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COVID-19 impact on jobs at private schools and colleges in Northern Ethiopia

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ABSTRACT
The disruptive effects of COVID-19 have impacted all sectors of our society including education. This study identified the factors influencing the private schools’ and colleges’ decision to reduce their teaching staff during the COVID-19 lockdown using survey data analyzed using Heckman two-step regression model. The results showed that age, accommodation level, hourly payment rate, tax grade level, money borrowed from government or banks, loan repayment suspension, tax payment deferral, the number of administrative employees, the student-to-administrative employee ratio, and the educational institution’s category were the significant factors affecting teaching employee reduction during the lockdown. The results of this study can help the various education sector stakeholders to take coordinated measures to withstand COVID-19 type of shocks.

1. Introduction
Health is essential to a prosperous productive society, whereas illness can stifle production, consumption, travel, recreation, and overall well-being (Fourie, 2020; Lawanson and Evans, 2019; Adeola and Evans, 2018; Marin, 2017). Health disasters such as the Middle East Respiratory Syndrome (MERS) outbreak in the Republic of Korea, the Ebola virus in West Africa, and the rise of COVID-19 have global health impacts and wide-range of socioeconomic disruptions. For example, during the Ebola virus in West Africa from 2013 to 2014, Smith et al. (2019) stated that in Guinea, Liberia and Sierra Leone, government revenues declined across the board, including direct taxes on companies, VAT receipts, and indirect taxes; additionally, decline in the confidence of private and foreign investors led to investment gaps of more than US $600 million over the two years. These impacts affect several sectors and have long-term consequences.

In the same fashion, the incidence of COVID-19 is growing at a disturbing rate with significant impacts on global economies and public health. According to Bloomberg, China’s first-quarter GDP growth may drop to 4.5 %; the global GDP is also expected to decline by roughly 0.42 % in the first quarter of 2020. Economists have estimated that, without urgent global actions to curtail the virus in time, China is expected to lose up to $62 billion in the first quarter of 2020, while the world is expected to lose over $280 billion.

Impacts may involve psychological, educational, or professional losses on individuals and households. The high death toll during the West Africa Ebola outbreak triggered expanded social and household economic impacts, stifled growth rates, and led to wage losses due to inability to work or fear of infection, which increased food insecurity. When the grave human, societal, and economic consequences are considered, there is a critical need for health professionals and policymakers to recognize the magnitude of COVID-19 pandemic and the potential devastation it may inflict, particularly in the developing countries (Evans, 2020) like Ethiopia.

Most of the economic impacts of COVID-19 will be from the actions people and governments take to avoid the virus and this response comes from three sources (Baldwin, 2020; Baldwin and di Mauro, 2020). First, government imposes bans on certain types of activities (such as restaurants, shops, schools etc.). Second, firms and institutions take precautionary measures including closures that result in lost wages for workers. Third, individuals reduce trips to the market, students fear to attend school, travel, going out, and other social activities, affecting the demand side. In contrast to the developed economies, Ethiopia’s economy is unlikely to sustain infusion of cash to the economy or support a dramatically increasing welfare-dependent population. Furthermore, the measures being taken in other countries to contain the pandemic may not totally apply to Ethiopia, given the differences in local contexts. One of the measures being taken by both developed and developing
countries is lockdown. During the lockdown, majority of economic activities are stopped. Compared to citizens in developing countries, citizens in developed countries have relatively good capacity to withstand the income reduction arising from the lockdown by using their past savings or financial support provided by the government. Moreover, unemployment rate is lower in developed or high-income countries compared to that in developing countries like Ethiopia. Furthermore, economic activities in the informal sector are very high in developing countries, which makes it difficult to know the effect of the pandemic on the informal sector of the economy. In Ethiopia, a significant number of urban dwellers’ source of income for consumption, education expenditure for family members, and for other social services is from the informal sector. During the lockdown period, citizens engaged in the informal sector were unable to pay for their education and other social services resulting in a reduction in the revenues of private schools and colleges. Therefore, the lockdown measure could have a high negative impact on the Ethiopian economy as compared to other countries.

Although the government of Ethiopia ordered private schools and colleges not to collect payments from students during the lockdown, due to the limited capacity of the private schools and colleges even before the pandemic, they were forced to reduce their teaching employees during the five-month long state of emergency. School closures during the lockdown highly affected students because schools and colleges in Ethiopia are not able to deliver their courses online using technologies. The education sector’s limited capacity to design and implement effective education responses due to a lack of technological infrastructure in rural areas and for most poor households in urban areas amplify the problem in Ethiopia (UN, 2020). This was not the case in developed countries where they have access to technological platforms to enable students continue their education during the lockdown.

COVID-19 outbreak impacted almost all sectors of our society including the education sector. Anecdotal evidence paints a bleak picture for both students, schools, colleges, and universities. Schools were closed, and when they reopen, teachers need to do formative assessments to identify remediation areas, and to do this effectively, they need to receive trainings (Kaffenberger, 2020). According to the American Council on Education, enrollment is likely to drop by 15% in the fall of 2020, while at the same time many institutions may have to face demands for substantial tuition cuts if classes continue to be virtual (Kaffenberger, 2020). Students are confronted with an increasingly uncertain health and financial shocks. COVID-19 pandemic has also decreased international student mobility significantly (Mok et al., 2021).

There is a need for adequate funding to improve the education system and to provide capacity development trainings to the stakeholders of education institutions; and such interventions should target where students come from the vulnerable section of society (Kapasia et al., 2020). Sabates et al. (2021) also highlighted the importance of support at home during time away from school due to COVID-19 school closures.

Exposure to economic difficulty during the early phase of the pandemic was higher among lower-paid occupations. These gradients are substantive as the probability of economic hardship was 49% for workers in the lowest earnings quintile and only 22% for those in the highest earnings quintile (Witteveen, 2020). The study by Lawson et al. (2020) identified parental job loss during the COVID-19 pandemic as a robust predictor of psychological maltreatment and physical abuse towards children during the pandemic. The outbreak of COVID-19 causes job and earning losses in various sectors of the economy; and the education sector, particularly the private schools and colleges, is one of them. The current COVID situation has revealed many underlying vulnerabilities and inequalities in the education system (Khanna and Kareem, 2020).

On 16 March 2020, the office of the Prime Minister of Ethiopia announced the suspension of schools, public gatherings, and sporting events for 15 days (Addis Fortune, 2020a). In Ethiopia, although it was intended to continue teaching students during the pandemic using technology platforms, most of the students were not able to do it due to low digital technology penetration and inadequate communications infrastructure. The private sector education institutions faced many challenges during the lockdown. Among these challenges, retaining teachers by paying their regular salaries became difficult, which forced private schools and colleges to either reduce their teachers’ monthly salary or layoff some of their employees.

This study aimed to analyze the impacts of COVID-19 on job security of teachers at private schools and colleges by using the decisions of their directors to temporarily reduce their teaching employees as the dependent variable and potential institution related factors as the independent variables. The study aimed to answer the following research questions:

1) What are the impacts of Covid-19 on job security of teachers at private schools and colleges?
2) What are the potential institutional factors that influence decisions of private school and college directors to reduce their teaching employees?

To answer these research questions, data were collected and analyzed using the Heckman two-stage regression model, which is an econometric method that avoids selection bias problems.

1.1. Definition of private schools and colleges in Ethiopian context

Educational institutions in Ethiopia are classified as either public or private. A public institution is an institution whose budget is allocated by the Federal or State government, and a private institution is an institution established by one or more individual owners, or by non-profit organizations, or founded as a cooperative society or commercial association, or higher education institution established abroad and operating in Ethiopia (Ethiopian Ministry of Education, 2020). According to Ministry of Science and Higher Education, an institution that may be granted the name and status of a ‘college’ by the Ministry shall have a curriculum that matches the national standards set by the Ministry, the necessary academic staff, institutional governing structures, teaching materials, classrooms, libraries, laboratories, and other appropriate discipline related facilities and shall offer higher education in degree programs at least in one academic unit.

Private schools are any formal schools outside the public education system (Kitaev, 1999). Different forms of privatization are discussed in Arakelyan (2005); Bray (1996), and Bast and Walberg (2013), but Kitaev (1999) identifies five types of private education in Sub-Saharan Africa: community, religious, spontaneous (bush), profit-making, and expatriate private schools. For the purpose of this study, private schools refer to all non-government schools.

1.2. COVID-19 in Ethiopia

The first COVID-19 case in Ethiopia was reported on 13 March 2020, then on 16 March 2020, the office of the Prime Minister suspended schools, public gatherings, and sporting events for two weeks, and on 20 March 2020, Ethiopian Airlines suspended flights to 30 countries affected by the COVID-19 virus. On 20 March 2020, the Government announced a mandatory self-quarantine for 14 days to anyone entering the country (Fana, 2020). On 23 March 2020, Ethiopia closed all land borders and deployed security forces to halt the movement of people along the borders (Bloomberg, 2020). The council of ministries declared a five-month long state of emergency on 08 April 2020 in response to the

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1. Although Ethiopia already has a strong learning assessments, teachers in both private and public schools and colleges have to take training on how to take assessments and remedial actions when schools and colleges are reopened.
2. See, the New York Times article “After coronavirus, Colleges worry: Will students come back?” (April 15, 2020) for a discussion surrounding students’ demands for tuition cuts.
The growing number of COVID-19 cases (Ethiopian Monitor, 2020); and the state of emergency was approved by the parliament on 10 April 2020. After multiple cases of the virus were reported, travel restrictions and lockdowns were imposed by several regions to curtail further spread of the virus.

COVID-19 has unexpected economic, educational, and political impacts. For example, the United Nations Economic Commission for Africa estimated that COVID-19 will shave 2.9% of Ethiopia’s economic growth in 2020 (UNICEF Ethiopia, 2020). The pandemic also affected Ethiopia’s flower export industry significantly because of the plummeted demand for flowers in Europe. A total of 150,000 employees in this industry are also at the risk of losing their jobs (Addis Fortune, 2020b). Ethiopian Airlines, the country’s flagship carrier, reported that it is working at only 10% of its passenger capacity because of the COVID-19 pandemic and reported a loss of $550 million in the month of January to April 2020 (Reuters, 2020). However, by repurposing its passenger planes to cargo and diversifying its activities it became one of the three airlines that made a small profit (Forbes, 2020). Such diversification can also help other sectors faced with COVID-19 challenges.

More than 2.6 million students are affected by school closures due to COVID-19. Consequently, school feeding programs for around 1 million children across multiple regions of the country have stopped (UNICEF Ethiopia, 2020). On 21 September 2020, schools are still closed, and the number of COVID-19 cases reached more than 69,000 in Ethiopia. After March 2020, private schools and colleges faced many challenges. Among these challenges, retaining their teaching employees and salary payments are difficult for the owners of private schools and colleges. Private schools and colleges faced two decisions after the declaration of a five-month long state of emergency in response to the growing number of COVID-19 cases. These decisions were to reduce either the monthly salary of teachers or reduce the number of teaching employees. This study focused on analyzing the impacts of COVID-19 during this five-month long state of emergency.

1.3. Job security in private schools and colleges, and labor protection

The COVID-19 lockdowns led to the layoff of several employees in different sectors. In case of a prolonged lockdown, there are higher chances that other businesses will also layoff their employees and will no longer pay the wages/salaries to employees without performing duties (Shaﬁ et al., 2020). One of the consequences of closing schools during the pandemic is increased unemployment (Espino-Díaz et al., 2020).

According to the 2018/19 annual report of Ethiopian Ministry of Education, there are 688,536 teachers in the education system. Majority of these teachers (598,648 or 87%) work in government schools, and the remaining 89,888 (23%) work in private schools. In Amhara regional state where this study was conducted, the total number of teachers working in government and private schools were 167,403 and 4,309, respectively. At the national level, there are 529,966 teachers in primary schools, of which 92% teach in government schools, and the remaining 8% teach in private schools. In Amhara regional state, the number of teachers teaching in government and primary schools were 167,403 and 4,309, respectively. At the national level, there are 529,966 teachers in primary schools, of which 92% teach in government schools, and the remaining 8% teach in private schools. In Amhara regional state, the number of teachers teaching in government and primary schools were 167,403 and 4,309, respectively. The number of teachers teaching in government and private primary schools were 135,238 and 1,913, respectively. The number of teachers teaching in government and private schools/colleges during the COVID-19 lockdown, descriptive and econometric analyses of the collected data were conducted. The descriptive statistics used were means and percentages of the variables of interest.

Either Tobit or Heckman two-step (Gujarati, 1998; Heckman, 1979) econometric models can be used to identify the factors influencing the decision of private schools/colleges to reduce their employees, and the extent/level of teaching employees who lost their jobs during COVID-19 lockdown. However, the Heckman two-stage regression model was used in this study because of its advantages over the Tobit model in its ability to eliminate selectivity bias, and its ability to separate the effect of variables on the probability of reducing employees from the influence on the level of employees reduced by private schools/colleges (Heckman, 1979). Using the Heckman sample selection model, the first stage estimated employee reduction decision equation that helps to identify the factors influencing employee reduction decision during COVID-19. Then, in the second stage, a regression model was fitted along with the probit estimate of the Inverse Mill’s ratio to identify the factors that determine the level of teaching employees reduced by private schools/colleges during the pandemic.

The first stage Heckman model, which estimates the probability of private schools/colleges to reduce their teaching employees during the pandemic is stated as:

\[ Y_i = \beta X_i + \epsilon_i \]

where \( \epsilon_i \sim N(0, \sigma^2); i = 1, 2, ..., n \)

\( Y_i \) is a dummy variable that takes a value of 1 if the private school/
college reduces its teaching employees, and 0 if otherwise.

\( \beta_i \) is a vector of the parameters.

\( X_i \) is a matrix of the factors that can influence the decision to reduce teaching employees.

\( \epsilon_i \) is the error term assumed to have normal distribution with 0 mean and constant variance \( \sigma^2 \).

The second stage Heckman two-stage equation model estimates the factors influencing the extent/level of teacher jobs lost in private schools and colleges during the pandemic and the model is specified as follows by including an estimate of the Inverse Mill’s ratio (\( \lambda_i \)):

\[
Y_j = \beta_1 X_{ij} + \lambda_i \mu + \epsilon_j
\]

where \( \epsilon_j \sim N(0, \sigma^2) \).

\( Y_j \) is the level of teaching employees reduced by private schools and colleges during the pandemic and observed if only the private schools/colleges reduced their teaching employees (i.e. \( Y_j = 1 \) in the first-stage Heckman model).

\( \beta_j \) is a vector of parameters to be estimated.

\( X_j \) is a matrix of the explanatory variables that can affect the level of teaching employees reduced by private schools and colleges during the pandemic.

\( \lambda_i \) is a correction factor for selection bias (Inverse Mill’s ratio), which will be significant if there is selection bias.

\[
\lambda = \frac{f(Y_i)}{1 - f(Y_i)}
\]

\( \epsilon_i \) is the error term assumed to have normal distribution with mean 0 and variance \( \sigma^2 \).

If the Inverse Mill’s ratio (IMR) is not significant, interpretation of the results from the Heckman two-step procedure would not be relevant because the procedure would be highly sensitive to model mis-specification. If the IMR included in the outcome equation by regressing all the variables in the selection equation is not significant, we need to drop it because it creates bias due to inclusion of irrelevant variables. This problem can be accounted for by estimating the two equations (employee reduction decision and the level of reduced teaching employees) simultaneously by the Heckman Maximum Likelihood method where the IMR is omitted from the set of the explanatory variables.

The definitions of the explanatory variables used in the models are shown below:

- \( X_1 \) = Age of the private school/college (measured in years from its establishment)
- \( X_2 \) = Accommodation level of the private school/college (measured in number of students)
- \( X_3 \) = Number of branches the private school/college has during the survey (in number)
- \( X_4 \) = Part-time per hour payments to private school/college teachers (converted to USD)
- \( X_5 \) = Number of administrative employees working in the private school/college (in number)
- \( X_6 \) = Educational status of the private school/college Director (1 = Diploma and 0 otherwise)
- \( X_7 \) = Minimum educational level required for hiring teachers by the private school/college (1 = Master’s and above; 0 otherwise)
- \( X_8 \) = Tax-payer category of the private school/college (1 = Category ‘A’; 0 otherwise)
- \( X_9 \) = Whether the private school/college borrowed money from government/other sources (1 = Yes; 0 otherwise)
- \( X_{10} \) = Whether the government allowed private school/college loan repayment suspension (1 = Yes; 0 otherwise)
- \( X_{11} \) = Whether the government allowed tax payment suspension period to the private school/college (1 = Yes; 0 otherwise)
- \( X_{12} \) = The educational institution category (1 = Private college; 0 otherwise)
- \( X_{13} \) = Student-to-administrative employee ratio
- \( X_{14} \) = Student-to-teacher ratio

The collected data were analyzed using STATA (Version 16) software.

3. Results and discussion

3.1. Description of socio-economic and institutional variables

The mean age of private schools/colleges that did not reduce their teaching employees was 11.75 years, while the mean age of those that reduced their teaching employees was 6.97 years. This result indicates that, younger private schools/colleges are not able to handle the negative influence of the pandemic. On the other hand, as reported by Van Nuland et al. (2020), older private schools/colleges were more experienced to retain their employees during shocks by using alternative teaching mechanisms, although they require a community support to transition from face-to-face learning to just-in-time learning utilizing wrap-around services.

The accommodation of private schools/colleges was measured in the number of students they accommodate. On average, the student accommodation level of private schools/colleges that reduced their teaching employees was 264 students whereas the average of those who did not reduce their employees was 164 students. This result indicates that the student accommodation level of private schools/colleges that reduced their employees during the pandemic has high accommodation level of students. Since the income earned by private schools/colleges is proportional to the number of students, the lockdown of the schools/colleges greatly affected the income of larger private schools/colleges, and in turn forced them to decide to temporarily reduce their teaching employees during the pandemic.

The operating number of branches the private schools and colleges have in Northern part of Ethiopia was expected to have influence on the decision of private schools/colleges to reduce their teaching employees during the pandemic. The average number of branches of the private schools/colleges that reduced their teaching employees was approximately 5 branches whereas that of those who did not reduce their
teaching employees was approximately 4 branches. However, the t-test results showed that these two averages are not significantly different.

The average per hour payments paid to part-time teachers by private schools/colleges that reduced their teaching employees during the pandemic was 3.0 USD, and that paid by private schools/colleges that did not reduce their teaching employees during the pandemic was 2.45 USD. This result indicates that, private schools/colleges who reduced their teaching employees during the pandemic period were paying slightly higher than those who did not reduce their teaching employees. However, the t-test results indicated that the difference between the average hourly rates of private schools/colleges that reduced their teaching employees and those that did not reduce is not significant.

The number of administrative employees working in private schools/colleges was found to be an important variable that forces private schools/colleges to decide to reduce their teaching employees temporarily during the pandemic. The average number of administrative employees working in private schools/colleges that reduced their teaching employees and those that did not reduce their teaching employees were approximately 8 and 6 employees, respectively. Although these averages are not significantly different, the trend indicates that the average number of administrative employees working in private schools/colleges that reduce their teaching employees during the pandemic tend to be higher than that who did not reduce their teaching employees during the pandemic.

Student-to-administrative employee ratio and student-to-teacher ratio were used as explanatory variables that can influence the decision of school/college directors to reduce their teaching employees during the Covid-19 pandemic. In the study area, the average student-to-administrative employee ratio of the private schools/colleges that reduced their teaching employees was 66 to 1, whereas that of the schools/colleges that did not reduce their teaching employees was 54 to 1. On the other hand, the average student-to-teacher ratio of the private schools/colleges that reduced their teaching employees during the pandemic was 46 to 1, and that of those who did not reduce their teaching employees was 38 to 1.

Table 2 shows the χ² test of independence results that reveal the significance of the association between each of the 7 categorical variables and decision of private schools/colleges to reduce employees during the COVID-19 pandemic. There was a highly significant relationship for 6 of the 7 variables; and the variable that did not have significant relationship with decision to reduce employees was the minimum required educational level for teachers. The absence of significant relationship is good, as it expected counts indicate which way the relationship sways. Accordingly, when the null hypothesis (the two categorical variables are independent) is true, and big discrepancy between the observed and the expected counts indicate which way the relationship sways. Accordingly, on average, fewer than the expected employees were reduced when the Director’s educational level was Master’s, and more than the expected employees were reduced when the Director’s education level was either Diploma or Bachelor’s degree. This suggests that directors with more advanced education were able to minimize the reduction of teaching employees during the pandemic.

The values shown in brackets of Table 2 are the expected values when the null hypothesis (the two categorical variables are independent) is true, and big discrepancy between the observed and the expected counts indicate which way the relationship sways. Accordingly, on average, fewer than the expected employees were reduced when the Director’s educational level was Master’s, and more than the expected employees were reduced when the Director’s education level was either Diploma or Bachelor’s degree. This suggests that directors with more advanced education were able to minimize the reduction of teaching employees during the pandemic.

| Table 2 | χ² test of independence results between each of the 7 categorical variables and employee reduction decision of private schools and colleges. Values shown in closed brackets [ ] are the expected values under the null hypothesis (no association). |  |
|---|---|---|
| Categorical variable | Category | Employees reduced |
| | | No | Yes | P-value* |
| Educational level of the Director | Diploma | 56 [66.9] | 56 [45.1] | <0.001*** |
| | Bachelor’s | 44 [57.9] | 53 [39.1] | 0.139 |
| | Master’s | 66 [41.2] | 3 [27.8] |
| Minimum required educational level for teachers | Diploma | 61 [66.3] | 50 [44.7] |
| | Bachelor’s | 88 [80.0] | 46 [54.0] |
| | Master’s | 17 [19.7] | 16 [13.3] |
| Tax-payer category | A | 16 [41.8] | 54 [28.2] | <0.001*** |
| | B | 38 [52.0] | 49 [35.1] |
| | C | 112 [72.3] | 9 [48.8] |
| Was money borrowed? | No | 129 [99.7] | 38 [67.3] | <0.001*** |
| | Yes | 37 [66.3] | 74 [44.7] |
| Was repayment suspended? | No | 49 [68.7] | 66 [46.3] | <0.001*** |
| | Yes | 117 [97.3] | 46 [65.7] |
| Was tax payment suspended? | No | 65 [84.8] | 77 [57.2] | <0.001*** |
| | Yes | 101 [81.2] | 35 [54.8] |
| Category of the institution | College | 50 [42.4] | 21 [26.9] | 0.033** |
| | School | 116 [123.6] | 91 [83.4] |

* *** and ** represent significance at the 1% and 5% level, respectively.

Whether the private school/colleges borrow money from the government/private banks in the previous years was found to be an important variable that influence the decisions of schools/colleges in relation to employee reduction. The private schools/colleges that borrowed money reduced significantly higher number of employees than expected (Table 2). On the other hand, private schools/colleges that did not borrow money from any source reduced significantly fewer teaching employees during the pandemic.

Significantly higher number of employee reduction was observed at private schools/colleges that were not given loan repayment suspension by the government (Table 2). Similar results were also observed regarding tax payment suspension. The schools/colleges that were granted tax payment deferral reduced significantly fewer than the expected employees, whereas those that were not granted reduced significantly more teaching employees (Table 2).

Although it was not highly significant, the relationship between the category of the institution (college or school) and decision to reduce teaching employees was significant (P-value = 0.033); and looking at the observed versus the expected values indicate that the schools had more reduction than the colleges (Table 2).

3.2. Correlation and regression analysis

3.2.1. Correlation analysis of explanatory variables

A correlation coefficient shows the strength and direction of the linear relationship between two numerical variables. The values of a correlation coefficient range from -1 to +1, with values closer to 0 indicating the absence of relationship, closer to -1 indicating strong negative relationship, and closer to +1 indicating strong positive relationship.
relationship. The presence of strong (>0.8 or <−0.8) correlation among the explanatory variables is an indication of a potential multicollinearity problem in the model.

In this study, correlation analysis was used to check whether the explanatory variables are correlated or not. The numerical explanatory variables are Age (age of the private schools/colleges from its establishment), Acco (Accommodation level [the number of students]), Norba (the number of branches the school/college has), Ptp (Per hour part-time payment rate to teachers), Admem (the number of administrative employees), Stuadmr (student-to-administrative employee ratio) and Stutear (student-to-teacher ratio). As shown in Table 3, all correlations between the pairs of the numerical explanatory variables are ≤ 0.5 indicating that the quality of the regression model is good and there is no multicollinearity problem.

3.2.2. Factors forcing private schools/colleges to reduce their teaching staff during COVID-19

Table 4 presents the Heckman two-stage selection equation results that show the relationship between the dependent variable (the employee reduction decisions of private schools and colleges) and the explanatory variables (the factors that force private schools and colleges to decide to reduce their employees during COVID-19 lockdown period).

The Heckman two-stage selection equation result showed that out of the total 12 variables, 5 variables had strongly significant (at the 1% level of significance), and 1 variable had a marginally significant (at the 10% level of significance) effect on the decision to reduce teaching employees. Age of the private school/college (the number of years the private school/college stayed in the education sector from its establishment) has a highly significant (P-value < 0.001) positive effect on the decision to reduce teaching employees (Table 4). This may be because older schools/colleges may have larger number of students. Per hour part-time payment to teachers by private schools and colleges has negative and strongly significant (P-value < 0.001) influence on the employee reduction decision of private schools and colleges during the COVID-19 lockdown (Table 4). This result implies that private schools/colleges paying higher hourly rate, which reflects having better qualified teachers, reduced fewer teaching employees. This could also be because private schools/colleges do not want to lose their highly qualified teachers during the post-pandemic period.

The tax category of the private school/college has a negative (i.e., those in the higher tax-bracket reduced fewer teachers) and strongly significant (at 1% level of significance) influence on the employee reduction decision of private schools and colleges during the pandemic (Table 4). This negative relationship is partly because the private schools and colleges in the higher tax-bracket have a strong financial reserve that could allow them to endure the financial shock caused by the COVID-19 pandemic. Borrowing money from government/private banks has a positive and strongly significant (at 1% level) influence on the decision to reduce teacher employee during the pandemic (Table 4).

The numbers of administrative employees working in the private school/college during the survey period has negative and highly significantly relationship with the employee reduction decision of the private schools/colleges during the pandemic (Table 4). This could be because larger private schools/colleges that would have larger number of administrative employees reduced fewer teachers due to the reason mentioned earlier. The coefficient for “did you get loan repayment suspension from the government?” was negative and marginally significant (Table 4), which implies that those private schools/colleges that received suspension of loan repayment reduced fewer teaching employees.

3.2.3. The marginal effects of variables for the Heckman two-stage selection equation results

The Heckman two stage selection equation results that show the marginal effects of variables are presented in Table 5. The results indicate that an additional 1-year increase in age of the private school/

| Variable                                                                 | Coefficient | P-value* |
|--------------------------------------------------------------------------|-------------|----------|
| Age of the private school/college from its establishments                | 0.319       | <0.001***|
| Educational status of the private school/college Director               | −0.419      | 0.362    |
| Accommodation level (number of students) of the school/college          | 0.002       | 0.188    |
| The number of branches the private schools/colleges have                | −0.184      | 0.162    |
| Per hour part-time payments to teachers                                 | −0.064      | <0.001***|
| The tax category of the private schools/colleges                         | −2.130      | <0.001***|
| Money borrowed from government/private banks                            | 1.252       | <0.001***|
| Did you get loan repayment suspension from the government               | −0.843      | 0.090*   |
| The number of administrative employees                                  | −0.543      | <0.001***|
| The educational institution category (private college dummy)            | 0.383       | 0.462    |
| The student-to-administrative employee ratio                            | 0.013       | 0.656    |
| Students-to-teacher ratio                                               | 10.602      | 0.488    |
| Constant                                                                 | 8.718       | <0.001***|

Table 3

Correlation coefficients among the numerical explanatory variables.

| Variable | Coefficient |
|----------|-------------|
| Age      | 1.000       |
| Acco     | −0.076      |
| Norba    | −0.333      |
| Ptp      | −0.103      |
| Admem    | −0.208      |
| Stuadmr  | −0.038      |
| Stutear  | 0.055       |

* *** and ** represent significance at the 1% and 5% levels of significance, respectively.
college, other things remaining constant, leads to a decrease in the probability of the private school/college to reduce their teaching employees by 7.5% during the pandemic and the influence was strongly significant at 1% level (Table 5).

An increase in per hour part-time payment to teachers by 1 USD, other things remaining constant, increases the probability of deciding to reduce teacher employee by 1.4% during the pandemic and the influence was significant at 1% level (Table 5). The results also indicate that being categorized under Category ‘A’ tax-payer level increases the chance of deciding to reduce teaching employees by 67%, keeping other things constant, and the effect was strongly significant at 1% (Table 5). This is because schools/colleges under Category ‘A’ are in the highest tax paying bracket.

Being a borrower of money from government/private banks in the previous years, other things remaining the same, decreases the probability of deciding to reduce teaching employees by 9.9% during the pandemic and the influence was significant at 5% (Table 5). An increase in the number of administrative employees, other things remaining constant, increases the probability of deciding to reduce their teaching employees by 10.9% during the pandemic and the effect was strongly significant at 1% (Table 5).

### 3.2.4. Factors influencing the extent of reduced private school/college teaching employees during COVID-19

Heckman two-step selection equation identifies the factors that determine the extent of the reduced teaching employees by private schools and colleges during the pandemic by using the selection model that includes the Inverse Mill’s ratio. The Inverse Mill’s ratio was calculated from Probit estimation of the employee reduction decisions in the first step. The coefficient of the Inverse Mill’s ratio (λ) in the Heckman two-step estimation was marginally (significant at the 10% level, but not at the 5% level) significant (Table 6). This indicates that a sample selection bias correction was made, and some unobservable private schools and college characteristics determine the decision to reduce teaching employees, and thereby affect the extent of employee reduction. The Wald test result indicates that the overall goodness of fit of the model (Model Adequacy) of the Heckman two-step selection models was statistically significant at the 1% level of significance (Table 6). This shows that the independent variables included in the selection model explain the extent/level of teacher employee reduction.

The Wald test result indicates that the overall goodness of fit of the model (Model Adequacy) of the Heckman two-step selection models was statistically significant at the 1% level of significance (Table 6). This indicates that sample selection bias correction was made, and some unobservable private schools and college characteristics determine the decision to reduce teaching employees, and thereby affect the extent of employee reduction. The Wald test result indicates that the overall goodness of fit of the model (Model Adequacy) of the Heckman two-step selection models was statistically significant at the 1% level of significance (Table 6). This shows that the independent variables included in the selection model explain the extent/level of teacher employee reduction by private schools/colleges during the Covid-19 lockdown.

As the Heckman two-stage outcome equation results indicate, accommodation level of the school/college, minimum required educational level for teachers, loan repayment suspension from the government during the pandemic, tax payment deferral from the government, the number of administrative employees, the educational institution category, and student-to-administrative employee ratio were the significant variables that influence the extent of employee reduction by private schools/colleges during the pandemic (Table 6). Particularly, the accommodation level of the school/college has a negative and strongly significant (at 1% level) influence on the degree of teachers’ reduction of private school/colleges during the pandemic (Table 6). Minimum required educational level for teachers has a negative and marginally significant effect on the degree of teachers’ reduction, which suggests that private schools/colleges that have higher minimum requirement reduced fewer teachers during the pandemic (Table 6).

Loan repayment suspension from the government has a negative and highly significant (at 1% level) influence on the extent of teacher employee reduction of private schools/colleges. Tax payment deferral from the government to the school/college also has a negative and significant (at 5% level) influence on the extent/level of employee reduction by private schools/colleges during the COVID-19 period (Table 6). These results indicate that loan and tax payment deferrals by the government are effective incentives to the schools/colleges to minimize the extent of their teaching employee reduction.

The number of administrative employees working in the private school/college has positive and strongly significant (at 1% level) influence on the extent of employee reduction during the pandemic. The impact of educational institution category on the degree of employment reduction during Covid-19 lockdown was negative and marginally significant (at 10% level) (Table 6). This result indicates that, private colleges reduce fewer numbers of teaching employees than the primary and secondary private schools. Lastly, student-to-administrative employee ratio has a negative and strongly significant (at 1% level) influence on the extent of teacher employee reduction by private schools and colleges during Covid-19 pandemic (Table 6). This result indicates that, higher number of administrative employees per student is associated with a high extent of employee reduction by private schools and colleges during the Covid-19 pandemic. This could be that when private schools/colleges are faced with financial stress, the teachers are more vulnerable than the administrators, some of whom could be shareholders of the school/college.

### 4. Conclusions

The main objective of this study was to analyze the impacts of COVID-19 on teaching job losses, and to identify institutional factors that influence private schools/colleges employee reduction decisions in Northern Ethiopia by using the Heckman two-step estimation models. To achieve the objective, survey was conducted from May 15, 2020 to July 1, 2020 to collect data from 278 private schools and colleges. The first step of the Heckman two-stage estimation, which shows the Probit regression model result, indicated that age of the private school/college, per hour part-time payments to school and college teachers, the tax category of the private school/college, money borrowed from government/private banks, the number of administrative employees, and whether they received loan repayment deferral from the government were the variables (institutional factors) that significantly influenced the employee reduction decision of private schools and colleges during COVID-19 lockdown.

In the second step of the Heckman two-step outcome equation results, the coefficient of the Inverse Mill’s ratio (λ) was marginally significant. This indicates that sample selection bias was corrected, and there are some unobservable school/college characteristics that determine the decision to reduce teaching employees. However, the Wald test result indicates that the overall goodness of fit of the model (Model

| Variable                                      | Coefficient | P-value |
|-----------------------------------------------|-------------|---------|
| Age of the private school/college from its establishment | -0.006      | 0.521   |
| Educational status of the private school/college | 0.027       | 0.816   |
| Director                                      | -0.011      | <0.001***|
| Accommodation level (number of students) of the school/college | -0.024      | 0.531   |
| The number of branches the private schools/colleges have | -0.011      | <0.001***|
| The tax category of the private schools/colleges | 0.097       | 0.616   |
| Minimum required educational level for teachers | -0.318      | 0.078*  |
| Per hour part-time payments to teachers        | -0.006      | 0.898   |
| Money borrowed from government/private banks   | 0.006       | 0.963   |
| Did you get loan repayment suspension from the government | -0.374      | 0.006***|
| Did you get tax payment deferral from the government | -0.266      | 0.026** |
| The number of administrative employees         | 0.605       | <0.001***|
| The educational institution category (private college dummy) | -0.213      | 0.054*  |
| Student-to-administrative employee ratio       | -0.069      | <0.001***|
| Student-to-teacher ratio                       | 3.947       | 0.159   |
| Constant                                      | -3.416      | <0.001***|
| Mills Lambda (IRM)                            | 0.469       | 0.083*  |
| Number of observations = 278                  |             |         |

* *** and ** represent significance at the 1%, 5%, and 10% level of significance, respectively.
Adequacy) of the Heckman two-step selection model was statistically highly significant, and the model was able to identify the important institutional factors that influence the extent of teaching employee reduction by private schools and colleges during the pandemic in Northern Ethiopia. These factors were accommodation level of the school/college, minimum required educational level for teachers, loan repayment suspension from the government during the pandemic, tax payment deferral from the government, the number of administrative employees, the educational institution category, and student-to-administrative employee ratio.

The findings of this study provide useful evidence-based information to stakeholders in different sectors so that they can take coordinated actions to withstand COVID-19 shocks. The government of Ethiopia should establish a fertile ground to the private education sector by making appropriate loan repayment and tax payment deferrals during this kind of shocks. As far as school/college teaching employees are concerned, Ethiopian labor and social affairs agency should have a clear and practical legislation to protect private sector employees particularly private school/college teaching employees during COVID-19 kind of shocks and other uncertainties. Furthermore, private schools and colleges should be operated and lead by innovative and visionary directors to enable the private education sector to become resilient to any future shocks. Furthermore, private schools/college directors should be able to plan how to withstand COVID-19 kinds of shocks and how to retain their teaching employees.

CRediT authorship contribution statement

Adino Andaregie: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Writing - original draft. Tsessema Astatkie: Methodology, Validation, Writing - review & editing.

Declaration of Competing Interest

The authors report no declarations of interest.

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