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COVID-19 and Food Security in Ethiopia

Do Social Protection Programs Protect?

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Abstract

We assess the impact of Ethiopia's flagship social protection program, the Productive Safety Net Program (PSNP) on the adverse impacts of the COVID-19 pandemic on food and nutrition security of households, mothers, and children. We use both pre-pandemic in-person household survey data and a post-pandemic phone survey. Two thirds of our respondents reported that their incomes had fallen after the pandemic began and almost half reported that their ability to satisfy their food needs had worsened. Employing a household fixed effects difference-in-difference approach, we find that the household food insecurity increased by 11.7 percentage points and the size of the food gap by 0.47 months in the aftermath of the onset of the pandemic. Participation in the PSNP offsets virtually all of this adverse change; the likelihood of becoming food insecure increased by only 2.4 percentage points for PSNP households and the duration of the food gap increased by only 0.13 months. The protective role of PSNP is greater for poorer households and those living in remote areas. Results are robust to definitions of PSNP participation, different estimators and how we account for the non-randomness of mobile phone ownership. PSNP households were less likely to reduce expenditures on health and education by 7.7 percentage points and were less likely to reduce expenditures on agricultural inputs by 13 percentage points. By contrast, mothers' and children's diets changed little, despite some changes in the composition of diets with consumption of animal source foods declining significantly.

Key words: COVID-19, Social Protection, Food Security, Diet Diversity, PSNP, Ethiopia

JEL codes: I30, I38, O10, Q18

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1. Introduction

The COVID-19 pandemic is testing global food and social protection systems at an unprecedented scale. The spread of the pandemic is disrupting food systems and undermining food and nutrition security of households (Amjath-Babu et al., 2020; Barrett, 2020; Béné, 2020; Devereux et al., 2020; GAIN, 2020; Reardon et al., 2020b; Swinnen, 2020; Torero, 2020). There is concern that developing countries with poor healthcare and more limited social protection systems may be especially badly affected. Recent projections show that globally the pandemic is likely to push 88-115 million people into extreme poverty in 2020 (World Bank, 2020), a third of these being from sub-Saharan Africa. Globally, the pandemic is projected to double the number of people facing acute food insecurity by the end of 2020 (about 135 million people before the crisis) (WFP, 2020).

There are at least three ways in which the pandemic may affect household food security. First, individuals in some households may contract the virus and this will have both direct economic impacts such as loss of earnings and indirect effects through the need to meet medical costs. Even in the absence of direct contraction, fear of contracting the virus could reduce income-generating activities. Second, government restrictions on movement and gatherings aimed at slowing the spread of COVID-19 has disrupted livelihood activities, thereby reducing household incomes (Abay et al., 2020; Amare et al., 2020; Arndt et al., 2020; World Bank, 2020). Third, access to food has been affected by disruptions to markets and food value chains (e.g., Aggarwal et al., 2020; Hirvonen et al., 2020; Mahajan and Tomar, 2020). However, empirical evidence on the magnitude of the impact of the pandemic on household food security remains scant, partly because the pandemic is still unfolding and detailed household survey data are not available yet.

Within this context, this paper makes three contributions. First, we add to the small but growing literature on the impact of the pandemic on household food security in sub-Saharan Africa, specifically rural Ethiopia. Second, we assess the effectiveness of a social protection intervention in mitigating these malign impacts. Gentilini et al (2020) note that since the outbreak of the pandemic, more than 150 countries and territories have implemented or announced plans to implement social protection measures, yet little is known about the effectiveness of these interventions. Similarly, in the context of the COVID-19 pandemic, the mechanisms through

which social protection and safety nets benefit recipients is ambiguous (Banerjee et al., 2020).[1] Third, we assess the impact of the pandemic on the diets of women and pre-school children. As is well understood, the impact of shocks on households can have unequal effects on individual household members (Alderman et al., 1995; Hoddinott 2006) and our data allow us to assess some of the intra-household impacts of COVID-19.

In March and August 2019, we conducted face-to-face surveys with mothers of children under the age of 24 months to assess how access to Ethiopia's flagship social protection program, the Productive Safety Net Program (PSNP) had affected their food security and nutritional status. In June 2020, we re-interviewed these mothers by phone. Our data covers drought-prone areas of Ethiopia, spanning the four main highland regions of the country. Having access to pre-pandemic data allows us to assess the extent to which household food security and diets of individual members have changed following the start of the pandemic in Ethiopia. The longitudinal nature of our data, together with a sample that included both PSNP and non-PSNP households allows us to combine a difference-in-difference approach with a household fixed effect estimator, allowing us to control for a wide range of confounding factors.

We find that the percentage of households reporting a food gap, a widely used measure of food insecurity in Ethiopia, increased by 11.7 percentage points and the size of the food gap by 0.47 months. Participation in the PSNP offsets virtually all of this adverse change; the likelihood of becoming food insecure increased by only 2.4 percentage points for PSNP households and the duration of the food gap increased by only 0.13 months. The protective role of PSNP in food security is higher for poorer households and those living in remote areas. Results are robust to definitions of PSNP participation, different estimators and how we account for the non-randomness of mobile phone ownership. PSNP households were less likely to reduce expenditures on health and education by 7.7 percentage points and were less likely to reduce expenditures on agricultural inputs by 13 percentage points. By contrast, mothers' and children's diets changed little, despite some changes in the composition of diets as consumption of animal source foods declined significantly. Our findings highlight the value of having a well-functioning social protection program in place prior to the pandemic in order to protect the food security of poor

[1] While safety nets and transfers enable beneficiaries smooth consumption during income losses, some forms of transfers can increase beneficiaries' exposure to the virus if these transfers trigger new economic activities and businesses (Banerjee et al., 2020).

households.

The paper is organized as follows. Section 2 describes how we implemented these surveys. Section 3 provides contextual information on the pandemic in Ethiopia, how it affected the households in our sample and how we define PSNP participation. Section 4 describes our estimation strategy; section 5 presents our results and we end with concluding remarks in Section 6.

2. Survey method and implementation

The PSNP is Ethiopia's flagship rural food security program, operational since 2005. Most beneficiaries are employed in labor-intensive public works for six months per year with a small fraction of beneficiaries (approximately 15 percent) receiving unconditional payments (Berhane et al., 2014; Berhane et al., 2020). Payments are largely made in cash, but in-kind (food) payments are also used in localities that have poor access to markets. It is targeted both geographically – operating in *woredas* (districts) which are considered chronically food insecure – and individually, with households selected for inclusion based on a series of criteria of which household food insecurity is particularly important. Households targeted for PSNP participation are historically food insecure, have low household asset holdings (e.g., land, oxen) and limited income from alternative sources of employment (Berhane et al., 2014; Berhane et al., 2020). Beginning in late 2018, in the Highland regions of Ethiopia (Amhara, Oromia, Southern Nations, Nationalities and Peoples (SNNP), and Tigray), additional activities were introduced into the PSNP that included the provision of information on improved maternal and child nutrition practices with the aim of making the program more nutrition sensitive.

In March and August 2019, we conducted face-to-face surveys in 88 woredas where the nutrition sensitive PSNP was supposed to operate. Three rural *kebeles* (sub-districts) were randomly selected from each woreda and, within these, one enumeration area (EA) was randomly chosen.[2] For each EA, a list of households was constructed. Inclusion in this list was based on the following criteria that were implemented sequentially. First, a household was eligible if it had a child less than 24 months of age. Conditional on having a child in this age range, households were eligible for survey inclusion if: (a) they had been included in the PSNP; or (b) if they were not

[2] *Kebele* is the smallest administrative unit in Ethiopia.

included in the PSNP but were considered poor.[3] From this list, we randomly selected five PSNP and five non-PSNP households. Our March 2019 sample included 2,626 households with a young child aged 0-24 months, of which 2,551[4] were successfully re-interviewed in August 2019 (Berhane et al., 2020).[5]

In June 2020, we conducted a phone survey of these households. As part of the 2019 surveys, we collected information on households' ownership of mobile phones, their phone numbers and permission to contact them by phone if needed. About 54 percent (1387/2551) of the August 2019 sample had access to a phone. In addition, members of our 2019 survey teams were able to help us locate additional households who now have mobile phones. Using this information, we interviewed 1,497 (about 59 percent) of the 2,551 households who took part in the August 2019 survey. As was the case in the 2019 surveys, the primary respondent was the mother of the pre-school child. Several methods were deployed by the survey team to minimize non-response, including using built-in out-of-network reminders, allowing extended appointments, and making several call attempts at different hours of the day. On average, each interview required about two call attempts to succeed, about 53 percent were reached at first attempt, and about 3 percent of the interviews needed a minimum of 7 (and a maximum of 17) call attempts to succeed.[6]

An obvious concern with this approach is that the phone sample will differ in systematic ways from the original 2019 sample, not least because ownership of mobile phones is correlated with wealth in this population (see Table 1). We account for this in the following way. Our 2019 survey contained a rich set of observable characteristics that we can use to predict the probability of response to our phone survey (see Table 1) using a logit model (see Table A1). We then construct sampling weights as the inverse of the predicted probability of response in the phone

[3] Poverty status was determined using a subjective poverty measure in which households were asked to rank themselves on a seven rung poverty ladder. The first rung represented the very poorest households in the village and the seventh rung, the very richest households in the village. Our previous work in Ethiopia shows that this poverty ladder is well correlated with other (more objective) welfare measures: durable asset levels, livestock holdings and self-reported food security. Non-PSNP households were chosen from the bottom four rungs of the ranking. Please see Berhane et al. (2020) for detailed discussion about this selection process.

[4] This is an attrition of 2.9 percent largely related to two reasons: absence of households at home in the rainy season and some areas were inaccessible because of ongoing civil unrest.

[5] The March 2019 sample considered 0-24 months old children. In June 2020, our children sample became 13 months older. In addition, a new child has been born to 15 percent of the mothers in our sample. Given the interest in younger children, whenever possible, we have replaced the old index child by the young ones. Thus, our current child sample is composed of 0-36 months old.

[6] The median interview time was 32 minutes.

survey. These weights were applied in all our analyses and estimations. As Table 1 shows, use of these weights markedly reduces the unweighted differences in the observable characteristics in the full sample and phone sample. Further, the weighted distribution for some observables in our phone survey is almost indistinguishable from those of the full sample (see Figure 1). In our analysis, we deploy these sampling weights to recover appropriate and representative statistics under the assumption that this list of observable factors can account for systematic non-responses in the phone survey (Wooldridge, 2007; Korinek et al., 2007).

3. Descriptive Results and Study Context

Here we provide some descriptive information on our sample, our outcome variables, the spread of COVID-19 in Ethiopia and our measures of PSNP participation.

3.1. Descriptive Results

About 90 percent of our sample households are male headed who are, on average, 39-years old and with three years of schooling (see Table 1). Households have an average family size of six, operate a little less than a hectare of land and own livestock equivalent to three tropical livestock units (TLU).[7] More than half of mothers have never been to school and those that did completed, on average, only two grades.

In evaluations of the PSNP, household food security is measured using a self-reported indicator called the food gap, the number of months the household was not able to satisfy its food needs (Berhane et al., 2014). In both the August 2019 and June 2020 surveys, households were asked to report their food gap over the previous six months; this outcome ranges from 0 ("no food gap") to 6 months ("acute food gap"). We use both this count outcome as well as a binary food insecurity indicator constructed from these responses and assuming a value of 1 for households that experienced problems in satisfying their food needs and 0 for those reporting no difficulty satisfying their food needs.

More than 51 percent of households reported to have experienced food insecurity in the pre-pandemic period, with the figure higher for PSNP beneficiaries (Figure 2). This incidence of food insecurity increased to 59 percent in the aftermath of the onset of the pandemic, largely driven

[7] Tropical Livestock Units are livestock numbers converted to a common unit. We apply the following formula: 1 TLU = 1 camel, 0.7 cattle, 0.8 horses, 0.5 donkeys, 0.5 mules, 0.1 sheep, 0.1 goats, and 0.01 chicken.

by the sharp increase in food insecurity among non-PSNP households. The average household reported a food gap of 1.3 months in the August 2019 survey, but this grew to 1.6 months in June 2020. Non-PSNP households reported a 0.5 month increase food gap while the corresponding increase for PSNP households was 0.1 month. Compared to August 2019, the food gap increased in three of the four surveyed regions. The largest increase was in SNNP (from 1.8 to 2.6 months) and Tigray (from 0.5 to 0.9 months). While the mean food gap was highest in Oromia, it changed little between the two rounds. PSNP beneficiaries report smaller increases in mean food gap (0.2 versus 0.5 months).

We asked respondents about their perception of their food security status in the last three months preceding the June 2020 survey compared to similar months the previous year. The food security question is framed in terms of households' ability to satisfy their food needs. As shown in Figure 3, almost half of the respondents (49 percent) report that their ability to satisfy their food needs worsened, and the rest report that it remained about the same (48 percent) or improved (3 percent). The worsening of the problem of satisfying food needs appears to have been greater in areas that are more severely affected by the pandemic. In addition to the household survey, we collected zone-level (sub-regional) data on spread of COVID-19 until June 2020. March 13 marked the first case of COVID-19 in Ethiopia and the pandemic begun to take off in June where cumulative new cases reached 5,846 by June 30 (EPHI, 2020). We construct an indicator variable of zone level status of COVID-19 spread using the number of cases reported as of end of June 2020. The indicator variable takes value 1 for zones in the top tercile of COVID-19 cases and 0 for zones in the bottom two terciles. Households reporting that their food security situation has worsened (34 percent vs 15 percent) or about the same (35 percent vs 13 percent) are concentrated in zones with high number of COVID-19 cases.

We obtained comparable data on maternal and child diets in both the 2019 face-to-face and 2020 phone surveys. Mothers were asked about their and the index child's food consumption in the 24 hours prior to the interview using a listing of food items. Mothers' food items are grouped into 10 food categories: all starchy staple foods, beans and peas, nuts and seeds, dairy, flesh foods, eggs, vitamin A-rich dark green leafy vegetables, other vitamin A-rich vegetables and fruits, other vegetables, and other fruits (FAO and FHI-360, 2016). Thus, mothers' dietary diversity score ranges from 0 to 10 food items. Children's food items are grouped into 7 categories: grains, roots and tubers, legumes and nuts, dairy products, flesh foods, eggs, vitamin A rich fruits and

vegetables, and other fruits and vegetables. Children's dietary diversity score ranges from 0 to 7.

Reductions in incomes and restrictions in access to food markets may lead to a decline in the diversity of diet as well as shifts away from high quality but more expensive items to cheaper substitutes. Figure 4 shows the percentage of mothers reporting that they or their children have consumed a specific food category in the last 24 hours. Starting with mothers, their diets are dominated by starchy staples, vegetables, and beans and peas, with almost all (97 percent) consuming starchy staples (Panel (a) of Figure 4). There was a small increase in the number of mothers reporting consumption of these items in June 2020 (93 percent to 97 percent for starchy staples and 61 percent to 63 percent for other vegetables); but no change in the consumption of beans and peas (60 percent). We observe a larger increase in consumption of vitamin A-rich dark green leafy vegetables (20 percent to 32 percent). There was a decline in the consumption of eggs (5 percent to 2 percent), dairy products (20 percent to 13 percent), and flesh foods (7 percent to 2 percent).

Changes in the food children consumed follow a similar pattern to that of their mothers, except for eggs, though the size of the change is much larger for children (Panel (b) of Figure 4). There is sharp increase in the consumption of grains, roots and tubers (84 percent to 96 percent), vitamin A-rich fruits and vegetables (8 percent to 31 percent), other fruits and vegetables (39 percent to 62 percent) and legumes and nuts (35 to 51 percent). The consumption of dairy products decreased from 16 percent to 11 percent and that of poultry, fish and meat decreased from 3 percent to just 1 percent. On the other hand, the number of mothers reporting that their children had consumed eggs in the last 24 hours increased from 6 percent to 10 percent. Overall, both mothers and their children increased consumption of vitamin A-rich fruits and vegetables while consumption of animal source foods have declined.

3.2. Context around COVID-19

The first COVID-19 case in Ethiopia was confirmed on March 13, 2020 in Addis Ababa. It has since spread to all 11 regions of the country. As of mid-October 2020, the number of confirmed cases exceeded 89,000 with more than 1,350 confirmed deaths. About 53 percent of the confirmed cases were in Addis, with Oromia (13.5 percent), Tigray (8 percent), Amhara (7 percent), and SNNPR (4 percent) being the other most affected regions (EPHI, 2020). To slow the spread of the pandemic, the federal Ethiopian government put in place several measures including restrictions

on movement of people, school closures and shelter in place orders. These culminated in the declaration state of emergency on April 8, 2020. Prior to that, a range of restrictions had been put in place including bans on overcrowded public transport and large gatherings, closure of primary and secondary schools, and closure of universities and colleges on March 16, 2020. Domestic travel restrictions were put in place on March 21, 2020; and halt in the movement of people along all borders was imposed on March 22, 2020. A mandatory quarantine for international travelers was imposed on March 23, 2020, followed by stay at home/shelter in place orders on March 23, 2020 (EPHI, 2020).

As of June 2020, all respondents (99.8 percent) had heard of COVID-19. The initial source of information was primarily mass media. Just over half of respondents indicated that they first learned about COVID-19 either on the radio (51 percent) or television (eight percent). Neighbors (18 percent) and family members (four percent) were also noteworthy sources of initial information. On average, respondents could describe 1.8 symptoms of COVID-19 and 93 percent could identify at least one symptom. Slightly more than one third (36 percent) reported that they did not leave their homesteads during the previous week. On average, respondents reported taking 3.2 actions to reduce the likelihood that they or someone in their household would contract COVID-19 and only five percent reporting taking no actions at all. The most common actions were washing hands for 20 seconds or more (82 percent), and conditional on going out, avoiding shaking hands or kissing when greeting others (77 percent) or avoiding large gatherings or queues (66 percent).

We asked respondents how worried or stressed they were because of the coronavirus pandemic, using a scale from one (Not worried/stressed at all) to 10 (Extremely worried/stressed). Two-thirds of respondents (68 percent) reported that they were extremely worried, 10 percent said they were not worried at all with the rest reporting stress levels scattered between these. We then asked which aspect of the coronavirus crisis had had the greatest impact on the respondent and her household? (Enumerators read these out and asked the respondent to indicate which item had the greatest effect). Aggregate responses are shown in Figure 5. Market closure, fear of getting infected by the virus, high food prices and loss of income were the most important effects of the pandemic on livelihoods. More than 24 percent of respondents reported market closure as the greatest impact of the pandemic. Responses disaggregated by self-reported stress levels (not stressed, responding from 1 to 3 on the 10-point scale; moderately stressed, responding from 4 to

8; extremely stressed, responding either 9 or 10) are reported in Table A2.

Not surprisingly, about 30 percent of respondents who are found in the not stressed category indicated that they had not been affected in any way. Extreme self-reported stress is strongly associated with fear of illness or death. A loss of employment or income is cited as the most important impact by more than 8 percent of all respondents, just under a third (30 percent) report that disruptions in food access was most important impact and another 9 percent stated that higher food prices were the most important impact.

Figure 5 lists the single most important impact, not the only impact. To assess further the consequences of the pandemic, we asked respondents to provide a qualitative assessment of changes in household income compared to incomes usually received at this time of the year. Across all respondents, two thirds stated that incomes were much less (26 percent) or somewhat less (41 percent) (Table A3). Only 27 percent reported that incomes were unchanged and few, just six percent, stated that incomes had increased. A potentially confounding factor, however, is that parts of southern and eastern Ethiopia were affected by locust swarms from February 2020 onwards. We asked respondents if, in the last month, their crops or livestock had been adversely affected by locusts on a scale from one (not at all) to five (totally lost). Most respondents (84 percent) reported that they were not affected, eight percent said that they had been affected "a little bit" with the remaining eight percent more severely affected. In Table A3, we disaggregate income losses by households affected by the locust invasion and those that were not. Households affected by the COVID-19 pandemic and the locust swarm report higher rate of income losses. However, even excluding those households that were affected by desert locust, we still see a large fraction (64.5 percent) of households reporting that their incomes were much less or less than usual.

We next explore how households cope with potential impacts of the pandemic and associated income losses. Specifically, we asked whether in the previous 30 days anyone in the household had undertaken certain actions because of a lack of food or a lack of money to buy food or meet other basic needs. These coping strategies are reported in Figure 6. These include reductions in: (i) food consumption, (ii) expenditure on non-food, (iii) expenses on agricultural inputs, and other approaches to smooth consumption. Several results emerge from Figure 6. First, households reporting the largest income losses were most likely to report the use of all these coping strategies. Second, households were more likely to report undertaking reductions in food consumption or expenditures on non-food items such as health, education and clothing, or to

reduce purchases of agricultural or livestock inputs than actions that reduced asset holdings or increased indebtedness. Third, borrowing money to buy food was used by more than half of households reporting that income was much less than usual. Fourth, few households reported selling consumer durables, possibly because these are relatively illiquid. A larger proportion (21 percent) reported selling productive assets but note that this category includes livestock which also serves as a store of value.

3.3. PSNP participation

We define PSNP participation in three different ways. First, we define access to PSNP based on self-reported receipt of any payments in the August 2019 survey. PSNP participation could be endogenous to the pandemic if, for example, the government expanded the program in response to the spread of the coronavirus; using pre-COVID-19 access to PSNP transfers to define participation in the program addresses this concern. This approach assumes that program participation remains stable during our study period. We compared the share of households receiving PSNP transfers in June 2020 and we find that 89 percent were also PSNP beneficiaries in August 2019.

Second, we use information on actual PSNP transfers made in the six months prior to the August 2019 survey and generate indicator variable assuming a value of 1 for households who received transfers exceeding 100 Birr (about 3.5 USD) and 0 for households receiving less than 100 Birr or not at all. This definition reduces potential measurement errors due to misreporting of program participation. Third, we generate aggregate district level access to PSNP transfers. Among the 88 woredas (districts) which were supposed to be included in the PSNP, there were six woredas that did not make any payments because of delays in implementation and related logistical problems. This provides a relatively more exogenous variation in households' access to PSNP transfers.

4. Estimation strategy

To assess the impact of PSNP participation on household food security as well as maternal and child diets under COVID-19, we compare the temporal evolutions of food security and nutrition outcomes between PSNP beneficiary and non-beneficiary households. We employ the following difference-in-difference specification:

$$Y_{ht} = \alpha_h + \beta_0 Post_t + \beta_1 PSNP_h * Post_t + \varepsilon_{ht} \quad (1)$$

where Y_{ht} stands for food security and related maternal and child diet measures for household h and round t. α_h stands for household fixed effects, which capture all time-invariant differences between PSNP beneficiaries and non-beneficiaries. $PSNP_h$ represents households' access to PSNP transfers. $Post_t$ is a dummy variable, assuming a value of 1 for the phone survey conducted during the COVID-19 pandemic (henceforth post-COVID-19 round) and 0 for the pre-COVID-19 round. The parameter associated with this time dummy captures aggregate trends in food security or potential differences in our outcomes of interest driven by differences in survey methods (face-to-face or phone survey).

The key parameter of interest in equation (1) is β_1. This parameter identifies potential differences in temporal evolution of food security outcomes of PSNP beneficiaries and non-beneficiaries. In the absence of unobservable time-varying variables with differential impact on PSNP beneficiaries, this parameter can be interpreted as the protective impact of the PSNP against income losses caused by the COVID-19 pandemic. To be credible as an estimation strategy, this requires that, in the absence of the pandemic, food security status of PSNP and non-PSNP beneficiaries would follow similar trends. To indirectly probe this assumption, we run the same specification using the two pre-COVID-19 surveys (March 2019 and August 2019) and assess changes in our outcomes of interest. As shown in Table A4, the trends in food gap and diet diversity of mothers and children across these two rounds for PSNP and non-PSNP beneficiaries were similar.

In all our specifications, we control for observable potential time-varying confounders such as the locust invasion that hit parts of the country. We include a categorical variable that measures whether households were affected by locust swarms. The use of alternative definitions of access to PSNP helps us to probe the robustness of our findings to potential time-varying unobserved factors. Our outcome variables are measured as binary and count outcomes. Hence, we estimate both linear and nonlinear specifications.

To account for potential systematic non-response in the post-COVID-19 phone survey, we use the weights described in Section 2. By using these sampling weights, we can generate representative statistics under the assumption that data are "missing at random" conditional on the

observables used in construction of weights (Wooldridge, 2007; Korinek et al., 2007). Access to PSNP and related unobserved factors are potentially correlated among households living in the same sampling unit, the kebele. To account for this, we cluster standard errors at the kebele level.

The impacts of the pandemic and the role of PSNP in mitigating them are likely to vary across households with varying socioeconomic characteristics. To uncover such potential differential impact of PSNP across various groups of households, we run our preferred specification in equation (1) for several dimensions of heterogeneity, including wealth quintiles and remoteness of location of residence.

5. Results

We first discuss our results on the impact of the PSNP in protecting household food security before considering impacts on maternal and child diets.

5.1. The role of PSNP in protecting household food security

Table 2 presents difference-in-difference estimates comparing the temporal evolution of food security of PSNP beneficiaries and non-beneficiaries under alternative definitions of PSNP participation and controlling for time invariant household characteristics. We report linear fixed effects regression results in the main text and present results from nonlinear models (fixed effects logit and fixed effects Poisson regression) in Appendix Table A5. We present results with and without sampling weights, although weighted regressions are our preferred specifications, to probe the robustness of our results. The first three columns of Table 2 report results for food insecurity dummy variable and columns 4-6 show results for the continuous food gap measure. Columns 1, 3, 4 and 6 are based on weighted fixed effects specifications while columns 2 and 5 are based on unweighted fixed effects models. Panel A of Table 2 provides results using self-reported access to PSNP benefits; Panel B reports results using information on amount of transfers; and Panel C provides estimates based on aggregate indicator of access to PSNP at district level.

Three important findings emerge from the results in Table 2. First, the share of food insecure households increased by 11.7 percentage points in the six months prior to the June 2020 round compared to similar period in 2019 (Panel A, Column 1) and the size of the food gap by 0.47 months (Column 4). Second, inclusion in the PSNP offsets virtually all of this adverse change. The magnitude of the coefficient β_1 is -0.093 in Panel A, Column 1, indicating that PSNP

participation reduced the likelihood that the household was food insecure by 9.3 percentage points. Adding coefficients β_0 and β_1 together shows that the likelihood of becoming food insecure increased by 11.7 percentage points for non-PSNP households and by 2.4 (= 11.7-9.3) percentage points for PSNP households. Looking at the results found in Panel A, Column 4, adding coefficients β_0 and β_1 together shows that the duration of the food gap increased by 0.47 months for non-PSNP households and by 0.133 (= 0.474- 0.341) months for PSNP households. Third, our finding that the PSNP offset the impact of the pandemic are robust to the definition of access to the PSNP (see panels B and C) and whether we weight or do not weight our data (see columns 5 and 6).[8]

We note four additional features of our results. First, our identification hinges on the assumption that in the absence of the pandemic, food security outcomes for PSNP beneficiaries and non-beneficiaries follow parallel trends. We probe this using pre-COVID-19 rounds and trends of food security. As shown in Table A4, before the pandemic, the food security trend of PSNP beneficiaries and non-beneficiaries for the March 2019 and August 2019 were similar. Second, alternative estimators, fixed effects logit and Poisson regressions, give comparable results, see Table A5. Third, we control for a second shock that occurred at this time – the locust invasion. Dropping this variable does not affect our findings (see Table A6). Fourth, to probe the role of other shocks, including conflict and civil unrest, we re-estimate our main specification dropping regions that have been affected by recent conflicts and civil unrest. Oromia was the region that has experienced conflicts and demonstrations the most in the months prior to our June 2020 survey. Excluding Oromia from our sample does not affect our results (see Table A7).

The role of PSNP in protecting food security and smoothing consumption is expected to be higher for poorer households, for whom the share of PSNP transfers in total consumption expenditure is higher. The impact of the COVID-19 pandemic is also likely to vary across households by socio-economic characteristics, with poorer households facing greater adverse exposure potentially leading to further deterioration in food security due to COVID-19 related income losses. Similarly, PSNP transfers, particularly those in-kind, may be more impactful for households with limited access to markets. PSNP cash transfers may also prove useful given rural

[8] While the interaction terms in Panels A and B capture actual impacts (average treatment on the treated) on the protective role of PSNP, the corresponding parameter in Panel C represents the role of living in a PSNP covered district (intention to treat). Thus, the latter (ITT) is expected to be higher than the former (ATT).

transactions take different forms, including reciprocities. Conversely, COVID-19 related disruptions in access to food may have limited impact on households who rely less on markets - often the poor and those residing in remote locations. PSNP would bridge the gap in own production that otherwise would need to be filled through purchases from food markets, an option unavailable for non-beneficiaries.

We test this hypothesis using several disaggregations. In Table 3 we split the sample by wealth quintiles: combining the bottom three quintiles into one group (poorest households) and the top two quintiles into another group ("less poor" households). The results in Table 3 suggest that PSNP transfers are more protective for poorer households' food security. Relatively, poorer PSNP non-beneficiaries report higher increase in food insecurity experience. In Table 4 we split the sample into remotely located and accessible households, using distance to urban centers. Using median distance to urban centers with population of 20,000 or higher, households located in areas with distances above the median are classified as remote. The results in Table 4 show that households living in remote areas and not receiving any PSNP transfers are more likely to experience a significant deterioration in food security.

Social protection and safety nets can also help households adopt effective coping strategies when they face income losses and related shocks. In our phone survey we elicited households' coping strategies in the last one month. Households are given a long list of coping strategies, options which are not mutually exclusive as households can choose more than one option. The most dominant strategies include: (i) spent savings, (ii) reduced food consumption, (iii) borrowed money from others, (iv) reduced health and education expenditure, (v) reduced expenditure on agricultural inputs, and (v) sold assets. Some of these coping strategies are likely to have lasting adverse impact on the livelihoods of rural households. For instance, decrease in education and health related investments will adversely affect human capital accumulation and reduce future earnings. Similarly, reduction in agricultural investments may limit households' production potential.

Table 5 presents single difference estimates as data on coping strategy were only collected in June 2020 and thus should be interpreted cautiously. It shows that households who received PSNP transfers are less likely to reduce expenditures on health and education by 7.7 percentage points and were less likely to reduce expenditures on agricultural inputs (fertilizer, seeds and livestock) by 13 percentage points. These associations are intuitive and consistent with our fixed

effects results and provide suggestive evidence that PSNP transfers can help households avoid detrimental coping strategies to deal with income losses associated with COVID-19.

5.2. The role of PSNP in protecting mother's and children's diets

COVID-19 could affect maternal and child diet through reductions in income or reduced market access. Households might alter their consumption as incomes drop due to limited on- and off-farm income generating opportunities and fall in remittances and other private transfers. The effect on diet could manifest both in the number of items household consume and the quality of diets. To measure the effect of COVID-19 on these dimensions of diet, we use diet diversity indices for mothers and children as well as changes in consumption of animal source products and vitamin A rich fruits and vegetables.

Table 6 shows how diet diversity has changed in response to the COVID-19 crisis and the implication of PSNP in protecting mothers' and children's diets. We present two sets of results using a continuous diet diversity index for mothers and children as well as a dummy variable that takes value 1 if minimum diet diversity is met and 0 otherwise. The minimum diet diversity is defined at 5 food categories for mothers and 4 food categories for children (WHO, 2010). There has been an increase in diet diversity in the COVID-19 period, with the effect particularly large and statistically significant for children. Similar patterns are observed for the likelihood of meeting minimum diet diversity requirement. Children are about 18 percent more likely to meet the minimum diet diversity compared to the pre-COVID-19 period. Disruptions in some value chains particularly those perishable foods that rural households usually produce for markets (e.g., fruits, vegetables, eggs) means that these foods may end up being temporarily consumed at home – an indirect evidence of which Hirvonen et al.(2020) report for urban food markets in Ethiopia.

Access to the PSNP does not appear to affect maternal or child diet diversity, a result consistent with what Berhane et al (2020) report using the 2019 data. This limited role PSNP plays in protecting mothers' and children's diets could be explained by several factors. First, as part of the transfers are given in cash and with limited market access, households cannot use cash transfers to buy food. Second, in kind transfers are likely given in consumption items households already consume (e.g. wheat, cooking oil) and contribute mainly to the intensive margin of how much of the food items they consume and not much to the extensive margin of whether they consume foods from specific food categories. Third, dietary diversity of mothers and children is already at a very

low level and, thus, unlikely to decline further despite the COVID-19 pandemic. Fourth, the PSNP transfers may not be sufficiently nutrition-sensitive, pointing to the need for further refinements to make the program nutrition-sensitive (Berhane et al., 2020).

Though the PSNP program had little differential impact on the diet diversity of mothers and their children, it could conceivably improve the quality of their diet. The cash and in-kind transfers from the PSNP program may allow participants to substitute lower quality foods (e.g. cereals and beans) with higher quality diet such as meat, dairy, milk and eggs. To gauge if this is indeed the case, we group dairy, flesh foods and eggs together into "animal source food" and vitamin A rich fruits and vegetables into another group. Table 7 presents regression estimates for mothers and children separately. We find that there has been a sharp decline in animal source food by mothers whereas children's intake of animal products has changed little in the COVID-19 period. On the contrary, consumption of vegetables and fruits increased both for mothers and children, though it is statistically insignificant for mothers. The increase in vegetable and fruits consumption is particularly large for children. We do not find any evidence of protective role of the PSNP program on the diets of mothers and children. This is not surprising given that the composition of the in-kind transfers is unlikely to have changed in the COVID-19 period, and restrictions in access to markets may mean cash transfers are unlikely to make meaningful difference in the range of foods available to households.

6. Summary and Concluding Remarks

We combine data from a pre-pandemic face-to-face survey with post-pandemic phone survey from Ethiopia, finding that household food security deteriorated in the aftermath of the onset of the pandemic. About half of households surveyed reported that food security had worsened compared to the same pre-pandemic period. Market closures, food price increases and loss of income appear to be the most important aspects in which the pandemic impacted livelihoods. We do not find significant changes in mothers' and children's diets, despite some changes in the composition of diets. Consumption of animal source foods declined significantly, perhaps due to closure of markets associated the pandemic.

Social protection, specifically Ethiopia's PSNP, mitigated the impacts of the pandemic on food security. We find that PSNP beneficiaries report relatively less deterioration in food security, compared to non-beneficiaries. The protective role of PSNP was slightly higher for poorer

households and those living in remote areas. We find that the PSNP reduced the likelihood that households adopted coping strategies such as reducing the likelihood that households reduced expenditures on education, health and agricultural inputs. However, we do not find evidence that PSNP protects mothers and children's diets.

Our findings highlight the value of having a well-functioning social protection program in place prior to the pandemic in order to protect the food security of poor households. This lends empirical support to the argument for expanding social safety nets (Gentilini et al., 2020; Gilligan, 2020; Devereux, et al., 2020). This is particularly an important finding in the context of Ethiopia where the pandemic is still unfolding, and the government is weighing up alternative measures to support poor and vulnerable households.

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Table 1: Sample characteristics by sample weights

Household characteristics	(1) Unweighted full sample	(2) Unweighted phone survey	(3) Weighted phone survey
Household head is male	0.89	0.91	0.89
Household head age in years	38.64	38.13	38.51
Education of household head (in years)	2.88	3.59	2.90
Highest level of education (in years) in household	5.61	6.34	5.58
Mother's education (in years)	2.37	2.95	2.37
Mother has no education	0.56	0.48	0.56
Household size	5.70	5.70	5.67
Dependency ratio	0.02	0.02	0.02
Food gap in months over the last 6 months	1.26	1.08	1.26
Number of tropical livestock units (TLU) owned	3.33	3.31	3.17
Own corrugated iron roof	0.49	0.57	0.49
Household has access to electricity	0.36	0.42	0.36
Land area (in hectares) operated	0.94	0.92	0.94
Durable asset index (Principal Components Analysis (PCA)	0.00	0.50	0.04
Household owns a mobile phone	0.49	0.72	0.49
Household member was engaged in business activity	0.14	0.17	0.15
Household member was employed in wage earning	0.22	0.22	0.22
Household is active in farming	0.90	0.89	0.90
Household participated in PSNP Public Works (PW)	0.35	0.32	0.33
Household received Temporary Direct Support (DS)	0.08	0.06	0.07
household received Permanent Direct Support (PDS)	0.06	0.05	0.06
Household benefitted from PSNP (PW, TDS or PDS)	0.42	0.38	0.40
Head or spouse was born in this location	0.95	0.94	0.95
Head's parent an important person in the community	0.36	0.37	0.36
Tigray	0.25	0.25	0.25
Amhara	0.26	0.25	0.26
Oromia	0.24	0.25	0.25
SNNP	0.25	0.24	0.24
Number of observations	2,535	1,497	1,497

Table 2: Fixed effects estimates of impact of PSNP on post COVID-19 household food security

	(1) Food insecure (had problems satisfying food need)	(2) Food insecure (had problems satisfying food need)	(3) Food insecure (had problems satisfying food need)	(4) Food gap in months	(5) Food gap in months	(6) Food gap in months
Panel A: Using household self-reported PSNP participation						
Post COVID-19 round	0.117***	0.153***	0.109***	0.474***	0.533***	0.406***
	(0.028)	(0.026)	(0.031)	(0.099)	(0.085)	(0.105)
PSNP*Post COVID-19 round	-0.093**	-0.087***	-0.092**	-0.341**	-0.294***	-0.339**
	(0.038)	(0.034)	(0.038)	(0.145)	(0.110)	(0.144)
Control for locust invasion	No	Yes	Yes	No	Yes	Yes
Household fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	No	Yes	Yes	No	Yes
R-squared	0.022	0.050	0.024	0.032	0.066	0.037
No. observations	2994	2994	2994	2994	2994	2994
Panel B: Using amount of PSNP transfers						
Post COVID-19 round	0.117***	0.153***	0.109***	0.470***	0.528***	0.402***
	(0.028)	(0.026)	(0.031)	(0.099)	(0.084)	(0.104)
PSNP*Post COVID-19 round	-0.094**	-0.089***	-0.093**	-0.333**	-0.284**	-0.331**
	(0.038)	(0.034)	(0.038)	(0.145)	(0.110)	(0.144)
Control for locust invasion	No	Yes	Yes	No	Yes	Yes
Household fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	No	Yes	Yes	No	Yes
R-squared	0.023	0.050	0.025	0.032	0.066	0.037
No. observations	2994	2994	2994	2994	2994	2994
Panel C: Using district-level access to PSNP						
Post COVID-19 round	0.282***	0.268***	0.274***	1.130***	0.985***	1.034***
	(0.065)	(0.065)	(0.068)	(0.242)	(0.200)	(0.246)
PSNP*Post COVID-19 round	-0.220***	-0.161**	-0.218***	-0.865***	-0.615***	-0.824***
	(0.069)	(0.066)	(0.070)	(0.255)	(0.206)	(0.254)
Control for locust invasion	No	Yes	Yes	No	Yes	Yes
Household fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	No	Yes	Yes	No	Yes
R-squared	0.027	0.050	0.029	0.039	0.069	0.043
No. observations	2994	2994	2994	2994	2994	2994

Notes: Estimates are from linear regressions controlling for household fixed effects. The dependent variable in columns 1-3 is an indicator variable equaling one for households unable to satisfy their food needs. The dependent variable in in columns 4-6 is the food gap measured in months. Even numbered columns are based on weighted fixed effects regressions. Odd numbered columns are from unweighted regressions. PSNP participation is defined as: Reported receiving PSNP payments in 2019 (Panel A); Reported receiving at least 100 Birr in PSNP payments prior to the August 2019 survey round (Panel B); and Living in woredas where PSNP is operational at the time of the 2020 (Panel C). Standard errors, clustered at kebele level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Impact of PSNP on post COVID-19 household food security by household wealth

	(1) Food insecure (poorest households)	(2) Food insecure (less poor households)	(3) Food gap in months (poorest households)	(4) Food gap in months (less poor households)
Post COVID-19 round	0.254***	0.319***	1.041***	1.074***
	(0.083)	(0.073)	(0.357)	(0.199)
PSNP*Post COVID-19 round	-0.236***	-0.163**	-0.934**	-0.588***
	(0.084)	(0.077)	(0.365)	(0.210)
Control for locust invasion	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	Yes	Yes
R-squared	0.017	0.087	0.027	0.111
No. observations	1800	1194	1800	1194

Notes: Estimates are from linear regressions controlling for household fixed effects. The dependent variable in columns 1-2 is an indicator variable equaling one for households unable to satisfy their food needs. The dependent variable in in columns 3-4 is the food gap measured in months. Odd columns provide results for the poorest three quintiles as measured by wealth. Even columns report results for the two richest quintiles. PSNP participation is defined as: Reported receiving PSNP payments in 2019. Standard errors, clustered at kebele level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Impact of PSNP on post COVID-19 household food security by remoteness

	(1) Food insecure (remote households)	(2) Food insecure (accessible households)	(3) Food gap in months (remote households)	(3) Food gap in months (accessible households)
Post COVID-19 round	0.344***	0.167**	1.107***	0.981***
	(0.105)	(0.065)	(0.398)	(0.259)
PSNP*Post COVID-19 round	-0.305***	-0.064	-0.913**	-0.688***
	(0.109)	(0.065)	(0.420)	(0.259)
Control for locust invasion	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	Yes	Yes
R-squared	0.039	0.038	0.046	0.042
No. observations	1274	1264	1274	1264

Notes: Estimates are from linear regressions controlling for household fixed effects. The dependent variable in columns 1-2 is an indicator variable equaling one for households unable to satisfy their food needs. The dependent variable in in columns 3-4 is the food gap measured in months. Odd columns provide results for households above the median distance to urban centers. Even columns report results for households less than the median distance to urban centers. PSNP participation is defined as: Reported receiving PSNP payments in 2019. Standard errors, clustered at kebele level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Linear probability estimates of the impact of the PSNP on post COVID-19 household coping strategies

	(1) Spend saving	(2) Reduced food consumption	(3) Borrowed money	(4) Reduced health and education expenditure	(5) Reduced expenditure on agricultural inputs	(6) Sold assets
Received PSNP transfer last month	0.023	-0.056	-0.022	-0.077*	-0.130**	0.016
	(0.040)	(0.045)	(0.044)	(0.045)	(0.052)	(0.033)
Sex head (male)	-0.018	0.021	-0.024	-0.077*	-0.008	0.021
	(0.046)	(0.068)	(0.063)	(0.044)	(0.062)	(0.046)
Age of head	-0.001	-0.003*	-0.002	-0.002	-0.001	-0.003***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Education of head	0.002	0.000	-0.004	-0.002	-0.000	-0.001
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)
Age of mother	-0.002	0.004	0.006**	-0.001	-0.001	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Education of mother	0.013***	-0.009	-0.005	0.001	-0.008	0.001
	(0.004)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)
Household size	0.023**	0.011	-0.004	0.014	0.001	0.019**
	(0.010)	(0.011)	(0.010)	(0.009)	(0.011)	(0.008)
Livestock asset (TLU)	-0.000	-0.011**	-0.017***	-0.003	-0.003	0.011**
	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)
Housing condition (good)	0.055*	-0.020	-0.041	-0.101***	-0.052	0.016
	(0.029)	(0.033)	(0.035)	(0.034)	(0.033)	(0.034)
Have electricity	0.003	0.029	-0.005	0.004	0.008	-0.052*
	(0.029)	(0.034)	(0.035)	(0.032)	(0.037)	(0.028)
Farm size	-0.013*	-0.036***	-0.029**	-0.023	-0.036***	-0.009
	(0.008)	(0.012)	(0.013)	(0.015)	(0.013)	(0.008)
Poor household	-0.064*	0.026	0.013	0.024	0.067*	0.013
	(0.033)	(0.036)	(0.036)	(0.035)	(0.034)	(0.032)
Log(distance to urban)	0.052**	0.002	0.005	0.016	-0.012	0.001
	(0.025)	(0.030)	(0.033)	(0.034)	(0.039)	(0.023)
Constant	0.104	0.443***	0.438**	1.019***	0.554***	0.016
	(0.129)	(0.152)	(0.173)	(0.159)	(0.194)	(0.126)
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sampling weight applied	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.047	0.124	0.074	0.205	0.038	0.060
No. observations	1267	1267	1267	1267	1267	1267

Notes: Outcome variables are indicator variables equaling one if the household reported using this coping strategy in the 30 days prior to the survey. PSNP participation is defined as: Reported receiving PSNP payments in 2019. Standard errors, clustered at kebele level, are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: OLS estimates of the impact of the PSNP on maternal and child diet diversity

	(1) Diet diversity index of mothers	(2) Minimum diet diversity dummy for mothers	(3) Diet diversity index of children	(4) Minimum diet diversity dummy for children
Post COVID-19 round	0.033	0.008	0.990***	0.157***
	(0.068)	(0.014)	(0.102)	(0.030)
PSNP*Post COVID-19 round	0.078	-0.013	0.141	-0.051
	(0.087)	(0.019)	(0.148)	(0.041)
Constant	2.795***	0.063***	1.751***	0.060***
	(0.028)	(0.006)	(0.025)	(0.007)
Control for locust invasion	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	Yes	Yes
R-squared	0.01	0.00	0.34	0.10
No. observations	2,994	2,994	1,781	1,781

Notes: The outcome variables in columns 1 and 3 are the number of food categories consumed in the last 24 hours, taking values 0-10 for mothers and 0-7 for children and estimated using OLS. The outcome variables in columns 2 and 4 are dummy variables taking value 1 if mothers (children) meet minimum diet diversity defined at 5 categories or more (4 categories or more), respectively, estimated as a linear probability model. PSNP participation is defined as: Reported receiving PSNP payments in 2019. Child estimates are based on children between 6 and 24 months old. Standard errors clustered at the kebele level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Linear probability estimates of the impact of the PSNP on maternal and child consumption of animal source foods and vegetables

	(1) Animal source food consumed by the mother	(2) Vegetables and fruits consumed by mothers	(3) Animal source food consumed by the child	(4) Vegetables and fruits consumed by the child
Post COVID-19 round	-0.116***	0.041	-0.009	0.352***
	(0.024)	(0.026)	(0.040)	(0.047)
PSNP*Post COVID-19 round	0.033	0.015	0.029	0.071
	(0.034)	(0.033)	(0.055)	(0.063)
Constant	0.272***	0.692***	0.228***	0.360***
	(0.010)	(0.011)	(0.009)	(0.011)
Control for locust invasion	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	Yes	Yes
R-squared	0.05	0.01	0.00	0.29
No. observations	2,994	2,994	1,781	1,781

Notes: The outcome variables in columns 1 and 3 are dummy variables that take value 1 if the mother (child) consumes dairy products, flesh foods, or eggs in the last 24 hours. The outcome variables in columns 2 and 4 are dummy variables taking value 1 if the mother (child) consumes vitamin A rich vegetables and fruits in the last 24 hours. PSNP participation is defined as: Reported receiving PSNP payments in 2019. Child estimates are based on children between 6 and 24 months old. Standard errors clustered at the kebele level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 1: Distribution of unweighted and weighted observable characteristics

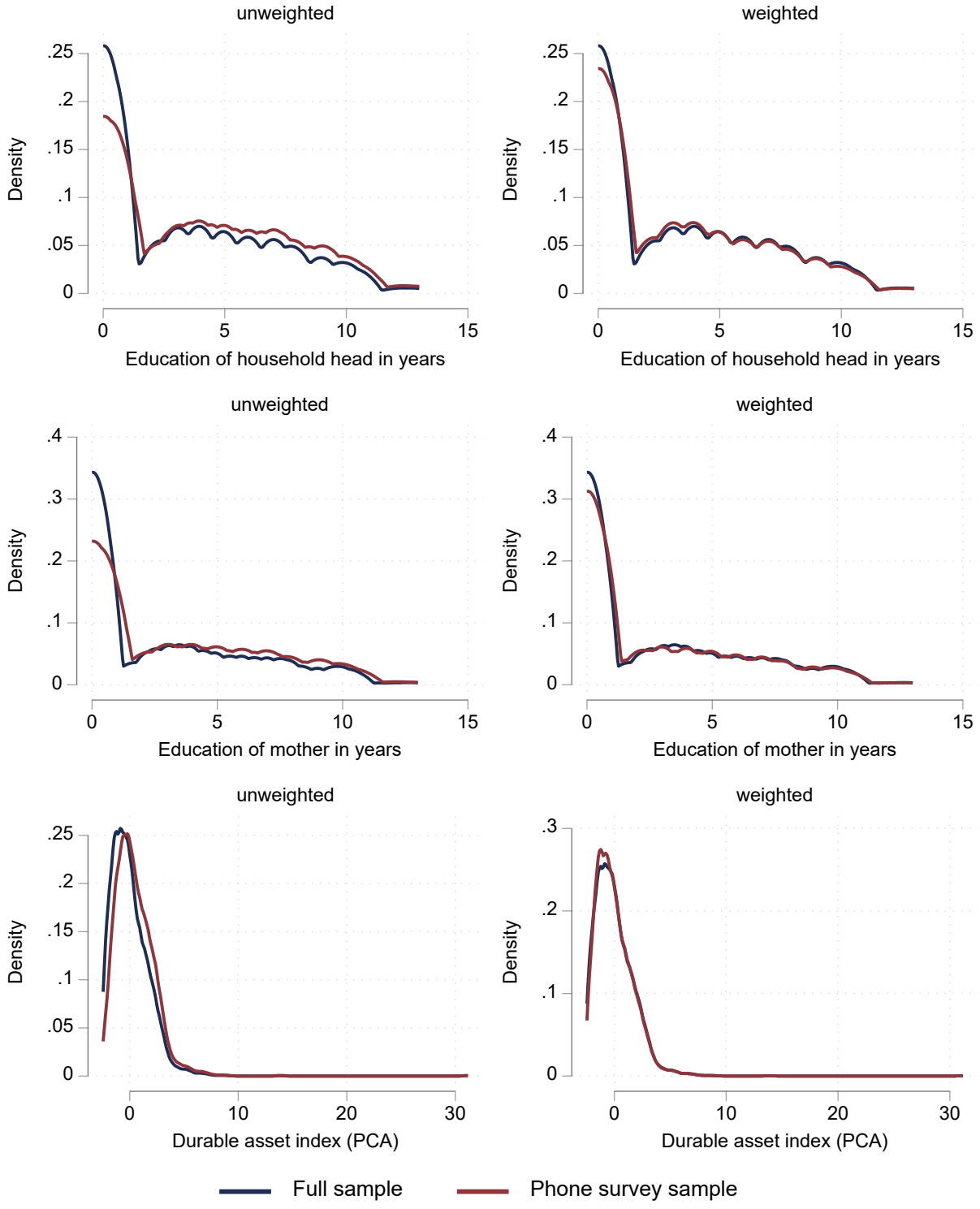
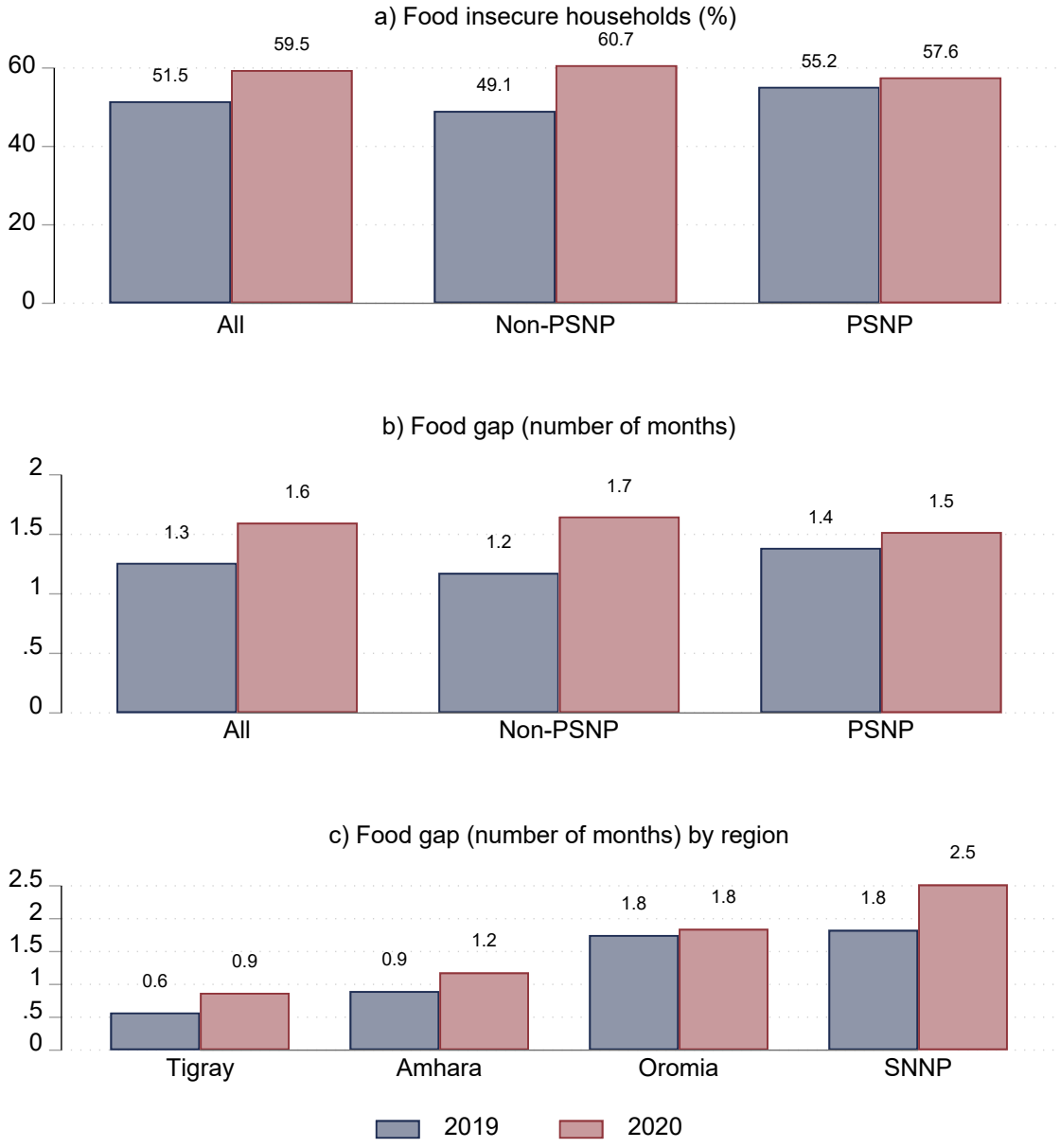
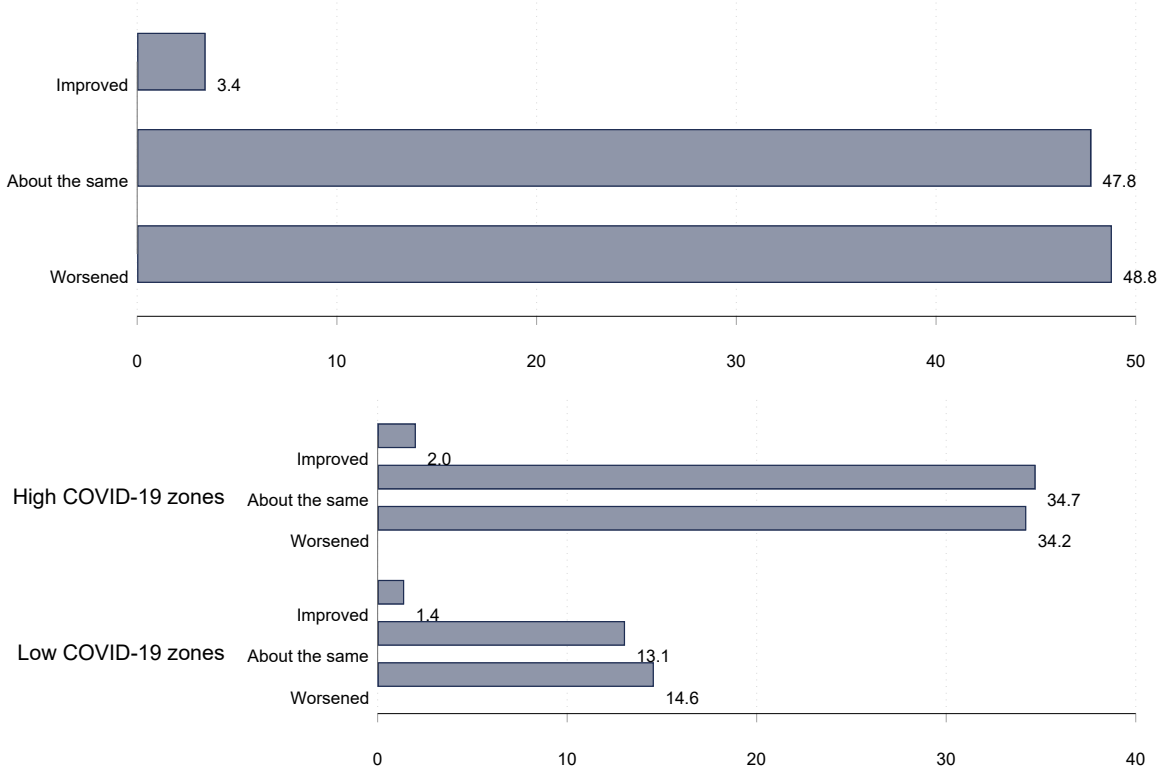


Figure 2: Food gap in number of months



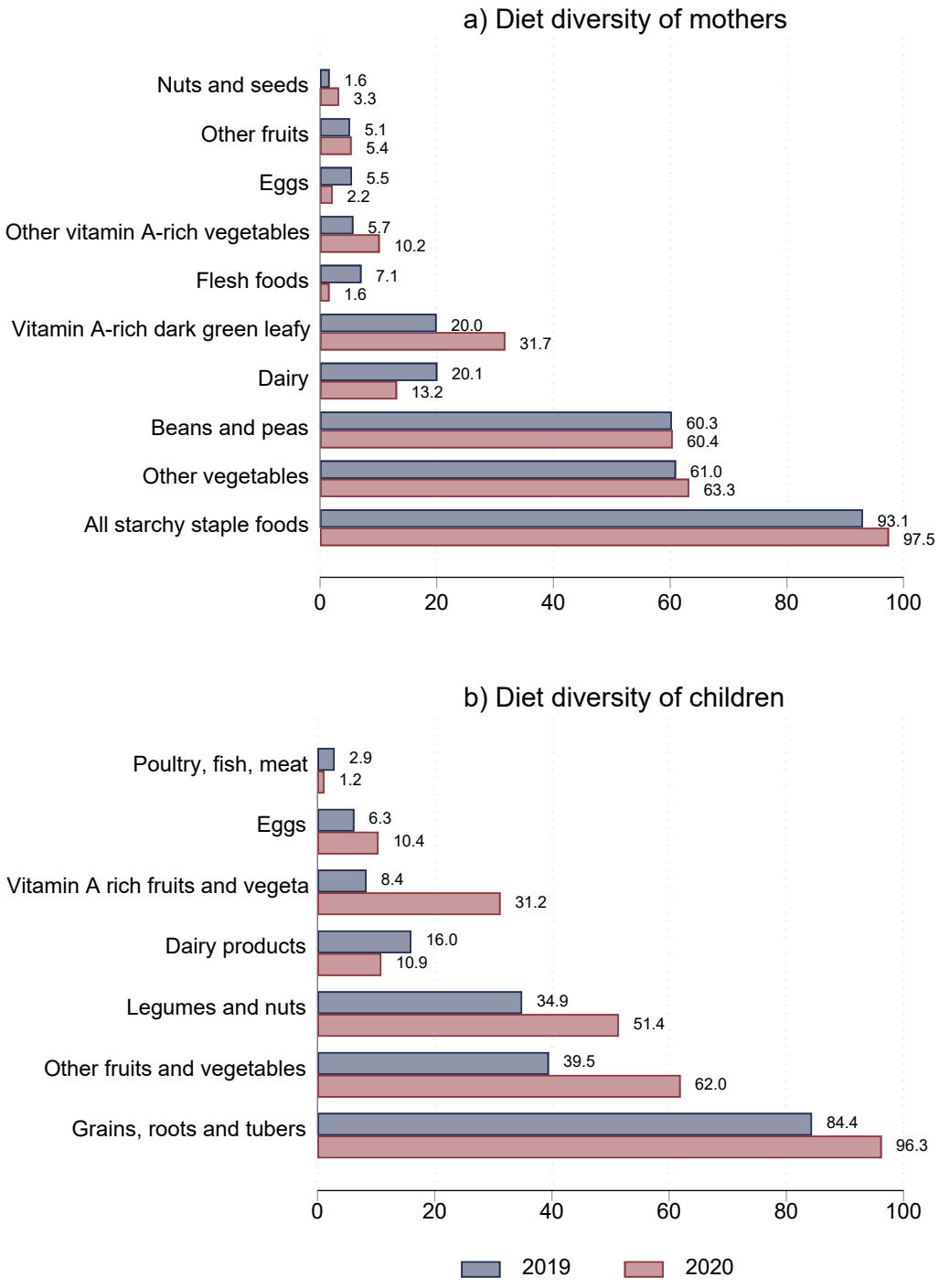
Notes: Sample weights applied.

Figure 3: Problems of satisfying food needs of the household



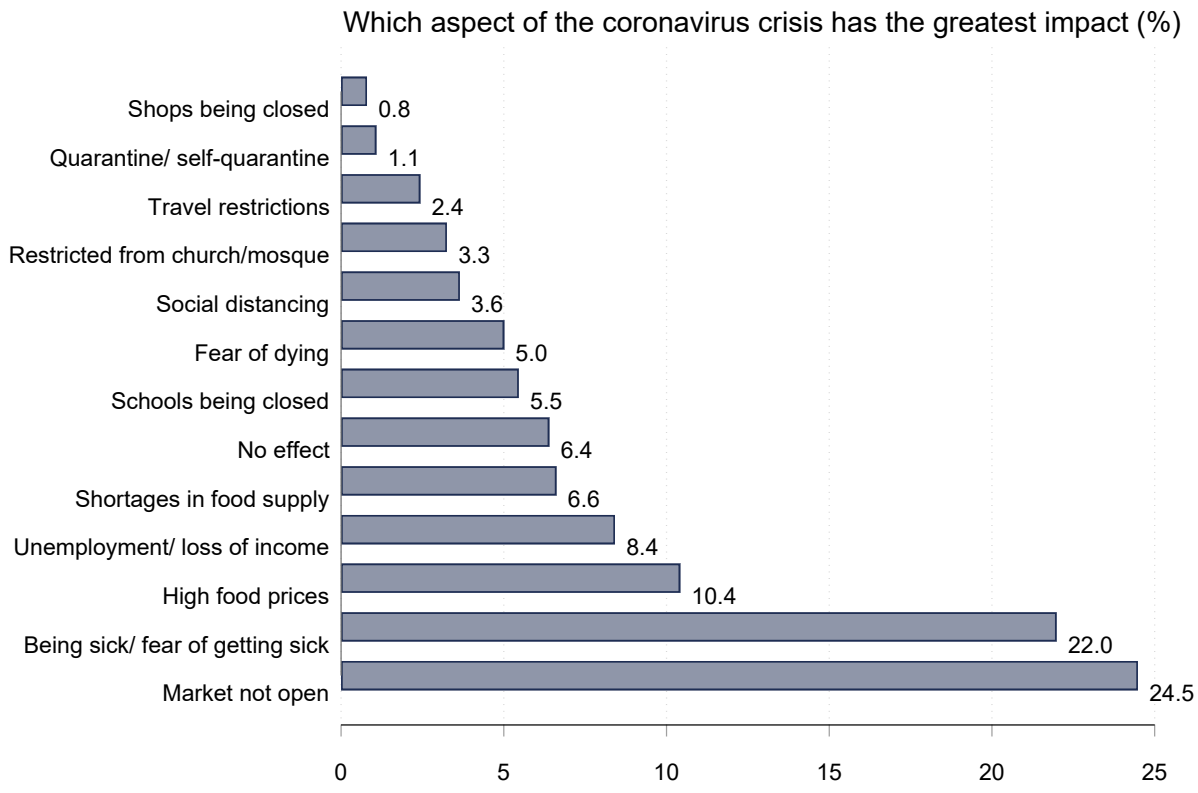
Notes: Sample weights applied.

Figure 4: Diet diversity of mothers and children



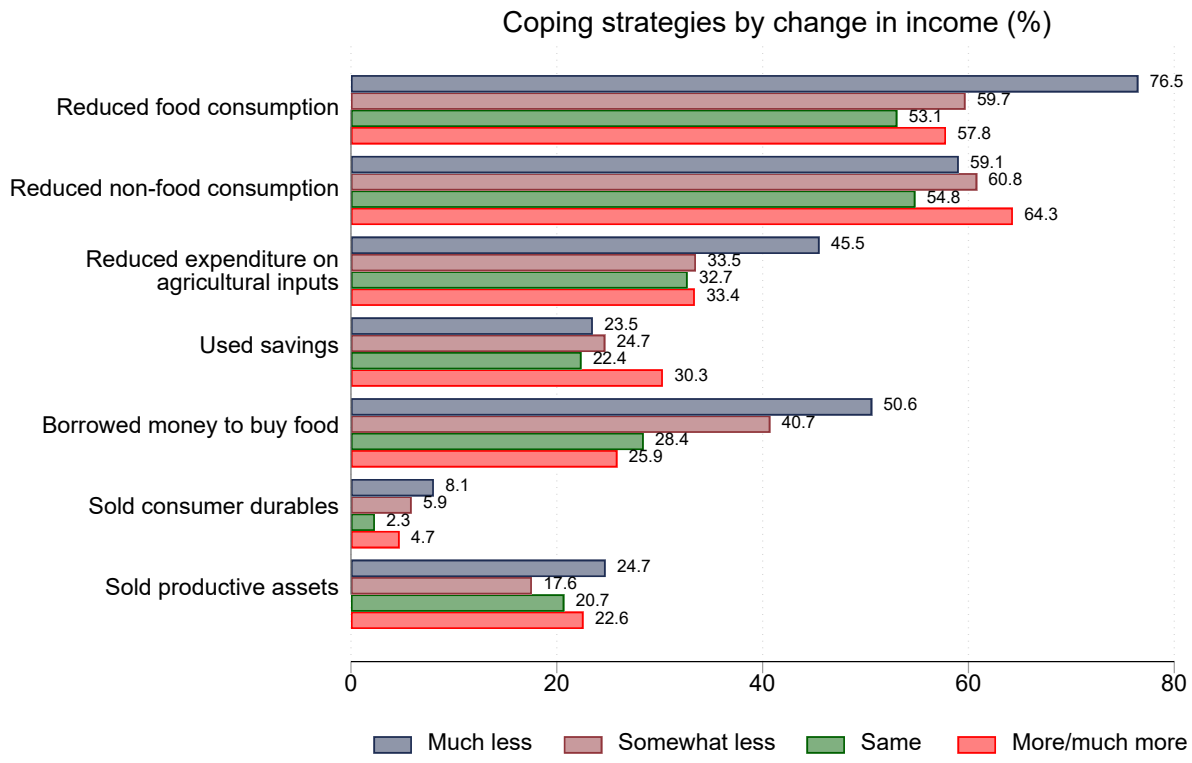
Notes: Sample weights applied.

Figure 5: Which aspect of the coronavirus crisis has the greatest impact (%)



Notes: Sample weights applied.

Figure 6: Household coping strategies



Notes: Sample weights applied.

Appendix

Table A1: Modeling the probability of response in the phone survey

Explanatory variables	Coefficients from a logit model
Household head is male	0.447**
	(0.176)
Household head age in years	-0.002
	(0.006)
Education of household head (in years)	0.020
	(0.022)
Highest level of education (in years) in household	0.056**
	(0.023)
Mother's education (in years)	0.051
	(0.034)
Mother has no education	-0.008
	(0.191)
Household size	-0.007
	(0.034)
Dependency ratio	-1.308
	(1.014)
Food gap in months over the last 6 months	-0.101***
	(0.035)
Number of tropical livestock units (TLU) owned	-0.021
	(0.013)
Own corrugated iron roof	0.212**
	(0.107)
Household has access to electricity	0.157
	(0.110)
Land area (in hectares) operated	-0.007
	(0.054)
Durable asset index based on Principal Components Analysis (PCA)	0.208***
	(0.044)
Household owns a mobile phone	2.184***
	(0.114)
Household member was engaged in business activity	0.281*
	(0.155)
Household member was employed in wage earning	-0.100
	(0.127)
Household is active in farming	-0.096
	(0.181)
Household participated in PSNP Public Works (PW)	-0.023
	(0.307)
Household received Temporary Direct Support (DS)	-0.088
	(0.210)
household received Permanent Direct Support (PDS)	0.242

	(0.331)
Household benefitted from PSNP (PW, TDS or PDS)	0.129
	(0.323)
Head or spouse was born in this location	-0.181
	(0.239)
Head's parent an important person in the community	-0.085
	(0.108)
Amhara region	0.520***
	(0.148)
Oromia region	0.617***
	(0.163)
SNNP region	0.256
	(0.168)
Constant	-1.314***
	(0.408)
Number of observations	2535

Notes: this table reports coefficients from a logit regression. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Household self-reports of most important impact of pandemic by self-reported stress levels

	Not stressed	Moderately stressed	Extremely stressed	All
No effect	29.86	6.16	3.12	7.2
Fear of sickness or death	10.91	19.12	36.01	29.72
Being sick or fear of getting sick	8.86	16.83	29.91	24.83
Fear of dying	2.05	2.29	6.09	4.89
Unemployment or loss of income	5.57	7.5	9.22	8.42
Disruptions in food access	29.78	28.93	29.87	29.7
Shortages in food supplies	3.53	3.09	4.51	4.13
Shops being closed	0	0	0.98	0.68
Markets not open	26.24	25.84	24.39	24.89
High food prices	8.39	14.76	7.89	9.16
Restrictions on social interactions, movement, or access to schools or churches	15.41	23.84	14.48	16.24
Travel restrictions	1.21	3.72	2.65	2.65
Restricted from church or mosque	1.7	4.93	2.55	2.85
Schools were closed	10.28	8.69	4.93	6.3
Social distancing	1.75	5.59	3.35	3.53
Quarantine or self-quarantine	0.47	0.91	0.99	0.91

Notes: Percent reporting not being stressed, 14; moderately stressed, 17; extremely stressed, 69.

Table A3: Households (percent) reporting change in this year's income (relative to same period before)

Households income relative the same period before	All	Households not affected by locusts	Households affected by locusts
Much less	25.68	22.66	41.15
Less	41.4	41.84	39.15
About the same	27.09	29.18	16.4
More	5.49	6.02	2.8
Much more	0.34	0.3	0.49

Notes: This table reports self-reported income trends, relative to incomes usually received at this time of the year. Sample weights have been applied.

Table A4: Testing pre-COVID-19 trend differences

	(1) Food gap in months	(2) Diet diversity index of mothers	(3) Minimum diet diversity dummy for mothers	(4) Diet diversity index of children	(5) Minimum diet diversity dummy for children
Panel A: Using household self-reported PSNP participation					
August 2019 round	0.175**	-0.065	-0.004	0.413***	0.049***
	(0.084)	(0.059)	(0.014)	(0.062)	(0.016)
PSNP*August 2019 round	-0.150	-0.051	0.004	-0.125	-0.045**
	(0.134)	(0.079)	(0.017)	(0.091)	(0.022)
Household fixed effects	Yes	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	Yes	Yes	Yes
R-squared	0.005	0.004	0.000	0.074	0.011
No. observations	2994	2994	2994	2072	2072
Panel B: Using amount of PSNP transfers					
August 2019 round	0.173**	-0.059	-0.004	0.416***	0.048***
	(0.084)	(0.059)	(0.014)	(0.061)	(0.016)
PSNP*August 2019 round	-0.146	-0.068	0.004	-0.135	-0.044**
	(0.134)	(0.079)	(0.017)	(0.091)	(0.022)
Household fixed effects	Yes	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	Yes	Yes	Yes
R-squared	0.005	0.004	0.000	0.074	0.011
No. observations	2994	2994	2994	2072	2072
Panel C: Using district-level access to PSNP					
August 2019 round	0.388**	-0.043	0.025	0.487**	0.036**
	(0.179)	(0.145)	(0.026)	(0.197)	(0.014)
PSNP*August 2019 round	-0.298	-0.046	-0.030	-0.136	-0.006
	(0.192)	(0.154)	(0.028)	(0.202)	(0.018)
Household fixed effects	Yes	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	Yes	Yes	Yes
R-squared	0.006	0.004	0.001	0.072	0.007
No. observations	2994	2994	2994	2072	2072

Notes: This table provides tests of pre-COVID-19 trend in food and nutrition security outcomes. Estimates are from linear regressions controlling for household fixed effects. The dependent variable in the first column is the food gap measured in months. The outcome variables in columns 2 and 4 are the number of food categories consumed in the last 24 hours, taking values 0-10 for mothers and 0-7 for children. The outcome variables in columns 3 and 5 are dummy variables taking value 1 if mothers (children) meet minimum diet diversity defined at 5 categories or more (4 categories or more), respectively, estimated as a linear probability model. Child estimates are based on children between 6 and 24 months old. PSNP participation is defined as: Reported receiving PSNP payments in 2019 (Panel A); Reported receiving at least 100 Birr in PSNP payments prior to the August 2019 survey round (Panel B); and Living in woredas where PSNP is operational at the time of the 2020 (Panel C). Standard errors, clustered at kebele level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: PSNP and households food security using fixed effects logit and fixed effects Poisson regression

	(1) Food insecure (had problems satisfying food need)	(2) Food gap in months	(3) Food insecure (had problems satisfying food need)	(4) Food gap in months
Panel A: Using household self-reported PSNP participation				
Post COVID-19 round	0.564***	0.311***	0.802***	0.459***
	(0.091)	(0.032)	(0.121)	(0.058)
PSNP*Post COVID-19 round	-0.475***	-0.247***	-0.444**	-0.246***
	(0.137)	(0.043)	(0.185)	(0.080)
Control for locust invasion	Yes	Yes	Yes	Yes
Household fixed effect	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	No	No
No. observations	1130	2122	1130	2122
Panel B: Using amount of PSNP transfers				
Post COVID-19 round	0.567***	0.307***	0.806***	0.453***
	(0.091)	(0.031)	(0.120)	(0.058)
PSNP*Post COVID-19 round	-0.484***	-0.240***	-0.456**	-0.235***
	(0.137)	(0.043)	(0.185)	(0.080)
Control for locust invasion	Yes	Yes	Yes	Yes
Household fixed effect	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	No	No
No. observations	1130	2122	1130	2122
Panel C: Using district-level access to PSNP				
Post COVID-19 round	1.659***	1.971***	0.618***	0.581***
	(0.386)	(0.359)	(0.112)	(0.065)
PSNP*Post COVID-19 round	-1.112***	-1.700***	-0.286**	-0.409***
	(0.396)	(0.365)	(0.117)	(0.067)
Control for locust invasion	Yes	Yes	Yes	Yes
Household fixed effect	Yes	Yes	No	No
Sampling weights applied	Yes	Yes	No	No
No. observations	1130	2122	1130	2122

Notes: These are fixed effect estimates from nonlinear regressions. The first and third column results represent fixed effects logit regression coefficients while the second and fourth column results are estimates from fixed effects Poisson regression. The outcome variable in the first and third columns is indicator variable for those households who were unable to satisfy their food needs. The outcome variables in the last second and fourth columns is food gap measured in months. The first two column results are based on weighted fixed effects regressions while columns come from unweighted regressions. In Panel A access to PSNP transfers is based on self-reported PSNP membership. In Panel B PSNP beneficiaries are those households who received a PSNP transfer worth of 100 Ethiopian Birr and above in the last six months. In Panel C PSNP beneficiaries are those households living in districts (woredas) where PSNP is operational at the time of the survey while non-beneficiaries are those households living in those districts PSNP is not operational or delayed because of logistical or other reasons. Standard errors, clustered at kebele level, are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: PSNP and households food security using alternative definitions of access to PSNP and dropping those households affected by locust invasion

	(1) Food insecure (had problems satisfying food need)	(2) Food gap in months	(3) Food insecure (had problems satisfying food need)	(3) Food gap in months
Panel A: Using household self-reported PSNP participation				
Post COVID-19 round	0.107***	0.400***	0.151***	0.523***
	(0.032)	(0.108)	(0.027)	(0.087)
PSNP*Post COVID-19 round	-0.088**	-0.324**	-0.081**	-0.269**
	(0.043)	(0.161)	(0.037)	(0.120)
Household fixed effect	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	No	No
R-squared	0.018	0.023	0.041	0.051
No. observations	2492	2492	2492	2492
Panel B: Using amount of PSNP transfers				
Post COVID-19 round	0.107***	0.396***	0.151***	0.518***
	(0.032)	(0.107)	(0.027)	(0.087)
PSNP*Post COVID-19 round	-0.089**	-0.315*	-0.083**	-0.257**
	(0.043)	(0.160)	(0.037)	(0.120)
Household fixed effect	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	No	No
R-squared	0.018	0.023	0.041	0.051
No. observations	2492	2492	2492	2492
Panel C: Using district-level access to PSNP				
Post COVID-19 round	0.320***	1.011***	0.317***	1.040***
	(0.082)	(0.277)	(0.077)	(0.243)
PSNP*Post COVID-19 round	-0.268***	-0.799***	-0.215***	-0.674***
	(0.086)	(0.292)	(0.080)	(0.254)
Household fixed effect	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	Yes	No	No
R-squared	0.025	0.027	0.045	0.055
No. observations	2492	2492	2492	2492

Notes: These are fixed effect estimates from linear regressions controlling for household fixed effects and excluding those households affected by the locust invasion. The outcome variable in the first two columns is indicator variable for those households who were unable to satisfy their food needs. The outcome variable in the first and third columns is indicator variable for those households who were unable to satisfy their food needs. The outcome variables in the last second and fourth columns is food gap measured in months. The first two column results are based on weighted fixed effects regressions while columns come from unweighted regressions. In Panel A access to PSNP transfers is based on self-reported PSNP membership. In Panel B, PSNP beneficiaries are those households who received a PSNP transfer worth of 100 Ethiopian Birr and above in the last six months. In Panel C PSNP beneficiaries are those households living in districts (woredas) where PSNP is operational at the time of the survey while non-beneficiaries are those households living in those districts PSNP is not operational or delayed because of logistical or other reasons. Standard errors, clustered at kebele level, are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: PSNP and households food security using alternative definitions of access to PSNP and excluding Oromia region

	(1) Food insecure (had problems satisfying food need)	(2) Food insecure (had problems satisfying food need)	(3) Food insecure (had problems satisfying food need)	(4) Food gap in months	(5) Food gap in months	(6) Food gap in months
Panel A: Using household self-reported PSNP participation						
Post COVID-19 round	0.113***	0.097***	0.590***	0.468***	0.134***	0.532***
	(0.030)	(0.033)	(0.110)	(0.116)	(0.028)	(0.094)
PSNP*Post COVID-19 round	-0.098**	-0.095**	-0.386**	-0.363**	-0.080**	-0.288**
	(0.042)	(0.042)	(0.160)	(0.155)	(0.037)	(0.118)
Control for locust invasion	No	Yes	Yes	No	Yes	Yes
Household fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	No	Yes	Yes	No	Yes
R-squared	0.020	0.027	0.048	0.070	0.048	0.093
No. observations	2232	2232	2232	2232	2232	2232
Panel B: Using amount of PSNP transfers						
Post COVID-19 round	0.114***	0.098***	0.591***	0.469***	0.136***	0.534***
	(0.030)	(0.033)	(0.109)	(0.116)	(0.028)	(0.094)
PSNP*Post COVID-19 round	-0.100**	-0.097**	-0.390**	-0.367**	-0.084**	-0.294**
	(0.042)	(0.041)	(0.159)	(0.155)	(0.037)	(0.118)
Control for locust invasion	No	Yes	Yes	No	Yes	Yes
Household fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sampling weights applied	Yes	No	Yes	Yes	No	Yes
R-squared	0.020	0.027	0.048	0.070	0.049	0.093
No. observations	2232	2232	2232	2232	2232	2232

Notes: These are fixed effect estimates from linear regressions controlling for household fixed effects. The outcome variable columns 1-3 is indicator variable for those households who were unable to satisfy their food needs. The outcome variable in columns 4-6 is food gap measured in months. The results in even numbered columns are based on weighted fixed effects regressions while the odd numbered columns come from unweighted regressions. In Panel A access to PSNP transfers is based on self-reported PSNP membership. In Panel B PSNP beneficiaries are those households who received a PSNP transfer worth of 100 Ethiopian Birr and above in the last six months. Standard errors, clustered at kebele level, are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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