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Child education in the time of pandemic: Learning loss and dropout

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ABSTRACT

The disruptive effects of the COVID-19 pandemic had affected the education sector at an unprecedented scale. In order to contain the spread of the virus, a large number of countries across the globe have shut their schools to handle the pandemic. However, it has adversely affected students’ learning and school attendance. In this regard, we assess the impact of COVID-19 on the learning loss, school dropout, and the economic costs in term of foregone earnings for children in Pakistan. The study finds a substantial decrease in Learning Adjusted Years of Schooling (LAYS) with worsening consequences for girls than boys. Likewise, the aggregate economic cost amounts to 107 billion dollars when adjusted for human capital utilisation. Besides, our simulation results suggest that about 7.2 million children dropout due to a reduction in household expenditure by 50 percent. In comparison, the dropout is more pronounced at the primary level of schooling. The results recommend that the government design robust social protection and remote education strategies to mitigate school closure’s adverse effect on children’s learning. The emphasis should be rather on the long run strategies to cope with a resilient education system of futuristic orientation.

1. Background

Globally, the COVID-19 crises have resulted in lockdowns, quarantines, and social distancing to combat disease transmission. In response, to impede the pandemic’s likely accelerated spread, Pakistan’s government has also closed public and private institutions in mid-March 2020. Before the COVID-19 outbreak, the country’s education system was already suffering from structural weakness and learning crises. Thus, the unenrolled schoolchildren closures have resulted in a further dent in the country’s efforts to build productive human capital for the future.

To date, the lockdown strategies have been proven effective to slow the transmission of disease, but complete lockdowns might not be efficient in the long run (Kanga, Meraj, Farooq, Nathawat, & Singh, 2020a; Ranga, Pani, Kanga, Meraj, Farooq, Nathawat, & Singh, 2020). For instance, the COVID-19 related school closures have affected 55.3 million children in Pakistan between 5 and 16 (pre-primary up to higher secondary). Besides, Pakistan has about 22.8 million children already out of school between the ages of 5–16, which accounts for 44 percent of children in this age group (Shah, Amin, Muhammad, Piracha, & Adeel, 2018). The primary school completion rate is very low in the country, as the average dropout rate before completing primary school is 6.7 percent, whereas 18.6 percent at the end of primary school (PSLM, 2018).

The initial response of the government during school closures has been primarily related to remote learning such as online or televised broadcasting to ensure continued learning for children (Pal & Vanijja, 2020). The standard environment used for online lectures is student homes, personal laptop, and smartphone. However, the quality of interactions can vary depending on the teachers’ access to technology and network stability (Shim et al., 2020). Despite different attempts to continue education, the closures would still produce substantial learning losses (Rogers & Sabarwal, 2020). Recognizing that these effects will be highly heterogeneous, as children of the poor households are more vulnerable due to inadequate digital gadgets, internet connectivity, and top of all – lower parental education (Kuhfeld et al., 2020; Mundy & Hares, 2020). Consequently, these children may end up with low learning and schooling (Lustig et al., 2020). This will further deepen the learning gap among children and push a sizeable proportion of children out of school.

The PSLM (2018) survey shows more significant regional disparity on the internet and mobile services penetration in Pakistan. For instance, access to digital facilities such as laptops, tablets, and computers is around 14 percent, i.e., 27 percent in urban and 7 percent in the country’s rural areas. Along with that, only 45 percent of individuals

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own a mobile/smartphone. Furthermore, as for mobile phone use, 94 percent of individuals in urban areas reported having used a mobile/smartphone compared to 90 percent in rural areas. Although access to the internet is minimal and unequal; only 17 percent individuals of age ten years and above reported that they used the internet in the past three months. Of these, roughly 29 percent reside in urban and 10 percent in rural areas. Hence, the pandemic has exposed the pre-existing deficits in the education system and would probably intensify the already disadvantaged communities’ risk and vulnerabilities. Therefore, this study attempts to better understand how school closure due to pandemic may impact the learning crises and dropout. This study’s aim is fourfold; firstly, we simulate the likely effect on child school attendance of a reduction in household income (i.e., by 10, 25, and 50 percent) of an average household in Pakistan to know the effect of the COVID-19 pandemic on child school attendance. Secondly, to understand the likely change in LAYS for the children in Pakistan after school closures using the scenario-based analysis. Thirdly, to gauge the effect of changes in LAYS on individual earnings and aggregate economic cost in terms of forgone earnings. Finally, to predict the children dropout in effect of income contraction and workers layoff due to COVID-19.

As the reduced human capital due to the pandemic could have negative implications for important future outcomes. Therefore, the analysis in this study could help policymakers to devise effective learning and social protection strategies to lessen the adverse effects of pandemic cum school closure in Pakistan.

This paper is organised as follows. Section 2 presents the review of existing literature, section 3 explains the learning gap in Pakistan, section 4 discusses the methodology, and section 5 reports the empirical results. Finally, section 6 concludes with policy recommendations.

2. Review of existing literature

Research has been conducted on the previous health crises (such as the Spanish flu, H1N1, and the Ebola epidemics) and their impact on children’s education in other countries. It has been shown that such a crisis had not only cost lives and employment but had also substantially deteriorated learning achievement and dropout of school-age children (Amorim et al., 2020; Elston et al., 2017; Fischer et al., 2018; Percoco, 2016; Smith, 2020).

Recently in response to the COVID-19 crisis, some studies have also analysed the pandemic’s impact on learning outcomes and school dropouts from other countries (Azevedo, Hasan, Goldemberg, Iqbal, & Geven, 2020; Dorn, Hancock, Sarakatsannis, & Viruleg, 2020). However, the effect will be more profound in low-income families with greater learning deficits and higher dropout rates (Ruhfeld et al., 2020; Chetty, Friedman, Hendren, & Stepner, 2020; Rogers & Sabarwal, 2020).

At the global level, Azevedo et al. (2020) estimate that the school closure amid COVID-19 could result in a loss of 0.3 to 0.9 years of LAYS. This will bring down the effective years of schooling that students achieve during their lifetime from 7.9 years to between 7.0 and 7.6 years. The learning loss is more likely among students attending public and low-cost private schools with fewer resources or students from poor backgrounds (Ruhfeld et al., 2020). Alternatively, Chetty et al. (2020) show that the effectiveness of the online mode of instructions decreases significantly with poorer ZIP codes. Likewise, Mundy and Hares (2020) reported that improved access to remote learning tools and materials is complemented by higher parental engagement at home in the learning process enhances educational outcomes.

Consequently, when the schools reopened the children of the well-off parents performed well after relatively to the children of the less well-off parents (Fuchs et al., 2020). In the same vein, Lustig et al. (2020) suggest that the school completion rates among children from low-educated families are likely to drop substantially compared to the highly educated families’ children. Besides, the adverse effect would exacerbate as the school support has been reduced, and the increase in demand for students’ independent tasks (Bonal & González, 2020).

Similarly, digital inequality and teacher inexperience in providing high-quality remote learning adversely affect the students’ learning opportunities (Kay et al., 2020). In India’s case, Alvi and Gupta (2020) argue that school closure impacts are likely to be more substantial for girls and children from already disadvantaged ethnic and caste groups. Therefore, family response to school closure is likely to produce significant differences in children’s learning opportunities from different social backgrounds (Burgess & Sievertsen, 2020). In addition to learning loss, COVID-19 school closures will probably increase school dropout rates. Globally, the income shock due to COVID-19 alone would contribute to around 7 million more dropouts from primary up to secondary education (Azevedo et al., 2020). In another study, Dorn et al. (2020) estimate that 2 to 9 percent of students could dropout during COVID-19 school closure. The learning loss and increase dropout rates— are not likely to be temporary shocks but could continue to accumulate learning losses even after children return to school. Kaffenberger (2020) suggests the school closure for three months, reducing long-term learning by a year’s worth of education. However, the government’s effective remediation measure would reduce long-term learning losses.

In Pakistan’s context, Rehman and Ahmed, and Sarwar (2020) explain that students with limited or no access to digital technology during the current school closures would have adverse effects on their wellbeing and learning. Therefore, a significant concern is that short term losses in learning due to school closure could continue to accumulate after children return to school. Subsequently, the closures could cause disproportionate learning losses and lead more of them to drop out of school in the long run. Beyond the recent pandemic, Andrabi, Daniels, and Das (2020) analysed the impact of the 2005 earthquake in Pakistan on children’s learning four years later using a comparison group. The schools in the affected area were closed for about 14 weeks. The study suggests that learning loss by one-third of a school year in grade 3 diminishes later learning by a much larger amount. Other empirical studies in the case of Pakistan have found that a child’s specific and household characteristics and the community-level factors influence the children lost learning and dropout of school. Concerning the dropout from the school, Mughal, Aldridge, and Monaghan (2019) argue that poor educational records and poverty increase the likelihood of school dropout.

Furthermore, Andrabi et al. (2010) reported that poverty is one of the main factors for children dropping out of school, suggesting that the rationing of limited resources leads to parents picking winners at an early age. They invest in the child if they believe it is most likely to succeed. Besides, the opportunity cost of having a child enrolled in school is reasonably high for the disadvantaged group of households. Parents cannot be convinced to bear the education cost if they observe that education quality is low. The possible benefits are not significant to keep children in school. The other factors include higher travelling costs for school put extra burden on vulnerable families, causing dropout or parents avoid sending their children to school, particularly the girls (Naz, Ejaz, & Khan, 2019; Ali, Hussain, & Khan, 2012; Hussian et al., 2011; Khan, Tahir, & Shah, 2011).

Moreover, this distance – dropout effect may also be higher among girls due to safety and cultural issues prevail in the rural areas (Bilquees and Saqib, 2004). Further, the level of education of the father and gender of the child were playing part in student dropouts (Naz et al., 2019). In Pakistan’s context, the present study departs from the previous literature to study the broader grasp of the school closure during Covid-19 and its impact on learning loss and dropout.

3. Learning gap in Pakistan

Pakistan is ranked 134 out of 157 countries on the Human Capital Index (HCI) ranking of the World Bank. This low ranking on the Human Development Index indicates that investment in education is not given due importance. The country’s education quality is bad enough that the
Expected Years of Schooling (EYS) and LAYS differ by about four years. For instance, children in Pakistan can expect to complete 9.4 years of pre-primary, primary, and secondary school by age 18. However, when adjusted for quality of learning, it is only equivalent to 5.1 years: a learning gap of 4.3 years exhibiting the low quality of the education system (see Fig. 1)—the advantage of using this measure that it captures both the changes in attainment and average learning outcome. The disaggregated level analysis over gender shows that girls have lower expected years of schooling compared to boys. The quality of education in Pakistan is more worrisome when comparing to other South Asian countries. Pakistan falls behind both in EYS and LAYS except Afghanistan with a very marginal change. (See Fig. 2.)

The ASER (2019) survey shows the same picture. Only 59 percent of class 5 students can read a story in Urdu/Sindhi/Pashto. Whereas 55 percent of class 5 students can read class 2 level a sentence in English. Likewise, 57 Percent of class 5 students can do a 2-digit division (Economic Survey of Pakistan, 2019). Pakistani school kids’ low performance could be due to a range of factors, ineffective teaching and learning processes, poor classroom management, language issues, multi-grade teaching, inadequate textbook quality, and low quality of assessments and examinations (Andrabi et al., 2010).

Likewise, household circumstances also play a role. Azevedo et al. (2020) show that students at the top pull ahead while students at the bottom fall behind; inequality worsens. As compared to the low-income families, the relatively better-off families are in comfortable homes, good internet connections, can hire a tutor, and are more likely better placed for home-schooling by well-educated parents. These inequalities would widen the gap, as poor students without access to television, the internet, and electronic gadgets during school closure (Rehman & Ahmed, and Sarwar, N., 2020). Therefore, the loss of learning during school closure significantly varies by access to remote learning.

4. Methodology and data

In this section, we discuss the methods and materials of the study. Section 4.1 presents the estimation technique, the logit model for the simulation of child attendance, and variables used in the analysis, such as household income and other child and household characteristics. Section 4.2 discusses the data source used in the study. Whereas section 4.3 explains the analytical framework to estimate the effect of COVID-19 on LAYS, children dropout, and economic cost in terms of foregone earnings in Pakistan.

4.1. Estimation strategy

To assess the effect of household expenditure on child school attendance, we employ the logit model. The dependent variable is the child current enrolment.

The logit model for child enrolment is given as.

\[ y_i = \alpha_0 + \alpha_1 C_i + \alpha_2 H_i + \alpha_3 R_i + \epsilon_i \]  

In eq. 1 \( y_i \) is the dependent variable, which indicates enrolment of child \( i \). It is a binary choice variable i.e., if a child currently attend school takes value 1 and 0 otherwise. \( C_i \) is the vector of independent variables which include specific characteristics of the children i.e. child’s age, age-squared and child’s gender. Variable gender takes value 1 if the child is male and 0 if female. The effect of age might be positive and quadratic. As the child’s age increases, the probability of child enrolment also increases because of the low opportunity cost of education. However, after reaching a thresholds level, the opportunity cost set in rising along with an increase in age due to the rise in labour productivity of the child (Khan, 2019). Hence, in the analysis, we used the child’s age and age-square.

The vector \( H \) includes household characteristics, i.e., the gender of...
the household head, education of the household head, and per capita household expenditure. In addition to child-level characteristics, household-level factors also play an important role in school attendance. The effect of variable head education on child schooling is positive as educated heads value schooling and usually see the returns to education. Alternatively, it is argued that educated heads have higher income and spend more on education. Likewise, we also control for the gender of the household head as households headed by females have lower income due to wage discrimination and lower education (Khan, 2019). We also accounted for per capita household expenditure to control for the income effect.

Whereas vector \( R_i \) represents regional dummies, i.e., dummies for provinces and rural and urban areas. In Pakistan, there are significant differences between provinces in terms of education and literacy. To control for these differences, our study includes separate dummies for provinces; Punjab, Sindh, Khyber Pakhtunkhwa (KPK) and Baluchistan. \( \varepsilon_i \) is the error term.

In equation 1 \( y_i \) is the variable for child current enrolment. Whereas \( y^* \) is defined as the latent unobserved variable showing the chances of child schooling in household \( i \). Here \( y^* \) is dependent on explanatory variable \( X_i \) and error \( \varepsilon \).

Thus, the latent desired level of schooling is presented as:

\[
y^* = \beta X + \varepsilon
\]

We do not have data on the desired latent enrolment in practice, but the survey data we use have information regarding the current attendance. The observed \( y \) are based on comparison of attitude towards child school attendance \( y^* \) relative to a certain unknown threshold value which has been normalised to zero in the current model. However, the zero threshold is of no significance once intercept is accounted for in the vector \( X \). A child is sent to school (\( y = 1 \)) if the utility difference exceeds some threshold level (\( y^*_i > 0 \)) and zero otherwise (\( y^*_i \leq 0 \)). Therefore, the logit model of the probability of child attendance is written as:

\[
Pr(y_i = 1 | X_i, \beta) = \lambda(X_i \beta)
\]

### 4.2. Data Source

To investigate the effect of household expenditure on child enrolment, we used representative data from the Pakistan Social and Living Standards Measurements (PSLM) 2018–19 survey. The dataset covers both rural and urban areas of all the four provinces; Punjab, Khyber Pakhtunkhwa (KPK), Sindh, and Baluchistan, covered 24,809 households from 1802 primary sampling units. The survey contains in-depth information on education, health, population welfare, income, and expenditure. In the study, we account for children between 5 and 16 years of age. In total, about 55,606 children comprised 28,684 boys and 26,922 girls, on which we focus in our simulation exercise.

### 4.3. Analytical framework

Conceptually, learning can be lost due to COVID-19 pandemics in two ways. Firstly, no learning occurs due to school closure, which is associated with schooling adjusted for quality. Secondly, already acquired knowledge will be forgotten when students are not at school. Therefore, we calculated the LAYS for the children in Pakistan. For this purpose, we relied on the scenario-based analysis of Azevedo et al. (2020) with slight modification. Besides, we calculated the income elasticity of children drop out due to the GDP contraction using the Pakistan Institute of Development Economics (PIDE) growth projections for FY20 and FY21 (PIDE, 2020). The effect of changes in LAYS on individual earnings and aggregate economic cost in terms of foregone earnings are also calculated. For this purpose, we use existing evidence on return to education, adult life expectancy, human capital utilisation, and labour market earnings in Pakistan.

### Assumptions.

- We examine three possible scenarios regarding school closure. In the optimistic scenario, it is assumed that schools will reopen in August after summer vacations with an average closure of 3 months or 30 percent of the school year. In the intermediate scenario, with an average of 5 months of school closure (50 percent school year), and in the pessimistic scenario, seven months of school closure (70 percent school year).
- The learning gains are equal to 30 (as students move from one grade to the next grade), as estimated by the World Bank for Lower Middle-Income Countries (LMIC). They assume learning gains will differ from 20 to 50 learning points depending on the country’s income level.
- This relates to the effectiveness of mitigation (\( m \)) strategies adopted by individual countries related to education; for instance, the tele-school launched by the Ministry of Federal Education in Pakistan. However, remote learning is never as effective as classroom instruction (George, 2020). Besides, being the main channels of distant education, access to digital devices and electricity provision is highly unequal. About 39.25 percent of Pakistani households have broadband internet access (Pakistan Telecom Authority, 2020). However, only 15.51 percent of the population used the internet in 2017.
- Similarly, 71.09 of the total population, while 54.39 of the rural population have access to electricity in 2018 (World Development Indicator, 2018). In particular, when household income drops due to layoffs, the family food security situation will worsen, resulting in increased psychological distress. This will negatively affect the ability of children to use the available mitigating strategies effectively.

#### 4.3.1. Reduction in LAYS and aggregate economic cost

We calculated the average student per year economic cost at the present value of the reduction in LAYS using Azevedo et al. (2020). For this purpose, we use existing evidence on return to education, adult life expectancy, human capital utilisation and labour market earnings in Pakistan. The effect of a reduction in LAYS on earnings using the return estimates of 8 percent and the ILO estimates of mean monthly income which is 489 for Pakistan in 2017 PPP $. To calculate long-term effect at a discount rate of 3 percent, it is assumed that the currently enrolled children will have a working life of 45 years. On average, they will enter the labour market in 10 years (Azevedo et al., 2020).

The formula is given as:

\[
\Delta Earnings_{per_{student_{year}}} = (\Delta LAYS \times RE \times Wages)
\]

\[
\Delta Earnings_{per_{year}} = TS \times AS \times HU \times \Delta Earnings_{per_{student_{year}}}
\]

\[
\Delta Lifetime_{earnings} = PV(\Delta Earnings_{per_{year}})
\]

Here,

- \( \Delta Lifetime_{earnings} \) stands for the return to one year of schooling.
- \( Wages \) stands for the ILO estimates of mean monthly income for Pakistan in 2017 PPP $.
- \( TS \) stands for a total number of currently enrolled children in primary, primary, middle, and secondary from Pakistan’s Economic Survey (2019).
- \( AS \) is the adult survival rate in Pakistan from Human Capital Index database.
- \( HU \) is the adjustment for human capital utilisation in Pakistan as per Pennings (2020).
- \( r \) stands for the discount rate, and \( i \) stands for years of working life.
5. Empirical results and discussion

In this section, we provide the empirical results of our analysis. First, we discuss the determinants of child school attendance. In particular, we simulate the effect of a reduction in household income on child attendance for an average household in Pakistan to see the potential impact of the COVID-19 pandemic on child school attendance. Afterwards, we provide the results and discussion of LAYS estimates, children dropout, and economic cost in terms of foregone earnings due to the pandemic related school closures.

5.1. Simulating the effect of household expenditure on child school attendance

In this section, we explain the results of our regression analysis. First, we discuss our important variables. Onwards, we deliberate on the effect of household expenditure on child enrolment. We simulate the impact of per capita household expenditure on child attendance under different scenarios (i.e., reducing income by 10, 25, and 50 percent). The summary statistics of our selected variables are given in Table 1. The marginal effects for all children, pre-primary, primary, middle and secondary school-age children are given in Table 2. Whereas the probability estimates of the simulation is given in Table 3.

Table 1 shows that about 59 percent of the children are currently attending school in all provinces of the country. The enrolment rate is relatively low in the survey under consideration. Hence, it is pertinent to assess the role of different factors, including household expenditure, of such a low enrolment in Pakistan. About 52 percent of the children are male. As for the household, characteristics are concerned, the monthly per capita household expenditure is about Rs.4937. A majority (about 92 percent) of the household heads are male. Nearly half of the heads lack education (about 47 percent), with about 16 percent of the heads having a primary education level. Similarly, about 40 percent of the enrolled children are from the Punjab province, followed by Sindh (24 percent). The relative proportion of children in the rural areas of the country is 68 percent.

| Variable                  | Obs  | Mean  | Std. Dev. | Min  | Max  |
|---------------------------|------|-------|-----------|------|------|
| School attendance (yes)   | 55,606 | 0.59  | 0.49      | 0    | 1    |
| Child age                 | 55,606 | 8.70  | 3.69      | 3    | 15   |
| Child gender              | 55,606 | 0.52  | 0.50      | 0    | 1    |
| Household Expenditure     | 55,606 | 39176.66 | 29262.41 | 5900.31 | 1317169.00 |
| Household Expenditure (total) | 55,606 | 4937.62 | 4012.26 | 1142.31 | 263157.10 |
| Household size            | 55,606 | 8.51  | 4.08      | 2    | 55   |
| Head gender (male)        | 55,606 | 0.92  | 0.27      | 0    | 1    |
| Education                 | 55,606 | 0.47  | 0.50      | 0    | 1    |
| Pre-Primary               | 55,606 | 0.0004 | 0.02      | 0    | 1    |
| Primary                   | 55,606 | 0.16  | 0.37      | 0    | 1    |
| Middle                    | 55,606 | 0.12  | 0.32      | 0    | 1    |
| Matric/SSC                | 55,606 | 0.14  | 0.35      | 0    | 1    |
| FSc/HSSC                  | 55,606 | 0.053 | 0.22      | 0    | 1    |
| Bachelor                  | 55,606 | 0.021 | 0.14      | 0    | 1    |
| MA/M.Sc. & higher         | 55,606 | 0.041 | 0.20      | 0    | 1    |
| Khyber                    | 55,606 | 0.23  | 0.42      | 0    | 1    |
| Pakhtunkhwa               | 55,606 | 0.40  | 0.49      | 0    | 1    |
| Punjab                    | 55,606 | 0.24  | 0.43      | 0    | 1    |
| Sindh                     | 55,606 | 0.13  | 0.34      | 0    | 1    |
| Baluchistan               | 55,606 | 0.68  | 0.47      | 0    | 1    |

Source: Authors’ calculations based on PSLM-2018-19.

Table 2 reports the estimates of our regression analysis. We present estimates for all the children and separately for pre-primary, primary, middle, and secondary school-age children. We control the possible effect of children’s characteristics like child age, age-square, and child gender in all the regressions. The impact of child age is positive and statistically significant in all the regressions. The effect of age-square is negative, showing that schooling’s opportunity cost increases as child age increases.

Our analysis also has other important household characteristics such as household expenditure, head education, and head gender. Child school attendance is increasing in household expenditure. Also, the effect of heads’ education on child school attendance is statistically significant and positive. Educated heads have more income opportunities and they do not need the labour of their children (Guarcello et. al. 2010; Thai & Falaris, 2014). The estimated coefficient of the variable household head gender is negative and statistically significant in all regressions, showing that on average children attendance is higher in female headed households.

We also include provincial-level dummies and a dummy for the rural areas in our analysis. Their estimates show that child enrolment on average is higher in Punjab, KP, and Sindh than that of Baluchistan. In addition, relative to urban areas, child school attendance is statistically lower in the country’s rural areas as shown in Table 2.

Besides, we also simulate the likely effect on child school attendance of a reduction in household income (i.e., by 10, 25, and 50 percent) of an average household in Pakistan to know the likely effect of the COVID-19 pandemic on child school attendance. We estimate the reduction in the probability of child school attendance for all children, pre-primary, primary, middle, and secondary school-age children in Table 3.

Expression 1 in Table 3 shows that the probability of child school attendance for all children is about 63.94 percent when we keep the values of all correlates at the sample mean (i.e., an average household). Expression 2 shows that the probability of child school attendance decreased to 61.44 percent for the same average household when income is reduced by 10 percent (a decrease of Rs. 493.86). The 10 percent decrease in income decreases the chances of child school attendance by 2.4 percent. Expression 3 depicts that when income is decreased by 25 percent, the probability of child school attendance decreased to 57.6 percent. Whereas when the income is slashed by about 50 percent, the likelihood of school attendance is decreased to 51 percent for the same average household (a decrease in the probability of child school attendance by 13 percent). Besides, to know the likely effect of the reduction in household expenditure on their school attendance, we undertake similar simulations, separately for pre-primary, primary, middle, and secondary school children. Their estimated probabilities in Table 3 show that the decrease in the probability of child school attendance due to the reduction in household expenditure is higher for primary and secondary school children relative to pre-primary and middle school-age children (also see Fig. 3).

Also, there is indication that the adverse effect of the reduction in household expenditure would be higher for older than younger children, as the opportunity cost of going to school increases with the age of these children. For instance, in Fig. 3 the decrease in the probability of child school attendance is higher for secondary school children than the rest of them. This evidence suggests that the older children would not back to school after the forced interruption.

5.2. School closure and education outcomes

5.2.1. Effect on test score

Table 4 assesses the possible effect of school closures and mitigation effectiveness on children’s test scores. In particular, the pre-existing learning crisis is expected to be magnified during out of school time due to COVID-19. In the optimistic scenario of school closure of 3 months and about 30 percent of government mitigation measures, the
A decrease in scores would be 6.4 points.

Whereas, in the more pessimistic scenario of school closure for seven months and about 7 percent of mitigation effectiveness, the students will lose about 20 points on test scores.

Table 2
Logit Model by (All Children, Pre-Primary, Primary, Middle and Matric Age Children) (Dependent Variable: Child Current School Attendance).

|                      | (1) All Children | (2) Pre-Primary | (3) Primary | (4) Middle | (5) Matric |
|----------------------|------------------|-----------------|-------------|------------|------------|
| Child age (years)    | 0.254***         | 0.620***        | 0.271***    | −0.880***  | −0.0564*** |
|                      | (0.00200)        | (0.0600)        | (0.0234)    | (0.180)    | (0.00966)  |
| Child age square     | −0.0127***       | −0.0468***      | −0.0156***  | 0.0345***  |           |
|                      | (0.006114)       | (0.00725)       | (0.00146)   | (0.00748)  |           |
| Child gender (male)  | 0.107***         | 0.0148**        | 0.0977***   | 0.167***   | 0.194***   |
|                      | (0.00330)        | (0.00629)       | (0.00494)   | (0.00701)  | (0.00903)  |
| Household Expenditure (per capita) | 0.0000340***       | 0.0000188***     | 0.0000505***      | 0.0000434***     | 0.0000546***     |
|                      | (0.0000128)      | (0.0000170)     | (0.0000233)  | (0.0000320) | (0.0000359) |
| Household size       | 0.000469         | −0.000541       | 0.00241***  | 0.000855   | 0.00153    |
|                      | (0.000463)       | (0.000791)      | (0.000734)  | (0.00107)  | (0.00148)  |
| Head gender (male)   | −0.0686***       | −0.0375***      | −0.0754***  | −0.0671*** | −0.0807*** |
|                      | (0.00674)        | (0.0119)        | (0.0112)    | (0.0147)   | (0.0185)   |
| Head education       | 0.0380***        | 0.0231***       | 0.0407***   | 0.0454***  | 0.0508***  |
|                      | (0.009914)       | (0.00164)       | (0.00147)   | (0.00215)  | (0.00259)  |
| Khyber Pakhtunkhwa   | 0.171***         | 0.128***        | 0.183***    | 0.173***   | 0.161***   |
|                      | (0.00544)        | (0.0133)        | (0.00756)   | (0.0114)   | (0.0159)   |
| Punjab               | 0.284***         | 0.339***        | 0.313***    | 0.213***   | 0.164***   |
|                      | (0.00505)        | (0.0117)        | (0.00691)   | (0.0107)   | (0.0151)   |
| Sindh                | 0.0744***        | 0.128***        | 0.0810***   | 0.0541***  | 0.00839    |
|                      | (0.00547)        | (0.0132)        | (0.00742)   | (0.0114)   | (0.0161)   |
| Region (rural)       | −0.0651***       | −0.0363***      | −0.0760***  | −0.0591*** | −0.0697*** |
|                      | (0.00939)        | (0.00722)       | (0.00619)   | (0.00889)  | (0.0113)   |

Marginal effects; Standard errors in parentheses
(d) for discrete change of dummy variable from 0 to 1
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 3
Simulation of School Attendance and Household Expenditure.

| Probability | All Children | Pre-Primary | Primary | Middle | Matric |
|-------------|--------------|-------------|---------|--------|--------|
| Expression 1| Baseline (at Mean) | 0.64*** | 0.19*** | 0.82*** | 0.80*** | 0.62*** |
|             |               | (0.0028)  | (0.0045) | (0.0038) | (0.0059) | (0.0075) |
| Expression 2| at 10%        | 0.61***   | 0.18*** | 0.79*** | 0.77*** | 0.59*** |
|             |               | (0.0026)  | (0.0044) | (0.0035) | (0.0053) | (0.0068) |
| Expression 3| at 25%        | 0.58***   | 0.17*** | 0.75*** | 0.73*** | 0.53*** |
|             |               | (0.0030)  | (0.0046) | (0.0039) | (0.0056) | (0.0075) |
| Expression 4| at 50%        | 0.51***   | 0.15*** | 0.66*** | 0.66*** | 0.43*** |
|             |               | (0.0049)  | (0.0053) | (0.0072) | (0.0098) | (0.0120) |

Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01

Fig. 3. Changes in Attendance Probabilities due to Changes in Household Expenditure.

Loss of approximately 20 points on test scores.
The pandemic will decrease both learning and enrolment. Table 5 presents our estimates for the change in LAYS for all children and separately for girls and boys. The estimates are calculated for three different scenarios. The estimates show that if schools are closed for three months, the pandemic could result in a loss of 0.3 years of schooling adjusted for quality. We know from the Human Capital Index for Pakistan that children in Pakistan receive, on average, 9.40 years of education throughout their lifetime.

Nevertheless, when adjusted for quality of learning, it amounts only to 5.10 years of schooling. Factoring in the effect of COVID-19, this decreases to 4.80 years in the optimistic scenario. In the moderate scenario, school closures due to the pandemic could bring the average learning that students achieve during their lifetime to 4.40 learning-adjusted years (a decrease of 13.73 percent). In the pessimistic scenario, the loss is 0.9 years, with a reduction in the LAYS of 17.65 percent.

The detrimental effect of the pandemic would be higher for girls than boys. The impacts of COVID-19 reach far beyond the hundreds of thousands of children who might not return to school. Here would underestimate the extent to which children will not return to school.

### 5.2.5. Household expenditure, income elasticity and children dropout

The children dropout is likely to affect the EYS. We used the estimates of the child attendance probabilities for each group of children to forecast dropout of children in Pakistan. We report dropout for 10 percent, 25 percent and 50 percent reduction in per capita expenditure in Table 7. Our predictions show that 10 percent reduction in income decreases children’s enrolment by about 1.659 million children. Whereas a 50 percent reduction in per capita expenditure decreases enrolment of all children by about 7.2 million. Furthermore, our projections show that the dropout would be higher for primary age children.

Besides, we also predict the dropout of children due to the economic slowdown. The economic recession due to the pandemic is predicted to contract global GDP per capita by 4 percent, which would increase the out-of-school children by 2 percent (Azvedo et al., 2020). Hence, in Pakistan’s context, a 1.48 percent contraction (PIDE projection) in GDP per capita would increase in out-of-school children by 0.74 percent. Using the PIDE projection, Table 7 shows that the COVID-19 would result in a total of 0.41 million children to dropout in Pakistan. The dropout rate would be higher for children enrolled in pre-primary and primary level classes.

### Table 5

| Scenario 1: Optimistic | Overall | Female | Male |
|------------------------|---------|--------|------|
| Expected Years of School | 9.40 | 8.70 | 10.00 |
| Learning Adjusted Years of Schooling (LAYS) | 5.10 | 4.80 | 5.40 |
| School closure (share of a school year) | 30.00 | 30.00 | 30.00 |
| Decrease in LAYS | 4.80 | 4.50 | 5.10 |
| % change | 5.88 | 6.25 | 5.96 |
| Scenario2: Intermediate | Overall | Female | Male |
| Expected Years of School | 9.40 | 8.70 | 10.00 |
| LAYS | 5.10 | 4.80 | 5.40 |
| School closure (share of a school year) | 50.00 | 50.00 | 50.00 |
| Decrease in LAYS | 4.40 | 4.10 | 4.70 |
| % change | 13.73 | 14.58 | 12.96 |
| Scenario 3: Pessimistic Scenario | Overall | Female | Male |
| Expected Years of School | 9.40 | 8.70 | 10.00 |
| LAYS | 5.10 | 4.80 | 5.40 |
| School closure (share of a school year) | 70.00 | 70.00 | 70.00 |
| Decrease in LAYS | 4.20 | 3.90 | 4.50 |
| % change | 17.65 | 18.75 | 16.67 |

Source: Authors’ calculations based on World Bank estimates.
5.2.6. Layoffs and children dropouts

The disruptions in schooling often lead to permanent dropouts among the vulnerable income group (Reddy & Sinha, 2010). One of the main reasons for this is the parent’s loss of employment or reduced earning capacity. To cope with economic distress, child labour is leveraged as a substitute to support their parents in earning. As a result, the child labour has adverse consequences for test scores, and the effect gets larger as work hours increase (Orazem & Gunnarsson, 2003), thereby increasing the school dropout.

For the layoffs estimates (Table 8), we used the PIDE recent projections on layoffs for the fiscal year 2019–20 and 2020–21 (PIDE, 2020).

For the calculation of dropouts; as a first step, we divide the layoffs by 2 to convert the individual layoffs to household basis. Our estimates from Pakistan Standard Living and Measurement survey (PSLM, 2018) show that approximately two persons per household worked over the last month in Pakistan. In the second step, we multiplied the adjusted layoffs with the average number of currently enrolled children per household in Pakistan to estimate the number of children potentially vulnerable to school dropouts. Our estimates from PSLM (2018) show about 2.34 currently enrolled children per household in Pakistan. The results in Table 8 show that about 15.5 million children are vulnerable to dropout in moderate scenarios, however, approximately 20.28 in the case of the pessimistic scenario.

Due to the pandemic, the dropout could also trigger financial problems for the private sector schools in Pakistan. The private provision of education has become a significant phenomenon, both in urban and rural areas in Pakistan. This is evident from the growing share of the private sector in educational institutions, a national workforce of teachers, and its enrolment. Enrolment is higher in private schools (60.85 percent) in urban areas than in public schools. Private schools employ a more significant share of the workforce (about 52 percent) than public sector schools. However, public sector institutes are higher than that of private schools in Pakistan (See Table 9).

The income shock to households whose children are in private schools could increase their demand for public school in school fees. Hence, pressure on a cash strapped public system will increase. In the absence of government support for these households, the private schools would not pay teachers if a larger proportion of these households cannot pay their children’s fees. In such a scenario, the government should stimulate economic activities alongside extending the safety net interventions to these households, at least in the short run. Besides, the government should negotiate with the private schools to charge households an amount for meeting their operating expenses instead of charging them a full fee.

6. Conclusion and policy recommendations

The Covid-19 pandemic has emerged as a global health crisis, having negative educational consequences in particular for the school-age children. This study examines the effect of COVID-19 pandemic on students’ learning, foregone earning, and dropout in Pakistan. Our assessment confirms that school closures can substantially increase dropouts and diminish learning, which adversely affects important outcomes in the long-term. Considering the effect of COVID-19, the study finds a substantial decrease in LAYS with a worsening consequence for girls than boys. Whereas the aggregate economic cost amounts to 107.32 billion dollars in the pessimistic scenario when adjusted for human capital utilisation. Along with, about 1.7, 3.3, and 7.2 million children drop out due to a reduction in household expenditure of 10 percent, 25 percent and 50 percent, respectively. However, the dropout is more pronounced at the primary level of schooling. Likewise, about 15.5 million children are vulnerable to dropout due to workers’ layoffs in the intermediate scenario.

This shows that the current cohort’s economic cost is substantial in terms of reduced lifetime earnings, which negatively affect wellbeing and growth. Therefore, the government and other multilateral organisations need to devise an effective online and remote learning strategy to mitigate the learning loss to children until school reopens. In this regard, certain observations need to be kept in mind to enhance the effectiveness of the proposed strategies. For instance, any online learning strategy’s success depends on the availability and equality in access to computers and other gadgets such as laptops and tablets, along with dedicated internet service and other ICT tools. So, in practice, the proportion of households in different regions and areas with real-time access to such amenities needs to be evaluated.

Likewise, the online learning strategy can complement the adoption of an effective remote learning strategy to facilitate learning. In this regard, proper Virtual Learning Environments (VLE) can help students and educators to connect and have access to a dedicated repository of educational resources. Furthermore, education broadcasting needs to be strengthened alongside online learning, so that regions and households who do not access the internet are covered in teaching and teaching materials.

With regard to children’s dropout, the COVID-19 shock can compel families to put their children to work to meet subsistence. Besides, the income shock to households whose children are in private schools would

| Table 7 The Effect of Covid-19 on Children Dropouts (in thousands). |
|------------------|------------------|------------------|------------------|------------------|
|                  | 19.11            | 16.18            | 20.28            |
| Source: Authors’ calculations based on PIDE growth projections for FY20 (-1.59 percent), FY21 (Scenario III, – 1.48 percent) and World Bank projection for FY20 (-2.6 percent). |

| Table 8 The Effect of Layoffs on Children Dropouts. |
|------------------|------------------|------------------|------------------|------------------|
|                  | 16.3             | 13.8             | 15.5             | 17.3             |
|                  | 8.15             | 6.9              | 7.75             | 8.65             |
|                  | 19.11            | 16.18            | 18.17            | 20.28            |
| Source: Authors’ calculations based on PIDE projections. |
increase their demand for public support as families cannot afford any fees, pressure on a cash strapped public system will increase. Therefore, the government’s priority should be to stimulate economic activities and the initiatives needed to cushion the economic impact on marginalised families to discourage child labour.

Thus far, the lockdown strategies have been proven effective in slowing the transmission of disease. Still, complete lockdowns might not be efficient, in the long run, in a densely populated country like Pakistan. To manage the COVID-19 risk more efficiently for a long term, the COVID-19 risk assessment and mapping (CRAM) and Geographic information system (GIS) have been used to investigate the flow patterns, lethality, and spread of the pandemic (Kanga et al. 2020a; Kanga et al. 2020b; Ranga et al. 2020). Identifying the affected areas will help raise the school closure in a targeted area, thereby minimise the potential negative impact of the disruptions on students learning and dropout.

Due to the second wave of the outbreak of COVID-19, the situation is still evolving. Given that vaccine coverage issue would remain pertinent for quite a while. Hence, the Covid-19 crisis has created an opportunity for governments to build back better in such situations. In this context, the focus should be to strengthen our capacity through consistent investment in the infrastructure to develop a resilient education system of futuristic orientation.

CRediT authorship contribution statement

Muhammad Jehangir Khan: Conceptualization, Methodology, Formal analysis, Writing - review & editing. Junaid Ahmed: Writing - original draft, Visualization, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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