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OUR WELFARE AT THE TIME OF COVID-19: EARLY EMPIRICAL ASSESSMENT FOR ETHIOPIA

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Abstract:

Current evidences reveal that COVID-19 will have nontrivial consequences on the global economies. A balanced intervention is expected from policymakers of strong restriction versus the economic and social impacts of the intervention. The main objective here is to quantify the impacts of COVID-19 on welfare through employed propensity score matching and endogenous switching regression methods and using the World Bank high-frequency phone call data in Ethiopia. The results showed that COVID-19 adversely affected all outcomes used here and the impacts vary disproportionally by different household groups. As of now, however, there are no clear indicators that show how these impacts could vary in future. As the pandemic is in its early stage, the condition calls more researches to be conducted with wider datasets that can fully capture the potential and long-term impacts of the pandemic. Finally, this study also sheds light on the effects that COVID-19 has on general welfare in the short-run.

Keywords: *Welfare, COVID-19, food security, employment, Ethiopia.*
JEL Codes: *I00, I30, I38, M54, Q18.*

1. Introduction

Our planet has experienced one of the greatest crises, perhaps since the 2nd World War. This is the outbreak of a new virus called 'novel coronavirus disease 2019 (COVID-19 or SARS-CoV-2)'

[1] . It was first reported in Wuhan city, China, on December 31, 2019 (Gautam, 2020a; Gautam, 2020b) and possibly the most disruptive global event since the 1929 the World Economic Great Depression[2]. The World Health Organization (WHO) has declared the virus as a pandemic on March 11, 2020 following 118,319 confirmed cases globally in over 110 countries (WHO, 2020a). By the first week of June 2020, the spread of COVID-19 has covered almost 216 countries on the planet (WHO, 2020b), and this trend shows how much the virus is a big threat to the globe.

Recent evidences indicate that the virus is not only the global public health threat, but it is also an indicator of high inequity and lack of social progress (Chakraborty & Maity, 2020). The name COVID-19 is a short-hand representation where, 'CO' stands for 'corona,' 'VI' for 'virus,' and 'D' for the disease, and 19 denotes the year of its outbreak. After the first reported case in China, several primary cases were connected to source infection from a seafood wholesale market (Yang et al., 2020). Through time, the disease has reached every part of the planet and quickly surrounded and affected all sections of the globe excluding Antarctica.

In Sub-Saharan Africa (SSA) including Ethiopia, though the spread of the virus seems slower at its early stage, through time both the direct and indirect effects were felt later. On 13 March 2020, Ethiopia has recorded the first COVID-19 confirmed case (ONE UN

ASSESSMENT, 2020) whereas on the first week of May 2020, there were 135 confirmed cases in the country. During that time, the country has given a lab tests for about 0.019% portion of the total population (18,754 people). By 2 August, the country has conducted about 437,319 lab tests out of which 18,706 confirmed cases were obtained (4 % of all tests) (MoH & EPHI, 2020) and 310 deaths were reported due to the virus, where significant portions of these positive tests have been in the capital, Addis Ababa.

Following the first reported case in Ethiopia, several measures and restrictions were taken by the government including awareness creation, isolation and quarantine, physical distancing, public service closure, stop/limit public gatherings, school closures, partial lockdown, state of emergency, stay-at-home, etc. (Goshu et al.,2020) to control the spread of the virus. At the country level, a state of emergency was declared on 8 April, 2020 and following that, except for cargo services, all land borders were locked. Step-by-step, the government followed a relatively tight policy restrictions, and by 16 April, 2020, the first restriction measures were enforced, which includes closures of schools, stopped all public gatherings, and encouraged physical distancing. Following the fast spread of the pandemic, a 14-day mandatory quarantine was enforced for travelers from elsewhere to the country and traveling through land borders was also prohibited.

Ethiopia has more than 110 million population and out of this about 80 % of are engaged in subsistence farming system (CSA, 2017), and this makes the effects of the virus more widespread where in such society with no better health service, the effect may go beyond the expected level. Poverty, drought, and lack of access to food are great challenges in Ethiopia. Undoubtedly, the COVID-19 pandemic can exacerbate the already-precarious agriculture sector and food security situations, both along and at the end of the COVID- 19 pandemic.

The COVID-19 pandemic is a health and humanitarian crisis threatening the food security and nutrition of millions of people around the world (UN, 2020). Soon, the combined effects of COVID-19 itself, as well as corresponding prevention measures and global crisis could disorder the performance of the production and food systems globally. The pandemic's impact on food availability and prices depends on the functioning of the agricultural sector and what happens to the demand and supply of foods. Because of such issues in the food security concerns, assessing and analyzing food security follows different approaches (Habtewold, 2018b; Mulugeta & Hundie, 2012). At the start of the pandemic, many experts feared that the crisis would lead to a series of food price increases (e.g., Reardon et al., 2020), though, the global staple food prices have been stable to date, most likely due to good harvests in the previous season and sufficient global storage conditions (Glauber et al., 2020).

As discussed in Béné (2020), COVID has various adverse effects on local food systems' agents and is likely to have negative impacts on food security including the disruption in inputs' supply chain, the drop in the demand of certain food commodities, the reduction in workers' availability, and the disruption in transportation. As Mogues (2020) also states the food price increase is another likely supply-side channel through which COVID-19 may affect food insecurity.

The economic impact is already visible after three months of the pandemic; economic growth in Sub-Saharan Africa is projected to tumble from +2.4% in 2019 to between –2.1 and –5.1% in 2020, announcing the region's first recession in more than two decades (Calderon et al., 2020). The World Bank's recent forecasts also indicate that, globally, the pandemic is likely to push 49 million people into extreme poverty in 2020 (World Bank, 2020a). From these, more than 45% of these people are in SSA, implying that the region will be hit hardest in terms of increased extreme poverty and hunger. The United Nations World Food Programme (WFP) estimated that the number of people globally facing acute food insecurity would almost double by the end of 2020 (about 135 million people before the crisis), due to income and remittance losses, and disruption of food systems associated with the virus (WFP, 2020a & b).

COVID has also adversely affected all levels of the education system, from preschool to tertiary education. Around end of May 2020, about 368 million schoolchildren were missing out on daily school meals on which they depend on. The pandemic is expected to push additional 49 million people into extreme poverty in 2020[3] and each percentage point reduction in global GDP is expected to result in an additional 0.7 million stunted children[4]. These income effects jointly with supply shocks could lead to a rapid increase in the number of people acutely food or nutrition insecure in the coming periods.

The pandemic also affects the agricultural sector and supply chains as well as all levels of employment conditions. There are also disruptions in supply chains because of transportation problems and other restrictions including stay-at-home and lockdowns. According to the reports of FAO (FAO, 2020a) the pandemic is affecting agriculture sector in two significant aspects: the supply and demand for food, where the two aspects are directly related to food security (Habtewold, 2018b) implying that food security is also at risk.

The impact of the current economic crisis is much wider. Both the pandemic and the corresponding public health measures have taken their toll on people's ability to work across the income distribution. It must be clear that a balanced intervention is expected from policymakers to exploit the positive health effects of strong controlling measures, such as stay home, lockdowns, etc., against their economic and social impacts, especially the burden imposed on a low income, food insecure and/or vulnerable households. It is also important to empirically evaluate the impacts of the spread of the virus on welfare.

Although a rapidly growing body of research investigates the impact of the COVID-19 crisis on the macroeconomy and stock market (e.g., Baker et al., 2020; Eichenbaum et al., 2020; Gormsen & Koijen, 2020; Guerrieri et al., 2020; Lewis et al., 2020; Topcu & Gulal, 2020), only a few pieces of research to date have attempted to analyze empirically how COVID-19 affects the economy at large. Even if the ongoing research is assessing the economic consequences of COVID-19, most of these studies focused on the macroeconomic and financial impact of the COVID-19 (Beyene et al.,2020; Zheng & Zhang., 2020; Baker et al., 2020; Eichenbaum et al., 2020; Gormsen Koijen, 2020; Guerrieri et al., 2020; Lewis et al., 2020; Goshu et al., 2020; He & Harris, 2020; Arbex et al., 2020 ; Arndt et al., 2020), and several studies of the available literature indicate that these studies are also qualitative in type and used descriptive statistical analysis (Goshu et al., 2020; Chakraborty & Maity., 2020; Eftimov et al., 2020; Arouna et al., 2020; He & Harris, 2020; Dantas et al., 2020; Mbunge ,2020; Workie et al., 2020) in which the impact may not be fully captured and correctly estimated. Other few studies also explored the pandemic's impact on the environment (Chakraborty & Maity, 2020; Ravindra et al., 2021). Few notable exceptions are the research work by Martin *et al.* (2020) and Amare et al. (2020) that evaluated the socio-economic impact of COVID-19 on individuals/household's welfare and Topcu & Gulal (2020) on stock markets. Overall, this study is a first step in empirically quantifying the household-level impacts of COVID-19 on welfare in the Eastern African context through program evaluation modeling. The impacts of the outbreak on education are also less studied which is the other novelty of the current study.

The rest of the paper is organized as follows. Section 2 describes the methodology used for estimating the impacts of COVID-19 on welfare. Section 3 discusses the findings of the study and Section 4 gives the concluding remarks and implications of the study's findings.

2. Methodology

2.1 Empirical Modeling

This study employs a combination of propensity score matching (PSM) and endogenous switching regression (ESR)[5] methods to ensure the consistency of results and for checking the

robustness of its empirical findings in evaluating the impact of COVID-19 on welfare. The variations in welfare are more likely to be driven by both government responses to the pandemic and household-level decision to accept the measures and restrictions. The socio-economic consequences of the pandemic are expected to vary depending on individuals' precautionary measures and state-level responses (Abay et al., 2020; Koren & Peto, 2020). Thus, the heterogeneity in the decision to accept the measures and restrictions set by governments and the household-level unobservable characteristics are controlled by estimating a simultaneous equations model with endogenous switching using the full information maximum likelihood (FIML) estimation method, and the robustness of results is checked by PSM results.

The decision to accept the measures and restrictions set by the government (more formally, the selection equation to accept the measures) is defined as:

$$D_i^* = \beta X_i + U_i, with \quad D_i = \begin{cases} 1 & if \ D_i^* > 0 \\ 0 & otherwise \end{cases} \tag{1}$$

where *D* is a binary variable for accepting the measures or agree with government's response to COVID-19; *D*= 1, otherwise D = 0. β is a vector of parameters to be estimated, *X* is a vector that represents household and farm-level characteristics, and *U* is the random error term, and D_i* *is* the unobservable or latent variable component of D_i.

2.1.1 Model Specification

The propensity score is defined as the conditional probability of receiving a treatment given pre-treatment characteristics as:

$$P(X) \equiv Pr\{D_i = 1|X\} = E\{D_i|X\} \tag{2}$$

where $D_i = \{0, 1\}$ is the indicator of exposure to treatment (accepting the measures or agree with the government's response) and *X* is the multidimensional vector of pre-treatment characteristics.

Rosenbaum & Rubin (1983) show that if the exposure to treatment is random within cells defined by *X*, it is also random within cells defined by the values of the mono-dimensional variable *P(X).* As a result, given a population of units denoted by i, and if the propensity score $P(X_i)$ is known as the average treatment effect on the treated (ATT) can be estimated as:

$$\begin{aligned} ATT = E\{Y_{1i} - Y_{0i}|D = 1\} &= E(Y_{1i}|D = 1) - E(Y_{0i}|D = 1) \\ &= E(Y_{1i}|D = 1, p(X) - E(Y_{0i}|D = 1, p(X)\big) \end{aligned} \tag{3}$$

where Y_{1i} stands for food insecurity, labor market participation, and education outcomes for each household that accept the measures and restrictions set by the governments and Y_{0i} for those who don't agree (don't accept) the restrictions. To account for sample selection biases this study uses an ESR model of welfare outcomes where households face two situations: (1) agree/accept the restrictions, and (2) don't agree/don't accept the restrictions. This is defined as:

$$\text{Regime } 1: Y_{1i} = \alpha_1 X_{1i} + e_{1i} \quad \text{if } D_i = 1 \tag{4a}$$

$$\text{Regime } 2: Y_{0i} = \alpha_0 X_{0i} + e_{0i} \quad \text{if } D_0 = 0 \tag{4b}$$

X_i represents a vector of exogenous variables thought to influence food insecurity, labor market participation and education levels. Thus, Equations (4a) and (4b) describe the relationship between the variables of interest in each of the two regimes[6].

2.2 Data Sources and Measurement of Variables

Although official data are not yet available, most analysts believe that the outbreak, mass quarantine, and international travel ban began to severely affect all economic sectors. The current study utilized the dataset collected by the World Bank using high-frequency phone call survey (WB-HFPCS) (round 1) undertaken between April 22 to May 13, 2020, that comprises 70% from urban and 30% from rural areas in Ethiopia. This phone survey was planned to be conducted for a total of seven rounds to track the impact of the pandemic to provide data to the government and development partners in near real-time for supporting an evidence-based response to the COVID-19 crisis in Ethiopia. A total of 3,249 households selected from the fourth (2018/19) Living Standard Measurement Study (LSMS)[7] samples were called back every three to four weeks for each survey round (World Bank, 2020).

Intense food insecurity implies that food shortages and hunger are occurring (Coates et al., 2007), i.e., adults and children in the household skip meals and/or cut portion sizes due to lack of resources available to purchase needed food ingredients. The socio-economic consequences of the pandemic are expected to vary depending on both the government's responses to the pandemic as well as household-level responses associated with precautionary measures to reduce the contraction of the virus (Abay et al., 2020; Koren & Peto, 2020).

2.3 Outcome Variables

Food insecurity indicators: Food insecurity is measured using four indicators, capturing households' experience of food insecurity using the self-reported experience of hunger and food shortage in the last 30 days (Shiferaw et al., 2014; Bellemare &Novak, 2017). The first indicator asks if a household has run out of food or not because there was not enough money or other resources to get food. The second indicator asks whether a household head or any other adult in the household had to skip a meal because there was not enough money or other resources to get food and the third indicator takes a value of 1 if the household or any other adult in the household went without eating for a whole day because of a lack of money or other resources, and the final indicator asks whether the household reduce food consumption or not following the outbreak.

Labor market participation: This variable capture information on households' participation in income-generating activities including farming, non-farm business, and wage-related activities. Farming activities are defined as indicator variable for which household head or any member of the household worked on a household farm whereas a non-farm business is defined as an indicator variable in which a household head or any member of the household operated family business or not. Both farm and non-farm activities are observed at the household level. Finally, in this category wage-related activities (observed at the individual level), which assumes a value of 1 if the household head or any other member of the household did work wage job, either at their place of work or from home, and 0 otherwise.

Education: Households were asked about whether their children attended school before the outbreak or not which assumes a value of 1 if children attended school, 0 otherwise, and change in children's school attendance which captures the variation of educational activities before and after the outbreak.

Intervention Variable: In this study the following restrictions and measures of COVID-19: advised citizens to stay at home, restricted travel within country/area, curfew/lockdown,

building more hospitals for the pandemic, and stopping or limiting social gatherings are considered as treatment indicators or intervention variables.

3. Empirical Results and Discussion

3.1 Results of Descriptive Analyses

Detailed socio-economic characteristics of the respondents are presented in the following sections. Table 1 below reports the first key outcome variable: the food insecurity status of respondents disaggregated in area of residence and gender . As the result shows a significant number of the respondents are suffering from food insecurity in all indicators. For example, households' food insecurity experiences, as measured by incidence of running out of food, skipping a meal, going without eating in the last 30 days, and reducing food consumption is about 22, 17,11, and 16 percentage points, respectively. A comparison between gender showed that female-headed households were more food insecure than male-headed ones in all indicators, except any household member went without eating the whole day. An area of residence-based comparison also showed that people in rural areas are relatively more food insecure.

Farming households may have a fear that the pandemic persists longer, and if so, they cannot run their farm activities as usual which forces them to eat all their seeds instead of saving some to replant, and once a rural farming family does that, becoming self-reliant again will be difficult. In such conditions, the rural population stays longer without having enough food. Some might have no choice than to leave their homes and possibly be subjected to trafficking, in search of subsistence elsewhere. The possible reason behind this fact might attribute to the fact that urban people better underlying food security conditions and have improved access to markets.

Table 1. Food Insecurity Situation of Households since the Outbreak of COVID-19

Food Security Indicators	Respondents (%)				
	Total	Area of Residence		Gender	
		Rural	Urban	Male	Female
Run out of food (0/1)	21.86	28.99	18.82	20.52	24.92
Skip a meal (0/1)	17.03	25.47	13.43	16.19	18.95
Went without eating for a whole day (0/1)	10.81	18.32	7.60	12.66	9.99
Reduce food consumption (0/1)	15.59	24.31	11.85	14.02	16.26
Observation (No.)	3,229	966	2,263	2,242	987

Source: Author's computation using the WB-HFPCS (round 1),2020

The other important sector adversely affected by the COVID-19 is the labor market and different business operation. The business operation of different sectors and the employment condition in these sectors have dramatically changed since the outbreak of the pandemic. Households were asked for major sources of livelihood in the last 12 months and changes in associated income since the outbreak of COVID-19. As shown in Table 2, about 59% of households reported that their income comes from wage-related employment while about 33% of households responded that their income sources are farming and agricultural activities. Before the pandemic, about 25% of the households were employed in the non-farm business sector. Job losses were also another adverse effect of the pandemic such that job losses experienced by nonrespondent household members since the outbreak of COVID-19 are

generally related to the pandemic. Of those household members who lost their job, about 89 % are due to the outbreak of the pandemic while the reaming attributes to some other factors.

Most farm households (94%) responded that they are normally undertaking their agricultural operations. As all may expect in Ethiopia in April and May 2020, agriculture is less adversely affected by the pandemic. Though the pandemic is in its early stage and the farming practice goes normally, farmers feel the fear that they may keep a substantial portion of the seed and other food consumption items for future use as the food insecurity condition above indicates. For various reasons, only 6% of the farm households were not able to run their farm operations normally. Considering the early stage of the pandemic, it is not surprising to note that about 98% of the households are operating in the same job before and after the pandemic.

Table 2. Labor Market Participation of Households

Labor Market Participation	**Respondents (%)**				
	Total	**Area of Residence**		**Gender**	
		Rural	**Urban**	**Male**	**Female**
Wage employment (0/1)	59.10	59.51	58.92	49.45	63.37
Farm activities (0/1)	33.29	78.94	13.63	38.72	21.01
Non-farm business activities (0/1)	25.25	19.84	27.59	26.11	23.32
Farm running normally since the outbreak	94.08				
Similar job before/after the outbreak	98				
Non-respondent household member lost job since the outbreak	21.93				
Household member job loss related to COVID-19					
Related to COVID-19	89.29				
Unrelated to COVID-19	10.71				
Observation (No.)	3,247	978	2,269	2,252	995

Source: Author's computation using the WB-HFPCS (round 1), 2020.

The final sector considered in the current study that is adversely affected by COVID-19 is the education sector. "Going to school is the best public policy tool available to raise skills. While school time can be fun and can raise social skills and social awareness, from an economic point of view the primary point of being in school is that it increases a child's ability. Even a relatively short time in school does this; even a relatively short period of missed school will have consequences for skill growth. But can we estimate how much the COVID-19 interruption will affect learning?"[8]

Schools and universities were closed following the outbreak of the pandemic and as soon as few cases were confirmed in the country. Teaching has moved to online forms and students are expected to involve in some educational activities using different media platforms including online and radio learning programs, although its outreach and efficacy are doubtful. In this case, the doubt is because student assessments are moving online, with a lot of trial and error and uncertainty faced by everyone. Many assessments have simply been canceled. Notably these interruptions will not just be a short-term issue but can also have long-term

impacts on the affected cohorts and are likely to increase inequality between rural and urban students.

Table 3. Educational Activities since the Outbreak of the Pandemic

Educational Activities	Respondents (%)				
	Total	Area of Residence		Gender	
		Rural	Urban	Male	Female
Children attended school before the outbreak (0/1)	91.03	91.92	90.53	92.15	88.31
Listened to educational programs on the radio (0/1)	29.51	72.28	21.29	30.66	26.84
Completed assignments provided by the teacher (0/1)	31.26	11.88	34.98	33.41	26.32
Watched educational TV programs (0/1)	30.78	10.89	34.60	30.57	31.58
Children engaged in learning activities after the outbreak (0/1)	32.64	14.41	43.00	31.71	34.99
Used mobile learning applications (0/1)	21.53	7.92	24.14	19.91	25.26
Session/meeting with lesson teacher (Tutor) (0/1)	14.99	11.88	15.59	16.25	12.11
Observation (No.)	627	101	526	437	190

Source: Author's computation using the WB-HFPCS (round 1), 2020.

Households were asked about whether their children are involved in different media platforms (See Table 3). Depending on the nature of media suitable to rural and urban areas, 72.28% of the students in rural areas listen to educational programs on radio compared to the national rate (29.51%). Following the closure of schools due to the pandemic, only 31.26% of the students have completed assignments provided by their teachers with significant variation between rural (11.88%) and urban (34.98%). Similarly, there were large variations between rural (10.89%) and urban households (34.60%) in terms of watching educational TVs nationally (30.78%), for the fact that access to TV programs is very low in rural areas of Ethiopia. Use of mobile telephone applications for learning also varied in a similar way between urban (24.14%) and rural (7.92%) dwellers. The rural urban difference is due to less access to electricity, internet connectivity, and mobile telephone signals to rural students. This leads to differential educational attainments of students between rural and urban because of COVID-19.

3.2 Results of Empirical Analyses

3.2.1 Impacts on Food Security

This section discusses results obtained from the two methods (first we report the PSM results followed by an ESR output). Table 4 below presents PSM[9] results for all the three outcome variables, but the coefficient estimates from the first stage of PSM are not discussed because of space limitations as the study considers many treatments and three outcome variables. For the first outcome variable, food insecurity, the government's restriction following COVID-19 led to an increase in the probability of food insecurity as all the four

included indicators show, run out of food, skip a meal, went without eating for a whole day, and reducing food consumption.

For example, accepting the restriction of "Stay home" is associated with an 8.20-9.80 percentage point increase in the probability that a household ran out of food or went without eating a meal for a whole day in the last 30 days. If a household or any member went without eating a meal for a whole day this indicator captures insufficient of food quantity and are indicators of severe food insecurity or hunger (Ballard et al., 2013). So, respondents included in the current study face a severe food insecurity problem of about 8.20%. However, the remaining two food security indicators are not strongly affected by stay home restrictions.

Households that accept "limited social gatherings" and "no traveling within country/area" measures are hit food security more impactfully. Households experience the greatest increase in food insecurity measured by went without eating for a whole day in which accepting the restriction leads to an increase in the probability of food insecurity by about 20.6 % due to the former measure and run out of food 13% following the later (no traveling within country/area) restriction. This is equivalent to say that government-induced limiting social gatherings and restricting traveling within country measures are increasing the probability food insecurity. It is also observed that the remaining restriction increase the probability of food insecurity. For example, the estimated results find that national-level lockdowns increase the probability that a household run out of food by 8.40 percentage points and reduce food consumption by about 9.30 %.

To sum, for the food insecurity case, the government-induced measures and accepting them by people led to an increase in the probability of food insecurity measured by households have run out of food or at least worried about not having enough food to eat in the last 30 days, households were hungry but unable to eat healthy and nutritious/preferred foods in the last 30 days i.e. adults and children in the household skip meals and/or cut portion sizes and due to lack of resources, there were also times in the last 30 days when households were hungry but unable to eat for a full day and reducing food consumption[10].

3.2.2 Impacts on Labor Market Participation

Results in Table 4 also show the impacts of COVID-19 on labor market participation and its implication of the spread of the pandemic on employment conditions in wage-related, farming, and non-farming sectors. As expected, the spread of the pandemic is associated with a significant reduction in various economic activities. The results evidenced that government-induced measures and accepting them is associated with a 6.20 -15 percentage points reduction in the probability of participation in wage-related economic activity followed by an 8-10% reduction of the probability of participating in agriculture sectors and a 5.3-18 % reduction in the non-farm business activities.

In the case of wage-related activities, national-level lockdown measures are more impactful in reducing participation in the sector. It affected the sector at large which leads to a reduction of the probability of participation by about 15% while wage-related activities are less hit by restrictions like stay home and no social gatherings. The results of Table 4 also show that restricting travel within areas adversely affects the agricultural sector that is associated with a 9.30% reduction in the probability of participation in the sector. Similarly, the non-farming sector is also adversely affected by restrictions like stay home (5.30%), no traveling within areas (5.40%), and building more hospitals (18%).

Employment in agriculture sector activities is the least affected and the majority of farm households and related subsectors have been undertaking their normal agricultural operations since the outbreak of the pandemic (13 March 2020). Our results, in this case, contradict with the findings of Dingel & Neiman, (2020) which states that wage-related activities are the least affected by COVID-19 probably because some of these activities can be performed remotely

and/or are under formal contracts. It seems that agriculture has served as a fallback activity as some workers who lost their jobs in other sectors tend to end up in agriculture (Goshu et al., 2020), though it is too early to conclude using only the first-round survey. It should, however, be noted that some sectors gain in employment while others experience a fall. However, it is important to know the net employment gains at the country level, as well as the return to labor to different sectorsmay differ in terms of their productivity and factor returns.

3.2.3 Impacts on Educational Activities

The other important sector adversely affected by the pandemic is the education sector. The impacts of the pandemic are likely based on the types of restriction and the way people react to it. The bottom row of Table 4 shows the impacts of COVID-19 on children's education attainment measured by 'children attended school before the outbreak' and 'change in children's school attendance' which captures the variation of educational activities before and after the outbreak. The results indicate that government-induced restriction adversely affected 'children attended school before outbreak', though the impact is not statistically significant. However, the restrictions affected 'change in children's school attendance' impactfully such that the associated impact ranges from 7.70 -20.6 percentage points reduction in attending school. Building more hospitals or renting hotels to accommodate COVID-19 patients measures are more impactful in reducing school attendance. The possible impact pathway here is through a reduction in government budget(assistance) for school since the usual budget support is directed to fight the pandemic now (and no more budget to support the education sector), and finance activities in the health sector. Stay home and lockdown measures also affected the education sector significantly.

3.2.4 Endogenous Switching Regression (ESR) Estimation Results

Table 5 below presents ESR results for all the three outcome variables and for major restrictions including stay home and lockdown. Results of the ESR method indicate that almost all the food insecurity indicators are affected by the government's restriction. For example, the stay home measure increases the probability of people run out of food by about 5.90% and lockdown leads to an increase in the probability of food insecurity by about 11.20 percentage points measured by run out of food. On the other hand, stay home restriction contributes more to households skip a meal in which it increases the probability by about 8%. The results for other outcome variables can be interpreted in a similar fashion. However, from the four food security indicators, households run out of food is the most affected component in general.

The impacts of COVID-19 on labor market participation, similar to PSM outputs, government-induced measures and accepting them is associated with a 4.5 -22.6 percentage points reduction in the probability of participation in wage-related economic activity followed by a 2.0-5.5% reduction of the probability of participating in agriculture sectors and a 1.7-6.4 % reduction in the non-farm business activities. The individual-level effect, for example, travel limits within country/area impacted wage-related activities more than other measures in which it leads to a reduction in wage-employment by 22.6 percentage points. On the other hand, stay home affects both agriculture and non-farming sector activities , it reduces participation in the sectors by about 5.5% and 6.4 %, respectively.

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Table 4. Impact of COVID-19 on Welfare: Average Treatment Effects (PSM Results)

Outcome Variables		Treatment/Intervention Indicator Variables				
		Stay home	**No travel within country/area**	**Curfew/lockdown**	**Building more hospitals**	**limiting social gatherings**
Food Security	Run out of food (0/1)	0.528 0.431 0.098[11](2.92) ***	0.178 0.045 0.133(6.94) ***	0.206 0.123 0.084(3.43) ***	0.100 0.033 0.068(4.28) ***	0.319 0.207 0.112(3.88) ***
	Skip a meal (0/1)	0.483 0.429 0.055(1.42)	0.073 0.065 0.007(0.35)	0.142 0.125 0.016(0.59)	0.036 0.051 -0.014(0.82)	0.358 0.221 0.136(4.12) ***
	Went without eating for a whole day (0/1)	0.550 0.469 0.082(1.73) *	0.106 0.063 0.043(1.63) *	0.142 0.125 0.016(0.59)		0.429 0.223 0.206(4.94) ***
	Reduce food consumption (0/1)	0.469 0.388 0.082(1.61)	0.096 0.082 0.014(0.46)	0.256 0.163 0.093(2.29) ***	0.064 0.049 0.014(0.57)	0.388 0.274 0.113(2.39) ***
Labor market participation	Wage employment (0/1)	0.590 0.612 -0.022(0.50)	0.510 0.572 -0.062(1.70) *	0.486 0.637 -0.151(3.65) ***	0.547 0.489 0.058(0.84)	0.616 0.562 0.052(1.21)
	Farm activities (0/1)	0.351 0.443 -0.093(2.15) **	0.344 0.434 -0.093(2.49) ***	0.449 0.487 -0.039(0.90)	0.285 0.3y84 -0.100(1.50) *	0.459 0.540 -0.080(1.79) *
	Non-farm business activities (0/1)	0.265 0.319 -0.053(1.67) *	0.235 0.289 -0.054(1.61) *	0.280 0.292 -0.012(0.31)	0.241 0.431 -0.180(3.04) ***	0.210 0.269 -0.058(1.14)
Education	Children attended school (0/1)	0.908 0.913 -0.032(1.09)	0.901 0.913 -0.011(0.37)	0.891 0.930 -0.039(1.45)	0.882 0.935 -0.054(1.18)	
	Change in children's school attendance	0.554 0.631 -0.077(1.57) *	0.530 0.569 -0.039(0.55)	0.509 0.628 -0.119(1.93) *	0.397 0.603 -0.206(1.89) *	

Note: The first value(row-wise) in each cell belongs to the outcome mean for the treated and the second for the controlled one.
*, **, and *** indicate significance levels at 10, 5, and 1%, respectively. Absolute values of t-statistics in parenthesis.
Source: Author's calculations using the WB-HFPCS (round 1),2020

Table 5. Impact of COVID-19 on Welfare: Average Treatment Effects (ESR Results)

Outcome Variables		Treatment/Intervention Indicator Variables				
		Stay Home	**No Travel within Country/Area**	**Curfew/Lockdown**	**Building More Hospitals**	**Limiting Social Gatherings**
Food Insecurity	Run out of food (0/1)	0.259 0.0.139 0.059[12](10.01) ***	0.275 0.189 0.085(13.59) ***	0.310 0.198 0.112(15.69) ***	0.330 0.153 0.177(22.90) ***	0.249 0.214 0.036(6.49) ***
	Skip a meal (0/1)	0.183 0.103 0.080(13.14) ***	0.167 0.164 0.002(0.28)	0.184 0.168 0.016(1.75) *	0.072 0.114 -0.042(8.20)	0.189 0.155 0.034(4.33) ***
	Went without eating for a whole day (0/1)	0.133 0.039 0.094(8.91) ***	0.174 0.082 0.092(9.65) ***	0.122 0.84 0.039(4.50) ***	0.057 0.026 0.031(5.93) ***	0.131 0.076 0.055(6.19)***
	Reduce food consumption (0/1)	0.136 0.199 -0.063(9.02) ***	0.168 0.153 0.015(2.01) **	0.225 0.126 0.098(13.27) ***	0.013 0.096 -0.082(5.09) ***	0.143 0.141 0.001(0.25)
Labor market participation	Wage employment (0/1)	0.521 0.566 -0.045(5.76(***	0.382 0.608 -0.226(19.89) ***	0.106 0.627 -0.520(25.64) ***	0.586 0.555 0.031(3.53) ***	0.581 0.501 0.08(12.75) ***
	Farm activities (0/1)	0.350 0.406 -0.055(4.35) ***	0.347 0.367 -0.020(1.67) *	0.381 0.353 0.027(2.25) ***	0.317 0.315 0.003(0.22)	0.353 0.348 0.005(0.43)
	Non-farm business activities (0/1)	0.263 0.199 0.06(7.98) ***	0.235 0.218 0.017(2.68) ***		0.165 0.221 -0.056(7.25) ***	0.225 0.255 -0.029(4.98)***
Education	Children attended school (0/1)	0.904 0.907 -0.003(1.15)	0.898 0.902 -0.004(1.68) *	0.906 0.907 -0.001(0.18)	0.927 0.900 -0.027(4.44) ***	0.908 0.896 0.024(10.8) ***
	Change in children's school attendance	0.388 0.433 -0.045(19.11) ***	0.414 0.530 -0.116(9.23) ***	0.310 0.327 -0.017(1.83) *		0.314 0.266 0.047(7.71) ***

Note: The first value(row-wise) in each cell belongs to the outcome mean for the treated and the second for the controlled one.
*, **, and *** indicate significance levels at 10, 5, and 1%, respectively.
Absolute values of t-statistics in parenthesis.
Source: Author's calculations using the WB-HFPCS (round 1),2020

Table 6. Heterogeneous Impacts of COVID-19 by Areas of Residence and Gender

			Stay Home				Curfew/Lockdown			
			Gender		Location		Gender		Location	
			Male	Female	Rural	Urban	Male	Female	Rural	Urban
	Run out of food (0/1)	PSM	0.06 ***	0.10 ***	0.11 ***	0.05 ***	0.12***	0.21***	0.06*	0.17***
		ESR	0.08***	0.05***	0.38***	0.32***	0.12***	0.27***		
	Skip a meal (0/1)	PSM	0.01	0.06***	0.01	0.02*	-0.00	0.06	-0.04	0.00
		ESR	0.00	-0.03***	-0.39***	0.17***	-0.00	0.05***		
	Wage employment (0/1)	PSM	-0.03	0.05	-0.08***	0.03	-0.16***	-0.05	-0.22***	-0.04
		ESR	0.02***	0.03***	0.11***	-0.05***	-0.04***	-0.37***	-0.14***	-0.72***
	Farm activities (0/1)	PSM	0.03	0.05**	-0.12***	0.04***	0.16***	0.03	-0.06*	0.01
		ESR	-0.06***	-0.13***	0.48***	0.19***	-0.10***	0.10***	0.43***	-0.36***
	Non-farm business activities (0/1)	PSM	0.02	0.19	0.23	0.02	0.02	0.17	0.16	0.08
		ESR	0.04***	0.42***	0.29***	0.18***	0.08***	0.06***		
	Children attended school (0/1)	PSM	0.01	-0.04*	-0.02	0.00	-0.02	-0.04	-0.02	-0.04*
		ESR	-0.01***	-0.03***	-0.99***	0.37***	0.00	0.14***	0.88***	-0.99***

Note: *, **, and *** indicate significance levels at 10, 5, and 1%, respectively.
Source: Author's calculations using the WB-HFPCS (round 1),2020

Concerning the education sector, the impacts of the pandemic are likely to affect both children's educational attainment and change in children's school. The results indicate that those restrictions significantly reduced children attended school as the sign of the ATT term is negative throughout except for 'no social gathering'. As it was observed in the case of PSM results, building more hospitals or renting hotels to accommodate COVID-19 patients measures are more impactful in reducing school attendance, probably due to a reduction in government assistance for schools. Stay home and no traveling within areas are the two measures that also affected the education sector more significantly.

To conclude, the results of both ESR and PSM methods showed that the impact of COVID-19 is almost similar. However, slightly higher estimates of impact from the ESR method compared to estimates from the PSM results may be due to the fact that the effects of unobserved heterogeneity are not a significant problem in our data.

3.2.5 Heterogeneous Impacts

3.2.5.1 Differential household impacts of COVID-19 by Areas of residence and Gender

The impact of COVID-19 is likely to vary across households due to differences in areas people live (urban vs rural) which may determine the probability of exposure to the pandemic as well as in associated government measures and gender-related factors such as types of employment and workload. Therefore, this part targets to uncover the potential differential impact of COVID-19 across various groups of households by disaggregating the impacts into those categories. It is expected that urban households are more likely to experience higher exposure to the pandemic, and hence they are likely to face adverse effects on their economic activities. In this part, we compared the impacts of COVID-19 based on people's areas of residence and gender using the above- discussed outcomes and the two restrictions (stay home and lockdown).

Results presented in Table 6 using both PSM and ESR show that the impact of the pandemic on most of the outcomes is almost related both in sign and in magnitude, though in limited cases the ESR results are higher. For instance, using stay home restriction, the probability a male- headed household run out of food increases by 6% in case of PSM result and 8% using the EER method, while female-headed household's run out of food by about 10% in the former method and 5% in the latter case. On the other hand, although urban households reduce economic activities, they do not suffer much from significant reductions in food security like rural people. The probability that a rural household runs out of food is between 11%-38%. This finding supports the descriptive statistics of Table 1 above where more rural households (about 29%) run out of food as compared to only 18% of urban people. This is probably because urban people better understand food security conditions and have improved access to markets, and the findings are consistent with the results of Amare et al.,2020 .

As long as lockdown restriction measure is concerned, female-headed households experience significant increases in both indicators of food insecurity, although some of their activities are not meaningfully affected by national-level lockdowns (both farm and non-farm activities are not affected by lockdowns). This is likely driven by differences in responses to lockdown measures between female and male-headed households.

The results for labor market participation, though results seem mixing, under both restrictions outputs show that differences exist between male and female-headed households as well as between rural and urban people. In particular, the impacts are expected to be higher among urban and female- headed households. In general, the former expectation goes in the other way round, when most rural households were affected more than the urban once while

the latter expectation seems real in that in most of the indicators the ATT term for female-headed households are higher (See Table 6). The results for other outcome variables can be compared and interpreted in a similar fashion.

In general, the disaggregation of results between different household groups we conducted in this section enables us to uncover the disproportionally affecting impacts of the pandemic. Though the pandemic meaningfully affected different welfare indicators of household, it seems that results come with mixing nature. It is important, however, to note that the current analysis is measuring the short-term impacts of the pandemic based on a single round of data. It is not yet clear how these impacts may change over time and the pandemic continues to affect different households implying that more researches with wider datasets need to be conducted to fully capture the potential and long-term impacts of the pandemic.

4. Conclusions and Implications

Livelihoods and lives are at risk from the coronavirus pandemic which is evident from the current study. Since the first case in March 2020, COVID-19 infection rates have been on a steady rise in Ethiopia. It seems likely that it will even take several months before the epidemic is over. The Government of Ethiopia has taken various measures (e.g., isolation and quarantine, stay-at-home, limit public gatherings, lockdown, etc.) to control the spread of the pandemic. The main objective of this study is to empirically quantify the household-level impacts of COVID-19 on welfare and provide empirical evidence regarding the effects of these interventions on household livelihoods.

About one-third of our respondents indicated that they run out of food or household members worried about not having enough food in the last 30 days due to the pandemic while about one-fourth of the female-headed households run out of food. Similarly, for other food security indicators the status of urban people is not yet at risky condition possibly due to the fact that most households have been able to use their savings to buffer food consumption in towns and urban centers than the rural people. About 59% of the respondents engage in wage-related activities, and this seems the rural households were underrepresented in the phone survey (only about 30%) while about 33% and 25% participated in farming and non-farming activities, respectively. In terms of education, there was no as such variation between urban-rural and male-female headed households before the outbreak, though, after the pandemic children in rural areas were more limited in education accesses and adversely affected than urban children.

The empirical analysis of both PSM and ESR methods also indicates that the government-induced restrictions and measures are associated with measurable food insecurity, employment and education effects in general. Those measures increased the probability of households' experience of food insecurity in the range between 1.5% and 20.6% under the two estimation methods. The restriction also adversely affected the remaining outcomes, however, the pandemic impactfully affected the food insecurity of households more than the other considered indicators in the current study as most of the workforce remains in agriculture based on family labor, and jobs of most Ethiopians were unaffected by the crisis. The results also indicate that those restrictions significantly reduced children attended school, but results are not as consistent as it was in the case of food insecurity. Furthermore, the results indicate that impacts vary disproportionally by different household groups, and each restriction is not equally important in affecting welfare.

Given the above results, it should be noted however that additional efforts are needed to better understand the nature of the pandemic and protect people from the wide-ranging effect of the virus. It is not yet clear how these impacts may change over time and the pandemic continues to affect different households implying that more researches with wider datasets

need to be conducted to fully capture the potential and long-term impacts of the pandemic. Government and other stakeholders are expected to do the following: protect job losses, and create new jobs across all sectors; improve social assistance programs such as rural and urban safety-net grograms; upgrading and modernizing government support to the functioning of major economic sectors including agricultural activities; extending, strengthening and sustaining public awareness campaign and strengthen access to health and education service for all.

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[1] Different terminology revolves around the news, therefore, here we are describing the terms linked with the disease to make it clear for the readers: Novel coronavirus or 2019- nCoV was a temporary name of COVID-19 before its formal name declaration by WHO. COVID-19 is a

disease that is caused by the virus known as "SARS-CoV2". SARS-CoV-2 is a severe acute respiratory syndrome coronavirus-2.

[2] https://www.iisd.org/system/files/publications/covid-19-employment-mining-en.pdf

[3]https://blogs.worldbank.org/voices/covid-19-will-hit-poor-hardest-heres-what-we-can-do-about-it

[4] Global Nutrition Report, 2020.

[5] The researcher advises interested readers to refer to Rosenbaum & Rubin (1983); Becerril & Abdulai (2010); Caliendo &Kopeinig (2008); Kassie et al. (2011); Habtewold (2018a) for PSM and Di Falco et al., (2011); Shiferaw et al., (2014); Khonje et al., (2015); Habtewold (2021); Lokshin & Sajaia (2004) for ESR.

[6] For identification and issues related to exclusion restrictions, refer to Di Falco et al. (2011)

[7] www.microdata.worldbank.org

[8] https://voxeu.org/article/impact-covid-19-education?.

[9] The reported results are the nearest neighborhood matching (NNM) estimates with replacement. Though not reported here, results from kernel-based matching (KBM) and radius matching (RM) are almost similar in many cases.

[10] Laborde et al. (2020) argues that the COVID-19 pandemic has the potential to dramatically disrupt food security, impacting all dimensions of food security from production and supply to accessibility, availability, and usage.

[11] In each cell these values are ATT of PSM estimates