Educational inequalities during COVID-19: Results from longitudinal surveys in Sub-Saharan Africa☆

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ABSTRACT

While the literature on the COVID-19 pandemic is growing, there are few studies on learning inequalities in a lower-income, multi-country context. Analyzing a rich database consisting of 34 longitudinal household and phone survey rounds from Burkina Faso, Ethiopia, Malawi, Mali, Nigeria, Tanzania, and Uganda with a rigorous linear mixed model framework, we find lower school enrolment rates during the pandemic. But countries exhibit heterogeneity. Our variance decomposition analysis suggests 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.

1. 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; Belot *et al.*, 2021; Dang and Nguyen, 2021; Dang et al., 2024; Egger et al., 2021; Sumner et al., 2022). Many countries witnessed learning disruptions, including school closures for extended periods. Various studies provide supportive evidence for the harmful effects of the pandemic on deepening learning inequities in high-income countries (Jæger, Blaabæk, 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 lower-income, multi-country context, most likely because of lack of data (Betthäuser et al.,

2023). Poorer 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, especially during time of crisis (Edmonds, 2007; 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 countries (World Bank, 2018). Consequently, the learning inequalities seen during the pandemic in richer countries might 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. Worrisomely, Asanov et al. (2021) find that Ecuadorian students from 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. 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 due to faster recovery for children with less-educated mothers and from poorer households (Singh, Romero, Muralidharan, 2024).

Other cross-country studies mainly employ phone survey data alone for descriptive analysis. Josephson et al. (2021) analyze a subset of the phone survey data that we analyze from Ethiopia, Malawi, Nigeria, and Uganda and find that student– teacher contact sharply drop from among households with school-aged children. 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. Implementing a half-an-hour phone survey in seven countries in Southeast Asia during June-October 2022, Maddawin et al. (2024) find that 79 % of the respondents felt that their children's learning progress was slower during school closures than it would have been with in-person schooling. The authors also find that boys were more likely than girls to experience very little or no progress, children from richer households were more likely to progress at the same rate as in-person classes, and remote learning modes generally helped to protect learning progress.

Just a couple exceptions exist that analyze other data sources. Conto et al. (2021) and Bracco et al. (2024) analyze a mix of surveys from poorer countries and find lower school enrolment and worse reading skills for those not attending school compared to their peers who continue attending school. Analyzing grade 4 students' reading scores from Progress in International Reading Literacy Study (PIRLS) data during 2001–2021, Jakubowski, Gajderowicz, and Patrinos (2023) find that scores declined an average of 33 percent of a standard deviation, equivalent to more than a year of schooling. Further meta-analysis by Moscoviz and Evans (2022), Betthäuser et al. (2023), and Di Pietro (2023) offer qualitatively similar results. Specifically, reviewing studies from 40 poorer and richer countries, Moscoviz and Evans (2022) find that learning loss is concentrated among poorer students in low-income

countries and dropout rates vary widely across countries.[2] We provide a more detailed review of the cross-country studies in Table A.1 (Appendix A).

We make several new contributions in this study. First, we offer an assessment of student learning inequalities during the COVID-19 pandemic, 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. Since a considerable share of workers work in the informal sector in poorer countries, Egger et al. (2021) observe that the approaches national statistical agencies and researchers in richer countries have used to document the pandemic-induced economic losses cannot easily be implemented in these countries. Consequently, poorer countries have to reply more on household consumption surveys in normal times and particularly high-frequency phone surveys implemented during the pandemic as key sources of data. The rich panel database that we construct from household surveys and phone surveys helps address data challenges and offer better insights on student learning activities during the pandemic for poorer countries.[3]

Second, we analyze a combination of phone surveys and household surveys, which enables us to improve on previous studies that only rely on phone surveys in various aspects. Different from the typical household survey, various technical challenges can affect the data quality of phone surveys (including low response rates, under-coverage or selection bias toward richer households, and shorter questionnaires with much fewer variables), 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). Another key limitation is that phone surveys do not offer detailed information on household pre-pandemic socioeconomic status, given its short questionnaire nature. To address these data challenges, 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 offer richer analysis than using either the phone surveys or the pre-pandemic household surveys alone.

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 that are not readily available in most existing studies. Furthermore, this model also enables us to examine the impacts of various household characteristics more comprehensively. In fact, to our knowledge, we offer the first study that employs the linear mixed model, which represents a more

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[2] In the absence of survey data particularly for poorer countries, 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. Neidhöfer et al. (2021) find that while Latin American students from higher parental education backgrounds (secondary education or more) experience instructional losses below 10 %, those from lower parental educational backgrounds face much higher instructional losses. Using a general equilibrium approach, Buffie et al. (2023) find the pandemic to result in a significant degradation of human capital in low-income countries, which can have long-term effects on labor productivity.

[3] Most poorer countries do not collect panel data; for those that do, various issues such as attrition can undermine the quality of panel data (see, e.g., Dang and Lanjouw 2023 for a recent review in the context of poverty measurement).

generalized and more rigorous version of the standard household (or country) effects econometric models that most existing studies employ.

We find reduced learning activities during the pandemic, 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, 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 or household head employment and 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 2. We subsequently present the analytical framework in Section 3 and discuss the estimation results in Section 4 regarding the variance decomposition (Section 4.1), the correlates with learning activities (Section 4.2), and robustness checks (Section 4.3). We extend the analysis in Section 5 to include pandemic-induced shocks and public assistance (Section 5.1) and child-level data for Uganda (Section 5.2) before finally concluding in Section 6. We provide additional results in Appendix A and further robustness checks in Appendix B.

2. Descriptive analysis

2.1. 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, coping strategies, and whether the household received assistance from the government to cope with the pandemic.[4]

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). Under the LSMS-ISA project, face-

to-face panel surveys had been conducted in six countries.[5] 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 National Longitudinal Phone Survey).

The same households were tracked over several months, with selected 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 callbacks, 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. 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. Reweighting helps improves the representativeness of the estimates for phone survey respondents compared to those of the general adult population (Brubaker et al., 2021; Gourlay et al., 2021).

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 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.

Table 1 (and Figure A.1 in Appendix A) also shows the durations (in weeks) of partial or complete school closures, which vary widely across countries. Specifically, Uganda experienced the longest duration of school closures, with schools being fully closed for 66 weeks and partially open for around 23 weeks. Schools in Ethiopia were fully closed for 21 weeks and partially open for 41 weeks. Nigeria and Malawi had relatively shorter periods of full closure of around 20 weeks, to be followed by Mali and Tanzania. Burkina Faso had the shortest duration of full school closures among the countries listed.

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

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[4] For income loss, respondents were asked whether total household income increased, stayed the same, fell, or was totally lost. We combine respondents who reported a reduction or total loss of income to create a binary indicator of "income loss".

[5] More information on the LSMS-ISA can be found at https://www.worldbank.org/en/programs/lsms/initiatives/lsms-ISA.

Table 1
High frequency phone survey timeline.

	Burkina Faso	Ethiopia	Malawi	Mali	Nigeria	Tanzania	Uganda
Planned start/end of school year (based on 2019)	October 2019/ July 2020	September 2019/ July 2020	October 2019/ July 2020	October 2019/ June 2020	September 2019/ July 2020	January-December (varies)	February 2019/December 2020
Date of first school closures 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
Last day of full school closures due to COVID−19	June 1, 2020	October 20, 2020	February 21, 2021	March 31, 2021	September 20, 2020	May 31, 2020	January 9, 2022
Last day of full or partial school closures due to COVID−19	September 30, 2021	July 30, 2021	February 21, 2021	March 31, 2021	November 1, 2020	June 28, 2020	January 9, 2022
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	1968	3249	1729	1766	1950	2734	2227
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	2037 (95 %)	3107 (96 %)	1646 (96 %)		1820 (91 %)		2199 (97 %)
R 3 Date of data collection		June 4–26, 2020			July 2–16, 2020		September 14 - October 7, 2020
Sample size		3058 (94 %)			1790 (90 %)		2147 (94 %)
R 4 Date of data collection		July 27 - August 14, 2020			August 9–24, 2020		October 27- November 17, 2020
Sample size		2878 (89 %)			1789 (89 %)		2136 (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	1945 (90 %)	2770 (85 %)			1773 (89 %)		2126 (93 %)
R 6 Date of data collection					October 9–24, 2020		March 23-April 13, 2021
Sample size					1762 (88 %)		2102 (92 %)
R 7 Date of data collection							October 20-November 15, 2021*
Sample size							1950 (85 %)
R 8 Date of data collection		December 1–21, 2020					
Sample size		2222 (68 %)					
R 11 Date of data collection		April 12-May 8, 2021					
Sample size		1982 (61 %)					
Total Sample Size (round-household obs.)	**5950**	**19,266**	**3375**	**1766**	**10,884**	**2734**	**14,887**
Panel households (participated in all rounds)	**1726**	**1524**	**1646**	**1766**	**1636**	**2734**	**1706**

Note: The table displays only the rounds of phone surveys where educational information was collected; rounds without educational variables are not included. Each survey round was conducted at different times across countries due to country-specific logistical constraints, funding availability, and coordination requirements with each national statistical office. Sample size numbers refer to the 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. The source of academic calendar is from UNESCO Institute for Statistics (academic calendar for pre-primary to post-secondary education levels) and NCAA for Tanzania academic calendar http://fs.ncaa.org/Docs/eligibility_center/International_Information/Guide/Countries/Tanzania.pdf The source of the school closure and reopening dates/days is from UNESCO map on school closures (https://en.unesco.org/covid19/educationresponse) and UIS, March 2022 (http://data.uis.unesco.org).

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 closures (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.

2.2. Overview of learning activities before and after COVID-19

Fig. 1 shows in a decreasing order the participation rate—or the share of households with children being engaged—in any learning activity after school closures 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 similar activities 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 school closures 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 regarding learning activities, followed by Nigeria, Burkina Faso, Uganda, Mali, Ethiopia, and Malawi.

Access to quality remote and hybrid learning also varied across countries. Figure A.3 (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 teacher assignments. Of all countries, Tanzania leads in working on teacher assignments, while 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. Assuming all these specific activities are equally important, we can obtain the ranking for each country by averaging its ranks for the five activities (Table A.3 in Appendix A). Using this average ranking, Nigeria comes first (1.2), followed by Tanzania (3), Ethiopia (3.4), Burkina Faso (4.4), Uganda (4.4), Mali (5.4), and Malawi (6.2). Figure A.3 (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 A.4 in Appendix A, the average number of contacts for

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[6] We provide the exact numbers underlying Fig. 1 in Appendix A, Table A.2. An urban-rural gap in engagement in learning activities exists as well (Appendix A, Figure A.2).

households with some contact with teachers.

3. Analytical model

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

$$y_{ijrt} = \gamma_t + reg_r + com_j + household_i + \varepsilon_{ijrt} \tag{1}$$

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. 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) 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 $\gamma_t = \gamma_0 + \delta_t$ indicates a constant term and the survey round fixed effects δ_t to control for unobserved characteristics that are common to each survey round. Note that 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 model assumes that the random effects across the different levels and the random effects across households at the same level are uncorrelated. Eq. (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

$$\sigma_{ijrt}^2 = \sigma_i^2 + \sigma_j^2 + \sigma_r^2 + \sigma_{it}^2 \tag{2}$$

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

$$y_{ijrkt} = \alpha_t + country_k + reg_r + com_j + household_i + \eta_{ijrkt} \tag{3}$$

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 Eq. (1), we now add the random effects $country_k$ at the country level.

Similar to Eq. (2), we can decompose the total variance in learning activities across the seven countries into five components attributed to households (ν_i^2), communities (ν_j^2), regions (ν_r^2), countries (ν_k^2), and within-household residuals (ν_{it}^2).

$$\nu_{ijrkt}^2 = \nu_i^2 + \nu_j^2 + \nu_r^2 + \nu_k^2 + \nu_{it}^2 \tag{4}$$

To further examine the specific correlates with learning activities, we add the household characteristics to Eqs. (1) and (3) to estimate the following models for each country

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

and for all the countries

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

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

Table 2

Summary statistics.

		Burkina	Ethiopia	Malawi	Mali	Nigeria	Tanzania	Uganda	All
Outcome variables after covid−19 school closures									
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)
Pre- covid−19 variables (with any learning activity)									
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)
No. of observations		4549	11154	2338	1249	7353	781	11508	38932
No. of panel households (participated in all rounds)		1069	682	1113	1249	487	781	1247	1929
Phone survey variables									
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)
No. of observations		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)
No. of observations			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)
No. of observations		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)
No. of observations		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)
No. of observations		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.

categories), demographic composition, and residence location (i.e., urban or rural areas). Eqs. (5) and (6) can be considered the conditional version of Eqs. (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 Eqs. (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 Eqs. (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
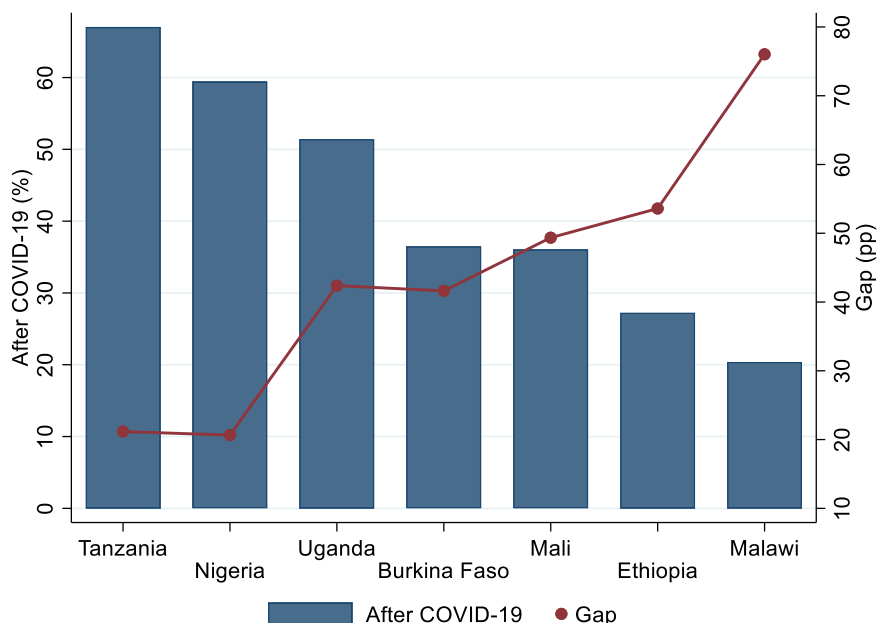
Fig. 1. Any learning activities after COVID-19 school closures vs. difference with pre-pandemic school enrolment. Note: Question about learning activities in phone survey was asked conditional on the household containing a school-aged child who attend school before COVID-19-induced school-closures. The gap is the difference between the share of households with children attending school before COVID-19-induced school closures and the share of households with children being engaged in any learning activity after COVID-19-induced school closures. Sampling weights are applied.

(whether the household has any learning activities or teacher contacts) is a binary variable, the regression results for these outcomes can be interpreted similarly to 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. 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), Eq. (2) is equivalent to the standard (household) random effects model commonly used in econometrics.[7] The above equations can be easily modified or extended to analyze various data situations.

Three data situations are most relevant for our analysis. Firstly, 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 seven countries, these surveys collect certain variables for some countries only. These variables include whether the household's total income decreased, or whether the head was employed, or whether the household experienced food insecurity during the pandemic. For example, 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. 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.

While the available data do not allow us to identify causal impacts, examining the correlation of these time-varying variables (Z_{ijrt}) with learning activities can provide useful policy advice. We will investigate the following equations for each country

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

and for all the countries

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

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 Eq. (2) to include the random effects at the child level as the fourth level (i.e., using a similar equation to Eq. (4) but with the child random effects instead of the country random effects).

4. Estimation results

4.1. Variance decomposition

Fig. 2 plots 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 Eqs. (2) and (4), with the exact numbers shown in Appendix A, Tables A.4 to A.7.

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[7] See, for example, Skrondal and Rabe-Hesketh (2004) for a comprehensive treatment of multilevel modeling and Dang and Glewwe (2018) for a recent application of this model in Vietnam.
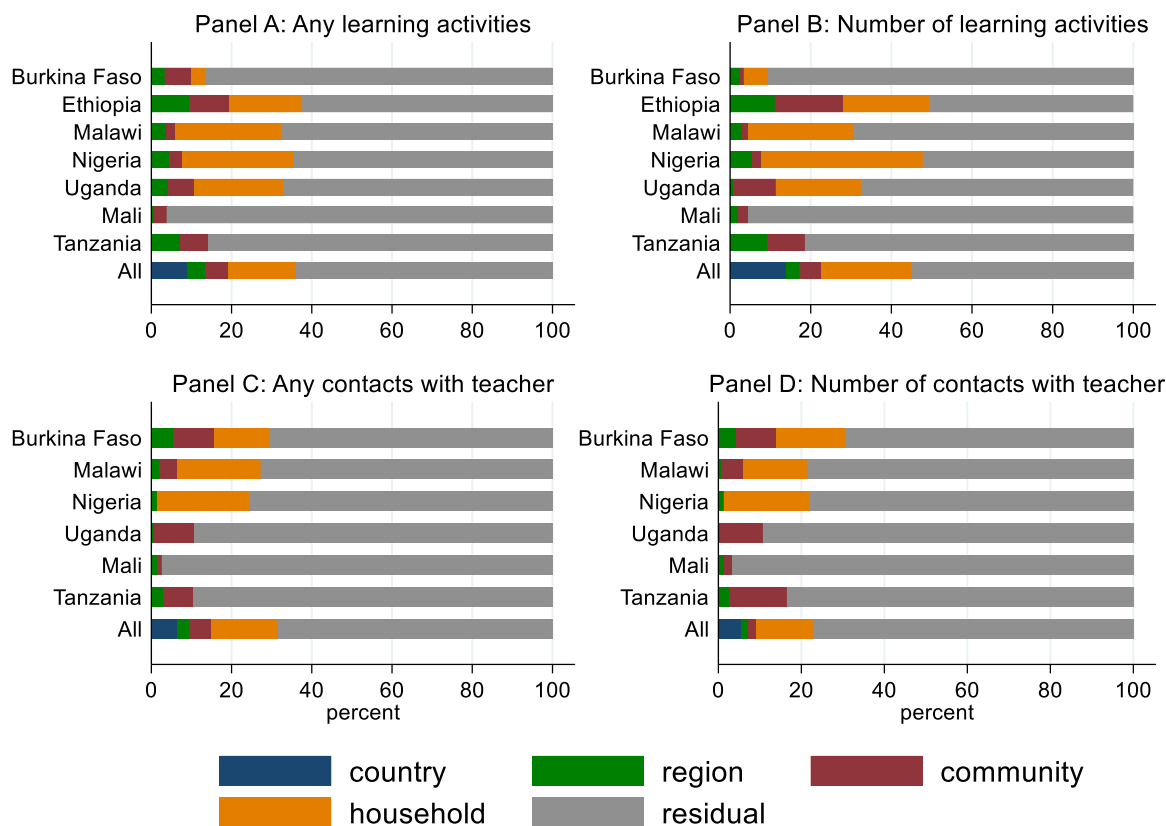
Fig. 2. Proportion of the unconditional variance in any learning activity after pandemic-induced school closures due to variation in household, commune, regional and country factors, percentage. Note: In each plot, the blue bar indicates the estimate of random effects at country level from unconditional mixed model regressions shown as a share of total variance. The green bar indicates estimate of random effects at regional level. The red bar represents the estimate of random effects at community level. The orange bar represents the estimate of random effect at household level. The grey bar shows the residual or fixed effect part of the model as a share of total variance.

Fig. 2 (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 hovers around two-thirds of the total variance for Ethiopia, Malawi, Nigeria, and Uganda, but can increase 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.

Considering all seven countries together, the largest variation for any learning activities is also due to within-household variation (64 percent), 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 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), 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 appear 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 (Figs. 1 and 2) that countries perform differently regarding learning activities during the pandemic. Building on these results, we turn to examining the specific correlates with household learning activities after the pandemic-induced school closures.

4.2. Specific correlates with learning activities

The estimation results for any learning activities are shown in Table 3. For all the countries (last column on the right, using Eq. (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

Table 3

Correlates with 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	0.002***	0.002	0.000	0.002***	0.003**	0.003**	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
Head is female	0.046**	0.028*	−0.025	−0.020	0.017	0.013	0.001	0.006
	(0.020)	(0.016)	(0.024)	(0.024)	(0.016)	(0.050)	(0.035)	(0.008)
Head is employee	0.080***	0.033*	0.015	0.034	−0.035	0.041	0.031	0.019*
	(0.026)	(0.019)	(0.041)	(0.040)	(0.027)	(0.048)	(0.051)	(0.012)
Head is self-employed	0.073***	0.001	0.010	0.008	−0.009	0.061	0.022	0.017*
	(0.020)	(0.016)	(0.033)	(0.030)	(0.020)	(0.039)	(0.043)	(0.009)
Head's education level								
Primary	0.012	0.041**	0.044	0.094***	0.109***	0.018	0.068	0.053***
	(0.019)	(0.017)	(0.039)	(0.024)	(0.026)	(0.044)	(0.045)	(0.009)
Secondary incomplete	−0.002	0.082***	0.112***	0.117***	0.175***	0.112**	0.120**	0.098***
	(0.025)	(0.022)	(0.043)	(0.042)	(0.030)	(0.052)	(0.054)	(0.012)
Secondary complete	−0.006	0.121***	0.121**	0.126***	0.135***	0.187***	0.109	0.113***
	(0.030)	(0.024)	(0.061)	(0.027)	(0.036)	(0.048)	(0.103)	(0.013)
Post-secondary	−0.013	0.110***	0.305***	0.133***	0.249***	0.250***	0.166*	0.147***
	(0.034)	(0.032)	(0.067)	(0.030)	(0.035)	(0.051)	(0.101)	(0.014)
Household composition								
Number of members aged 0–14	0.009**	0.014***	−0.006	0.000	0.037***	0.002	−0.001	0.011***
	(0.004)	(0.005)	(0.007)	(0.004)	(0.004)	(0.007)	(0.009)	(0.002)
Number of members aged 15–24	0.001	0.018***	0.018**	−0.009	0.031***	0.003	0.005	0.013***
	(0.005)	(0.006)	(0.008)	(0.007)	(0.005)	(0.010)	(0.012)	(0.003)
Number of members aged 25–59	0.007	0.033***	0.004	0.015	0.023**	0.026**	−0.028	0.015***
	(0.007)	(0.008)	(0.014)	(0.010)	(0.010)	(0.012)	(0.020)	(0.004)
Number of members aged 60 and older	0.008	0.007	−0.027	0.020	−0.026	0.009	−0.034	−0.007
	(0.014)	(0.019)	(0.027)	(0.020)	(0.018)	(0.025)	(0.042)	(0.008)
Household consumption								
Log of consumption per capita	0.074***	0.054***	0.026	0.039**	0.097***	0.078***	0.007	0.064***
	(0.015)	(0.012)	(0.019)	(0.019)	(0.012)	(0.029)	(0.029)	(0.006)
Urban	0.065***	0.131***	0.046*	0.064***	0.045**	−0.020	0.028	0.065***
	(0.019)	(0.022)	(0.028)	(0.020)	(0.018)	(0.034)	(0.035)	(0.009)
Constant	−0.071	−0.443***	−0.165	0.204	−0.416***	−0.502**	0.535**	−0.195**
	(0.119)	(0.102)	(0.138)	(0.147)	(0.094)	(0.248)	(0.233)	(0.080)
$\ln\sigma_k$								−1.791***
								(0.275)
$\ln\sigma_r$	−2.583***	−2.112***	−2.926***	−2.621***	−2.614***	−19.719	−2.052***	−2.434***
	(0.231)	(0.227)	(0.357)	(0.323)	(0.338)	(0.000)	(0.200)	(0.104)
$\ln\sigma_j$	−2.231***	−2.027***	−2.647***	−2.575***	−2.303***	−2.518***	−3.047**	−2.250***
	(0.091)	(0.064)	(0.254)	(0.208)	(0.104)	(0.426)	(1.434)	(0.044)
$\ln\sigma_i$	−2.673***	−1.633***	−1.614***	−1.397***	−1.571***			−1.617***
	(0.330)	(0.030)	(0.063)	(0.033)	(0.032)			(0.017)
$\ln\sigma_{it}$	−0.905***	−0.961***	−1.084***	−0.947***	−0.897***	−0.755***	−0.984***	−0.908***
	(0.013)	(0.007)	(0.021)	(0.009)	(0.007)	(0.023)	(0.033)	(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	3117
Number of households	1874	2276	1226	1621	1940	1249	781	10,967
Number of observations	4549	11,154	2338	7395	11,508	1249	781	38,974
Log likelihoodLoglikelihood	−2527	−6192	−1127	−4364	−6991	−846.7	−364.3	−23649

Note: Standard errors are in parentheses.

* $p<0.1$. The reference group is head without any education (for head's education).

** $p<0.05$,

*** $p<0.01$,

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 A.8 (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 Eq. (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

Table 4

Correlates with 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*	0.004***	0.002	0.004	0.003**	0.003**	0.004	0.003***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.002)	(0.003)	(0.001)
Head is female	0.006	0.028	−0.039	−0.146	0.044*	0.149**	0.024	−0.001
	(0.040)	(0.028)	(0.028)	(0.097)	(0.025)	(0.062)	(0.068)	(0.019)
Head is employee	0.166***	0.022	0.032	0.228	−0.068	0.125**	0.007	0.040
	(0.052)	(0.035)	(0.048)	(0.161)	(0.043)	(0.060)	(0.095)	(0.028)
Head is self-employed	0.086**	0.004	0.016	0.018	−0.002	0.074	−0.032	0.018
	(0.040)	(0.028)	(0.039)	(0.118)	(0.032)	(0.049)	(0.081)	(0.021)
Head's education level								
Primary	0.097**	0.051*	0.051	0.095	0.096**	−0.002	0.103	0.071***
	(0.038)	(0.030)	(0.047)	(0.098)	(0.040)	(0.054)	(0.085)	(0.022)
Secondary incomplete	−0.009	0.150***	0.151***	0.307*	0.209***	0.165**	0.250**	0.167***
	(0.050)	(0.039)	(0.051)	(0.167)	(0.048)	(0.064)	(0.103)	(0.028)
Secondary complete	−0.037	0.196***	0.154**	0.257**	0.158***	0.277***	0.348*	0.204***
	(0.060)	(0.042)	(0.071)	(0.109)	(0.056)	(0.059)	(0.195)	(0.030)
Post-secondary	−0.038	0.262***	0.367***	0.272**	0.345***	0.339***	0.520***	0.297***
	(0.068)	(0.058)	(0.079)	(0.118)	(0.055)	(0.064)	(0.189)	(0.034)
Household composition								
Number of members aged 0–14	0.017**	0.024***	0.000	0.010	0.065***	0.024***	0.009	0.024***
	(0.008)	(0.008)	(0.008)	(0.018)	(0.007)	(0.009)	(0.018)	(0.005)
Number of members aged 15–24	0.022**	0.031***	0.019**	−0.009	0.054***	0.018	0.011	0.028***
	(0.011)	(0.010)	(0.010)	(0.027)	(0.008)	(0.012)	(0.022)	(0.006)
Number of members aged 25–59	0.009	0.050***	−0.004	0.069*	0.039**	0.020	0.046	0.031***
	(0.014)	(0.015)	(0.017)	(0.038)	(0.016)	(0.015)	(0.038)	(0.009)
Number of members aged 60 and older	−0.001	−0.010	−0.035	−0.007	−0.013	0.023	−0.043	−0.016
	(0.029)	(0.033)	(0.032)	(0.079)	(0.027)	(0.031)	(0.078)	(0.018)
Household consumption								
Log of consumption per capita	0.177***	0.099***	0.029	0.192***	0.207***	0.073**	0.000	0.145***
	(0.028)	(0.021)	(0.022)	(0.074)	(0.019)	(0.037)	(0.058)	(0.014)
Urban	0.100***	0.236***	0.059*	0.137*	0.117***	−0.050	0.063	0.142***
	(0.034)	(0.042)	(0.032)	(0.079)	(0.029)	(0.044)	(0.072)	(0.020)
Constant	−0.791***	−0.901***	−0.210	−0.885	−1.045***	−0.661**	0.376	−0.835***
	(0.228)	(0.182)	(0.162)	(0.591)	(0.144)	(0.310)	(0.465)	(0.189)
$\ln\sigma_k$								−0.924***
								(0.276)
$\ln\sigma_r$	−2.206***	−1.511***	−2.928***	−1.100***	−2.458***	−3.252***	−1.396***	−1.729***
	(0.251)	(0.227)	(0.394)	(0.313)	(0.424)	(0.663)	(0.198)	(0.100)
$\ln\sigma_j$	−3.506	−1.278***	−2.653***	−1.506***	−1.710***	−2.290***	−1.520***	−1.497***
	(2.652)	(0.053)	(0.320)	(0.373)	(0.089)	(0.352)	(0.230)	(0.051)
$\ln\sigma_i$	−1.914***	−1.079***	−1.459***	0.078***	−1.152***			−0.671***
	(0.354)	(0.029)	(0.064)	(0.028)	(0.033)			(0.014)
$\ln\sigma_{it}$	−0.320***	−0.605***	−0.904***	0.224***	−0.429***	−0.536***	−0.529***	−0.207***
	(0.018)	(0.009)	(0.021)	(0.010)	(0.007)	(0.022)	(0.039)	(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	3063
Number of households	1844	2068	1226	1614	1940	1249	594	10,535
Number of observations	3208	8397	2338	6549	11,508	1249	594	33,843
Log likelihoodLoglikelihood	−3604	−8022	−1527	−11883	−12355	−1122	−580.9	−45488

Note: Standard errors are in parentheses.

* p<0.1. The reference group is head without any education (for head's education).

** p<0.05,

*** p<0.01,

significant at the 5 percent level. Urban residence becomes statistically insignificant for both Tanzania and Mali.

Table 4 looks more into the correlates with 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 A.9).

The estimation results for the correlates with households having any contact with teachers, shown in Table A.10, 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 A.11).

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 A.12 provides estimates on the correlates with the number of types of contacts with teachers. The results are qualitatively similar to those for Table A.10, 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 A.13). Again, country heterogeneity exists with none of the control variables being statistically significant for Nigeria.

4.3. Robustness checks

We show several model variants that we analyze for robustness checks in Appendix B. These include a household random effects model and (more general) linear mixed models with random slopes for heads' age, gender, and household consumption per capita. We also show the results for a linear mixed model with interaction between urban residence and household per capita consumption but we find the interaction terms insignificant. We provide more details on these model variants in Appendix B. The estimation results are shown in Appendix B, Tables B.1 to B.10. To further address concerns with attrition issues, we show the results for a linear mixed model where inverse probability weights were used to account for attrition as suggested in Wooldridge (2002) in Appendix B, Table B.11. The results suggest that our main findings remain similar.

As another robustness check, we add to the regression the duration (number of days) between the first day of school closures and last day of full school closures due to COVID-19. The results, shown in Appendix B, Table B.12, suggest that this variable is not statistically significant.

5. 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.

5.1. Pandemic-induced shocks and public assistance

We plot the estimation results for the correlation of public transfer and learning activities in Fig. 3 (using Eqs. (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. These results concur with those in (Brooks et al., 2022; Karlan et al., 2022), who find cash transfers during the pandemic to increase food expenditure in Ghana and Kenya.

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.

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 Fig. 4, which are largely statistically insignificant. Considering all the seven countries together, now only households whose income decreased

Fig. 3. Public transfers during the pandemic and educational outcomes, conditional mixed model. Note: Point estimates (dots) obtained through conditional mixed model regressions, with 95 % confidence intervals (error bars) based on standard errors. The full regression results are shown in Tables A.14-A.17, Appendix A. Data are not available in Mali.

Fig. 4. Household total income decrease during the pandemic and educational outcomes, conditional mixed model. Note: Point estimates (dots) obtained through conditional mixed model regressions, with 95 % confidence intervals (error bars) based on standard errors. The full regression results are shown in Tables A.18-A.21, Appendix A. Data are not available in Mali, Burkina Faso and Tanzania.

Fig. 5. Household head was employed during the pandemic and educational outcomes, conditional mixed model. Note: Point estimates (dots) obtained through conditional mixed model regressions, with 95 % confidence intervals (error bars) based on standard errors. The full regression results are shown in Tables A.22-A.25, Appendix A.

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, Fig. 5 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 pandemic 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).

Fig. 6 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 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.

5.2. Further 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 5 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 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).

To further investigate whether this gender difference might be due to the fact that girls were more likely to have contact with the school, we consider Rounds 3 and 5 of the phone survey for Uganda. These survey rounds collected information during the period when some schools in Uganda were partially open, asking respondents if they were currently in school. If we exclude children who responded that they did not attend school before the pandemic or were not currently attending school due to closures related to the pandemic or holidays, were awaiting admissions, or were too young or too old to attend, among the remaining children aged 3–18 who were "supposed" to be in school, 33.5 % of boys and 35 % of girls reported currently attending school. Controlling for pre-COVID household characteristics and children's ages, we found that gender differences persisted in the likelihood of remaining enrolled in school, which is similar to our findings with learning activities. The results suggest that, compared to Ugandan boys, Ugandan girls are 0.03 (or 3 percentage points) more likely to stay enrolled in school.

For other factors, Table 5 shows that, similar to the analysis of household-level data above, household heads' education achievement, household per capita consumption, and urban residence have positive
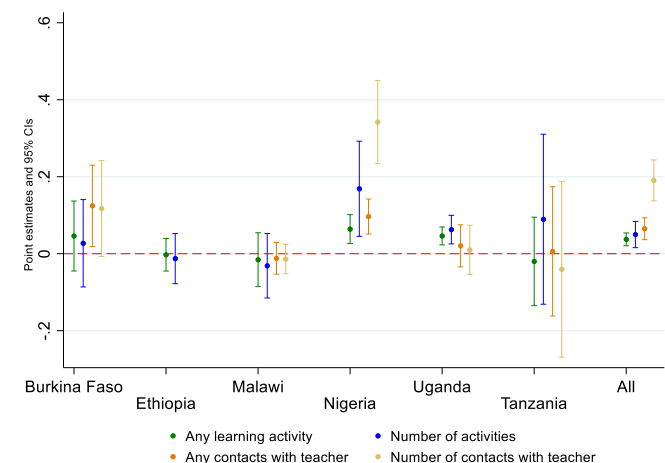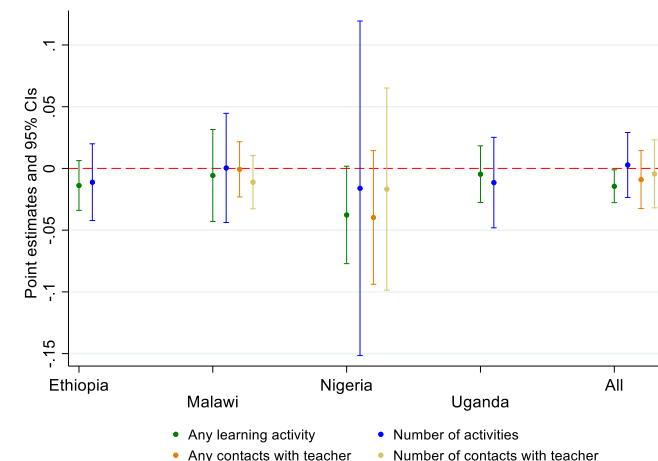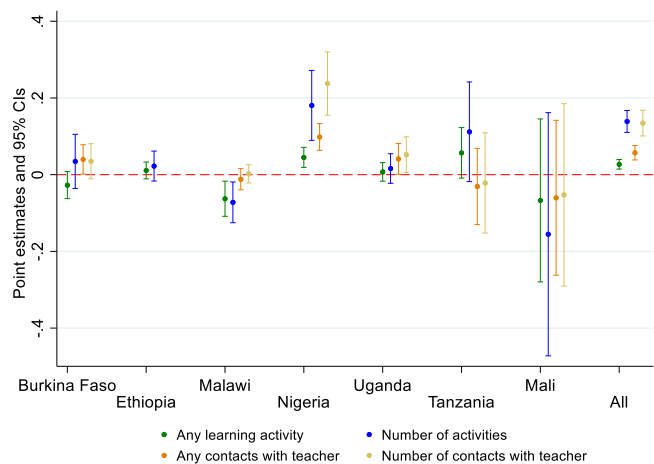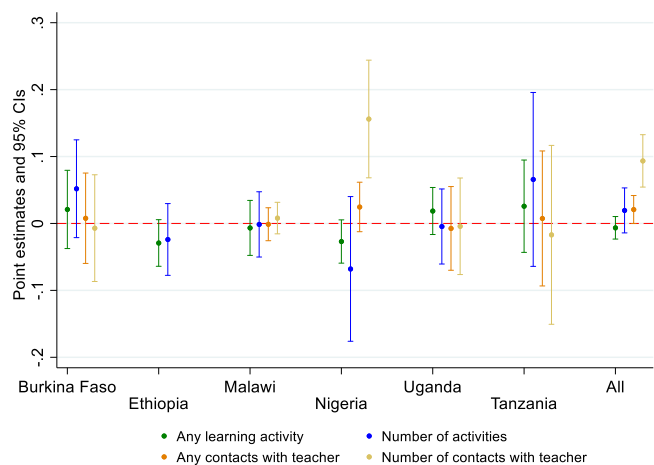

Fig. 6. Household severe food insecurity during the pandemic and educational outcomes, conditional mixed model. Note: Point estimates (dots) obtained through conditional mixed model regressions, with 95 % confidence intervals (error bars) based on standard errors. Data are not available in Mali. The full regression results are shown in Tables A.26-A.29, Appendix A.

Table 5
Correlates with learning activities in Uganda after COVID-19 school closures, conditional mixed model.

	Any Learning Activities	Number of Learning Activities	Remaining enrolled in school
Child`s age	0.012***	0.079***	0.047***
	(0.001)	(0.004)	(0.00)
Girl	0.011**	0.065*	0.025**
	(0.006)	(0.033)	(0.01)
Pre-COVID−19 variables			
Head's age	−0.001	0.001	0.001
	(0.001)	(0.003)	(0.00)
Head is female	0.000	0.005	0.028
	(0.015)	(0.074)	(0.02)
Head is employee	−0.029**	−0.072	−0.006
	(0.015)	(0.126)	(0.03)
Head is self-employed	−0.001	−0.029	0.001
	(0.001)	(0.094)	(0.02)
Head`s education level			
Primary	0.075***	0.250**	−0.016
	(0.024)	(0.119)	(0.03)
Secondary incomplete	0.127***	0.488***	0.050
	(0.028)	(0.140)	(0.04)
Secondary complete	0.109***	0.434***	0.051
	(0.033)	(0.165)	(0.04)
Post-secondary	0.227***	0.785***	0.040
	(0.033)	(0.163)	(0.04)
Household composition			
Number of members aged 0–14	0.009**	0.047**	−0.001
	(0.004)	(0.019)	(0.00)
Number of members aged 15–24	0.002	0.011	0.007
	(0.005)	(0.023)	(0.01)
Number of members aged 25–59	0.008	0.004	0.025**
	(0.010)	(0.048)	(0.01)
Number of members aged 60 and older	−0.000	−0.081	−0.012
	(0.016)	(0.080)	(0.02)
Household consumption			
Log of consumption per capita	0.052***	0.248***	0.034***
	(0.011)	(0.054)	(0.01)
Urban	0.036**	0.257***	0.021
	(0.017)	(0.084)	(0.02)
Constant	−0.044	1.333***	0.034***
	(0.090)	(0.431)	(0.01)
$\ln\sigma_r$	−2.430***	−1.109***	−0.345***
	(0.321)	(0.328)	(0.02)
$\ln\sigma_j$	−2.266***	−0.749***	−0.225**
	(0.092)	(0.101)	(0.11)
$\ln\sigma_h$	−1.563***	−0.032	−2.798***
	(0.026)	(0.029)	(0.35)
$\ln\sigma_i$	−20.372***	−1.572***	−2.621***
	(0.288)	(0.541)	(0.20)
$\ln\sigma_{it}$	−0.927***	0.835***	−2.028***
	(0.004)	(0.006)	(0.09)
Number of regions	6	6	6
Number of communities	648	648	517
Number of households	1893	1893	1315
Number of individuals	8177	8130	3497
Number of observations	27,339	25,903	3880
Log likelihoodLoglikelihood	−14982	−59647	−1715.55

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

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. But only household per capita consumption is positively correlated with whether children are currently in school.

6. Conclusion and policy discussion

We offer an early assessment of learning activities during the pandemic in a multi-country, sub-Saharan African setting. We find that the pandemic is associated with 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. For comparison, in the US, distance learning was only mandated for around 52 percent of K–12 students in 28 states (Dorn et al., 2020). During lockdown in the UK, more than half of primary school children from the poorest families did not have access to their own study space and were less well-equipped for distance learning than higher-income families (Andrew et al., 2020). Notably, even for the Netherlands, a high-income country, students were observed to make little or no progress while learning from home (Engzell et al., 2021). Consequently, potential learning losses could be even larger for poorer countries.

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 is associated with an increase in the probability of any learning activities by 0.006 (or a 0.6 percentage point increase). This positive result 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), households in the second poorest or the middle consumption quintile are 0.05–0.06 more likely to have any learning activities. These figures (more than) double 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, further 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 or household head employment and learning activities during the pandemic for all the countries (except for household head employment in Malawi). Considering all the seven countries together, the largest variation for any learning activities is largest due to within-household variation (64 percent), 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.

Our results suggest that policies targeting individual household members would likely be most effective for improving learning activities, 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. Promising interventions can include individualized tutoring to students, or low-tech interventions such as text messages or phone calls to parents, which were found to help improve Botswanan student achievement during school disruptions (Angrist et al., 2022). Furthermore, special training targeted at low-income parents, including classes

and access to a library of home-use kits, may also help increase the quality of parent support for their pre-kindergarten children (Goudeau et al., 2021).

Finally, our findings also highlight the important role of data, and especially data combination using different data sources, in timely monitoring the pandemic impacts. In a poorer country context, where more resources-intensive data sources such as long-run administrative data are rarely available, the maintenance of a good household consumption survey cannot be overemphasized. Such surveys can offer a good tool that can be combined with rapid assessment non-consumption

phone surveys to help provide a better understanding of future pandemic effects.

CRediT authorship contribution statement

Hai-Anh Dang: Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Conceptualization. **Gbemisola Oseni:** Funding acquisition, Conceptualization, Supervision. **Kseniya Abanokova:** Investigation, Formal analysis, Data curation.

Appendix A. Additional Tables and Figures
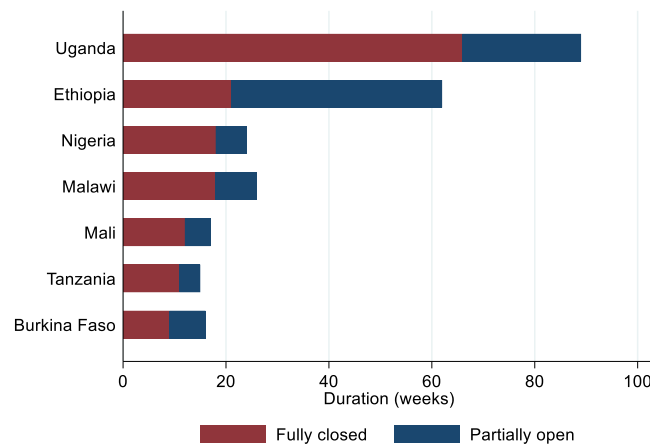
Figure A.1. Duration of school closures (February 2020-March 2022). Data source: https://covid19.uis.unesco.org/global-monitoring-school-closures-covid19/country-dashboard/.
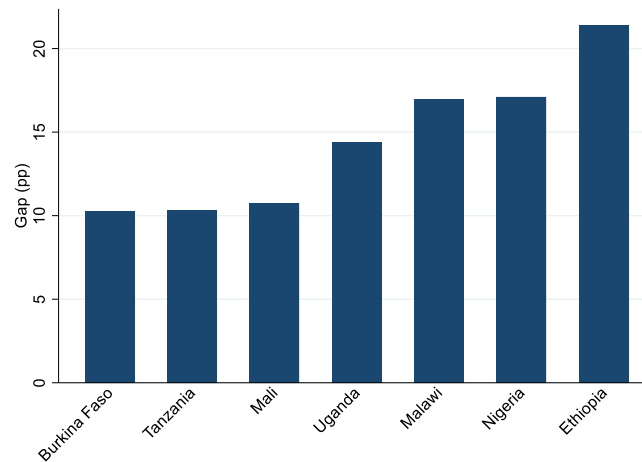
Figure A.2. Urban/ rural gaps in any learning activities after COVID-19-induced school closures.
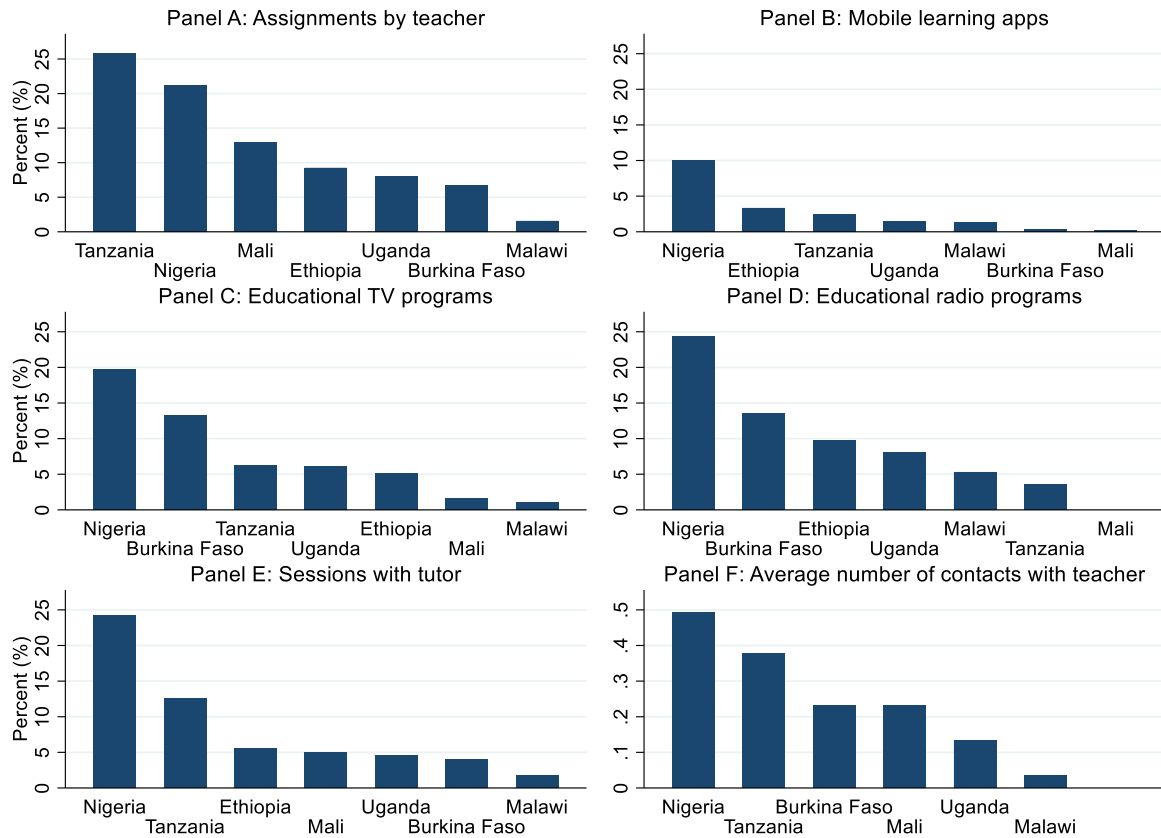
Figure A.3. Share of households with children participating in specific learning activities after COVID-19 school closures Note: Types of learning activities include working on the assignments provided by teacher, using mobile teaching applications, watching educational programs on TV and listening to lessons from radio, sessions/meetings with teacher/tutor. Households whose children was not engaged into any learning activity are assigned a value of zero for their types of learning activities. Household sampling weights are applied.
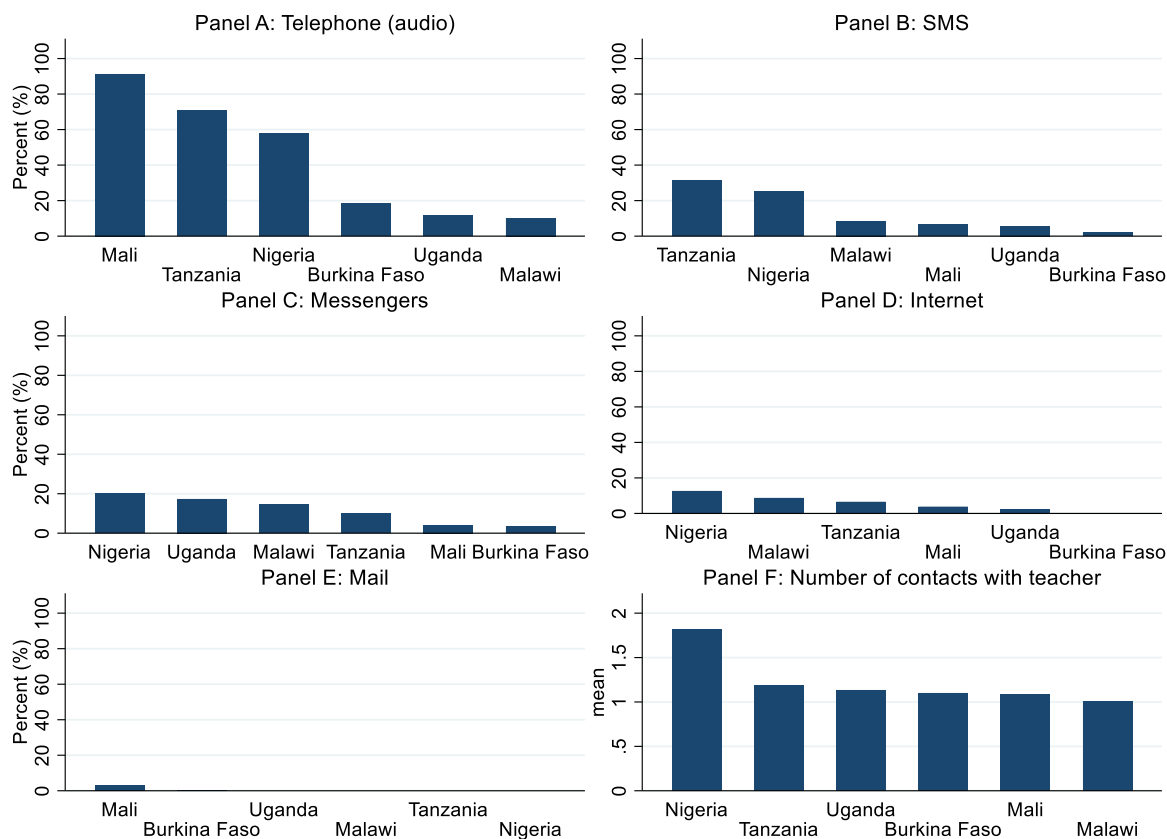
Figure A.4. Share of households with children engaging in contacts with teacher after COVID-19 school closures. Note: Types of contacts with teacher include SMS, online applications, email, mail, telephone, WhatsApp, Facebook, and other methods. The maximum number of contacts is 8. The sample is restricted to households who had some contacts with teacher.

Table A.1
Brief literature review of selected recent cross-country studies on COVID-19 on education in poorer countries

Author(s)	Countries	Data	Method	Results
Angrist et al. (2021)				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.
Azevedo et al. (2023).	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 is calibrated to replicate typical learning trajectories	School closures lead to significant declines in both absolute and relative educational mobility. The reduction in absolute educational mobility in low- and lower-middle-income countries due to COVID−19 learning losses is estimated at 5–10 %. Learning losses in these countries are higher for children from lower-income families.
Betthäuser et al. (2023)	174 countries, including low and lower-middle income countries	Global Database on Intergenerational Mobility (GDIM), High-Frequency Phone Surveys (HFPS)	Simulation model estimates the impact of school closures on Learning Adjusted Years of Schooling (LAYS) to project potential educational losses	Pandemic reduced student performance by about 0.14 standard deviations with significant learning loss and larger deficits in mathematics. On average, students lost about 35 % of a typical school year's learning. Low and middle-countries experienced larger learning deficits compared to high-income countries due to longer school closures and fewer resources for remote learning.
	15 countries, including Colombia, Mexico and South Africa		Meta-analysis	

(continued on next page)

Table A.1 (*continued*)

Author(s)	Countries	Data	Method	Results
Buffie et al. (2023)		The model is calibrated to average values for low-income countries	General equilibrium model calibrated to replicate key dimensions of the COVID−19 shock	The pandemic has led to a significant degradation of human capital in low-income countries due to the loss of learning. This decrease in human capital can have long-term effects on labor productivity, which in turn impacts the broader economic recovery and sustainability in these countries.
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.
Bracco et al. (2024)	18 Latin American countries	National household surveys EPHC, EH, PNAD/PNADC, CASEN, GEIH, ENAHO, ENFT/ECNFT, ENEMDU, EHPM, ENIGH, EPHC, ENAHO over the period of 2010–2020	OLS regression estimates enrollment changes in 2020	The estimated enrollment rates in 2020 show a significant drop from the trend of the previous decade, with enrollment of children and young people (ages 6–24) falling by around 2pps, translating to nearly three million students who either dropped out or did not advance in their education due to the pandemic. This decline is higher in Chile and Peru (5 pps), and particularly affects young adults (ages 18–24) in tertiary education.
Conto et al. (2021)	13 low and lower middle-income countries	MICS6, UNESCO-UNICEF-World Bank surveys, and the UNICEF COVID−19 Education Response Tracker	Linear Probability Model	The educational disruptions caused by COVID−19 could have a substantial negative impact on children's foundational skill acquisition. The likelihood of children displaying reading skills is 4–51 percentage points lower for those not attending school compared to their peers who continue education. Not attending school for up to one year is associated with a 5–16 percentage points lower probability of demonstrating foundational skills.
Di Pietro (2023)	19 countries, including Brazil, China, Egypt, Mexico and South Africa	Meta-analysis		Pandemic reduced student performance on average by about 0.19 standard deviations. Learning deficits were larger in math and science, with student achievement in these subjects averaging 0.17 standard deviations lower than in humanities or mixed subjects. On average, students lost about half of a typical school year's learning. Studies focusing on non-European countries (including USA) show greater learning deficits.
Jakubowski et al. (2023)	55 countries	Progress in International Reading Literacy Study (PIRLS) matched with UNESCO database on school closures	Linear regression, quintile regression	The study shows an average reading achievement decline of 18 % SD, increasing to 33 % SD after adjustments for age and grade. Students in schools with longer closures experienced greater declines, with every 10 weeks of closures reducing scores by 8 points (9 % SD), while 50 weeks resulted in a 40-point decline (47 % SD). For countries with minimal delays in covid testing, the overall decline was 24 % SD, with 25 weeks of closures leading to a 23 % reduction in achievement. Lower-performing students experienced greater learning losses due to school closures.
Josephson et al. (2021)	Ethiopia, Malawi, Nigeria, and Uganda	High-frequency phone surveys on COVID−19 implemented in Ethiopia, Malawi, Nigeria and Uganda during May-August 2020 combined with pre-COVID LSMS-ISA household surveys	Linear regression (OLS) models	The study find student– teacher contact drop from a pre-COVID−19 rate of 96 % to just 17 % among households with school-aged children. An estimated 68 million children across four countries lacked educational engagement, disproportionately affecting poorer households, despite attempts to use

Table A.1 (*continued*)

Author(s)	Countries	Data	Method	Results
Maddawin et al. (2024)				technologies like radio, TV, and mobile apps to mitigate learning losses, which reached fewer than 50 % of households.
Moscoviz and Evans (2022)	Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Thailand, and Viet Nam	Phone survey of 1000 households in each country implemented from June 2022 to October 2022	Ordered probit with parent-reported learning progress as the dependent variable	Boys are more likely than girls to experience learning loss during school closures, with a 4.5 % lower chance of achieving in-person progress levels. Children from wealthier households have a better chance of maintaining progress than those in the bottom 30 % of income distribution. Internet- and mobile-based learning modes are the most effective for learning, providing a 16–18 % higher chance of achieving progress compared to no remote learning mode. Boys with a good internet connection have a higher chance of maintaining regular learning progress, while this effect is not significant for girls. Senior high school students have greater learning interruptions with closures of 3–5 months and 9 months or more compared to closures of only 1–3 months.
Neidhöfer et al. (2021)	40 countries, including 13 middle- and low-income countries	Meta-analysis using 2020/21 COVID impact studies		Learning loss is concentrated among poorer students in low-income countries. Secondary students in Brazil and Mexico experience more substantial losses, especially in math due to reduced access to educational technology. Dropout rates vary widely across countries, with higher rates among older children. Nigeria and Brazil show the highest dropout rates, with Nigeria's enrollment falling from 90 % to 82 % and São Paulo's secondary dropout risk reach 35 % for lower and upper secondary students. In Liberia, Malawi, Senegal, Sierra Leone, South Africa, and Uganda the changes in dropout rates are only a few percent. Some evidence suggests that girls are more likely to drop out than boys due to adolescent pregnancies in Kenya and Nigeria.
	17 Latin American countries	Latinobarometro, a representative survey including 18 Latin American countries	The simulation estimates pandemic-related instructional time lost as a reduction in human capital, adjusting years of schooling to reflect a counterfactual educational attainment while accounting for country and parental education	Individuals from higher parental education backgrounds (secondary education or more) experience losses below 10 %. Those from lower educational backgrounds face much higher instructional losses, with Bolivia, El Salvador, Mexico, Panama, and Peru showing the highest average losses, around 60 % of the school year. The likelihood of completing secondary education decreases from an average of 56–42 % after accounting for COVID−19 instructional losses with children from low-educated families experiencing a significant decrease in likelihood, dropping nearly 20 percentage points. The pandemic increases intergenerational persistence in education across Latin American countries by an average of 7 %, with the most significant impacts seen in Peru, Mexico, and Bolivia.

Table A.2

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
Panel A. Before COVID−19							
Mean	78.1	80.8	96.4	85.4	80.1	88.2	93.8
	(0.6)	(0.3)	(0.4)	(0.9)	(0.4)	(0.7)	(0.2)
Number of observations	5568	14,380	2498	1438	9645	2157	12,368
Panel B. After COVID−19							
Mean	36.5	27.2	20.4	36.0	59.4	67.0	51.4

Table A.2 (*continued*)

	Burkina Faso	Ethiopia	Malawi	Mali	Nigeria	Tanzania	Uganda
	(0.7)	*(0.4)*	*(0.8)*	*(1.4)*	*(0.6)*	*(1.1)*	*(0.5)*
Number of observations	4549	11,166	2368	1249	7353	1949	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 A.3
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 A.4
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 A.5
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 A.6
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 A.7
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 A.8
Correlates with 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	0.002***	0.002	0.000	0.002***	0.003**	0.003**	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
Head is female	0.043**	0.027*	−0.024	−0.021	0.018	0.011	−0.002	0.006
	(0.020)	(0.016)	(0.024)	(0.024)	(0.016)	(0.050)	(0.035)	(0.008)
Head is employee	0.080***	0.034*	0.016	0.033	−0.038	0.040	0.028	0.020*
	(0.026)	(0.019)	(0.041)	(0.040)	(0.027)	(0.048)	(0.051)	(0.012)
Head is self-employed	0.071***	0.001	0.012	0.008	−0.010	0.061	0.023	0.017*
	(0.020)	(0.016)	(0.033)	(0.030)	(0.020)	(0.039)	(0.043)	(0.009)
Head's education level								
Primary	0.012	0.040**	0.046	0.091***	0.110***	0.017	0.066	0.052***
	(0.019)	(0.017)	(0.039)	(0.025)	(0.026)	(0.044)	(0.045)	(0.009)
Secondary incomplete	−0.001	0.083***	0.115***	0.116***	0.178***	0.113**	0.117**	0.099***
	(0.025)	(0.022)	(0.043)	(0.042)	(0.030)	(0.052)	(0.054)	(0.012)
Secondary complete	0.001	0.121***	0.125**	0.122***	0.141***	0.187***	0.099	0.115***
	(0.030)	(0.024)	(0.060)	(0.027)	(0.035)	(0.048)	(0.102)	(0.013)
Post-secondary	0.015	0.109***	0.312***	0.134***	0.264***	0.262***	0.161	0.154***
	(0.033)	(0.032)	(0.066)	(0.029)	(0.035)	(0.051)	(0.099)	(0.014)
Household composition								
Number of members aged 0–14	0.008**	0.014***	−0.006	0.001	0.038***	0.002	−0.001	0.011***
	(0.004)	(0.005)	(0.007)	(0.004)	(0.004)	(0.007)	(0.009)	(0.002)
Number of members aged 15–24	0.001	0.018***	0.017**	−0.009	0.032***	0.003	0.004	0.013***
	(0.005)	(0.006)	(0.008)	(0.007)	(0.005)	(0.010)	(0.012)	(0.003)
Number of members aged 25–59	0.007	0.032***	0.004	0.016*	0.022**	0.026**	−0.028	0.015***
	(0.007)	(0.008)	(0.014)	(0.010)	(0.010)	(0.012)	(0.020)	(0.004)
Number of members aged 60 and older	0.008	0.005	−0.027	0.018	−0.027	0.008	−0.039	−0.008
	(0.014)	(0.019)	(0.027)	(0.020)	(0.017)	(0.025)	(0.042)	(0.008)
Household consumption quintiles								
Q2 (second poorest)	−0.005	0.049*	−0.011	0.003	0.095***	0.047	0.107*	0.047***
	(0.029)	(0.029)	(0.039)	(0.032)	(0.022)	(0.060)	(0.063)	(0.012)
Q3 (middle quintile)	0.007	0.017	−0.028	0.050	0.114***	0.111**	0.049	0.058***
	(0.028)	(0.029)	(0.038)	(0.032)	(0.022)	(0.056)	(0.061)	(0.012)
Q4 (second richest)	0.058**	0.062**	0.034	0.063*	0.184***	0.114**	0.033	0.100***
	(0.028)	(0.029)	(0.037)	(0.034)	(0.023)	(0.056)	(0.061)	(0.013)
Q5 (richest)	0.101***	0.109***	0.028	0.064*	0.217***	0.156***	0.074	0.128***
	(0.030)	(0.030)	(0.038)	(0.036)	(0.027)	(0.058)	(0.065)	(0.013)
Urban	0.062***	0.132***	0.046	0.066***	0.046**	−0.018	0.030	0.066***
	(0.019)	(0.022)	(0.028)	(0.020)	(0.018)	(0.034)	(0.035)	(0.009)
Constant	0.433***	−0.124**	−0.002	0.436***	0.082	−0.014	0.518***	0.177***
	(0.053)	(0.060)	(0.076)	(0.071)	(0.062)	(0.098)	(0.111)	(0.068)
$\ln\sigma_k$								−1.783***
								(0.274)
$\ln\sigma_r$	−2.568***	−2.117***	−2.902***	−2.626***	−2.611***	−19.807	−2.065***	−2.435***
	(0.230)	(0.227)	(0.344)	(0.323)	(0.339)	(0.000)	(0.202)	(0.104)
$\ln\sigma_j$	−2.233***	−2.029***	−2.643***	−2.585***	−2.325***	−2.550***	−3.129*	−2.251***
	(0.091)	(0.064)	(0.251)	(0.212)	(0.107)	(0.452)	(1.699)	(0.044)
$\ln\sigma_i$	−2.668***	−1.635***	−1.619***	−1.398***	−1.573***			−1.618***
	(0.327)	(0.030)	(0.063)	(0.033)	(0.032)			(0.017)
$\ln\sigma_{it}$	−0.905***	−0.961***	−1.083***	−0.947***	−0.897***	−0.755***	−0.985***	−0.908***
	(0.013)	(0.007)	(0.021)	(0.009)	(0.007)	(0.023)	(0.034)	(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	3117
Number of households	1874	2276	1226	1621	1940	1249	781	10,967
Number of observations	4549	11,154	2338	7395	11,508	1249	781	38,974
Log-likelihood	−2528	−6189	−1125	−4362	−6984	−845.8	−362.2	−23649

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

Table A.9
Correlates with 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*	0.004***	0.002	0.004	0.003**	0.003**	0.005	0.003***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.002)	(0.003)	(0.001)
Head is female	0.001	0.025	−0.039	−0.147	0.043*	0.146**	0.022	−0.002
	(0.040)	(0.028)	(0.028)	(0.097)	(0.025)	(0.062)	(0.068)	(0.019)
Head is employee	0.166***	0.024	0.033	0.225	−0.075*	0.123**	0.004	0.041
	(0.052)	(0.035)	(0.048)	(0.161)	(0.043)	(0.060)	(0.095)	(0.028)
Head is self-employed	0.083**	0.006	0.018	0.021	−0.002	0.075	−0.028	0.019
	(0.040)	(0.028)	(0.039)	(0.118)	(0.032)	(0.049)	(0.080)	(0.021)
Head's education level								
	0.095**	0.049*	0.053	0.088	0.110***	0.000	0.109	0.070***
Primary	(0.039)	(0.030)	(0.047)	(0.098)	(0.040)	(0.054)	(0.085)	(0.022)
	−0.005	0.150***	0.153***	0.315*	0.230***	0.165**	0.252**	0.168***
Secondary incomplete	(0.050)	(0.039)	(0.051)	(0.167)	(0.048)	(0.065)	(0.102)	(0.028)
	−0.016	0.196***	0.159**	0.247**	0.180***	0.275***	0.346*	0.209***
Secondary complete	(0.060)	(0.042)	(0.071)	(0.109)	(0.056)	(0.060)	(0.192)	(0.030)
	0.032	0.257***	0.374***	0.278**	0.385***	0.346***	0.520***	0.314***
Post-secondary	(0.066)	(0.058)	(0.078)	(0.117)	(0.055)	(0.064)	(0.186)	(0.033)
Household composition								
Number of members aged 0–14	0.015*	0.023***	0.000	0.009	0.064***	0.024***	0.009	0.023***
	(0.008)	(0.008)	(0.008)	(0.018)	(0.007)	(0.008)	(0.018)	(0.005)
Number of members aged 15–24	0.021*	0.031***	0.018*	−0.010	0.055***	0.018	0.010	0.028***
	(0.011)	(0.010)	(0.010)	(0.027)	(0.008)	(0.012)	(0.022)	(0.006)
Number of members aged 25–59	0.010	0.049***	−0.004	0.071*	0.036**	0.019	0.042	0.030***
	(0.014)	(0.015)	(0.017)	(0.038)	(0.016)	(0.015)	(0.038)	(0.009)
Number of members aged 60 and older	−0.004	−0.013	−0.035	−0.014	−0.017	0.022	−0.057	−0.018
	(0.029)	(0.033)	(0.032)	(0.079)	(0.028)	(0.031)	(0.078)	(0.018)
Household consumption quintiles								
Q2 (second poorest)	0.059	0.073	−0.008	−0.088	0.120***	−0.045	0.259**	0.047
	(0.058)	(0.051)	(0.045)	(0.128)	(0.034)	(0.075)	(0.125)	(0.029)
Q3 (middle quintile)	0.064	0.051	−0.029	0.135	0.159***	0.041	0.102	0.099***
	(0.056)	(0.051)	(0.044)	(0.129)	(0.035)	(0.069)	(0.119)	(0.029)
Q4 (second richest)	0.189***	0.095*	0.049	0.235*	0.277***	0.067	0.132	0.182***
	(0.055)	(0.051)	(0.043)	(0.135)	(0.036)	(0.071)	(0.118)	(0.030)
Q5 (richest)	0.285***	0.195***	0.032	0.278*	0.423***	0.107	0.150	0.262***
	(0.058)	(0.053)	(0.045)	(0.144)	(0.042)	(0.073)	(0.125)	(0.031)
Urban	0.095***	0.238***	0.059*	0.140*	0.119***	−0.048	0.063	0.143***
	(0.034)	(0.042)	(0.032)	(0.079)	(0.030)	(0.044)	(0.072)	(0.020)
Constant	0.360***	−0.311***	−0.034	0.333	0.079	−0.157	0.220	0.044
	(0.103)	(0.108)	(0.090)	(0.288)	(0.093)	(0.124)	(0.211)	(0.160)
$\ln\sigma_k$								−0.929***
								(0.276)
$\ln\sigma_r$	−2.183***	−1.511***	−2.899***	−1.114***	−2.430***	−3.275***	−1.392***	−1.734***
	(0.248)	(0.228)	(0.378)	(0.314)	(0.413)	(0.683)	(0.197)	(0.100)
$\ln\sigma_j$	−3.346*	−1.274***	−2.651***	−1.514***	−1.711***	−2.294***	−1.529***	−1.491***
	(1.911)	(0.053)	(0.319)	(0.378)	(0.089)	(0.357)	(0.231)	(0.051)
$\ln\sigma_i$	−1.897***	−1.082***	−1.464***	0.076***	−1.147***			−0.671***
	(0.342)	(0.029)	(0.065)	(0.028)	(0.033)			(0.014)
$\ln\sigma_{it}$	−0.320***	−0.605***	−0.904***	0.224***	−0.429***	−0.537***	−0.533***	−0.207***
	(0.018)	(0.009)	(0.021)	(0.010)	(0.007)	(0.022)	(0.039)	(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	3067
Number of households	1844	2068	1226	1614	1940	1249	594	10,535
Number of observations	3208	8397	2338	6549	11,508	1249	594	33,843
Log-likelihood	−3605	−8021	−1525	−11881	−12361	−1121	−578.3	−45490

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

Table A.10
Correlates with 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	0.002***	−0.000	−0.000	0.000	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
Head is female	−0.008	0.007	−0.026	0.041*	0.054	−0.078	0.003
	(0.023)	(0.014)	(0.028)	(0.023)	(0.042)	(0.053)	(0.011)
Head is employee	−0.007	−0.016	0.065	−0.077**	0.057	0.077	0.019
	(0.029)	(0.024)	(0.046)	(0.039)	(0.041)	(0.072)	(0.016)
Head is self-employed	0.019	0.006	−0.000	−0.052*	0.044	0.083	0.016

Table A.10 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Malawi	Nigeria	Uganda	Mali	Tanzania	All
	(0.022)	(0.019)	(0.034)	(0.030)	(0.033)	(0.062)	(0.012)
Head's education level							
Primary	0.001	0.018	0.025	0.074*	0.030	−0.003	0.017
	(0.022)	(0.023)	(0.027)	(0.044)	(0.037)	(0.068)	(0.012)
Secondary incomplete	0.037	0.038	0.041	0.073	0.027	0.057	0.030**
	(0.028)	(0.025)	(0.047)	(0.049)	(0.044)	(0.079)	(0.014)
Secondary complete	0.066*	0.046	0.032	0.112**	0.021	0.256*	0.042***
	(0.034)	(0.035)	(0.030)	(0.055)	(0.040)	(0.148)	(0.015)
Post-secondary	0.020	0.180***	0.043	0.128**	0.116***	0.352***	0.067***
	(0.039)	(0.039)	(0.033)	(0.053)	(0.044)	(0.132)	(0.017)
Household composition							
Number of members aged 0–14	0.015***	0.001	0.003	0.013**	0.017***	0.023	0.010***
	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)	(0.015)	(0.002)
Number of members aged 15–24	0.001	0.004	0.002	0.009	0.004	0.028	0.004
	(0.006)	(0.005)	(0.007)	(0.007)	(0.008)	(0.018)	(0.003)
Number of members aged 25–59	−0.014*	0.008	0.001	−0.028**	0.021**	0.005	0.001
	(0.008)	(0.008)	(0.011)	(0.014)	(0.010)	(0.029)	(0.004)
Number of members aged 60 and older	−0.021	−0.035**	0.021	−0.036	−0.012	0.046	−0.009
	(0.016)	(0.016)	(0.023)	(0.025)	(0.021)	(0.061)	(0.009)
Household consumption							
Log of consumption per capita	0.055***	0.035***	0.026	0.044***	0.084***	0.129***	0.049***
	(0.017)	(0.011)	(0.021)	(0.016)	(0.025)	(0.046)	(0.008)
Urban	−0.009	−0.020	0.001	−0.021	0.018	0.208***	0.002
	(0.022)	(0.017)	(0.021)	(0.024)	(0.030)	(0.055)	(0.010)
Constant	−0.255*	−0.306***	−0.011	−0.206*	−0.636***	−0.968***	−0.272***
	(0.136)	(0.081)	(0.162)	(0.124)	(0.209)	(0.369)	(0.070)
$\ln\sigma_k$							−2.521***
							(0.318)
$\ln\sigma_r$	−2.299***	−3.512***	−3.050***	−3.777***	−3.200***	−1.761***	−2.570***
	(0.223)	(0.376)	(0.364)	(0.982)	(0.480)	(0.229)	(0.132)
$\ln\sigma_j$	−2.019***	−3.124***	−14.163	−2.370***	−9.467***	−2.279***	−2.411***
	(0.086)	(0.250)	(896.774)	(0.184)	(1.186)	(0.573)	(0.080)
$\ln\sigma_i$	−1.907***	−2.249***	−1.567***				−1.844***
	(0.097)	(0.079)	(0.060)				(0.047)
$\ln\sigma_{it}$	−1.052***	−1.565***	−0.956***	−1.282***	−0.910***	−0.933***	−1.102***
	(0.019)	(0.021)	(0.019)	(0.028)	(0.020)	(0.048)	(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	2332
Number of households	1844	1226	1483	1018	437	1249	7257
Number of observations	3208	2338	2850	1018	1249	437	11,100
Log likelihood	−1566	64.71	−1657	−192.3	−241.6	−638.3	−4888

Note: Standard errors are in parentheses.

* $p<0.1$. The reference group is head without any education (for head's education).

** $p<0.05$,

*** $p<0.01$,

Table A.11

Correlates with 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	0.002***	−0.000	−0.000	0.000	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
Head is female	−0.007	0.006	−0.025	0.041*	0.055	−0.077	0.002
	(0.023)	(0.014)	(0.028)	(0.023)	(0.042)	(0.053)	(0.011)
Head is employee	−0.005	−0.013	0.058	−0.075*	0.057	0.086	0.020
	(0.030)	(0.024)	(0.046)	(0.039)	(0.041)	(0.073)	(0.016)
Head is self-employed	0.019	0.009	−0.002	−0.051*	0.046	0.089	0.016
	(0.023)	(0.019)	(0.034)	(0.030)	(0.033)	(0.063)	(0.012)
Head's education level							
Primary	0.002	0.020	0.030	0.078*	0.035	0.017	0.018
	(0.022)	(0.023)	(0.027)	(0.044)	(0.037)	(0.068)	(0.012)
Secondary incomplete	0.043	0.044*	0.049	0.081*	0.029	0.083	0.034**
	(0.028)	(0.025)	(0.047)	(0.049)	(0.044)	(0.079)	(0.015)
Secondary complete	0.081**	0.056	0.039	0.117**	0.023	0.347**	0.048***
	(0.034)	(0.035)	(0.030)	(0.055)	(0.040)	(0.145)	(0.015)
Post-secondary	0.050	0.195***	0.049	0.137***	0.127***	0.438***	0.079***
	(0.038)	(0.039)	(0.033)	(0.053)	(0.043)	(0.131)	(0.017)
Household composition							
Number of members aged 0–14	0.014***	−0.000	0.001	0.013**	0.015***	0.016	0.009***
	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)	(0.015)	(0.002)
Number of members aged 15–24	−0.000	0.003	0.002	0.010	0.005	0.027	0.004
	(0.006)	(0.005)	(0.007)	(0.007)	(0.008)	(0.018)	(0.003)

Table A.11 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Number of members aged 25–59	−0.013*	0.008	0.001	−0.031**	0.020**	0.006	0.001
	(0.008)	(0.008)	(0.011)	(0.014)	(0.010)	(0.029)	(0.004)
Number of members aged 60 and older	−0.022	−0.035**	0.018	−0.043*	−0.014	0.046	−0.010
	(0.016)	(0.016)	(0.023)	(0.025)	(0.021)	(0.061)	(0.009)
Household consumption quintiles							
Q2 (second poorest)	0.001	0.010	−0.011	−0.032	−0.060	0.130	−0.007
	(0.033)	(0.023)	(0.036)	(0.034)	(0.051)	(0.106)	(0.016)
Q3 (middle quintile)	0.055*	−0.000	0.013	0.017	0.008	0.147	0.025
	(0.032)	(0.022)	(0.036)	(0.034)	(0.047)	(0.103)	(0.016)
Q4 (second richest)	0.047	0.009	−0.041	0.064*	0.032	0.228**	0.024
	(0.033)	(0.022)	(0.037)	(0.035)	(0.048)	(0.104)	(0.016)
Q5 (richest)	0.073**	0.035	0.029	0.065*	0.084*	0.197*	0.059***
	(0.035)	(0.022)	(0.040)	(0.039)	(0.049)	(0.108)	(0.017)
Urban	−0.007	−0.012	0.004	−0.023	0.014	0.221***	0.004
	(0.022)	(0.017)	(0.021)	(0.024)	(0.030)	(0.056)	(0.010)
Constant	0.098	−0.091**	0.177**	0.047	−0.012	−0.215	0.048
	(0.062)	(0.045)	(0.075)	(0.081)	(0.084)	(0.170)	(0.048)
$\ln\sigma_k$							−2.396***
							(0.312)
$\ln\sigma_r$	−2.305***	−3.504***	−3.017***	−3.879***	−3.259***	−1.796***	−2.573***
	(0.224)	(0.374)	(0.359)	(1.113)	(0.507)	(0.234)	(0.132)
$\ln\sigma_j$	−2.026***	−3.087***	−12.725***	−2.404***	−3.946	−2.233***	−2.411***
	(0.087)	(0.237)	(1.159)	(0.195)	(4.166)	(0.530)	(0.081)
$\ln\sigma_i$	−1.897***	−2.248***	−1.574***				−1.841***
	(0.095)	(0.079)	(0.061)				(0.047)
$\ln\sigma_{it}$	−1.053***	−1.565***	−0.956***	−1.281***	−0.911***	−0.932***	−1.102***
	(0.019)	(0.021)	(0.019)	(0.028)	(0.022)	(0.048)	(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	2342
Number of households	1844	1226	1614	1018	1249	437	7388
Number of observations	3208	2338	2850	1018	1249	437	11,100
Log-likelihood	−1567	62.71	−1653	−188.1	−639.1	−241.8	−4895

Note: Standard errors are in parentheses.

* $p<0.1$. The reference groups are head without any education (for head's education) and the poorest consumption quintile (for household consumption quintiles).

** $p<0.05$,

*** $p<0.01$,

Table A.12

Correlates with 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	0.002***	0.000	−0.001	−0.000	0.005	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)
Head is female	−0.023	0.011	−0.053	0.039	0.045	−0.041	−0.004
	(0.027)	(0.013)	(0.065)	(0.026)	(0.049)	(0.069)	(0.018)
Head is employee	0.005	−0.002	0.163	−0.100**	0.058	0.072	0.043
	(0.035)	(0.023)	(0.108)	(0.045)	(0.047)	(0.096)	(0.026)
Head is self-employed	0.018	0.008	0.039	−0.068**	0.056	0.095	0.025
	(0.027)	(0.018)	(0.079)	(0.034)	(0.038)	(0.082)	(0.021)
Head's education level							
Primary	0.004	0.013	−0.007	0.087*	0.033	−0.011	0.016
	(0.026)	(0.021)	(0.064)	(0.051)	(0.043)	(0.090)	(0.019)
Secondary incomplete	0.060*	0.032	0.019	0.081	0.015	0.114	0.037
	(0.034)	(0.023)	(0.110)	(0.056)	(0.051)	(0.105)	(0.024)
Secondary complete	0.096**	0.047	−0.007	0.120*	0.046	0.443**	0.038
	(0.041)	(0.033)	(0.071)	(0.063)	(0.047)	(0.193)	(0.026)
Post-secondary	0.054	0.207***	0.064	0.148**	0.189***	0.647***	0.118***
	(0.047)	(0.037)	(0.077)	(0.061)	(0.051)	(0.180)	(0.028)
Household composition							
Number of members aged 0–14	0.017***	0.003	0.009	0.014**	0.020***	0.017	0.013***
	(0.005)	(0.004)	(0.012)	(0.007)	(0.007)	(0.019)	(0.004)
Number of members aged 15–24	0.001	0.001	0.015	0.014*	0.009	0.041*	0.009*
	(0.007)	(0.004)	(0.018)	(0.008)	(0.010)	(0.023)	(0.005)
Number of members aged 25–59	−0.016*	0.012	0.003	−0.032*	0.023**	0.021	0.000
	(0.010)	(0.008)	(0.026)	(0.016)	(0.011)	(0.038)	(0.007)
Number of members aged 60 and older	−0.034*	−0.025*	0.070	−0.027	−0.003	−0.027	0.001
	(0.020)	(0.015)	(0.053)	(0.028)	(0.024)	(0.080)	(0.015)
Household consumption							
Log of consumption per capita	0.065***	0.034***	0.048	0.061***	0.078***	0.153**	0.060***
	(0.020)	(0.010)	(0.049)	(0.018)	(0.029)	(0.061)	(0.013)
Urban	−0.011	−0.019	−0.015	−0.006	0.022	0.205***	0.003
	(0.026)	(0.015)	(0.050)	(0.028)	(0.035)	(0.076)	(0.016)

Table A.12 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Constant	−0.328**	−0.325***	−0.217	−0.287**	−0.584**	−1.303***	−0.371***
	(0.163)	(0.074)	(0.383)	(0.144)	(0.241)	(0.488)	(0.116)
$\ln\sigma_k$							−2.024***
							(0.307)
$\ln\sigma_r$	−2.238***	−19.349	−2.147***	−3.637***	−3.223***	−1.683***	−2.483***
	(0.230)	(0.000)	(0.356)	(1.125)	(0.545)	(0.288)	(0.137)
$\ln\sigma_j$	−1.894***	−3.035***	−18.047***	−2.236***	−3.266**	−1.450***	−2.416***
	(0.091)	(0.172)	(1.187)	(0.184)	(1.393)	(0.211)	(0.186)
$\ln\sigma_i$	−1.642***	−2.501***	−0.753***				−1.403***
	(0.081)	(0.123)	(0.065)				(0.050)
$\ln\sigma_{it}$	−0.890***	−1.571***	−0.077***	−1.138***	−0.770***	−0.703***	−0.531***
	(0.018)	(0.022)	(0.019)	(0.027)	(0.022)	(0.050)	(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	2332
Number of households	1844	1224	1483	1018	1248	437	7254
Number of observations	3208	2310	2850	1018	1248	437	11,071
Log likelihood	−2123	159.2	−4129	−336.2	−817.2	−363.4	−10811

Note: Standard errors are in parentheses.

* p<0.1. The reference group is head without any education (for head's education).

** p<0.05,

*** p<0.01,

Table A.13

Correlates with 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	0.002***	0.000	−0.001	−0.000	0.005	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)
Head is female	−0.022	0.010	−0.051	0.038	0.045	−0.043	−0.005
	(0.027)	(0.013)	(0.065)	(0.026)	(0.049)	(0.070)	(0.018)
Head is employee	0.007	0.000	0.150	−0.099**	0.058	0.077	0.043*
	(0.036)	(0.023)	(0.108)	(0.045)	(0.047)	(0.097)	(0.026)
Head is self-employed	0.018	0.011	0.037	−0.067**	0.058	0.099	0.025
	(0.027)	(0.018)	(0.079)	(0.034)	(0.038)	(0.083)	(0.021)
Head's education level							
Primary	0.005	0.016	−0.000	0.091*	0.039	0.010	0.018
	(0.026)	(0.022)	(0.064)	(0.051)	(0.043)	(0.090)	(0.019)
Secondary incomplete	0.068**	0.038	0.034	0.091	0.016	0.139	0.041*
	(0.034)	(0.023)	(0.110)	(0.056)	(0.051)	(0.105)	(0.024)
Secondary complete	0.114***	0.057*	0.003	0.127**	0.046	0.545***	0.044*
	(0.041)	(0.033)	(0.071)	(0.063)	(0.047)	(0.190)	(0.026)
Post-secondary	0.089**	0.222***	0.068	0.161***	0.199***	0.740***	0.129***
	(0.045)	(0.036)	(0.077)	(0.061)	(0.050)	(0.178)	(0.028)
Household composition							
Number of members aged 0–14	0.015***	0.001	0.006	0.014**	0.018***	0.009	0.011***
	(0.005)	(0.004)	(0.012)	(0.007)	(0.007)	(0.019)	(0.004)
Number of members aged 15–24	−0.000	0.000	0.016	0.015*	0.010	0.040*	0.008
	(0.007)	(0.004)	(0.018)	(0.008)	(0.010)	(0.023)	(0.005)
Number of members aged 25–59	−0.015	0.012	0.003	−0.035**	0.022*	0.022	0.000
	(0.010)	(0.008)	(0.026)	(0.017)	(0.011)	(0.038)	(0.007)
Number of members aged 60 and older	−0.035*	−0.026*	0.064	−0.035	−0.005	−0.026	−0.000
	(0.020)	(0.015)	(0.053)	(0.029)	(0.024)	(0.081)	(0.015)
Household consumption quintiles							
Q2 (second poorest)	0.009	0.010	−0.072	−0.029	−0.092	0.166	−0.029
	(0.040)	(0.021)	(0.084)	(0.039)	(0.059)	(0.139)	(0.027)
Q3 (middle quintile)	0.064	−0.002	0.015	0.017	−0.015	0.201	0.025
	(0.039)	(0.021)	(0.085)	(0.039)	(0.054)	(0.136)	(0.026)
Q4 (second richest)	0.050	0.011	−0.081	0.079**	0.021	0.262*	0.012
	(0.039)	(0.020)	(0.088)	(0.040)	(0.055)	(0.136)	(0.026)
Q5 (richest)	0.086**	0.034*	0.051	0.090**	0.064	0.252*	0.070**
	(0.041)	(0.021)	(0.095)	(0.045)	(0.057)	(0.142)	(0.028)
Urban	−0.008	−0.011	−0.012	−0.007	0.019	0.223***	0.006
	(0.027)	(0.014)	(0.050)	(0.028)	(0.034)	(0.077)	(0.016)
Constant	0.094	−0.116***	0.138	0.060	0.009	−0.410*	0.029
	(0.073)	(0.041)	(0.176)	(0.094)	(0.097)	(0.225)	(0.076)
$\ln\sigma_k$							−1.950***
							(0.304)
$\ln\sigma_r$	−2.246***	−11.088	−2.134***	−3.693***	−3.291***	−1.715***	−2.490***
	(0.231)	(0.000)	(0.355)	(1.211)	(0.582)	(0.297)	(0.137)
$\ln\sigma_j$	−1.897***	−3.014***	−18.329***	−2.263***	−3.133***	−1.442***	−2.414***
	(0.091)	(0.168)	(0.985)	(0.192)	(1.075)	(0.209)	(0.186)
$\ln\sigma_i$	−1.633***	−2.497***	−0.758***				−1.404***

Table A.13 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Malawi	Nigeria	Uganda	Mali	Tanzania	All
	(0.080)	(0.122)	(0.066)				(0.050)
	−0.890***	−1.571***	−0.077***	−1.136***	−0.772***	−0.700***	−0.531***
$\ln\sigma_{it}$	(0.018)	(0.022)	(0.019)	(0.027)	(0.022)	(0.050)	(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	2332
Number of households	1844	1224	1483	1018	1248	437	7254
Number of observations	3208	2310	2850	1018	1248	437	11,071
Log-likelihood	−2125	156.3	−4127	−335.0	−815.4	−364.5	−10812

Note: Standard errors are in parentheses.

* p<0.1. The reference groups are head without any education (for head's education) and the poorest consumption quintile (for household consumption quintiles).

** p<0.05,

*** p<0.01,

Table A.14

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	−0.003	−0.011	0.064***	0.046***	−0.019	0.037***
	(0.046)	(0.022)	(0.035)	(0.019)	(0.012)	(0.059)	(0.008)
Pre-COVID−19 variables							
Head's age	0.001	0.002***	0.002*	0.001	0.002***	0.003**	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Head is female	−0.025	0.038**	−0.015	−0.027	0.016	0.007	−0.000
	(0.026)	(0.018)	(0.025)	(0.025)	(0.016)	(0.035)	(0.009)
Head is employee	0.001	0.002***	0.002*	0.001	0.002***	0.003**	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
Head is self-employed	−0.025	0.040**	−0.013	−0.027	0.017	0.009	0.001
	(0.026)	(0.018)	(0.025)	(0.025)	(0.016)	(0.035)	(0.009)
Head's education level							
	0.047	0.035	0.024	0.038	−0.034	0.036	0.018
	−0.008	0.040**	0.037	0.087***	0.109***	0.069	0.049***
Primary	(0.025)	(0.019)	(0.041)	(0.026)	(0.026)	(0.045)	(0.011)
	−0.022	0.111***	0.109**	0.108**	0.175***	0.124**	0.103***
Secondary incomplete	(0.033)	(0.025)	(0.045)	(0.044)	(0.030)	(0.054)	(0.014)
	−0.029	0.127***	0.124*	0.115***	0.135***	0.104	0.102***
Secondary complete	(0.038)	(0.027)	(0.065)	(0.028)	(0.036)	(0.103)	(0.014)
	−0.013	0.125***	0.319***	0.130***	0.249***	0.160	0.144***
Post-secondary	(0.043)	(0.037)	(0.070)	(0.031)	(0.035)	(0.100)	(0.016)
Household composition							
Number of members aged 0–14	0.007	0.009	−0.006	0.001	0.036***	−0.001	0.012***
	(0.005)	(0.005)	(0.008)	(0.005)	(0.004)	(0.009)	(0.002)
Number of members aged 15–24	0.006	0.015**	0.019**	−0.011	0.031***	0.007	0.016***
	(0.007)	(0.006)	(0.009)	(0.007)	(0.005)	(0.012)	(0.003)
Number of members aged 25–59	0.000	0.039***	−0.003	0.014	0.023**	−0.025	0.015***
	(0.009)	(0.010)	(0.015)	(0.010)	(0.010)	(0.020)	(0.005)
Number of members aged 60 and older	0.002	0.010	−0.036	0.013	−0.027	−0.037	−0.010
	(0.019)	(0.021)	(0.029)	(0.021)	(0.017)	(0.042)	(0.009)
Household consumption							
	0.058***	0.056***	0.014	0.041**	0.097***	0.012	0.064***
Log of consumption per capita	(0.018)	(0.013)	(0.020)	(0.019)	(0.012)	(0.029)	(0.007)
	0.029	0.136***	0.064**	0.061***	0.045**	0.022	0.062***
Urban	(0.022)	(0.024)	(0.025)	(0.021)	(0.018)	(0.035)	(0.010)
	−0.417***	−0.463***	−0.078	0.191	−0.421***	0.481**	−0.281***
Constant	(0.149)	(0.114)	(0.143)	(0.154)	(0.094)	(0.233)	(0.104)
$\ln\sigma_k$							−1.461***
							(0.275)
$\ln\sigma_r$	−2.945***	−2.015***	−3.780***	−2.518***	−2.597***	−2.035***	−2.263***
	(0.283)	(0.227)	(1.014)	(0.318)	(0.337)	(0.198)	(0.120)
$\ln\sigma_j$	−2.682***	−1.958***	−2.710***	−2.664***	−2.312***	−3.156*	−2.236***
	(0.255)	(0.066)	(0.246)	(0.267)	(0.105)	(1.760)	(0.048)
$\ln\sigma_i$	−1.169	−1.521***	−1.668***	−1.402***	−1.572***		−1.564***
	(5.783)	(0.029)	(0.081)	(0.037)	(0.032)		(0.018)
$\ln\sigma_{it}$	−1.972	−1.028***	−1.080***	−0.942***	−0.898***	−0.988***	−0.955***
	(28.864)	(0.009)	(0.025)	(0.011)	(0.007)	(0.034)	(0.005)
Country							6
Region	13	11	31	6	6	30	97
Community	511	444	162	475	655	371	2.695
Household	1609	2068	1215	1595	1940	778	9205
Observations	1609	8353	1896	5639	11,508	778	29,783
Log likelihood	−587.6	−4367	−899.9	−3420	−6982	−358.7	−17169

Note: Standard errors are in parentheses.

* p<0.1. The reference group is head without any education (for head's education).

** p<0.05,
*** p<0.01,

Table A.15
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	−0.013	−0.033	0.170***	0.063***	0.090	0.050***
	(0.058)	(0.033)	(0.043)	(0.063)	(0.019)	(0.113)	(0.017)
Pre-COVID−19 variables							
Head's age	0.001	0.004***	0.002*	0.004	0.003**	0.004	0.003***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)
Head is female	−0.014	0.027	−0.022	−0.136	0.043*	0.030	−0.007
	(0.033)	(0.028)	(0.030)	(0.097)	(0.025)	(0.068)	(0.021)
Head is employee	0.050	0.023	0.042	0.225	−0.068	0.021	0.012
	(0.043)	(0.035)	(0.051)	(0.161)	(0.043)	(0.095)	(0.030)
Head is self-employed	0.065**	0.007	0.026	0.031	−0.001	−0.028	0.014
	(0.032)	(0.028)	(0.041)	(0.118)	(0.032)	(0.080)	(0.023)
Head's education level							
	−0.025	0.050*	0.038	0.061	0.096**	0.106	0.043*
	(0.031)	(0.030)	(0.049)	(0.098)	(0.040)	(0.085)	(0.024)
Primary	−0.045	0.148***	0.145***	0.272	0.210***	0.262**	0.147***
	(0.041)	(0.039)	(0.053)	(0.167)	(0.048)	(0.103)	(0.031)
Secondary incomplete	−0.030	0.195***	0.157**	0.209*	0.159***	0.341*	0.173***
	(0.049)	(0.042)	(0.076)	(0.108)	(0.056)	(0.194)	(0.033)
Secondary complete	−0.006	0.259***	0.399***	0.234**	0.345***	0.514***	0.282***
	(0.057)	(0.058)	(0.083)	(0.117)	(0.055)	(0.188)	(0.037)
Post-secondary	0.009	0.024***	−0.000	0.017	0.065***	0.010	0.026***
Household composition							
Number of members aged 0–14	(0.006)	(0.008)	(0.009)	(0.018)	(0.007)	(0.018)	(0.005)
	0.009	0.031***	0.020**	−0.009	0.054***	0.014	0.028***
Number of members aged 15–24	(0.009)	(0.010)	(0.010)	(0.027)	(0.008)	(0.022)	(0.007)
	−0.003	0.050***	−0.006	0.055	0.039**	0.054	0.032***
Number of members aged 25–59	(0.011)	(0.015)	(0.018)	(0.038)	(0.016)	(0.038)	(0.010)
	0.001	−0.011	−0.040	−0.023	−0.015	−0.053	−0.020
Number of members aged 60 and older	(0.023)	(0.033)	(0.034)	(0.079)	(0.027)	(0.078)	(0.021)
Household consumption							
	0.081***	0.099***	0.015	0.210***	0.207***	0.013	0.143***
	(0.023)	(0.021)	(0.023)	(0.073)	(0.019)	(0.058)	(0.015)
Log of consumption per capita	0.036	0.237***	0.068**	0.125	0.117***	0.058	0.132***
	(0.028)	(0.042)	(0.034)	(0.078)	(0.029)	(0.072)	(0.022)
Urban	−0.584***	−0.899***	−0.129	−0.998*	−1.053***	0.247	−0.948***
	(0.185)	(0.183)	(0.171)	(0.587)	(0.144)	(0.466)	(0.212)
Constant							
$\ln\sigma_k$							−0.649***
							(0.015)
$\ln\sigma_r$	−2.886***	−1.509***	−2.907***	−1.144***	−2.428***	−1.389***	−0.787***
	(0.313)	(0.227)	(0.394)	(0.314)	(0.416)	(0.196)	(0.276)
$\ln\sigma_j$	−2.623***	−1.278***	−2.626***	−1.758***	−1.714***	−1.529***	−1.710***
	(0.332)	(0.053)	(0.334)	(0.586)	(0.089)	(0.231)	(0.104)
$\ln\sigma_i$	−0.857**	−1.078***	−1.585***	0.056*	−1.152***		−1.456***
	(0.376)	(0.029)	(0.096)	(0.029)	(0.033)		(0.052)
$\ln\sigma_{it}$	−2.869	−0.604***	−0.882***	0.221***	−0.429***	−0.534***	−0.252***
	(20.983)	(0.009)	(0.025)	(0.011)	(0.007)	(0.039)	(0.005)
Country							6
Region	13	11	31	6	6	30	96
Community	511	444	162	475	655	326	2.660
Household	1609	2068	1215	1595	1940	592	9065
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<0.1. The reference group is head without any education (for head's education).
** p<0.05,
*** p<0.01,

Table A.16
Public transfers during the pandemic and any teaching contact, conditional mixed model

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	All
Public transfers	0.129**	−0.011	0.097***	0.020	0.011	0.065***
	(0.054)	(0.021)	(0.023)	(0.028)	(0.086)	(0.014)
Pre-COVID−19 variables						
Head's age	0.001	0.002***	−0.001	−0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)

Table A.16 (*continued*)

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	All
Head is female	−0.007	0.006	−0.035	0.041*	−0.078	−0.006
	(0.030)	(0.015)	(0.028)	(0.023)	(0.053)	(0.012)
Head is employee	−0.062	−0.037	0.070	−0.077**	0.077	−0.013
	(0.039)	(0.025)	(0.046)	(0.039)	(0.072)	(0.019)
Head is self-employed	0.001	−0.014	0.004	−0.051*	0.083	−0.003
	(0.029)	(0.020)	(0.034)	(0.030)	(0.063)	(0.015)
Head's education level						
	0.012	*0.015*	*0.018*	*0.075**	*−0.003*	*0.014*
	(0.029)	(0.024)	(0.027)	(0.044)	(0.068)	(0.014)
Primary	0.055	0.028	0.036	0.074	0.058	0.028
	(0.037)	(0.026)	(0.047)	(0.049)	(0.079)	(0.017)
Secondary incomplete	0.094**	0.038	0.025	0.113**	0.257*	0.046**
	(0.044)	(0.037)	(0.030)	(0.055)	(0.148)	(0.018)
Secondary complete	−0.035	0.174***	0.035	0.129**	0.352***	0.053***
	(0.052)	(0.041)	(0.033)	(0.053)	(0.132)	(0.020)
Post-secondary	0.016***	−0.001	0.004	0.013**	0.023	0.008***
Household composition						
Number of members aged 0–14	(0.006)	(0.004)	(0.005)	(0.006)	(0.015)	(0.003)
	0.008	0.003	0.002	0.009	0.028	0.006*
Number of members aged 15–24	(0.008)	(0.005)	(0.008)	(0.007)	(0.018)	(0.004)
	−0.020*	0.002	0.001	−0.028*	0.005	−0.003
Number of members aged 25–59	(0.010)	(0.009)	(0.011)	(0.014)	(0.029)	(0.005)
	−0.013	−0.040**	0.022	−0.035	0.046	−0.005
Number of members aged 60 and older	(0.021)	(0.017)	(0.023)	(0.025)	(0.061)	(0.011)
Household consumption						
	0.064***	0.030***	0.028	0.044***	0.129***	0.044***
	(0.022)	(0.011)	(0.021)	(0.016)	(0.046)	(0.009)
Log of consumption per capita	−0.004	−0.016	0.001	−0.022	0.209***	0.005
	(0.028)	(0.017)	(0.021)	(0.024)	(0.055)	(0.012)
Urban	−0.306*	−0.234***	−0.037	−0.207*	−0.971***	−0.232***
	(0.179)	(0.084)	(0.163)	(0.125)	(0.370)	(0.081)
Constant						
$\ln\sigma_k$						−1.897***
						(0.063)
$\ln\sigma_r$	−1.969***	−3.471***	−3.019***	−3.605***	−1.758***	−2.460***
	(0.220)	(0.342)	(0.359)	(0.941)	(0.229)	(0.330)
$\ln\sigma_j$	−1.838***	−3.327***	−14.273***	−2.372***	−2.284***	−2.315***
	(0.099)	(0.357)	(1.135)	(0.185)	(0.581)	(0.124)
$\ln\sigma_i$	−1.169	−2.313***	−1.578***			−2.376***
	(2.936)	(0.098)	(0.062)			(0.098)
$\ln\sigma_{it}$	−1.577	−1.593***	−0.956***	−1.282***	−0.933***	−1.106***
	(6.639)	(0.025)	(0.019)	(0.028)	(0.048)	(0.014)
Country						5
Region	13	31	6	5	29	84
Community	511	239	465	446	255	1916
Household	1609	1215	1465	1018	437	5744
Observations	1609	1896	2828	1018	437	7788
Log likelihood	−821	115	−1638	−190	−241	−3409

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

Table A.17
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*	−0.013	0.341***	0.009	−0.032	0.193***
	(0.064)	(0.019)	(0.055)	(0.033)	(0.117)	(0.027)
Pre-COVID−19 variables						
Head's age	0.002	0.002***	−0.000	−0.001	0.005	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)
Head is female	−0.019	0.011	−0.077	0.039	−0.039	−0.014
	(0.036)	(0.013)	(0.065)	(0.027)	(0.071)	(0.023)
Head is employee	−0.050	−0.024	0.163	−0.102**	0.070	0.016
	(0.046)	(0.023)	(0.108)	(0.045)	(0.098)	(0.035)
Head is self-employed	0.011	−0.013	0.041	−0.071**	0.094	0.008
	(0.034)	(0.019)	(0.079)	(0.035)	(0.084)	(0.028)
Head's education level						
	0.030	*0.009*	*−0.027*	*0.087**	*−0.012*	*0.017*
	(0.034)	(0.022)	(0.064)	(0.051)	(0.092)	(0.026)
Primary	0.088**	0.021	0.001	0.083	0.112	0.041
Secondary incomplete	(0.044)	(0.024)	(0.110)	(0.057)	(0.107)	(0.033)

Table A.17 (*continued*)

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	All
	0.147***	0.042	−0.030	0.124*	0.441**	0.041
	(0.053)	(0.034)	(0.071)	(0.064)	(0.197)	(0.034)
Secondary complete	−0.018	0.190***	0.045	0.150**	0.646***	0.102***
	(0.062)	(0.038)	(0.077)	(0.062)	(0.184)	(0.036)
Post-secondary	0.018***	0.000	0.010	0.014**	0.017	0.011**
Household composition						
Number of members aged 0–14						
	(0.007)	(0.004)	(0.012)	(0.007)	(0.020)	(0.005)
	0.010	−0.000	0.016	0.015*	0.041*	0.012*
Number of members aged 15–24	(0.009)	(0.005)	(0.018)	(0.008)	(0.024)	(0.007)
	−0.021*	0.007	0.005	−0.030*	0.022	−0.003
Number of members aged 25–59	(0.012)	(0.008)	(0.026)	(0.017)	(0.039)	(0.010)
	−0.018	−0.028*	0.072	−0.026	−0.026	0.013
Number of members aged 60 and older	(0.025)	(0.015)	(0.053)	(0.029)	(0.082)	(0.021)
Household consumption						
	0.088***	0.026**	0.052	0.060***	0.152**	0.058***
	(0.026)	(0.010)	(0.049)	(0.019)	(0.062)	(0.017)
Log of consumption per capita	−0.002	−0.018	−0.013	−0.003	0.203***	−0.000
	(0.032)	(0.015)	(0.051)	(0.028)	(0.077)	(0.021)
Urban	−0.510**	−0.228***	−0.279	−0.290*	−1.294***	−0.417***
	(0.210)	(0.076)	(0.384)	(0.148)	(0.499)	(0.150)
Constant						
$\ln\sigma_k$						−1.357***
						(0.062)
$\ln\sigma_r$	−1.890***	−15.272	−2.064***	−2.990***	−1.644***	−1.800***
	(0.223)	(.)	(0.346)	(0.757)	(0.288)	(0.334)
$\ln\sigma_j$	−1.800***	−3.109***	−12.944***	−2.237***	−1.434***	−2.295***
	(0.112)	(0.199)	(0.951)	(0.186)	(0.211)	(0.147)
$\ln\sigma_i$	−0.869	−2.538***	−0.757***			−2.606***
	(6.075)	(0.130)	(0.066)			(0.376)
$\ln\sigma_{it}$	−1.886	−1.646***	−0.081***	−1.131***	−0.685***	−0.431***
	(46.496)	(0.025)	(0.019)	(0.028)	(0.050)	(0.011)
Country						5
Region	13	31	6	5	29	84
Community	511	239	465	446	255	1916
Household	1609	1207	1465	1018	437	5736
Observations	1609	1868	2828	1018	437	7760
Log likelihood	−1086	256	−4086	−385	−396	−8289

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

Table A.18
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	−0.004	−0.037*	−0.005	−0.013**
	(0.010)	(0.019)	(0.020)	(0.012)	(0.007)
Pre-COVID−19 variables					
Head's age	0.002***	0.001	0.000	0.002**	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Head is female	0.040**	−0.025	−0.036	0.003	0.003
	(0.018)	(0.024)	(0.027)	(0.019)	(0.010)
Head is employee	0.033	0.015	0.019	−0.040	0.006
	(0.022)	(0.026)	(0.045)	(0.032)	(0.014)
Head is self-employed	0.005	−0.020	−0.011	−0.006	−0.004
	(0.018)	(0.024)	(0.033)	(0.024)	(0.011)
Head's education level					
Primary	0.040**	0.047	0.092***	0.090***	0.058***
	(0.019)	(0.040)	(0.028)	(0.030)	(0.013)
Secondary incomplete	0.112***	0.118***	0.147***	0.165***	0.126***
	(0.025)	(0.044)	(0.047)	(0.036)	(0.016)
Secondary complete	0.126***	0.124**	0.124***	0.104**	0.121***
	(0.027)	(0.062)	(0.031)	(0.042)	(0.017)
Post-secondary	0.127***	0.289***	0.141***	0.261***	0.176***
Household composition					
Number of members aged 0–14	(0.037)	(0.068)	(0.034)	(0.042)	(0.019)
	0.009*	−0.005	−0.000	0.035***	0.013***
Number of members aged 15–24	(0.005)	(0.007)	(0.005)	(0.005)	(0.003)
	0.015**	0.019**	−0.015**	0.029***	0.015***
Number of members aged 25–59	(0.006)	(0.008)	(0.008)	(0.006)	(0.003)
	0.038***	0.002	0.018*	0.009	0.019***
					(*continued on next page*)

Table A.18 (*continued*)

Variables	Ethiopia	Malawi	Nigeria	Uganda	All
Number of members aged 60 and older	(0.010)	(0.014)	(0.011)	(0.012)	(0.006)
Household consumption	0.010	−0.028	0.025	−0.031	−0.005
	(0.021)	(0.027)	(0.022)	(0.021)	(0.011)
Log of consumption per capita	0.057***	0.025	0.035*	0.082***	0.060***
	(0.013)	(0.019)	(0.021)	(0.014)	(0.008)
Urban	0.137***	0.063***	0.068***	0.050**	0.076***
	(0.024)	(0.024)	(0.023)	(0.022)	(0.012)
Constant	−0.458***	−0.157	0.294*	−0.298***	−0.277***
	(0.114)	(0.137)	(0.167)	(0.112)	(0.098)
$\ln\sigma_k$					−1.931***
					(0.413)
$\ln\sigma_r$	−2.021***	−21.750	−2.821***	−2.356***	−2.139***
	(0.227)	(0.000)	(0.350)	(0.328)	(0.164)
$\ln\sigma_j$	−1.954***	−2.608***	−2.699***	−2.162***	−2.122***
	(0.065)	(0.194)	(0.340)	(0.107)	(0.050)
$\ln\sigma_i$	−1.522***	−1.578***	−1.982***	−1.477***	−1.517***
	(0.029)	(0.059)	(0.176)	(0.036)	(0.020)
$\ln\sigma_{it}$	−1.029***	−1.085***	−0.823***	−0.947***	−0.981***
	(0.009)	(0.021)	(0.020)	(0.010)	(0.006)
Country					4
Region	11	31	6	6	54
Community	444	239	474	624	1781
Household	2068	1226	1598	1805	6698
Observations	8391	2338	2848	6634	20,211
Log likelihood	−4376	−1134	−1859	−3968	−11534

Note: Standard errors are in parentheses.

* p<0.1. The reference group is head without any education (for head's education).

** p<0.05

*** p<0.01,

Table A.19

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	0.002	−0.019	−0.012	0.003
	(0.016)	(0.022)	(0.069)	(0.019)	(0.013)
Pre-COVID−19 variables					
Head's age	0.004***	0.002	0.004	0.003**	0.003***
	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)
Head is female	0.028	−0.039	−0.148	0.028	−0.007
	(0.028)	(0.028)	(0.099)	(0.030)	(0.022)
Head is employee	0.019	0.032	0.174	−0.067	0.002
	(0.035)	(0.048)	(0.164)	(0.051)	(0.032)
Head is self-employed	0.005	0.016	0.034	0.009	0.005
Head's education level	(0.028)	(0.039)	(0.120)	(0.038)	(0.025)
	0.051*	0.051	0.105	0.121**	0.080***
Primary	(0.030)	(0.047)	(0.100)	(0.048)	(0.027)
	0.150***	0.151***	0.380**	0.249***	0.198***
Secondary incomplete	(0.039)	(0.051)	(0.171)	(0.056)	(0.033)
	0.196***	0.155**	0.293***	0.151**	0.224***
Secondary complete	(0.042)	(0.072)	(0.111)	(0.066)	(0.036)
	0.264***	0.367***	0.257**	0.433***	0.339***
Post-secondary	(0.058)	(0.080)	(0.121)	(0.066)	(0.041)
Household composition					
Number of members aged 0–14	0.024***	0.000	0.018	0.067***	0.031***
	(0.008)	(0.008)	(0.018)	(0.008)	(0.006)
Number of members aged 15–24	0.031***	0.019**	−0.006	0.053***	0.031***
	(0.010)	(0.010)	(0.028)	(0.009)	(0.007)
Number of members aged 25–59	0.050***	−0.004	0.063	0.020	0.036***
	(0.015)	(0.017)	(0.039)	(0.019)	(0.012)
Number of members aged 60 and older	−0.010	−0.035	0.033	−0.013	0.002
Household consumption	(0.033)	(0.032)	(0.081)	(0.033)	(0.023)
	0.099***	0.029	0.225***	0.190***	0.142***
Log of consumption per capita	(0.021)	(0.022)	(0.076)	(0.022)	(0.017)
	0.237***	0.059*	0.108	0.123***	0.142***
Urban	(0.042)	(0.032)	(0.079)	(0.035)	(0.026)
	−0.896***	−0.211	−1.104*	−0.965***	−0.963***
Constant	(0.183)	(0.164)	(0.601)	(0.168)	(0.256)
$\ln\sigma_k$					−0.734***
					(0.021)
$\ln\sigma_r$	−1.513***	−2.928***	−1.406***	−2.437***	−0.816**

Table A.19 (*continued*)

Variables	Ethiopia	Malawi	Nigeria	Uganda	All
	(0.228)	(0.394)	(0.335)	(0.379)	(0.362)
$\ln\sigma_j$	−1.277***	−2.653***	−1.946**	−1.504***	−1.749***
	(0.053)	(0.320)	(0.891)	(0.087)	(0.128)
$\ln\sigma_i$	−1.076***	−1.459***	−0.297***	−1.063***	−1.276***
	(0.029)	(0.064)	(0.073)	(0.039)	(0.049)
$\ln\sigma_{it}$	−0.605***	−0.904***	0.352***	−0.478***	−0.319***
	(0.009)	(0.021)	(0.020)	(0.010)	(0.006)
Country					4
Region	11	31	6	6	54
Community	444	239	474	624	1781
Household	2068	1226	1598	1805	6697
Observations	8389	2338	2848	6634	20209
Log likelihood	−8013	−1527	−5375	−7063	−25391

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

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

Variables	Malawi	Nigeria	All
Total household income decreased	−0.000	−0.041	−0.009
	(0.011)	(0.028)	(0.012)
Pre-COVID−19 variables			
Head's age	0.002***	−0.002	0.000
	(0.001)	(0.001)	(0.001)
Head is female	0.007	−0.042	−0.017
	(0.014)	(0.032)	(0.016)
Head is employee	−0.016	0.033	0.007
	(0.024)	(0.054)	(0.027)
Head is self-employed	0.006	0.033	0.021
Head's education level	(0.019)	(0.040)	(0.021)
	0.018	−0.009	−0.001
Primary	(0.023)	(0.032)	(0.020)
	0.038	−0.021	0.003
Secondary incomplete	(0.025)	(0.055)	(0.024)
	0.046	−0.004	0.021
Secondary complete	(0.036)	(0.036)	(0.024)
	0.180***	0.018	0.067**
Post-secondary	(0.039)	(0.040)	(0.027)
Household composition			
Number of members aged 0–14	0.001	0.003	0.002
	(0.004)	(0.006)	(0.004)
Number of members aged 15–24	0.004	0.010	0.007
	(0.005)	(0.009)	(0.005)
Number of members aged 25–59	0.008	0.005	0.008
	(0.008)	(0.013)	(0.008)
Number of members aged 60 and older	−0.035**	0.012	−0.012
	(0.016)	(0.027)	(0.015)
Household consumption			
	0.035***	0.051**	0.040***
Log of consumption per capita	(0.011)	(0.025)	(0.012)
	−0.020	0.022	0.003
Urban	(0.017)	(0.025)	(0.015)
	−0.305***	−0.100	−0.202**
Constant	(0.082)	(0.192)	(0.102)
$\ln\sigma_k$			−1.589***
			(0.050)
$\ln\sigma_r$	−3.512***	−4.664	−2.748***
	(0.376)	(2.920)	(0.524)
$\ln\sigma_j$	−3.124***	−2.845***	−4.036***
	(0.250)	(0.588)	(0.605)
$\ln\sigma_i$	−2.249***	−1.657	−2.438***
	(0.079)	(46.086)	(0.145)
$\ln\sigma_{it}$	−1.565***	−1.037	−1.455***
	(0.021)	(13.334)	(0.027)
Country			2
Region	31	6	37
Community	239	462	701
Household	1226	1384	2610
Observations	2338	1384	3722
Log likelihood	65	−719	−908

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

Table A.21

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	−0.019	−0.005
	(0.011)	(0.041)	(0.014)
Pre-COVID−19 variables			
Head's age	0.002***	−0.002	−0.000
	(0.001)	(0.002)	(0.001)
Head is female	0.011	−0.075	−0.032
	(0.013)	(0.049)	(0.024)
Head is employee	−0.003	0.051	0.023
	(0.023)	(0.082)	(0.040)
Head is self-employed	0.008	0.065	0.035
Head's education level	(0.018)	(0.060)	(0.031)
	0.012	−0.046	−0.029
Primary	(0.021)	(0.048)	(0.029)
	0.030	−0.107	−0.034
Secondary incomplete	(0.023)	(0.083)	(0.035)
	0.044	−0.054	−0.015
Secondary complete	(0.033)	(0.053)	(0.035)
	0.204***	0.027	0.091**
Post-secondary	(0.037)	(0.059)	(0.039)
Household composition			
Number of members aged 0–14	0.003	0.018*	0.012**
	(0.004)	(0.009)	(0.005)
Number of members aged 15–24	0.001	0.020	0.011
	(0.004)	(0.014)	(0.007)
Number of members aged 25–59	0.012	0.000	0.007
	(0.008)	(0.020)	(0.011)
Number of members aged 60 and older	−0.026*	0.057	0.020
	(0.015)	(0.041)	(0.023)
Household consumption			
	0.034***	0.085**	0.057***
Log of consumption per capita	(0.010)	(0.037)	(0.018)
	−0.019	0.044	−0.002
Urban	(0.015)	(0.037)	(0.019)
	−0.314***	−0.333	−0.298**
Constant	(0.075)	(0.286)	(0.148)
$\ln\sigma_k$			−0.933***
			(0.024)
$\ln\sigma_r$	−19.968	−9.373	−2.450***
			(0.521)
$\ln\sigma_j$	−3.027***	−10.681	−4.952
	(0.170)		(4.459)
$\ln\sigma_i$	−2.507***	−0.510	−2.393***
	(0.124)		(0.281)
$\ln\sigma_{it}$	−1.571***	−2.144	−1.530***
	(0.022)		(0.024)
Country			2
Region	31	6	37
Community	239	462	701
Household	1224	1384	2608
Observations	2310	1384	3694
Log likelihood	160	−1284	−1854

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

Table A.22

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	0.011	−0.063***	0.045***	0.007	0.057*	−0.067	0.027***
	(0.018)	(0.011)	(0.023)	(0.013)	(0.012)	(0.034)	(0.108)	(0.006)
Pre-COVID−19 variables								
Head's age	0.001	0.002***	0.002	0.000	0.002***	0.003**	0.009***	0.002***

(continued on next page)

Table A.22 (*continued*)

Variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Tanzania	Mali	All
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.000)
Head is female	0.044**	0.029*	−0.015	−0.020	0.019	0.014	−0.169	0.008
	(0.020)	(0.016)	(0.027)	(0.024)	(0.016)	(0.037)	(0.129)	(0.008)
Head is employee	0.085***	0.032	0.032	0.029	−0.033	0.035	0.010	0.014
	(0.026)	(0.019)	(0.047)	(0.040)	(0.027)	(0.052)	(0.120)	(0.012)
Head is self-employed	0.078***	0.000	−0.005	0.005	−0.009	0.031	0.180	0.015
	(0.020)	(0.016)	(0.038)	(0.030)	(0.020)	(0.045)	(0.125)	(0.009)
Head's education level								
Primary	0.009	0.041**	0.043	0.094***	0.110***	0.065	0.029	0.050***
	(0.019)	(0.017)	(0.045)	(0.024)	(0.026)	(0.046)	(0.122)	(0.010)
Secondary incomplete	−0.003	0.082***	0.121**	0.112***	0.176***	0.120**	0.194	0.095***
	(0.025)	(0.022)	(0.049)	(0.042)	(0.030)	(0.055)	(0.127)	(0.012)
Secondary complete	−0.008	0.120***	0.110	0.130***	0.136***	0.102	0.391***	0.108***
	(0.030)	(0.024)	(0.071)	(0.027)	(0.036)	(0.103)	(0.094)	(0.013)
Post-secondary	−0.027	0.109***	0.292***	0.131***	0.250***	0.166*	0.330***	0.134***
Household composition	(0.035)	(0.032)	(0.076)	(0.029)	(0.035)	(0.101)	(0.096)	(0.015)
Number of members aged 0–14	0.009**	0.014***	−0.003	0.001	0.037***	−0.004	0.034	0.013***
	(0.004)	(0.005)	(0.008)	(0.004)	(0.004)	(0.009)	(0.022)	(0.002)
Number of members aged 15–24	0.001	0.018***	0.019**	−0.009	0.032***	0.006	0.032	0.015***
	(0.005)	(0.006)	(0.009)	(0.007)	(0.005)	(0.012)	(0.022)	(0.003)
Number of members aged 25–59	0.007	0.033***	−0.007	0.014	0.023**	−0.018	−0.034	0.014***
	(0.007)	(0.008)	(0.016)	(0.010)	(0.010)	(0.021)	(0.029)	(0.004)
Number of members aged 60 and older	0.009	0.007	−0.048	0.020	−0.026	−0.032	−0.000	−0.008
	(0.014)	(0.019)	(0.031)	(0.020)	(0.018)	(0.043)	(0.065)	(0.008)
Household consumption	0.075***	0.054***	0.009	0.044**	0.098***	−0.005	0.101	0.064***
	(0.015)	(0.012)	(0.021)	(0.019)	(0.012)	(0.029)	(0.079)	(0.006)
Log of consumption per capita	0.064***	0.132***	0.066**	0.068***	0.045**	0.026	−0.075	0.076***
	(0.019)	(0.022)	(0.032)	(0.020)	(0.019)	(0.036)	(0.099)	(0.009)
Urban	−0.053	−0.449***	0.000	0.148	−0.429***	0.567**	−0.847	−0.201**
	(0.120)	(0.102)	(0.158)	(0.147)	(0.095)	(0.238)	(0.652)	(0.084)
Constant								
$\ln\sigma_k$								−1.768***
								(0.286)
$\ln\sigma_r$	−2.587***	−2.106***	−22.004	−2.652***	−2.615***	−2.092***	−18.714	−2.329***
	(0.231)	(0.227)	(16.516)	(0.325)	(0.339)	(0.206)	(0.000)	(0.118)
$\ln\sigma_j$	−2.258***	−2.028***	−2.930***	−2.596***	−2.298***	−3.111*	−1.755***	−2.246***
	(0.096)	(0.064)	(0.395)	(0.216)	(0.104)	(1.642)	(0.401)	(0.045)
$\ln\sigma_i$	−2.626***	−1.632***	−16.340***	−1.399***	−1.571***			−1.624***
	(0.303)	(0.030)	(0.575)	(0.033)	(0.032)			(0.018)
$\ln\sigma_{it}$	−0.905***	−0.961***	−0.975***	−0.948***	−0.898***	−0.992***	−0.862***	−0.908***
	(0.013)	(0.007)	(0.021)	(0.009)	(0.007)	(0.034)	(0.077)	(0.004)
Country								7
Region	13	11	31	6	6	30	9	106
Community	532	446	238	475	654	358	129	2832
Household	1870	2276	1175	1617	1937	737	202	9814
Observations	4514	11,153	1266	7316	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<0.1. The reference group is head without any education (for head's education).
** p<0.05,
*** p<0.01,

Table A.23
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	0.022	−0.072***	0.181***	0.015	0.120*	−0.178	0.139***
	(0.036)	(0.020)	(0.027)	(0.047)	(0.020)	(0.067)	(0.162)	(0.015)
Pre-COVID−19 variables								
Head's age	0.002*	0.004***	0.002	0.004	0.003**	0.003	0.009*	0.003***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.003)	(0.005)	(0.001)
Head is female	0.010	0.029	−0.026	−0.143	0.047*	0.045	−0.103	0.003
	(0.040)	(0.028)	(0.032)	(0.097)	(0.025)	(0.074)	(0.193)	(0.021)
Head is employee	0.171***	0.019	0.040	0.198	−0.067	0.000	0.177	0.019
	(0.053)	(0.035)	(0.055)	(0.162)	(0.043)	(0.100)	(0.180)	(0.030)
Head is self-employed	0.088**	0.003	−0.001	−0.006	−0.004	−0.038	0.312*	0.006
	(0.040)	(0.028)	(0.045)	(0.118)	(0.032)	(0.086)	(0.188)	(0.023)
Head's education level								
Primary	0.095**	0.050*	0.050	0.088	0.098**	0.094	−0.021	0.067***
	(0.038)	(0.030)	(0.053)	(0.098)	(0.040)	(0.090)	(0.184)	(0.024)
Secondary incomplete	−0.008	0.149***	0.164***	0.295*	0.211***	0.234**	0.190	0.164***

Table A.23 (*continued*)

Variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Tanzania	Mali	All
	(0.050)	(0.039)	(0.057)	(0.167)	(0.048)	(0.108)	(0.192)	(0.031)
Secondary complete	−0.039	0.194***	0.147*	0.262**	0.159***	0.324	0.486***	0.198***
	(0.061)	(0.042)	(0.083)	(0.108)	(0.056)	(0.200)	(0.142)	(0.033)
Post-secondary	−0.053	0.260***	0.329***	0.269**	0.344***	0.511***	0.304**	0.284***
Household composition	(0.069)	(0.058)	(0.089)	(0.118)	(0.056)	(0.193)	(0.144)	(0.037)
	0.017**	0.024***	0.001	0.011	0.065***	0.006	0.054	0.025***
Number of members aged 0–14	(0.008)	(0.008)	(0.010)	(0.018)	(0.007)	(0.019)	(0.033)	(0.005)
	0.022**	0.031***	0.022**	−0.010	0.054***	0.013	0.123***	0.030***
Number of members aged 15–24	(0.011)	(0.010)	(0.011)	(0.027)	(0.008)	(0.023)	(0.033)	(0.007)
	0.010	0.049***	−0.012	0.064*	0.039**	0.076*	−0.035	0.032***
Number of members aged 25–59	(0.014)	(0.015)	(0.019)	(0.038)	(0.016)	(0.042)	(0.044)	(0.010)
	0.003	−0.009	−0.056	−0.008	−0.013	−0.027	−0.099	−0.016
Number of members aged 60 and older	(0.029)	(0.033)	(0.036)	(0.079)	(0.027)	(0.084)	(0.098)	(0.020)
Household consumption	0.178***	0.099***	0.015	0.210***	0.208***	−0.015	0.157	0.152***
	(0.028)	(0.021)	(0.025)	(0.074)	(0.019)	(0.060)	(0.119)	(0.016)
Log of consumption per capita	0.098***	0.238***	0.073**	0.152*	0.117***	0.086	−0.081	0.166***
	(0.034)	(0.042)	(0.035)	(0.079)	(0.030)	(0.075)	(0.150)	(0.023)
Urban	−0.828***	−0.915***	−0.052	−1.081*	−1.056***	0.394	−1.484	−0.970***
	(0.232)	(0.183)	(0.182)	(0.592)	(0.145)	(0.490)	(0.986)	(0.195)
Constant								
$\ln\sigma_k$								−0.632***
								(0.015)
$\ln\sigma_r$	−2.225***	−1.506***	−3.732*	−1.123***	−2.473***	−1.478***	−27.886***	−0.927***
	(0.254)	(0.227)	(1.936)	(0.314)	(0.429)	(0.210)	(10.630)	(0.277)
$\ln\sigma_j$	−3.447	−1.279***	−2.629***	−1.525***	−1.691***	−1.502***	−1.257***	−1.696***
	(2.386)	(0.053)	(0.347)	(0.386)	(0.087)	(0.237)	(0.373)	(0.103)
$\ln\sigma_i$	−1.948***	−1.079***	−17.066***	0.075***	−1.155***			−1.458***
	(0.379)	(0.029)	(0.657)	(0.028)	(0.033)			(0.053)
$\ln\sigma_{it}$	−0.321***	−0.605***	−0.833***	0.224***	−0.428***	−0.516***	−0.480***	−0.191***
	(0.018)	(0.009)	(0.021)	(0.010)	(0.007)	(0.041)	(0.077)	(0.005)
Country								7
Region	13	11	31	6	6	30	9	106
Community	529	444	238	475	654	311	129	2780
Household	1835	2068	1175	1610	1937	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<0.1. The reference group is head without any education (for head's education).

** p<0.05,

*** p<0.01,

Table A.24
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**	−0.012	0.099***	0.043**	−0.043	−0.077	0.057***
	(0.020)	(0.014)	(0.018)	(0.021)	(0.051)	(0.103)	(0.010)
Pre-COVID−19 variables							
Head's age	0.001	0.002**	−0.000	−0.000	0.001	0.004	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.000)
Head is female	−0.005	0.002	−0.033	0.043*	−0.065	0.152	−0.001
	(0.023)	(0.017)	(0.028)	(0.023)	(0.056)	(0.124)	(0.012)
Head is employee	−0.008	−0.034	0.055	−0.071*	0.093	0.100	0.007
	(0.030)	(0.028)	(0.046)	(0.039)	(0.075)	(0.114)	(0.018)
Head is self-employed	0.013	−0.020	−0.010	−0.047	0.088	0.226*	0.005
	(0.023)	(0.023)	(0.034)	(0.030)	(0.067)	(0.118)	(0.014)
Head's education level							
Primary	0.003	0.023	0.015	0.073*	−0.007	0.029	0.014
	(0.022)	(0.027)	(0.027)	(0.044)	(0.071)	(0.118)	(0.013)
Secondary incomplete	0.036	0.039	0.034	0.075	0.052	0.075	0.031*
	(0.028)	(0.030)	(0.046)	(0.049)	(0.082)	(0.120)	(0.017)
Secondary complete	0.071**	0.073*	0.029	0.113**	0.252*	0.133	0.052***
	(0.034)	(0.043)	(0.030)	(0.055)	(0.150)	(0.091)	(0.017)
Post-secondary	0.026	0.158***	0.040	0.125**	0.350***	0.152*	0.063***
Household composition	(0.040)	(0.046)	(0.033)	(0.053)	(0.133)	(0.092)	(0.019)
	0.015***	−0.009*	0.001	0.014**	0.029*	0.005	0.008***
Number of members aged 0–14	(0.004)	(0.005)	(0.005)	(0.006)	(0.016)	(0.021)	(0.003)
	0.002	0.007	0.003	0.007	0.025	−0.009	0.004
Number of members aged 15–24	(0.006)	(0.006)	(0.007)	(0.007)	(0.018)	(0.021)	(0.003)
	−0.016*	−0.001	0.002	−0.028*	−0.000	0.039	−0.005
Number of members aged 25–59	(0.008)	(0.010)	(0.011)	(0.014)	(0.031)	(0.028)	(0.005)
	−0.019	−0.044**	0.022	−0.033	0.070	−0.050	−0.008

Table A.24 (*continued*)

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	Mali	All
Number of members aged 60 and older	(0.016)	(0.018)	(0.023)	(0.025)	(0.065)	(0.063)	(0.010)
Household consumption	0.054***	0.014	0.032	0.046***	0.130***	0.141*	0.044***
	(0.017)	(0.013)	(0.021)	(0.016)	(0.047)	(0.073)	(0.009)
Log of consumption per capita	−0.010	0.004	0.009	−0.019	0.198***	−0.042	0.004
	(0.022)	(0.020)	(0.021)	(0.024)	(0.056)	(0.093)	(0.012)
Urban	−0.283**	−0.098	−0.087	−0.250**	−0.953**	−1.220**	−0.242***
	(0.139)	(0.095)	(0.163)	(0.124)	(0.385)	(0.611)	(0.077)
Constant							−1.897***
							(0.057)
$\ln\sigma_k$							
$\ln\sigma_r$	−2.287***	−3.732***	−3.029***	−4.366**	−1.747***	−18.554**	−2.593***
	(0.223)	(0.629)	(0.359)	(1.926)	(0.239)	(7.448)	(0.331)
$\ln\sigma_j$	−2.021***	−3.027***	−20.891	−2.293***	−2.635**	−17.989***	−2.519***
	(0.087)	(0.278)	(1855.569)	(0.167)	(1.198)	(2.232)	(0.140)
$\ln\sigma_i$	−1.893***	−25.134***	−1.582***				−2.359***
	(0.096)	(0.681)	(0.062)				(0.083)
$\ln\sigma_{it}$	−1.054***	−1.498***	−0.959***	−1.289***	−0.914***	−0.848***	−1.066***
	(0.019)	(0.021)	(0.019)	(0.028)	(0.049)	(0.050)	(0.012)
Country							6
Region	13	31	6	5	29	9	93
Community	529	238	465	444	244	129	2049
Household	1835	1175	1479	1005	411	202	6107
Observations	3175	1266	2824	1005	411	202	8883
Log likelihood	−1553	72	−1627	−187	−229	−115	−4134

Note: Standard errors are in parentheses.

* p<0.1. The reference group is head without any education (for head's education).

** p<0.05,

*** p<0.01,

Table A.25

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	0.002	0.238***	0.055**	−0.037	−0.070	0.135***
	(0.023)	(0.012)	(0.042)	(0.024)	(0.067)	(0.121)	(0.017)
Pre-COVID−19 variables							
Head's age	0.001	0.001*	0.001	−0.001	0.004	0.004	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.004)	(0.001)
Head is female	−0.021	0.007	−0.070	0.041	−0.042	0.142	−0.008
	(0.027)	(0.014)	(0.065)	(0.027)	(0.073)	(0.146)	(0.021)
Head is employee	0.006	−0.015	0.129	−0.096**	0.116	0.116	0.033
	(0.036)	(0.025)	(0.108)	(0.045)	(0.099)	(0.134)	(0.032)
Head is self-employed	0.013	−0.020	0.004	−0.065*	0.126	0.251*	0.006
	(0.027)	(0.020)	(0.080)	(0.034)	(0.087)	(0.140)	(0.025)
Head's education level							
Primary	0.007	0.009	−0.023	0.087*	−0.009	0.032	0.015
	(0.027)	(0.023)	(0.064)	(0.051)	(0.093)	(0.140)	(0.023)
Secondary incomplete	0.058*	0.026	0.006	0.084	0.121	0.066	0.041
	(0.034)	(0.025)	(0.110)	(0.056)	(0.108)	(0.142)	(0.029)
Secondary complete	0.101**	0.076**	−0.006	0.122*	0.466**	0.157	0.052*
	(0.041)	(0.037)	(0.071)	(0.063)	(0.196)	(0.107)	(0.030)
Post-secondary	0.060	0.187***	0.060	0.146**	0.671***	0.261**	0.117***
Household composition	(0.048)	(0.040)	(0.077)	(0.061)	(0.179)	(0.108)	(0.033)
	0.017***	−0.008*	0.007	0.016**	0.021	0.010	0.011**
Number of members aged 0–14	(0.005)	(0.004)	(0.012)	(0.007)	(0.020)	(0.025)	(0.005)
	0.002	0.004	0.017	0.012	0.039*	−0.005	0.009
Number of members aged 15–24	(0.007)	(0.005)	(0.018)	(0.008)	(0.024)	(0.025)	(0.006)
	−0.018*	0.007	0.004	−0.032*	0.017	0.044	−0.007
Number of members aged 25–59	(0.010)	(0.009)	(0.026)	(0.017)	(0.041)	(0.034)	(0.009)
	−0.032	−0.021	0.072	−0.024	0.011	−0.072	0.004
Number of members aged 60 and older	(0.020)	(0.016)	(0.053)	(0.028)	(0.085)	(0.074)	(0.018)
Household consumption	0.065***	0.005	0.064	0.062***	0.135**	0.145*	0.058***
	(0.020)	(0.011)	(0.049)	(0.018)	(0.062)	(0.087)	(0.016)
Log of consumption per capita	−0.012	−0.002	0.008	−0.002	0.206***	−0.061	0.008
	(0.027)	(0.016)	(0.051)	(0.028)	(0.075)	(0.109)	(0.020)
Urban	−0.351**	−0.052	−0.429	−0.342**	−1.166**	−1.319*	−0.429***
	(0.166)	(0.081)	(0.385)	(0.142)	(0.507)	(0.721)	(0.132)
Constant							−1.344***
							(0.054)
$\ln\sigma_k$							
$\ln\sigma_r$	−2.225***	−18.334***	−2.066***	−4.576	−1.656***	−22.764***	−2.131***
	(0.230)	(4.784)	(0.346)	(3.689)	(0.297)	(8.131)	(0.318)

Table A.25 (*continued*)

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	Mali	All
$\ln\sigma_j$	−1.891***	−3.084***	−17.683***	−2.137***	−1.695***	−17.816***	−2.410***
	(0.091)	(0.197)	(1.099)	(0.164)	(0.335)	(1.756)	(0.144)
$\ln\sigma_i$	−1.637***	−23.756***	−0.768***				−2.452***
	(0.081)	(0.692)	(0.068)				(0.237)
$\ln\sigma_{it}$	−0.889***	−1.659***	−0.077***	−1.146***	−0.676***	−0.682***	−0.460***
	(0.019)	(0.022)	(0.019)	(0.028)	(0.050)	(0.050)	(0.011)
Country							6
Region	13	31	6	5	29	9	93
Community	529	237	465	444	244	129	2049
Household	1835	1147	1479	1005	411	202	6107
Observations	3175	1238	2824	1005	411	202	8883
Log likelihood	−2107	269	−4083	−332	−340	−149	−9286

Note: Standard errors are in parentheses.

* p<0.1. The reference group is head without any education (for head's education).

** p<0.05,

*** p<0.01,

Table A.26

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	−0.029	−0.006	−0.027*	0.019	0.025	−0.006
	(0.030)	(0.018)	(0.021)	(0.016)	(0.018)	(0.035)	(0.009)
Pre-COVID−19 variables							
Head's age	0.001	0.002***	0.002	0.000	0.002***	0.003**	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
Head is female	−0.022	0.040**	−0.024	−0.017	0.017	0.007	0.002
	(0.026)	(0.018)	(0.024)	(0.026)	(0.016)	(0.035)	(0.009)
Head is employee	0.058*	0.036	0.015	0.035	−0.035	0.038	0.010
	(0.034)	(0.022)	(0.041)	(0.043)	(0.027)	(0.051)	(0.013)
Head is self-employed	0.050**	0.004	0.010	0.001	−0.009	0.026	0.007
Head's education level	(0.025)	(0.017)	(0.033)	(0.031)	(0.020)	(0.043)	(0.010)
Primary	−0.009	0.039**	0.044	0.091***	0.110***	0.072	0.050***
	(0.025)	(0.019)	(0.039)	(0.026)	(0.026)	(0.045)	(0.011)
Secondary incomplete	−0.026	0.111***	0.112***	0.121***	0.175***	0.131**	0.106***
	(0.033)	(0.025)	(0.043)	(0.045)	(0.030)	(0.054)	(0.013)
Secondary complete	−0.032	0.125***	0.120**	0.120***	0.136***	0.114	0.105***
	(0.039)	(0.027)	(0.061)	(0.029)	(0.036)	(0.103)	(0.015)
Post-secondary	−0.021	0.125***	0.304***	0.133***	0.250***	0.166*	0.149***
Household composition	(0.046)	(0.037)	(0.067)	(0.032)	(0.035)	(0.100)	(0.016)
Number of members aged 0–14	0.007	0.009*	−0.006	−0.000	0.036***	−0.001	0.012***
	(0.005)	(0.005)	(0.007)	(0.005)	(0.004)	(0.009)	(0.002)
Number of members aged 15–24	0.006	0.015**	0.018**	−0.009	0.031***	0.008	0.016***
	(0.007)	(0.006)	(0.008)	(0.007)	(0.005)	(0.012)	(0.003)
Number of members aged 25–59	−0.000	0.038***	0.004	0.016	0.023**	−0.025	0.016***
	(0.009)	(0.010)	(0.014)	(0.010)	(0.010)	(0.020)	(0.005)
Number of members aged 60 and older	0.002	0.011	−0.027	0.028	−0.026	−0.043	−0.007
Household consumption	(0.019)	(0.021)	(0.027)	(0.021)	(0.017)	(0.042)	(0.009)
Log of consumption per capita	0.061***	0.056***	0.025	0.039**	0.097***	0.012	0.064***
	(0.019)	(0.013)	(0.019)	(0.020)	(0.012)	(0.029)	(0.007)
Urban	0.027	0.136***	0.046*	0.056***	0.045**	0.021	0.063***
	(0.022)	(0.024)	(0.028)	(0.021)	(0.018)	(0.035)	(0.010)
Constant	−0.435***	−0.450***	−0.159	0.224	−0.420***	0.463**	−0.265**
	(0.150)	(0.114)	(0.139)	(0.157)	(0.094)	(0.233)	(0.113)
$\ln\sigma_k$							−1.410***
							(0.293)
$\ln\sigma_r$	−2.935***	−2.037***	−2.920***	−2.622***	−2.610***	−2.029***	−2.372***
	(0.282)	(0.228)	(0.355)	(0.324)	(0.338)	(0.197)	(0.107)
$\ln\sigma_j$	−2.669***	−1.955***	−2.648***	−2.796***	−2.305***	−3.102**	−2.233***
	(0.249)	(0.065)	(0.254)	(0.360)	(0.105)	(1.561)	(0.048)
$\ln\sigma_i$	−1.120***	−1.523***	−1.614***	−1.503***	−1.571***		−1.587***
	(0.022)	(0.029)	(0.063)	(0.049)	(0.032)		(0.018)
$\ln\sigma_{it}$	−2.357	−1.029***	−1.084***	−0.904***	−0.897***	−0.989***	−0.953***
	(0.000)	(0.009)	(0.021)	(0.014)	(0.007)	(0.033)	(0.005)
Country							6
Region	13	11	31	6	6	30	97
Community	511	446	239	475	655	371	2695
Household	1605	2068	1226	1603	1940	777	9219
Observations	1605	8396	2338	4304	11,508	777	28,928
Log likelihood	−583.8	−4379	−1127	−2718	−6990	−358.2	−16670

Table A.27

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	−0.024	−0.001	−0.070	−0.004	0.066	0.020
	(0.037)	(0.027)	(0.025)	(0.055)	(0.029)	(0.066)	(0.017)
Pre-COVID−19 variables							
Head's age	0.001	0.004***	0.002	0.004	0.003**	0.004	0.003***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
Head is female	−0.014	0.027	−0.039	−0.101	0.044*	0.027	−0.004
	(0.033)	(0.028)	(0.028)	(0.094)	(0.025)	(0.068)	(0.019)
Head is employee	0.048	0.023	0.032	0.211	−0.068	0.009	0.007
	(0.043)	(0.035)	(0.048)	(0.158)	(0.043)	(0.095)	(0.028)
Head is self-employed	0.061*	0.004	0.016	0.064	−0.002	−0.038	0.015
Head's education level	(0.032)	(0.028)	(0.039)	(0.115)	(0.032)	(0.081)	(0.022)
Primary	−0.026	0.050*	0.051	0.081	0.096**	0.095	0.048**
	(0.031)	(0.030)	(0.047)	(0.095)	(0.040)	(0.085)	(0.023)
Secondary incomplete	−0.048	0.149***	0.150***	0.303*	0.209***	0.259**	0.154***
	(0.041)	(0.039)	(0.051)	(0.164)	(0.048)	(0.103)	(0.029)
Secondary complete	−0.031	0.194***	0.154**	0.226**	0.158***	0.343*	0.172***
	(0.049)	(0.042)	(0.072)	(0.106)	(0.056)	(0.195)	(0.031)
Post-secondary	−0.007	0.260***	0.367***	0.252**	0.345***	0.517***	0.287***
Household composition	(0.057)	(0.058)	(0.079)	(0.116)	(0.056)	(0.188)	(0.035)
Number of members aged 0–14	0.009	0.024***	0.000	0.014	0.065***	0.009	0.026***
	(0.006)	(0.008)	(0.008)	(0.017)	(0.007)	(0.018)	(0.005)
Number of members aged 15–24	0.009	0.031***	0.019**	−0.004	0.054***	0.014	0.030***
	(0.009)	(0.010)	(0.010)	(0.026)	(0.008)	(0.022)	(0.006)
Number of members aged 25–59	−0.003	0.049***	−0.004	0.060	0.039**	0.053	0.031***
	(0.011)	(0.015)	(0.017)	(0.037)	(0.016)	(0.038)	(0.010)
Number of members aged 60 and older	0.001	−0.010	−0.035	0.007	−0.013	−0.046	−0.014
Household consumption	(0.023)	(0.033)	(0.032)	(0.077)	(0.027)	(0.079)	(0.019)
Log of consumption per capita	0.085***	0.098***	0.029	0.212***	0.207***	0.014	0.142***
	(0.023)	(0.021)	(0.022)	(0.072)	(0.019)	(0.058)	(0.014)
Urban	0.035	0.236***	0.059*	0.109	0.117***	0.057	0.125***
	(0.028)	(0.042)	(0.032)	(0.077)	(0.029)	(0.072)	(0.021)
Constant	−0.618***	−0.888***	−0.209	−1.037*	−1.044***	0.237	−0.885***
	(0.186)	(0.183)	(0.163)	(0.572)	(0.144)	(0.466)	(0.220)
$\ln\sigma_k$							−0.758***
							(0.017)
$\ln\sigma_r$	−2.904***	−1.519***	−2.927***	−1.344***	−2.462***	−1.374***	−0.774***
	(0.318)	(0.228)	(0.394)	(0.326)	(0.426)	(0.195)	(0.294)
$\ln\sigma_j$	−2.589***	−1.277***	−2.653***	−1.693***	−1.710***	−1.527***	−1.767***
	(0.314)	(0.053)	(0.320)	(0.503)	(0.089)	(0.229)	(0.108)
$\ln\sigma_i$	−0.878	−1.079***	−1.459***	−0.058	−1.152***		−1.432***
	(2.787)	(0.029)	(0.064)	(0.036)	(0.033)		(0.047)
$\ln\sigma_{it}$	−2.292	−0.605***	−0.904***	0.250***	−0.429***	−0.535***	−0.292***
	(47.066)	(0.009)	(0.021)	(0.014)	(0.007)	(0.039)	(0.005)
Country							6
Region	13	11	31	6	6	30	97
Community	511	444	239	465	655	326	2650
Household	1605	2068	1226	1483	1940	591	9033
Observations	1605	8394	2338	4304	11508	591	28740
Log likelihood	−943	−8020	−1527	−7914	−12355	−575	−36258

Table A.28

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	−0.001	0.024	−0.010	0.002	0.021*
	(0.034)	(0.013)	(0.019)	(0.032)	(0.052)	(0.011)
Pre-COVID−19 variables						
Head's age	0.001	0.002***	−0.000	−0.000	0.001	0.001

(continued on next page)

Table A.28 (*continued*)

Variables	Burkina Faso	Malawi	Nigeria	Uganda	Tanzania	All
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)
Head is female	−0.007	0.007	−0.025	0.042*	−0.081	−0.004
	(0.030)	(0.014)	(0.028)	(0.023)	(0.053)	(0.012)
Head is employee	−0.062	−0.016	0.066	−0.077**	0.071	−0.007
	(0.039)	(0.024)	(0.046)	(0.039)	(0.073)	(0.019)
Head is self-employed	−0.002	0.006	0.002	−0.052*	0.076	0.001
Head's education level	(0.029)	(0.019)	(0.034)	(0.030)	(0.063)	(0.014)
Primary	0.012	0.018	0.025	0.074*	−0.009	0.015
	(0.029)	(0.023)	(0.027)	(0.044)	(0.069)	(0.014)
Secondary incomplete	0.050	0.038	0.043	0.072	0.052	0.033*
	(0.037)	(0.025)	(0.047)	(0.049)	(0.080)	(0.017)
Secondary complete	0.092**	0.046	0.035	0.111**	0.249*	0.050***
	(0.044)	(0.036)	(0.030)	(0.055)	(0.149)	(0.018)
Post-secondary	−0.041	0.180***	0.047	0.126**	0.347***	0.060***
Household composition	(0.052)	(0.039)	(0.033)	(0.053)	(0.133)	(0.020)
	0.016***	0.001	0.003	0.013**	0.023	0.008***
Number of members aged 0–14	(0.006)	(0.004)	(0.005)	(0.006)	(0.015)	(0.003)
	0.009	0.004	0.002	0.009	0.027	0.006*
Number of members aged 15–24	(0.008)	(0.005)	(0.008)	(0.007)	(0.018)	(0.004)
	−0.021**	0.008	0.001	−0.029**	0.006	−0.003
Number of members aged 25–59	(0.011)	(0.008)	(0.011)	(0.014)	(0.029)	(0.005)
	−0.011	−0.035**	0.023	−0.036	0.052	−0.006
Number of members aged 60 and older	(0.022)	(0.016)	(0.023)	(0.025)	(0.062)	(0.011)
Household consumption						
	0.065***	0.035***	0.027	0.045***	0.130***	0.045***
Log of consumption per capita	(0.022)	(0.011)	(0.021)	(0.016)	(0.046)	(0.009)
	−0.009	−0.020	0.002	−0.021	0.210***	0.002
Urban	(0.028)	(0.017)	(0.021)	(0.024)	(0.055)	(0.012)
	−0.296	−0.304***	−0.030	−0.205*	−0.964***	−0.241***
Constant	(0.181)	(0.082)	(0.164)	(0.124)	(0.372)	(0.082)
$\ln\sigma_k$						−1.864***
						(0.057)
$\ln\sigma_r$	−1.944***	−3.509***	−3.054***	−3.851***	−1.766***	−2.389***
	(0.219)	(0.375)	(0.365)	(1.064)	(0.231)	(0.349)
$\ln\sigma_j$	−1.819***	−3.125***	−18.521***	−2.370***	−2.285***	−2.316***
	(0.096)	(0.250)	(1.240)	(0.184)	(0.580)	(0.126)
$\ln\sigma_i$	−1.052	−2.249***	−1.566***			−2.335***
	(2.644)	(0.079)	(0.061)			(0.090)
$\ln\sigma_{it}$	−2.031	−1.565***	−0.955***	−1.282***	−0.932***	−1.129***
	(18.705)	(0.021)	(0.019)	(0.028)	(0.048)	(0.013)
Country						5
Region	13	31	6	5	29	84
Community	511	239	465	466	255	1916
Household	1605	1226	1473	1018	436	5785
Observations	1605	2338	2836	1018	436	8233
Log likelihood	−823	65	−1651	−190	−240	−3477

Note: Standard errors are in parentheses.

* p<0.1. The reference group is head without any education (for head's education).

** p<0.05,

*** p<0.01,

Table A.29

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	0.008	0.155***	−0.007	−0.023	0.093***
	(0.041)	(0.012)	(0.045)	(0.037)	(0.068)	(0.020)
Pre-COVID−19 variables						
Head's age	0.002	0.002***	0.000	−0.001	0.005	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)
Head is female	−0.019	0.010	−0.051	0.039	−0.044	−0.010
	(0.036)	(0.013)	(0.065)	(0.026)	(0.070)	(0.022)
Head is employee	−0.049	−0.002	0.164	−0.100**	0.068	0.018
	(0.046)	(0.023)	(0.108)	(0.045)	(0.096)	(0.034)
Head is self-employed	0.008	0.009	0.046	−0.069**	0.090	0.008
Head's education level	(0.035)	(0.018)	(0.079)	(0.034)	(0.083)	(0.027)
	0.030	0.013	−0.005	0.087*	−0.017	0.016
Primary	(0.034)	(0.021)	(0.064)	(0.051)	(0.091)	(0.025)
	0.084*	0.033	0.025	0.081	0.104	0.046
Secondary incomplete	(0.044)	(0.023)	(0.111)	(0.056)	(0.106)	(0.031)
Secondary complete	0.145***	0.049	0.010	0.119*	0.430**	0.050

Table A.29 (*continued*)

	(0.053)	(0.033)	(0.071)	(0.063)	(0.194)	(0.033)
	−0.023	0.209***	0.093	0.147**	0.636***	0.118***
Post-secondary	(0.062)	(0.037)	(0.078)	(0.061)	(0.181)	(0.036)
Household composition	0.018***	0.003	0.010	0.014**	0.018	0.011**
	(0.007)	(0.004)	(0.012)	(0.007)	(0.019)	(0.005)
Number of members aged 0–14	0.010	0.001	0.015	0.014*	0.040*	0.011*
	(0.009)	(0.004)	(0.018)	(0.008)	(0.023)	(0.007)
Number of members aged 15–24	−0.022*	0.012	0.003	−0.032*	0.022	−0.002
	(0.012)	(0.008)	(0.026)	(0.016)	(0.038)	(0.010)
Number of members aged 25–59	−0.015	−0.026*	0.072	−0.028	−0.018	0.011
	(0.025)	(0.015)	(0.053)	(0.028)	(0.081)	(0.020)
Number of members aged 60 and older	0.002	0.002***	0.000	−0.001	0.005	0.001
Household consumption						
	0.088***	0.035***	0.056	0.061***	0.152**	0.063***
Log of consumption per capita	(0.026)	(0.010)	(0.049)	(0.018)	(0.061)	(0.016)
	−0.007	−0.019	−0.012	−0.005	0.208***	−0.003
Urban	(0.033)	(0.015)	(0.051)	(0.028)	(0.076)	(0.021)
	−0.493**	−0.332***	−0.350	−0.286**	−1.279***	−0.460***
Constant	(0.212)	(0.075)	(0.386)	(0.144)	(0.491)	(0.146)
$\ln\sigma_k$						−1.354***
						(0.059)
$\ln\sigma_r$	−1.868***	−20.837	−2.195***	−3.699***	−1.676***	−1.794***
	(0.221)	(.)	(0.363)	(1.221)	(0.289)	(0.332)
$\ln\sigma_j$	−1.784***	−3.040***	−15.301***	−2.237***	−1.443***	−2.345***
	(0.110)	(0.173)	(1.009)	(0.184)	(0.208)	(0.148)
$\ln\sigma_i$	−0.904	−2.501***	−0.744***			−2.570***
	(4.440)	(0.123)	(0.064)			(0.348)
$\ln\sigma_{it}$	−1.675	−1.571***	−0.079***	−1.137***	−0.704***	−0.455***
	(20.762)	(0.022)	(0.019)	(0.027)	(0.050)	(0.011)
Country						5
Region	13	31	6	5	29	84
Community	511	239	465	466	255	1916
Household	1605	1224	1473	1018	436	5756
Observations	1605	2310	2836	1018	436	8205
Log likelihood	−1087	159	−4108	−336	−363	−8597

Note: Standard errors are in parentheses.

* p<0.1. The reference group is head without any education (for head's education).

** p<0.05,

*** p<0.01,

Appendix B. Further robustness analysis

We estimate several model variants for robustness checks. These include the following models

1. Household random effects models (Tables B.1 and B.2)

for each country

$$y_{it} = \alpha + \beta X_{it} + \sum_{t=2}^{T} \varphi_t round_t + household_i + \epsilon_{it}$$

and for all the countries

$$y_{it} = \alpha + \beta X_{it} + \sum_{t=2}^{T} \varphi_t round_t + household_i + \tau_{it}$$

where α is an overall intercept, and $\sum_{t=2}^{T} \varphi_t round_t$ are survey round fixed effects

2. Mixed models with slope for age (Tables B.3 and B.4)

for each country

$$y_{ijrt} = \theta_t + \delta X_{ijr} + (\gamma + u_i)age_i + reg_r + com_j + household_i + \epsilon_{ijrt}$$

and for all the countries

$$y_{ijrkt} = \pi_t + \lambda X_{ijrk} + (\gamma + u_i)age_i + country_k + com_j + reg_r + household_i + \tau_{ijrkt}$$

where $(\gamma + u_i)age_i$ is a random slope for head's age at the household level, γ represents the fixed effects across all households and u_i represents the random effects.

3. Mixed models with slope for gender (Tables B.5 and B.6)

for each country

$$y_{ijrt} = \theta_t + \delta X_{ijr} + (\gamma + u_i)female_i + reg_r + com_j + household_i + \epsilon_{ijrt}$$

and for all the countries

$$y_{ijrkt} = \pi_t + \lambda X_{ijrk} + (\gamma + u_i)female_i + country_k + com_j + reg_r + household_i + \tau_{ijrkt}$$ where $(\gamma + u_i)female_i$ is a random slope for head's gender at the household level, γ represents the fixed effects across all households and u_i represents the random effects.

4. Mixed models with slope for consumption (Tables B.7 and B.8)

for each country

$$y_{ijrt} = \theta_t + \delta X_{ijr} + (\gamma + u_i)consumption_i + reg_r + com_j + household_i + \epsilon_{ijrt}$$

and for all the countries

$$y_{ijrkt} = \pi_t + \lambda X_{ijrk} + (\gamma + u_i)consumption_i + country_k + com_j + reg_r + household_i + \tau_{ijrkt}$$

where $(\gamma + u_i)consumption_i$ is a random slope for household consumption per capita at the household level, γ represents the fixed effects across all households and u_i represents the random effects.

5. Mixed models with interaction between urban location and consumption per capita (Tables B.9 and B.10)

for each country

$$y_{ijrt} = \theta_t + \delta X_{ijr} + \beta_1 consumption_{ij} + \beta_2 urban_{ij} + \beta_3(consumption_{ij} \times urban_{ij}) + reg_r + com_j + household_i + \epsilon_{ijrt}$$

and for all the countries

$$y_{ijrkt} = \pi_t + \lambda X_{ijrk} + \beta_1 consumption_{ij} + \beta_2 urban_{ij} + \beta_3(consumption_{ij} \times urban_{ij}) + country_k + com_j + reg_r + household_i + \tau_{ijrkt}$$

where $\beta_3(consumption_{ij} \times urban_{ij})$ is an interaction term between consumption per capita and urban location.

Table B.1

Correlates with any learning activities after COVID-19 school closures, Random Effects Model

Pre-COVID−19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Head's age	0.001	0.003***	0.001	0.001	0.002***	0.004***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.048**	0.040**	−0.021	−0.009	0.031*	0.040***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.01)
Head is employee	0.079***	0.029	0.023	0.055	0.012	0.035***
	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.01)
Head is self-employed	0.079***	−0.001	0.022	0.011	0.021	0.053***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.01)
Head's education level						
	0.018	0.087***	0.062*	0.114***	0.107***	0.129***
Primary	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.01)
	0.006	0.124***	0.132***	0.136***	0.164***	0.151***
Secondary incomplete	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.01)
	−0.022	0.172***	0.142**	0.150***	0.113***	0.235***
Secondary complete	(0.03)	(0.03)	(0.06)	(0.03)	(0.04)	(0.01)
	−0.016	0.160***	0.317***	0.136***	0.220***	0.279***
Post-secondary	(0.04)	(0.04)	(0.08)	(0.03)	(0.04)	(0.01)
Household composition						
Number of members aged 0–14	0.010**	0.001	−0.004	−0.001	0.042***	0.011***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Number of members aged 15–24	−0.000	0.008	0.019**	−0.015**	0.023***	0.004
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 25–59	0.005	0.042***	0.005	0.009	0.015	0.008**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 60 and older	0.021	0.004	−0.025	0.009	−0.035*	−0.017**
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)
Household consumption						
	0.077***	0.055***	0.021	0.061***	0.137***	0.052***
Log of consumption per capita	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
	0.065***	0.144***	0.068***	0.105***	0.066***	0.060***
Urban	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
	−0.023	−0.489***	−0.157	0.008	−0.716***	−0.227***
Constant	(0.11)	(0.10)	(0.12)	(0.14)	(0.08)	(0.04)
Number of observations	4549	11154	2338	7395	11508	38974

Note: Standard errors are in parentheses.

* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included.

** p<0.05,

*** p<0.01,

Table B.2
Correlates with number of learning activities after COVID-19 school closures, Random Effects Model

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Head's age	0.002*	0.006***	0.002	0.008**	0.003**	0.010***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.014	0.022	−0.036	−0.100	0.053**	0.032
	(0.04)	(0.03)	(0.03)	(0.10)	(0.03)	(0.02)
Head is employee	0.164***	−0.021	0.037	0.322*	−0.017	0.029
	(0.05)	(0.04)	(0.05)	(0.17)	(0.04)	(0.03)
Head is self-employed	0.091**	0.013	0.026	0.035	0.022	0.170***
	(0.04)	(0.03)	(0.04)	(0.12)	(0.03)	(0.02)
Head's education level						
Primary	0.103**	0.131***	0.065*	0.205**	0.092**	0.215***
	(0.04)	(0.03)	(0.04)	(0.10)	(0.04)	(0.02)
Secondary incomplete	−0.004	0.233***	0.166***	0.418**	0.201***	0.255***
	(0.05)	(0.05)	(0.04)	(0.18)	(0.05)	(0.03)
Secondary complete	−0.037	0.303***	0.170**	0.363***	0.138**	0.614***
	(0.06)	(0.05)	(0.07)	(0.11)	(0.06)	(0.04)
Post-secondary	−0.017	0.369***	0.373***	0.277**	0.314***	0.724***
	(0.08)	(0.08)	(0.10)	(0.12)	(0.06)	(0.04)
Household composition						
Number of members aged 0–14	0.017**	0.007	0.002	0.004	0.071***	0.024***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Number of members aged 15–24	0.019*	0.010	0.021**	−0.035	0.051***	0.001
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)
Number of members aged 25–59	0.012	0.052***	−0.003	0.042	0.032*	0.013
	(0.01)	(0.02)	(0.02)	(0.04)	(0.02)	(0.01)
Number of members aged 60 and older	0.016	−0.009	−0.033	−0.054	−0.015	−0.048**
	(0.03)	(0.04)	(0.03)	(0.08)	(0.03)	(0.02)
Household consumption						
Log of consumption per capita	0.191***	0.138***	0.024	0.298***	0.239***	0.134***
	(0.03)	(0.02)	(0.02)	(0.07)	(0.02)	(0.01)
Urban	0.094***	0.221***	0.072**	0.327***	0.131***	0.120***
	(0.03)	(0.03)	(0.03)	(0.08)	(0.03)	(0.02)
Constant	−0.795***	−1.206***	−0.190	−1.853***	−1.239***	−1.068***
	(0.21)	(0.19)	(0.14)	(0.54)	(0.14)	(0.10)
Number of observations	3208	8397	2338	6549	11508	33843

Note: Standard errors are in parentheses.

* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included.

** p<0.05,

*** p<0.01,

Table B.3
Correlates with any learning activities after COVID-19 school closures, conditional mixed model with a random slope on the age of the household head

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Head's age	0.001	0.002***	0.002	0.000	0.002***	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.046**	0.028*	−0.025	−0.020	0.017	0.006
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Head is employee	0.080***	0.033*	0.016	0.034	−0.035	0.019*
	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.01)
Head is self-employed	0.073***	0.001	0.011	0.008	−0.009	0.017*
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.01)
Head's education level						
Primary	0.012	0.041**	0.043	0.094***	0.109***	0.053***
	(0.02)	(0.02)	(0.04)	(0.02)	(0.03)	(0.01)
Secondary incomplete	−0.002	0.082***	0.112***	0.117***	0.175***	0.098***
	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.01)
Secondary complete	−0.006	0.121***	0.121**	0.126***	0.135***	0.113***
	(0.03)	(0.02)	(0.06)	(0.03)	(0.04)	(0.01)
Post-secondary	−0.013	0.110***	0.304***	0.133***	0.249***	0.147***
	(0.03)	(0.03)	(0.07)	(0.03)	(0.04)	(0.01)
Household composition						
Number of members aged 0–14	0.009**	0.014***	−0.006	0.000	0.037***	0.011***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Number of members aged 15–24	0.001	0.018***	0.018**	−0.009	0.031***	0.013***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 25–59	0.007	0.033***	0.004	0.015	0.023**	0.015***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 60 and older	0.008	0.007	−0.027	0.020	−0.026	−0.007
	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)
Household consumption						
Log of consumption per capita	0.074***	0.054***	0.026	0.039**	0.097***	0.064***

(continued on next page)

Table B.3 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
	0.065***	0.131***	0.046*	0.064***	0.045**	0.065***
Urban	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)
	−0.071	−0.443***	−0.170	0.204	−0.416***	−0.195**
Constant	(0.12)	(0.10)	(0.14)	(0.15)	(0.09)	(0.08)
						−1.779***
$\ln\sigma_k$						(0.28)
	−2.583***	−2.112***	−2.934***	−2.621***	−2.614***	−2.439***
$\ln\sigma_r$	(0.23)	(0.23)	(0.36)	(0.32)	(0.34)	(0.10)
	−2.231***	−2.027***	−2.633***	−2.575***	−2.303***	−2.251***
$\ln\sigma_j$	(0.09)	(0.06)	(0.25)	(0.21)	(0.10)	(0.04)
	−2.673***	−1.633***	−1.649***	−1.397***	−1.571***	−1.618***
$\ln\sigma_i$	(0.33)	(0.03)	(0.13)	(0.03)	(0.03)	(0.02)
$\ln\sigma_{AGE,i}$	−14.793	−18.933	−6.799***	−14.366	−17.324	−14.315
	(232.86)	(326.47)	(1.58)	(217.41)	(280.69)	(85.70)
	−0.905***	−0.961***	−1.084***	−0.947***	−0.897***	−0.908***
$\ln\sigma_{it}$	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)
Number of countries						7
Number of regions	13	11	31	6	6	108
Number of communities	532	446	239	475	655	3117
Number of households	1874	2276	1226	1621	1940	10,967
Number of observations	4549	11154	2338	7395	11508	38974
Log likelihood	−2527.16	−6191.86	−1126.55	−4363.56	−6990.71	−23645.16

Note: Standard errors are in parentheses.

* $p<0.1$. The reference group for household head's education levels is head without any education. Survey round fixed effects are included. The model includes a random slope for household head's age, allowing age effects to vary across households.

** $p<0.05$,

*** $p<0.01$,

Table B.4

Correlates with number of learning activities after COVID-19 school closures, conditional mixed model with a random slope on the age of the household head

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Head's age	0.002*	0.004***	0.002	0.004	0.003**	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.006	0.028	−0.039	−0.149	0.043*	−0.001
	(0.04)	(0.03)	(0.03)	(0.10)	(0.03)	(0.02)
Head is employee	0.166***	0.022	0.032	0.233	−0.069	0.041
	(0.05)	(0.03)	(0.05)	(0.16)	(0.04)	(0.03)
Head is self-employed	0.086**	0.004	0.016	0.022	−0.002	0.023
	(0.04)	(0.03)	(0.04)	(0.12)	(0.03)	(0.02)
Head's education level						
Primary	0.097**	0.051*	0.051	0.088	0.097**	0.066***
	(0.04)	(0.03)	(0.05)	(0.10)	(0.04)	(0.02)
Secondary incomplete	−0.009	0.150***	0.151***	0.305*	0.211***	0.162***
	(0.05)	(0.04)	(0.05)	(0.17)	(0.05)	(0.03)
Secondary complete	−0.037	0.196***	0.154**	0.248**	0.158***	0.189***
	(0.06)	(0.04)	(0.07)	(0.11)	(0.06)	(0.03)
Post-secondary	−0.038	0.262***	0.367***	0.261**	0.345***	0.281***
Household composition	(0.07)	(0.06)	(0.08)	(0.12)	(0.06)	(0.03)
Number of members aged 0–14	0.017**	0.024***	0.000	0.008	0.065***	0.023***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.00)
Number of members aged 15–24	0.022**	0.031***	0.019**	−0.009	0.054***	0.027***
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)
Number of members aged 25–59	0.009	0.050***	−0.004	0.072*	0.039**	0.034***
	(0.01)	(0.01)	(0.02)	(0.04)	(0.02)	(0.01)
Number of members aged 60 and older	−0.001	−0.009	−0.035	−0.009	−0.014	−0.018
	(0.03)	(0.03)	(0.03)	(0.08)	(0.03)	(0.02)
Household consumption						
Log of consumption per capita	0.177***	0.099***	0.029	0.189**	0.207***	0.141***
	(0.03)	(0.02)	(0.02)	(0.07)	(0.02)	(0.01)
Urban	0.100***	0.236***	0.059*	0.144*	0.116***	0.149***
	(0.03)	(0.04)	(0.03)	(0.08)	(0.03)	(0.02)
Constant	−0.791***	−0.901***	−0.210	−0.855	−1.047***	−0.823***
	(0.23)	(0.18)	(0.16)	(0.59)	(0.14)	(0.19)
						−0.908***
$\ln\sigma_k$						(0.28)
	−2.206***	−1.511***	−2.928***	−1.098***	−2.460***	−1.734***
$\ln\sigma_r$	(0.25)	(0.23)	(0.39)	(0.31)	(0.42)	(0.10)
	−3.506	−1.277***	−2.653***	−1.514***	−1.708***	−1.483***
$\ln\sigma_j$	(2.65)	(0.05)	(0.32)	(0.38)	(0.09)	(0.05)
$\ln\sigma_i$	−1.914***	−1.083***	−1.459***	0.009	−1.188***	−1.028***

Table B.4 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
	(0.35)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)
$\ln\sigma_{AGE,i}$	−18.092	−7.338	−13.633	−4.874***	−6.393***	−4.883***
	(369.42)	(6.90)	(216.95)	(0.40)	(0.79)	(0.06)
	−0.320***	−0.605***	−0.904***	0.224***	−0.429***	−0.207***
$\ln\sigma_{it}$	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)
Number of countries						7
Number of regions	13	11	31	6	6	108
Number of communities	529	446	239	475	655	3063
Number of households	1844	2068	1226	1614	1940	10,535
Number of observations	3208	8397	2338	6549	11,508	33,843
Log likelihood	−3603.51	−8022.25	−1527.09	−11882.30	−12355.10	−45440.29

Note: Standard errors are in parentheses.

* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included. The model includes a random slope for household head's age, allowing age effects to vary across households.

** p<0.05,

*** p<0.01,

Table B.5

Correlates with any learning activities after COVID-19 school closures, conditional mixed model with a random slope on the gender of the household head

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Head's age	0.001	0.002***	0.002	0.000	0.002***	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.046**	0.027*	−0.025	−0.022	0.017	0.006
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.01)
Head is employee	0.080***	0.034*	0.015	0.031	−0.035	0.020*
	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.01)
Head is self-employed	0.073***	0.001	0.010	0.006	−0.009	0.017*
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.01)
Head's education level						
	0.012	0.040**	0.044	0.096***	0.109***	0.053***
Primary	(0.02)	(0.02)	(0.04)	(0.02)	(0.03)	(0.01)
	−0.002	0.081***	0.112***	0.117***	0.175***	0.098***
Secondary incomplete	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.01)
	−0.006	0.120***	0.121**	0.125***	0.135***	0.112***
Secondary complete	(0.03)	(0.02)	(0.06)	(0.03)	(0.04)	(0.01)
	−0.013	0.110***	0.305***	0.133***	0.249***	0.146***
Post-secondary	(0.03)	(0.03)	(0.07)	(0.03)	(0.04)	(0.01)
Household composition						
Number of members aged 0–14	0.009**	0.014***	−0.006	0.000	0.037***	0.011***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Number of members aged 15–24	0.001	0.018***	0.018**	−0.010	0.031***	0.013***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 25–59	0.007	0.033***	0.004	0.016*	0.023**	0.015***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 60 and older	0.008	0.006	−0.027	0.019	−0.026	−0.008
	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)
Household consumption						
	0.074***	0.054***	0.026	0.039**	0.097***	0.064***
Log of consumption per capita	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
	0.065***	0.132***	0.046*	0.065***	0.045**	0.065***
Urban	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)
	−0.071	−0.442***	−0.165	0.202	−0.416***	−0.195**
Constant	(0.12)	(0.10)	(0.14)	(0.15)	(0.09)	(0.08)
						−1.779***
$\ln\sigma_k$						(0.28)
	−2.583***	−2.113***	−2.926***	−2.634***	−2.614***	−2.439***
$\ln\sigma_r$	(0.23)	(0.23)	(0.36)	(0.32)	(0.34)	(0.10)
	−2.231***	−2.025***	−2.647***	−2.583***	−2.303***	−2.251***
$\ln\sigma_j$	(0.09)	(0.06)	(0.25)	(0.21)	(0.10)	(0.04)
	−2.673***	−1.646***	−1.614***	−1.415***	−1.571***	−1.625***
$\ln\sigma_i$	(0.33)	(0.04)	(0.06)	(0.04)	(0.03)	(0.02)
$\ln\sigma_{FEMALE,i}$	−16.069	−2.835***	−17.598	−2.121***	−9.414	−3.043***
	(509.46)	(0.75)	(858.69)	(0.39)	(132.67)	(0.66)
	−0.905***	−0.961***	−1.084***	−0.947***	−0.897***	−0.908***
$\ln\sigma_{it}$	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)
Number of countries						7
Number of regions	13	11	31	6	6	108
Number of communities	532	446	239	475	655	3117
Number of households	1874	2276	1226	1621	1940	10,967
Number of observations	4549	11154	2338	7395	11508	38974
Log likelihood	−2527.16	−6191.63	−1126.60	−4362.61	−6990.71	−23644.87

Note: Standard errors are in parentheses.

* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included. The model includes a

random slope for household head's gender, allowing gender effects to vary across households.
** p<0.05,
*** p<0.01,

Table B.6
Correlates with number of learning activities after COVID-19 school closures, conditional mixed model with a random slope on the gender of the household head

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Head's age	0.002*	0.004***	0.002	0.004	0.003**	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.007	0.028	−0.039	−0.146	0.044*	−0.001
	(0.04)	(0.03)	(0.03)	(0.10)	(0.03)	(0.02)
Head is employee	0.166***	0.022	0.032	0.228	−0.068	0.040
	(0.05)	(0.03)	(0.05)	(0.16)	(0.04)	(0.03)
Head is self-employed	0.086**	0.004	0.016	0.018	−0.002	0.018
	(0.04)	(0.03)	(0.04)	(0.12)	(0.03)	(0.02)
Head's education level						
Primary	0.097**	0.051*	0.051	0.095	0.096**	0.068***
	(0.04)	(0.03)	(0.05)	(0.10)	(0.04)	(0.02)
Secondary incomplete	−0.009	0.150***	0.151***	0.307*	0.209***	0.163***
	(0.05)	(0.04)	(0.05)	(0.17)	(0.05)	(0.03)
Secondary complete	−0.038	0.196***	0.154**	0.257**	0.158***	0.198***
	(0.06)	(0.04)	(0.07)	(0.11)	(0.06)	(0.03)
Post-secondary	−0.038	0.262***	0.367***	0.272**	0.345***	0.293***
	(0.07)	(0.06)	(0.08)	(0.12)	(0.06)	(0.03)
Household composition						
Number of members aged 0–14	0.017**	0.024***	0.000	0.010	0.065***	0.024***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.00)
Number of members aged 15–24	0.022**	0.031***	0.019**	−0.009	0.054***	0.027***
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)
Number of members aged 25–59	0.010	0.050***	−0.004	0.069*	0.039**	0.031***
	(0.01)	(0.01)	(0.02)	(0.04)	(0.02)	(0.01)
Number of members aged 60 and older	−0.001	−0.010	−0.035	−0.007	−0.013	−0.016
	(0.03)	(0.03)	(0.03)	(0.08)	(0.03)	(0.02)
Household consumption						
Log of consumption per capita	0.177***	0.099***	0.029	0.192***	0.207***	0.143***
	(0.03)	(0.02)	(0.02)	(0.07)	(0.02)	(0.01)
Urban	0.100***	0.236***	0.059*	0.137*	0.117***	0.147***
	(0.03)	(0.04)	(0.03)	(0.08)	(0.03)	(0.02)
Constant	−0.709***	−0.897***	−0.194	−0.867	−1.047***	−0.807***
	(0.22)	(0.18)	(0.16)	(0.58)	(0.14)	(0.19)
$\ln\sigma_k$						−0.912***
						(0.28)
$\ln\sigma_r$	−2.206***	−1.511***	−2.928***	−1.100***	−2.458***	−1.735***
	(0.25)	(0.23)	(0.39)	(0.31)	(0.42)	(0.10)
$\ln\sigma_j$	−3.508	−1.278***	−2.653***	−1.506***	−1.710***	−1.496***
	(2.64)	(0.05)	(0.32)	(0.37)	(0.09)	(0.05)
$\ln\sigma_i$	−1.938***	−1.079***	−1.459***	0.078***	−1.152***	−0.671***
	(0.38)	(0.03)	(0.06)	(0.03)	(0.03)	(0.01)
$\ln\sigma_{FEMALE,i}$	−2.378	−12.192	−16.580	−11.637	−18.405	−14.075***
	(1.84)	(174.13)	(576.46)	(205.13)	(304.67)	(0.21)
$\ln\sigma_{it}$	−0.320***	−0.605***	−0.904***	0.224***	−0.429***	−0.207***
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)
Number of countries						7
Number of regions	13	11	31	6	6	108
Number of communities	529	446	239	475	655	3063
Number of households	1844	2068	1226	1614	1940	10,535
Number of observations	3208	8397	2338	6549	11,508	33,843
Log likelihood	3208	8397	2338	6549	11508	33843

Note: Standard errors are in parentheses.
* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included. The model includes a random slope for household head's gender, allowing gender effects to vary across households.
** p<0.05,
*** p<0.01,

Table B.7
Correlates with any learning activities after COVID-19 school closures, conditional mixed model with a random slope on the consumption per capita

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Head's age	0.001	0.002***	0.002	0.000	0.002***	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.046**	0.026*	−0.024	−0.020	0.017	0.006
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Head is employee	0.080***	0.033*	0.014	0.034	−0.035	0.019*

Table B.7 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.01)
Head is self-employed	0.073***	−0.001	0.009	0.008	−0.009	0.017*
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.01)
Head's education level						
	0.012	0.039**	0.045	0.094***	0.109***	0.053***
Primary	(0.02)	(0.02)	(0.04)	(0.02)	(0.03)	(0.01)
	−0.002	0.080***	0.112***	0.117***	0.175***	0.098***
Secondary incomplete	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.01)
	−0.006	0.116***	0.121**	0.126***	0.135***	0.113***
Secondary complete	(0.03)	(0.02)	(0.06)	(0.03)	(0.04)	(0.01)
	−0.013	0.105***	0.308***	0.133***	0.249***	0.147***
Post-secondary	(0.03)	(0.03)	(0.07)	(0.03)	(0.04)	(0.01)
Household composition						
Number of members aged 0–14	0.009**	0.013***	−0.005	0.000	0.037***	0.011***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Number of members aged 15–24	0.001	0.018***	0.019**	−0.009	0.031***	0.013***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 25–59	0.007	0.033***	0.006	0.015	0.023**	0.015***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 60 and older	0.008	0.008	−0.026	0.020	−0.026	−0.007
	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)
Household consumption						
Log of consumption per capita	0.074***	0.053***	0.025	0.039**	0.097***	0.064***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Urban	0.065***	0.130***	0.047*	0.064***	0.045**	0.065***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)
Constant	−0.067	−0.428***	−0.168	0.204	−0.416***	−0.195**
	(0.12)	(0.10)	(0.14)	(0.15)	(0.09)	(0.08)
$\ln\sigma_k$						−1.791***
						(0.28)
$\ln\sigma_r$	−2.580***	−2.117***	−2.925***	−2.621***	−2.614***	−2.434***
	(0.23)	(0.23)	(0.35)	(0.32)	(0.34)	(0.10)
$\ln\sigma_j$	−2.237***	−2.024***	−2.677***	−2.575***	−2.303***	−2.250***
	(0.09)	(0.06)	(0.26)	(0.21)	(0.10)	(0.04)
$\ln\sigma_i$	−15.137	−11.670	−13.876	−1.397***	−1.571***	−1.617***
	(939.95)	(207.65)	(1161.74)	(0.03)	(0.03)	(0.02)
$\ln\sigma_{consumption.i}$	−4.582***	−3.604***	−3.522***	−13.091	−18.516	−15.824***
	(0.26)	(0.03)	(0.06)	(170.69)	(329.37)	(0.15)
$\ln\sigma_{it}$	−0.908***	−0.962***	−1.089***	−0.947***	−0.897***	−0.908***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)
Number of countries						7
Number of regions	13	11	31	6	6	108
Number of communities	532	446	239	475	655	3117
Number of households	1874	2276	1226	1621	1940	10,967
Number of observations	4549	11154	2338	7395	11508	38974
Log likelihood	−2526.38	−6186.88	−1120.52	−4363.56	−6990.71	−23649.32

Note: Standard errors are in parentheses.

* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included. The model includes a random slope for household consumption per capita, allowing the effects of consumption per capita to vary across households.

** p<0.05,

*** p<0.01,

Table B.8

Correlates with number of learning activities after COVID-19 school closures, conditional mixed model with a random slope on the consumption per capita

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Head's age	0.002*	0.004***	0.002	0.004	0.003**	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.008	0.027	−0.039	−0.144	0.041*	0.000
	(0.04)	(0.03)	(0.03)	(0.10)	(0.02)	(0.02)
Head is employee	0.166***	0.020	0.031	0.239	−0.070*	0.036
	(0.05)	(0.04)	(0.05)	(0.16)	(0.04)	(0.03)
Head is self-employed	0.085**	0.004	0.016	0.023	−0.005	0.017
	(0.04)	(0.03)	(0.04)	(0.12)	(0.03)	(0.02)
Head's education level						
Primary	0.097**	0.048	0.051	0.098	0.096**	0.073***
	(0.04)	(0.03)	(0.05)	(0.10)	(0.04)	(0.02)
Secondary incomplete	−0.009	0.147***	0.149***	0.302*	0.206***	0.167***
	(0.05)	(0.04)	(0.05)	(0.17)	(0.05)	(0.03)
Secondary complete	−0.038	0.192***	0.152**	0.253**	0.156***	0.201***
	(0.06)	(0.04)	(0.07)	(0.11)	(0.06)	(0.03)
Post-secondary	−0.039	0.251***	0.370***	0.267**	0.339***	0.295***
	(0.07)	(0.06)	(0.08)	(0.12)	(0.06)	(0.03)

Table B.8 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	All
Household composition						
Number of members aged 0–14	0.017**	0.022***	0.001	0.007	0.063***	0.022***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.00)
Number of members aged 15–24	0.022**	0.029***	0.020**	−0.009	0.054***	0.029***
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)
Number of members aged 25–59	0.009	0.049***	−0.002	0.076**	0.040**	0.033***
	(0.01)	(0.01)	(0.02)	(0.04)	(0.02)	(0.01)
Number of members aged 60 and older	−0.000	−0.013	−0.034	0.002	−0.018	−0.016
	(0.03)	(0.03)	(0.03)	(0.08)	(0.03)	(0.02)
Household consumption						
Log of consumption per capita	0.176***	0.100***	0.028	0.190**	0.208***	0.145***
	(0.03)	(0.02)	(0.02)	(0.07)	(0.02)	(0.01)
Urban	0.100***	0.234***	0.060*	0.142*	0.109***	0.141***
	(0.03)	(0.04)	(0.03)	(0.08)	(0.03)	(0.02)
Constant	−0.781***	−0.894***	−0.212	−0.866	−1.041***	−0.832***
	(0.23)	(0.18)	(0.16)	(0.59)	(0.14)	(0.19)
$\ln\sigma_k$						−0.928***
						(0.28)
$\ln\sigma_r$	−2.211***	−1.520***	−2.926***	−1.104***	−2.530***	−1.736***
	(0.25)	(0.23)	(0.39)	(0.31)	(0.45)	(0.10)
$\ln\sigma_j$	−17.348***	−1.291***	−2.704***	−1.536***	−1.759***	−1.539***
	(0.09)	(0.05)	(0.34)	(0.39)	(0.09)	(0.05)
$\ln\sigma_i$	−17.918	−16.434	−18.458	−0.312	−15.925	−12.345
	(528.00)	(310.13)	(748.68)	(0.34)	(223.81)	(182.39)
$\ln\sigma_{consumption,i}$	−3.583***	−3.048***	−3.359***	−2.190***	−3.016***	−2.618***
	(0.16)	(0.03)	(0.06)	(0.29)	(0.03)	(0.01)
$\ln\sigma_{it}$	−0.340***	−0.607***	−0.912***	0.224***	−0.430***	−0.208***
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)
Number of countries						7
Number of regions	13	11	31	6	6	108
Number of communities	529	446	239	475	655	3063
Number of households	1844	2068	1226	1614	1940	10,535
Number of observations	3208	8397	2338	6549	11,508	33,843
Log likelihood	−3599.46	−8002.96	−1519.21	−11881.69	−12332.42	−45418.42

Note: Standard errors are in parentheses.

* $p<0.1$. The reference group for household head's education levels is head without any education. Survey round fixed effects are included. The model includes a random slope for household consumption per capita, allowing the effects of consumption per capita to vary across households.

** $p<0.05$,

*** $p<0.01$,

Table B.9

Correlates with any learning activities after COVID-19 school closures, conditional mixed model with interaction between urban location and consumption per capita

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.001	0.002***	0.002	0.000	0.002***	0.003**	0.003**	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.046**	0.028*	−0.024	−0.021	0.017	0.013	0.003	0.006
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.01)
Head is employee	0.080***	0.033*	0.015	0.035	−0.035	0.041	0.027	0.020*
	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.05)	(0.05)	(0.01)
Head is self-employed	0.073***	0.001	0.011	0.008	−0.009	0.061	0.016	0.017*
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.04)	(0.04)	(0.01)
Head's education level								
Primary	0.012	0.041**	0.043	0.094***	0.109***	0.018	0.073	0.053***
	(0.02)	(0.02)	(0.04)	(0.02)	(0.03)	(0.04)	(0.04)	(0.01)
Secondary incomplete	−0.002	0.082***	0.111**	0.116***	0.175***	0.113**	0.126**	0.098***
	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.05)	(0.05)	(0.01)
Secondary complete	−0.006	0.119***	0.122**	0.125***	0.135***	0.187***	0.064	0.113***
	(0.03)	(0.02)	(0.06)	(0.03)	(0.04)	(0.05)	(0.10)	(0.01)
Post-secondary	−0.012	0.108***	0.309***	0.134***	0.249***	0.252***	0.138	0.147***
	(0.03)	(0.03)	(0.07)	(0.03)	(0.04)	(0.05)	(0.10)	(0.01)
Household composition								
Number of members aged 0–14	0.009**	0.014***	−0.006	0.001	0.036***	0.002	−0.002	0.011***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)
Number of members aged 15–24	0.001	0.018***	0.018**	−0.010	0.031***	0.002	0.002	0.013***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Number of members aged 25–59	0.007	0.033***	0.004	0.016*	0.023**	0.026**	−0.029	0.015***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.00)
Number of members aged 60 and older	0.008	0.007	−0.027	0.020	−0.026	0.009	−0.030	−0.008
	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.04)	(0.01)
Household consumption								
Log of consumption per capita	0.077***	0.040**	0.036	0.051**	0.097***	0.074**	−0.082**	0.068***
	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)	(0.03)	(0.04)	(0.01)

Table B.9 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania	All
	0.094	−0.022	0.224	0.307	0.034	−0.126	−1.220***	0.133*
Urban	(0.20)	(0.16)	(0.24)	(0.23)	(0.15)	(0.42)	(0.38)	(0.07)
	−0.004	0.022	−0.026	−0.034	0.002	0.014	0.171***	−0.010
Log of consumption per capita # Urban	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.06)	(0.05)	(0.01)
	−0.094	−0.345**	−0.233	0.115	−0.413***	−0.470*	1.163***	−0.227***
Constant	(0.19)	(0.14)	(0.17)	(0.17)	(0.10)	(0.28)	(0.30)	(0.09)
								−1.791***
$\ln\sigma_k$								(0.28)
	−2.584***	−2.111***	−2.926***	−2.614***	−2.614***	−11.068	−2.022***	−2.435***
$\ln\sigma_r$	(0.23)	(0.23)	(0.36)	(0.32)	(0.34)	(266.46)	(0.19)	(0.10)
	−2.231***	−2.029***	−2.645***	−2.586***	−2.302***	−2.526***	−13.536	−2.252***
$\ln\sigma_j$	(0.09)	(0.06)	(0.25)	(0.21)	(0.10)	(0.43)	(2088.14)	(0.04)
	−2.672***	−1.633***	−1.612***	−1.397***	−1.571***			−0.908***
$\ln\sigma_i$	(0.33)	(0.03)	(0.06)	(0.03)	(0.03)			(0.00)
	−0.905***	−0.961***	−1.084***	−0.947***	−0.897***	−0.755***	−0.984***	−1.617***
$\ln\sigma_{it}$	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.03)	(0.02)
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	3117
Number of households	1874	2276	1226	1621	1940	1249	781	10,967
Number of observations	4549	11,154	2338	7395	11,508	1249	781	38,974
Log likelihood	−2527.14	−6191.37	−1126.31	−4362.99	−6990.71	−846.68	−358.98	−23648.85

Note: Standard errors are in parentheses.

* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included.

** p<0.05,

*** p<0.01,

Table B.10

Correlates with number of learning activities after COVID-19 school closures, conditional mixed model with interaction between urban location and consumption per capita

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania	All
Head's age	0.002*	0.004***	0.002	0.004	0.003**	0.003**	0.004	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Head is female	0.007	0.028	−0.039	−0.149	0.044*	0.148**	0.024	−0.001
	(0.04)	(0.03)	(0.03)	(0.10)	(0.03)	(0.06)	(0.07)	(0.02)
Head is employee	0.170***	0.022	0.032	0.232	−0.063	0.124**	0.004	0.040
	(0.05)	(0.03)	(0.05)	(0.16)	(0.04)	(0.06)	(0.09)	(0.03)
Head is self-employed	0.087**	0.004	0.017	0.017	0.001	0.074	−0.037	0.018
	(0.04)	(0.03)	(0.04)	(0.12)	(0.03)	(0.05)	(0.08)	(0.02)
Head's education level								
	0.096**	0.050*	0.049	0.095	0.097**	−0.002	0.108	0.071***
Primary	(0.04)	(0.03)	(0.05)	(0.10)	(0.04)	(0.05)	(0.09)	(0.02)
	−0.005	0.149***	0.149***	0.306*	0.211***	0.166***	0.252**	0.167***
Secondary incomplete	(0.05)	(0.04)	(0.05)	(0.17)	(0.05)	(0.06)	(0.10)	(0.03)
	−0.029	0.191***	0.155**	0.254**	0.158***	0.278***	0.322	0.204***
Secondary complete	(0.06)	(0.04)	(0.07)	(0.11)	(0.06)	(0.06)	(0.20)	(0.03)
	−0.026	0.256***	0.372***	0.276**	0.336***	0.342***	0.506***	0.297***
Post-secondary	(0.07)	(0.06)	(0.08)	(0.12)	(0.06)	(0.06)	(0.19)	(0.03)
Household composition								
Number of members aged 0–14	0.018**	0.023***	0.001	0.010	0.064***	0.025***	0.007	0.023***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.00)
Number of members aged 15–24	0.022**	0.031***	0.019**	−0.011	0.053***	0.018	0.009	0.028***
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.02)	(0.01)
Number of members aged 25–59	0.010	0.050***	−0.004	0.072*	0.040**	0.020	0.046	0.031***
	(0.01)	(0.01)	(0.02)	(0.04)	(0.02)	(0.01)	(0.04)	(0.01)
Number of members aged 60 and older	−0.001	−0.009	−0.035	−0.008	−0.013	0.023	−0.040	−0.016
	(0.03)	(0.03)	(0.03)	(0.08)	(0.03)	(0.03)	(0.08)	(0.02)
Household consumption								
	0.224***	0.063*	0.041	0.239***	0.173***	0.065	−0.065	0.143***
Log of consumption per capita	(0.05)	(0.03)	(0.03)	(0.09)	(0.02)	(0.04)	(0.08)	(0.02)
	0.544	−0.164	0.263	1.048	−0.651***	−0.241	−0.745	0.111
Urban	(0.39)	(0.28)	(0.28)	(0.90)	(0.23)	(0.53)	(0.76)	(0.17)
	−0.062	0.057	−0.029	−0.126	0.115***	0.026	0.112	0.004
Log of consumption per capita # Urban	(0.05)	(0.04)	(0.04)	(0.12)	(0.03)	(0.07)	(0.11)	(0.02)
	−1.135***	−0.654***	−0.289	−1.219*	−0.842***	−0.603*	0.839	−0.822***
Constant	(0.38)	(0.25)	(0.19)	(0.68)	(0.16)	(0.35)	(0.64)	(0.20)
								−0.924***
$\ln\sigma_k$								(0.28)
	−2.209***	−1.508***	−2.931***	−1.096***	−2.289***	−3.229***	−1.392***	−1.729***
$\ln\sigma_r$	(0.25)	(0.23)	(0.39)	(0.31)	(0.40)	(0.65)	(0.20)	(0.10)
	−3.583	−1.283***	−2.652***	−1.498***	−1.714***	−2.298***	−1.536***	−1.497***
$\ln\sigma_j$	(3.07)	(0.05)	(0.32)	(0.37)	(0.09)	(0.36)	(0.24)	(0.05)

Table B.10 (*continued*)

Pre-COVID-19 variables	Burkina Faso	Ethiopia	Malawi	Nigeria	Uganda	Mali	Tanzania	All
$\ln\sigma_i$	−1.915***	−1.079***	−1.456***	0.077***	−1.158***			−0.207***
	(0.35)	(0.03)	(0.06)	(0.03)	(0.03)			(0.00)
$\ln\sigma_{it}$	−0.320***	−0.605***	−0.905***	0.224***	−0.429***	−0.536***	−0.528***	−0.671***
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.04)	(0.01)
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	3063
Number of households	1844	2068	1226	1614	1940	1249	594	10,535
Number of observations	3208	8397	2338	6549	11,508	1249	594	33,843
Log likelihood	−3602.85	−8021.20	−1526.81	−11882.64	−12349.77	−1122.14	−580.34	−45488.10

Note: Standard errors are in parentheses.

* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included.

** p<0.05,

*** p<0.01,

Table B.11

Correlates with any learning activities/ number of learning activities after COVID-19 school closures with correction for attrition, conditional mixed model

Pre-COVID-19 variables	Determinants of any learning activities	Determinants of number of learning activities
Head's age	0.002***	0.003***
	(0.00)	(0.00)
Head is female	0.010	−0.006
	(0.01)	(0.03)
Head is employee	0.030	0.036
	(0.03)	(0.05)
Head is self-employed	0.022	0.026
	(0.02)	(0.03)
Head's education level		
Primary	0.051**	0.073***
	(0.02)	(0.02)
Secondary incomplete	0.097***	0.167***
	(0.03)	(0.04)
Secondary complete	0.100***	0.197***
	(0.03)	(0.06)
Post-secondary	0.138***	0.298***
	(0.04)	(0.07)
Household composition		
Number of members aged 0–14	0.015**	0.029**
	(0.01)	(0.01)
Number of members aged 15–24	0.015	0.031**
	(0.01)	(0.01)
Number of members aged 25–59	0.013*	0.031*
	(0.01)	(0.02)
Number of members aged 60 and older	−0.007	−0.012
	(0.01)	(0.02)
Household consumption		
Log of consumption per capita	0.064***	0.154***
	(0.02)	(0.04)
Urban	0.083***	0.157***
	(0.02)	(0.03)
Constant	−0.308**	−0.888***
	(0.14)	(0.28)
$\ln\sigma_k$	−1.978***	−0.766
	(0.56)	(0.70)
$\ln\sigma_r$	−2.467***	−1.685***
	(0.66)	(0.64)
$\ln\sigma_j$	−2.192***	−1.408***
	(0.14)	(0.18)
$\ln\sigma_i$	−1.380***	−0.458
	(0.05)	(0.33)
$\ln\sigma_{it}$	−1.000***	−0.223
	(0.04)	(0.23)
Number of countries	5	5
Number of regions	67	67
Number of communities	2319	2319
Number of households	8734	8573
Number of observations	30,800	29,301
Log likelihood	−25097.01	−58352.81

Note: Standard errors are in parentheses.

* p<0.1. The reference group for household head's education levels is head without any education. Survey round fixed effects are included. Inverse probability weights were used to account for attrition as suggested in Wooldridge (2002), where the inverse probability weights were calculated based on the probability of each household's continued participation across survey rounds. Only households that participated in at least two rounds were included in the regression analysis.

** p<0.05,

*** p<0.01,

Table B.12

Correlates with any learning activities/ number of learning activities after COVID-19 school closures, conditional mixed model

Pre-COVID−19 variables	Correlates with any learning activities	Correlates with number of learning activities
Number of calendar days between the first day and the last day of full school closures due to COVID−19	−0.000	−0.000
	(0.00)	(0.00)
Head's age	0.002***	0.003***
	(0.00)	(0.00)
Head is female	0.006	−0.001
	(0.01)	(0.02)
Head is employee	0.019*	0.040
	(0.01)	(0.03)
Head is self-employed	0.017*	0.018
	(0.01)	(0.02)
Head's education level		
	0.053***	0.071***
Primary	(0.01)	(0.02)
	0.098***	0.167***
Secondary incomplete	(0.01)	(0.03)
	0.113***	0.204***
Secondary complete	(0.01)	(0.03)
	0.147***	0.297***
Post-secondary	(0.01)	(0.03)
Household composition		
Number of members aged 0–14	0.011***	0.024***
	(0.00)	(0.00)
Number of members aged 15–24	0.013***	0.028***
	(0.00)	(0.01)
Number of members aged 25–59	0.015***	0.031***
	(0.00)	(0.01)
Number of members aged 60 and older	−0.007	−0.016
	(0.01)	(0.02)
Household consumption		
	0.064***	0.145***
Log of consumption per capita	(0.01)	(0.01)
	0.065***	0.142***
Urban	(0.01)	(0.02)
	−0.168	−0.756***
Constant	(0.12)	(0.29)
	−1.799***	−0.934***
$\ln\sigma_k$	(0.28)	(0.28)
	−2.434***	−1.729***
$\ln\sigma_r$	(0.10)	(0.10)
	−2.250***	−1.497***
$\ln\sigma_j$	(0.04)	(0.05)
	−1.617***	−0.671***
$\ln\sigma_i$	(0.02)	(0.01)
	−0.908***	−0.207***
$\ln\sigma_{it}$	(0.00)	(0.00)
Number of countries	7	7
Number of regions	108	108
Number of communities	3117	3063
Number of households	10,967	10,535
Number of observations	38,974	33,843
Log likelihood	−23649.27	−45488.05

Note: Standard errors are in parentheses.

* $p<0.1$. The reference group for household head's education levels is head without any education. Survey round fixed effects are included.

** $p<0.05$,

*** $p<0.01$,

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