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

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**Abstract**

This paper identifies the impact of a shock to adolescent school availability—potentially affecting both household childcare burdens and child labor—on adult labor supply in the context of COVID-19-related school closures in Kenya. We compare changes in outcomes after schools partially reopened in October 2020 for households with children in a grade eligible to return against those with children in adjacent grades. Using nationally-representative bi-monthly panel data, we find that an adolescent returning to school increases adults' weekly work by 4.3 hours (27%) in the short run, concentrated among the most flexible margins of adjustment and particularly household agriculture. Contrary to evidence from high-income settings, overall effects are not gendered. We find no effects of the partial reopening on respondent childcare hours and heterogeneity in labor supply effects by household characteristics does not align with predictions based on a childcare mechanism. Instead, the results indicate that increased adult work hours substitute for reduced child work in household agriculture as a child goes back to school. Impacts on labor supply are driven by less wealthy households with children engaged in household agriculture, while wealthier agricultural households substitute child labor with increased hired labor. Our results show that adolescent schooling has important consequences for household production and labor supply decisions. Poor agricultural households face particularly high opportunity costs for children's education.

**JEL codes:** D13, J13, J22, J43, O17

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An Online Appendix is available.

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# 1 Introduction

Children in many low-and middle-income countries (LMICs) play an important role in household productive activities (Rosenzweig and Evenson 1977; Kielland and Tovo 2006). Around 20 percent of children in Sub-Saharan Africa are estimated to engage in child labor, primarily concentrated in household farm work (ILO 2017a; UIS and UNICEF 2017), and more contribute to household production without being formally considered child laborers (Bourdillon 2006). In addition to household production, children also contribute to the care of younger siblings (Jakiela et al. 2020; Levison and Moe 1998; Qureshi 2018). These contributions to household production increase the opportunity cost of children attending school, and several studies have explored how households respond to this trade-off.[1] Children's roles as recipients of childcare and providers of household labor may also affect adult labor supply decisions. In this paper, we study the effects of changes in children's school availability on adult labor supply in the context of COVID-19 school closures in Kenya.

In 2020, countries around the world closed schools in response to the COVID-19 pandemic. Studies have shown that these closures led to learning loss and other adverse outcomes for affected children, with little evidence that they significantly reduced COVID-19 transmission and morbidity.[2] In addition, a large literature shows that school closures affected the labor supply of students' parents.[3] These studies tend to find greater reductions in labor supply for mothers with school-age children and point to increases in childcare burdens as the main mechanism.[4]

Most of these studies consider high-income countries, however, and school closures may have had different effects in Sub-Saharan Africa countries. A greater share of labor is concentrated in informal family farm or non-farm enterprise work (ILO 2017b), with women and mothers in particular more likely than men to be engaged in such work (Lo Bue et al. 2021). To the extent these activities are more accommodating of childcare needs than wage employment, school closures may have been less of a childcare shock. Moreover, the use of formal early childhood care is also low in these settings (Samman et al. 2016), meaning more care may already have been concentrated within the household. Importantly, unlike children in LMICs, those in high-income countries rarely contribute to household production activities. The COVID-19 school closures reduced the opportunity cost of having children work on the household farm, and increases in child labor and children's work at home were reported in many LMIC countries during this period (Habib et al. 2024). For example, in Uganda the share of children engaged in child labor increased from 21% in 2019 to 36% in 2020

1. See e.g., Basu and Van (1998), Beegle, R. Dehejia, and Gatti (2009), Levison and Moe (1998), Edmonds (2006), Ray (2000), Rosenzweig and Evenson (1977), and Shah and Steinberg (2021).

2. Engzell, Frey, and Verhagen (2021), Felfe et al. (2023), Hume, Brown, and Mahtani (2023), Jack and Oster (2023), Munro et al. (2023), and Singh, Romero, and Muralidharan (2024).

3. See e.g., Albanesi and Kim (2021), Alon et al. (2022), Amuedo-Dorantes et al. (2023), Collins et al. (2021), Couch, Fairlie, and Xu (2022), Del Boca et al. (2020), Furman, Kearney, and Powell (2021), Giurge, Whillans, and Yemiscigil (2021), Hansen, Sabia, and Schaller (2024), Heggeness (2020), Liu, Wei, and Xu (2021), Prados and Zamarro (2021), and Zamarro and Prados (2021))

4. Unlike school breaks or vacations, pandemic closures were generally of undetermined duration and were concurrent with restrictions on alternative sources of childcare, limiting parents' ability to cope.

while schools were closed (UBOS 2021). Adults may also have benefited from adolescents being home and being able to take on some care responsibility for younger siblings, potentially reducing the intensity of adult childcare burdens even if their care responsibilities increased overall. It is therefore not clear *a priori* how changes in adolescent school availability in Kenya affect adult labor supply and whether childcare or child labor mechanisms are more important.

This paper leverages COVID-19 school closure policies in Kenya as exogenous shocks to provide empirical estimates of the causal impact of school availability on adult labor supply and the intra-household allocation of productive activities in a LMIC setting. Kenya closed all schools nationwide after its first COVID-19 case in March 2020, partially reopened schools for specific grades in October 2020, and fully reopened schools for all grades in January 2021. We exploit the quasi-random variation in when children enrolled in different grades were eligible to return to school to implement a difference-in-differences analysis comparing changes in labor supply after the October partial reopening for adults in households with children in grades 4 or 8—eligible to return (99% did)—against those with children in adjacent grades. We show that observable characteristics of eligible households are statistically indistinguishable from those with children in adjacent grades, and provide support for the parallel trends assumption. Our data consists of a nationally representative bi-monthly panel from the Kenya COVID-19 Rapid Response Phone Survey (RRPS), including information on household composition, adult labor supply, childcare, and child labor. The timing of surveys is ideally suited for our study, with two rounds conducted when schools were fully closed, one round completed after the partial reopening, and further rounds after all schools reopened.

First, we document childcare and child labor arrangements in Kenya and how these varied with changes in school closure policies. Among sample households with at least one child in grades 3 to 9, both female and male survey respondents increase their weekly childcare hours by 15-20 hours while schools are closed relative to the periods before schools closed and after they fully reopen, from a base of 40 hours for women and 25 hours for men. Adult childcare hours (which may be combined with other activities) vary little as the number of household children increases. This suggests significant economies of scale in childcare. We do not have data on sibling childcare during the closures period, but children provide an average of 15 hours of care to siblings in the survey round after schools reopened in 2021. Very few households report any childcare provided by non-household members, nor any formal or paid childcare, even after the majority of pandemic restrictions were lifted in 2021. Child labor in household agriculture is reported by 40% of households during the school closures period and children account for 20-25% of total farm work hours among these households. Reported child work hours on household farms are 33% higher while schools were closed in 2020 than in the same calendar months in 2021 when schools were open. These facts indicate that the partial school reopening in Kenya could have affected adult labor supply by decreasing childcare demanded by the returning children, decreasing the amount of sibling childcare provided, and decreasing child hours in household agricultural production. We test for both child labor and childcare mechanisms.

Next, we analyze causal impacts of the partial school reopening on adults' labor supply. Effects are concentrated on the intensive margin: weekly work hours increase by 4.3 (27%) after the partial reopening for adults with a child eligible to return to school, driven by a 33% increase in hours worked in household agriculture. Household agriculture is likely more flexible in allowing adults to adjust working hours in the short-run. Participation in household agriculture was also less affected by the pandemic. We find no effects on wage employment hours, household enterprise hours, or on the extensive margin of employment in the weeks following the reopening,[5].

The labor supply impacts of schools' reopening are not significantly different by sex, contrasting with evidence on labor supply effects of COVID-19 school closures from high-income contexts (see e.g., Alon et al. 2022; Amuedo-Dorantes et al. 2023; Collins et al. 2021; Hansen, Sabia, and Schaller 2024; Heggeness 2020) and expectations based on women's role as primary caregivers in most Kenyan households. The main reason is that the partial reopening does not appear to have been a shock to household childcare burdens. Unlike the school closure policies studied in high-income countries, we study a policy change in which school availability changed only for selected adolescent children. This implies limited effects on marginal childcare demand in a setting where 80% of sample households have multiple children. In line with this reasoning, we find no effects of the partial reopening on respondent childcare hours, and patterns of effects in respondent childcare hours and adult work hours across households with different characteristics and composition do not align with predictions based on a childcare mechanism. The results also suggest there were no adverse labor supply effects on adults due to potential decreases in sibling-provided childcare.

Instead, the evidence indicates that increases in adult labor supply are driven by a need to make up for reductions in child labor. In households that reported any child engagement in household agriculture while schools were closed, children in grades 4 and 8 work 3.2 hours (31%) less per week in the period after the partial school reopening relative to children in adjacent grades, similar in magnitude to the concurrent increase in adult labor hours. While estimated impacts of the partial reopening on total child hours in household agriculture are noisy, but patterns align with predictions under a child labor mechanism. In addition to households with any child farm labor before the reopening, child farm hours hours also fall more in treated households with only one child, where a boy returned to school (compared to those where a girl returned to school), and those in the bottom half of the wealth distribution (who cannot substitute child labor with increased hiring).[6]

In line with the child labor hypothesis, the patterns of effects on adult work hours by household characteristics largely mirror the patterns for child agriculture hours, and are similar for both women and men. The partial reopening coincided with the main harvest season for most of Kenya, and adults work 7.8 hours more after the partial reopening in treated households where children were engaged in household labor during school closures, compared to no effect in treated households not reporting child farm work. The partial reopening also increases the probability of hiring any outside agricultural labor by 5 percentage points (70%), concentrated among wealthier households, which

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

6. We find no significant effects of the partial reopening on child farm work hours or adult work hours in 'mixed' households with both children eligible to return to school *and* children in adjacent grades who do not return. The child labor mechanism is muted in these households as they can substitute reduced labor of the child returning to school with labor from other children of similar ages, rather than adult labor.

do not increase adult work hours. These results indicate that poorer households substitute reduced child labor with adult labor while wealthier households substitute with hired labor.[7]

This paper makes three main contributions. First, we consider how school availability for adolescents affects household childcare burdens and adult labor supply in a context where these children are often both recipients and providers of childcare. This paper builds on a growing literature identifying causal impacts of childcare availability on mothers' labor market outcomes in LMICs, generally finding that access to childcare increases labor supply,[8] where the variation we study comes from the ability to send children to school, an implicit but important source of childcare that has been studied less frequently outside of pre-primary education.[9] We document household childcare arrangements in Kenya using a nationally-representative sample of households with mobile phones, showing significant increases in childcare hours for both women and men during the COVID-19 school closures and important contributions of older siblings to household childcare together with very little use of non-household care providers (other than schools). Using a natural experiment based on changes in school closure policies in Kenya, we show that adult work hours increase when an adolescent child returns to school but no evidence that this is due to a decreased childcare burden or affected by potential decreases in care provided to younger siblings. Childcare effects of school availability appear to be limited when other children remain at home, and may in general be limited for adolescents in this setting in contrast to evidence from school closures in high-income countries.

Second, we demonstrate that a change in children's labor availability around harvest time—due to required school attendance—affects parents' labor supply and the decision to hire farm labor. This result is consistent with evidence on the importance of the timing of school breaks for both child and household outcomes in LMICs.[10] Much of this literature has focused on impacts of school calendar policy on outcomes for children. We show that child farm hours decrease in Kenya when a student that had been a labor provider returns to school, and that adults make up for this by increasing their time allocation to household agriculture. This is true particularly for less wealthy households, while wealthier households instead increase hired labor.[11] The finding aligns with many studies considering the opportunity cost of children's school attendance in LMICS.[12] More generally,

7. The magnitudes of effects on total child work hours are smaller than effects on total adult work hours, and we also find no significant effect on child work hours in wealthier households. These differences could indicate that that child work hours are under-reported, or that child labor substitution is not be the only mechanism.

8. See Halim, Perova, and Reynolds (2023) for a review of causally-identified studies in LMICs and J-PAL Policy Insight (2023) for another recent review of 9 RCTs of childcare interventions in LMICs. Recent studies from Sub-Saharan African contexts include Ajayi et al. (2024), Bjorvatn et al. (2022), Clark et al. (2019), and Donald and Vaillant (2023). A much broader literature considers this relationship in high-income contexts; see Morrissey (2017) for a recent review.

9. Contreras and Sepúlveda (2017) find that a policy to extend the school day in Chile increased labor participation of single mothers with eligible children, but only if they had no younger children. Jaume and Willén (2021) find that teacher strikes in Argentina lead mothers to drop out of the work force.

10. See e.g., Admassie (2003), Allen (2024), Duryea and Arends-Kuenning (2003), Ito, Shonchoy, et al. (2020), Kadzamira and Rose (2003), and Merfeld (2024).

11. Allen (2024) reports that households in Malawi respond to harvest-period overlap with the school calendar by increasing expenditure on hired labor but does not report on household adult labor.

12. See e.g., Bai and Wang (2020), Bau et al. (2020), Doran (2013), Edmonds (2006), Galdo (2024), Li and Sekhri (2020), Ray (2000), Rosenzweig and Evenson (1977), Shah and Steinberg (2021), and Tagliati (2022).

the results add to a broad literature on child labor in LMICs,[13] further demonstrating how children can play an important role in household agricultural production and labor supply decisions.

Finally, we contribute to understanding the labor supply impacts of pandemics and pandemic-related policies—school closures in particular. Many studies have analyzed the gendered effects of the COVID-19 pandemic on childcare and employment. These primarily report on high-income settings and fairly consistently find that increased childcare burdens due to school closures contributed to greater adverse labor effects for mothers during the pandemic.[14] Descriptive evidence on the gendered impacts of COVID-19 in LMICs suggests that women increased domestic work and reduced their labor supply more than men, but causal estimates and analyses of the mechanisms behind labor supply changes are lacking.[15] We show that time spent on childcare increased by about the same amount for both women and men in Kenya during the COVID-19 school closures in 2020, and returned to pre-pandemic levels after schools reopened in 2021. Contrary to evidence from other contexts, we find that the partial reopening of schools in October 2020 significantly increased adults' labor supply with no significant difference by sex and that the increase was primarily driven by changes in child agricultural labor rather than childcare burdens.

The remainder of the paper is organized as follows. In Section 2 we describe the context around COVID-19 and school closures in Kenya, discuss the data used in this paper, and present descriptive statistics on childcare arrangements and child agricultural labor as school closures policies changed in Kenya. Section 3 presents the empirical approach. Section 4 presents overall results on the impacts of school reopenings on adult labor supply, while Section 5 explores mechanisms. Section 6 concludes.

## 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 and child agricultural labor.

### 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-school has also become broadly available, particularly for children aged 5. Academic years in Kenya begin in January and end in late October, and consist of three terms.

13. See e.g., Baland and Robinson (2000), Basu and Van (1998), Basu (1999), Basu and Tzannatos (2003), Beegle, R. H. Dehejia, and Gatti (2006), Beegle, R. Dehejia, and Gatti (2009), Bharadwaj, Lakdawala, and Li (2020), Edmonds (2005), Kozhaya and Flores (2025), and Udry (2006).

14. For example, Heggeness (2020) uses variation in the timing of school closures over space in the US and shows that mothers of school-age children with jobs were significantly more likely to not be working after schools closed, with no effects on working fathers and other women. Hansen, Sabia, and Schaller (2024) use variation in the timing of K-12 school reopenings over space in the US and show reopenings increased labor supply for married women with school-age children only.

15. See e.g., Casale and Posel (2020), Chauhan (2021), Deshpande (2020), Grantham et al. (2021), Kugler et al. (2021), Ma, Sun, and Xue (2020), and Torres et al. (2023).

Schools in Kenya closed on March 16, 2020, days after the first reported COVID-19 case in the country, 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 A1 shows a timeline of school closures and reopenings, other key pandemic-related policy changes, and weekly confirmed COVID-19 cases in Kenya.[16] Pandemic school closure policy in Kenya was decided nationally, and is thus unrelated to local variation in economic or health conditions.

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 schools reopened as parents had already paid fees for the 2020 school year, 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.[17]

Students in grades 4, 8, and 12 returned for Term 3 from January-March 2021 while all 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. 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.

Kenya's economy was beginning to recover from the initial COVID-19 shock by the time of the partial school reopening. Quarterly GDP growth was -4.1% and -3.6% in the second and third quarters of 2020, respectively, but 2.0% in the fourth quarter as the most restrictive pandemic policies had been lifted. GDP growth was 2.4% in the first quarter of 2021 and over 8.5% each quarter for the rest of the year. For comparison, quarterly growth rates for 2018-2019 and 2022-2023 were between 3.5-6% (KNBS 2023). Overall, Kenya's economy was less adversely affected by COVID-19 than many other countries', though effects were larger and the recovery more difficult for low-income populations (FSD Kenya 2021).

We focus on the impacts of the partial school reopening on adults' labor supply for several reasons. First, unlike initial school closures, the partial reopening did not coincide with other pandemic-related policies (see Appendix D), allowing for cleaner identification. Moreover, the reopening was largely unanticipated. Second, we can exploit differences in the timing that children enrolled in different grades were eligible to return to school to isolate the effect of the shock, allowing us to create a comparable control group of households with children in adjacent grades to those returning to school. Third, analyzing impacts of availability of schooling for adolescent children

16. An overview of specific pandemic-related policies is presented in Appendix D.

17. 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.

(who may be engaged in child labor and are both recipients and potential providers of childcare) allows us to test both childcare and child labor mechanisms and understand how these affect adult labor supply in this setting.

## 2.2 Data

Data come from the Kenya COVID-19 Rapid Response Phone Survey (RRPS) panel (Pape 2021).[18] 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 primarily use data from the first three survey rounds, covering May-November 2020, though we also use data from three rounds in 2021 to show the evolution of certain outcomes over time.In addition, we construct measures for certain variables in February 2020, before the first COVID-19 cases in Kenya, using recall questions from the first round.

The surveys include information on a rich set of socioeconomic characteristics. We use data on housing characteristics and ownership of major assets before the pandemic to construct a normalized wealth index, and categorize households as either above or below the mean of this index across the full RRPS sample. Household roster data includes the age and sex of all household members, as well as school enrollment information for all children. We describe how we use data on children's grades at the time of the 2020 school closures to define the analysis sample in Section 3.

The outcomes of interest are measures of labor supply which are reported for all household adults (aged 18 or over).[19] 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 in the last 7 days, and whether the household hired any agricultural workers in this period. Child agricultural work hours are reported by 42.7% of agricultural households.[20]

In addition to work hours, survey respondents also report their hours spent providing childcare hours in the last 7 days. This measure does not distinguish between time actively spent caring for a child and time spent on other activities while responsible for a child—the specific question is "In the past 7 days, how many hours have you spent doing childcare for your household, even if it overlapped with other tasks?'—representing a quite broad definition of 'childcare.' Consequently,

18. See Appendix E for more detail.

19. 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.

20. The surveys also include data on income by activity, but this is reported only for the past 14 days and for all activities the 90th percentile of household earnings in the analysis sample is zero. As the measure also does not accommodate seasonality or other variability in earnings, particularly important for agricultural households, we do not analyze impacts of school closure policies on incomes.

some adults report that all of their time involves providing childcare. We topcode reported childcare hours at 140, or 20 hours a day, and results are qualitatively the same when topcoding at 16 hours a day. Childcare hours are available for each household adult starting in the September-November 2020 round and for all household children starting in the January-March 2021 round.

### 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. In addition, over 90% of children age 5 were also enrolled in pre-school. Children primarily stayed at home with a parent during the COVID-19 school closures (Figure A2), including in 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. In January-March 2021 after many pandemic restrictions were lifted, 86% of households with children report 0 hours of care from non-household members in the last 7 days, though we note that care provided by schools is not included and is considered as separate from childcare provision in the survey. 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). Such sources of childcare would therefore not have provided much or any relief for increased childcare burdens during the school closures period. 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.

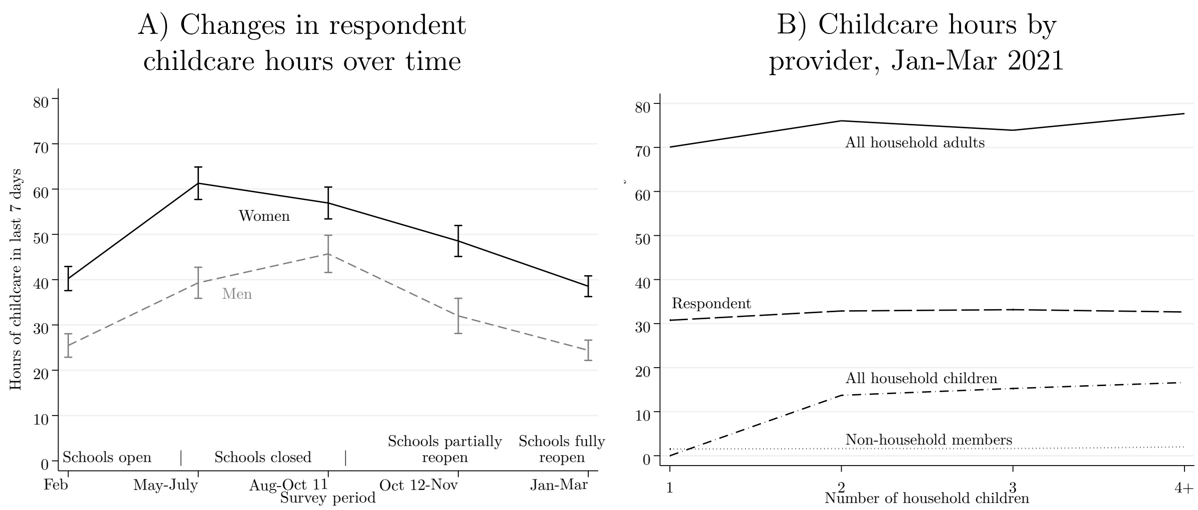
Figure 1 Panel A presents how respondent childcare hours changed over time as school closure policy changed for analysis sample households with at least one child in any grade from 3 to 9, separately for women and men. Female respondents provide around 15-20 more weekly childcare hours than men, who contribute around 25 hours per week on average. This contrasts with a recent study of family structure and childcare arrangements in Sub-Saharan Africa (Donald, Lowes, and Vaillant 2024), which finds that mothers are responsible for most childcare with grandmothers providing some support, but is consistent with recent evidence from South Africa (Clark, Cotton, and Marteleto 2015) and Cameroon (Kah 2012). We note, however, that the nature of care provided in these 'childcare' hours might vary by adult sex, given the broad definition of childcare hours in the data which includes time spent caring for children while doing other activities. For 85% of children in the sample their primary caregiver is a woman, and for 78% it is the mother compared to 10% for the father, suggesting there are likely differences in the intensity of women's childcare hours relative to men's. The RRPS measure of childcare hours should best be understood as a measure of time responsible for children rather than as a measure of active childcare, meaning it may fail to capture variation in the intensity of childcare burdens.

Respondent childcare hours increase substantially during the school closures period, by 15-20 hours for both women and men.[21] Childcare hours begin to drop in October-November 2020,

21. Other studies also find increases in domestic work during the pandemic for both men and women in India (Deshpande 2020), South Africa (Casale and Posel 2020), and many higher-income countries (see e.g., Andrew et

coinciding with the partial reopening of schools, and after schools fully reopen they return almost exactly to pre-pandemic levels from the year before. These patterns are consistent with children requiring more care and supervision when out of school, and suggest that the partial reopening of schools in October 2020 may have represented a decrease in childcare burdens for households with children in grades 4 and 8.[22]

Figure 1: Childcare hours in the last 7 days among analysis sample households, by provider of care and school closure status




Note: The figures show mean childcare hours in the last 7 days among analysis sample households (with at least one child in any grade from 3 to 9), by by time period for survey respondents (Panel A) and by provider and number of household children in round 4 (Panel B). Patterns are very similar when considering all households with at least one school-age child (age 5-17). Panel A includes only respondent hours as data on childcare hours for other care providers was not included before survey round 3 (October-November 2020). Panel B presents data from round 4 (January-March 2021) after schools fully reopened, when respondents reported on childcare hours for each household adult, for all children in total, and for all non-household members in total. The hours for 'all household adults' include the respondent's hours.

To understand the conditions under which childcare needs would have been likely to change with school availability, we consider how childcare provision from different sources changes with the number of household children among analysis sample households. We use data from the January-March 2021 survey round after schools fully reopened, as previous survey rounds do not include data on childcare provided by children. Figure 1 Panel B shows that respondents in the analysis sample provide 30-35 hours of childcare on average per week—46% of total household adult childcare hours.Respondent and total adult childcare hours increase very little with increasing numbers of household children. This may reflect the broad survey measure of childcare, as adults responsible for their children for all (or most) of the day will report spending the same number of hours on childcare regardless of their number of children. Households with more children may also benefit from economies of scale in childcare on the extensive margin, even if more children require more

al. 2020; Del Boca et al. 2020; Farré et al. 2020; İlkkaracan and Memiş 2021), though most studies report larger increases for women.

22. Another possible contributor to the decrease in respondent childcare hours from October 12-November is a change in the survey instrument, as respondents began to be asked for both their own childcare hours as well as those of all other households adults. This change may have led respondents to reassess their own childcare hours downward in the context of total adult childcare hours.

active attention during a given hour of childcare on the intensive margin. This result implies that the partial reopening would primarily be expected to decrease reported childcare hours in households where the child returning to school is the only child and their marginal childcare demand is most important.

Consistent with prior studies in Kenya (Jakiela et al. 2020) and other LMICs (Levison and Moe 1998; Qureshi 2018), siblings in the sample also contribute to childcare. In households with at least 2 children, 59% of children age 5-17—and 66% of children in grades 3-9—provided childcare to siblings in the last 7 days, for 15-20 hours on average in total in early 2021 after schools fully reopened. Sibling childcare provision as reported by the survey respondent may primarily represent 'active' childcare since that would be most easily observed and recalled, and since they might report supervised sibling care-giving under their own or another adult's childcare time rather than the child's. If this is the case, sibling-provided childcare may be a complement rather than a substitute for reported adult-provided childcare even if it reduces adults' active childcare burdens. The importance of sibling childcare in this setting suggests that a student returning to school might increase rather than decrease parents' childcare burden in situations where they were net childcare providers while schools were closed. This is most likely to be the case in households with young children.

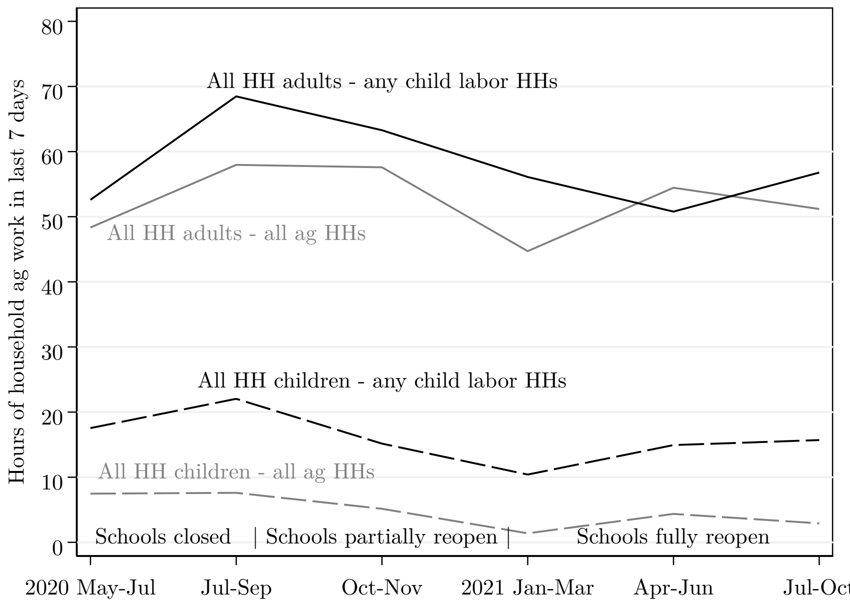
The patterns in Figure 1 suggest that although respondent childcare hours increased when schools closed in Kenya and began to decrease over the period of the partial reopening, the return of selected children to school may not meaningfully affect adult childcare burdens. Multiple children are present in 80% of analysis sample households, including 37% with a child age 0-4 that would require a significant amount of childcare regardless of an older sibling's school attendance. But having one fewer child at home may still reduce the intensity of adult childcare hours and therefore potentially affect their labor supply decisions. On the other hand, the returning child's ability to provide care for younger siblings while at home also creates a possibility of an increase in the intensity of adults' childcare burden following the partial school reopening. It is therefore not clear *a priori* how the partial reopening will affect average adult childcare hours and labor supply on average in this setting, but we would expect significant differences across households with different compositions of children if the partial reopening affects adult childcare burdens.

## 2.4 Child agricultural labor

Another aspect of household labor supply that could be affected by child school availability is child participation in household production, and in agricultural labor in particular. Moyi (2011) reports that around 30% of Kenyan children aged 6-14 engage in farm work (often alongside attending school), indicating this is fairly common in the study setting. In our analysis sample, 80% percent of households report having engaged in household agricultural work during the school closures period, and 40% report that children provided some farm labor (Table A1).

Figure 2 shows how mean total adult and child hours of work in household agriculture change over time in the analysis sample. In agricultural households, adults work between 45-60 combined hours per week in all survey rounds, with some variation due to agricultural seasonality (September to November is the main harvest season for grains in most of Kenya). Adult labor hours are higher in households with any child farm labor reported during the school closures period, at 58 hours per work on average. Children are reported to work less than 10 hours per week in all survey rounds on average across agricultural households. In households reporting any child farm labor during school closures, children work a total of 20 hours per week on average while schools were closed in 2020 compared to 15 hours during the same months in 2021 when schools were fully open. This 5 hour difference aligns with school attendance constraining child participation in farm work. On average, when schools are open children account for just under 10% of total household farm work hours across all agricultural households, but 20-25% of total hours among households reporting any child farm labor.

Figure 2: Mean adult and child hours in household agriculture by survey round, agricultural households




Note: The figure shows mean reported hours of work in household agriculture over the last 7 days before the survey date for analysis sample households engaged in agriculture. The solid lines show total hours reported across all household adults—reported individually and then summed—while the dashed lines show total hours reported across all household children—reported as a single total by the respondent. The black lines include all agricultural households while the blue lines include only those reporting any child agricultural work hours during the round. Schools were fully closed during the first two survey rounds, partially reopened in October-November 2020, and fully reopened during the three 2021 survey rounds.

We note that child labor in household agriculture is likely to be under-reported. First, social desirability bias may lead respondents to deliberately misreport child work hours.[23] Second, respondents may struggle to accurately recall hours worked by all household children, since these are reported as a single number.[24] The respondent is asked about household agriculture hours for each

23. Jouvin (2024) finds that child participation in household farm labor in Cote d'Ivoire cocoa farms is twice as high when elicited in list experiments compared to direct reporting by farmers.

24. Dillon et al. (2012) experimentally vary questionnaire designs in Tanzania and find that choices significantly affects child labor reporting. Galdo, Dammert, and Abebaw (2021) find bias in proxy reports of farm child labor in Ethiopia, particularly for girls.

adult member and then for the total across all children. In survey round 3, respondents report agricultural work hours for a randomly selected child as well as the total for all children. For households with a randomly selected child in grade 3-9 (in the analysis sample), 15% report more hours of work for the random child than they report for all children in total and just 10% report more total child farm work hours than hours for the individual child. This indicates that estimates of child work on the household farm would likely be higher if respondents reported hours for each child individually rather than for all children in total.

Despite this measurement issue, it is clear that children can and do contribute to household farm work. In addition, the figure suggests that one effect of school closures may have been to increase children's labor supply on the household farm. A potential effect of the partial school reopening in October 2020 would then be for adults with children returning to school to increase their agricultural work hours to make up for a reduction in children's work hours. In this case, we would expect larger increases in adult agricultural work hours in households where children were engaged in agricultural labor during the school closures period.

## 3 Empirical Approach

Our empirical strategy exploits quasi-random variation in which households are affected by the partial reopening, identified using information on what grades children were enrolled in at the start of the academic year interrupted by the pandemic school closures. Students in grades 4, 8, and 12 were eligible to return to school, and nearly 99% of eligible students are reported to have returned to school at the time of the partial reopening.[25] We focus on the effects of students in grades 4 and 8 returning to school as grade 12 students are effectively adults and often live outside the parental home or attend boarding school. We exclude households with any grade 12 student from the analysis sample to avoid misclassifying control households, but there are few such households and the main results are qualitatively similar if they are included.

We compare 'treated' households with children enrolled in grades 4 or 8 prior to the pandemic (eligible for the partial reopening) against 'control' households with children in grades 3, 5, 6, 7, or 9, but not in grade 4 or 8. The results are robust to varying the grades included in the definition of control households (Figure A6). We separate 'mixed' households with children in both 'treatment' and 'control' grades from 'treated' households as they might experience different effects when not all children in the relevant grade range return to school, and because these households are different ex-ante (e.g., by having more children by construction). All three categories of households may also have additional children not enrolled in grades 3-9.[26] The main analysis sample includes 323 treated, 348 mixed, and 919 control households. These households are broadly similar to the full sample of survey households with any children (Table A1), but with 1 additional child on average,

25. A survey of 3,000 grade 8 students in Busia County, Kenya similarly shows that 97% reported back to school after the partial reopening (Bonds 2023). Across all grades, 97% of previously enrolled students in the RRPS returned to school after the full reopening in January 2021.

26. 44% of analysis sample households have a child outside grades 3-9 and on average these households have 1.5 such children, with no difference by treatment group.

more engagement in household agriculture, and respondents more likely to be working (driven by agriculture).

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 children who are eligible to return to school.[27] We estimate two-way fixed effects regressions of the form

$$y_{iht} = \alpha + \beta_1 \cdot Post_t \times Treated_h + \beta_2 \cdot Post_t \times Mixed_h + \mu_h + \tau_t + \epsilon_{iht} \tag{1}$$

where $y_{iht}$ are outcomes for adults (age 18+) $i$ in household $h$ at time $t$, or household-level outcomes. We include observations from three survey rounds spanning May-November 2020, when schools were fully closed or partially reopened, but omit data from survey rounds after schools fully reopened. $Post_t$ is an indicator for observations after the partial reopening, and is absorbed by the month fixed effects.$Treated_h$ is an indicator for whether all household children in grades 3-9 are eligible to return to school. $Mixed_h$ is an indicator for whether the household has both eligible and ineligible children in this grade range. The omitted reference category is control households with children in this grade range but none eligible for the partial reopening. Household fixed effects $\mu_h$ absorb time invariant characteristics of households which may affect labor supply outcomes. Month fixed effects $\tau_t$ control for common shocks affecting households over time. We test robustness of the main results to specifications with different fixed effects and additional time-varying household- and individual-level controls and find that the coefficients generally remain stable (see Appendix B). We cluster standard errors at the household level.

We estimate heterogeneity in effects by household or adult characteristics by interacting both the $Post \times Treat$ term and the month fixed effects with a dummy variable for a given characteristic. All characteristics considered in tests of heterogeneity are fixed and defined based on the first two survey rounds when schools were fully closed—with the exception of the household wealth index which is constructed based on assets and housing characteristics before the pandemic—to avoid potential endogeneity.

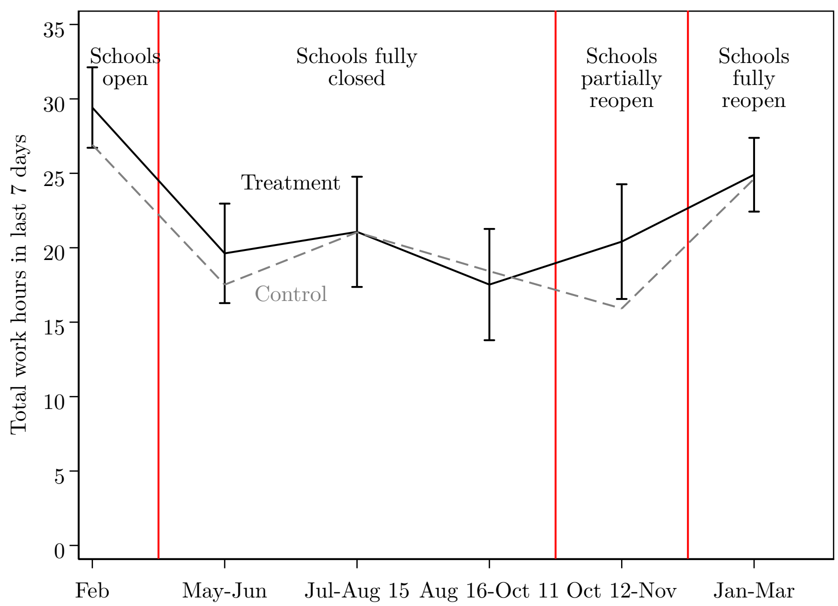
Causal identification is based on the argument that unobserved factors that could affect labor supply outcomes are continuous around the thresholds of children being in adjacent grades, and do not differentially affect treated and control households around the time of schools reopening. By this argument we would expect parallel trends in outcomes across treated and control households in the absence of the partial reopening, the critical assumption in a difference-in-differences framework. As expected given how these household groups are defined, respondent and household characteristics are balanced by treatment status during the school closures period (Table A2). Treated household respondents are slightly older and are more likely to be engaged in any non-farm enterprise than those in control households, but there are no other statistically significant differences and we cannot reject that all characteristics are jointly zero in explaining treated status ($p = 0.50$). Notably, we fail

27. Since schools partially reopened all at once, our two-way fixed effects estimator should not suffer from the negative weighting issues that arise in staggered difference-in-difference designs (see e.g. Callaway and Sant'Anna 2021; Goodman-Bacon 2021).

to reject that respondent work and childcare hours are the same during the school closures period and that there are equal levels of child engagement in household farm work.

Critically for the identification strategy, Figure 3 shows that work hours trend almost identically for respondents in treated and control households from February to early October 2020, before the partial school-reopening.[28] Differences emerge following the partial reopening but are eliminated after schools fully reopen, when all households become ‘treated’. We find no significant differences between treated and control adults in overall labor supply in the periods when schools were fully closed, and cannot reject the joint hypothesis that the pre-reopening period treated coefficients are all 0 (Table A6). This indicates that treated and control households not only were on parallel trends prior to schools reopening but also statistically balanced in *levels*. There is also no evidence of anticipation effects in the period from August 16 to 11 October which is not surprising as the specific timing and the partial nature of reopening was not announced until the week before students were invited to return to school. Taken together, these results support the validity of the parallel trends assumption in our setting.

Figure 3: Mean respondent work hours by treatment group over time




Note: The figure shows mean total work hours in the last 7 days for survey respondents by treatment status over time, along with 95% confidence intervals around the treated group means. Means are shown for the respondent only due to missing data on February (pre-pandemic) working hours for other household adults. Data for February are based on recall from the first time a respondent is surveyed. Figure A5 shows differences in work hours by period for all adults in the analysis sample, excluding the February time period. 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.

While we include mixed households with children in both treated and adjacent grades in our analyses, we do not interpret estimates for these households as representing causal effects of the

28. We focus on respondents as work hours in February 2020 are available only for the respondent. Figure A5 shows differences in work hours by period for all adults in the analysis sample. The patterns are nearly identical. The fall in hours in the period of the partial reopening for control households reflects the end of main harvest period in Kenya, as 80% of households are engaged in agriculture.

partial reopening because their characteristics differ significantly from those of control households (Table A2). Respondent labor supply during the school closures period is similar between control and mixed households, but respondents in mixed households are more likely to be married and have lower levels of education than those in control households. Mixed households are also more likely to be engaged in household agriculture and to have children providing farm labor. Importantly, mixed households have 3.5 children on average compared to 2.9 in control households and 2.8 in treated households. This difference is mechanical, as mixed households must have at least one child in both the treatment and control grades.[29]

Effectively, differences between mixed and control households after the partial reopening represent the effect of having an additional adolescent that returns in school, in contrast to differences between treated and control households which represent the effect of having a given adolescent being in school. We therefore only include results for mixed households for the main analysis of impacts of the partial reopening on adult labor supply outcomes to highlight differences between treatment and mixed households, and generally suppress these results from the subsequent exhibits and discussion.

## 4 Results

Table 1 presents results for the impacts of the partial school reopening on adults' labor supply. Among control households, 56% of adults were working during the school closures period. Mean work hours of 15.7 in the last 7 days—27.6 among those that were working—reflect that many workers were not working 'full-time'. Work is concentrated in household agriculture, which is common even in areas categorized as urban in the RRPS. Agricultural work on the homestead would have been less affected by pandemic restrictions on mobility, social distancing, or market closures.

We find no significant effects of the partial reopening on the extensive margin of labor supply. Although the point estimate represents a 13% increase in the probability of being engaged in any work in the last 7 days relative to control households, it is noisy ($p = 0.17$). But adult labor supply responses to schools partly reopening for treated households are large and statistically significant on the intensive margin. Work hours in the last 7 days increase by 4.3 (27%) relative to adults in control households ($p = 0.02$). This more than offsets a small reduction in hours worked in this time period for control households, potentially linked to the end of the main harvest season (Figure 3).

The increase in work hours is driven by household agriculture, where adults in treated households work 3.8 (33.5%) hours more in the last 7 days ($p = 0.01$) after the partial reopening than those in control households. In line with this, increases in adult work hours are only statistically significant in households engaged in agriculture (80%), and the point estimate is close to zero in non-agricultural households (Figure 4). We find no significant effects on hours of work in wage employment or non-farm household enterprises.

29. Mixed households have 2.6 children in grades 3-9 on average, compared to 1.4 for control households and 1.2 for treated households, accounting for the entire difference.

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

| | N | Control Mean (SD) | Post x Treat (SE) | Post x Mixed (SE) |
|---|---|---|---|---|
| Engaged in any work in last 7 days | 8694 | 0.557 | 0.073 | 0.063 |
| | | (0.497) | (0.053) | (0.051) |
| Engaged in wage employment in last 7 days | 8694 | 0.058 | 0.015 | -0.006 |
| | | (0.234) | (0.012) | (0.012) |
| Engaged in HH agriculture in last 7 days | 8694 | 0.486 | 0.066 | 0.053 |
| | | (0.500) | (0.055) | (0.049) |
| Engaged in HH non-ag enterprise in last 7 days | 8694 | 0.067 | 0.004 | 0.015 |
| | | (0.249) | (0.022) | (0.020) |
| Total work hours in last 7 days | 8694 | 15.68 | 4.32** | 0.93 |
| | | (19.68) | (1.88) | (1.79) |
| Wage employment hours in last 7 days | 8694 | 1.91 | 0.61 | -0.13 |
| | | (9.16) | (0.51) | (0.51) |
| HH agriculture hours in last 7 days | 8694 | 11.42 | 3.83** | 1.22 |
| | | (15.29) | (1.56) | (1.51) |
| HH non-ag enterprise hours in last 7 days | 8694 | 2.46 | -0.07 | -0.29 |
| | | (10.81) | (0.81) | (0.76) |

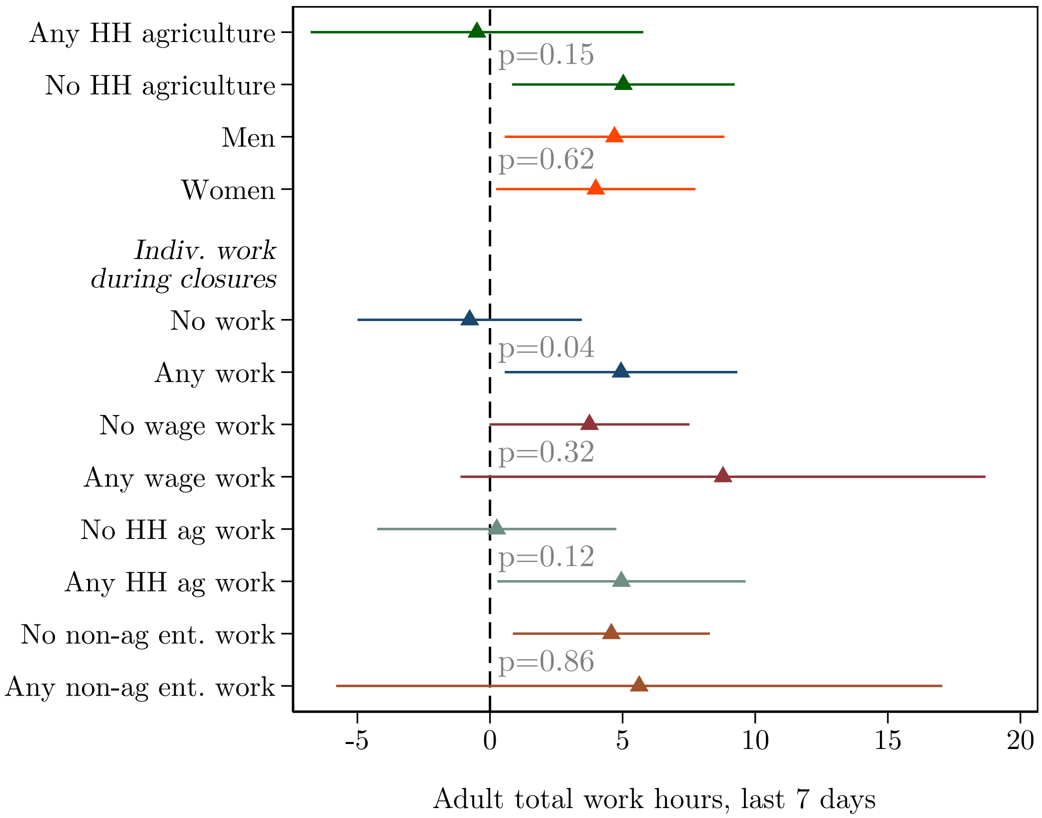
Note: This table presents estimates of Equation 1 for individual labor supply. Individuals not working in a given sector are coded as working 0 hours. From left to right, the columns show the dependent variable, number of observations, the control mean prior to the partial reopening, and the impacts of being in the partial reopening period for treated households (Post x Treat) and mixed households (Post x Mixed). Impacts for control households are absorbed by month fixed effects. Control households have a child in grades 3, 5, 6, 7, or 9, treated 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 month fixed effects. Standard errors are clustered at the household level. Data include observations for adults age 18+ from May to November 2020. Treated impacts on total and agricultural work hours remain marginally statistically significant after FDR multiple testing adjustment across all 8 Post x Treat estimates ($q = 0.086$ for both).
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

'Mixed' households with children eligible to return to school as well as children in adjacent grades do not change labor supply following the partial reopening relative to control households. One adolescent returning to school while another of a similar age stays home is unlikely to meaningfully reduce adult childcare burdens, and the child remaining at home may help make up for reductions in sibling childcare or agricultural labor provided by the child returning to school.

Consistent with the short-run nature of the partial school reopening treatment we estimate, we find evidence that adults adjust their labor supply only on the intensive margin and only in activities they were already engaged in (Figure 4). Treated adults that worked at any point while schools were closed (70%) increase their weekly work by 4.9 hours after one of their children returns to school, while those not working during the closures period do not significantly change their work hours after the partial reopening, with a point estimate close to 0 ($p = 0.04$ for the test of difference in effects). This pattern is again driven by engagement in household agriculture (63% of adults). The point estimate for the effect of the partial reopening is also larger for adults engaged in wage work during the school closures (8%), but we cannot reject equality of effects with those not engaged in such activity as many of these adults were working in household agriculture. Engagement and hours in wage work and household non-farm enterprise may be constrained in the short run and take longer to adjust while hours in household agriculture are more flexible.

Impacts on work hours are not significantly different for women (54% of the sample) relative to men—men in treated households work 4.7 more hours after the partial reopening compared to

Figure 4: Heterogeneity in effects on adult work hours in the last 7 days




Note: The figure summarizes estimated coefficients and 95% confidence intervals for the effect on the partial reopening across households or individuals with different characteristics. In between each pair of coefficients are *p*-values for the test that the coefficients are equal to each other. Individual work participation during school closures is based on participation in a given sector from May-October 11 2020. Observations include data from adults age 18+ in the analysis sample from May to November 2020. Results for mixed households are not shown. All regressions include household and month fixed effects, and SEs are clustered at household level. Full results are reported in Table A10.

4.0 for women. This contrasts with evidence from high-income countries, which consistently shows larger effects of pandemic school closures on mothers' labor supply relative to fathers' and other women's (e.g., Alon et al. (2022), Collins et al. (2021), and Hansen, Sabia, and Schaller (2024)). One explanation is suggested by the data on childcare hours in our context: responsibilities prior to the pandemic are less gendered than expected and both women's and men's hours increase by around 15 hours during school closures. So both women and men may benefit from reduced childcare hours after the partial reopening. Another factor is that our study focuses on the return of a subset of household children rather than on effects of all children being either in or out of school, implying smaller changes in the household childcare burden. Moreover, the children who return to school are adolescent, an age where childcare arrangements may be less gendered than for younger children. Finally, effects concentrated in household agriculture could reflect a greater importance of substitution for reduced child farm labor as a mechanism behind these results, and this mechanism may be less gendered than a childcare mechanism. We analyze possible mechanisms further in Section 5.

We conduct a variety of robustness tests, focusing on the main impacts on total working hours in the last 7 days (Table A7, Figure A6). Estimated impacts of the partial reopening on treated households are not sensitive to dropping month fixed effects, to the inclusion of individual or time-varying household controls, to using individual rather than household fixed effects, or to dropping household fixed effects and including household controls. Results are effectively identical if we drop mixed households or households surveyed in round 3 of the RRPS but before the date of the partial reopening from the analysis sample. We find slightly smaller estimated impacts when defining *Post* by the date the potential reopening was announced rather than the actual reopening date, which together with no differential pre-trends suggests limited anticipation effects. Estimated effects on hours of work are similar—coefficients between 4.0 and 4.9—when focusing on sub-samples of adults more likely to be parent caregivers or engaged in work, though the point estimate is larger for survey respondents, at 5.4 hours. Finally, effects remain statistically significant and are close in magnitude when varying which grades are included in the treatment group definitions, including adding households with a child in grade 12 to the treated group and those with children in grades 10 or 11 to the control group.

## 5 Mechanisms

We now consider the mechanisms driving increased adult labor supply after a child returns to school. A simple model of household production, labor supply, and the intra-household allocation of different activities guides our analysis. (we describe the model in more detail in Appendix F). Adults in the household supply labor to home production and other work activities, they provide childcare to children present in the household, and consume leisure. Adults get utility from consuming the returns to household labor, from leisure, and from altruistically caring about the well-being of their children.

Child well-being is subject to a constraint that total care received must not be below childcare needs, which decrease with by age. Childcare can be provided by household adults, older siblings, non-household care providers, and schools, and exhibits increasing returns to scale as a function of the number of children receiving care in line with the patterns in Figure 1. In addition to receiving childcare, children present in the household may also contribute to home production and to childcare of other siblings. Children that provide care to siblings still require some care and supervision from adults.

In the model, the return of a child to school has three main effects on household adults' labor supply.[30] First, it decreases the childcare demanded by that child from other household members

30. In theory, costs of sending a child to school may also lead to an income effect, increasing overall labor supply. Though some parents may have paid outstanding bills and/or purchased school materials, there were no additional fees incurred when schools reopened in Kenya so this is unlikely to drive the labor supply effects we observe. To the extent there were costs of sending children back to school they would have been greater for households with children in private school (20% of households), but work hours do not increase (and the point estimate is negative) for households with any children in private school (Table A10). We therefore concentrate our discussion of mechanisms for the increase in treated households' labor supply on changes in childcare needs and child labor.

as part of its needs are met by the school. Second, it reduces the child's ability to provide childcare to any younger siblings, as school attendance constrains their availability at home. Whether the net effect is a decrease or increase in childcare demands on adult household members depends on whether the marginal childcare demand of the child going to school exceeds their provision of sibling childcare. Third, spending more time at school also decreases labor provided by the child to any home production. This reduced labor availability increases adult marginal returns to home production labor relative to work outside the household as well as the returns to hiring workers from outside the household.

Which effects dominate depend on the age distribution of household children and the economic activities the household engages in (which—following our main results—we consider fixed in the short run). Separating households with children eligible to return to school into pure treated and mixed households implicitly tests for different effects by presence of additional un-schooled adolescents in treated households. The presence of other adolescent children remaining in the household after schools reopen—demanding both similar levels of childcare and providing similar levels of sibling childcare and household productive labor on average as their siblings who return to school—mutes the potential mechanisms by which one adolescent returning to school could affect parent labor supply. The marginal childcare demanded by the returning child would be minimal in these households, and their siblings could help substitute for any decreases in contributions to sibling childcare and home production, reducing demands on household adults. In line with this prediction, Table 1 shows no significant impacts of the partial reopening on mixed households.

The lack of differences in effects on women's and men's work hours could imply that changes in childcare burdens are important for both, that both sexes substitute for reduced child agricultural labor, or that the mechanisms affect each sex differently but produce a similar total effect. We cannot conclude from the results thus far which mechanism is more important for the effects we observe in treated households.

The model predicts different effects of the partial reopening across households with different characteristics depending on whether changes in childcare burdens or child agricultural labor are a more important mechanism. We consider each of these in turn by testing for heterogeneity by household characteristics in impacts of the partial reopening on total adult work hours,[31] childcare hours for the respondent (not available across all rounds for other adults), total child work hours in household agriculture, and whether the household hired any agricultural workers. For all tests, we interact the regressors in Equation 1 (except household fixed effects) with household or individual characteristics, corresponding to stacking separate regressions for each group. We focus the discussion on differences for treated households, as effects of the partial reopening for mixed households are not statistically significant and do not have a clear causal interpretation due to differences in mixed and control household characteristics.

31. These follow the effects on hours in household agriculture and we find no significant effects or heterogeneity for hours of work outside household agriculture (Table A15).

### 5.1 Childcare

We first test for evidence of a childcare mechanism. Although the grade 4 and 8 children returning to school are older they will still require some level of care or supervision when out of school which could constrain adults' labor supply. On the other hand, because 37% of analysis sample households have children age 0-4 (Table A1), these older children could also have provided childcare to younger siblings while schools were closed that adults would need to replace after the partial reopening. The effects of the partial reopening on adult childcare burdens are therefore uncertain ex-ante.

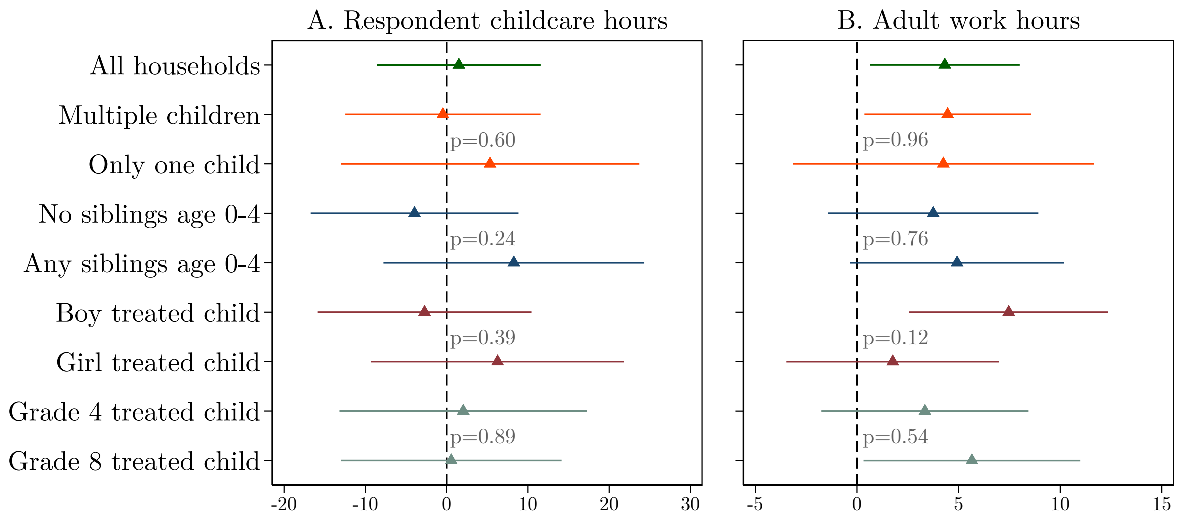
If effects on childcare burdens are the main mechanism behind the increased adult work hours in Table 1, Figure 1 suggests we would expect small or null effects of the partial reopening on adult childcare hours and work hours if there are other children present in the household still requiring care and significant effects if there is only one child, due to variation in the marginal childcare demand of the returning child (Contreras and Sepúlveda 2017). The importance of sibling childcare suggests changes in adult childcare hours should be smaller or even positive if there are young children as this increases the likelihood that the returning child was a net provider of household childcare, implying smaller or null effects on adult work hours. To the extent girls provide more childcare to siblings than boys while out of schools—as suggested by evidence on gender differences in sibling childcare provision in similar settings (Jakiela et al. 2020; Levison and Moe 1998)—we would expect a girl returning to school to decrease adult childcare hours and increase adult work hours by less than a boy. Finally, as younger children are likely to demand more childcare than older children and may provide less to siblings, decreases in adult childcare hours and increases in work hours should be larger in households where a grade 4 child (aged 10 on average) returns to school than in households where a grade 8 child (aged 14) returns.

Figure 5 presents the tests of these predictions. We find no impact of the partial reopening on respondent childcare hours on average. Effects on respondent childcare hours do not differ significantly across any household characteristics, nor do patterns in adult work hours correspond with predictions based on a childcare mechanism. The results indicate that this mechanism is not a primary driver of increases in adult work hours after the partial school reopening.

Consistent with null effects on childcare hours, mean respondent childcare hours trend very similarly across treated and control households over the survey period for both women and men (Figure A3). The approximately 10 hour average decrease in respondent childcare hours for both treated and control households in the period when schools partially reopened therefore appears to be a result of a change in the survey instrument—the addition of questions about childcare provided by each adult, discussed in subsection 2.3—rather than an effect of eligible children returning to school.

There are two limitations to the analysis of respondent childcare hours in testing for a childcare mechanism. First, the RRPS definition of 'childcare hours' includes time spent 'caring' for children while doing other tasks, leading 15% of respondents across rounds to report at least 20 hours per day of childcare. This broad measure may contribute to the lack of precision in estimated effects. The data do not allow us to measure whether 'active' childcare hours—likely the main constraint

Figure 5: Tests of childcare mechanism: heterogeneity in impacts of partial reopening on respondent childcare hours and adult work hours




Note: The figures show estimated coefficients and 95% confidence intervals for the effect of the partial reopening on respondent childcare hours (Panel A) and adult work hours (Panel B) across households with different characteristics, with $p$-values for the test of equality of coefficients for each pair. Outcomes are measured over the last 7 days. For control households, the 'treated child' is the child in a grade adjacent to those eligible to return. The comparison group for treated households where the returning child is a girl is control households with a girl in an adjacent grade. The comparison groups for treated households where the returning child is in grade 4 or 8 are control households with a child in and adjacent grade. Observations include data from adults age 18+ in the analysis sample from May to November 2020. Results for mixed households are not shown. All regressions include household and month fixed effects, and SEs are clustered at household level. Full results and tests of significant differences are reported in Table A11 and Table A12.

to adult labor supply—were affected by the partial school reopening. Second, it is possible that changes in the respondent's childcare hours do not accurately reflect changes for other household members. Respondents are more likely to be female (58%), and we find significantly greater reported childcare hours for females and for respondents in survey round 4 when this information is collected for all household adults (Table A8). But if anything this would lead us to expect more of an effect on childcare hours for survey respondents, who account for just under half of total adult childcare hours (Figure 1).

While these limitations mean we cannot rule out that the household childcare burden changes after the partial reopening, the results for respondent childcare hours suggest no clear effects on adult childcare responsibilities. Moreover, the results for adult work hours also do not align with expectations if childcare burdens were changing meaningfully.

We find no difference in effects of the partial reopening on total work hours by whether there is only one child (20% of households) or by whether there is a young child in the household (37%). A boy returning to school (45% of households) significantly increases adult work hours by 7.5 hours compared to no effect for a girl, and this difference is close to marginally significant ($p$=0.12). Null effects for girls could indicate a more important role for girls in sibling childcare provision, but we find no clear differences by returning child sex on respondent childcare hours suggesting a different mechanism drives the large effect for boys returning to school. We find no significant difference by age of the treated child, though we note that work hours only increase significantly for households with a grade 8 child returning to school (54%) compared to when the child is in grade 4 which is contrary to expectations for a childcare mechanism. We find similar patterns for impacts on adult work hours for both women and men (Table A9), indicating the childcare mechanism is not more relevant for women. We cannot test for differences in effects on childcare hours by adult sex as childcare hours are only reported for the respondent before round 3 and respondent sex is associated with various household characteristics which could affect the distribution of childcare hours.

The results in Figure 5 indicate that adolescents in this setting—largely agricultural Kenyan households—require limited additional care or supervision when out of school, or at least no care that constrains household adults' ability to continue working. This may be a function of the type of work most adults in this sample are engaged in: household agricultural production. Adults can more flexibly combine this activity with childcare and indeed children may be able to contribute to this activity while under an adult's supervision. This contrasts with wage work activities in high-income countries which cannot easily be combined with childcare or conducted at home. Another difference between school closures in Kenya and high-income countries is that remote learning activities were limited in Kenya, implying a lower care burden.[32] The increased childcare hours reported in the RRPS while schools were closed in Kenya (Figure 1 Panel A) may therefore have included a smaller share of 'active' childcare and a larger share of time spent doing other activities while nominally supervising children.

The results also imply that while adolescents in the sample households often provide care to younger siblings (Figure 1 Panel B), this either does not change significantly for treated households after the partial reopening or any changes do not affect the overall amount of care provided by adults or their ability to work. Unfortunately we do not measure childcare hours provided by children over the period of the partial reopening, but several scenarios could explain this finding. First, decreases in childcare provided by the returning child to younger siblings could be offset by decreases in childcare demanded by that child from adults, leading to a small net effect on adult childcare burdens. Second, efforts to make up for decreases in care provided by the returning child could be spread out across multiple household members such that effects on respondent childcare hours are not significant. Third, adolescent childcare may largely complement rather than substitute for adult childcare, reducing adult childcare burdens on the intensive margin but not the extensive margin.

## 5.2 Child labor

We next explore whether adult labor supply increases may be driven by the need to make up for reduced child labor when the child returns to school. Though children may also contribute to non-farm enterprises we focus particularly on child labor in household agriculture as this is

32. A report by the African Population and Health Research Center finds that 42% of children in Kenya were at risk of not being reached by mobile learning solutions and that 25% of households reported no distance learning during the COVID-19 pandemic (Ngware and Ochieng 2021). Low rates of computer or tablet access also limited the availability of many remote learning options, with radio the main option available for many children.

reported by 40% of analysis sample households during the school closures period and therefore most quantitatively relevant in this setting.

Child farm work hours are reported in aggregate in all rounds of the RRPS and for a randomly selected child in agricultural households starting in round 3. In line with the discontinuity around grades eligible to return to school, we find lower hours of work in household agriculture for children in grades 4 and 8 on average relative to children in adjacent grades in round 3 when schools partly reopened for grades 4 and 8 (Figure A4). The differences are particularly noticeable if we consider only households reporting any child agricultural work while schools were closed. On average in round 3 for these households, children in grade 4 or 8 worked 7.0 hours in household agriculture in the last 7 days compared to 10.2 for children in adjacent grades. This 3.2 hour (31%) difference is statistically significant ($p = 0.054$)

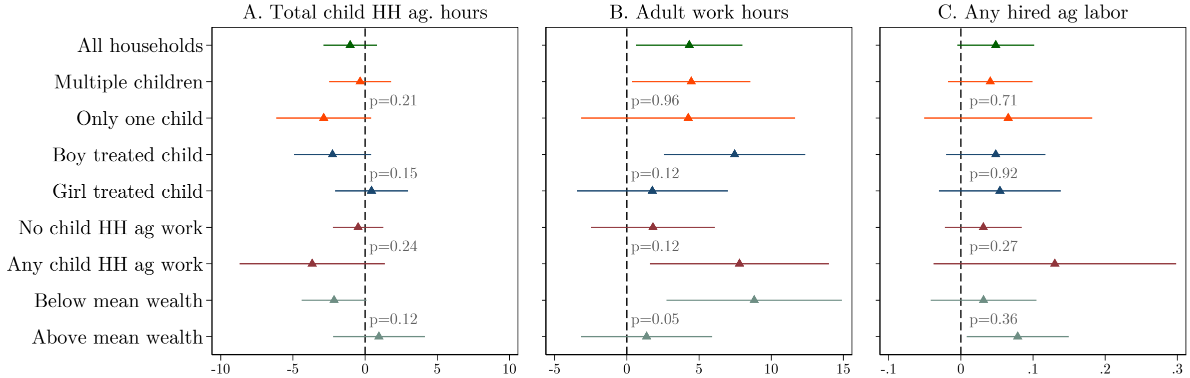
Turning to total hours of child work in household agriculture in the last 7 days, we find statistically similar levels and trends for treated and control households over the study period.Children in analysis sample households—including non-agricultural households—are reported to work 4.5 hours on average in total while schools are closed. These hours decrease for all households over rounds 3 and 4, coinciding with the end of the main harvest season and before the start of the next planting season. Total child hours of work in household agriculture fall by 3.2 hours after the partial reopening for treated households compared to 1.7 hours for control households.

These differences are consistent with children having less time available for work after returning to school. If this mechanism explains adult labor supply effects, we would expect impacts of the partial reopening on adult work hours, child engagement in household farm work, and the probability of hiring farm labor to be largest in households reporting child labor on the household farm during the periods when schools were closed. Effects should be also larger in households with only one child where other siblings are not available to help make up for reduced agricultural labor, and where the returning child is a boy—in round 3 we find that boys in grades 3-9 worked 3.2 hours in the last 7 days compared to 2.6 hours for girls. Finally, labor supply effects might be larger in less wealthy households which rely more on child labor (Table A4) and may be less able to hire outside labor.

Figure 6 presents the tests of the child labor mechanism. The average effect of the partial reopening on child hours in household agriculture is not statistically significant, with a point estimate of -1, but we find marginally significant decreases for households with only one child, where a boy returns to school, and in low-wealth households. The largest point estimate—a 3.7 hour decrease—is as expected for households with children engaged in agricultural work while schools were closed, but this is not statistically significant ($p$=0.15). These point estimates are not large in absolute terms but are large relative to the mean of 4.5 total child agricultural work hours in the last 7 days when schools were closed. While we cannot reject the null hypotheses of no heterogeneity along these dimensions, the signs of the differences and which individual effects are statistically significant all align with predictions based on a child labor mechanism.

Further, the treated households where decreases in child work hours in household agriculture are largest are the same households where increases in adult work hours are largest, with the exception

Figure 6: Tests of child agricultural labor mechanism: heterogeneity in impacts of partial reopening on child agricultural work hours, adult work hours, and hiring any agricultural labor




Note: The figures show estimated coefficients and 95% confidence intervals for the effect of the partial reopening on total child hours in HH agricultural work (Panel A), adult work hours (Panel B), and the probability of hiring any agricultural labor (Panel C) across households with different characteristics, with $p$-values for the test of equality of coefficients for each pair. Outcomes are measured over the last 7 days. For control households, the 'treated child' is the child in a grade adjacent to those eligible to return. Child engagement in HH agricultural work is defined over the period when schools were fully closed. The HH wealth index is a normalized index based on housing quality and asset ownership prior to the pandemic. Observations include data from adults age 18+ in the analysis sample from May to November 2020. Results for mixed households are not shown. All regressions include household and month fixed effects, and SEs are clustered at household level. Full results and tests of significant differences are reported in Table A11, Table A13, and Table A14.

of households with only one child where we do not observe any difference in adult work hours. We again cannot reject the null that the effects are identical at conventional significance levels, but adults in households where a boy returns to school work 7.5 hours more after the partial reopening compared to no effect when a girl returns to school ($p = 0.12$ for the test of differences in effects), and 7.8 hours more in households where children were engaged in household agriculture while schools were closed compared to no effect where they were not ($p = 0.12$). We do observe a significant difference by household wealth, with adults in less wealthy households working 8.8 hours more compared to no effect for wealthier households ($p = 0.05$). Patterns of heterogeneity in effects on adult work hours are similar for both women and men (Table A9), indicating both sexes are affected by this mechanism.

These results imply that adults in treated households are increasing agricultural work to substitute for reduced work hours by the child returning to school. As adults do not reduce childcare hours or non-agricultural work hours, these increases in work hours appear to be drawn from time that had been allocated to leisure or other domestic activities.

Another possible response to reduced child labor availability is to hire agricultural labor. On average, the partial reopening increases the probability that treated households hire any agricultural labor in the past 7 days by 5 percentage points ($p = 0.08$), a 70% increase relative to the control mean (Table A14).[33] We cannot reject that effects are the same across any household characteristic, but the effect is largest in households using child agricultural labor—a 13 percentage point increase. It is statistically significant only for treated households with above mean wealth—proxied by a

33. This aligns with findings from Allen (2024) in Malawi that overlap between the harvest period and the school calendar increases household expenditures on hired labor.

normalized index based on housing quality and asset ownership prior to the pandemic—which are 8 percentage points likelier to hire labor after the partial reopening.[34] These results could indicate that adults in wealthier households partly substitute child labor with hired labor rather than their own labor while less wealthy households are constrained in their ability to hire and therefore increase adult labor.

Taken together, the evidence is largely consistent with child labor in household agriculture being an important feature of the Kenyan context, and a key mechanism behind the increases in adult work hours following the partial school reopening, particularly among poorer and agricultural households.

A caveat is that not all of the results support this conclusion. For instance, while we find significant decreases in child labor for less wealthy households and concurrent increases in adult work hours, we find no effects on child labor for wealthier households that could explain the increase in hired agricultural labor. Moreover, we find no decrease in child labor in treated households with multiple children but significant increases in adult work hours in these households. This could be due to other children offsetting the decreased labor provided by children returning to school, consistent with the patterns we find for mixed households (Table A13). Finally, the magnitudes of impacts on child farm hours and adult work hours do not quite align. For example, the partial reopening decreases total child household farm work by 3.7 hours but increases adult work by 7.8 hours in households with any child labor while schools were closed, more than we would expect if adults are simply substituting for reduced child labor.

These discrepancies may reflect under-reporting of child agricultural work due to either social desirability bias or data collection issues as described in Section 2.4. We have no reason to expect different reporting by treatment status, as baseline child engagement and hours in household farm work are balanced (Table A2). Potential measurement issues should therefore not bias the direction of the estimated effect of the partial reopening on child agricultural work hours, but limit our ability to confidently estimate the magnitudes of the effects.

To summarize, while the broad patterns in the data largely align with the predictions of the child labor mechanism—and do not align with the childcare mechanism—the above caveats imply that other mechanisms may explain part of the effect of the partial reopening. While the evidence suggests that changes in child farm labor are an important mechanism for the increase in adult work hours in treated households after the partial school reopening, we cannot conclude that they fully explain this increase.

## 6 Conclusion

We present nationally-representative estimates of the impacts of a shock to adolescent school availability on adult labor supply in a lower-middle-income African country using pandemic-related school closure policy changes in Kenya as an exogenous shock. We find large and positive impacts

34. Less wealthy households are less likely to hire labor in general, with just 3% of analysis sample households with below mean wealth reporting any hired labor during the school closures period compared to 8% of wealthier households.

of Kenya's partial school reopening on adult labor supply for both women and men in households with a child eligible to return, but no evidence that this is explained by changes in the household childcare burden. This contrasts with studies of pandemic school closures in high-income countries which also find labor supply effects but point to childcare as a key mechanism and find the largest impacts are concentrated on mothers.

While this was not self-evident *a priori*, differences in context help explain why childcare is not a more important mechanism in this study. First, we study a policy which only affected school availability for a subset of children and most sample households have multiple children, reducing the effect on marginal demand for adult childcare. The results may differ for policies affecting school availability for all children or for an additional child conditional on other children already being in school or other childcare arrangements. Second, the main activity of adults in this sample is household agriculture, which is likely more flexible in accommodating childcare responsibilities than the wage employment that is the dominant activity in high-income countries. We might expect childcare to be a more important mechanism in settings where adults are more engaged in wage employment or non-farm enterprise. Lastly, the children returning to school were adolescent (between 10 - 14 years old), an age at which childcare may be less intensive than for younger children. This result does not indicate that childcare is not important for parents' labor supply in Kenya or that schooling does not provide an important form of childcare, but rather that the particular policy we study did not meaningfully change childcare burdens.

Instead, the evidence indicates that increased adult work hours after the partial reopening, which coincides with the end of the main harvest season in most of Kenya, are due at least in part to reductions in child labor in household agriculture. Patterns of reductions in child farm work hours align with increases in adult work hours with greater changes in treated households where children worked in agriculture during school closures. The increases in adult work hours are concentrated in less wealthy households, while more wealthy treated households instead are more likely to hire outside agricultural labor. These results are consistent with child agricultural labor being an important input for many households in low-income countries, with implications for the relative return to schooling.

The school availability shock we analyze takes place in the context of a global pandemic, but the results on labor supply impacts will continue to have relevance. Further school closures may be enacted in response to future outbreaks of COVID-19 variants or other diseases despite strong evidence of adverse effects on children. The findings also shed light on potential effects on adult labor supply of school closures for reasons unrelated to public health events, such as teacher strikes (e.g., Jaume and Willén 2021 in Argentina)—schools in Kenya were closed due to teacher strikes in 2013, 2015, and 2024 (BBC News 2013, 2015; Atiena 2024). In addition, although some pandemic-related restrictions were still in effect at the time schools partly reopened in Kenya in October 2020, many (including the most severe) had been relaxed even if economic activities had not yet fully returned to normal. The impacts we estimate may therefore generalize to policies or events affecting school availability in similar settings, such as mandatory secondary schooling, reduced school costs, or changes in school calendars.

While school closures in Kenya affected the availability of child labor for households, school breaks more generally determine when and how much children are available to work. Changes in the Kenyan academic calendar following the COVID-19 school closures varied the timing of school breaks relative to periods of peak agricultural labor demand each year from 2020 to 2023. The current calendar includes a break between terms 1 and 2 around the time of the main planting season in most of Kenya, but term 3 overlaps with much of the main harvest season. Our results suggest that such overlap may significantly affect labor availability on household farms, and the opportunity costs of children attending school for less wealthy households in particular. This is in line with recent work that has studied how the overlap between school days and peak agricultural periods in developing countries affects children's school participation and advancement (Allen 2024) and children's labor supply (Merfeld 2024). Future work could consider how differences in this overlap affect adults' labor supply, use of hired farm labor, and agricultural productivity, as well as human capital formation and longer-term effects for children in agricultural communities more broadly.

**Data availability:** The RRPS data used in this article can be accessed from the World Bank Microdata Catalog at https://microdata.worldbank.org/index.php/catalog/3774.

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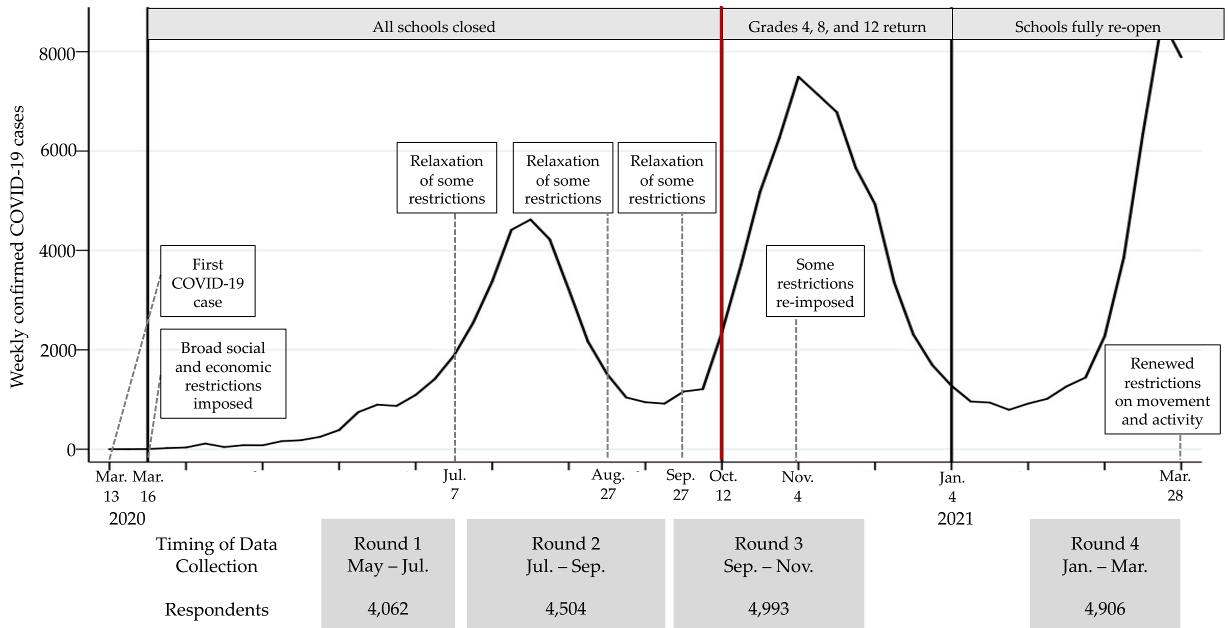
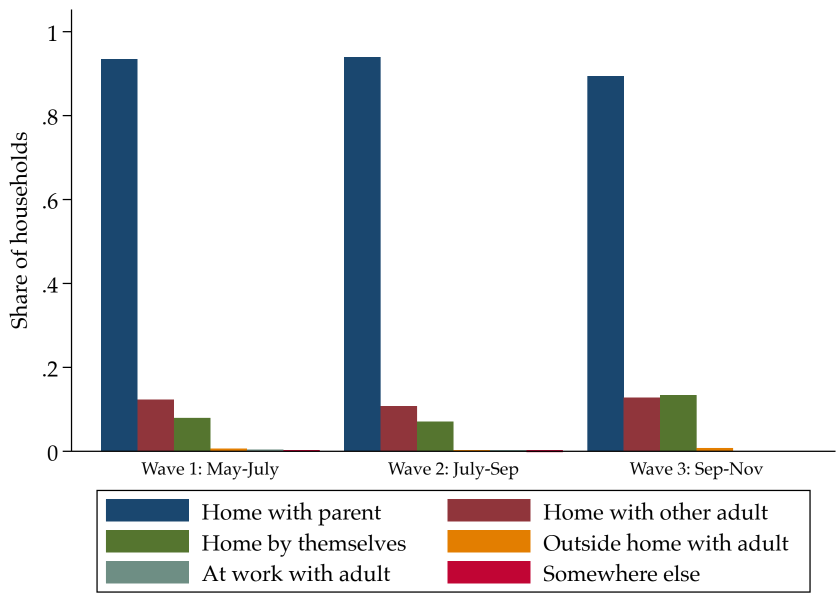
# Appendix A: Additional Figures and Tables

Figure A1: Kenya COVID-19 cases, pandemic policy, and data collection timeline




Note: 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

Figure A2: Childcare arrangements when children are out of school




Note: 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 analysis sample households with at least one child in any grade from 3 to 9, but the distribution is nearly identical when considering all households with children.

Table A1: Comparison of analysis sample to other survey households

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Sample | All households | Households with children | Analysis sample households | All HHs ever using child farm labor | Analysis HHs ever using child farm labor |
| Observations | 7171 | 4901 | 1590 | 1494 | 631 |
| *Household characteristics* | | | | | |
| Female household head | 0.32 | 0.30 | 0.29 | 0.28 | 0.26 |
| | (0.47) | (0.46) | (0.45) | (0.45) | (0.44) |
| Count adults | 2.40 | 2.61 | 2.61 | 2.77 | 2.70 |
| | (1.28) | (1.27) | (1.21) | (1.32) | (1.19) |
| Count of all kids age 0-17 | 1.44 | 1.98 | 3.12 | 2.43 | 3.44 |
| | (1.72) | (1.75) | (1.60) | (1.97) | (1.73) |
| Any child age 0-4 | 0.25 | 0.35 | 0.37 | 0.28 | 0.35 |
| | (0.44) | (0.48) | (0.48) | (0.45) | (0.48) |
| Household wealth index | 0.05 | 0.02 | -0.06 | -0.22 | -0.27 |
| | (1.01) | (0.99) | (0.94) | (0.93) | (0.89) |
| Urban | 0.53 | 0.51 | 0.47 | 0.42 | 0.38 |
| | (0.50) | (0.50) | (0.50) | (0.49) | (0.49) |
| Any HH agriculture activity | 0.65 | 0.71 | 0.80 | 1.00 | 1.00 |
| | (0.48) | (0.46) | (0.40) | (0.04) | (0.04) |
| Any child engaged in HH farm labor | 0.21 | 0.29 | 0.40 | 1.00 | 1.00 |
| | (0.41) | (0.46) | (0.49) | (0.00) | (0.00) |
| Total child HH farm labor hours in last 7 days | 2.46 | 3.59 | 4.76 | 11.79 | 11.99 |
| | (9.39) | (11.18) | (11.90) | (17.70) | (16.45) |
| Any HH non-farm enterprise activity | 0.20 | 0.22 | 0.25 | 0.18 | 0.19 |
| | (0.40) | (0.42) | (0.43) | (0.38) | (0.39) |
| *Respondent characteristics* | | | | | |
| Age | 39.39 | 38.66 | 40.56 | 42.53 | 42.38 |
| | (13.81) | (12.42) | (11.64) | (13.36) | (12.30) |
| Female | 0.52 | 0.56 | 0.58 | 0.53 | 0.54 |
| | (0.50) | (0.50) | (0.49) | (0.50) | (0.50) |
| Completed primary school | 0.89 | 0.89 | 0.87 | 0.83 | 0.82 |
| | (0.32) | (0.32) | (0.34) | (0.38) | (0.39) |
| Completed secondary school | 0.55 | 0.52 | 0.47 | 0.42 | 0.37 |
| | (0.50) | (0.50) | (0.50) | (0.49) | (0.48) |
| Married | 0.64 | 0.72 | 0.75 | 0.74 | 0.78 |
| | (0.48) | (0.45) | (0.43) | (0.44) | (0.42) |
| *Respondent labor supply* | | | | | |
| Engaged in any work in last 7 days | 0.59 | 0.63 | 0.68 | 0.84 | 0.84 |
| | (0.49) | (0.48) | (0.47) | (0.37) | (0.37) |
| Engaged in wage employment in last 7 days | 0.13 | 0.12 | 0.10 | 0.07 | 0.06 |
| | (0.34) | (0.32) | (0.30) | (0.26) | (0.24) |
| Engaged in HH agriculture in last 7 days | 0.43 | 0.49 | 0.56 | 0.80 | 0.82 |
| | (0.49) | (0.50) | (0.50) | (0.40) | (0.39) |
| Engaged in HH non-ag enterprise in last 7 days | 0.09 | 0.10 | 0.10 | 0.07 | 0.07 |
| | (0.29) | (0.30) | (0.30) | (0.26) | (0.26) |
| Total work hours in last 7 days | 17.51 | 18.52 | 20.11 | 22.70 | 24.25 |
| | (21.96) | (22.03) | (21.72) | (21.79) | (21.77) |
| Wage employment hours in last 7 days | 4.63 | 3.80 | 3.34 | 1.91 | 1.85 |
| | (13.90) | (12.56) | (11.87) | (9.17) | (9.12) |
| HH agriculture hours in last 7 days | 9.65 | 11.25 | 13.44 | 18.72 | 20.42 |
| | (15.34) | (16.08) | (16.80) | (17.89) | (17.73) |
| HH non-ag enterprise hours in last 7 days | 3.23 | 3.54 | 3.50 | 2.40 | 2.28 |
| | (12.25) | (12.71) | (12.43) | (10.13) | (9.80) |
| Childcare hours, last 7 days | 43.67 | 43.71 | 48.34 | 44.09 | 49.49 |
| | (43.20) | (43.21) | (44.73) | (43.61) | (45.91) |

Note: The table compares means for household and respondent characteristics across different samples of survey households. Data are from the first time a household is observed, typically in survey round 1 (May-early July) while schools were fully closed. Column (1) includes all households surveyed at least once in the first 4 rounds of the survey. Column (2) includes households with any children. Column (3) includes analysis sample households: those with at least one child in grades 3-9. Column (4) includes all households reporting any child HH ag work at any point during the first 4 rounds of the survey. Column (5) is the same but restricted to analysis sample households. “HH” indicates “household”.

Table A2: Baseline balance by treatment status

| | Control (N=919) Mean (SD) | Treated (N=323) Difference (SE) | Mixed (N=348) Difference (SE) |
|---|---|---|---|
| *Household characteristics* | | | |
| Female household head | 0.29 | 0.01 | -0.02 |
| | (0.46) | (0.03) | (0.01) |
| Count adults | 2.55 | 0.10 | 0.10** |
| | (1.16) | (0.08) | (0.04) |
| Count of all kids age 0-17 | 2.89 | -0.12 | 0.59*** |
| | (1.56) | (0.10) | (0.05) |
| Any child age 0-4 | 0.38 | -0.03 | 0.00 |
| | (0.48) | (0.03) | (0.02) |
| Household wealth index | -0.05 | 0.09 | -0.04 |
| | (0.95) | (0.06) | (0.03) |
| Urban | 0.46 | 0.02 | 0.01 |
| | (0.50) | (0.03) | (0.02) |
| Any HH agriculture activity | 0.79 | -0.04 | 0.03** |
| | (0.40) | (0.03) | (0.01) |
| Any child engaged in HH farm labor | 0.37 | 0.00 | 0.06*** |
| | (0.48) | (0.03) | (0.02) |
| Total child HH farm labor hours in last 7 days | 4.36 | 0.40 | 0.72** |
| | (11.01) | (0.75) | (0.37) |
| Any HH non-farm enterprise activity | 0.25 | 0.01 | -0.00 |
| | (0.43) | (0.03) | (0.01) |
| *Respondent characteristics* | | | |
| Age | 39.97 | 1.37* | 0.70* |
| | (11.44) | (0.76) | (0.36) |
| Female | 0.59 | -0.03 | -0.01 |
| | (0.49) | (0.03) | (0.02) |
| Completed primary school | 0.88 | -0.01 | -0.02* |
| | (0.33) | (0.02) | (0.01) |
| Completed secondary school | 0.48 | -0.01 | -0.03** |
| | (0.50) | (0.03) | (0.02) |
| Married | 0.74 | -0.02 | 0.03** |
| | (0.44) | (0.03) | (0.01) |
| *Respondent labor supply* | | | |
| Engaged in any work in last 7 days | 0.68 | 0.02 | -0.00 |
| | (0.47) | (0.03) | (0.01) |
| Engaged in wage employment in last 7 days | 0.10 | 0.02 | -0.01 |
| | (0.30) | (0.02) | (0.01) |
| Engaged in HH agriculture in last 7 days | 0.55 | -0.02 | 0.02 |
| | (0.50) | (0.03) | (0.02) |
| Engaged in HH non-ag enterprise in last 7 days | 0.09 | 0.04** | 0.00 |
| | (0.29) | (0.02) | (0.01) |
| Total work hours in last 7 days | 19.79 | 1.82 | -0.13 |
| | (21.38) | (1.40) | (0.68) |
| Wage employment hours in last 7 days | 3.60 | 0.34 | -0.75** |
| | (12.36) | (0.81) | (0.36) |
| HH agriculture hours in last 7 days | 13.11 | 0.27 | 0.61 |
| | (16.45) | (1.08) | (0.52) |
| HH non-ag enterprise hours in last 7 days | 3.20 | 1.15 | 0.14 |
| | (11.98) | (0.81) | (0.38) |
| Childcare hours in last 7 days | 48.36 | -3.05 | 1.37 |
| | (44.13) | (2.85) | (1.41) |
| Test of joint significance | | $F = 0.97$ | $F = 8.52$ |
| | | $p = 0.500$ | $p < 0.001$ |

Note: The table presents means for control households with a child in grade 3, 5, 6, 7, or 9 and results from separate bivariate regressions of specific characteristics on treatment status. Treated households have a child in grade 4 or 8, and mixed households have 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. At the bottom of the table are results from tests of the joint significance of all characteristics in explaining treatment status.

Table A3: Impacts of partial school reopening on household income in the last 14 days

| | KSH | | | | Log(KSH+1) | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) Total | (2) Wage work | (3) HH ag. | (4) HH ent. | (5) Total | (6) Wage work | (7) HH ag. | (8) HH ent. |
| Post x Treat | -122.4 | 287.9 | -259.5 | -150.8 | -0.600 | -0.176 | -0.308 | -0.209 |
| | (656.9) | (466.1) | (176.7) | (428.5) | (0.369) | (0.241) | (0.257) | (0.227) |
| Post x Mixed | -813.8 | -99.6 | -299.0** | -415.2 | -0.570 | -0.202 | -0.365* | -0.123 |
| | (688.2) | (404.6) | (138.5) | (534.1) | (0.362) | (0.237) | (0.214) | (0.230) |
| Observations | 2997 | 2997 | 2997 | 2997 | 2997 | 2997 | 2997 | 2997 |
| Mean, pre-reopen control | 2404.0 | 833.8 | 303.8 | 1266.3 | 2.145 | 0.708 | 0.735 | 0.894 |

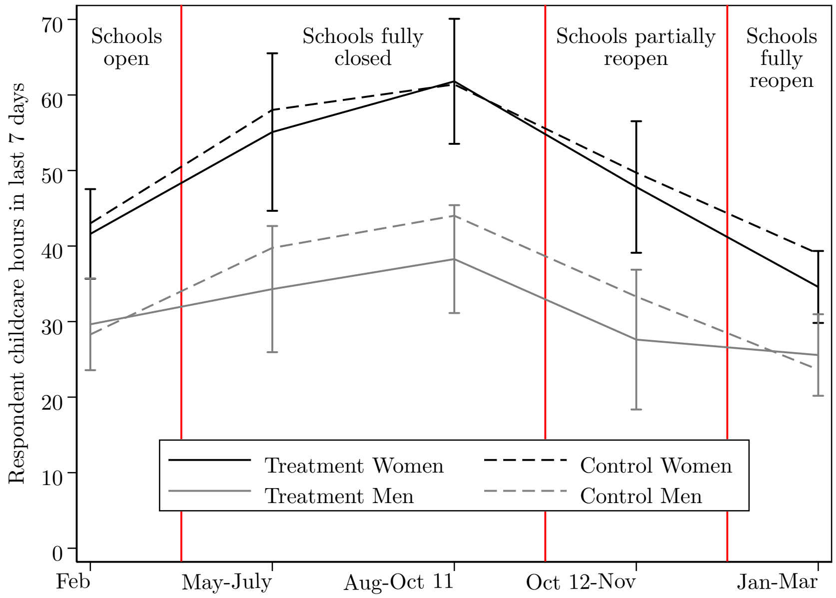
Note: This table presents estimates of Equation 1 for measures of household income over the last 14 days. Columns 1-4 report estimates for income in Kenyan Shillings (KSH; USD 1 $\approx$ 107 KSH) and columns 5-8 report estimates for the log of income + 1. Observations include data from May to November 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 types of children. '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 A4: Correlates of sample household characteristics

| | (1)<br>Above mean<br>HH wealth | (2)<br>Any child<br>HH ag work |
|---|---|---|
| Treat | -0.003 | 0.025 |
| | (0.031) | (0.028) |
| Mixed | 0.002 | 0.036 |
| | (0.032) | (0.029) |
| Female household head | -0.032 | -0.024 |
| | (0.027) | (0.025) |
| Count adults | -0.016 | -0.012 |
| | (0.010) | (0.010) |
| Count of all kids age 0-17 | -0.030*** | 0.046*** |
| | (0.009) | (0.008) |
| Any child age 0-4 | -0.002 | -0.109*** |
| | (0.028) | (0.026) |
| Urban | 0.084*** | -0.040* |
| | (0.025) | (0.023) |
| Any HH agriculture activity | -0.137*** | 0.437*** |
| | (0.034) | (0.029) |
| Any HH non-farm enterprise activity | 0.103*** | -0.042 |
| | (0.028) | (0.026) |
| Any child engaged in HH farm labor | -0.099*** | |
| | (0.027) | |
| Above mean household wealth | | -0.085*** |
| | | (0.023) |
| Observations | 1590 | 1590 |
| Outcome mean | 0.590 | 0.397 |

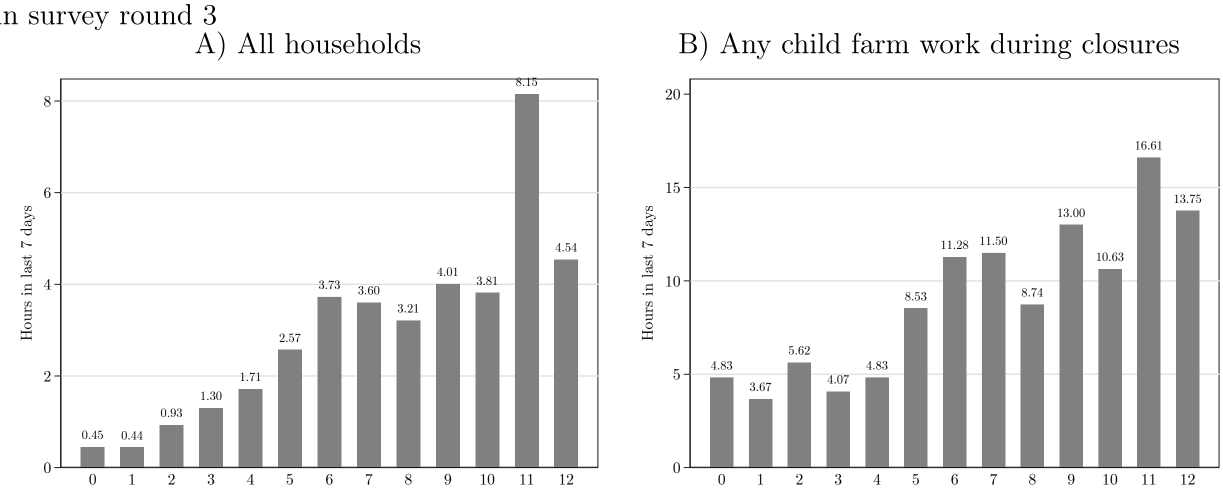
Note: This table presents correlates of whether the household is above the mean for a normalized index of household wealth (based on housing and asset ownership before the pandemic) and whether the household reports any children engaged in household agricultural work. Data are from the first time a household is observed in the RRPS. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure A3: Mean respondent childcare hours by treatment group and sex over time




Note: The figure shows mean respondent childcare hours in the last 7 days by treatment status and sex over time, along with 95% confidence intervals around the treated group means. Childcare hours include time spent doing other activities while caring for children. 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.

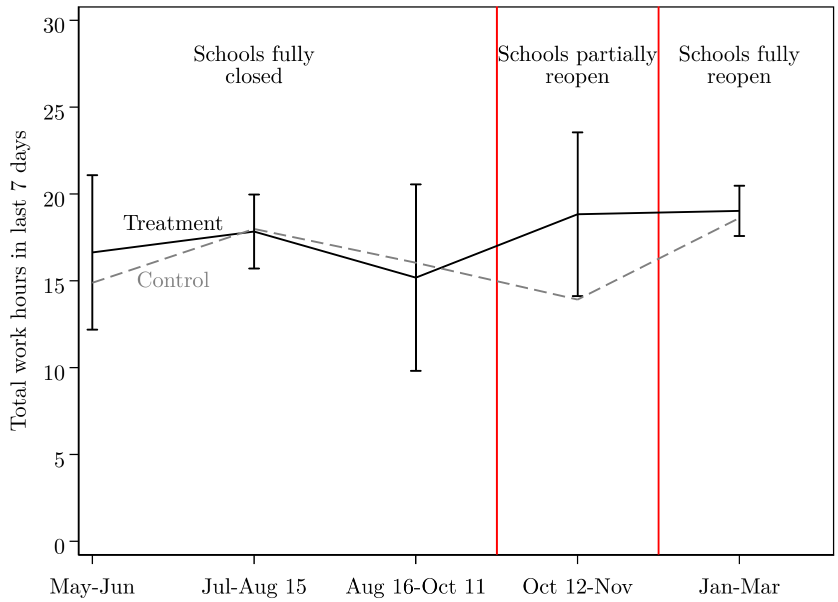
Figure A4: Mean child hours in household agricultural work by grade, randomly selected children in survey round 3




Note: The figure shows mean child hours in household agriculture in the last 7 days by grade of the randomly selected child for survey round 3, which coincides with the partial school reopening for grades 4, 8, and 12. Hours for individual children are not available for survey rounds 1 and 2 while schools were closed.

# 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 |

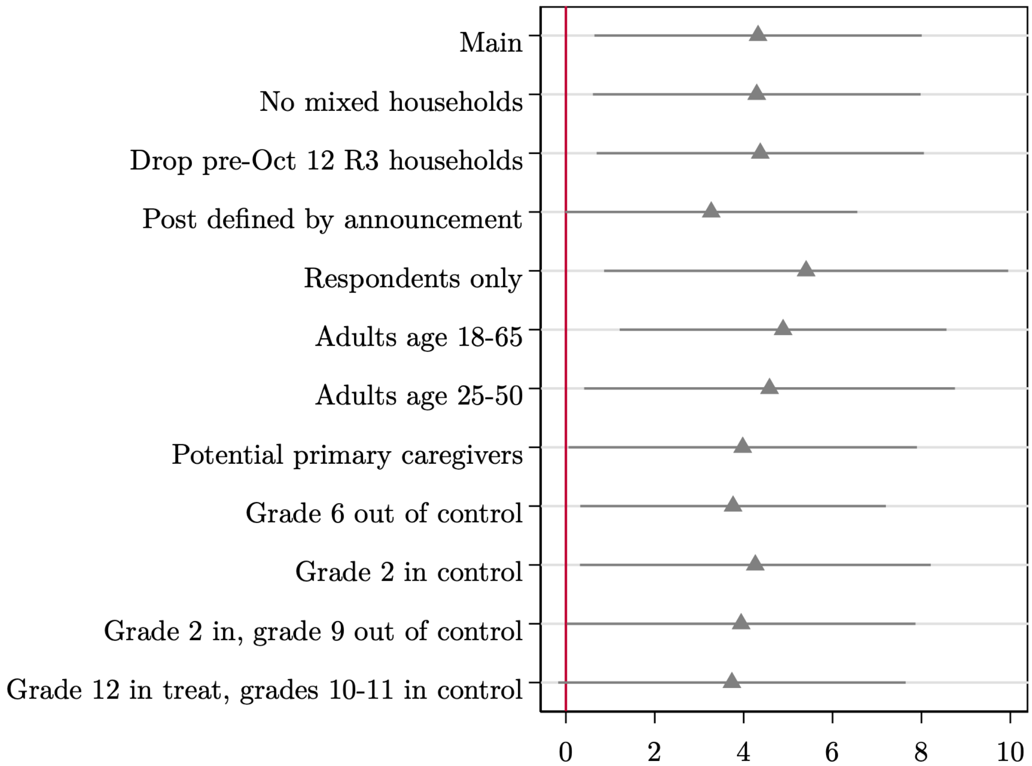
Note: This table presents estimates from Figure A5 of the interaction between *Treat* and time period from Equation 1, where *Post* is replaced with time period dummies, which also enter separately into the equation. The reference period is July-August 15, while schools were closed and before the partial 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)<br>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

| Interaction term Z: | (1) Female | (2) Any work during closures | (3) Any wage employmt during closures | (4) Any HH ag work during closures | (5) Any HH ent. work during closures | (6) Ag HH | (7) Urban location | (8) Large urban location | (9) 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

| Interaction term Z | (1)<br>None | (2)<br>Only 1 HH child | (3)<br>Any child age 0-4 | (4)<br>Any girl in grades 3-9 | (5)<br>Any child in grades 7-9 | (6)<br>Any child in HH ag | (7)<br>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

| Interaction term Z | (1) None | (2) Only 1 HH child | (3) Any child age 0-4 | (4) Any girl in grades 3-9 | (5) Any child in grades 7-9 | (6) Any child in HH ag | (7) 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

| Interaction term Z | (1) None | (2) Only 1 HH child | (3) Any child age 0-4 | (4) Any girl in grades 3-9 | (5) Any child in grades 7-9 | (6) Any child in HH ag | (7) 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

| Interaction term Z | (1) None | (2) Only 1 HH child | (3) Any child age 0-4 | (4) Any girl in grades 3-9 | (5) Any child in grades 7-9 | (6) Any child in HH ag | (7) 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

| Interaction term Z | (1) None | (2) Only 1 HH child | (3) Any child age 0-4 | (4) Any girl in grades 3-9 | (5) Any child in grades 7-9 | (6) Any child in HH ag | (7) 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 $\theta$ of home production time that simultaneously provides passive childcare. $\psi_g$ 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 $Q_k = Q_k(CC_k, \bar{C}C_k(age_k, S))$ is a concave function of childcare provided to the child and their minimum required care.[40] Minimum required care $\bar{C}C_k(age_k, S)$ 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.