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Learning Inequalities during COVID-19: Evidence from Longitudinal Surveys from Sub-Saharan Africa

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ABSTRACT

Learning Inequalities during COVID-19: Evidence from Longitudinal Surveys from Sub-Saharan Africa*

There is hardly any study on learning inequalities during the COVID-19 pandemic in a low-income, multi-country context. Analyzing 34 longitudinal household and phone survey rounds from Burkina Faso, Ethiopia, Malawi, Mali, Nigeria, Tanzania, and Uganda, we find that while countries exhibit heterogeneity, the pandemic generally results in lower school enrolment rates. We find that policies targeting individual household members are most effective for improving learning activities, followed by those targeting households, communities, and regions. Households with higher education levels or living standards or those in urban residences are more likely to engage their children in learning activities and more diverse types of learning activities. Furthermore, we find some evidence for a strong and positive relationship between public transfers and household head employment with learning activities for almost all the countries.

JEL Classification: D0, H0, I2, O1

Keywords: COVID-19, education, learning activities, enrolment, sub-Saharan Africa, household surveys

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I. Introduction

The COVID-19 pandemic has wreaked havoc on the global economy in innumerable ways, bringing particularly adverse impacts on vulnerable population groups, such as women and poorer households (Alon *et al.*, 2022; Bargain and Aminjonov, 2021; Dang and Nguyen, 2021; Dang *et al.*, 2022; Sumner *et al.*, 2022). Many countries also witnessed learning disruptions, including school closures for extended periods. These unexpected negative shocks might have had consequential effects on children's learning outcomes in poorer households since these households were long known to be more likely to reduce their children's education expenditures or enrolment during times of crisis (Edmonds, 2007). Various studies provide supportive evidence for the harmful effects of the pandemic on deepening learning inequities in richer countries (Jæger and Blaabæ, 2020; Bacher-Hicks *et al.*, 2021; Blanden *et al.*, 2022).¹

Yet, despite the growing literature that focuses on richer countries, much fewer studies rigorously investigate the factors affecting children's learning activities during the pandemic in a low-income, multi-country context. Lower-income countries merit special attention for different reasons. Students in lower-income countries generally have lower education achievement than their peers in richer countries and have limited access to education resources (Glewwe and Muralidharan, 2016). During the COVID-19 pandemic, the education budgets in richer countries were estimated to be more than 40 times higher than those in poorer countries (Al-Samarrai *et al.*, 2020). Furthermore, even within these poor countries, stark divides exist between rich and poor households. Only five percent of girls from the poorest quintile of households in Cameroon learned enough to continue school, compared with 76 percent of girls from the richest quintile; a similar situation occurs in other sub-Saharan Africa (World Bank, 2018). Consequently, the learning

¹ See also Bloom *et al.* (2022) and Brodeur *et al.* (2021) for recent reviews of the economics literature on COVID-19 and Miguel and Mobarak (2022) for a review focused on developing countries.

inequalities that were seen during the pandemic in richer countries discussed above might likely be amplified in poorer countries.

The emerging literature on poorer countries mostly focuses on single-country case studies and points to more learning loss for disadvantaged children. For example, Dessy *et al.* (2021) and Kidman *et al.* (2022) find lower school attendance, between 7 and 14 percent, following school reopening in Nigeria and Malawi. Ardington *et al.* (2021) further estimate that primary school children in South Africa could experience a learning loss of up to 81% of a typical school year. Yet, a recent study for India shows that students in rural Tamil Nadu tested 18 months after the pandemic-induced school closures displayed considerable learning deficits in math and in language compared to identically-aged students in the same villages before the pandemic, but this deficit was largely made up within 6 months after school reopening (Singh, Romero, Muralidharan 2022).

Other studies employ phone survey data alone for descriptive analysis. Offering an overview study using phone survey data from 31 low- and middle-income countries, Bundervoet *et al.* (2022) find that 30 percent of children did not continue in alternative learning activities as schools closed, and these children tend to come from poor households. Descriptive analysis by Favara *et al.* (2022) based on phone survey data from the Young Lives project similarly indicates higher dropout rates and less remote learning during the pandemic in Ethiopia, India, Peru, and Vietnam. We provide a more detailed review of these studies in Table A1 (Appendix A).²

² In the absence of survey data, other studies rely on simulation to predict the pandemic's negative effects. For example, Angrist *et al.* (2021) estimate the pandemic to cause learning loss ranging from 6 months to more 1 year, with short-term learning deficits for a child in grade 3 possibly accumulating 2.8 years of lost learning by grade 10. Azevedo *et al.* (2021) estimate a pandemic-induced lifetime earnings loss of US\$2375 to US\$6848 per person in sub-Saharan Africa.

We make several new contributions in this study. First, we offer an early assessment of the impacts of the COVID-19 pandemic on learning inequalities, using panel data from around 11,000 households across 34 survey rounds for seven lower-income Sub-Saharan African countries: Burkina Faso, Ethiopia, Malawi, Mali, Nigeria, Tanzania, and Uganda.

Second, our analysis improves on previous studies that only rely on phone surveys in various aspects. In addition to many technical challenges that can affect the data quality of phone surveys,³ one key limitation is that phone surveys do not offer detailed information on household pre-pandemic socioeconomic status given its short questionnaire nature. We construct a richer, novel household database by combining standard pre-COVID-19 Living Standard Measurement Study (LSMS-ISA) household consumption surveys with multiple rounds of panel phone surveys recently collected by the World Bank. Since the phone surveys used the pre-COVID-19 LSMS-ISA surveys as the sample frame, we were able to match these phone surveys with the LSMS-ISA household surveys and analyze useful pre-pandemic variables, such as household consumption and demographics, and household head characteristics. The combined household and phone panel surveys allow us to address the limitations of phone surveys discussed above.

Finally, we employ a statistical multi-level (linear mixed) model that allows us to decompose the contributions to education activities from the country, region, community, and household levels. Insights into the relative contributions of these levels offer policy relevant inputs. Furthermore, since this linear mixed model also represents a generalized version of the standard household effects econometric models, we can examine the impacts of various household

³ Notably, phone survey data are more susceptible to various issues (including low response rates, under-coverage or selection bias toward richer households, and shorter questionnaires with much fewer variables) than the typical household survey, so typically do not allow rigorous and comprehensive analysis as can be implemented with the standard household survey (Egger *et al.*, 2021; Miguel and Mobarak, 2022).

characteristics just as with the latter model, but we do so more rigorously after fully taking into account the other sources of effects.

We find that the pandemic results in reduced learning activities, and countries exhibit much heterogeneity both in these learning activities and their determining factors. We also find that policies targeting individual household members are most effective for improving learning activities, to be followed by those targeting households, communities, and regions. Controlling for other factors, households with higher education levels or living standards or those who reside in urban areas are more likely to engage their children in learning activities and more diverse types of learning activities.

A sharp education gradient exists, where household heads who completed primary education are 5 percentage points more likely to engage their children in any learning activities, but the corresponding figures are two to three times higher for heads with some secondary education or post-secondary education. More educated households and richer households are also more likely to have contacts with teachers and have more diverse options to contact teachers. Furthermore, we find a strong and positive relationship between public transfers and household head employment with learning activities during the pandemic for all the countries (except for household head employment in Malawi).

This paper consists of six sections. We offer an overview of the data in the next section before briefly comparing the education outcomes before and after the pandemic in Section III. We subsequently present the analytical framework in Section III and discuss the estimation results in Section IV regarding the variance decomposition (Section IV.1) and the determinants of learning activities (Section IV.2). We extend the analysis in Section V to include pandemic-induced shocks

and public assistance (Section V.1) and child-level data for Uganda (Section V.2) before finally concluding in Section VI.

II. Descriptive Analysis

II.1. Data

To monitor the impact of the COVID-19 pandemic for policy interventions, the World Bank has been conducting High-Frequency Phone Surveys of Households (HFPSs) in several countries. We analyze data from around 11,000 panel households in 34 survey rounds. These include 27 phone survey rounds from seven lower-income sub-Saharan African countries: Burkina Faso (3), Ethiopia (7), Malawi (2), Mali (1), Nigeria (6), Tanzania (1), and Uganda (7) (with the numbers in parentheses indicating the number of phone survey rounds for each country) and seven LSMS-ISA household survey rounds, one for each country. The implementation of the phone surveys varies by country, mostly starting between April-June 2020 and finishing by November 2021 (Table 1). In each survey round, the surveyed households were asked a set of core questions on topics such as access to educational activities during school closures, employment, income loss and coping strategies, and whether the household received assistance from the government to cope with the pandemic.

Building on the national sample of households that had been interviewed face-to-face during the most recent LSMS-ISA national longitudinal household surveys, the HFPSs aimed to recontact the entire sample of households that had a phone number for at least one household member (or a reference individual).⁴ The same households were tracked over several months, with selected

⁴ Under the LSMS-ISA project, face-to-face panel surveys had been conducted in six countries. More information on the LSMS-ISA can be found at <https://www.worldbank.org/en/programs/lsmis/initiatives/lsmis-isa>. Households from previous surveys could also be added to the sample if the non-contact/ non-response rate was too high to obtain a nationally representative sample (as with Nigeria's COVID-19 NLPS).

respondents completing phone-based interviews every three to four weeks (Table 1). The respondent is typically the household head. Where the household head could not be reached despite numerous call-backs, another knowledgeable household member was selected as the respondent. The final dataset covers a panel of households that is nationally representative of households with access to a mobile phone residing in urban and rural areas.⁵

While the HFPSs have a light questionnaire since the mode of collection is by phone, we can link the households in the HFPSs with the most recent LSMS-ISA survey rounds. These include the Enquête Harmonisée sur le Conditions de Vie des Ménages (EHCVM) 2018/19 for Burkina Faso, the Ethiopia Socioeconomic Survey (ESS) 2018/19 for Ethiopia, the Integrated Household Panel Survey (IHPS) 2019 for Malawi, the Enquête Harmonisée sur le Conditions de Vie des Ménages (EHCVM) 2018/19 for Mali, the General Household Survey (GHS-Panel) 2018/19 for Nigeria, the Tanzania National Panel Survey (NPS 2014/15) for Tanzania, and the Uganda National Panel Survey (UNPS) 2019/20 for Uganda. The extensive data collected in the LSMS-ISA surveys just prior to the pandemic provides a rich background on households surveyed in the HFPSs, which sets our analysis apart from previous studies that analyze phone surveys alone.

One limitation of the HFPSs, however, is comparability of the education data across countries. Despite the original plan to standardize the questionnaire design to allow for cross-country comparisons, due to varying country specific engagement and consultation processes, the questionnaires end up being slightly different between countries. Table A2 in Appendix A compares the education questions from the different HFPS questionnaires. Another limitation is

⁵ There can be low phone penetration rates in some countries, especially in rural or remote areas. This not only means that the HFPS sample size in rural areas is relatively low, but we can also observe a systematic difference among households owning a phone and those who do not. For example, households with phones can be better off in terms of total consumption, educational attainment, access to improved water and sanitation, access to assets, and access to electricity. To overcome potential selection bias and to mitigate against non-response bias, the phone surveys include sampling weights that are calculated using pre-COVID-19 LSMS-ISA data.

that except for Uganda, the HFPSs mostly collect household-level, rather than individual-level panel data. In particular, the typical survey question on pre-COVID-19 school attendance for each surveyed household is “Were any children attending school before schools were closed due to coronavirus?” The HFPSs then asks households whether children who were in school before the outbreak began were engaged in any learning activities after schools were closed. As such, our definition of school enrolment rates before the pandemic is based on household-level data, and the participation rate in learning activities after the pandemic is restricted to children who went to school before the pandemic.

We provide, in Table 2, the full summary statistics for the variables employed in the regression analysis. For all the seven countries before the pandemic (last column on the right), the average age of household heads is 46.1, and households have more school-age children (2.8 children age 0-14) than older members (e.g., 1.8 and 0.3 members age 25-59 and 59 and older respectively). About one-fifth of all households are female-headed. A considerable share (one-third) of all household heads either have no formal education or complete primary education, while the corresponding figures with (some) secondary education and post-secondary education are respectively 21 percent and 9 percent. The majority of household heads are self-employed (76 percent), with some working for wages (9 percent) and the remaining not working (15 percent). Less than one-third (28 percent) of all households live in an urban area.

After the pandemic-induced school closures, half of all households engage in some learning activities but have just fewer than one (0.9) type of learning activity on average. Only 23 percent of all households have any contact with teachers and all households have 0.4 contacts on average. More than half of all households (53 percent) experienced decreased (total) income since school closure (for the first round of the data collection) or during the past four weeks (for other rounds

of data collection). While the majority of heads work (79 percent), one-fifth of all households experience food insecurity and about 9 percent of all households receive some public transfer. Table 2 also shows much country heterogeneity exists regarding learning activities, which we consider next.

II.2. Overview of Learning Activities before and after COVID-19

Figure 1 shows in a decreasing order the participation rate—or the share of households with children being engaged—in any learning activity after schools were closed due to COVID-19 (blue bars) for the seven countries. The participation rate is highest in Tanzania (67 percent), followed by Nigeria (59 percent), Uganda (51 percent), Burkina Faso (37 percent), Mali (36 percent), Ethiopia (27 percent), and Malawi (20 percent). To compare with a similar education outcome before COVID-19, we also show the absolute differences between this rate and the enrolment rate—or the share of households with children attending school—before schools were closed due to COVID-19 (red dots).⁶ These differences produce a similar ranking for the countries, except that Burkina Faso and Uganda switch places because Burkina Faso has a lower pre-pandemic enrolment rate. Put differently, Tanzania appears least affected by the pandemic in terms of learning activities, followed by Nigeria, Burkina Faso, Uganda, Mali, Ethiopia, and Malawi.

Access to quality remote and hybrid learning also varied across countries. Figure 2 (Panels A to E) looks more closely at the specific learning activities and suggests that the most popular type of educational activities in all countries is working on the assignments provided by teacher. When compared to the other countries, Tanzania leads in working on the teacher assignments, while

⁶ We provide the exact numbers underlying Figure 1 in Appendix A, Table A3. Restricting the HFPS samples to those implemented in 2021 only produces similar numbers for Tanzania, Uganda, and Ethiopia (results available upon request). An urban-rural gap in engagement in learning activities exists as well (Appendix A, Figure A1).

Nigeria leads in engaging into all other types of educational activities including using mobile learning apps and tutoring sessions, watching educational television programs or listening to educational radio programs. If we consider all these specific activities as equally important, we can obtain the ranking for each country by averaging its ranks for the five activities (Table A4 in Appendix A). Using this average ranking, Nigeria comes first (1.2), to be followed by Tanzania (3), Ethiopia (3.4), Burkina Faso (4.4), Uganda (4.4), Mali (5.4), and Malawi comes last (6.2).

Figure 2 (Panel F) further confirms that Nigeria performs strongly during the pandemic with students having an average number of 0.5 contacts with their teachers, followed by Tanzania (0.38 contacts), Burkina Faso (0.23 contacts), Mali (0.23 contacts), Uganda (0.13 contacts), and Malawi (0.03 contacts). The Ethiopia HFPS does not collect data on the teacher contacts, so we omit Ethiopia from this figure. For further reference, we also plot in Figure A2 in Appendix A, the average number of contacts for households with some contact with teachers.

III. Analytical Model

We first estimate a multi-level (linear mixed) model for each country with three levels of nested random effects

$$y_{ijrt} = \gamma_t + reg_r + com_j + household_i + \varepsilon_{ijrt} \quad (1)$$

where y_{ijrt} represents the learning activities after the pandemic-induced school closures for household i in community (village) j and region r in survey round t .⁷ y_{ijrt} includes four outcomes: i) whether the household has any learning activities for their children, ii) the household's number of (types of) learning activities, iii) whether the household has any contact with teachers, and iv)

⁷ The community is often the same as the enumeration area. In rural areas, the enumeration areas are defined by village/ward boundaries and therefore community refers to the village/ward. The region can be regions (Burkina Faso, Ethiopia, Tanzania, Mali, Uganda), districts (Malawi), or zones (Nigeria).

the household's number of contacts with teachers. For households that do not have any learning activities (or teacher contacts), we assign a value of zero to their number of learning activities (or number of teacher contacts). Again, we analyze these learning activities for the households that enrolled their children before the pandemic since the HFPSs only collected data on these households. The parameter $\gamma = \gamma_0 + \delta_t$ indicates a constant term and the survey round fixed effects δ_t to control for unobserved characteristics that are common to each survey round.

The model assumes that the random effects across the different levels and the random effects across households at the same level are uncorrelated. Equation (1) allows us to decompose the variation in learning activities into variation at each of the three levels (region, community (or school), and household) as follows

$$\sigma_{ijrt}^2 = \sigma_i^2 + \sigma_j^2 + \sigma_r^2 + \sigma_{it}^2 \quad (2)$$

where the total variance can be broken down into variance components attributed to households (σ_i^2), communities (σ_j^2), regions (σ_r^2), and within-household residuals (σ_{it}^2).

For the multi-country analysis, we estimate a multi-level model for all the seven countries with four levels of nested random effects

$$y_{ijrkt} = \alpha_t + \text{country}_k + \text{reg}_r + \text{com}_j + \text{household}_i + \eta_{ijrkt} \quad (3)$$

where y_{ijkt} represents the education outcomes of household i 's in community j , region r , and country k in survey round t . Compared to Equation (1), we now add the random effects country_k at the country level.

Similar to Equation (2), we can decompose the total variance in learning activities across the seven countries into five components attributed to households (v_i^2), communities (v_j^2), regions (v_r^2), countries (v_k^2), and within-household residuals (v_{it}^2).

$$v_{ijrkt}^2 = v_i^2 + v_j^2 + v_r^2 + v_k^2 + v_{it}^2 \quad (4)$$

To further examine the specific determinants of learning activities, we add the household characteristics to Equations (1) and (3) to estimate the following models for each country

$$y_{ijrt} = \theta_t + \delta X_{ijr} + reg_r + com_j + household_i + \epsilon_{ijrt} \quad (5)$$

and for all the countries

$$y_{ijrkt} = \pi_t + \lambda X_{ijrk} + country_k + com_j + reg_r + household_i + \tau_{ijrkt} \quad (6)$$

where X_{ijr} is a vector of independent variables that includes the household head's age, gender, highest education achievement, employment status (including whether the household head had wage/ salaried work or was self-employed in the past week), as well as the household's consumption per capita (in natural logarithmic form or five-quintiles categories), demographic composition, and residence location (i.e., urban or rural areas). Equations (5) and (6) can be considered the conditional version of Equations (1) and (3) (where we control for household characteristics).

Several remarks are in order for interpreting the linear mixed model. First, a good understanding of the relative contribution to the total variation in learning activities from each level (obtained from the decomposition in Equations (2) and (4)) can help provide appropriate policy advice. For example, if the community (school) level explains a larger share of the total variation than the regional level does, policies focusing on improving schools would likely be more effective than those aiming at equalizing learning access across regions.

Second, the estimated coefficients on the fixed portion associated with the observable variables (i.e., δ and λ in Equations (5) and (6)) can be easily read off of the regression results just as with the standard OLS regression. In particular, since the outcomes in (i) and (iii) above (whether the household has any learning activities or teacher contacts) is a binary variable, the regression results

for these outcomes can be interpreted similarly as with those from the standard linear probability model.

Finally, the linear mixed model is a generalized version of the commonly used random effects model in econometrics.⁸ Thus the above equations can be easily modified or extended to analyze various data situations. Three data situations are most relevant for our analysis. First, all the countries have panel phone surveys, except for Mali and Tanzania. We thus estimate the linear mixed model without the random effects at the household level for these two countries. Consequently, the within-community variations for these two countries are most comparable to the sum total of the variations at the household level and within households for the other five countries.

Secondly, while the phone surveys collect data on whether a household receives some public transfer during the pandemic for all the seven countries, these surveys collect certain variables for some countries only.⁹ These include whether the household's total income decreased, or whether the head was employed, or whether the household experienced food insecurity during the pandemic.¹⁰ It is hard to identify causal impacts given the available data, examining the correlation of these time-varying variables with learning activities can provide useful policy advice. However,

⁸ If there are only two levels of unobserved factors in this model (for example, one at the individual level and the other at the household level), Equation (2) is equivalent to the standard (household) random effects model commonly used in econometrics. See, for example, Skrondal and Rabe-Hesketh (2004) for a comprehensive treatment of multilevel modeling.

⁹ The following question asks about public transfer "Since the day when schools were closed/ since the last interview on, has any member of your household received any assistance from any institution such as the government, international organizations, religious bodies in form of [assistance]?" Forms of assistance such as cash, food, and other in-kind transfers were available for selection. We generate dummy variables indicating whether the household received any public transfer.

¹⁰ The following questions ask about i) income loss "Since the day when schools were closed/ since the last interview on, has income from [source]. Increased, stayed the same or reduced?" ii) work in the past week "Last week, that is from Monday up to Sunday, did you do any work for pay, do any kind of business, farming or other activity to generate income, even if only for one hour?", and iii) food insecurity "You, or any other adult in your household, went without eating for a whole day because of a lack of money or other resources?" We generate dummy variables indicating whether the household experienced income loss or food insecurity or the head worked in the past 7 days.

we will investigate the correlation with these variables with learning activities using the following equations for each country

$$y_{ijrt} = \theta + \varphi Z_{ijrt} + \delta X_{ijr} + reg_r + com_j + household_i + \epsilon_{ijrt} \quad (7)$$

and for all the countries

$$y_{ijrkt} = \pi + \phi Z_{ijrt} + \lambda X_{ijrk} + country_k + com_j + reg_r + household_i + \tau_{ijrkt} \quad (8)$$

where φ and ϕ are the coefficients of interest.

Thirdly, Uganda is the only country that collects panel child-level data and we will further study whether there is any gender difference in learning activities for this country at the child level. It is straightforward to extend the variance decomposition exercise in Equation (2) to include the random effects at the child level as the fourth level (i.e., using a similar equation to Equation (4) but with the child random effects instead of the country random effects).

IV. Estimation Results

IV.1. Variance Decomposition

Figure 3 graphs the variance decomposition results for any learning activities (Panel A), the number of learning activities (Panel B), any contact with teachers (Panel C), and the number of contact with teachers (Panel D) for each country and all the seven countries. The results are obtained using Equations (2) and (4), with the exact numbers shown in Appendix A, Tables A5 to A8.

Figure 3 (Panel A) shows that for any learning activities the lion's share of the total variance is due to within-household variation over time (the gray bar). This share roughly hovers around two-thirds of the total variance for Ethiopia, Malawi, Nigeria, and Uganda, but can go up to as much as 86 percent of the total variance for Burkina Faso. The second largest share of the total variance is accounted for by the household level (the orange bar), ranging from 18 to 28 percent

for the former four countries. The variations are smaller at the community level and the regional level, averaging between three and 10 percent. However, they are different from the variation at the household level, whether the community variation is larger or smaller than the regional variation is specific for each country. In particular, the community variation is larger for Burkina Faso, Ethiopia, Tanzania, and Uganda, and smaller for the remaining three other countries.

If all the seven countries are considered together, the largest variation for any learning activities is also due to within-household variation (64 percent), to be followed by that at the household level (17 percent), the country level (9 percent), the community level (6 percent), and the regional level (5 percent). Notably, the decomposition results are generally qualitatively similar for all the other learning activities variables. For example, averaging across all the countries, the largest variation for any teacher contact is also due to within-household variation (68 percent), to be followed by that at the household level (17 percent), the community level (6 percent), the country level (6 percent), and the regional level (3 percent) (Panel C).

These findings suggest that policy interventions that can accurately target individual household members are by far the most effective for improving learning activities. Similarly, policies that accurately target households also appear to be far more effective than those aimed at the communities or regions. There is also considerable variation at the country level, confirming our earlier discussion (Figures 1 and 2) that countries perform differently regarding learning activities during the pandemic. Building on these results, we turn to examining the specific determinants of household learning activities after the pandemic-induced school closures.

IV.2. Specific Determinants of Learning Activities

The estimation results for any learning activities are shown in Table 3. For all the countries (last column on the right, using Equation (6)), Table 3 shows that household heads' education

achievement, household per capita consumption and urban residence have positive and statistically significant impacts on whether children in the household are engaged in any learning activities. Furthermore, there is a gradient with more education and higher living standards.

Compared to households where heads have no formal education, households where heads have completed primary education are 0.05 (or 5 percentage points) more likely to engage their children in any learning activities. These positive effects double to 0.10 for heads with incomplete secondary education, and steadily increase to 0.11, and 0.15 for heads with completed secondary education and post-secondary education, respectively. Since household per capita consumption is in natural logarithm, the magnitude of its impacts (semi-elasticity) for small changes can be read directly from the estimated coefficients. A 10 percent increase in household per capita consumption increases the probability of any learning activity by 0.006 (or a 0.6 percentage point increase). This positive impact is similar to the corresponding increase in any learning activities caused by moving from rural areas to urban areas.

As an alternative interpretation, we also control for whether the household per capita consumption belongs to any of five consumption quintiles instead of the natural logarithmic scale. The estimation results, shown in Table A9 (Appendix A), are qualitatively similar and indicates stronger impacts for richer households. These results suggest that, compared to households in the poorest consumption quintile (quintile 1), the positive impacts of raising the probability of any learning activities of households in the second poorest or the middle consumption quintile are around 0.05-0.06, which equal those of heads completing primary education. The corresponding increases for households in the second richest or richest consumption quintiles are around 0.10-0.13, which roughly equal those of heads having (some) secondary education.

The other variables have the expected sign. In particular, households with older heads or with heads being employed (either working for wages or being self-employed) are more likely to engage their children in learning activities. But the results are marginally statistically significant at the 10 percent level. Households with younger members are more likely to engage in learning activities.

While these results generally hold for each country, the country-specific regression results (using Equation (5)) clearly exhibit heterogeneities. First, the results tend to have weaker statistical significance, perhaps partly due to a smaller sample size when each country is considered separately. In particular, household consumption level still has a positive sign, but is statistically insignificant for Malawi and Tanzania. Second, some results vary for specific countries. For example, for Burkina Faso, while household heads' education achievement has no statistical significance, their gender (i.e., whether the head is female) and employment status have positive impacts and are statistically significant at the 5 percent level. Urban residence becomes statistically insignificant for both Tanzania and Mali.

Table 4 looks more into the determinants of the number of (types of) learning activities and offers qualitatively similar results. For all the seven countries considered together (last column on the right), household heads with more education or higher living standards have more learning activities for their children. Urban households have more learning activities than rural households. Compared to heads with no formal education, the increases in the number of learning activities for heads with primary education, incomplete secondary education, complete secondary education, or post-secondary education are respectively 0.07, 0.17, 0.20, and 0.30. A 10 percent increase in the household per capita consumption increases the number of learning activities by 0.15, as does living in the urban areas (compared to living in the rural areas). Put differently, households

belonging to the middle, second richest, and richest consumption quintiles have respectively 0.10, 0.18, and 0.26 more learning activities (Appendix A, Table A10).

The estimation results for the determinants of households having any contact with teachers, shown in Table 5, are qualitatively similar to those in Table 3, albeit with weaker impacts for heads' higher education levels and living standards and no statistically significant impacts for urban residence. For all the countries (last column on the right), compared to household heads without any formal education, heads who have completed some or all of secondary education or post-secondary education are respectively 0.03, 0.04, and 0.07 more likely to have any contact with teachers. A 10 percent increase in household per capita consumption increases the probability of any teacher contact by 0.005. Alternatively, if household consumption quintiles are considered, only the richest households (quintile 5) are 0.06 more likely to have any teacher contact (Appendix A, Table A11).

Furthermore, the employment status of household heads no longer has any statistically significant impacts, and only households with the youngest children age 0-14 appear to engage in teacher contact. There is also country heterogeneity. Notably, all the control variables are statistically insignificant for Nigeria.

Table 6 provides estimates on the determinants of the number of types of contacts with teachers. The results are qualitatively similar to those for Table 5, although are somewhat weaker (which is seen earlier with Tables 4 and 3). Now only heads with the highest education level have more types of contacts. Compared to heads with no formal education, the increases in the number of types of learning activities for heads with post-secondary education is 0.12 (last column on the right). A 10 percent increase in the household per capita consumption increases the number of types of teacher contacts by 0.15. Alternatively, if household consumption quintiles are

considered, only the richest households (quintile 5) have 0.07 more teacher contacts than the poorest households (Appendix A, Table A12). Again, country heterogeneity exists with none of the control variables being statistically significant for Nigeria.

V. Further Extensions

We turn next to examine the relationship between learning activities and the pandemic-induced shocks (such as decreased income and food insecurity) and public transfer.

V.1. Pandemic-induced Shocks and Public Assistance

We plot the estimation results for the correlation of public transfer and learning activities in Figure 4 (using Equations (7) and (8)), which shows positive and strongly statistically significant correlation coefficients. Overall, this figure shows that households who received some public transfers have a four percentage point higher probability of enrolling their children in any learning activities. These households also have 0.05 more learning activities. The corresponding increases for the probability of having any teacher contact and the number of teacher contacts are respectively 0.07 and 0.19.¹¹

For specific countries, again heterogeneity exists. Nigerian households appear to benefit the most from public transfers, with the estimated correlation coefficients being positive and strongly statistically significant for all the learning activities variables. For this country, receiving public transfers is associated with increases of 0.06 and 0.17 for the probability of any learning activities and the number of learning activities. The corresponding increases for the probability of any teacher contact and the number of teacher contacts are 0.1 and 0.3.

¹¹ Cash transfers during the pandemic are also observed to increase food expenditure in Ghana and Kenya (Brooks *et al.*, 2022; Karlan *et al.*, 2022).

On the other hand, Ugandan households see higher probabilities of enrolling in learning activities and more learning activities only. For this country, receiving public transfers are associated with increases of 0.05 and 0.06 for the probability of any learning activities and the number of learning activities. For Burkina Faso, receiving public transfers is only positively correlated with more teacher contacts for this country. The corresponding increases for receiving public transfers are 0.12 and 0.13 for the probability of having any teacher contact and the number of teacher contacts.

Next, we plot the estimation results for the correlation of the decrease in (total) household income and learning activities in Figure 5, which are largely statistically insignificant. Considering all the seven countries together, now only households whose income decreased during the pandemic have a one percentage point lower probability of enrolling their children in any learning activities, which is statistically significant at the 5 percent level. Nigeria is the only country that shows a marginally statistically significant correlation (at the 10 percent level) between income decrease and any learning activities. For this country, decreased household income is associated with a 0.04 reduction in the probability of any learning activities.

Plotting the estimation results for household heads' employment status and learning activities, Figure 6 mostly shows a positive and statistically significant relationship. Overall, compared to households with non-working heads, households whose head was working during the pandemic have a three percentage point higher probability of enrolling their children in any learning activities. These households also have 0.14 more learning activities. The corresponding increases for the probability of having any teacher contact and the number of teacher contacts are 0.06 and 0.14.

Regarding specific countries, the impacts are statistically strongest for Nigeria, where households with working heads are 0.05 and 0.10 more likely to enroll their children in learning activities and have teacher contacts. These households also have 0.18 and 0.24 more learning activities and teacher contacts. On the other hand, for working heads, Burkina Faso and Uganda are 0.04 more likely to have teacher contact, and Uganda has 0.06 more teacher contacts; Tanzania households are 0.06 more likely to have teacher contact and have 0.12 more teacher contacts (but these results are marginally statistically significant at the 10 percent level for Tanzania).

Figure 7 shows that households with severe food insecurity have 0.09 more teacher contacts than households without this problem (with the remaining learning activities being marginally statistically significant or statistically insignificant). This result appears to be mostly driven by Nigeria, where severely food insecure households have 0.16 more teacher contacts. This seemingly counterintuitive results suggests that teachers might have contacted food insecure households more in Nigeria, possibly to offer other help (e.g., food assistance) beyond school activities for these households during the pandemic.

In summary, we found a strong and positive relationship between public transfers and household head employment with learning activities during the pandemic for all the countries (except for household head employment in Malawi). We did not find a similar relationship for the other variables including household income loss and food insecurity.

V.2. Child-level Analysis for Uganda

We next exploit the panel child-level data in Uganda to investigate whether any gender differences in learning activities exist for this country. We show in Table 7 the estimation results for any learning activities (first column) and the number of learning activities (second column). The results suggest that compared to Ugandan boys, Ugandan girls are 0.01 (or 1 percentage point)

more likely to engage in any learning activities. Ugandan girls also have 0.07 more learning than boys (although this result is marginally statistically significant at the 10 percent level). These results perhaps seem counter-intuitive, as Björkman-Nyqvist (2013) finds that Ugandan households could respond to income shocks by reducing the amount of schooling and resources provided to girls while boys are to a large extent sheltered.

Yet, it is useful to note that while primary education in Uganda has been free for all girls and boys since 1997, secondary education is provided through a network of government-owned, private sector-owned, or community-owned schools. The Government of Uganda has also initiated various projects in remote learning since 2010, long before the pandemic, to equalize access to secondary education. It is likely that modern forms of educational technology, such as radio and TV, were affordable and beneficial for girls' learning activities during the pandemic (Damani *et al.*, 2022).

For other factors, Table 7 shows that, similar to the analysis of household-level data above, household heads' education achievement, household per capita consumption, and urban residence have positive and statistically significant impacts on whether a child is engaged in any learning activities or on the number of activities the child is engaged in. Children from extended households with younger members are more likely to be engaged in any learning activities and have more learning activities.

VI. Summary and Conclusion

We offer the first study that analyzes the impacts of COVID-19 on learning activities in a multi-country, sub-Saharan African setting. We find that the pandemic resulted in reduced enrolment rates and countries exhibit much heterogeneity. In particular, Tanzania shows the highest participation rate in learning activities after the pandemic at 67 percent, followed by

Nigeria (59 percent), Uganda (51 percent), Burkina Faso and Mali (approximately 37 percent), Ethiopia (27 percent), and Malawi (20 percent). While Tanzania leads in working on the teacher assignments, Nigeria leads in engaging into all other types of educational activities.

Considering all the seven countries together, the largest variation for any learning activities is largest due to within-household variation (64 percent), to be followed by that at the household level (17 percent), the country level (9 percent), the community level (6 percent), and the regional level (5 percent). These decomposition results are qualitatively similar for all the other learning activities variables.

We also find that households with a higher education level or living standard or residing in urban areas are more likely to engage their children in learning activities and more diverse types of learning activities. More educated households and richer households are also more likely to have contacts with teachers and more diverse types of contacts. In particular, compared to households where heads have no formal education, households where heads have completed primary education, or (some) secondary education or post-secondary education respectively are 0.05, 0.10, or 0.15 more likely to engage their children in any learning activities. A 10 percent increase in household per capita consumption increases the probability of any learning activities by 0.006 (or a 0.6 percentage point increase). This positive impact is similar to the corresponding increase in any learning activities caused by moving from rural areas to urban areas. Alternatively, compared to households in the poorest consumption quintile (quintile 1), the positive impacts of raising the probability of any learning activities of households in the second poorest or the middle consumption quintile are around 0.05-0.06, which increase to around 0.10-0.13 for households in the second richest or richest consumption quintiles. While our analysis is mostly based on panel

household-level data, analysis using panel child-level data for Uganda suggests that girls might do slightly better than boys during the pandemic.

We also find a strong and positive relationship between public transfers and household head employment with learning activities during the pandemic for all the countries (except for household head employment in Malawi).

Our results suggest that policies targeting individual household members are most effective for improving learning activities, to be followed by those targeting households, communities, and regions. Furthermore, policy interventions that focus on households that are poor, have less education or reside in rural areas can be useful in protecting them against deepening inequalities caused by the pandemic. Providing public transfers and employment to households can help as well.

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Table 1. High frequency phone survey timeline

		Burkina Faso	Ethiopia	Malawi	Mali	Nigeria	Tanzania	Uganda
Planned start/end of school year (based on 2019)		September/May, 2020	August/June, 2020	September/July, 2020		September/July, 2020		February/November, 2020
Date of first school closure due to COVID-19		March 15, 2020	March 16, 2020	March 23, 2020	March 17, 2020	March 30, 2020	March 17, 2020	March 20, 2020
High Frequency Phone Survey Timeline								
R 1	Date of data collection	June 9 - July 1, 2020	April 22 - May 13, 2020	May 26 - June 14, 2020	May 11- June 3, 2020	April 20 - May 11, 2020	February 21 - March 15, 2021	June 3 - 20, 2020
	Sample size	1,968	3,249	1,729	1,766	1,950	2,734	2,227
R 2	Date of data collection	July 2 - August 24, 2020	May 14 - June 3, 2020	July 2 - 16, 2020		June 2 - 16, 2020		July 31 - August 21, 2020
	Sample size	2,037 (95%)	3,107 (96%)	1,646 (96%)		1,820 (91%)		2,199 (97%)
R 3	Date of data collection		June 4 - 26, 2020			July 2 - 16, 2020		September 14 - October 7, 2020
	Sample size		3,058 (94%)			1,790 (90%)		2,147 (94%)
R 4	Date of data collection		July 27 - August 14, 2020			August 9 - 24, 2020		October 27- November 17, 2020
	Sample size		2,878 (89%)			1,789 (89%)		2,136 (94%)
R 5	Date of data collection	December 09-30, 2020	August 24- September 17, 2020			September 7-21, 2020		February 02-21, 2021
	Sample size	1,945 (90%)	2,770 (85%)			1,773 (89%)		2,126 (93%)
R 6	Date of data collection					October 9-24, 2020		March 23-April 13, 2021
	Sample size					1,762 (88%)		2,102 (92%)
R 7	Date of data collection							October 20- November 15, 2021*
	Sample size							1,950 (85%)
R 8	Date of data collection		December 1-21, 2020					
	Sample size		2,222 (68%)					
R 11	Date of data collection		April 12-May 8, 2021					
	Sample size		1,982 (61%)					
Total Sample Size (round-household obs.)		5,950	19,266	3,375	1,766	10,884	2,734	14,887
Panel households (participated in all rounds)		1,726	1,524	1,646	1,766	1,636	2,734	1,706

Note: All sample size numbers refer to number of households with completed interviews. The proportions of households interviewed in the first round that were also surveyed in later rounds are shown in parentheses.

Table 2. Summary statistics for regression tables

		Burkina	Ethiopia	Malawi	Mali	Nigeria	Tanzania	Uganda	All
<i>Outcome variables after covid-19 school closure</i>									
Any learning activity	Mean	0.36	0.27	0.20	0.36	0.59	0.78	0.51	0.45
	(Std.)	(0.48)	(0.45)	(0.40)	(0.48)	(0.49)	(0.41)	(0.50)	(0.50)
Number of learning activities	Mean	0.48	0.33	0.22	0.32	1.52	0.82	0.61	0.91
	(Std.)	(0.80)	(0.62)	(0.45)	(0.57)	(1.76)	(0.65)	(0.84)	(1.39)
Any contact with a teacher	Mean	0.21	N/A	0.04	0.21	0.27	0.25	0.12	0.23
	(Std.)	(0.41)		(0.20)	(0.41)	(0.45)	(0.44)	(0.32)	(0.42)
Number of contacts with a teacher	Mean	0.23	N/A	0.04	0.23	0.49	0.30	0.13	0.39
	(Std.)	(0.47)		(0.19)	(0.46)	(1.12)	(0.56)	(0.38)	(0.98)
<i>Pre- covid-19 variables (with any learning activity)</i>									
Head's age	Mean	48.12	43.48	45.31	49.06	48.65	41.01	45.51	46.09
	(Std.)	(13.55)	(13.15)	(13.48)	(13.18)	(13.51)	(12.52)	(14.24)	(13.70)
Male	Mean	0.87	0.78	0.70	0.92	0.84	0.71	0.67	0.79
	(Std.)	(0.34)	(0.42)	(0.46)	(0.27)	(0.36)	(0.45)	(0.47)	(0.41)
Female	Mean	0.13	0.22	0.30	0.08	0.16	0.29	0.33	0.21
	(Std.)	(0.34)	(0.42)	(0.46)	(0.27)	(0.36)	(0.45)	(0.47)	(0.41)
No formal education	Mean	0.74	0.55	0.12	0.67	0.33	0.18	0.08	0.37
	(Std.)	(0.44)	(0.50)	(0.32)	(0.47)	(0.47)	(0.38)	(0.27)	(0.48)
Primary	Mean	0.13	0.29	0.60	0.13	0.26	0.66	0.53	0.32
	(Std.)	(0.33)	(0.45)	(0.49)	(0.33)	(0.44)	(0.47)	(0.50)	(0.47)
Secondary incomplete	Mean	0.06	0.09	0.25	0.06	0.04	0.13	0.18	0.09
	(Std.)	(0.24)	(0.28)	(0.43)	(0.24)	(0.19)	(0.34)	(0.38)	(0.28)
Secondary complete	Mean	0.04	0.05	0.02	0.08	0.22	0.02	0.08	0.13
	(Std.)	(0.19)	(0.22)	(0.15)	(0.27)	(0.42)	(0.13)	(0.27)	(0.33)
Post-secondary	Mean	0.04	0.01	0.02	0.06	0.15	0.01	0.14	0.09
	(Std.)	(0.19)	(0.12)	(0.13)	(0.24)	(0.36)	(0.12)	(0.34)	(0.29)
Not working	Mean	0.15	0.25	0.08	0.20	0.09	0.12	0.12	0.15
	(Std.)	(0.35)	(0.43)	(0.27)	(0.40)	(0.28)	(0.33)	(0.32)	(0.36)
Wage employed	Mean	0.11	0.06	0.08	0.14	0.07	0.19	0.17	0.09
	(Std.)	(0.31)	(0.24)	(0.27)	(0.35)	(0.26)	(0.39)	(0.38)	(0.28)
Self-employed	Mean	0.74	0.69	0.84	0.66	0.84	0.69	0.71	0.76
	(Std.)	(0.44)	(0.46)	(0.36)	(0.48)	(0.37)	(0.46)	(0.45)	(0.43)
Number of members aged 0-14	Mean	3.55	2.57	2.44	4.05	3.03	2.36	2.64	2.80
	(Std.)	(2.50)	(1.71)	(1.40)	(2.61)	(2.38)	(1.72)	(1.63)	(2.04)
Number of members aged 15-24	Mean	1.22	1.15	1.27	1.21	1.08	0.94	1.13	1.12
	(Std.)	(1.30)	(1.13)	(1.16)	(1.33)	(1.25)	(1.07)	(1.26)	(1.21)
Number of members aged 25-59	Mean	2.20	1.77	1.65	2.35	1.95	1.55	1.58	1.82
	(Std.)	(1.22)	(0.80)	(0.78)	(1.23)	(1.04)	(0.78)	(0.75)	(0.93)
Number of members aged over 59	Mean	0.36	0.17	0.25	0.42	0.32	0.16	0.25	0.25
	(Std.)	(0.61)	(0.44)	(0.53)	(0.65)	(0.59)	(0.41)	(0.54)	(0.53)
Rural	Mean	0.68	0.72	0.82	0.71	0.72	0.59	0.70	0.71

	(Std.)	(0.47)	(0.45)	(0.39)	(0.45)	(0.45)	(0.49)	(0.46)	(0.45)
Urban	Mean	0.32	0.28	0.18	0.29	0.28	0.41	0.30	0.29
	(Std.)	(0.47)	(0.45)	(0.39)	(0.45)	(0.45)	(0.49)	(0.46)	(0.45)
<i>No. of observations</i>		4549	11154	2338	1249	7353	781	11508	38932
<i>No. of panel households (participated in all rounds)</i>		1,069	682	1,113	1,249	487	781	1,247	1,929
<i>Phone survey variables</i>									
Received public transfers	Mean	0.05	0.05	0.09	1.00	0.10	0.05	0.14	0.09
	(Std.)	(0.23)	(0.23)	(0.28)	(0.00)	(0.30)	(0.22)	(0.35)	(0.29)
<i>No. of observations</i>		1609	8353	1896	46	5633	778	11508	29823
Total income decreased	Mean	N/A	0.43	0.76	N/A	0.74	N/A	0.41	0.53
	(Std.)		(0.50)	(0.43)		(0.44)		(0.49)	(0.50)
<i>No. of observations</i>			8391	2338		2839		6634	20202
Head worked in last 7 days	Mean	0.85	0.82	0.68	0.91	0.76	0.71	0.83	0.79
	(Std.)	(0.36)	(0.38)	(0.47)	(0.29)	(0.43)	(0.45)	(0.37)	(0.40)
<i>No. of observations</i>		4514	11153	1266	202	7282	737	11452	36606
Household is severe food insecure	Mean	0.12	0.13	0.28	N/A	0.34	0.23	0.06	0.19
	(Std.)	(0.33)	(0.34)	(0.45)		(0.47)	(0.42)	(0.24)	(0.39)
<i>No. of observations</i>		1605	8396	2338		4291	777	11508	28915
Price shock	Mean	0.17	N/A	0.38	N/A	0.34	N/A	0.12	0.15
	(Std.)	(0.26)		(0.48)		(0.47)		(0.15)	(0.36)
<i>No. of observations</i>		4549		2338		7353		11508	38932

Note: Household sampling weights are applied. The number of observations in the table is related to households with children who engaged in any learning activity after the pandemic. The number of observations in the table is different for other outcomes. “Std.” stands for Standard deviation. “N/A” stands for unavailable data.

Table 3. Determinants of any learning activities after COVID-19 school closures, conditional mixed model

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.001 (0.001)	0.002*** (0.001)	0.002 (0.001)	0.000 (0.001)	0.002*** (0.001)	0.003** (0.001)	0.003** (0.002)	0.002*** (0.000)
Head is female	0.046** (0.020)	0.028* (0.016)	-0.025 (0.024)	-0.020 (0.024)	0.017 (0.016)	0.013 (0.050)	0.001 (0.035)	0.006 (0.008)
Head is employee	0.080*** (0.026)	0.033* (0.019)	0.015 (0.041)	0.034 (0.040)	-0.035 (0.027)	0.041 (0.048)	0.031 (0.051)	0.019* (0.012)
Head is self-employed	0.073*** (0.020)	0.001 (0.016)	0.010 (0.033)	0.008 (0.030)	-0.009 (0.020)	0.061 (0.039)	0.022 (0.043)	0.017* (0.009)
<i>Head's education level</i>								
Primary	0.012 (0.019)	0.041** (0.017)	0.044 (0.039)	0.094*** (0.024)	0.109*** (0.026)	0.018 (0.044)	0.068 (0.045)	0.053*** (0.009)
Secondary incomplete	-0.002 (0.025)	0.082*** (0.022)	0.112*** (0.043)	0.117*** (0.042)	0.175*** (0.030)	0.112** (0.052)	0.120** (0.054)	0.098*** (0.012)
Secondary complete	-0.006 (0.030)	0.121*** (0.024)	0.121** (0.061)	0.126*** (0.027)	0.135*** (0.036)	0.187*** (0.048)	0.109 (0.103)	0.113*** (0.013)
Post-secondary	-0.013 (0.034)	0.110*** (0.032)	0.305*** (0.067)	0.133*** (0.030)	0.249*** (0.035)	0.250*** (0.051)	0.166* (0.101)	0.147*** (0.014)
<i>Household composition</i>								
Number of members aged 0-14	0.009** (0.004)	0.014*** (0.005)	-0.006 (0.007)	0.000 (0.004)	0.037*** (0.004)	0.002 (0.007)	-0.001 (0.009)	0.011*** (0.002)
Number of members aged 15-24	0.001 (0.005)	0.018*** (0.006)	0.018** (0.008)	-0.009 (0.007)	0.031*** (0.005)	0.003 (0.010)	0.005 (0.012)	0.013*** (0.003)
Number of members aged 25-59	0.007 (0.007)	0.033*** (0.008)	0.004 (0.014)	0.015 (0.010)	0.023** (0.010)	0.026** (0.012)	-0.028 (0.020)	0.015*** (0.004)
Number of members aged 60 and older	0.008 (0.014)	0.007 (0.019)	-0.027 (0.027)	0.020 (0.020)	-0.026 (0.018)	0.009 (0.025)	-0.034 (0.042)	-0.007 (0.008)
<i>Household consumption</i>								
Log of consumption per capita	0.074*** (0.015)	0.054*** (0.012)	0.026 (0.019)	0.039** (0.019)	0.097*** (0.012)	0.078*** (0.029)	0.007 (0.029)	0.064*** (0.006)
Urban	0.065*** (0.019)	0.131*** (0.022)	0.046* (0.028)	0.064*** (0.020)	0.045** (0.018)	-0.020 (0.034)	0.028 (0.035)	0.065*** (0.009)
Constant	-0.071 (0.119)	-0.443*** (0.102)	-0.165 (0.138)	0.204 (0.147)	-0.416*** (0.094)	-0.502** (0.248)	0.535** (0.233)	-0.195** (0.080)
$\ln\sigma_k$								-1.791*** (0.275)
$\ln\sigma_r$	-2.583*** (0.231)	-2.112*** (0.227)	-2.926*** (0.357)	-2.621*** (0.323)	-2.614*** (0.338)	-19.719 (0.000)	-2.052*** (0.200)	-2.434*** (0.104)
$\ln\sigma_j$	-2.231*** (0.091)	-2.027*** (0.064)	-2.647*** (0.254)	-2.575*** (0.208)	-2.303*** (0.104)	-2.518*** (0.426)	-3.047** (1.434)	-2.250*** (0.044)
$\ln\sigma_i$	-2.673*** (0.330)	-1.633*** (0.030)	-1.614*** (0.063)	-1.397*** (0.033)	-1.571*** (0.032)			-1.617*** (0.017)
$\ln\sigma_{it}$	-0.905*** (0.013)	-0.961*** (0.007)	-1.084*** (0.021)	-0.947*** (0.009)	-0.897*** (0.007)	-0.755*** (0.023)	-0.984*** (0.033)	-0.908*** (0.004)
Number of countries								7
Number of regions	13	11	31	6	6	11	30	108
Number of communities	532	446	239	475	655	398	372	3,117
Number of households	1,874	2,276	1,226	1,621	1,940	1,249	781	10,967
Number of observations	4,549	11,154	2,338	7,395	11,508	1,249	781	38,974
Log likelihood	-2527	-6192	-1127	-4364	-6991	-846.7	-364.3	-23649

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table 4. Determinants of number of learning activities after COVID-19 school closures, conditional mixed model

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania	All	
Head's age	0.002* (0.001)	0.004*** (0.001)	0.002 (0.001)	0.004 (0.004)	0.003** (0.001)	0.003** (0.002)	0.004 (0.003)	0.003*** (0.001)	
Head is female	0.006 (0.040)	0.028 (0.028)	-0.039 (0.028)	-0.146 (0.097)	0.044* (0.025)	0.149** (0.062)	0.024 (0.068)	-0.001 (0.019)	
Head is employee	0.166*** (0.052)	0.022 (0.035)	0.032 (0.048)	0.228 (0.161)	-0.068 (0.043)	0.125** (0.060)	0.007 (0.095)	0.040 (0.028)	
Head is self-employed	0.086** (0.040)	0.004 (0.028)	0.016 (0.039)	0.018 (0.118)	-0.002 (0.032)	0.074 (0.049)	-0.032 (0.081)	0.018 (0.021)	
<i>Head's education level</i>									
Primary	0.097** (0.038)	0.051* (0.030)	0.051 (0.047)	0.095 (0.098)	0.096** (0.040)	-0.002 (0.054)	0.103 (0.085)	0.071*** (0.022)	
Secondary incomplete	-0.009 (0.050)	0.150*** (0.039)	0.151*** (0.051)	0.307* (0.167)	0.209*** (0.048)	0.165** (0.064)	0.250** (0.103)	0.167*** (0.028)	
Secondary complete	-0.037 (0.060)	0.196*** (0.042)	0.154** (0.071)	0.257** (0.109)	0.158*** (0.056)	0.277*** (0.059)	0.348* (0.195)	0.204*** (0.030)	
Post-secondary	-0.038 (0.068)	0.262*** (0.058)	0.367*** (0.079)	0.272** (0.118)	0.345*** (0.055)	0.339*** (0.064)	0.520*** (0.189)	0.297*** (0.034)	
<i>Household composition</i>									
Number of members aged 0-14	0.017** (0.008)	0.024*** (0.008)	0.000 (0.008)	0.010 (0.018)	0.065*** (0.007)	0.024*** (0.009)	0.009 (0.018)	0.024*** (0.005)	
Number of members aged 15-24	0.022** (0.011)	0.031*** (0.010)	0.019** (0.010)	-0.009 (0.027)	0.054*** (0.008)	0.018 (0.012)	0.011 (0.022)	0.028*** (0.006)	
Number of members aged 25-59	0.009 (0.014)	0.050*** (0.015)	-0.004 (0.017)	0.069* (0.038)	0.039** (0.016)	0.020 (0.015)	0.046 (0.038)	0.031*** (0.009)	
Number of members aged 60 and older	-0.001 (0.029)	-0.010 (0.033)	-0.035 (0.032)	-0.007 (0.079)	-0.013 (0.027)	0.023 (0.031)	-0.043 (0.078)	-0.016 (0.018)	
<i>Household consumption</i>									
Log of consumption per capita	0.177*** (0.028)	0.099*** (0.021)	0.029 (0.022)	0.192*** (0.074)	0.207*** (0.019)	0.073** (0.037)	0.000 (0.058)	0.145*** (0.014)	
Urban	0.100*** (0.034)	0.236*** (0.042)	0.059* (0.032)	0.137* (0.079)	0.117*** (0.029)	-0.050 (0.044)	0.063 (0.072)	0.142*** (0.020)	
Constant	-0.791*** (0.228)	-0.901*** (0.182)	-0.210 (0.162)	-0.885 (0.591)	-1.045*** (0.144)	-0.661** (0.310)	0.376 (0.465)	-0.835*** (0.189)	
	$ln\sigma_k$							-0.924*** (0.276)	
	$ln\sigma_r$	-2.206*** (0.251)	-1.511*** (0.227)	-2.928*** (0.394)	-1.100*** (0.313)	-2.458*** (0.424)	-3.252*** (0.663)	-1.396*** (0.198)	-1.729*** (0.100)
	$ln\sigma_j$	-3.506 (2.652)	-1.278*** (0.053)	-2.653*** (0.320)	-1.506*** (0.373)	-1.710*** (0.089)	-2.290*** (0.352)	-1.520*** (0.230)	-1.497*** (0.051)
	$ln\sigma_i$	-1.914*** (0.354)	-1.079*** (0.029)	-1.459*** (0.064)	0.078*** (0.028)	-1.152*** (0.033)		-0.671*** (0.014)	
	$ln\sigma_{it}$	-0.320*** (0.018)	-0.605*** (0.009)	-0.904*** (0.021)	0.224*** (0.010)	-0.429*** (0.007)	-0.536*** (0.022)	-0.529*** (0.039)	-0.207*** (0.004)
Number of countries								7	
Number of regions	13	11	31	6	6	11	30	108	
Number of communities	529	446	239	475	655	398	327	3,063	
Number of households	1,844	2,068	1,226	1,614	1,940	1,249	594	10,535	
Number of observations	3,208	8,397	2,338	6,549	11,508	1,249	594	33,843	
Log likelihood	-3604	-8022	-1527	-11883	-12355	-1122	-580.9	-45488	

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table 5. Determinants of contacts with teacher after COVID-19 school closures, conditional mixed model

Pre-COVID-19 variables	Burkina Faso	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.001 (0.001)	0.002*** (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.001 (0.002)	0.000 (0.000)
Head is female	-0.008 (0.023)	0.007 (0.014)	-0.026 (0.028)	0.041* (0.023)	0.054 (0.042)	-0.078 (0.053)	0.003 (0.011)
Head is employee	-0.007 (0.029)	-0.016 (0.024)	0.065 (0.046)	-0.077** (0.039)	0.057 (0.041)	0.077 (0.072)	0.019 (0.016)
Head is self-employed	0.019 (0.022)	0.006 (0.019)	-0.000 (0.034)	-0.052* (0.030)	0.044 (0.033)	0.083 (0.062)	0.016 (0.012)
<i>Head's education level</i>							
Primary	0.001 (0.022)	0.018 (0.023)	0.025 (0.027)	0.074* (0.044)	0.030 (0.037)	-0.003 (0.068)	0.017 (0.012)
Secondary incomplete	0.037 (0.028)	0.038 (0.025)	0.041 (0.047)	0.073 (0.049)	0.027 (0.044)	0.057 (0.079)	0.030** (0.014)
Secondary complete	0.066* (0.034)	0.046 (0.035)	0.032 (0.030)	0.112** (0.055)	0.021 (0.040)	0.256* (0.148)	0.042*** (0.015)
Post-secondary	0.020 (0.039)	0.180*** (0.039)	0.043 (0.033)	0.128** (0.053)	0.116*** (0.044)	0.352*** (0.132)	0.067*** (0.017)
<i>Household composition</i>							
Number of members aged 0-14	0.015*** (0.004)	0.001 (0.004)	0.003 (0.005)	0.013** (0.006)	0.017*** (0.006)	0.023 (0.015)	0.010*** (0.002)
Number of members aged 15-24	0.001 (0.006)	0.004 (0.005)	0.002 (0.007)	0.009 (0.007)	0.004 (0.008)	0.028 (0.018)	0.004 (0.003)
Number of members aged 25-59	-0.014* (0.008)	0.008 (0.008)	0.001 (0.011)	-0.028** (0.014)	0.021** (0.010)	0.005 (0.029)	0.001 (0.004)
Number of members aged 60 and older	-0.021 (0.016)	-0.035** (0.016)	0.021 (0.023)	-0.036 (0.025)	-0.012 (0.021)	0.046 (0.061)	-0.009 (0.009)
<i>Household consumption</i>							
Log of consumption per capita	0.055*** (0.017)	0.035*** (0.011)	0.026 (0.021)	0.044*** (0.016)	0.084*** (0.025)	0.129*** (0.046)	0.049*** (0.008)
Urban	-0.009 (0.022)	-0.020 (0.017)	0.001 (0.021)	-0.021 (0.024)	0.018 (0.030)	0.208*** (0.055)	0.002 (0.010)
Constant	-0.255* (0.136)	-0.306*** (0.081)	-0.011 (0.162)	-0.206* (0.124)	-0.636*** (0.209)	-0.968*** (0.369)	-0.272*** (0.070)
$ln\sigma_k$							-2.521*** (0.318)
$ln\sigma_r$	-2.299*** (0.223)	-3.512*** (0.376)	-3.050*** (0.364)	-3.777*** (0.982)	-3.200*** (0.480)	-1.761*** (0.229)	-2.570*** (0.132)
$ln\sigma_j$	-2.019*** (0.086)	-3.124*** (0.250)	-14.163 (896.774)	-2.370*** (0.184)	-9.467*** (1.186)	-2.279*** (0.573)	-2.411*** (0.080)
$ln\sigma_i$	-1.907*** (0.097)	-2.249*** (0.079)	-1.567*** (0.060)				-1.844*** (0.047)
$ln\sigma_{it}$	-1.052*** (0.019)	-1.565*** (0.021)	-0.956*** (0.019)	-1.282*** (0.028)	-0.910*** (0.020)	-0.933*** (0.048)	-1.102*** (0.011)
Number of countries							6
Number of regions	13	31	6	5	11	29	95
Number of communities	529	239	465	446	398	255	2,332
Number of households	1,844	1,226	1,483	1,018	437	1,249	7,257
Number of observations	3,208	2,338	2,850	1,018	1,249	437	11,100
Log likelihood	-1566	64.71	-1657	-192.3	-241.6	-638.3	-4888

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table 6. Determinants of number of contacts with teacher after COVID-19 school closures, conditional mixed model

Pre-COVID-19 variables	Burkina Faso	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.001 (0.001)	0.002*** (0.001)	0.000 (0.002)	-0.001 (0.001)	-0.000 (0.001)	0.005 (0.003)	0.001 (0.001)
Head is female	-0.023 (0.027)	0.011 (0.013)	-0.053 (0.065)	0.039 (0.026)	0.045 (0.049)	-0.041 (0.069)	-0.004 (0.018)
Head is employee	0.005 (0.035)	-0.002 (0.023)	0.163 (0.108)	-0.100** (0.045)	0.058 (0.047)	0.072 (0.096)	0.043 (0.026)
Head is self-employed	0.018 (0.027)	0.008 (0.018)	0.039 (0.079)	-0.068** (0.034)	0.056 (0.038)	0.095 (0.082)	0.025 (0.021)
<i>Head's education level</i>							
Primary	0.004 (0.026)	0.013 (0.021)	-0.007 (0.064)	0.087* (0.051)	0.033 (0.043)	-0.011 (0.090)	0.016 (0.019)
Secondary incomplete	0.060* (0.034)	0.032 (0.023)	0.019 (0.110)	0.081 (0.056)	0.015 (0.051)	0.114 (0.105)	0.037 (0.024)
Secondary complete	0.096** (0.041)	0.047 (0.033)	-0.007 (0.071)	0.120* (0.063)	0.046 (0.047)	0.443** (0.193)	0.038 (0.026)
Post-secondary	0.054 (0.047)	0.207*** (0.037)	0.064 (0.077)	0.148** (0.061)	0.189*** (0.051)	0.647*** (0.180)	0.118*** (0.028)
<i>Household composition</i>							
Number of members aged 0-14	0.017*** (0.005)	0.003 (0.004)	0.009 (0.012)	0.014** (0.007)	0.020*** (0.007)	0.017 (0.019)	0.013*** (0.004)
Number of members aged 15-24	0.001 (0.007)	0.001 (0.004)	0.015 (0.018)	0.014* (0.008)	0.009 (0.010)	0.041* (0.023)	0.009* (0.005)
Number of members aged 25-59	-0.016* (0.010)	0.012 (0.008)	0.003 (0.026)	-0.032* (0.016)	0.023** (0.011)	0.021 (0.038)	0.000 (0.007)
Number of members aged 60 and older	-0.034* (0.020)	-0.025* (0.015)	0.070 (0.053)	-0.027 (0.028)	-0.003 (0.024)	-0.027 (0.080)	0.001 (0.015)
<i>Household consumption</i>							
Log of consumption per capita	0.065*** (0.020)	0.034*** (0.010)	0.048 (0.049)	0.061*** (0.018)	0.078*** (0.029)	0.153** (0.061)	0.060*** (0.013)
Urban	-0.011 (0.026)	-0.019 (0.015)	-0.015 (0.050)	-0.006 (0.028)	0.022 (0.035)	0.205*** (0.076)	0.003 (0.016)
Constant	-0.328*** (0.163)	-0.325*** (0.074)	-0.217 (0.383)	-0.287** (0.144)	-0.584** (0.241)	-1.303*** (0.488)	-0.371*** (0.116)
$ln\sigma_k$							-2.024*** (0.307)
$ln\sigma_r$	-2.238*** (0.230)	-19.349 (0.000)	-2.147*** (0.356)	-3.637*** (1.125)	-3.223*** (0.545)	-1.683*** (0.288)	-2.483*** (0.137)
$ln\sigma_j$	-1.894*** (0.091)	-3.035*** (0.172)	-18.047*** (1.187)	-2.236*** (0.184)	-3.266** (1.393)	-1.450*** (0.211)	-2.416*** (0.186)
$ln\sigma_i$	-1.642*** (0.081)	-2.501*** (0.123)	-0.753*** (0.065)				-1.403*** (0.050)
$ln\sigma_{it}$	-0.890*** (0.018)	-1.571*** (0.022)	-0.077*** (0.019)	-1.138*** (0.027)	-0.770*** (0.022)	-0.703*** (0.050)	-0.531*** (0.010)
Number of countries							6
Number of regions	13	31	6	5	11	29	95
Number of communities	529	239	465	446	398	255	2,332
Number of households	1,844	1,224	1,483	1,018	1,248	437	7,254
Number of observations	3,208	2,310	2,850	1,018	1,248	437	11,071
Log likelihood	-2123	159.2	-4129	-336.2	-817.2	-363.4	-10811

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table 7. Determinants of learning activities in Uganda after COVID-19 school closures, conditional mixed model

	Any Learning Activities	Number of Learning Activities
Child's age	0.012*** (0.001)	0.079*** (0.004)
Girl	0.011** (0.006)	0.065* (0.033)
<i>Pre-COVID-19 variables</i>		
Head's age	-0.001 (0.001)	0.001 (0.003)
Head is female	0.000 (0.015)	0.005 (0.074)
Head is employee	-0.029** (0.015)	-0.072 (0.126)
Head is self-employed	-0.001 (0.001)	-0.029 (0.094)
<i>Head's education level</i>		
Primary	0.075*** (0.024)	0.250** (0.119)
Secondary incomplete	0.127*** (0.028)	0.488*** (0.140)
Secondary complete	0.109*** (0.033)	0.434*** (0.165)
Post-secondary	0.227*** (0.033)	0.785*** (0.163)
<i>Household composition</i>		
Number of members aged 0-14	0.009** (0.004)	0.047** (0.019)
Number of members aged 15-24	0.002 (0.005)	0.011 (0.023)
Number of members aged 25-59	0.008 (0.010)	0.004 (0.048)
Number of members aged 60 and older	-0.000 (0.016)	-0.081 (0.080)
<i>Household consumption</i>		
Log of consumption per capita	0.052*** (0.011)	0.248*** (0.054)
Urban	0.036** (0.017)	0.257*** (0.084)
Constant	-0.044 (0.090)	1.333*** (0.431)
$\ln\sigma_r$	-2.430*** (0.321)	-1.109*** (0.328)
$\ln\sigma_j$	-2.266*** (0.092)	-0.749*** (0.101)
$\ln\sigma_h$	-1.563*** (0.026)	-0.032 (0.029)
$\ln\sigma_i$	-20.372*** (0.288)	-1.572*** (0.541)
$\ln\sigma_{it}$	-0.927*** (0.004)	0.835*** (0.006)
Number of regions	6	6
Number of communities	648	648
Number of households	1,893	1,893
Number of individuals	8,177	8,130
Number of observations	27,339	25,903
Log likelihood	-14982	-59647

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Figure 1. Any learning activities after COVID-19 school closures vs. difference with pre-pandemic school enrolment

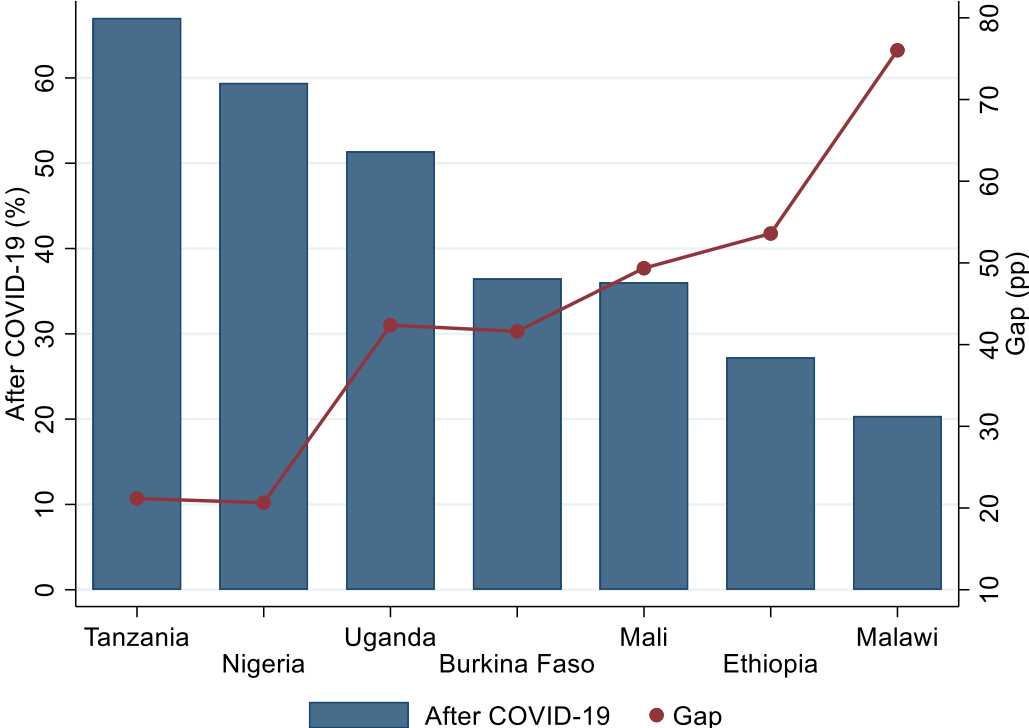
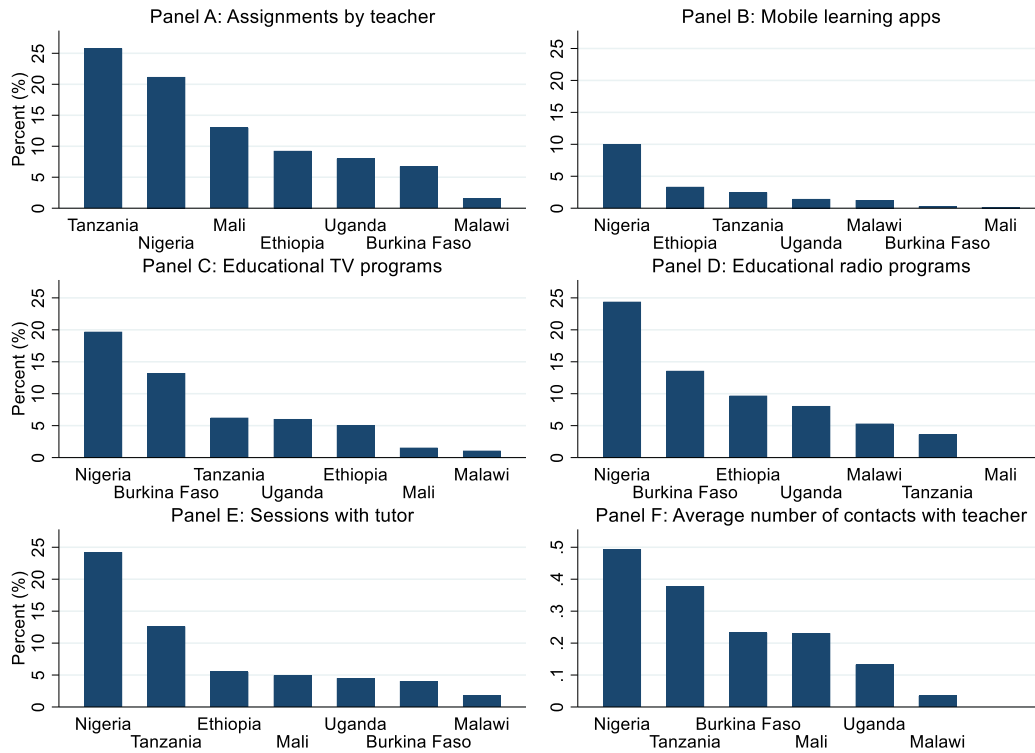


Figure 2. Share of households with children participating in specific learning activities after COVID-19 school closures



Note: Types of learning activities include working on the assignments provided by teacher, using mobile teaching applications, watching educational programs on TV and listening to lessons from radio, sessions/meetings with teacher/tutor. Households that do not have any teacher contacts are assigned a value of zero for their number of teacher contacts.

Figure 3. Proportion of the unconditional variance in any learning activity after pandemic-induced school closures due to variation in household, commune, regional and country factors, percentage

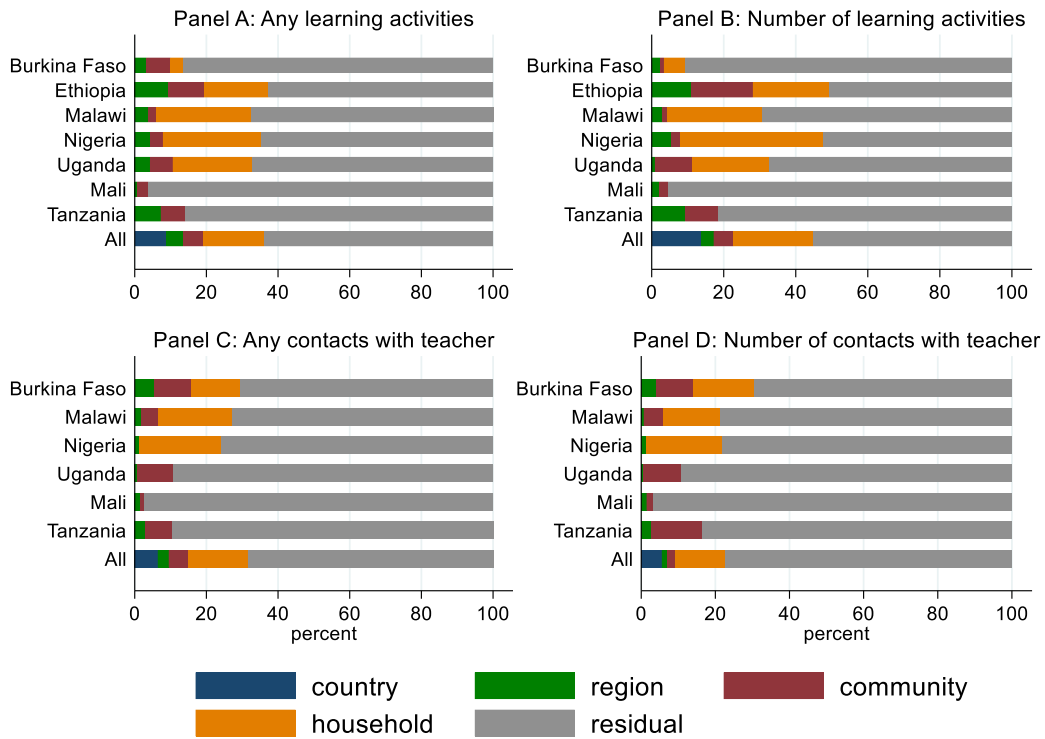
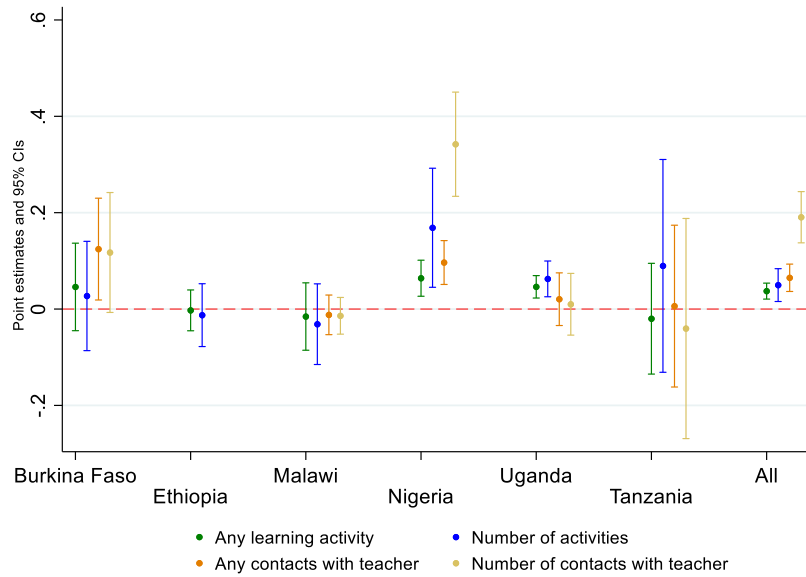
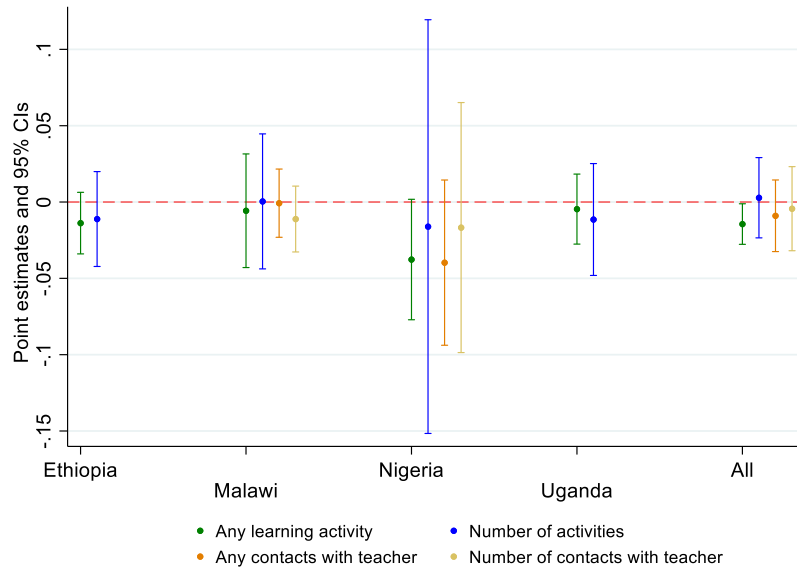


Figure 4. Public transfers during the pandemic and educational outcomes, conditional mixed model



Note: data are not available in Mali

Figure 5. Household total income decrease during the pandemic and educational outcomes, conditional mixed model



Note: data are not available in Mali, Burkina Faso and Tanzania

Figure 6. Household head was employed during the pandemic and educational outcomes, conditional mixed model

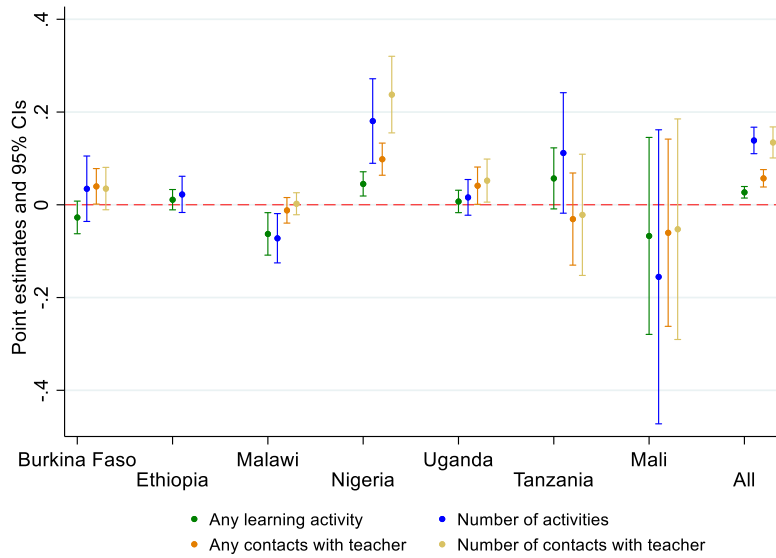
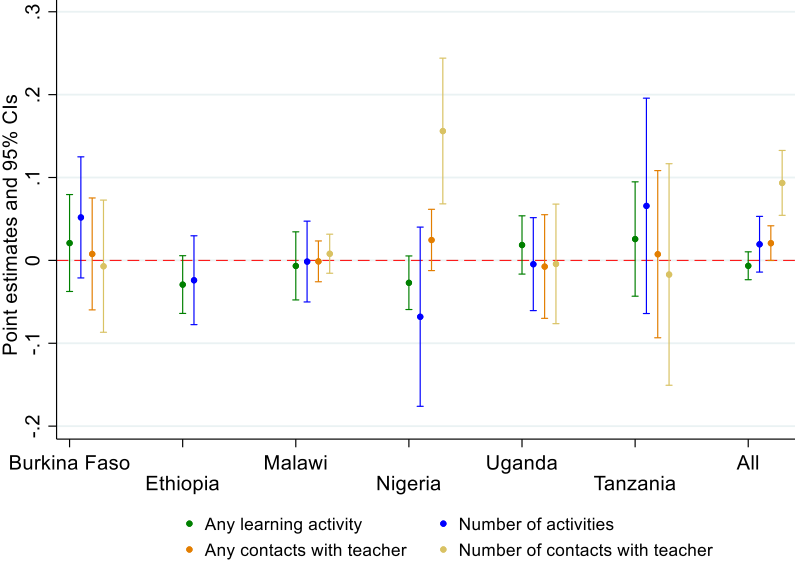


Figure 7. Household severe food insecurity during the pandemic and educational outcomes, conditional mixed model



Note: data are not available in Mali.

Appendix A: Additional Tables and Figures

Table A1. Brief literature review of COVID-19 on education in poorer countries

Author(s)	Countries	Data	Method	Results
Angrist et al. (2021)	Ethiopia, Kenya, Liberia, Tanzania, and Uganda	Kenya Tusome Midline in 2016; Tanzania Tusome Pamoja Baseline in 2016; Liberia LTTP Endline in 2015; UGANDA SHRP COHORT 1 in 2014; Ethiopia IQPEP in 2014.	Simulation model calibrated to replicate typical learning trajectories	The pandemic has resulted in learning losses ranging from 6 months to more than one year. Short-term and long term-losses are found to be severe, with short-term learning deficits for a child in grade 3 could accumulate to 2.8 years of lost learning by grade 10. School closures that reduced education by three-quarters of a year for the grade 3 cohort reduced their eventual grade 10 learning by 2.2 years. In this scenario, by grade 10, 92 % of in-school children would have fallen behind the level of instruction.
Ardington et al. (2021)	South Africa	Longitudinal studies of early grade reading in home languages and English in 2019-2021; Early Grade Reading Study in 2017-2020; Story Powered Schools 2018-2019	Difference-in-differences comparing learning gains for grade 2 and 4 students during the pandemic against gains of their peers prior to the pandemic	The study found a significant short-term impact of the pandemic on reading and reported that Grade 2 and Grade 4 primary school children experienced learning loss between 57-70% and 62-81% of a typical school year.
Asanov et al. (2021)	Ecuador	The phone survey of 2412 students from 88 schools in March-April 2020	Descriptive analysis	Students from four disadvantaged groups – the lowest wealth quartile, indigenous students, students whose mothers have secondary education or lower, and students without internet access - had less access to remote learning technologies and were less likely to do schoolwork. Less than half of the students (39-49%) in the lower wealth quintile had a computer/tablet or internet compared to 75-80% of wealthier students.
Bundervoet et al. (2022)	34 mainly low and middle-income countries	Harmonized dataset of high-frequency surveys from 31 countries and over 41,000 respondents in December 2020	Logistic regressions of the four main indicators: stopped working, income loss, food security, continued learning	The study found immediate impacts of the pandemic when over 30% of children could not continue learning during school closures. The pandemic exacerbated existing educational inequalities when children of secondary- and higher education were 6 and 9 percentage points (pps) more likely to engage in learning activities during school closures than children of low-educated respondents, and children in urban areas were 7 pps more likely to continue learning. The pandemic-related negative shocks, such as job loss, and food insecurity, were negatively related to learning outcomes, decreasing the probability by 3-4 pps.
Dessy et al. (2021)	Nigeria	High-frequency phone survey. Longitudinal phone surveys of a sample of 4,006 members aged 5-18 from 4,325 eligible individuals were interviewed in October 2020 (round 6) and were matched with the pre-covid-19 GHS-Panel Survey in 2018/19. The longitudinal phone survey on March 2021	Linear probability model with FEs of school attendance status including interaction with gender and area of residence of respondents. The three-period difference-in-difference model includes observations for the same individuals just before school closure.	The study found a decline in school attendance of 7% following school reopening with an increasing effect with age: by 5.2 pps for children aged 5-11 and 8.6 pps for children aged 12-18, and by 11 pps for children aged 15-18. The study did not find a statistically significant effect on gender inequality in school attendance, except in South-West Nigeria, where lockdown measures reduced the gender gap in school attendance by 4.32 pps. The study suggested the pandemic's long-term effect, with the pandemic's negative impact being persistent for children aged 12 -18.
Kidman et al. (2022)	Malawi	Sub-sample of 1396 respondents drawn from the Malawi Longitudinal Study of Families and Health	Logistic regressions of the school enrollment and dropout	The pandemic has led to dropouts, with varying impacts by age and gender. Only 86% of those previously school returned after the school closure. Having children was associated with 97% lower odds of returning to school, and being married/cohabitating or behind in school before the pandemic was associated with 88% and 69% lower odds of returning to school. Girls being lagged in school before the pandemic are associated with a 50% decrease in odds of returning to school.
Singh et al. (2022)	India	A panel survey of around 19,000 primary-school-aged children in rural Tamil Nadu	Value-added models that control for lagged achievement and child/household characteristics	Students tested in December 2021 (18 months after school closures) displayed learning deficits of 0.7 standard deviations in math and 0.34 standard deviations in language compared to identically-aged students in the same villages in 2019. Two-thirds of this deficit was made up within 6 months after school reopening. Further, while learning loss was regressive, the recovery was progressive. A government-run after-school remediation program contributed 24% of the cohort-level recovery.

Table A2. Education questions in phone surveys

	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania
Round 1	Are there any children (aged 3 and over) in the household who were enrolled in school for the 2019/2020 school year?	Before schools closed on [date], were there any children in your household who attended school?	Were any children attending school before schools were closed due to coronavirus?	Were any of the children attending primary or secondary school before schools were closed due to coronavirus?	Were any of the children attending school before schools were closed due to coronavirus?	Did any of these children attend school before the coronavirus crisis?	Were any children in HH attending school before schools closed last year March?
		Have the children been engaged in any education or learning activities since the schools closed?	Have the children been engaged in any education or learning activities in the last week?	Have the children been engaged in any education or learning activities during the past 7 days?	Have the children been engaged in any education or learning activities since the schools closed?	Have these children been participating in education or learning activities since the schools closed?	While schools closed did children engage in any education/learning activities?
Round 2	Are there any children (aged 3 and over) in the household who were enrolled in the school / medersa for the 2019/2020 school year?	Before schools closed on [date], were there any children in your household who attended school?	Were any children attending school before schools were closed due to coronavirus?	Are there children in the households who attended school (primary/secondary) before school closed due to the coronavirus?	Was respondent attending school before schools were closed due to coronavirus?		
		Children engaged in learning activities after outbreak?	Have the children been engaged in any education or learning activities in the last week?	Have the children been engaged in any education or learning activities during the past 7 days?	Has respondent been engaged in any education or learning activities in the past 7 days?		
Round 3		Before schools closed on [date], were there any children in your household who attended primary/secondary school?			Was respondent attending school before schools were closed due to coronavirus?		
		Primary/secondary school children engaged in learning activities after outbreak		Have the children been engaged in any education or learning activities during the past 7 days?	Has respondent been engaged in any education or learning activities in the past 7 days?		
Round 4		Before schools closed on [date], were there any children in your household who attended primary/secondary school?					
		Have the children in primary/secondary school been engaged in any education or learning activities since the schools closed?		Have the children been engaged in any education or learning activities in the past 7 days, excluding religious study and instruction?	Has respondent been engaged in any education or learning activities in the past 7 days?		
Round 5	Has respondent been in school at any time during the 2019/2020 school year?	Before schools closed on [date], were there any children in your household who attended primary/secondary school?					
	Did respondent participate in any education or learning activities after schools were closed in mid-March due to the coronavirus crisis?	Have the children in primary/secondary school been engaged in any education or learning activities since the schools closed?	Have the children been engaged in any education or learning activities during last week?	Have the children been engaged in any education or learning activities during the past 7 days?	Has respondent been engaged in any education or learning activities in the past 7 days?		

Round 6				Did respondent attend school at any time during the 2019/2020 school year?	Was respondent attending school before schools were closed due to coronavirus in the past 7 days?		
				Was respondent engaged in any education or learning activities after schools closed in mid-March due to the coronavirus crisis?	Has respondent been engaged in any education or learning activities in the past 7 days?		
Round 7					Was respondent attending school before schools were closed due to the first school closure		
					Has respondent been engaged in any education or learning activities		
Round 8		Have the children in school been engaged in any education or learning activities last four weeks?					
Round 11		Have the children in school been engaged in any education or learning activities last four weeks?					

Table A3. Share of households with children attending school before COVID-19-induced school closures and share of households with children being engaged in any learning activity after COVID-19-induced school closures

	Burkina Faso	Ethiopia	Malawi	Mali	Nigeria	Tanzania	Uganda
<i>Panel A. Before COVID-19</i>							
Mean	78.1 (0.6)	80.8 (0.3)	96.4 (0.4)	85.4 (0.9)	80.1 (0.4)	88.2 (0.7)	93.8 (0.2)
Number of observations	5,568	14,380	2,498	1,438	9,645	2,157	12,368
<i>Panel B. After COVID-19</i>							
Mean	36.5 (0.7)	27.2 (0.4)	20.4 (0.8)	36.0 (1.4)	59.4 (0.6)	67.0 (1.1)	51.4 (0.5)
Number of observations	4,549	11,166	2,368	1,249	7,353	1,949	11,652

Note: Panel A shows the estimates where the numerator is the number of households that answer yes to having children attending schools before the pandemic; the denominator is the number of households who answered the question about having children attending schools before the pandemic. Panel B shows the estimates where the numerator is the number of households that answer yes to having children being engaged in any education activity in the last 7 days or since the school closed; the denominator is the number of households having children attending schools before the pandemic. All estimates are weighted with household weights.

Table A4. Country rankings for the specific learning activities

	Burkina Faso	Ethiopia	Malawi	Mali	Nigeria	Tanzania	Uganda
Teacher assignments	6	4	7	3	2	1	5
Mobile learning apps	6	2	5	7	1	3	4
Educational TV programs	2	5	7	6	1	3	4
Educational radio programs	2	3	5	7	1	6	4
Sessions with tutors	6	3	7	4	1	2	5
Average ranking	4.4	3.4	6.2	5.4	1.2	3	4.4

Table A5. Decomposition of unconditional variation (% of total variation) in any learning activity

	Country	Region	Community	Household	Residual	Total
Burkina Faso		3.3	6.7	3.6	86.4	100
Ethiopia		9.5	9.9	18.0	62.6	100
Malawi		3.8	2.2	26.5	67.5	100
Nigeria		4.5	3.4	27.5	64.7	100
Uganda		4.2	6.4	22.3	67.1	100
Mali		0.7	3.1		96.2	100
Tanzania		7.3	6.9		85.9	100
All	8.9	4.6	5.8	16.9	63.8	100

Table A6. Decomposition of unconditional variation (% of total variation) in the number of learning activities

	Country	Region	Community	Household	Residual	Total
Burkina Faso		2.5	0.9	5.9	90.7	100
Ethiopia		11.1	17.0	21.3	50.6	100
Malawi		3.0	1.4	26.2	69.3	100
Nigeria		5.4	2.4	39.9	52.2	100
Uganda		0.9	10.4	21.3	67.4	100
Mali		2.0	2.5		95.4	100
Tanzania		9.3	9.2		81.4	100
All	13.9	3.3	5.5	22.2	55.1	100

Table A7. Decomposition of unconditional variation (% of total variation) in the contacts with teachers

	Country	Region	Community	Household	Residual	Total
Burkina Faso		5.5	10.3	13.7	70.5	100
Malawi		1.9	4.6	20.7	72.8	100
Nigeria		1.4	0.0	22.9	75.7	100
Uganda		0.6	10.1		89.2	100
Mali		1.5	1.1		97.4	100
Tanzania		3.1	7.3		89.6	100
All	6.4	3.1	5.6	16.5	68.4	100

Table A8. Decomposition of unconditional variation (% of total variation) in the number of contacts with teachers

	Country	Region	Community	Household	Residual	Total
Burkina Faso		4.2	9.7	16.6	69.4	100
Malawi		0.7	5.3	15.3	78.7	100
Nigeria		1.3	0.0	20.7	78.0	100
Uganda		0.6	10.2		89.3	100
Mali		1.4	1.9		96.7	100
Tanzania		2.7	13.8		83.5	100
All	5.6	1.5	2.1	13.6	77.2	100

Table A9. Determinants of any learning activities after COVID-19 school closures, conditional mixed model

	Burkina Faso							
Pre-COVID-19 variables	Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.001 (0.001)	0.002*** (0.001)	0.002 (0.001)	0.000 (0.001)	0.002*** (0.001)	0.003** (0.001)	0.003** (0.002)	0.002*** (0.000)
Head is female	0.043** (0.020)	0.027* (0.016)	-0.024 (0.024)	-0.021 (0.024)	0.018 (0.016)	0.011 (0.050)	-0.002 (0.035)	0.006 (0.008)
Head is employee	0.080*** (0.026)	0.034* (0.019)	0.016 (0.041)	0.033 (0.040)	-0.038 (0.027)	0.040 (0.048)	0.028 (0.051)	0.020* (0.012)
Head is self-employed	0.071*** (0.020)	0.001 (0.016)	0.012 (0.033)	0.008 (0.030)	-0.010 (0.020)	0.061 (0.039)	0.023 (0.043)	0.017* (0.009)
<i>Head's education level</i>								
Primary	0.012 (0.019)	0.040** (0.017)	0.046 (0.039)	0.091*** (0.025)	0.110*** (0.026)	0.017 (0.044)	0.066 (0.045)	0.052*** (0.009)
Secondary incomplete	-0.001 (0.025)	0.083*** (0.022)	0.115*** (0.043)	0.116*** (0.042)	0.178*** (0.030)	0.113** (0.052)	0.117** (0.054)	0.099*** (0.012)
Secondary complete	0.001 (0.030)	0.121*** (0.024)	0.125** (0.060)	0.122*** (0.027)	0.141*** (0.035)	0.187*** (0.048)	0.099 (0.102)	0.115*** (0.013)
Post-secondary	0.015 (0.033)	0.109*** (0.032)	0.312*** (0.066)	0.134*** (0.029)	0.264*** (0.035)	0.262*** (0.051)	0.161 (0.099)	0.154*** (0.014)
<i>Household composition</i>								
Number of members aged 0-14	0.008** (0.004)	0.014*** (0.005)	-0.006 (0.007)	0.001 (0.004)	0.038*** (0.004)	0.002 (0.007)	-0.001 (0.009)	0.011*** (0.002)
Number of members aged 15-24	0.001 (0.005)	0.018*** (0.006)	0.017** (0.008)	-0.009 (0.007)	0.032*** (0.005)	0.003 (0.010)	0.004 (0.012)	0.013*** (0.003)
Number of members aged 25-59	0.007 (0.007)	0.032*** (0.008)	0.004 (0.014)	0.016* (0.010)	0.022** (0.010)	0.026** (0.012)	-0.028 (0.020)	0.015*** (0.004)
Number of members aged 60 and older	0.008 (0.014)	0.005 (0.019)	-0.027 (0.027)	0.018 (0.020)	-0.027 (0.017)	0.008 (0.025)	-0.039 (0.042)	-0.008 (0.008)
<i>Household consumption quintiles</i>								
Q2 (second poorest)	-0.005 (0.029)	0.049* (0.029)	-0.011 (0.039)	0.003 (0.032)	0.095*** (0.022)	0.047 (0.060)	0.107* (0.063)	0.047*** (0.012)
Q3 (middle quintile)	0.007 (0.028)	0.017 (0.029)	-0.028 (0.038)	0.050 (0.032)	0.114*** (0.022)	0.111** (0.056)	0.049 (0.061)	0.058*** (0.012)
Q4 (second richest)	0.058** (0.028)	0.062** (0.029)	0.034 (0.037)	0.063* (0.034)	0.184*** (0.023)	0.114** (0.056)	0.033 (0.061)	0.100*** (0.013)
Q5 (richest)	0.101*** (0.030)	0.109*** (0.030)	0.028 (0.038)	0.064* (0.036)	0.217*** (0.027)	0.156*** (0.058)	0.074 (0.065)	0.128*** (0.013)
Urban	0.062*** (0.019)	0.132*** (0.022)	0.046 (0.028)	0.066*** (0.020)	0.046** (0.018)	-0.018 (0.034)	0.030 (0.035)	0.066*** (0.009)
Constant	0.433*** (0.053)	-0.124** (0.060)	-0.002 (0.076)	0.436*** (0.071)	0.082 (0.062)	-0.014 (0.098)	0.518*** (0.111)	0.177*** (0.068)
$\ln\sigma_k$								-1.783*** (0.274)
$\ln\sigma_r$	-2.568*** (0.230)	-2.117*** (0.227)	-2.902*** (0.344)	-2.626*** (0.323)	-2.611*** (0.339)	-19.807 (0.000)	-2.065*** (0.202)	-2.435*** (0.104)
$\ln\sigma_j$	-2.233*** (0.091)	-2.029*** (0.064)	-2.643*** (0.251)	-2.585*** (0.212)	-2.325*** (0.107)	-2.550*** (0.452)	-3.129* (1.699)	-2.251*** (0.044)
$\ln\sigma_i$	-2.668*** (0.327)	-1.635*** (0.030)	-1.619*** (0.063)	-1.398*** (0.033)	-1.573*** (0.032)			-1.618*** (0.017)
$\ln\sigma_{it}$	-0.905*** (0.013)	-0.961*** (0.007)	-1.083*** (0.021)	-0.947*** (0.009)	-0.897*** (0.007)	-0.755*** (0.023)	-0.985*** (0.034)	-0.908*** (0.004)
Number of countries								7
Number of regions	13	11	31	6	6	11	30	108
Number of communities	532	446	239	475	655	398	372	3,117
Number of households	1,874	2,276	1,226	1,621	1,940	1,249	781	10,967
Number of observations	4,549	11,154	2,338	7,395	11,508	1,249	781	38,974
Log-likelihood	-2528	-6189	-1125	-4362	-6984	-845.8	-362.2	-23649

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference groups are the head without any education (for head's education) and the poorest consumption quintile (for household consumption quintiles).

Table A10. Determinants of number of learning activities after COVID-19 school closures, conditional mixed model

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.003* (0.001)	0.004*** (0.001)	0.002 (0.001)	0.004 (0.004)	0.003** (0.001)	0.003** (0.002)	0.005 (0.003)	0.003*** (0.001)
Head is female	0.001 (0.040)	0.025 (0.028)	-0.039 (0.028)	-0.147 (0.097)	0.043* (0.025)	0.146** (0.062)	0.022 (0.068)	-0.002 (0.019)
Head is employee	0.166*** (0.052)	0.024 (0.035)	0.033 (0.048)	0.225 (0.161)	-0.075* (0.043)	0.123** (0.060)	0.004 (0.095)	0.041 (0.028)
Head is self-employed	0.083** (0.040)	0.006 (0.028)	0.018 (0.039)	0.021 (0.118)	-0.002 (0.032)	0.075 (0.049)	-0.028 (0.080)	0.019 (0.021)
<i>Head's education level</i>								
Primary	0.095** (0.039)	0.049* (0.030)	0.053 (0.047)	0.088 (0.098)	0.110*** (0.040)	0.000 (0.054)	0.109 (0.085)	0.070*** (0.022)
Secondary incomplete	-0.005 (0.050)	0.150*** (0.039)	0.153*** (0.051)	0.315* (0.167)	0.230*** (0.048)	0.165** (0.065)	0.252** (0.102)	0.168*** (0.028)
Secondary complete	-0.016 (0.060)	0.196*** (0.042)	0.159** (0.071)	0.247** (0.109)	0.180*** (0.056)	0.275*** (0.060)	0.346* (0.192)	0.209*** (0.030)
Post-secondary	0.032 (0.066)	0.257*** (0.058)	0.374*** (0.078)	0.278** (0.117)	0.385*** (0.055)	0.346*** (0.064)	0.520*** (0.186)	0.314*** (0.033)
<i>Household composition</i>								
Number of members aged 0-14	0.015* (0.008)	0.023*** (0.008)	0.000 (0.008)	0.009 (0.018)	0.064*** (0.007)	0.024*** (0.008)	0.009 (0.018)	0.023*** (0.005)
Number of members aged 15-24	0.021* (0.011)	0.031*** (0.010)	0.018* (0.010)	-0.010 (0.027)	0.055*** (0.008)	0.018 (0.012)	0.010 (0.022)	0.028*** (0.006)
Number of members aged 25-59	0.010 (0.014)	0.049*** (0.015)	-0.004 (0.017)	0.071* (0.038)	0.036** (0.016)	0.019 (0.015)	0.042 (0.038)	0.030*** (0.009)
Number of members aged 60 and older	-0.004 (0.029)	-0.013 (0.033)	-0.035 (0.032)	-0.014 (0.079)	-0.017 (0.028)	0.022 (0.031)	-0.057 (0.078)	-0.018 (0.018)
<i>Household consumption quintiles</i>								
Q2 (second poorest)	0.059 (0.058)	0.073 (0.051)	-0.008 (0.045)	-0.088 (0.128)	0.120*** (0.034)	-0.045 (0.075)	0.259** (0.125)	0.047 (0.029)
Q3 (middle quintile)	0.064 (0.056)	0.051 (0.051)	-0.029 (0.044)	0.135 (0.129)	0.159*** (0.035)	0.041 (0.069)	0.102 (0.119)	0.099*** (0.029)
Q4 (second richest)	0.189*** (0.055)	0.095* (0.051)	0.049 (0.043)	0.235* (0.135)	0.277*** (0.036)	0.067 (0.071)	0.132 (0.118)	0.182*** (0.030)
Q5 (richest)	0.285*** (0.058)	0.195*** (0.053)	0.032 (0.045)	0.278* (0.144)	0.423*** (0.042)	0.107 (0.073)	0.150 (0.125)	0.262*** (0.031)
Urban	0.095*** (0.034)	0.238*** (0.042)	0.059* (0.032)	0.140* (0.079)	0.119*** (0.030)	-0.048 (0.044)	0.063 (0.072)	0.143*** (0.020)
Constant	0.360*** (0.103)	-0.311*** (0.108)	-0.034 (0.090)	0.333 (0.288)	0.079 (0.093)	-0.157 (0.124)	0.220 (0.211)	0.044 (0.160)
$\ln\sigma_k$								-0.929*** (0.276)
$\ln\sigma_r$	-2.183*** (0.248)	-1.511*** (0.228)	-2.899*** (0.378)	-1.114*** (0.314)	-2.430*** (0.413)	-3.275*** (0.683)	-1.392*** (0.197)	-1.734*** (0.100)
$\ln\sigma_j$	-3.346* (1.911)	-1.274** (0.053)	-2.651*** (0.319)	-1.514*** (0.378)	-1.711*** (0.089)	-2.294** (0.357)	-1.529*** (0.231)	-1.491*** (0.051)
$\ln\sigma_i$	-1.897*** (0.342)	-1.082*** (0.029)	-1.464*** (0.065)	0.076*** (0.028)	-1.147*** (0.033)			-0.671*** (0.014)
$\ln\sigma_{it}$	-0.320*** (0.018)	-0.605*** (0.009)	-0.904*** (0.021)	0.224*** (0.010)	-0.429*** (0.007)	-0.537*** (0.022)	-0.533*** (0.039)	-0.207*** (0.004)
Number of countries								7
Number of regions	13	11	31	6	6	11	30	108
Number of communities	529	444	239	475	655	398	327	3,067
Number of households	1,844	2,068	1,226	1,614	1,940	1,249	594	10,535
Number of observations	3,208	8,397	2,338	6,549	11,508	1,249	594	33,843
Log-likelihood	-3605	-8021	-1525	-11881	-12361	-1121	-578.3	-45490

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference groups are head without any education (for head's education) and the poorest consumption quintile (for household consumption quintiles).

Table A11. Determinants of contacts with the teacher after COVID-19 school closures, conditional mixed model

Pre-COVID-19 variables	Burkina Faso	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.001 (0.001)	0.002*** (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.000 (0.001)	0.001 (0.002)	0.000 (0.000)
Head is female	-0.007 (0.023)	0.006 (0.014)	-0.025 (0.028)	0.041* (0.023)	0.055 (0.042)	-0.077 (0.053)	0.002 (0.011)
Head is employee	-0.005 (0.030)	-0.013 (0.024)	0.058 (0.046)	-0.075* (0.039)	0.057 (0.041)	0.086 (0.073)	0.020 (0.016)
Head is self-employed	0.019 (0.023)	0.009 (0.019)	-0.002 (0.034)	-0.051* (0.030)	0.046 (0.033)	0.089 (0.063)	0.016 (0.012)
<i>Head's education level</i>							
Primary	0.002 (0.022)	0.020 (0.023)	0.030 (0.027)	0.078* (0.044)	0.035 (0.037)	0.017 (0.068)	0.018 (0.012)
Secondary incomplete	0.043 (0.028)	0.044* (0.025)	0.049 (0.047)	0.081* (0.049)	0.029 (0.044)	0.083 (0.079)	0.034** (0.015)
Secondary complete	0.081** (0.034)	0.056 (0.035)	0.039 (0.030)	0.117** (0.055)	0.023 (0.040)	0.347** (0.145)	0.048*** (0.015)
Post-secondary	0.050 (0.038)	0.195*** (0.039)	0.049 (0.033)	0.137*** (0.053)	0.127*** (0.043)	0.438*** (0.131)	0.079*** (0.017)
<i>Household composition</i>							
Number of members aged 0-14	0.014*** (0.004)	-0.000 (0.004)	0.001 (0.005)	0.013** (0.006)	0.015*** (0.006)	0.016 (0.015)	0.009*** (0.002)
Number of members aged 15-24	-0.000 (0.006)	0.003 (0.005)	0.002 (0.007)	0.010 (0.007)	0.005 (0.008)	0.027 (0.018)	0.004 (0.003)
Number of members aged 25-59	-0.013* (0.008)	0.008 (0.008)	0.001 (0.011)	-0.031** (0.014)	0.020** (0.010)	0.006 (0.029)	0.001 (0.004)
Number of members aged 60 and older	-0.022 (0.016)	-0.035** (0.016)	0.018 (0.023)	-0.043* (0.025)	-0.014 (0.021)	0.046 (0.061)	-0.010 (0.009)
<i>Household consumption quintiles</i>							
Q2 (second poorest)	0.001 (0.033)	0.010 (0.023)	-0.011 (0.036)	-0.032 (0.034)	-0.060 (0.051)	0.130 (0.106)	-0.007 (0.016)
Q3 (middle quintile)	0.055* (0.032)	-0.000 (0.022)	0.013 (0.036)	0.017 (0.034)	0.008 (0.047)	0.147 (0.103)	0.025 (0.016)
Q4 (second richest)	0.047 (0.033)	0.009 (0.022)	-0.041 (0.037)	0.064* (0.035)	0.032 (0.048)	0.228** (0.104)	0.024 (0.016)
Q5 (richest)	0.073** (0.035)	0.035 (0.022)	0.029 (0.040)	0.065* (0.039)	0.084* (0.049)	0.197* (0.108)	0.059*** (0.017)
Urban	-0.007 (0.022)	-0.012 (0.017)	0.004 (0.021)	-0.023 (0.024)	0.014 (0.030)	0.221*** (0.056)	0.004 (0.010)
Constant	0.098 (0.062)	-0.091** (0.045)	0.177** (0.075)	0.047 (0.081)	-0.012 (0.084)	-0.215 (0.170)	0.048 (0.048)
$ln\sigma_k$							-2.396*** (0.312)
$ln\sigma_r$	-2.305*** (0.224)	-3.504*** (0.374)	-3.017*** (0.359)	-3.879*** (1.113)	-3.259*** (0.507)	-1.796*** (0.234)	-2.573*** (0.132)
$ln\sigma_j$	-2.026*** (0.087)	-3.087*** (0.237)	-12.725*** (1.159)	-2.404*** (0.195)	-3.946 (4.166)	-2.233*** (0.530)	-2.411*** (0.081)
$ln\sigma_i$	-1.897*** (0.095)	-2.248*** (0.079)	-1.574*** (0.061)				-1.841*** (0.047)
$ln\sigma_{it}$	-1.053*** (0.019)	-1.565*** (0.021)	-0.956*** (0.019)	-1.281*** (0.028)	-0.911*** (0.022)	-0.932*** (0.048)	-1.102*** (0.011)
Number of countries							6
Number of regions	13	31	6	5	11	29	95
Number of communities	529	239	475	446	398	255	2,342
Number of households	1,844	1,226	1,614	1,018	1,249	437	7,388
Number of observations	3,208	2,338	2,850	1,018	1,249	437	11,100
Log-likelihood	-1567	62.71	-1653	-188.1	-639.1	-241.8	-4895

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference groups are head without any education (for head's education) and the poorest consumption quintile (for household consumption quintiles).

Table A12. Determinants of number of contacts with the teacher after COVID-19 school closures, conditional mixed model

Pre-COVID-19 variables	Burkina Faso	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.001 (0.001)	0.002*** (0.001)	0.000 (0.002)	-0.001 (0.001)	-0.000 (0.001)	0.005 (0.003)	0.001 (0.001)
Head is female	-0.022 (0.027)	0.010 (0.013)	-0.051 (0.065)	0.038 (0.026)	0.045 (0.049)	-0.043 (0.070)	-0.005 (0.018)
Head is employee	0.007 (0.036)	0.000 (0.023)	0.150 (0.108)	-0.099** (0.045)	0.058 (0.047)	0.077 (0.097)	0.043* (0.026)
Head is self-employed	0.018 (0.027)	0.011 (0.018)	0.037 (0.079)	-0.067** (0.034)	0.058 (0.038)	0.099 (0.083)	0.025 (0.021)
<i>Head's education level</i>							
Primary	0.005 (0.026)	0.016 (0.022)	-0.000 (0.064)	0.091* (0.051)	0.039 (0.043)	0.010 (0.090)	0.018 (0.019)
Secondary incomplete	0.068** (0.034)	0.038 (0.023)	0.034 (0.110)	0.091 (0.056)	0.016 (0.051)	0.139 (0.105)	0.041* (0.024)
Secondary complete	0.114*** (0.041)	0.057* (0.033)	0.003 (0.071)	0.127** (0.063)	0.046 (0.047)	0.545*** (0.190)	0.044* (0.026)
Post-secondary	0.089** (0.045)	0.222*** (0.036)	0.068 (0.077)	0.161*** (0.061)	0.199*** (0.050)	0.740*** (0.178)	0.129*** (0.028)
<i>Household composition</i>							
Number of members aged 0-14	0.015*** (0.005)	0.001 (0.004)	0.006 (0.012)	0.014** (0.007)	0.018*** (0.007)	0.009 (0.019)	0.011*** (0.004)
Number of members aged 15-24	-0.000 (0.007)	0.000 (0.004)	0.016 (0.018)	0.015* (0.008)	0.010 (0.010)	0.040* (0.023)	0.008 (0.005)
Number of members aged 25-59	-0.015 (0.010)	0.012 (0.008)	0.003 (0.026)	-0.035** (0.017)	0.022* (0.011)	0.022 (0.038)	0.000 (0.007)
Number of members aged 60 and older	-0.035* (0.020)	-0.026* (0.015)	0.064 (0.053)	-0.035 (0.029)	-0.005 (0.024)	-0.026 (0.081)	-0.000 (0.015)
<i>Household consumption quintiles</i>							
Q2 (second poorest)	0.009 (0.040)	0.010 (0.021)	-0.072 (0.084)	-0.029 (0.039)	-0.092 (0.059)	0.166 (0.139)	-0.029 (0.027)
Q3 (middle quintile)	0.064 (0.039)	-0.002 (0.021)	0.015 (0.085)	0.017 (0.039)	-0.015 (0.054)	0.201 (0.136)	0.025 (0.026)
Q4 (second richest)	0.050 (0.039)	0.011 (0.020)	-0.081 (0.088)	0.079** (0.040)	0.021 (0.055)	0.262* (0.136)	0.012 (0.026)
Q5 (richest)	0.086** (0.041)	0.034* (0.021)	0.051 (0.095)	0.090** (0.045)	0.064 (0.057)	0.252* (0.142)	0.070** (0.028)
Urban	-0.008 (0.027)	-0.011 (0.014)	-0.012 (0.050)	-0.007 (0.028)	0.019 (0.034)	0.223*** (0.077)	0.006 (0.016)
Constant	0.094 (0.073)	-0.116*** (0.041)	0.138 (0.176)	0.060 (0.094)	0.009 (0.097)	-0.410* (0.225)	0.029 (0.076)
$\ln\sigma_k$							-1.950*** (0.304)
$\ln\sigma_r$	-2.246*** (0.231)	-11.088 (0.000)	-2.134*** (0.355)	-3.693*** (1.211)	-3.291*** (0.582)	-1.715*** (0.297)	-2.490*** (0.137)
$\ln\sigma_j$	-1.897*** (0.091)	-3.014*** (0.168)	-18.329*** (0.985)	-2.263*** (0.192)	-3.133*** (1.075)	-1.442*** (0.209)	-2.414*** (0.186)
$\ln\sigma_i$	-1.633*** (0.080)	-2.497*** (0.122)	-0.758*** (0.066)				-1.404*** (0.050)
$\ln\sigma_{it}$	-0.890*** (0.018)	-1.571*** (0.022)	-0.077*** (0.019)	-1.136*** (0.027)	-0.772*** (0.022)	-0.700*** (0.050)	-0.531*** (0.010)
Number of countries							6
Number of regions	13	31	6	5	11	29	95
Number of communities	529	239	465	446	398	255	2,332
Number of households	1,844	1,224	1,483	1,018	1,248	437	7,254
Number of observations	3,208	2,310	2,850	1,018	1,248	437	11,071
Log-likelihood	-2125	156.3	-4127	-335.0	-815.4	-364.5	-10812

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference groups are head without any education (for head's education) and the poorest consumption quintile (for household consumption quintiles).

Table A.13. Public transfers during the pandemic and any learning activities, conditional mixed model

Variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Tanzania	All
Public transfers	0.046 (0.046)	-0.003 (0.022)	-0.011 (0.035)	0.064*** (0.019)	0.046*** (0.012)	-0.019 (0.059)	0.037*** (0.008)
<i>Pre-COVID-19 variables</i>							
Head's age	0.001 (0.001)	0.002*** (0.001)	0.002* (0.001)	0.001 (0.001)	0.002*** (0.001)	0.003** (0.001)	0.002*** (0.000)
Head is female	-0.025 (0.026)	0.038** (0.018)	-0.015 (0.025)	-0.027 (0.025)	0.016 (0.016)	0.007 (0.035)	-0.000 (0.009)
Head is employee	0.001 (0.001)	0.002*** (0.001)	0.002* (0.001)	0.001 (0.001)	0.002*** (0.001)	0.003** (0.002)	0.002*** (0.000)
Head is self-employed	-0.025 (0.026)	0.040** (0.018)	-0.013 (0.025)	-0.027 (0.025)	0.017 (0.016)	0.009 (0.035)	0.001 (0.009)
<i>Head's education level</i>							
	0.047 (0.025)	0.035 (0.019)	0.024 (0.041)	0.038 (0.026)	-0.034 (0.026)	0.036 (0.045)	0.018 (0.011)
Primary	-0.008 (0.025)	0.040** (0.011***)	0.037 (0.041)	0.087*** (0.026)	0.109*** (0.026)	0.069 (0.045)	0.049*** (0.011)
Secondary incomplete	-0.022 (0.033)	0.111*** (0.025)	0.109** (0.045)	0.108** (0.044)	0.175*** (0.030)	0.124** (0.054)	0.103*** (0.014)
Secondary complete	-0.029 (0.038)	0.127*** (0.027)	0.124* (0.065)	0.115*** (0.028)	0.135*** (0.036)	0.104 (0.103)	0.102*** (0.014)
Post-secondary	-0.013 (0.043)	0.125*** (0.037)	0.319*** (0.070)	0.130*** (0.031)	0.249*** (0.035)	0.160 (0.100)	0.144*** (0.016)
<i>Household composition</i>							
Number of members aged 0-14	0.007 (0.005)	0.009 (0.005)	-0.006 (0.008)	0.001 (0.005)	0.036*** (0.004)	-0.001 (0.009)	0.012*** (0.002)
Number of members aged 15-24	0.006 (0.007)	0.015** (0.006)	0.019** (0.009)	-0.011 (0.007)	0.031*** (0.005)	0.007 (0.012)	0.016*** (0.003)
Number of members aged 25-59	0.000 (0.009)	0.039*** (0.010)	-0.003 (0.015)	0.014 (0.010)	0.023** (0.010)	-0.025 (0.020)	0.015*** (0.005)
Number of members aged 60 and older	0.002 (0.019)	0.010 (0.021)	-0.036 (0.029)	0.013 (0.021)	-0.027 (0.017)	-0.037 (0.042)	-0.010 (0.009)
<i>Household consumption</i>							
Log of consumption per capita	0.058*** (0.018)	0.056*** (0.013)	0.014 (0.020)	0.041** (0.019)	0.097*** (0.012)	0.012 (0.029)	0.064*** (0.007)
Urban	0.029 (0.022)	0.136*** (0.024)	0.064** (0.025)	0.061*** (0.021)	0.045** (0.018)	0.022 (0.035)	0.062*** (0.010)
Constant	-0.417*** (0.149)	-0.463*** (0.114)	-0.078 (0.143)	0.191 (0.154)	-0.421*** (0.094)	0.481** (0.233)	-0.281*** (0.104)
$\ln\sigma_k$							-1.461*** (0.275)
$\ln\sigma_r$	-2.945*** (0.283)	-2.015*** (0.227)	-3.780*** (1.014)	-2.518*** (0.318)	-2.597*** (0.337)	-2.035*** (0.198)	-2.263*** (0.120)
$\ln\sigma_j$	-2.682*** (0.255)	-1.958*** (0.066)	-2.710*** (0.246)	-2.664*** (0.267)	-2.312*** (0.105)	-3.156* (1.760)	-2.236*** (0.048)
$\ln\sigma_i$	-1.169 (5.783)	-1.521*** (0.029)	-1.668*** (0.081)	-1.402*** (0.037)	-1.572*** (0.032)		-1.564*** (0.018)
$\ln\sigma_{it}$	-1.972 (28.864)	-1.028*** (0.009)	-1.080*** (0.025)	-0.942*** (0.011)	-0.898*** (0.007)	-0.988*** (0.034)	-0.955*** (0.005)
Country							6
Region	13	11	31	6	6	30	97
Community	511	444	162	475	655	371	2,695
Household	1,609	2,068	1,215	1,595	1,940	778	9,205
Observations	1,609	8,353	1,896	5,639	11,508	778	29,783
Log likelihood	-587.6	-4367	-899.9	-3420	-6982	-358.7	-17169

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.14. Public transfers during the pandemic and number of learning activities, conditional mixed model

Variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Tanzania	All
Public transfers	0.029 (0.058)	-0.013 (0.033)	-0.033 (0.043)	0.170*** (0.063)	0.063*** (0.019)	0.090 (0.113)	0.050*** (0.017)
<i>Pre-COVID-19 variables</i>							
Head's age	0.001 (0.001)	0.004*** (0.001)	0.002* (0.001)	0.004 (0.004)	0.003** (0.001)	0.004 (0.003)	0.003*** (0.001)
Head is female	-0.014 (0.033)	0.027 (0.028)	-0.022 (0.030)	-0.136 (0.097)	0.043* (0.025)	0.030 (0.068)	-0.007 (0.021)
Head is employee	0.050 (0.043)	0.023 (0.035)	0.042 (0.051)	0.225 (0.161)	-0.068 (0.043)	0.021 (0.095)	0.012 (0.030)
Head is self-employed	0.065** (0.032)	0.007 (0.028)	0.026 (0.041)	0.031 (0.118)	-0.001 (0.032)	-0.028 (0.080)	0.014 (0.023)
<i>Head's education level</i>							
Primary	-0.025 (0.031)	0.050* (0.030)	0.038 (0.049)	0.061 (0.098)	0.096** (0.040)	0.106 (0.085)	0.043* (0.024)
Secondary incomplete	-0.045 (0.041)	0.148*** (0.039)	0.145*** (0.053)	0.272 (0.167)	0.210*** (0.048)	0.262** (0.103)	0.147*** (0.031)
Secondary complete	-0.030 (0.049)	0.195*** (0.042)	0.157** (0.076)	0.209* (0.108)	0.159*** (0.056)	0.341* (0.194)	0.173*** (0.033)
Post-secondary	-0.006 (0.057)	0.259*** (0.058)	0.399*** (0.083)	0.234** (0.117)	0.345*** (0.055)	0.514*** (0.188)	0.282*** (0.037)
<i>Household composition</i>							
Number of members aged 0-14	0.009 (0.006)	0.031*** (0.008)	0.020** (0.009)	-0.009 (0.018)	0.054*** (0.007)	0.014 (0.018)	0.028*** (0.005)
Number of members aged 15-24	-0.003 (0.009)	0.050*** (0.010)	-0.006 (0.010)	0.055 (0.027)	0.039** (0.008)	0.054 (0.022)	0.032*** (0.007)
Number of members aged 25-59	0.001 (0.011)	-0.011 (0.015)	-0.040 (0.018)	-0.023 (0.038)	-0.015 (0.016)	-0.053 (0.038)	-0.020 (0.010)
Number of members aged 60 and older	0.001 (0.023)	-0.011 (0.033)	-0.040 (0.034)	-0.023 (0.079)	-0.015 (0.027)	-0.053 (0.078)	-0.020 (0.021)
<i>Household consumption</i>							
Log of consumption per capita	0.081*** (0.023)	0.099*** (0.021)	0.015 (0.023)	0.210*** (0.073)	0.207*** (0.019)	0.013 (0.058)	0.143*** (0.015)
Urban	0.036 (0.028)	0.237*** (0.042)	0.068** (0.034)	0.125 (0.078)	0.117*** (0.029)	0.058 (0.072)	0.132*** (0.022)
Constant	-0.584*** (0.185)	-0.899*** (0.183)	-0.129 (0.171)	-0.998* (0.587)	-1.053*** (0.144)	0.247 (0.466)	-0.948*** (0.212)
$ln\sigma_k$							-0.649*** (0.015)
$ln\sigma_r$	-2.886*** (0.313)	-1.509*** (0.227)	-2.907*** (0.394)	-1.144*** (0.314)	-2.428*** (0.416)	-1.389*** (0.196)	-0.787*** (0.276)
$ln\sigma_j$	-2.623*** (0.332)	-1.278*** (0.053)	-2.626*** (0.334)	-1.758*** (0.586)	-1.714*** (0.089)	-1.529*** (0.231)	-1.710*** (0.104)
$ln\sigma_i$	-0.857** (0.376)	-1.078*** (0.029)	-1.585*** (0.096)	0.056* (0.029)	-1.152*** (0.033)		-1.456*** (0.052)
$ln\sigma_{it}$	-2.869 (20.983)	-0.604*** (0.009)	-0.882*** (0.025)	0.221*** (0.011)	-0.429*** (0.007)	-0.534*** (0.039)	-0.252*** (0.005)
Country							6
Region	13	11	31	6	6	30	96
Community	511	444	162	475	655	326	2,660
Household	1,609	2,068	1,215	1,595	1,940	592	9,065
Observations	1609	8351	1896	5639	11508	592	29,641
Log likelihood	-947	-7989	-1236	-10256	-12350	-576	-38788

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.15. Public transfers during the pandemic and any teaching contact, conditional mixed model

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	All
Public transfers	0.129** (0.054)	-0.011 (0.021)	0.097*** (0.023)	0.020 (0.028)	0.011 (0.086)	0.065*** (0.014)
<i>Pre-COVID-19 variables</i>						
Head's age	0.001 (0.001)	0.002*** (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.002)	0.001 (0.000)
Head is female	-0.007 (0.030)	0.006 (0.015)	-0.035 (0.028)	0.041* (0.023)	-0.078 (0.053)	-0.006 (0.012)
Head is employee	-0.062 (0.039)	-0.037 (0.025)	0.070 (0.046)	-0.077** (0.039)	0.077 (0.072)	-0.013 (0.019)
Head is self-employed	0.001 (0.029)	-0.014 (0.020)	0.004 (0.034)	-0.051* (0.030)	0.083 (0.063)	-0.003 (0.015)
<i>Head's education level</i>						
	0.012 (0.029)	0.015 (0.024)	0.018 (0.027)	0.075* (0.044)	-0.003 (0.068)	0.014 (0.014)
Primary	0.055 (0.037)	0.028 (0.026)	0.036 (0.047)	0.074 (0.049)	0.058 (0.079)	0.028 (0.017)
Secondary incomplete	0.094** (0.044)	0.038 (0.037)	0.025 (0.030)	0.113** (0.055)	0.257* (0.148)	0.046** (0.018)
Secondary complete	-0.035 (0.052)	0.174*** (0.041)	0.035 (0.033)	0.129** (0.053)	0.352*** (0.132)	0.053*** (0.020)
Post-secondary	0.016*** (0.006)	-0.001 (0.004)	0.004 (0.005)	0.013** (0.006)	0.023 (0.015)	0.008*** (0.003)
<i>Household composition</i>						
Number of members aged 0-14	0.008 (0.008)	0.003 (0.005)	0.002 (0.008)	0.009 (0.007)	0.028 (0.018)	0.006* (0.004)
Number of members aged 15-24	-0.020* (0.010)	0.002 (0.009)	0.001 (0.011)	-0.028* (0.014)	0.005 (0.029)	-0.003 (0.005)
Number of members aged 25-59	-0.013 (0.021)	-0.040** (0.017)	0.022 (0.023)	-0.035 (0.025)	0.046 (0.061)	-0.005 (0.011)
<i>Household consumption</i>						
	0.064*** (0.022)	0.030*** (0.011)	0.028 (0.021)	0.044*** (0.016)	0.129*** (0.046)	0.044*** (0.009)
Log of consumption per capita	-0.004 (0.028)	-0.016 (0.017)	0.001 (0.021)	-0.022 (0.024)	0.209** (0.055)	0.005 (0.012)
Urban	-0.306* (0.179)	-0.234*** (0.084)	-0.037 (0.163)	-0.207* (0.125)	-0.971*** (0.370)	-0.232*** (0.081)
Constant						
$ln\sigma_k$						-1.897*** (0.063)
$ln\sigma_r$	-1.969*** (0.220)	-3.471*** (0.342)	-3.019*** (0.359)	-3.605*** (0.941)	-1.758*** (0.229)	-2.460*** (0.330)
$ln\sigma_j$	-1.838*** (0.099)	-3.327*** (0.357)	-14.273*** (1.135)	-2.372*** (0.185)	-2.284*** (0.581)	-2.315*** (0.124)
$ln\sigma_i$	-1.169 (2.936)	-2.313*** (0.098)	-1.578*** (0.062)			-2.376*** (0.098)
$ln\sigma_{it}$	-1.577 (6.639)	-1.593*** (0.025)	-0.956*** (0.019)	-1.282*** (0.028)	-0.933*** (0.048)	-1.106*** (0.014)
Country						5
Region	13	31	6	5	29	84
Community	511	239	465	446	255	1,916
Household	1,609	1,215	1,465	1,018	437	5,744
Observations	1609	1896	2828	1018	437	7788
Log likelihood	-821	115	-1638	-190	-241	-3409

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.16. Public transfers during the pandemic and number of teaching contacts, conditional mixed model

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	All
Public transfers	0.122* (0.064)	-0.013 (0.019)	0.341*** (0.055)	0.009 (0.033)	-0.032 (0.117)	0.193*** (0.027)
<i>Pre-COVID-19 variables</i>						
Head's age	0.002 (0.001)	0.002*** (0.001)	-0.000 (0.002)	-0.001 (0.001)	0.005 (0.003)	0.001 (0.001)
Head is female	-0.019 (0.036)	0.011 (0.013)	-0.077 (0.065)	0.039 (0.027)	-0.039 (0.071)	-0.014 (0.023)
Head is employee	-0.050 (0.046)	-0.024 (0.023)	0.163 (0.108)	-0.102** (0.045)	0.070 (0.098)	0.016 (0.035)
Head is self-employed	0.011 (0.034)	-0.013 (0.019)	0.041 (0.079)	-0.071** (0.035)	0.094 (0.084)	0.008 (0.028)
<i>Head's education level</i>						
	0.030 (0.034)	0.009 (0.022)	-0.027 (0.064)	0.087* (0.051)	-0.012 (0.092)	0.017 (0.026)
Primary	0.088** (0.044)	0.021 (0.024)	0.001 (0.110)	0.083 (0.057)	0.112 (0.107)	0.041 (0.033)
Secondary incomplete	0.147*** (0.053)	0.042 (0.034)	-0.030 (0.071)	0.124* (0.064)	0.441** (0.197)	0.041 (0.034)
Secondary complete	-0.018 (0.062)	0.190*** (0.038)	0.045 (0.077)	0.150** (0.062)	0.646*** (0.184)	0.102*** (0.036)
Post-secondary	0.018*** (0.007)	0.000 (0.004)	0.010 (0.012)	0.014** (0.007)	0.017 (0.020)	0.011** (0.005)
<i>Household composition</i>						
Number of members aged 0-14	0.010 (0.009)	-0.000 (0.005)	0.016 (0.018)	0.015* (0.008)	0.041* (0.024)	0.012* (0.007)
Number of members aged 15-24	-0.021* (0.012)	0.007 (0.008)	0.005 (0.026)	-0.030* (0.017)	0.022 (0.039)	-0.003 (0.010)
Number of members aged 25-59	-0.018 (0.025)	-0.028* (0.015)	0.072 (0.053)	-0.026 (0.029)	-0.026 (0.082)	0.013 (0.021)
<i>Household consumption</i>						
Log of consumption per capita	0.088*** (0.026)	0.026** (0.010)	0.052 (0.049)	0.060*** (0.019)	0.152** (0.062)	0.058*** (0.017)
Urban	-0.002 (0.032)	-0.018 (0.015)	-0.013 (0.051)	-0.003 (0.028)	0.203*** (0.077)	-0.000 (0.021)
Constant	-0.510** (0.210)	-0.228*** (0.076)	-0.279 (0.384)	-0.290* (0.148)	-1.294*** (0.499)	-0.417*** (0.150)
$ln\sigma_k$						-1.357*** (0.062)
$ln\sigma_\tau$	-1.890*** (0.223)	-15.272 (.)	-2.064*** (0.346)	-2.990*** (0.757)	-1.644*** (0.288)	-1.800*** (0.334)
$ln\sigma_j$	-1.800*** (0.112)	-3.109*** (0.199)	-12.944*** (0.951)	-2.237*** (0.186)	-1.434*** (0.211)	-2.295*** (0.147)
$ln\sigma_i$	-0.869 (6.075)	-2.538*** (0.130)	-0.757*** (0.066)			-2.606*** (0.376)
$ln\sigma_{it}$	-1.886 (46.496)	-1.646*** (0.025)	-0.081*** (0.019)	-1.131*** (0.028)	-0.685*** (0.050)	-0.431*** (0.011)
Country						5
Region	13	31	6	5	29	84
Community	511	239	465	446	255	1,916
Household	1,609	1,207	1,465	1,018	437	5,736
Observations	1609	1868	2828	1018	437	7760
Log likelihood	-1086	256	-4086	-385	-396	-8289

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.17. Household income decrease during the pandemic and any learning activities, conditional mixed model

Variables	Ethiopia	Malawi	Nigeria	Uganda	All	
Total household income decreased	-0.013 (0.010)	-0.004 (0.019)	-0.037* (0.020)	-0.005 (0.012)	-0.013** (0.007)	
<i>Pre-COVID-19 variables</i>						
Head's age	0.002*** (0.001)	0.001 (0.001)	0.000 (0.001)	0.002** (0.001)	0.002*** (0.000)	
Head is female	0.040** (0.018)	-0.025 (0.024)	-0.036 (0.027)	0.003 (0.019)	0.003 (0.010)	
Head is employee	0.033 (0.022)	0.015 (0.026)	0.019 (0.045)	-0.040 (0.032)	0.006 (0.014)	
Head is self-employed	0.005 (0.018)	-0.020 (0.024)	-0.011 (0.033)	-0.006 (0.024)	-0.004 (0.011)	
<i>Head's education level</i>						
Primary	0.040** (0.019)	0.047 (0.040)	0.092*** (0.028)	0.090*** (0.030)	0.058*** (0.013)	
Secondary incomplete	0.112*** (0.025)	0.118*** (0.044)	0.147*** (0.047)	0.165*** (0.036)	0.126*** (0.016)	
Secondary complete	0.126*** (0.027)	0.124** (0.062)	0.124*** (0.031)	0.104** (0.042)	0.121*** (0.017)	
Post-secondary	0.127*** (0.037)	0.289*** (0.068)	0.141*** (0.034)	0.261*** (0.042)	0.176*** (0.019)	
<i>Household composition</i>						
Number of members aged 0-14	0.009* (0.005)	-0.005 (0.007)	-0.000 (0.005)	0.035*** (0.005)	0.013*** (0.003)	
Number of members aged 15-24	0.015** (0.006)	0.019** (0.008)	-0.015** (0.008)	0.029*** (0.006)	0.015*** (0.003)	
Number of members aged 25-59	0.038*** (0.010)	0.002 (0.014)	0.018* (0.011)	0.009 (0.012)	0.019*** (0.006)	
Number of members aged 60 and older	0.010 (0.021)	-0.028 (0.027)	0.025 (0.022)	-0.031 (0.021)	-0.005 (0.011)	
<i>Household consumption</i>						
Log of consumption per capita	0.057*** (0.013)	0.025 (0.019)	0.035* (0.021)	0.082*** (0.014)	0.060*** (0.008)	
Urban	0.137*** (0.024)	0.063*** (0.024)	0.068*** (0.023)	0.050** (0.022)	0.076*** (0.012)	
Constant	-0.458*** (0.114)	-0.157 (0.137)	0.294* (0.167)	-0.298*** (0.112)	-0.277*** (0.098)	
	$\ln\sigma_k$				-1.931*** (0.413)	
	$\ln\sigma_r$	-2.021*** (0.227)	-21.750 (0.000)	-2.821*** (0.350)	-2.356*** (0.328)	-2.139*** (0.164)
	$\ln\sigma_j$	-1.954*** (0.065)	-2.608*** (0.194)	-2.699*** (0.340)	-2.162*** (0.107)	-2.122*** (0.050)
	$\ln\sigma_i$	-1.522*** (0.029)	-1.578*** (0.059)	-1.982*** (0.176)	-1.477*** (0.036)	-1.517*** (0.020)
	$\ln\sigma_{it}$	-1.029*** (0.009)	-1.085*** (0.021)	-0.823*** (0.020)	-0.947*** (0.010)	-0.981*** (0.006)
Country					4	
Region	11	31	6	6	54	
Community	444	239	474	624	1,781	
Household	2,068	1,226	1,598	1,805	6,698	
Observations	8,391	2,338	2,848	6,634	20,211	
Log likelihood	-4376	-1134	-1859	-3968	-11534	

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.18. Household income decrease during the pandemic and number of learning activities, conditional mixed model

Variables	Ethiopia	Malawi	Nigeria	Uganda	All
Total household income decreased	-0.011 (0.016)	0.002 (0.022)	-0.019 (0.069)	-0.012 (0.019)	0.003 (0.013)
<i>Pre-COVID-19 variables</i>					
Head's age	0.004*** (0.001)	0.002 (0.001)	0.004 (0.004)	0.003** (0.001)	0.003*** (0.001)
Head is female	0.028 (0.028)	-0.039 (0.028)	-0.148 (0.099)	0.028 (0.030)	-0.007 (0.022)
Head is employee	0.019 (0.035)	0.032 (0.048)	0.174 (0.164)	-0.067 (0.051)	0.002 (0.032)
Head is self-employed	0.005 (0.028)	0.016 (0.039)	0.034 (0.120)	0.009 (0.038)	0.005 (0.025)
<i>Head's education level</i>					
Primary	0.051* (0.030)	0.051 (0.047)	0.105 (0.100)	0.121** (0.048)	0.080*** (0.027)
Secondary incomplete	0.150*** (0.039)	0.151*** (0.051)	0.380*** (0.171)	0.249*** (0.056)	0.198*** (0.033)
Secondary complete	0.196*** (0.042)	0.155** (0.072)	0.293*** (0.111)	0.151** (0.066)	0.224*** (0.036)
Post-secondary	0.264*** (0.058)	0.367*** (0.080)	0.257** (0.121)	0.433*** (0.066)	0.339*** (0.041)
<i>Household composition</i>					
Number of members aged 0-14	0.024*** (0.008)	0.000 (0.008)	0.018 (0.018)	0.067*** (0.008)	0.031*** (0.006)
Number of members aged 15-24	0.031*** (0.010)	0.019** (0.010)	-0.006 (0.028)	0.053*** (0.009)	0.031*** (0.007)
Number of members aged 25-59	0.050*** (0.015)	-0.004 (0.017)	0.063 (0.039)	0.020 (0.019)	0.036*** (0.012)
Number of members aged 60 and older	-0.010 (0.033)	-0.035 (0.032)	0.033 (0.081)	-0.013 (0.033)	0.002 (0.023)
<i>Household consumption</i>					
Log of consumption per capita	0.099*** (0.021)	0.029 (0.022)	0.225*** (0.076)	0.190*** (0.022)	0.142*** (0.017)
Urban	0.237*** (0.042)	0.059* (0.032)	0.108 (0.079)	0.123*** (0.035)	0.142*** (0.026)
Constant	-0.896*** (0.183)	-0.211 (0.164)	-1.104* (0.601)	-0.965*** (0.168)	-0.963*** (0.256)
$\ln\sigma_k$					-0.734*** (0.021)
$\ln\sigma_r$	-1.513*** (0.228)	-2.928*** (0.394)	-1.406*** (0.335)	-2.437*** (0.379)	-0.816** (0.362)
$\ln\sigma_j$	-1.277*** (0.053)	-2.653*** (0.320)	-1.946** (0.891)	-1.504*** (0.087)	-1.749*** (0.128)
$\ln\sigma_i$	-1.076*** (0.029)	-1.459*** (0.064)	-0.297*** (0.073)	-1.063*** (0.039)	-1.276*** (0.049)
$\ln\sigma_{it}$	-0.605*** (0.009)	-0.904*** (0.021)	0.352*** (0.020)	-0.478*** (0.010)	-0.319*** (0.006)
Country					4
Region	11	31	6	6	54
Community	444	239	474	624	1,781
Household	2,068	1,226	1,598	1,805	6,697
Observations	8389	2338	2848	6634	20209
Log likelihood	-8013	-1527	-5375	-7063	-25391

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.19. Household income decreased during the pandemic and any contacts with teacher, conditional mixed model

Variables	Malawi	Nigeria	All
Total household income decreased	-0.000 (0.011)	-0.041 (0.028)	-0.009 (0.012)
<i>Pre-COVID-19 variables</i>			
Head's age	0.002*** (0.001)	-0.002 (0.001)	0.000 (0.001)
Head is female	0.007 (0.014)	-0.042 (0.032)	-0.017 (0.016)
Head is employee	-0.016 (0.024)	0.033 (0.054)	0.007 (0.027)
Head is self-employed	0.006 (0.019)	0.033 (0.040)	0.021 (0.021)
<i>Head's education level</i>			
Primary	0.018 (0.023)	-0.009 (0.032)	-0.001 (0.020)
Secondary incomplete	0.038 (0.025)	-0.021 (0.055)	0.003 (0.024)
Secondary complete	0.046 (0.036)	-0.004 (0.036)	0.021 (0.024)
Post-secondary	0.180*** (0.039)	0.018 (0.040)	0.067** (0.027)
<i>Household composition</i>			
Number of members aged 0-14	0.001 (0.004)	0.003 (0.006)	0.002 (0.004)
Number of members aged 15-24	0.004 (0.005)	0.010 (0.009)	0.007 (0.005)
Number of members aged 25-59	0.008 (0.008)	0.005 (0.013)	0.008 (0.008)
Number of members aged 60 and older	-0.035** (0.016)	0.012 (0.027)	-0.012 (0.015)
<i>Household consumption</i>			
Log of consumption per capita	0.035*** (0.011)	0.051** (0.025)	0.040*** (0.012)
Urban	-0.020 (0.017)	0.022 (0.025)	0.003 (0.015)
Constant	-0.305*** (0.082)	-0.100 (0.192)	-0.202** (0.102)
	$\ln\sigma_k$		-1.589*** (0.050)
	$\ln\sigma_r$	-3.512*** (0.376)	-2.748*** (0.524)
	$\ln\sigma_j$	-3.124*** (0.250)	-4.036*** (0.605)
	$\ln\sigma_i$	-2.249*** (0.079)	-2.438*** (0.145)
	$\ln\sigma_{it}$	-1.565*** (0.021)	-1.455*** (0.027)
Country			2
Region	31	6	37
Community	239	462	701
Household	1,226	1,384	2,610
Observations	2338	1384	3722
Log likelihood	65	-719	-908

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.20. Household income decreased during the pandemic and number of contacts with teacher, conditional mixed model

Variables	Malawi	Nigeria	All
Total household income decreased	-0.011 (0.011)	-0.019 (0.041)	-0.005 (0.014)
<i>Pre-COVID-19 variables</i>			
Head's age	0.002*** (0.001)	-0.002 (0.002)	-0.000 (0.001)
Head is female	0.011 (0.013)	-0.075 (0.049)	-0.032 (0.024)
Head is employee	-0.003 (0.023)	0.051 (0.082)	0.023 (0.040)
Head is self-employed	0.008 (0.018)	0.065 (0.060)	0.035 (0.031)
<i>Head's education level</i>			
Primary	0.012 (0.021)	-0.046 (0.048)	-0.029 (0.029)
Secondary incomplete	0.030 (0.023)	-0.107 (0.083)	-0.034 (0.035)
Secondary complete	0.044 (0.033)	-0.054 (0.053)	-0.015 (0.035)
Post-secondary	0.204*** (0.037)	0.027 (0.059)	0.091** (0.039)
<i>Household composition</i>			
Number of members aged 0-14	0.003 (0.004)	0.018* (0.009)	0.012** (0.005)
Number of members aged 15-24	0.001 (0.004)	0.020 (0.014)	0.011 (0.007)
Number of members aged 25-59	0.012 (0.008)	0.000 (0.020)	0.007 (0.011)
Number of members aged 60 and older	-0.026* (0.015)	0.057 (0.041)	0.020 (0.023)
<i>Household consumption</i>			
Log of consumption per capita	0.034*** (0.010)	0.085** (0.037)	0.057*** (0.018)
Urban	-0.019 (0.015)	0.044 (0.037)	-0.002 (0.019)
Constant	-0.314*** (0.075)	-0.333 (0.286)	-0.298** (0.148)
	$\ln\sigma_k$		-0.933*** (0.024)
	$\ln\sigma_r$		-2.450*** (0.521)
	$\ln\sigma_j$		-4.952 (4.459)
	$\ln\sigma_i$		-2.393*** (0.281)
	$\ln\sigma_{it}$		-1.530*** (0.024)
Country			2
Region	31	6	37
Community	239	462	701
Household	1,224	1,384	2,608
Observations	2310	1384	3694
Log likelihood	160	-1284	-1854

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.21. Household head was employed during the pandemic and any learning activities, conditional mixed model

Variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Tanzania	Mali	All
Household head worked last 7 days	-0.027 (0.018)	0.011 (0.011)	-0.063*** (0.023)	0.045*** (0.013)	0.007 (0.012)	0.057* (0.034)	-0.067 (0.108)	0.027*** (0.006)
<i>Pre-COVID-19 variables</i>								
Head's age	0.001 (0.001)	0.002*** (0.001)	0.002 (0.001)	0.000 (0.001)	0.002*** (0.001)	0.003** (0.002)	0.009*** (0.003)	0.002*** (0.000)
Head is female	0.044** (0.020)	0.029* (0.016)	-0.015 (0.027)	-0.020 (0.024)	0.019 (0.016)	0.014 (0.037)	-0.169 (0.129)	0.008 (0.008)
Head is employee	0.085*** (0.026)	0.032 (0.019)	0.032 (0.047)	0.029 (0.040)	-0.033 (0.027)	0.035 (0.052)	0.010 (0.120)	0.014 (0.012)
Head is self-employed	0.078*** (0.020)	0.000 (0.016)	-0.005 (0.038)	0.005 (0.030)	-0.009 (0.020)	0.031 (0.045)	0.180 (0.125)	0.015 (0.009)
<i>Head's education level</i>								
Primary	0.009 (0.019)	0.041** (0.017)	0.043 (0.045)	0.094*** (0.024)	0.110*** (0.026)	0.065 (0.046)	0.029 (0.122)	0.050*** (0.010)
Secondary incomplete	-0.003 (0.025)	0.082*** (0.022)	0.121** (0.049)	0.112*** (0.042)	0.176*** (0.030)	0.120** (0.055)	0.194 (0.127)	0.095*** (0.012)
Secondary complete	-0.008 (0.030)	0.120*** (0.024)	0.110 (0.071)	0.130*** (0.027)	0.136*** (0.036)	0.102 (0.103)	0.391*** (0.094)	0.108*** (0.013)
Post-secondary	-0.027 (0.035)	0.109*** (0.032)	0.292*** (0.076)	0.131*** (0.029)	0.250*** (0.035)	0.166* (0.101)	0.330*** (0.096)	0.134*** (0.015)
<i>Household composition</i>								
Number of members aged 0-14	0.009** (0.004)	0.014*** (0.005)	-0.003 (0.008)	0.001 (0.004)	0.037*** (0.004)	-0.004 (0.009)	0.034 (0.022)	0.013*** (0.002)
Number of members aged 15-24	0.001 (0.005)	0.018*** (0.006)	0.019** (0.009)	-0.009 (0.007)	0.032*** (0.005)	0.006 (0.012)	0.032 (0.022)	0.015*** (0.003)
Number of members aged 25-59	0.007 (0.007)	0.033*** (0.008)	-0.007 (0.016)	0.014 (0.010)	0.023** (0.010)	-0.018 (0.021)	-0.034 (0.029)	0.014*** (0.004)
Number of members aged 60 and older	0.009 (0.014)	0.007 (0.019)	-0.048 (0.031)	0.020 (0.020)	-0.026 (0.018)	-0.032 (0.043)	-0.000 (0.065)	-0.008 (0.008)
<i>Household consumption</i>								
Log of consumption per capita	0.075*** (0.015)	0.054*** (0.012)	0.009 (0.021)	0.044** (0.019)	0.098*** (0.012)	-0.005 (0.029)	0.101 (0.079)	0.064*** (0.006)
Urban	0.064*** (0.019)	0.132*** (0.022)	0.066** (0.032)	0.068*** (0.020)	0.045** (0.019)	0.026 (0.036)	-0.075 (0.099)	0.076*** (0.009)
Constant	-0.053 (0.120)	-0.449*** (0.102)	0.000 (0.158)	0.148 (0.147)	-0.429*** (0.095)	0.567** (0.238)	-0.847 (0.652)	-0.201** (0.084)
$ln\sigma_k$								-1.768*** (0.286)
$ln\sigma_r$	-2.587*** (0.231)	-2.106*** (0.227)	-22.004 (16.516)	-2.652*** (0.325)	-2.615*** (0.339)	-2.092*** (0.206)	-18.714 (0.000)	-2.329*** (0.118)
$ln\sigma_j$	-2.258*** (0.096)	-2.028*** (0.064)	-2.930*** (0.395)	-2.596*** (0.216)	-2.298*** (0.104)	-3.111* (1.642)	-1.755*** (0.401)	-2.246*** (0.045)
$ln\sigma_i$	-2.626*** (0.303)	-1.632*** (0.030)	-16.340*** (0.575)	-1.399*** (0.033)	-1.571*** (0.032)			-1.624*** (0.018)
$ln\sigma_{it}$	-0.905*** (0.013)	-0.961*** (0.007)	-0.975*** (0.021)	-0.948*** (0.009)	-0.898*** (0.007)	-0.992*** (0.034)	-0.862*** (0.077)	-0.908*** (0.004)
Country								7
Region	13	11	31	6	6	30	9	106
Community	532	446	238	475	654	358	129	2,832
Household	1,870	2,276	1,175	1,617	1,937	737	202	9,814
Observations	4,514	11,153	1,266	7,316	11,452	737	202	36,640
Log likelihood	-2509	-6191	-572.7	-4312	-6955	-336.8	-127.3	-22175

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.22. Household head was employed during the pandemic and number of learning activities, conditional mixed model

Variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Tanzania	Mali	All
Household head worked last 7 days	0.034 (0.036)	0.022 (0.020)	-0.072*** (0.027)	0.181*** (0.047)	0.015 (0.020)	0.120* (0.067)	-0.178 (0.162)	0.139*** (0.015)
<i>Pre-COVID-19 variables</i>								
Head's age	0.002* (0.001)	0.004*** (0.001)	0.002 (0.001)	0.004 (0.004)	0.003** (0.001)	0.003 (0.003)	0.009* (0.005)	0.003*** (0.001)
Head is female	0.010 (0.040)	0.029 (0.028)	-0.026 (0.032)	-0.143 (0.097)	0.047* (0.025)	0.045 (0.074)	-0.103 (0.193)	0.003 (0.021)
Head is employee	0.171*** (0.053)	0.019 (0.035)	0.040 (0.055)	0.198 (0.162)	-0.067 (0.043)	0.000 (0.100)	0.177 (0.180)	0.019 (0.030)
Head is self-employed	0.088** (0.040)	0.003 (0.028)	-0.001 (0.045)	-0.006 (0.118)	-0.004 (0.032)	-0.038 (0.086)	0.312* (0.188)	0.006 (0.023)
<i>Head's education level</i>								
Primary	0.095** (0.038)	0.050* (0.030)	0.050 (0.053)	0.088 (0.098)	0.098** (0.040)	0.094 (0.090)	-0.021 (0.184)	0.067*** (0.024)
Secondary incomplete	-0.008 (0.050)	0.149*** (0.039)	0.164*** (0.057)	0.295* (0.167)	0.211*** (0.048)	0.234** (0.108)	0.190 (0.192)	0.164*** (0.031)
Secondary complete	-0.039 (0.061)	0.194*** (0.042)	0.147* (0.083)	0.262** (0.108)	0.159*** (0.056)	0.324 (0.200)	0.486*** (0.142)	0.198*** (0.033)
Post-secondary	-0.053 (0.069)	0.260*** (0.058)	0.329*** (0.089)	0.269** (0.118)	0.344*** (0.056)	0.511*** (0.193)	0.304** (0.144)	0.284*** (0.037)
<i>Household composition</i>								
Number of members aged 0-14	0.017** (0.008)	0.024*** (0.008)	0.001 (0.010)	0.011 (0.018)	0.065*** (0.007)	0.006 (0.019)	0.054 (0.033)	0.025*** (0.005)
Number of members aged 15-24	0.022** (0.011)	0.031*** (0.010)	0.022** (0.011)	-0.010 (0.027)	0.054*** (0.008)	0.013 (0.023)	0.123*** (0.033)	0.030*** (0.007)
Number of members aged 25-59	0.010 (0.014)	0.049*** (0.015)	-0.012 (0.019)	0.064* (0.038)	0.039** (0.016)	0.076* (0.042)	-0.035 (0.044)	0.032*** (0.010)
Number of members aged 60 and older	0.003 (0.029)	-0.009 (0.033)	-0.056 (0.036)	-0.008 (0.079)	-0.013 (0.027)	-0.027 (0.084)	-0.099 (0.098)	-0.016 (0.020)
<i>Household consumption</i>								
Log of consumption per capita	0.178*** (0.028)	0.099*** (0.021)	0.015 (0.025)	0.210*** (0.074)	0.208*** (0.019)	-0.015 (0.060)	0.157 (0.119)	0.152*** (0.016)
Urban	0.098*** (0.034)	0.238*** (0.042)	0.073** (0.035)	0.152* (0.079)	0.117*** (0.030)	0.086 (0.075)	-0.081 (0.150)	0.166*** (0.023)
Constant	-0.828*** (0.232)	-0.915*** (0.183)	-0.052 (0.182)	-1.081* (0.592)	-1.056*** (0.145)	0.394 (0.490)	-1.484 (0.986)	-0.970*** (0.195)
$\ln\sigma_k$								-0.632*** (0.015)
$\ln\sigma_r$	-2.225*** (0.254)	-1.506*** (0.227)	-3.732* (1.936)	-1.123*** (0.314)	-2.473*** (0.429)	-1.478*** (0.210)	-27.886*** (10.630)	-0.927*** (0.277)
$\ln\sigma_j$	-3.447 (2.386)	-1.279*** (0.053)	-2.629*** (0.347)	-1.525*** (0.386)	-1.691*** (0.087)	-1.502*** (0.237)	-1.257*** (0.373)	-1.696*** (0.103)
$\ln\sigma_i$	-1.948*** (0.379)	-1.079*** (0.029)	-17.066*** (0.657)	0.075*** (0.028)	-1.155*** (0.033)			-1.458*** (0.053)
$\ln\sigma_{it}$	-0.321*** (0.018)	-0.605*** (0.009)	-0.833*** (0.021)	0.224*** (0.010)	-0.428*** (0.007)	-0.516*** (0.041)	-0.480*** (0.077)	-0.191*** (0.005)
Country								7
Region	13	11	31	6	6	30	9	106
Community	529	444	238	475	654	311	129	2,780
Household	1,835	2,068	1,175	1,610	1,937	554	202	9,381
Observations	3175	8396	1266	6473	11452	554	202	31518
Log likelihood	-3560	-8021	-758	-11743	-12306	-548	-208	-42918

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.23. Household head was employed during the pandemic and any contacts with teacher, conditional mixed model

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	Mali	All
Household head worked last 7 days	0.040** (0.020)	-0.012 (0.014)	0.099*** (0.018)	0.043** (0.021)	-0.043 (0.051)	-0.077 (0.103)	0.057*** (0.010)
<i>Pre-COVID-19 variables</i>							
Head's age	0.001 (0.001)	0.002** (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.001 (0.002)	0.004 (0.003)	0.000 (0.000)
Head is female	-0.005 (0.023)	0.002 (0.017)	-0.033 (0.028)	0.043* (0.023)	-0.065 (0.056)	0.152 (0.124)	-0.001 (0.012)
Head is employee	-0.008 (0.030)	-0.034 (0.028)	0.055 (0.046)	-0.071* (0.039)	0.093 (0.075)	0.100 (0.114)	0.007 (0.018)
Head is self-employed	0.013 (0.023)	-0.020 (0.023)	-0.010 (0.034)	-0.047 (0.030)	0.088 (0.067)	0.226* (0.118)	0.005 (0.014)
<i>Head's education level</i>							
Primary	0.003 (0.022)	0.023 (0.027)	0.015 (0.027)	0.073* (0.044)	-0.007 (0.071)	0.029 (0.118)	0.014 (0.013)
Secondary incomplete	0.036 (0.028)	0.039 (0.030)	0.034 (0.046)	0.075 (0.049)	0.052 (0.082)	0.075 (0.120)	0.031* (0.017)
Secondary complete	0.071** (0.034)	0.073* (0.043)	0.029 (0.030)	0.113** (0.055)	0.252* (0.150)	0.133 (0.091)	0.052*** (0.017)
Post-secondary	0.026 (0.040)	0.158*** (0.046)	0.040 (0.033)	0.125** (0.053)	0.350*** (0.133)	0.152* (0.092)	0.063*** (0.019)
<i>Household composition</i>							
Number of members aged 0-14	0.015*** (0.004)	-0.009* (0.005)	0.001 (0.005)	0.014** (0.006)	0.029* (0.016)	0.005 (0.021)	0.008*** (0.003)
Number of members aged 15-24	0.002 (0.006)	0.007 (0.006)	0.003 (0.007)	0.007 (0.007)	0.025 (0.018)	-0.009 (0.021)	0.004 (0.003)
Number of members aged 25-59	-0.016* (0.008)	-0.001 (0.010)	0.002 (0.011)	-0.028* (0.014)	-0.000 (0.031)	0.039 (0.028)	-0.005 (0.005)
Number of members aged 60 and older	-0.019 (0.016)	-0.044** (0.018)	0.022 (0.023)	-0.033 (0.025)	0.070 (0.065)	-0.050 (0.063)	-0.008 (0.010)
<i>Household consumption</i>							
Log of consumption per capita	0.054*** (0.017)	0.014 (0.013)	0.032 (0.021)	0.046*** (0.016)	0.130*** (0.047)	0.141* (0.073)	0.044*** (0.009)
Urban	-0.010 (0.022)	0.004 (0.020)	0.009 (0.021)	-0.019 (0.024)	0.198*** (0.056)	-0.042 (0.093)	0.004 (0.012)
Constant	-0.283** (0.139)	-0.098 (0.095)	-0.087 (0.163)	-0.250** (0.124)	-0.953** (0.385)	-1.220** (0.611)	-0.242*** (0.077)
							-1.897*** (0.057)
$\ln\sigma_k$							
$\ln\sigma_r$	-2.287*** (0.223)	-3.732*** (0.629)	-3.029*** (0.359)	-4.366** (1.926)	-1.747*** (0.239)	-18.554** (7.448)	-2.593*** (0.331)
$\ln\sigma_j$	-2.021*** (0.087)	-3.027*** (0.278)	-20.891 (1855.569)	-2.293*** (0.167)	-2.635** (1.198)	-17.989*** (2.232)	-2.519*** (0.140)
$\ln\sigma_i$	-1.893*** (0.096)	-25.134*** (0.681)	-1.582*** (0.062)				-2.359*** (0.083)
$\ln\sigma_{it}$	-1.054*** (0.019)	-1.498*** (0.021)	-0.959*** (0.019)	-1.289*** (0.028)	-0.914*** (0.049)	-0.848*** (0.050)	-1.066*** (0.012)
Country							6
Region	13	31	6	5	29	9	93
Community	529	238	465	444	244	129	2,049
Household	1,835	1,175	1,479	1,005	411	202	6,107
Observations	3175	1266	2824	1005	411	202	8883
Log likelihood	-1553	72	-1627	-187	-229	-115	-4134

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.24. Household head was employed during the pandemic and number of contacts with teacher, conditional mixed model

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	Mali	All
Household head worked last 7 days	0.036 (0.023)	0.002 (0.012)	0.238*** (0.042)	0.055** (0.024)	-0.037 (0.067)	-0.070 (0.121)	0.135*** (0.017)
<i>Pre-COVID-19 variables</i>							
Head's age	0.001 (0.001)	0.001* (0.001)	0.001 (0.002)	-0.001 (0.001)	0.004 (0.003)	0.004 (0.004)	0.001 (0.001)
Head is female	-0.021 (0.027)	0.007 (0.014)	-0.070 (0.065)	0.041 (0.027)	-0.042 (0.073)	0.142 (0.146)	-0.008 (0.021)
Head is employee	0.006 (0.036)	-0.015 (0.025)	0.129 (0.108)	-0.096** (0.045)	0.116 (0.099)	0.116 (0.134)	0.033 (0.032)
Head is self-employed	0.013 (0.027)	-0.020 (0.020)	0.004 (0.080)	-0.065* (0.034)	0.126 (0.087)	0.251* (0.140)	0.006 (0.025)
<i>Head's education level</i>							
Primary	0.007 (0.027)	0.009 (0.023)	-0.023 (0.064)	0.087* (0.051)	-0.009 (0.093)	0.032 (0.140)	0.015 (0.023)
Secondary incomplete	0.058* (0.034)	0.026 (0.025)	0.006 (0.110)	0.084 (0.056)	0.121 (0.108)	0.066 (0.142)	0.041 (0.029)
Secondary complete	0.101** (0.041)	0.076** (0.037)	-0.006 (0.071)	0.122* (0.063)	0.466** (0.196)	0.157 (0.107)	0.052* (0.030)
Post-secondary	0.060 (0.048)	0.187*** (0.040)	0.060 (0.077)	0.146** (0.061)	0.671*** (0.179)	0.261** (0.108)	0.117*** (0.033)
<i>Household composition</i>							
Number of members aged 0-14	0.017*** (0.005)	-0.008* (0.004)	0.007 (0.012)	0.016** (0.007)	0.021 (0.020)	0.010 (0.025)	0.011** (0.005)
Number of members aged 15-24	0.002 (0.007)	0.004 (0.005)	0.017 (0.018)	0.012 (0.008)	0.039* (0.024)	-0.005 (0.025)	0.009 (0.006)
Number of members aged 25-59	-0.018* (0.010)	0.007 (0.009)	0.004 (0.026)	-0.032* (0.017)	0.017 (0.041)	0.044 (0.034)	-0.007 (0.009)
Number of members aged 60 and older	-0.032 (0.020)	-0.021 (0.016)	0.072 (0.053)	-0.024 (0.028)	0.011 (0.085)	-0.072 (0.074)	0.004 (0.018)
<i>Household consumption</i>							
Log of consumption per capita	0.065*** (0.020)	0.005 (0.011)	0.064 (0.049)	0.062*** (0.018)	0.135** (0.062)	0.145* (0.087)	0.058*** (0.016)
Urban	-0.012 (0.027)	-0.002 (0.016)	0.008 (0.051)	-0.002 (0.028)	0.206*** (0.075)	-0.061 (0.109)	0.008 (0.020)
Constant	-0.351** (0.166)	-0.052 (0.081)	-0.429 (0.385)	-0.342** (0.142)	-1.166** (0.507)	-1.319* (0.721)	-0.429*** (0.132)
							-1.344*** (0.054)
$\ln\sigma_k$							
$\ln\sigma_r$	-2.225*** (0.230)	-18.334*** (4.784)	-2.066*** (0.346)	-4.576 (3.689)	-1.656*** (0.297)	-22.764*** (8.131)	-2.131*** (0.318)
$\ln\sigma_j$	-1.891*** (0.091)	-3.084*** (0.197)	-17.683*** (1.099)	-2.137*** (0.164)	-1.695*** (0.335)	-17.816*** (1.756)	-2.410*** (0.144)
$\ln\sigma_i$	-1.637*** (0.081)	-23.756*** (0.692)	-0.768*** (0.068)				-2.452*** (0.237)
$\ln\sigma_{it}$	-0.889*** (0.019)	-1.659*** (0.022)	-0.077*** (0.019)	-1.146*** (0.028)	-0.676*** (0.050)	-0.682*** (0.050)	-0.460*** (0.011)
Country							6
Region	13	31	6	5	29	9	93
Community	529	237	465	444	244	129	2,049
Household	1,835	1,147	1,479	1,005	411	202	6,107
Observations	3175	1238	2824	1005	411	202	8883
Log likelihood	-2107	269	-4083	-332	-340	-149	-9286

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.25. Household had severe food insecurity during the pandemic and any learning activities, conditional mixed model

Variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Tanzania	All
Severe food insecurity	0.020 (0.030)	-0.029 (0.018)	-0.006 (0.021)	-0.027* (0.016)	0.019 (0.018)	0.025 (0.035)	-0.006 (0.009)
<i>Pre-COVID-19 variables</i>							
Head's age	0.001 (0.001)	0.002*** (0.001)	0.002 (0.001)	0.000 (0.001)	0.002*** (0.001)	0.003** (0.002)	0.002*** (0.000)
Head is female	-0.022 (0.026)	0.040** (0.018)	-0.024 (0.024)	-0.017 (0.026)	0.017 (0.016)	0.007 (0.035)	0.002 (0.009)
Head is employee	0.058* (0.034)	0.036 (0.022)	0.015 (0.041)	0.035 (0.043)	-0.035 (0.027)	0.038 (0.051)	0.010 (0.013)
Head is self-employed	0.050** (0.025)	0.004 (0.017)	0.010 (0.033)	0.001 (0.031)	-0.009 (0.020)	0.026 (0.043)	0.007 (0.010)
<i>Head's education level</i>							
Primary	-0.009 (0.025)	0.039** (0.019)	0.044 (0.039)	0.091*** (0.026)	0.110*** (0.026)	0.072 (0.045)	0.050*** (0.011)
Secondary incomplete	-0.026 (0.033)	0.111*** (0.025)	0.112*** (0.043)	0.121*** (0.045)	0.175*** (0.030)	0.131** (0.054)	0.106*** (0.013)
Secondary complete	-0.032 (0.039)	0.125*** (0.027)	0.120** (0.061)	0.120*** (0.029)	0.136*** (0.036)	0.114 (0.103)	0.105*** (0.015)
Post-secondary	-0.021 (0.046)	0.125*** (0.037)	0.304*** (0.067)	0.133*** (0.032)	0.250*** (0.035)	0.166* (0.100)	0.149*** (0.016)
<i>Household composition</i>							
Number of members aged 0-14	0.007 (0.005)	0.009* (0.005)	-0.006 (0.007)	-0.000 (0.005)	0.036*** (0.004)	-0.001 (0.009)	0.012*** (0.002)
Number of members aged 15-24	0.006 (0.007)	0.015** (0.006)	0.018** (0.008)	-0.009 (0.007)	0.031*** (0.005)	0.008 (0.012)	0.016*** (0.003)
Number of members aged 25-59	-0.000 (0.009)	0.038*** (0.010)	0.004 (0.014)	0.016 (0.010)	0.023** (0.010)	-0.025 (0.020)	0.016*** (0.005)
Number of members aged 60 and older	0.002 (0.019)	0.011 (0.021)	-0.027 (0.027)	0.028 (0.021)	-0.026 (0.017)	-0.043 (0.042)	-0.007 (0.009)
<i>Household consumption</i>							
Log of consumption per capita	0.061*** (0.019)	0.056*** (0.013)	0.025 (0.019)	0.039** (0.020)	0.097*** (0.012)	0.012 (0.029)	0.064*** (0.007)
Urban	0.027 (0.022)	0.136*** (0.024)	0.046* (0.028)	0.056*** (0.021)	0.045** (0.018)	0.021 (0.035)	0.063*** (0.010)
Constant	-0.435*** (0.150)	-0.450*** (0.114)	-0.159 (0.139)	0.224 (0.157)	-0.420*** (0.094)	0.463** (0.233)	-0.265** (0.113)
$\ln\sigma_k$							-1.410*** (0.293)
$\ln\sigma_r$	-2.935*** (0.282)	-2.037*** (0.228)	-2.920*** (0.355)	-2.622*** (0.324)	-2.610*** (0.338)	-2.029*** (0.197)	-2.372*** (0.107)
$\ln\sigma_j$	-2.669*** (0.249)	-1.955*** (0.065)	-2.648*** (0.254)	-2.796*** (0.360)	-2.305*** (0.105)	-3.102** (1.561)	-2.233*** (0.048)
$\ln\sigma_i$	-1.120*** (0.022)	-1.523*** (0.029)	-1.614*** (0.063)	-1.503*** (0.049)	-1.571*** (0.032)		-1.587*** (0.018)
$\ln\sigma_{it}$	-2.357 (0.000)	-1.029*** (0.009)	-1.084*** (0.021)	-0.904*** (0.014)	-0.897*** (0.007)	-0.989*** (0.033)	-0.953*** (0.005)
Country							6
Region	13	11	31	6	6	30	97
Community	511	446	239	475	655	371	2,695
Household	1,605	2,068	1,226	1,603	1,940	777	9,219
Observations	1,605	8,396	2,338	4,304	11,508	777	28,928
Log likelihood	-583.8	-4379	-1127	-2718	-6990	-358.2	-16670

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.26. Household had severe food insecurity during the pandemic and number of learning activities, conditional mixed model

Variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Tanzania	All
Severe food insecurity	0.050 (0.037)	-0.024 (0.027)	-0.001 (0.025)	-0.070 (0.055)	-0.004 (0.029)	0.066 (0.066)	0.020 (0.017)
<i>Pre-COVID-19 variables</i>							
Head's age	0.001 (0.001)	0.004*** (0.001)	0.002 (0.001)	0.004 (0.003)	0.003** (0.001)	0.004 (0.003)	0.003*** (0.001)
Head is female	-0.014 (0.033)	0.027 (0.028)	-0.039 (0.028)	-0.101 (0.094)	0.044* (0.025)	0.027 (0.068)	-0.004 (0.019)
Head is employee	0.048 (0.043)	0.023 (0.035)	0.032 (0.048)	0.211 (0.158)	-0.068 (0.043)	0.009 (0.095)	0.007 (0.028)
Head is self-employed	0.061* (0.032)	0.004 (0.028)	0.016 (0.039)	0.064 (0.115)	-0.002 (0.032)	-0.038 (0.081)	0.015 (0.022)
<i>Head's education level</i>							
Primary	-0.026 (0.031)	0.050* (0.030)	0.051 (0.047)	0.081 (0.095)	0.096** (0.040)	0.095 (0.085)	0.048** (0.023)
Secondary incomplete	-0.048 (0.041)	0.149*** (0.039)	0.150*** (0.051)	0.303* (0.164)	0.209*** (0.048)	0.259** (0.103)	0.154*** (0.029)
Secondary complete	-0.031 (0.049)	0.194*** (0.042)	0.154** (0.072)	0.226** (0.106)	0.158*** (0.056)	0.343* (0.195)	0.172*** (0.031)
Post-secondary	-0.007 (0.057)	0.260*** (0.058)	0.367*** (0.079)	0.252** (0.116)	0.345*** (0.056)	0.517*** (0.188)	0.287*** (0.035)
<i>Household composition</i>							
Number of members aged 0-14	0.009 (0.006)	0.024*** (0.008)	0.000 (0.008)	0.014 (0.017)	0.065*** (0.007)	0.009 (0.018)	0.026*** (0.005)
Number of members aged 15-24	0.009 (0.009)	0.031*** (0.010)	0.019** (0.010)	-0.004 (0.026)	0.054*** (0.008)	0.014 (0.022)	0.030*** (0.006)
Number of members aged 25-59	-0.003 (0.011)	0.049*** (0.015)	-0.004 (0.017)	0.060 (0.037)	0.039** (0.016)	0.053 (0.038)	0.031*** (0.010)
Number of members aged 60 and older	0.001 (0.023)	-0.010 (0.033)	-0.035 (0.032)	0.007 (0.077)	-0.013 (0.027)	-0.046 (0.079)	-0.014 (0.019)
<i>Household consumption</i>							
Log of consumption per capita	0.085*** (0.023)	0.098*** (0.021)	0.029 (0.022)	0.212*** (0.072)	0.207*** (0.019)	0.014 (0.058)	0.142*** (0.014)
Urban	0.035 (0.028)	0.236*** (0.042)	0.059* (0.032)	0.109 (0.077)	0.117*** (0.029)	0.057 (0.072)	0.125*** (0.021)
Constant	-0.618*** (0.186)	-0.888*** (0.183)	-0.209 (0.163)	-1.037* (0.572)	-1.044*** (0.144)	0.237 (0.466)	-0.885*** (0.220)
$\ln\sigma_k$							-0.758*** (0.017)
$\ln\sigma_r$	-2.904*** (0.318)	-1.519*** (0.228)	-2.927*** (0.394)	-1.344*** (0.326)	-2.462*** (0.426)	-1.374*** (0.195)	-0.774*** (0.294)
$\ln\sigma_j$	-2.589*** (0.314)	-1.277*** (0.053)	-2.653*** (0.320)	-1.693*** (0.503)	-1.710*** (0.089)	-1.527*** (0.229)	-1.767*** (0.108)
$\ln\sigma_i$	-0.878 (2.787)	-1.079*** (0.029)	-1.459*** (0.064)	-0.058 (0.036)	-1.152*** (0.033)		-1.432*** (0.047)
$\ln\sigma_{it}$	-2.292 (47.066)	-0.605*** (0.009)	-0.904*** (0.021)	0.250*** (0.014)	-0.429*** (0.007)	-0.535*** (0.039)	-0.292*** (0.005)
Country							6
Region	13	11	31	6	6	30	97
Community	511	444	239	465	655	326	2,650
Household	1,605	2,068	1,226	1,483	1,940	591	9,033
Observations	1605	8394	2338	4304	11508	591	28740
Log likelihood	-943	-8020	-1527	-7914	-12355	-575	-36258

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.27. Household had severe food insecurity during the pandemic and any contact with teacher, conditional mixed model

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	All
Severe food insecurity	0.007 (0.034)	-0.001 (0.013)	0.024 (0.019)	-0.010 (0.032)	0.002 (0.052)	0.021* (0.011)
<i>Pre-COVID-19 variables</i>						
Head's age	0.001 (0.001)	0.002*** (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.001 (0.002)	0.001 (0.000)
Head is female	-0.007 (0.030)	0.007 (0.014)	-0.025 (0.028)	0.042* (0.023)	-0.081 (0.053)	-0.004 (0.012)
Head is employee	-0.062 (0.039)	-0.016 (0.024)	0.066 (0.046)	-0.077** (0.039)	0.071 (0.073)	-0.007 (0.019)
Head is self-employed	-0.002 (0.029)	0.006 (0.019)	0.002 (0.034)	-0.052* (0.030)	0.076 (0.063)	0.001 (0.014)
<i>Head's education level</i>						
Primary	0.012 (0.029)	0.018 (0.023)	0.025 (0.027)	0.074* (0.044)	-0.009 (0.069)	0.015 (0.014)
Secondary incomplete	0.050 (0.037)	0.038 (0.025)	0.043 (0.047)	0.072 (0.049)	0.052 (0.080)	0.033* (0.017)
Secondary complete	0.092** (0.044)	0.046 (0.036)	0.035 (0.030)	0.111** (0.055)	0.249* (0.149)	0.050*** (0.018)
Post-secondary	-0.041 (0.052)	0.180*** (0.039)	0.047 (0.033)	0.126** (0.053)	0.347*** (0.133)	0.060*** (0.020)
<i>Household composition</i>						
Number of members aged 0-14	0.016*** (0.006)	0.001 (0.004)	0.003 (0.005)	0.013** (0.006)	0.023 (0.015)	0.008*** (0.003)
Number of members aged 15-24	0.009 (0.008)	0.004 (0.005)	0.002 (0.008)	0.009 (0.007)	0.027 (0.018)	0.006* (0.004)
Number of members aged 25-59	-0.021** (0.011)	0.008 (0.008)	0.001 (0.011)	-0.029** (0.014)	0.006 (0.029)	-0.003 (0.005)
Number of members aged 60 and older	-0.011 (0.022)	-0.035** (0.016)	0.023 (0.023)	-0.036 (0.025)	0.052 (0.062)	-0.006 (0.011)
<i>Household consumption</i>						
Log of consumption per capita	0.065*** (0.022)	0.035*** (0.011)	0.027 (0.021)	0.045*** (0.016)	0.130*** (0.046)	0.045*** (0.009)
Urban	-0.009 (0.028)	-0.020 (0.017)	0.002 (0.021)	-0.021 (0.024)	0.210*** (0.055)	0.002 (0.012)
Constant	-0.296 (0.181)	-0.304*** (0.082)	-0.030 (0.164)	-0.205* (0.124)	-0.964*** (0.372)	-0.241*** (0.082)
$\ln\sigma_k$						-1.864*** (0.057)
$\ln\sigma_r$	-1.944*** (0.219)	-3.509*** (0.375)	-3.054*** (0.365)	-3.851*** (1.064)	-1.766*** (0.231)	-2.389*** (0.349)
$\ln\sigma_j$	-1.819*** (0.096)	-3.125*** (0.250)	-18.521*** (1.240)	-2.370*** (0.184)	-2.285*** (0.580)	-2.316*** (0.126)
$\ln\sigma_i$	-1.052 (2.644)	-2.249*** (0.079)	-1.566*** (0.061)			-2.335*** (0.090)
$\ln\sigma_{it}$	-2.031 (18.705)	-1.565*** (0.021)	-0.955*** (0.019)	-1.282*** (0.028)	-0.932*** (0.048)	-1.129*** (0.013)
Country						5
Region	13	31	6	5	29	84
Community	511	239	465	466	255	1,916
Household	1,605	1,226	1,473	1,018	436	5,785
Observations	1605	2338	2836	1018	436	8233
Log likelihood	-823	65	-1651	-190	-240	-3477

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Table A.28. Household had severe food insecurity during the pandemic and number of contacts with teacher, conditional mixed model

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	All
Severe food insecurity	-0.008 (0.041)	0.008 (0.012)	0.155*** (0.045)	-0.007 (0.037)	-0.023 (0.068)	0.093*** (0.020)
<i>Pre-COVID-19 variables</i>						
Head's age	0.002 (0.001)	0.002*** (0.001)	0.000 (0.002)	-0.001 (0.001)	0.005 (0.003)	0.001 (0.001)
Head is female	-0.019 (0.036)	0.010 (0.013)	-0.051 (0.065)	0.039 (0.026)	-0.044 (0.070)	-0.010 (0.022)
Head is employee	-0.049 (0.046)	-0.002 (0.023)	0.164 (0.108)	-0.100** (0.045)	0.068 (0.096)	0.018 (0.034)
Head is self-employed	0.008 (0.035)	0.009 (0.018)	0.046 (0.079)	-0.069** (0.034)	0.090 (0.083)	0.008 (0.027)
<i>Head's education level</i>						
Primary	0.030 (0.034)	0.013 (0.021)	-0.005 (0.064)	0.087* (0.051)	-0.017 (0.091)	0.016 (0.025)
Secondary incomplete	0.084* (0.044)	0.033 (0.023)	0.025 (0.111)	0.081 (0.056)	0.104 (0.106)	0.046 (0.031)
Secondary complete	0.145*** (0.053)	0.049 (0.033)	0.010 (0.071)	0.119* (0.063)	0.430** (0.194)	0.050 (0.033)
Post-secondary	-0.023 (0.062)	0.209*** (0.037)	0.093 (0.078)	0.147** (0.061)	0.636*** (0.181)	0.118*** (0.036)
<i>Household composition</i>						
Number of members aged 0-14	0.018*** (0.007)	0.003 (0.004)	0.010 (0.012)	0.014** (0.007)	0.018 (0.019)	0.011** (0.005)
Number of members aged 15-24	0.010 (0.009)	0.001 (0.004)	0.015 (0.018)	0.014* (0.008)	0.040* (0.023)	0.011* (0.007)
Number of members aged 25-59	-0.022* (0.012)	0.012 (0.008)	0.003 (0.026)	-0.032* (0.016)	0.022 (0.038)	-0.002 (0.010)
Number of members aged 60 and older	-0.015 (0.025)	-0.026* (0.015)	0.072 (0.053)	-0.028 (0.028)	-0.018 (0.081)	0.011 (0.020)
<i>Household consumption</i>						
Log of consumption per capita	0.002 (0.026)	0.002*** (0.010)	0.000 (0.049)	-0.001 (0.018)	0.005 (0.061)	0.001 (0.016)
Urban	0.088*** (0.026)	0.035*** (0.010)	0.056 (0.049)	0.061*** (0.018)	0.152** (0.061)	0.063*** (0.016)
Constant	-0.007 (0.033)	-0.019 (0.015)	-0.012 (0.051)	-0.005 (0.028)	0.208*** (0.076)	-0.003 (0.021)
	-0.493** (0.212)	-0.332*** (0.075)	-0.350 (0.386)	-0.286** (0.144)	-1.279*** (0.491)	-0.460*** (0.146)
$\ln\sigma_k$						-1.354*** (0.059)
$\ln\sigma_r$	-1.868*** (0.221)	-20.837 (.)	-2.195*** (0.363)	-3.699*** (1.221)	-1.676*** (0.289)	-1.794*** (0.332)
$\ln\sigma_j$	-1.784*** (0.110)	-3.040*** (0.173)	-15.301*** (1.009)	-2.237*** (0.184)	-1.443*** (0.208)	-2.345*** (0.148)
$\ln\sigma_i$	-0.904 (4.440)	-2.501*** (0.123)	-0.744*** (0.064)			-2.570*** (0.348)
$\ln\sigma_{it}$	-1.675 (20.762)	-1.571*** (0.022)	-0.079*** (0.019)	-1.137*** (0.027)	-0.704*** (0.050)	-0.455*** (0.011)
Country						5
Region	13	31	6	5	29	84
Community	511	239	465	466	255	1,916
Household	1,605	1,224	1,473	1,018	436	5,756
Observations	1605	2310	2836	1018	436	8205
Log likelihood	-1087	159	-4108	-336	-363	-8597

Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The reference group is head without any education (for head's education).

Figure A1. Urban/ rural gaps in any learning activities after COVID-19-induced school closures

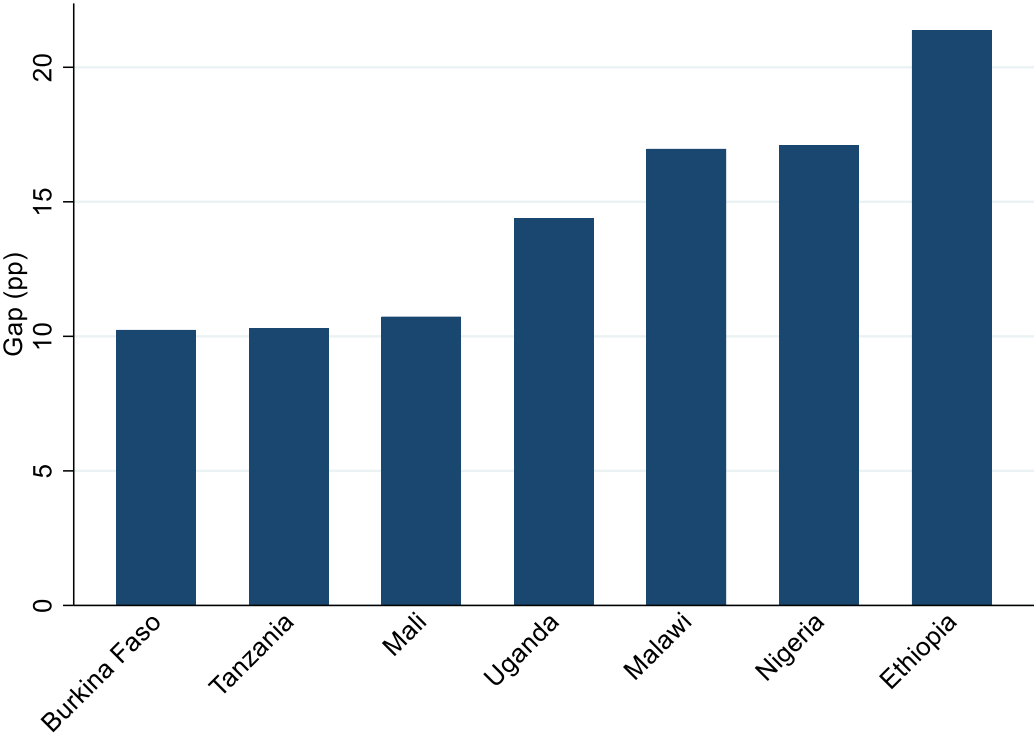
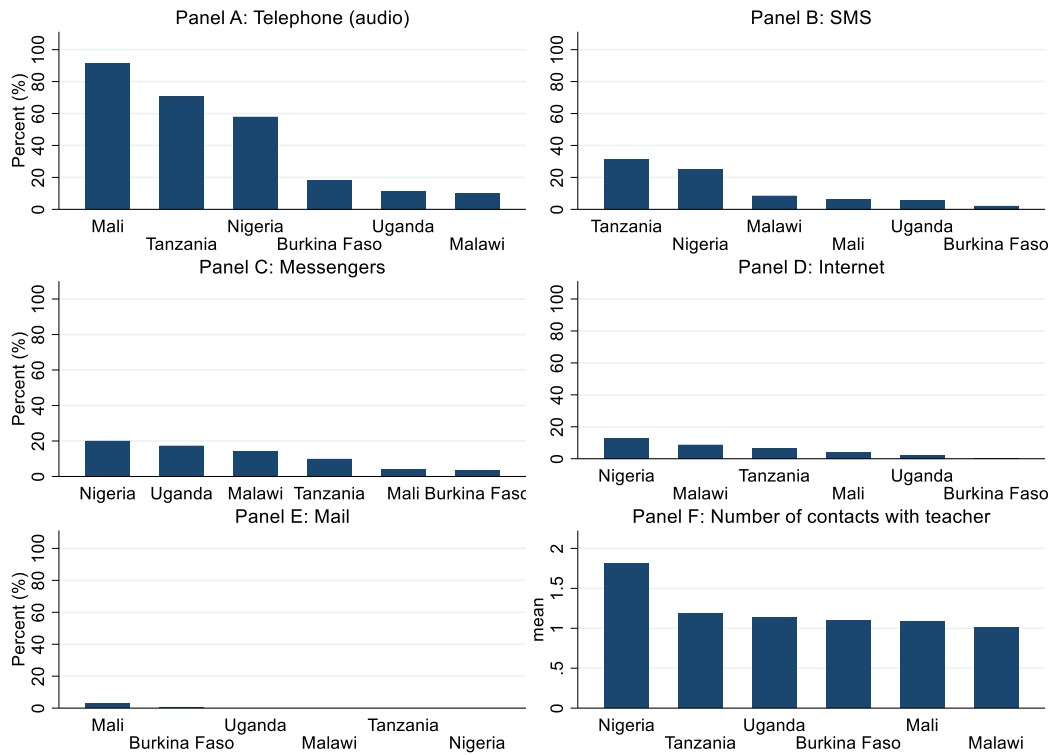


Figure A2. Share of households with children engaging in contacts with teacher after COVID-19 school closures



Note: Types of contacts with teacher include SMS, online applications, email, mail, telephone, WhatsApp, Facebook, and other methods. The maximum number of contacts is 8. The sample is restricted to households who had some contacts with teacher.