (the student is a net childcare provider). These results highlight the importance of sibling-provided childcare and the role of childcare in explaining labor supply impacts of the reopening.

Results indicate that childcare may only be particularly gendered for care of the youngest children. Women in treatment households with children ages 0-4 increase childcare by 39 hours more than women without after the partial reopening in households, a much larger difference than for men. Positive impacts of treatment among households without young children are driven more by women, suggesting the childcare mechanism is more important for women, but limited reductions in childcare hours on average may help explain the lack of significant difference in impacts of the partial school reopening by sex.

School reopenings may also affect adult work hours through the loss of child labor, particularly as the timing coincides with the main harvest season for most households in Kenya. Nearly 40% of agricultural households with children in grades 3 through 9 report that their children contribute to household agriculture.[16] Children combined to work an average of 4.6 hours per week on household farms during the school closures period across all households engaged in agriculture, around 9% of total household agriculture hours. This increases to 18.1 hours per week (28.6% of the total) for farm households with non-0 child agricultural hours. Part of treatment adults' increase in agriculture hours after partial reopening may therefore be driven by the need to make up for reduced child labor on the farm when a child returns to school.

Estimated impacts of schools reopening on child agricultural labor are negative and significant for treatment households (Table 3 Columns 7-8). A reduction of 1.48 hours suggests that students are not able to contribute as many hours when they return to school. Reductions are larger in households without other young children to make up for the lost child labor. For a two-parent household, the reduction in child labor represents 23.9% of the increase in adult work hours on the household farm. Substitution for lost child agricultural labor could thus explain part but not all of the impacts on adult work hours we observe.

This mechanism could also help explain similar impacts of the partial reopening for women and men: the impact of partial reopening on agricultural hours is larger for men than for women (Table A4). As women are more responsive to the change in childcare burdens and men to the change in child agricultural labor, these combined mechanisms could lead to similar impacts of the reopening for both women and men. Child labor could also contribute to the significantly different impacts by household wealth: poor households engaged in agriculture are 20.8% more likely to report child labor than more wealthy households.

Finally, though there were no additional fees incurred when schools reopened, adults may have also increased labor supply to generate income to pay for materials, meals, and extra lessons. Such

16. This appears consistent with Moyi (2011) who reports that around 30% of Kenyan children ages 6-14 engage in farm work (often alongside attending school). Child farm labor may be underreported but is not correlated with treatment prior to the partial reopening (Table A1).

costs would be higher for students in grade 12 than in grades 4 or 8. Estimated impacts of the partial reopening are smaller when including households with grade 12 children in the sample (Table A3). Given expected differences in school-related costs, net childcare burden, and child agricultural labor by student grade, smaller increases in parent work hours for a grade 12 student returning to school relative to a younger student suggest childcare burdens are the main mechanism, rather than school-related costs and child agricultural labor.

5 Discussion

How do the labor supply effects of the positive shock of partial school reopenings compare to the initial labor supply reductions at the onset of the pandemic in Kenya? Using recall data on respondents' labor supply in February 2020, we find that labor participation across adults ages 18-64 in Kenya fell from 76% before the pandemic to 59% in May-July.Average working hours in the last 7 days also fell, from 23.9 hours in February to 16.9 hours in May-July.[17] For respondents ages 18-64 in our analysis sample households, average weekly hours fell from 30.4 in February to 19.3 in May-July. Adult work hours in the last 7 days increased by 3.6 after the partial reopening, corresponding to 32.4% of the pandemic reduction in work hours in this sample.

The partial reopening only affected a subset of children older than those with the greatest childcare needs, whereas initial closures affected all school-age children. Reducing labor supply is also likely easier than increasing it, reflected in the lack of significant impacts of the partial reopening outside of household agriculture hours. Considering impacts of the partial school reopening should thus provide a conservative estimate of the contribution of school closures to initial pandemic labor participation decreases.

Increasing work hours for adults in households with school-age children (66.4% of households) during the school closure period by our estimate of the amount they increased due to the partial reopening reduces the drop in average work hours from February to May-July among all adults nationally from 7.0 hours to 4.8 hours. We therefore estimate that school closures account for (at least) 30% of the pandemic decrease in work hours.

Across Kenya's labor force of 23.7 million (ILO 2021), a reduction of 2.2 work hours per week over the period of the school closures adds up to over 2.1 billion hours, or USD 2.96 billion at the average hourly income observed in our sample—3.1% of Kenya's 2019 GDP. This is a simplified back-of-the-envelope calculation making many assumptions and focusing just on labor supply of adults in the household, but provides a likely conservative rough estimate of the magnitude of the labor supply impact of Kenya's school closures.

A better understanding of the labor supply impacts of school closures may inform discussion of school closures as a policy response to a resurgent COVID-19 or a future pandemic.

Although the childcare shock we analyze takes place in the context of a global pandemic, the results on labor supply impacts will continue to have relevance as the pandemic is unfortunately

17. Among those working, hours fell from 39.7 to 29.2.

unlikely to be completely overcome in many countries in the immediate future. For example, after fully reopening schools in January 2021, Kenya closed them again in late March after a spike in COVID-19 cases before reopening again in mid-May. Further, although some pandemic-related restrictions were still in effect at the time schools partly reopened in Kenya in October 2020, many had been relaxed, so the estimated impacts of a childcare shock may generalize to similar settings with some ongoing COVID-19 caseloads and basic government policies around public health and safety—likely to be the new normal moving forward.

6 Conclusion

We present some of the first nationally-representative results for the impacts of childcare on labor supply in an African or LMIC setting, using pandemic-related school closure policy changes as exogenous childcare shocks. Having a child eligible to return to school increases adult labor supply in the weeks after schools partially reopen, particularly in household agriculture hours. Increases are driven by less wealthy households who are more engaged in agriculture and may have been less able to cope with the shock of schools closing. Based on our results we estimate that school closures account for at least 30% of the decrease in average work hours observed during the first few months after the first COVID-19 cases in Kenya and cost the economy 2.3 billion USD.

Unlike studies of pandemic school closures in high-income countries, impacts of the partial school reopening in Kenya are not concentrated primarily among women. Men in our sample contribute a large amount of time to childcare (though less than women), and may also be responding to changes in child agricultural labor. In the many households where eligible students were likely net childcare providers, women bear more of the increased burden when they return to school, preventing increases in labor supply experienced by women in households where the reopening was a positive childcare shock. One student returning to school—particularly older students who may also provide household childcare—thus may not sufficiently reduce childcare needs on average for gendered differences to emerge. Some studies of changes in childcare availability or cost in Africa report significant impacts for men as well as women (Bjorvatn et al. 2021; Martinez, Naudeau, and Pereira 2012), but others focus exclusively on women (Clark et al. 2019; Lokshin, Glinskaya, and Garcia 2000; Quisumbing, Hallman, and Ruel 2007). Better data on how childcare burdens are allocated across all household members and other providers would help to shed light on the intra-household distributional impacts of childcare shocks in this context.

Our study generates three main policy-relevant takeaways. First, parents in Kenya appear to have limited feasible options for dealing with an increase in their childcare burden beyond reducing their work hours or combining work and childcare. This is true despite many households having additional adults, many parents being engaged in potentially more flexible household farm and non-farm enterprises, and adults working just 24 hours a week on average (less than 'full-time') before the pandemic.

Second, the cost of childcare may be a greater barrier than availability in this context. Older

siblings are an important source of (unpaid) childcare, and the results suggest that the partial school reopening increased the childcare burdens for parents with younger children when sibling caregivers returned to school.This indicates that either households lack alternative childcare options or their cost is more than adults could earn by working instead of caring for children themselves. Sample households report almost no childcare provision by non-household members, and several studies point to high costs as a main constraint to Kenyan parents in using formal childcare centers, and advocate for public subsidies to facilitate access (Clark et al. 2021; Murungi 2013). Policies aiming to increase availability of childcare may therefore be less effective if they are not complemented by policies to reduce cost.

Third, the timing of when children are in school affects some households through a reduction in child agricultural labor: treatment adults increase agriculture hours after the partial school reopening partly to make up for reduced child farm labor. Kenya's pandemic school closures pushed back two academic terms from 2020 to 2021, and efforts to gradually shift back toward the pre-pandemic academic calendar over 2021-2023 will change the timing of school terms and breaks relative to the agricultural cycle. This will affect whether children are in school during the main October-November harvest period in Kenya, with implications for households that rely partly on child labor. Given the role of children in agricultural household production, future work could consider how these changes affect parents' labor allocation, children's school attendance, demand for hired farm labor, and other household production decisions.

The results have relevance to other policies affecting household childcare burdens. If we expect that childcare needs are decreasing in child age, we would expect the impacts on labor supply we observe to be lower bounds on the impact of a policy that gives households access to free full-day childcare for young children during the working week (as schools implicitly provide for older children). Clark et al. (2019) show that subsidies for childcare centers increase labor supply for women in an informal settlement in Nairobi. Our results indicate such policies could have positive effects outside urban settings and also for men. Women could particularly benefit from policies that allow them to maintain labor market attachment while children are very young. Older children might also benefit from reduced need to care for younger siblings.

Finally, the large magnitude of the labor supply effects of the partial school reopening highlights another point that is often underappreciated: universal primary school (now close to reality across the globe), pre-school, and other forms of childcare may play a substantial role in increasing adult labor supply and promoting economic growth, and are a key component of development.

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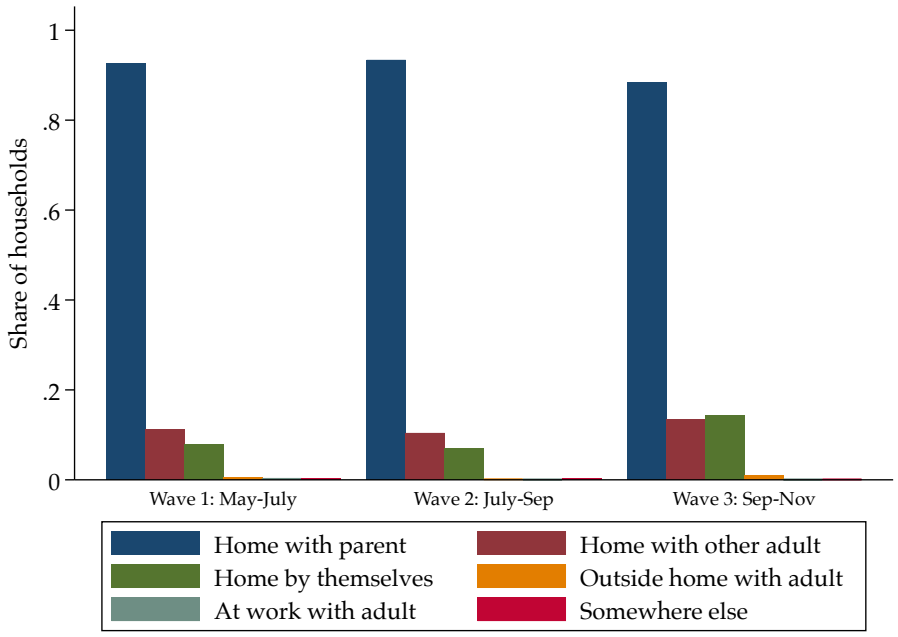
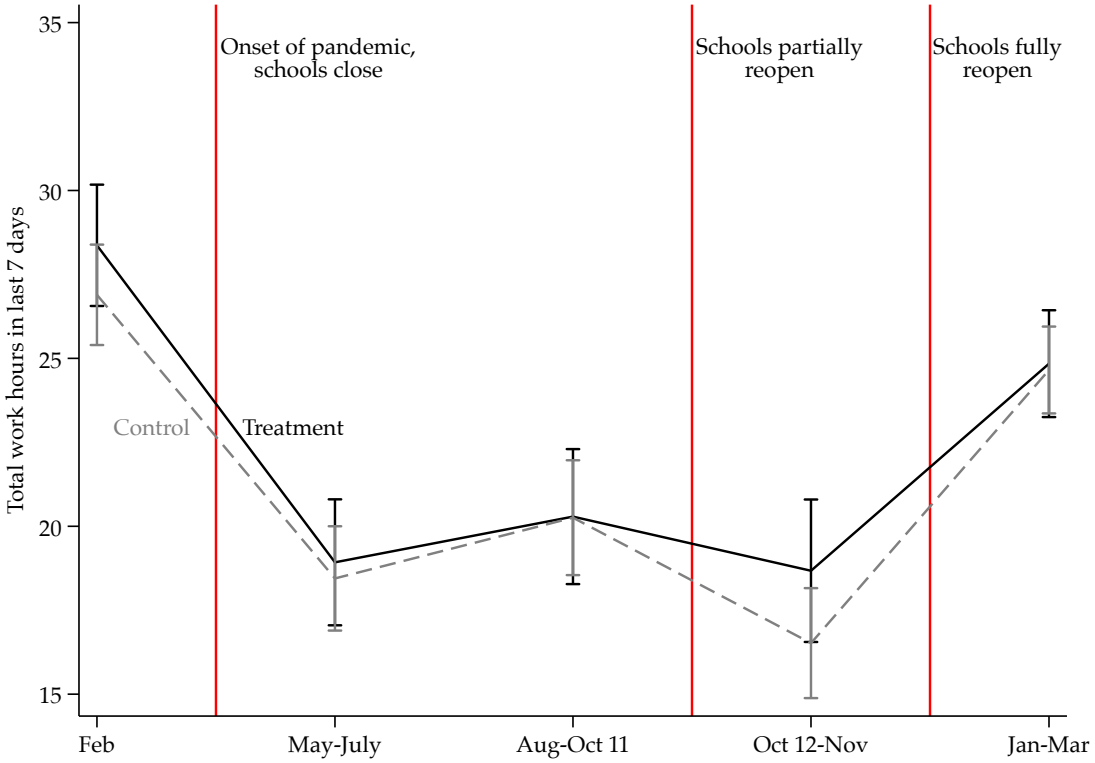
Appendix A: Additional Figures

Figure A1: Childcare arrangements when children are out of school



Respondents are asked to specify all of the situations where a randomly selected child spent at least some time when out of school in the past week. 'Somewhere else' combines 'daycare/other childcare' and 'at home with a maid/domestic helper.' The figure uses information on childcare arrangements for all children, but the distribution is nearly identical when considering only children in grades 3-9.

Figure A2: Work hours in the last 7 days by survey round and treatment status



The figure shows raw means and 95% confidence intervals for household respondents' total work hours in the last 7 days by treatment status in each time period. Means are shown for the respondent only due to missing data on pre-pandemic working hours for other household adults. Treatment 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. We do not show means for mixed households with children in both grade groups.
Data for February are based on recall from the first time a respondent is surveyed. We combine observations from the first two weeks of survey round 3, before the partial school reopening, with data from round 2. The red bars indicate changes in Kenya's school closures policy. The fall in hours after the partial reopening for control households reflects the end of main harvest period in Kenya, as 64% of households are engaged in agriculture.

Appendix B: Additional Tables

Table A1: Baseline balance by treatment status

	Control HH Mean	N	Mixed HH Mean	N	Treatment HH Mean	N	C-T p-value	C-M p-value
Respondent characteristics								
Age	40.02	948	41.26	361	41.28	335	0.102	0.079
Female	0.59	948	0.58	361	0.56	335	0.306	0.778
Completed primary school	0.88	945	0.84	361	0.87	335	0.524	0.070
Completed secondary school	0.48	945	0.42	361	0.47	335	0.753	0.048
Completed school beyond secondary	0.15	945	0.13	361	0.17	335	0.392	0.350
Married	0.74	937	0.8	356	0.72	328	0.396	0.020
Is the household head	0.63	948	0.63	361	0.65	335	0.516	0.791
Household characteristics								
Female household head	0.29	948	0.26	361	0.3	335	0.800	0.309
Age of household head	44.43	948	45.29	361	46.03	335	0.038	0.238
Count adults	2.55	948	2.75	361	2.64	335	0.289	0.015
More than 2 household adults	0.4	948	0.49	361	0.41	335	0.843	0.003
Only 1 household child	6.78	948	6.15	361	6.99	335	0.418	0.007
Age of youngest household child	0.42	948	0.43	361	0.36	335	0.033	0.648
Any young (0-4) children	0.66	948	0.71	361	0.66	335	0.800	0.058
Count young (0-4) children	0.56	948	0.63	361	0.46	335	0.040	0.199
Count school (5-17) children	2.47	948	3.26	361	2.35	335	0.143	0.000
Count adolescent (10-17) children	1.64	948	2.7	361	1.59	335	0.465	0.000
Household wealth index	-0.06	948	-0.15	361	0.03	335	0.169	0.113
Connected to electricity grid	0.46	948	0.41	361	0.51	335	0.111	0.105
Urban household	0.46	948	0.47	361	0.47	335	0.620	0.764
Household engaged in agriculture	0.61	948	0.65	361	0.59	335	0.573	0.217
Any child engaged in household farm labor	0.26	948	0.33	361	0.24	335	0.593	0.019
Household engaged in enterprise	0.15	948	0.16	361	0.19	335	0.134	0.683
Respondent labor participation								
Engaged in any work in last 7 days	0.68	948	0.67	361	0.7	335	0.534	0.888
Engaged in wage employment in last 7 days	0.1	948	0.08	361	0.13	335	0.211	0.150
Engaged in HH agriculture in last 7 days	0.55	948	0.6	361	0.53	335	0.479	0.171
Engaged in HH non-ag enterprise in last 7 days	0.09	948	0.1	361	0.13	335	0.100	0.563
Engaged in any work in February 2020	0.82	948	0.84	361	0.86	335	0.088	0.344

The table presents means for treatment households (T) with a child in grade 4 or 8, control households (C) with a child in grade 3, 5, 6, 7, or 9, and mixed households (M) with a child in both grade groups. Data are from the first time a household is observed, typically in survey round 1 (May-early July) while schools were fully closed. Individual-level data are for the survey respondent.

Columns on the right present differences and means and p-values for tests of equality for control households compared to treatment and mixed households, separately. The joint F-stat for differences across control and treatment households is 1.12, with p-value 0.305. It is 4.37 (p<0.001) for differences across control and mixed households.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Robustness of results

Panel A: Individual fixed effects

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.041	0.009	0.037	0.016	3.735***	0.314	3.203***	0.368
	(0.026)	(0.013)	(0.027)	(0.016)	(1.367)	(0.565)	(1.089)	(0.628)
Observations	7765	7765	7765	7765	7765	7765	7765	7765
Mean, pre-reopen control	0.593	0.062	0.518	0.065	16.372	2.051	12.068	2.209

Panel B: Adults age 25-50

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.009	0.005	0.033	0.031*	4.017***	0.029	3.511***	0.807
	(0.028)	(0.018)	(0.026)	(0.016)	(1.509)	(0.757)	(1.142)	(0.761)
Observations	5362	5362	5362	5362	5362	5362	5362	5362
Mean, pre-reopen control	0.600	0.083	0.499	0.082	17.480	2.685	11.807	2.916

Panel C: Potential parents and sole caregivers

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.024	0.011	0.042*	0.016	3.448**	0.419	3.007***	0.197
	(0.026)	(0.017)	(0.024)	(0.015)	(1.436)	(0.705)	(1.123)	(0.671)
Observations	6118	6118	6118	6118	6118	6118	6118	6118
Mean, pre-reopen control	0.606	0.079	0.515	0.075	17.568	2.589	12.277	2.616

Panel D: Post defined by timing of reopening announcement, 21 Sept 2020

	(1) Any work	(2) Wage work	(3) HH ag.	(4) HH ent.	(5) Total hrs	(6) Wage hrs	(7) HH ag hrs	(8) HH ent hrs
Post × Treat	0.015	0.007	0.017	0.014	2.725**	0.292	2.113**	0.387
	(0.023)	(0.012)	(0.023)	(0.015)	(1.213)	(0.504)	(0.953)	(0.562)
Observations	8538	8538	8538	8538	8538	8538	8538	8538
Mean, pre-reopen control	0.604	0.062	0.531	0.065	16.730	2.024	12.439	2.211

This table presents estimates of variations of Equation 1. Panel A replaces household with individual fixed effects. Panel B focuses on adults age 25-50—the most likely to be parent caregivers and engaged in work. Panel C includes only adults identified as potential parents—between 14 and 55 years older than the oldest household child—or sole caregivers (the only household adult). Panel D defines *Post* not by the date schools reopened on 12 October 2020 but by the timing it was announced, 27 September.
Dependent variables are defined over the last 7 days, and take a value of 0 for individuals not working in a particular activity. Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'mixed' households with both (results not shown). 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household (individual in Panel A) and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Heterogeneity in impacts of partial reopening by grade of child eligible to return to school

Panel A: All analysis households

	(1) Any work	(2) Wage work	(3) HH ag. work	(4) HH ent. work	(5) Total hrs	(6) Wage hrs	(7) HH ag. hrs	(8) HH ent. hrs	(9) Childcare hrs
Post × Treat	0.041	0.011	0.037	0.015	3.630***	0.395	3.090***	0.281	0.460
	(0.026)	(0.013)	(0.027)	(0.016)	(1.365)	(0.565)	(1.091)	(0.625)	(5.031)
Observations	8538	8538	8538	8538	8538	8538	8538	8538	3,073
Mean, pre-reopen control	0.592	0.063	0.517	0.064	16.483	2.089	12.124	2.205	52.743

Panel B: Analysis households with a child in grades 2-6

	(1) Any work	(2) Wage work	(3) HH ag. work	(4) HH ent. work	(5) Total hrs	(6) Wage hrs	(7) HH ag. hrs	(8) HH ent. hrs	(9) Childcare hrs
Post × Treat	0.017	0.002	0.012	0.027	1.586	0.450	1.558	-0.278	-1.322
	(0.033)	(0.018)	(0.033)	(0.019)	(1.668)	(0.833)	(1.295)	(0.864)	(6.414)
Observations	6724	6724	6724	6724	6724	6724	6724	6724	2453
Mean, pre-reopen control	0.592	0.066	0.511	0.070	16.679	2.148	12.023	2.414	52.950

Panel C: Analysis households with a child in grades 6-10

	(1) Any work	(2) Wage work	(3) HH ag. work	(4) HH ent. work	(5) Total hrs	(6) Wage hrs	(7) HH ag. hrs	(8) HH ent. hrs	(9) Childcare hrs
Post × Treat	0.024	0.014	0.049	0.005	4.926***	0.152	4.724***	0.256	1.781
	(0.033)	(0.017)	(0.035)	(0.021)	(1.809)	(0.737)	(1.490)	(0.695)	(6.168)
Observations	6282	6282	6282	6282	6282	6282	6282	6282	2235
Mean, pre-reopen control	0.597	0.059	0.528	0.061	16.676	1.929	12.590	2.121	53.812

Panel D: Include grade 12 in treatment definition

	(1) Any work	(2) Wage work	(3) HH ag. work	(4) HH ent. work	(5) Total hrs	(6) Wage hrs	(7) HH ag. hrs	(8) HH ent. hrs	(9) Childcare hrs
Post × Treat	0.043	0.014	0.049*	0.015	3.057**	0.554	2.449*	0.131	0.705
	(0.028)	(0.014)	(0.029)	(0.018)	(1.556)	(0.592)	(1.285)	(0.664)	(4.873)
Observations	9407	9407	9407	9407	9407	9407	9407	9407	3387
Mean, pre-reopen control	0.586	0.063	0.509	0.063	16.033	2.076	11.804	2.081	52.151

Panel E: Analysis households with a child in grades 10-12

	(1) Any work	(2) Wage work	(3) HH ag. work	(4) HH ent. work	(5) Total hrs	(6) Wage hrs	(7) HH ag. hrs	(8) HH ent. hrs	(9) Childcare hrs
Post × Treat	0.018	-0.019	0.081	0.018	0.260	0.767	1.143	-1.284	4.021
	(0.066)	(0.052)	(0.071)	(0.053)	(5.984)	(1.917)	(5.433)	(1.770)	(11.853)
Observations	2547	2547	2547	2547	2547	2547	2547	2547	841
Mean, pre-reopen control	0.648	0.054	0.565	0.083	18.414	1.978	13.403	2.860	46.725

This table presents estimates of Equation 1 for different sub-samples. Panel A includes all households in the main analysis sample (with children in grades 3-9). Panel B focuses on the subset of analysis households with a child in grades 2-6, for which treatment means having a child in grade 4 eligible to return to school. Panel C is analogous for but children in grade 8. Panel D expands the sample to include households with a child in grade 12 in the treatment group and households with a child in grades 10 or 11 in the control group. Panel E focuses on households with a child in grades 10-12, for which treatment means having a child in grade 12. In panels B, C, and E, households with a child in another treated grade outside the focus range are categorized as 'mixed.'
Dependent variables are defined over the last 7 days, and take a value of 0 for individuals not working in a particular activity. Childcare hours are observed for the household respondent only. Observations include data from May to November 2020. Results for 'mixed' households with children eligible to return to school as well as other children in nearby grades are not shown. All regressions include household and county by month fixed effects, and additional household controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Heterogeneity in impacts of partial school reopening on adult agriculture hours by individual/household characteristics

Interaction term Z	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Female	Ag HH	Urban	Large Urban	Above Mean Wealth	Any Kids Aged 0-4	>2 HH Adults
Post	0.014	0.546	1.075	1.075	0.240	-1.232	-1.002
	(1.495)	(1.440)	(2.298)	(2.302)	(2.115)	(1.890)	(1.804)
Post × Treat	4.021***	0.984	3.030*	3.030*	5.386**	3.314**	3.030*
	(1.282)	(1.074)	(1.799)	(1.802)	(2.224)	(1.664)	(1.635)
Post × Z=1	-0.577	-2.876	-1.140	2.115	-0.933	0.133	1.556
	(0.890)	(2.804)	(2.917)	(3.629)	(2.773)	(2.690)	(2.769)
Post × Treat × Z=1	-0.989	6.278**	0.107	-3.624	-2.917	-0.414	0.312
	(0.914)	(2.558)	(2.337)	(2.570)	(2.550)	(2.485)	(2.301)
Observations	8538	8538	8538	5177	8538	8538	8538
Mean, pre-reopen control	16.475	16.475	16.475	16.475	16.475	16.475	16.475

This table presents estimates of Equation 1 but interacting a characteristic Z with all right-hand side variables except the household fixed effects. The column label indicates which characteristic Z is being used. Values for household characteristics are from the first time they are observed in the data. '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. 'Above Mean Wealth' is a dummy for whether and index of household wealth, based on housing and asset ownership, is above the sample mean.
The dependent variable is household agriculture hours over the last 7 days, with individuals not working in household agriculture are coded as working 0 hours. Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'mixed' households with both (results not shown). 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Heterogeneity in impacts of partial school reopening on working hours by prior work

Interaction term Z	(1) Baseline Any	(2) Baseline Wage	(3) Baseline HH Ag	(4) Baseline HH Ent	(5) Closures Any	(6) Closures Wage	(7) Closures HH Ag	(8) Closures HH Ent
Post	-3.525	-0.345	-5.835	-2.436	1.248	-0.797	0.215	-0.806
	(2.767)	(1.833)	(4.320)	(2.586)	(2.301)	(1.772)	(2.481)	(1.843)
Post × Treat	3.474	2.918**	-0.953	4.500**	-1.281	3.290**	1.174	3.835***
	(2.429)	(1.420)	(3.188)	(2.154)	(1.873)	(1.394)	(1.937)	(1.421)
Post × Z=1	3.923	-10.741*	4.100	-14.419*	-2.055	6.325	-0.243	-0.336
	(2.704)	(6.105)	(5.422)	(7.998)	(3.016)	(6.224)	(3.339)	(6.113)
Post × Treat × Z=1	0.356	4.508	8.180**	0.782	5.290**	-1.348	4.150	-3.827
	(2.650)	(4.925)	(4.067)	(6.985)	(2.459)	(5.231)	(2.671)	(4.708)
Observations	8538	8538	2912	2912	8146	8146	8146	8146
Mean, pre-reopen control	16.475	16.475	16.475	16.475	16.475	16.475	16.475	16.475

This table presents estimates of Equation 1 but interacting a characteristic Z with all right-hand side variables except the household fixed effects. The column label indicates which characteristic Z is being used. 'Baseline' work participation is based on recall for February 2020, and is limited to the respondent for household agriculture and enterprise. 'Closures' work participation is based on any participation in a given sector from May-October 2020. The dependent variable is total working hours over the last 7 days, with individuals not working are coded as working 0 hours. Observations include data from May to November 2020, and include treatment households with children in grades 4 or 8 (indicated by 'Treat'), control households with children in an adjacent grade, and 'mixed' households with both (results not shown). 'Post' is a dummy for being observed on or after the partial school reopening on October 12. Regressions include household and county by month fixed effects, and additional household and individual controls. SEs clustered at household level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix C: 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 D: 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. 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 individual-level regression analyses, but do apply them for population-level inference based on our results.

The surveys include information on household composition, labor outcomes for household adults, and child schooling and care, as well as more general household information and COVID-specific modules. We use data from the first four rounds of the RRPS, covering May 2020-March 2021 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. Each round lasted approximately 2.5 months and covered a representative cross-section of households each week within each wave.

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).[18] The surveys also ask respondents for their hours spent on childcare in the last 7 days.[19] Childcare hours from other providers, including other household adults, all household children combined, and all non-household members combined are included in round 4 only.

18. 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).

19. 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.