Navigating Food Price Shocks in a Pandemic:
Food Insecurity and Coping Mechanisms in Burkina Faso

Abstract

Global food prices rose substantially after the start of the Covid-19 pandemic. This paper examines the impact of rising food prices during the pandemic on food security in Burkina Faso. We aim to answer two primary questions. First, what are the effects of food price shocks on household food insecurity? Second, what coping strategies do households adopt in response to these price shocks? Leveraging country-wide high-frequency longitudinal data, we employ household fixed effect models to examine the effects. In the absence of direct information on regional food prices, we use household-reported price shocks to capture regional-level price increases and show that the results are consistent with national-level price increases. We find significant and immediate increases in food insecurity following the price shocks, and this effect persists for at least two months. The price shocks most acutely affected the poorest households. Furthermore, food insecurity increased more in rural areas than in urban areas. The higher proportion of poorer households in rural areas explains part of this difference. We identify two main coping strategies in response to these shocks. First, we observe an increased likelihood of members leaving the household. Second, households receive substantially more assistance from relatives in Burkina Faso and abroad. This study is the first to show causal evidence of the negative repercussions of the food price rise during the pandemic on food insecurity in a developing country and to examine the coping mechanisms employed by households. Given that food prices are likely to remain high globally, our findings carry implications for the broader developing world. Furthermore, given the disproportionate effect on the poorest and those living in rural areas, the findings highlight the need for policies to mitigate the negative impacts of the price shocks and enhance overall food security in countries like Burkina Faso.

Keywords: Food price, food insecurity, coping mechanisms, Covid-19, Burkina Faso

JEL Codes: Q18, E31, O12

1. Introduction

Global food prices have been on the rise since the onset of the Covid-19 pandemic, but the impact of these price shocks on food insecurity remains poorly understood. This study examines the relationship between food price shocks and food insecurity using panel data from Burkina Faso. Burkina Faso is a particularly appropriate context for this analysis, given the country's high levels of food insecurity, with 40 percent of the population living below the poverty line and the relatively low levels of morbidity during the Covid-19 pandemic (WFP, 2022).

The influence of food price inflation on food insecurity is theoretically ambiguous. On the one hand, higher food prices can exacerbate food insecurity among poor households. Poor households spend a substantial portion of their income on food, and when the cost of staple foods rises, they may struggle even further to afford an adequate and nutritious diet.

On the other hand, there may be null or positive effects of food price increases. For example, subsistence farmers will likely be little affected by food price increases and remain at their, albeit already high, level of food insecurity. Furthermore, higher food prices may benefit poor households involved in agriculture by increasing their revenue from selling produce. Farmers may also be encouraged to invest more in agricultural activities when food prices rise. This can lead to increased productivity, and better farming techniques. Finally, food price increases may stimulate demand for labor and increase wages in the agricultural sector, creating job opportunities for poor households relying on manual labor for their livelihoods (Dorward, 2012; Headey & Martin, 2016).

Only a handful of prior studies examine the relationship between food price shocks and food insecurity, and consistent with the ambiguous theory, there is mixed evidence on the effects of

food price increases on food insecurity. The majority of studies found an increased food insecurity (Akter & Basher, 2014; Compton et al., 2010; Dávila, 2010; D'Souza & Jolliffe, 2012; Hadley et al., 2011, 2012; Jacobs, 2010; Sophal, 2011). However, others found no change or even improvements in food security due to factors such as strong economic growth and potential benefits to workers involved in the food production (Dorward, 2012; Headey, 2012, 2013; Verpoorten et al., 2013). Finally, there may be differential effects depending on the source of the food price increase. For example, a sudden increase in imported rice prices increased food insecurity in Nigeria, while increased domestic rice prices had an ambiguous effect (Amolegbe et al., 2021).

The current literature on food prices and food insecurity has three main limitations. First, most studies focus on the 2007-2008 world food price crisis.[1] Moreover, only two studies have examined the impact of rising food prices during the Covid-19 pandemic. Of those, one focused only on the first half of 2020, while the other analyzed the impact on dietary diversity rather than food insecurity per se (Erokhin & Gao, 2020; Madzorera et al., 2021).[2]

Second, most existing research uses cross-sectional data, making it difficult to establish the causal effects of price increases. This includes the more recent studies that focus on the Covid-19 pandemic. We found only two studies that employed panel data with estimation techniques like household fixed effects to control for time-invariant household characteristics that can help establish causal relationships and address endogeneity concerns (Akter & Basher, 2014; Amolegbe et al., 2021).

[1] Two pre-Covid studies did not focus on the 2007-2008 crisis (Amolegbe et al., 2021; Hadley et al., 2012).
[2] There is a related but distinct literature on the negative impact of Covid-19 lockdowns on food security in developing countries (Alam et al., 2022).

Finally, we know little about how households cope with food price increases. There is some evidence from studies using pre-pandemic data that households attempt to cope with rising food prices by reducing non-food spending, decreasing dietary diversity, utilizing savings and credit, selling assets, and seeking government assistance (Akter & Basher, 2014; Compton et al., 2010; D'Souza & Jolliffe, 2012; Hadley et al., 2012; Sophal, 2011). Yet, there is no empirical evidence of households employing other strategies often associated with households' responses to shocks, such as migration, remittance, or financial assistance from family members within the country.

Our study contributes to the literature in two ways. We are the first study to use country-wide panel data to examine the impact of food price shocks on food insecurity during the Covid-19 pandemic. The panel data allows us to analyze plausible causal relationships using a household fixed-effects model, which allows us to control for unobservable household characteristics. Second, we examine how households cope with food price shocks. Employing households' reports on remittance, assistance from family, assistance from non-family individuals, and migration of household members, we examine the specific channels households use to cope with price shock.

We use household data from Burkina Faso that incorporated the Food and Agriculture Organization's (FAO) eight-question food insecurity experience scale (FIES). This scale enables us to measure various aspects of food insecurity. Furthermore, households reported whether they had experienced any food price shock since the prior round, and we use this reported data to identify the impact of rising food prices. Employing four rounds of data, we compare changes in household food insecurity over a year to variations in reported price shocks during the same period.

This approach differs from some of the prior studies that relied on regional price data but focused solely on the price changes of a single primary cereal, such as rice, maize, or wheat flour, within the specific country under investigation (Akter & Basher, 2014; Amolegbe et al., 2021;

Dávila, 2010; D'Souza & Jolliffe, 2012). While our study has the limitation of lacking regional food price data, its strength lies in the fact that we do not restrict our analysis to a single cereal. Focusing on one cereal can be problematic in a country like Burkina Faso, which has three main cereals and where the primary cereal varies by region. Moreover, by using shocks reported by households, we capture the shocks relevant to the households' actual experiences. Importantly, our analysis remains robust when examining the impact on food insecurity using national food price indices.

We find that increases in food prices led to an immediate and significant rise in food insecurity. These effects persisted in the medium run, with food insecurity elevated one to two months after the initial price shock. The effect on food insecurity was significantly worse in rural areas compared to urban areas following the price shocks. Part of the reason for this effect is that the poor are more likely to live in rural areas, and poorer households were hit harder by the food price increase. We find that households cope with the price shock in two ways. First, financial assistance from family members within the country and remittance from family members abroad both increased. Second, individuals were more likely to leave the household following the price shock.

2. Burkina Faso

Burkina Faso is a landlocked West African country with a predominantly rural economy, with agriculture employing a significant portion of the population. The main crops include cotton, sorghum, millet, and maize. In addition to challenges in terms of food security and poverty, Burkina Faso has, in recent years, also faced security challenges due to the rise of armed extremist groups, particularly in the northern and eastern regions. These groups have attacked civilians, security forces, and infrastructure, leading to displacement and humanitarian crises.

Compared to many other developing countries, Burkina Faso allows us to isolate better the effects of food price increases on food insecurity during the Covid-19 pandemic. Burkina Faso experienced a relatively limited impact from the Covid-19 virus itself, with 17,632 confirmed cases and 318 deaths as of the end of 2021, which is low considering its population of approximately 22 million people (Mathieu et al., 2020). Furthermore, the lockdowns were much less onerous and short-lived than in other countries. The government implemented lockdown measures starting on March 21, 2020, including overnight curfews (7 pm to 5 am) and restrictions on public gatherings, including restaurants, cinemas, sports halls, and places of worship (Egger et al., 2022). The lockdowns were primarily applied in urban areas, meaning that market work in rural areas was not affected (Andrieu et al., 2021). The lockdowns were gradually eased from May 4, 2020, with most restrictions, including curfews, lifted by June 3, 2020 (Egger et al., 2022; USAID, 2020).

A more significant concern is the large internally displaced population resulting from violence. The ouster of President Blaise Compaore from office in 2014 left a power vacuum that worsened national security and caused Islamic militant groups to spread from the neighboring countries, Mali and Niger (IDMC, 2020; Lamarche, 2021). While their initial target was the government, they have been attacking civilians and trying to take control of communities since 2018 (Lamarche, 2021). To counter these threats, the government trained and financed militias, which worsened the crisis as these state-supported militias also started attacking civilians that they believed to be affiliated with insurgent groups. Attacks from both sides led to 519,000 newly displaced population in 2019 (IDMC, 2020). The displaced population reached a million by the end of 2020 and 1.5 million by 2021 (UN-OCHA, 2021b, 2022). Our robustness checks suggest that the internally displaced population does not bias our results.

3. Data

We use household data from the *Burkina Faso Covid-19 High-Frequency Phone Survey* (HFPS), conducted by the World Bank and the National Institute of Statistics and Demography of Burkina Faso. The survey was conducted monthly by phone over 11 rounds between June 2020 and July 2021. Each survey round was fielded over three weeks on average. The primary objective of the HFPS was to gain comprehensive insights into the impact of the Covid-19 pandemic on households by collecting frequent household-level data. In addition, the survey asked detailed questions on food insecurity, shocks, and outside assistance. The survey respondents were either the head of the household or any other knowledgeable adult household member.

The HFPS sample is a subsample of the 2018/19 Harmonized Living Conditions Household Survey (HLCHS), which interviewed 7010 households. Respondents in HLCHS 2018/19 were requested to provide a phone number, and 98% of households provided a number.[3] The target sample size for the HFPS was 1,800 households to ensure a nationally representative sample. To account for potential non-response and attrition, a total of 2,500 households were called, of which 1,968 were successfully interviewed in round 1. To ensure national representativeness and to avoid potential bias arising from households with access to phones being fundamentally different from those without access to phones, the HFPS provides survey weights that we used in our estimations.

3.1 Food Insecurity Measures

The survey utilizes the Food Insecurity Experience Scale (FIES) developed by the FAO (FAO, 2016) to measure food insecurity. FIES consists of eight questions with dichotomous (yes/no) responses that aim to capture the different challenges related to food insecurity. This

[3] The phone number could be of a household member or non-household member, such as a neighbor or a friend. Originally, the goal was to ensure households could be reached if they moved, but with the spread of the Covid-19 virus, the phone numbers became the basis for surveying households

measure has been empirically validated for cross-cultural use (Ballard et al., 2013; Kansiime et al., 2021). FIES asks whether, during the last 30 days, there was any time when any adult in the household experienced the following because of lack of money or other resources: (i) were worried about not having enough food to eat; (ii) were unable to eat healthy and nutritious/preferred foods; (iii) ate only a few kinds of foods; (iv) skipped a meal; (v) ate less than you thought you should; (vi) ran out of food; (vii) went hungry, but did not eat; and (viii) went without eating for a whole day. We generate an indicator variable for each question where one represents “yes,” and 0 represents “no.” Moreover, we create another variable to capture whether a household experienced any food insecurity, which takes a value of 1 if the response to at least one of the eight FIES questions is "yes," and 0 otherwise.

Food security questions were included in survey rounds 2 through 7 and 9 through 11. Additionally, questions on economic shocks were asked in every even-numbered round, namely rounds 2, 4, 6, 8, and 10. For our analysis of the short-run relationship between price shocks and food security, we limit our analysis to rounds that contain both types of questions, specifically rounds 2, 4, 6, and 10. The survey rounds were conducted in July-August 2020 (round 2), November 2020 (round 4), January-February 2021 (round 6), and May-June 2021 (round 10), respectively. The attrition rate from round 2 to round 10 was 9.6 percent. The final sample size for the short-run analyses was 1,995 households. This includes replacement households added in later rounds.

Furthermore, we analyze the medium-term impact by investigating the effect of shocks on food insecurity in the subsequent rounds. Specifically, we evaluate the influence of price shocks in rounds 2, 4, 6, and 10 on food insecurity in rounds 3, 5, 7, and 11, respectively. These rounds were conducted approximately one to two months after their preceding rounds: September 2020

(round 3), December 2020 (round 5), February 2021 (round 7), and July 2021 (round 11). The sample size for the medium-run analyses was 1,990 households.

3.2 Price Shock

HFPS collected information on shocks by asking households whether they were "negatively affected by the following problem over the past four weeks?" Response options included an increase in the price of the main food consumed, an increase in the price of inputs, a decrease in the selling price of production, poor harvest due to lack of manpower, rodent or insect infestation causing poor harvest, death of a household member, illness of a member, job loss, bankruptcy of non-agricultural business, and theft of property. The most reported shock was an increase in food prices, with 18 percent of households reporting this shock, on average, in each round. The next two most frequently reported shocks were the illness of household members (10.8 percent) and property theft (5.9 percent).

Given the potential for significant regional variations in prices over time due to poorly integrated markets, we use the percentage of households in each region and each round that report food price shocks to capture the impact of the price increases. This allows us to observe the region-level variations in price shocks. We also use national-level monthly food price indices data for sensitivity checks and to validate our price shock measure.[4]

3.3 Outside Assistance:

[4] The food price indices data are downloaded from the Humanitarian Data Exchange, which is part of the United Nation's Office for the Coordination of Humanitarian Affairs: https://data.humdata.org/dataset/faostat-prices-for-burkina-faso/resource/19a25a1a-6d55-407c-84ab-1313d6308bd7. The actual food price indices and inflation data originates from the International Monetary Fund (IMF).

HFPS included questions on household assistance received from three sources: (i) remittance from abroad, (ii) family assistance from within the country, and (iii) help from other non-family people. Households were not asked about the monetary value of the assistance; instead, they were asked to indicate whether the assistance from each source had increased, remained the same, decreased, or had no assistance from that source compared to a year earlier. The study utilizes these ordinal variables to understand the extent to which households received external assistance in response to food price shocks. Each variable was coded such that 1 denotes an increase in assistance, 0 indicates remaining the same, or there was no assistance a year ago, and -1 represents a decrease.

3.4 Descriptive Statistics

Table 1 presents the means of all food insecurity variables across four rounds. Close to two-thirds of households (62 percent) report at least one kind of food insecurity each round. The most reported specific food insecurities were "worry about not having enough to eat" (47.2 percent) and "had to eat only a few kinds of foods" (42.3 percent). It is crucial to note that the worst forms of food insecurity were also reported by a significant fraction of households in each round: 16.5 percent reported having to skip a meal, 10.9 percent went hungry without eating, 9.8 percent ran out of food, and 5.5 percent went without eating for a whole day. In addition to analyzing overall food insecurity, we pay particular attention to these worst forms of food insecurity.

<Table 1 here>

Figure 1 shows that in round 2, 32 percent of households reported experiencing an increase in the price of food in the prior four weeks, and 72 percent of households experienced food insecurity. In rounds 4 and 6, the percentage of households reporting a price shock decreased to

7.6 percent for both rounds, and food insecurity decreased to 62 and 54 percent, respectively. However, in round 10, there was a substantial increase in reported price shocks, with 25 percent of households reporting price increases and an increase in food insecurity to 59 percent.

<Figure 1 here>

This movement in price shocks is consistent with the national macroeconomic picture of food prices in Burkina Faso. After being below the five-year average throughout 2019, food prices significantly increased in June 2020 (Food and Agriculture Organization et al., 2021). Based on the national food price indices, the year-over-year food price inflation rate at the end of 2019 was -5.4%. However, by August 2020 (during round 2), the food price inflation had increased to 7.2%. This elevated inflationary trend persisted for two more months before decreasing to 4.8% in February 2021, coinciding with the completion of round six. Subsequently, the food price inflation rate increased again to 7.4% by April 2021, just before the start of the last survey round in May.

The food price increase, driven primarily by disruptions in the supply chain, included the rise in the price of main cereals, such as millet, sorghum, maize, and rice, somewhere between 5 to 15 percent depending on the market and region (Food and Agriculture Organization et al., 2021; World Bank, 2021). Figure 2 shows the reported price shocks for each region and round for the 13 administrative regions of Burkina Faso. For most regions, reporting of price shocks is high in round 2, followed by a decline in rounds 4 and 6, followed by an increase in round 10. However, there are variations in the levels of changes across regions. Some regions (like the region Est) did not see a reported price increase in round 10. In contrast, regions such as Plateau-Central and Sahel saw a large number of households, 48.8% and 43.5% of households, respectively, reporting price increases in round 2. While others, such as Central-Ouest and Central-Est, saw a smaller number of households, around 20%, reporting price shocks. Similar large variations are present in round

10 as well. Cascades saw 55% of households reporting price shock in round 10, whereas the Central region saw only 13.1%.

<Figure 2 here>

To understand the correlation in price shocks between regions, we calculated the correlation coefficient in the food price shocks across all 13 regions.[5] Most region-pairs exhibit strong correlations of 0.8 or above. Nevertheless, approximately 30 percent of region-pairs show weaker correlations below 0.8. Notably, the lowest correlation coefficient is 0.058, observed between the Cascades and Est regions, which are at the opposite ends of the country. These findings are consistent with prior research showing that many markets in developing countries are poorly integrated, particularly in Sub-Saharan Africa, due to high transportation costs, lack of information, weak infrastructure, and inefficient supply chains (Barrett, 2008; Fafchamps & Gavian, 1996; Moser et al., 2009; Ravallion, 1986).

4. Empirical Strategy

We use a linear model with household fixed effects. Using the equation below, our main specification regresses outcomes, Y, on a set of variables.

$$Y_{i,j,t} = \beta_0 + \beta_1 P_{j,t} + \beta_2 Cases_{i,j,t} + \delta_i + \varepsilon_{i,j,t}, \quad (1)$$

where i denote household, j denotes a region, and t survey rounds. $P_{j,t}$ is the fraction of households that report price shock in a region in a given round. We use this variation in reported price shocks to identify the impact on food insecurity, with β_1 the main coefficient of interest.

[5] The results are available in Appendix Table A1.

In addition to a food price increase, individuals may be ill, decide to self-isolate, or take other steps to avoid contact with others if they perceive a high risk of contracting Covid-19, which may also affect food insecurity. To capture the severity of the Covid situation, the *Cases* variable measures the number of new Covid-19 cases per 100,000 persons in the 30 days before the household's survey date. The number of Covid cases comes from "Our World in Data."[6]

The household fixed-effects, δ_i, control for unobserved household-level time-invariant factors that may bias the results. This approach allows us to control for time-invariant characteristics associated with the individual/household, such as gender, race and religion, constant preferences, household characteristics, area characteristics, and other time-invariant factors.[7] Finally, ε represents the error term.

Furthermore, because we use ordinal variables to represent changes in household assistance, we use a conditional fixed-effects ordered logistic model for the estimations on outside assistance. The standard conditional logit model applies a fixed-effects logit model for households that see a change in the dependent variable over time. However, for the conditional *ordered* logit model, the actual values of the dependent variable are irrelevant. Instead, higher numbers correspond to higher-value outcomes (Baetschmann et al., 2015). Hence, for our regressions, a positive coefficient for food price shock represents an increase in assistance, a negative coefficient represents a decrease, and a coefficient close to zero implies that assistance remained unchanged.

[6] The advantage of using "Our World in Data" is that it collects available Covid-19 data from many sources. The data are available at https://covid.ourworldindata.org/data/owid-covid-data.csv, and a complete listing of underlying sources is at https://github.com/owid/covid-19-data/tree/master/public/data/owid-covid-codebook.csv.

[7] This means that any variable that does not change over time, and which are likely to influence our outcome variables, are captured by the household fixed and would consequently drop out of the estimations. We also do not control for variables like household assets and the number of household members because these are possibly affected by the food price increase and, therefore, are endogenous.

5. Results

5.1 Short and Medium Run Effects

Table 2 shows the impact of the reported food price increase in Burkina Faso on the likelihood of food insecurity in the short run. The results indicate that the rise in food prices led to immediate, statistically significant increases in all food insecurity measures. Specifically, the point estimate for any food insecurity is 0.364. Hence, a one standard deviation increase in reported regional food price—equivalent to a 13.6 percentage points increase in the proportion of households reporting a food price shock—would result in a five percentage points increase in the likelihood of food insecurity (13.6 x 0.364). For context, the Plateau-Central region witnessed the most substantial change in the fraction of households reporting a shock, a 45 percentage point change from round 2 to 4. This implies that the food price shock caused a 16 percentage points higher food insecurity in that region.

<Table 2 here>

Table 3 presents the impact of shocks on food insecurity in the medium run, i.e., the effect in the following round. The results show that, like the short-run effect, the coefficients of the price shock variable for each food insecurity estimate are statistically significant and similar in magnitude, indicating the persistence of the impact in the medium run.

<Table 3 here>

5.2 Coping Mechanisms

Employing conditional fixed-effects ordered logistic model, Table 4 examines how households tried to cope with the food price increase. Family assistance from within the country

and remittance from abroad rose significantly in response to the food price shock. Yet, there was no increase in help from non-family individuals. We also examine the change in the number of household members compared to the prior round and find a reduction in the number of members following a reported price increase. This suggests that individuals were leaving the household in response to the price shocks.

<Table 4 here>

5.3 Heterogeneity in Effects

The literature suggests that there may be differences in effects between urban and rural areas but with no clear consensus (Dávila, 2010; Hadley et al., 2011; Verpoorten et al., 2013). Some studies find that households in urban areas were better off than rural areas following food price shocks, primarily because wealthier households are more likely to live in urban areas (Dávila, 2010; Hadley et al., 2011). However, a multi-country study found that food security was better for rural households than urban households (Verpoorten et al., 2013). The reason behind the differences in findings across studies is unclear from the literature.

To explore potential differences in the effects of food price shocks between rural and urban areas, we create an indicator variable for rural areas, where 1 represents rural and 0 represents urban. We interact the rural variable with the variable representing a rise in food prices. The results are presented in Table 5.[8] We find that rural areas are significantly more likely to experience an increase in food insecurity from price increases than urban areas for eight of the nine measures of food insecurity, with only the "went without eating a whole day" measure being statistically

[8] The dummy variable for rural area drops out of the estimations because of the household fixed effects. As households do not move over the survey rounds, the rural variable remains constant over time and therefore is captured by the household fixed effects which picks up any time invariant factor.

insignificant. The point estimates indicate a sizeable urban-rural difference: a standard deviation increase in reported regional food price shocks would lead to 5.8 percentage points greater increase in food insecurity in rural areas than in urban areas.

<Table 5 here>

To better understand the reasons behind the greater food insecurity in rural areas following a food price increase, we examined whether this was due to a higher proportion of poorer individuals living there. We used household wealth information from the survey round before the pandemic to explore this possibility. We sorted households by wealth and grouped them into four quartiles, from the highest to the lowest. A higher proportion of poorer households were in rural areas. Specifically, 84% of households in the lowest wealth quartile lived in rural areas, compared to only 26.8% in the highest wealth quartile.

We examined the differential impact of food price shocks on food insecurity across different wealth groups in Table 6. We interact food insecurity with each wealth quartile, where the lowest wealth quantile served as the excluded group. The interaction term for the highest wealth quartile is negative and statistically significant for eight of the nine food insecurity variables, including all four of the worst forms of food insecurity. This indicates that households in the highest wealth quartile were significantly less likely to experience food insecurity than the poorest group following the food price shocks. We find a smaller magnitude of effects with a slightly weaker relationship for the second-highest wealth quartile. For this quartile, the effect is negative and statistically significant for five food insecurity measures, although this includes three of the four worst forms of insecurity. For the second-lowest wealth quartile, the effect is significant for only one insecurity measure. These results suggest that the wealthier the households were, the greater their ability to cope with rising food prices.

<Table 6 here>

As the wealth data is self-reported, there can be measurement errors that may bias the results. While the survey does not have household income data, we can use the education of the household head as a proxy for income and wealth. To explore the relationship between education level and food insecurity, we created a dummy variable where 1 represented households with heads who had finished at least primary school and 0 represented households with heads who had not. In Table 7, we then interact the food price increase variable with the primary school completion dummy variable. Our findings indicate that households with heads who completed at least primary school were significantly less likely to experience seven of the nine food insecurity measures than those with heads who did not. The magnitude of the coefficients of the interaction terms is also relatively large. For example, for "any food insecurity," households with heads who completed primary education are 76 percent (-0.339/0.447) less likely to suffer a rise in food insecurity compared to households with heads that did not complete primary school. These results suggest that more education, likely a proxy for higher income and wealth, provides better protection against food insecurity.

<Table 7 here>

It is plausible that there exist interesting heterogeneities among agricultural households in rural areas based on whether they are net food producers or non-net food producers. However, the HFPS lacks data on the food production of households. Although the HLCHS 2018/19, conducted a year before the onset of the pandemic, captures information on households' food production, it does not include questions that allow us to identify households as net food producers or subsistence households. Consequently, we cannot conduct a heterogeneity analysis based on net food-producing households.

6. Seasonality and Robustness Checks

6.1 Seasonality

Agriculture in Burkina Faso is weather-dependent, with most farmers depending on a single season of rain-fed agriculture (Laudien et al., 2022; WFP, 2022). The primary cereal crops produced and consumed in Burkina Faso are sorghum, millet, and maize (Beal et al., 2023; Famine Early Warning System Network, 2017; Laudien et al., 2022). The harvest season for these crops typically spans from September through December (FAO, 2022; USAID, 2020; USDA, 2023), while the peak agricultural lean season, characterized by food scarcity, generally occurs from June to August (Action Against Hunger, 2021; USAID, 2022; WFP, 2023).

Notably, the two rounds with the highest proportion of reported food price shocks, rounds 2 (July through August 2020) and 10 (May through June 2021), coincided with the lean season. Thus, a concern is that changes in food insecurity may be driven by the lean season rather than the rising prices. We conduct two robustness checks to assess whether seasonality biases the results. We create a lean season dummy variable where 1 represents the rounds that fall within the lean season (rounds 2 and 10), and 0 represents non-lean season rounds.

First, we include the lean season dummy as a control variable in our estimations of the impact of food price increases on food insecurity. Results in Table 8 show that even after controlling for the lean season, food price increases significantly increased food insecurity. Moreover, all the coefficient estimates in Table 8 are larger than the corresponding coefficients in Table 2, where the lean season was not controlled for.

<Table 8 here>

Second, in Table 9, we examine the impact of the lean season dummy on food insecurity when excluding the food price increase variable. The lean season dummy is statistically insignificant for three out of the nine food insecurity measures. This suggests that the lean season alone does not drive the increased food insecurity across all measures, supporting the notion that the rise in food prices plays a significant role in the observed food insecurity patterns.

<Table 9 here>

6.2 Conflict

A further concern is whether the observed increases in food prices and food insecurity during rounds 2 and 10 are driven by the migration of internally displaced people. To address this concern, we conducted a series of robustness checks.

First, we analyzed data from UNHCR and plotted the total number of displaced individuals by month in Appendix Figure A1 (UNHCR, 2023). We highlight the months corresponding to the survey rounds with high reported food price increases in gray. Our analysis reveals no evidence of a sudden increase in the displaced population coinciding with the food price increases in rounds 2 and 10.

Most of the displaced population, over 70 percent, originated from the two northern regions of Sahel and Central-North (UN-OCHA, 2021b, 2022). Most displaced people moved to nearby provinces within the same region or, in some cases, neighboring regions (UNHCR, 2021; UN-OCHA, 2021a, 2021c). Considering that the origin and destination regions of the displaced people are often the same, we examine whether the two regions with the most displaced people were driving the regional food price shocks and contributing to higher food insecurity. Hence, as a robustness check, we exclude households residing in these two regions and estimate the impact of

price shocks on food insecurity using the remaining sample. Although this reduces our sample size by approximately 11 percent, affecting statistical power and potential variation in price shocks, the results presented in Appendix Table A2 show that the coefficients of price shocks for seven of the nine food insecurity measures remain statistically significant and qualitatively similar. This includes all four of the worst forms of food insecurity. Hence, our findings suggest that the high displacement regions do not significantly influence the impact of price shocks.

Displaced people also appeared more likely to move to urban areas (UNHCR, 2021). We provide three pieces of evidence that indicate that this is unlikely to bias our results. First, our earlier results indicated that the higher wealth of households was the main driving factor behind the better food security of urban households compared to rural ones following the food price shock.

Second, since most displaced people move to urban areas, food prices in urban areas may be more affected by increased demand, making households originally residing in urban areas to be systematically more likely to report food price shocks. Nonetheless, we find that, on average, 18.4 percent of households in rural areas reported a food price shock per round. In comparison, 17.6 percent of households in urban areas reported the shock. In other words, households in urban areas were slightly less likely to experience food price shocks.

Third, suppose that most displaced people move to urban areas and cause a change in both food prices and food insecurity. In that case, bias in estimations that include urban areas is possible. Thus, estimations focusing only on rural areas may provide more precise results. In Appendix Table A3, we examine the impact of food price shocks on food insecurity in rural areas. The results showed that food price shocks significantly increased all nine forms of food insecurity in rural areas. This suggests that even in areas less affected by displacements, there is a significant impact on food insecurity, indicating that our overall conclusions are not biased.

6.3 Measurement Error in Reported Price Shocks

Our price shock variable is based on the households' self-reports of variations in food price increases during the prior month. However, there may be potential measurement errors in these self-reported data.[9] To address this concern, we introduce an alternate measure of price shock using data from the national monthly food price indices. Specifically, we calculate the change in the food price indices during the survey month compared to the prior month, which aligns with our original shocks variable, which is also based on the month preceding the survey. Subsequently, we examine the impact of this change in the national food price index on food insecurity. The results are presented in Appendix Table A4.

Our analysis reveals that an increase in the food price index significantly and adversely affects all food insecurity variables. This finding further supports our earlier results, indicating that the impact of rising food prices on food insecurity remains robust even when using an alternative measure based on national food price indices.

Since the prices were rising during the pandemic, the estimations may capture the effects of other household-level shocks caused by the pandemic. These potential shocks could include illness related to Covid-19 or the lockdown, worker shortages resulting from lockdowns impacting agricultural returns, and job losses or business bankruptcies due to the lockdown measures. Given that the HFPS includes data on other shocks experienced by households, such as the illness of an earning household member, job loss experienced by any household member, the bankruptcy of a non-agricultural business, and poor harvest due to lack of labor, we can control for these other

[9] If the measurement error is random, it would likely bias the magnitude of the coefficient of interest lower, which would mean that our estimates are an underestimate. On the other hand, if the measurement error is fixed in nature, the inclusion of household fixed effects in our analysis would help control for it.

shocks experienced by the households. As shown in Appendix Table A5, the regional food price shock coefficient remains statistically significant and qualitatively similar after controlling for these shocks across all nine food insecurity measures. This finding suggests that the impact of the regional food price shock is distinct from the effects of other shocks related to the pandemic or lockdown measures.

7. Conclusion

This is the first study to use panel data to examine the impact of the rising food prices during the Covid-19 pandemic on food insecurity. Through the use of nationally representative data from Burkina Faso, we show that a surge in reported food prices substantially heightens the risk of food insecurity, with the effects persisting up to two months after the shock. We also find that households employ a variety of coping mechanisms in response to the shocks. Family assistance from within the country and remittance from abroad increased in response to the food price shock. There is also a reduction in household members, likely attributable to migration prompted by economic stress.

The study reveals a considerable variation in the effects of food price shocks. Food insecurity is more prevalent in rural areas than urban ones, likely due to a higher percentage of lower-income households residing in rural settings. Furthermore, we found that wealthier households are significantly less susceptible to food insecurity in the wake of food price shocks, highlighting the crucial role of wealth in buffering these effects.

Recommendations for future research include several key areas. First, investigating the long-term effects of rising food prices on food insecurity and coping mechanisms will provide insights into sustained impacts. Second, assessing the effectiveness of policy interventions to mitigate the

negative consequences of food price shocks is essential. Evaluating existing programs and proposing strategies to enhance household resilience and equitable access to nutritious food during price volatility is crucial. Finally, the literature suggests that economic shocks can have different effects based on the gender of both adults and children (Alam, 2015; Pitt & Rosenzweig, 1990; Rose, 2000). Consequently, exploring the gender-specific impacts of food price shocks on food insecurity and household coping strategies can help identify those most affected by such shocks.

This study's findings underscore food insecurity's complex nature and the significant impact of food price shocks. It highlights the need for policies focused on food price stability and addressing wealth disparities. Such policies can help to buffer the negative impacts of food price shocks and enhance overall food security in countries like Burkina Faso.

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Table 1: Mean of food insecurity variables across four rounds

	Mean (%)
Any food insecurity	62%
Worry about not having enough food to eat	47.2%
Unable to eat healthy and nutritious food	35.2%
Had to eat only a few kinds of food	42.3%
Ate less than they thought they should	23.3%
Had to skip a meal	16.5%
Ran out of food	9.8%
Went hungry but did not eat	10.9%
Went without eating for a whole day	5.5%
No of observations	7,776
Number of households	1,995

Figure 1: Changes in price shock and food insecurity over four rounds

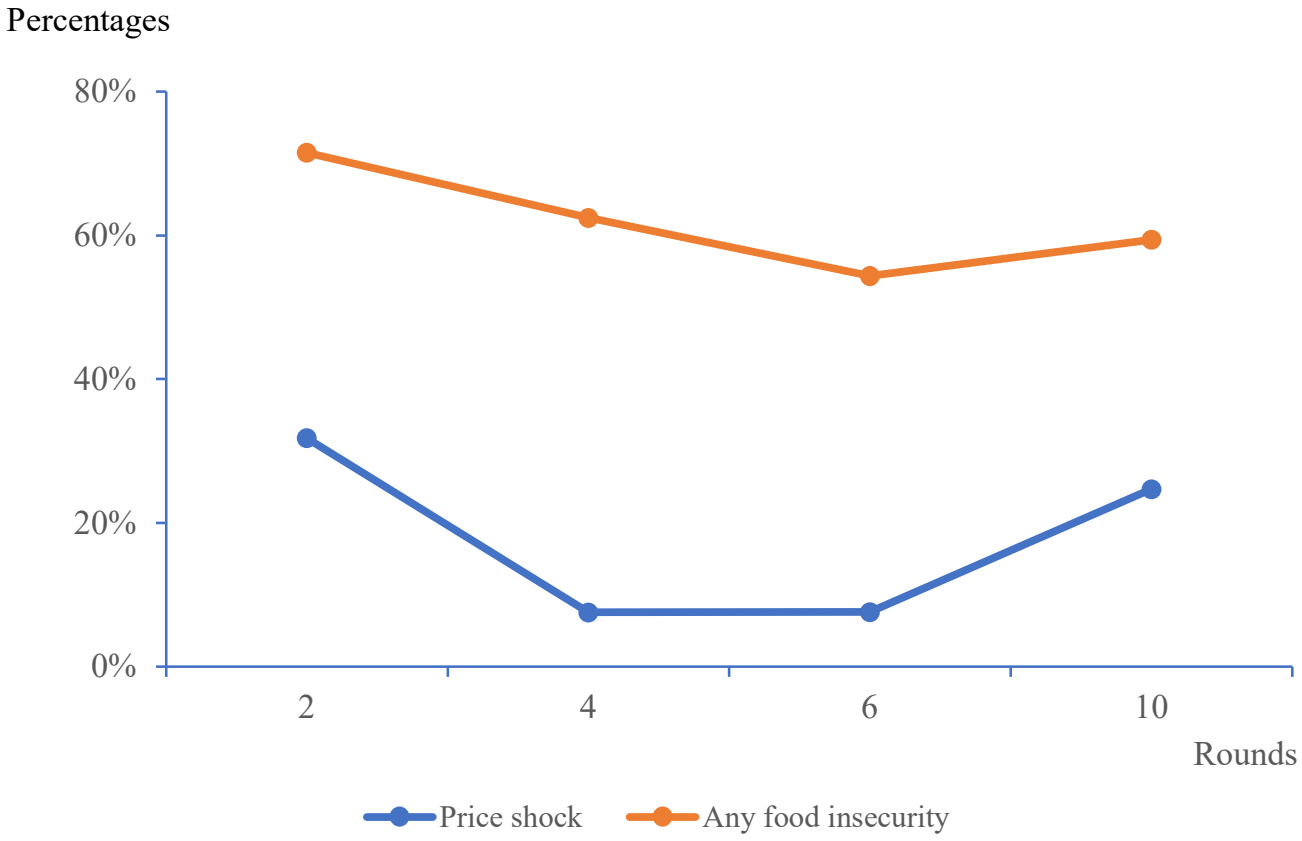

Figure 2: Changes in price shock across regions over four rounds

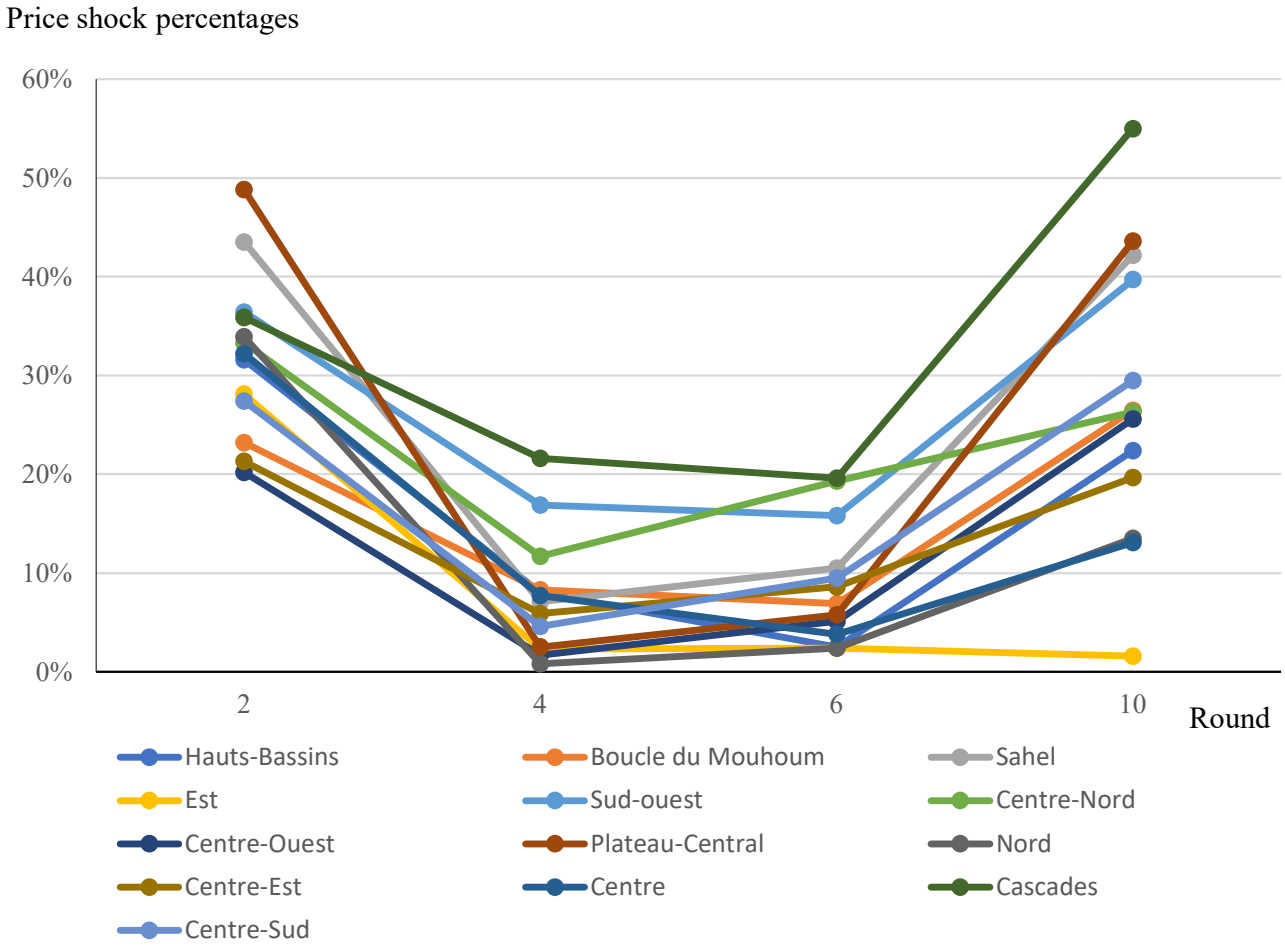

Table 2: Impact of regional food price increase on food insecurity in the short run

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Food price increase	0.364***	0.328***	0.311***	0.274***	0.332***
	(0.065)	(0.083)	(0.074)	(0.080)	(0.067)
Covid-19 cases/100,000	-0.004***	-0.005***	-0.002**	-0.003***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,776	7,773	7,767	7,769	7,762
Number of households	1,995	1,995	1,995	1,995	1,995

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of food	Went hungry but did not eat	Went without eating for a whole day
Food price increase	0.277***	0.281***	0.226***	0.151***
	(0.055)	(0.052)	(0.052)	(0.035)
Covid-19 cases/100,000	-0.002**	-0.001	-0.002***	0.000
	(0.001)	(0.001)	(0.001)	(0.000)
No of observations	7,769	7,763	7,702	7,758
Number of households	1,995	1,995	1,995	1,995

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table 3: Impact of regional food price increase on food insecurity in the medium run

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Food price increase	0.433***	0.522***	0.475***	0.418***	0.544***
	(0.069)	(0.090)	(0.078)	(0.082)	(0.076)
Covid-19 cases/100,000	0.000	-0.003	0.001	0.002	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
No of observations	7,561	7,557	7,555	7,558	7,551
Number of households	1,990	1,990	1,990	1,990	1,990

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of food	Went hungry but did not eat	Went without eating for a whole day
Food price increase	0.341***	0.328***	0.311***	0.203***
	(0.060)	(0.069)	(0.049)	(0.042)
Covid-19 cases/100,000	0.003*	0.001	0.003***	0.002*
	(0.002)	(0.001)	(0.001)	(0.001)
No of observations	7,554	7,552	7,493	7,550
Number of households	1,990	1,990	1,990	1,990

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table 4: Impact of food price increase on outside assistance and change in number of household members

	(1)	(2)	(3)	(4)
Outcome variables:	Remittance	Family assistance within the country	Help from non-family people	Change in number of household members
Food price increase	1.436*	1.210***	0.789	-0.345***
	(0.748)	(0.444)	(0.760)	(0.110)
Covid-19 cases/100,000	0.026**	0.011*	0.018	0.001
	(0.011)	(0.006)	(0.012)	(0.001)
No of observations	727	2,169	783	7,603
Number of households	169	509	190	1995

Note: Columns (1) to (3) represents coefficients from fixed effects ordered logit model, so for the dependent variables, 0 represents no change, 1 represents an increase, and -1 represents a decrease. Column (4) represents coefficients from a linear model with household fixed effects where dependent variable is a continuous variable. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%.

Table 5, Panel A: Differences in effect between rural and urban areas of food price increase on food insecurity

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Food price increase	0.056	-0.175**	-0.049	-0.036	0.072
	(0.082)	(0.085)	(0.087)	(0.087)	(0.070)
Food price increase x Rural	0.429***	0.700***	0.501***	0.432***	0.361***
	(0.107)	(0.118)	(0.112)	(0.120)	(0.094)
Covid-19 cases/100,000	-0.004***	-0.006***	-0.003***	-0.003***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,776	7,773	7,767	7,769	7,762
Number of households	1,995	1,995	1,995	1,995	1,995

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of money	Went hungry but did not eat	Went without eating for a whole day
Food price increase	0.151**	0.150***	0.080	0.151***
	(0.068)	(0.051)	(0.050)	(0.052)
Food price increase x Rural	0.176**	0.183**	0.203***	-0.001
	(0.089)	(0.075)	(0.074)	(0.059)
Covid-19 cases/100,000	-0.002***	-0.001	-0.002***	0.000
	(0.001)	(0.001)	(0.001)	(0.000)
No of observations	7,769	7,763	7,702	7,758
Number of households	1,995	1,995	1,995	1,995

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table 5, Panel B: Percentage of individuals living in rural areas in different wealth groups

	Percentage living in rural areas
Lowest wealth quartile	84.0%
Second-lowest wealth quartile	78.0%
Second-highest wealth quartile	59.9%
Highest wealth quartile	26.8%

Table 6: Differences in effect of regional food price increase by different asset quartiles on food insecurity

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Food price increase	0.414***	0.353***	0.448***	0.460***	0.463***
	(0.106)	(0.129)	(0.128)	(0.139)	(0.106)
Food price inc. x Second Lowest Wealth	-0.126	0.064	-0.022	-0.270	-0.017
	(0.150)	(0.192)	(0.163)	(0.191)	(0.146)
Food price inc. x Second Highest Wealth	0.089	0.027	-0.318*	-0.269	-0.305*
	(0.175)	(0.186)	(0.164)	(0.184)	(0.156)
Food price inc. x Highest Wealth	-0.194	-0.315*	-0.449**	-0.361**	-0.439***
	(0.165)	(0.175)	(0.184)	(0.181)	(0.146)
Covid-19 cases/100,000	-0.004***	-0.005***	-0.002***	-0.003***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,776	7,773	7,767	7,769	7,762
Number of households	1,995	1,995	1,995	1,995	1,995

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of money	Went hungry but did not eat	Went without eating for a whole day
Food price increase	0.414***	0.446***	0.345***	0.178***
	(0.102)	(0.098)	(0.092)	(0.060)
Food price inc. x Second Lowest Wealth	-0.117	-0.218*	-0.119	-0.023
	(0.137)	(0.119)	(0.113)	(0.074)
Food price inc. x Second Highest Wealth	-0.215*	-0.221*	-0.215*	0.031
	(0.130)	(0.121)	(0.120)	(0.080)
Food price inc. x Highest Wealth	-0.398***	-0.378***	-0.276**	-0.169*
	(0.127)	(0.128)	(0.133)	(0.088)
Covid-19 cases/100,000	-0.002***	-0.001	-0.002***	0.000
	(0.001)	(0.001)	(0.001)	(0.000)
No of observations	7,769	7,763	7,702	7,758
Number of households	1,995	1,995	1,995	1,995

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table 7: Differences in effect of regional food price increase by education on food insecurity

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Food price increase	0.447***	0.484***	0.406***	0.373***	0.404***
	(0.073)	(0.095)	(0.085)	(0.093)	(0.076)
Food price increase x Primary school	-0.339**	-0.645***	-0.389***	-0.405***	-0.298***
	(0.134)	(0.147)	(0.122)	(0.135)	(0.113)
Covid-19 cases/100,000	-0.004***	-0.005***	-0.002***	-0.003***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,776	7,773	7,767	7,769	7,762
Number of households	1,995	1,995	1,995	1,995	1,995

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of money	Went hungry but did not eat	Went without eating for a whole day
Food price increase	0.303***	0.342***	0.276***	0.156***
	(0.065)	(0.059)	(0.060)	(0.040)
Food price increase x Primary school	-0.106	-0.251***	-0.205**	-0.023
	(0.094)	(0.095)	(0.086)	(0.062)
Covid-19 cases/100,000	-0.002**	-0.001	-0.002***	0.000
	(0.001)	(0.001)	(0.001)	(0.000)
No of observations	7,769	7,763	7,702	7,758
Number of households	1,995	1,995	1,995	1,995

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table 8: Impact of regional food price increase on food insecurity after controlling for lean season

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Food price increase	0.744***	0.594***	1.094***	0.859***	0.551***
	(0.117)	(0.139)	(0.125)	(0.137)	(0.106)
Lean season dummy	-0.118***	-0.083**	-0.243***	-0.182***	-0.068***
	(0.030)	(0.033)	(0.029)	(0.030)	(0.025)
Covid-19 cases/100,000	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,776	7,773	7,767	7,769	7,762
Number of households	1,995	1,995	1,995	1,995	1,995

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of food	Went hungry but did not eat	Went without eating for a whole day
Food price increase	0.486***	0.623***	0.491***	0.312***
	(0.090)	(0.098)	(0.082)	(0.059)
Lean season dummy	-0.065***	-0.106***	-0.082***	-0.050***
	(0.022)	(0.023)	(0.020)	(0.015)
Covid-19 cases/100,000	-0.003***	-0.002***	-0.003***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,596	7,590	7,529	7,585
Number of households	1,995	1,995	1,995	1,995

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table 9: Impact of lean season on food insecurity

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Lean season dummy	0.036**	0.040**	-0.018	-0.004	0.046***
	(0.017)	(0.020)	(0.017)	(0.018)	(0.016)
Covid-19 cases/100,000	-0.006***	-0.006***	-0.006***	-0.005***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,776	7,773	7,767	7,769	7,762
Number of households	1,995	1,995	1,995	1,995	1,995

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of food	Went hungry but did not eat	Went without eating for a whole day
Lean season dummy	0.035***	0.022*	0.019	0.014*
	(0.014)	(0.012)	(0.013)	(0.009)
Covid-19 cases/100,000	-0.003***	-0.002***	-0.003***	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,769	7,763	7,702	7,758
Number of households	1,995	1,995	1,995	1,995

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Appendix

Figure A1: Total number of displaced people by month

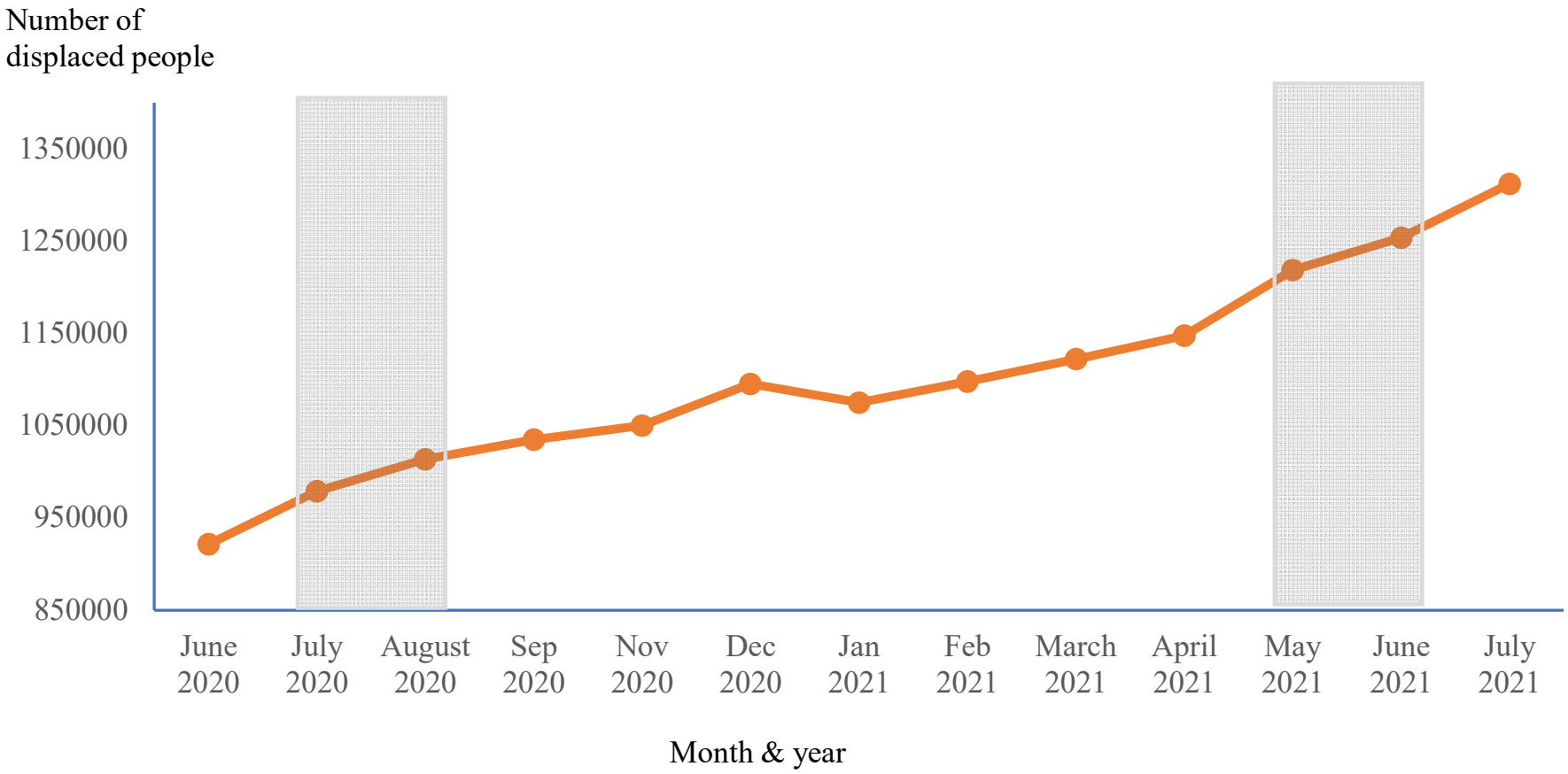

Table A1: Correlation coefficients of reported food price shock in each region

	Hauts-Bassins	Boucle du Mouhoun	Sahel	Est	Sud-ouest	Centre-Nord	Centre-Ouest	Plateau-Central	Nord	Centre-Est	Centre	Cascades	Centre-Sud
Hauts-Bassins	1												
Boucle du Mouhoun	0.9098	1											
Sahel	0.9353	0.982	1										
Est	0.7653	0.4544	0.5753	1									
Sud-ouest	0.9083	0.9998	0.9844	0.4566	1								
Centre-Nord	0.8719	0.8334	0.9227	0.742	0.8412	1							
Centre-Ouest	0.8459	0.9823	0.9766	0.3888	0.9852	0.8578	1						
Plateau-Central	0.9536	0.9732	0.9979	0.6255	0.9754	0.9334	0.9608	1					
Nord	0.9413	0.7658	0.8525	0.9179	0.7685	0.9232	0.7222	0.8836	1				
Centre-Est	0.9248	0.9632	0.9963	0.6028	0.9671	0.9509	0.9684	0.9955	0.8688	1			
Centre	0.933	0.7061	0.781	0.9435	0.7057	0.8312	0.6286	0.8193	0.9806	0.7876	1		
Cascades	0.6726	0.9156	0.8426	0.0581	0.9147	0.6043	0.9278	0.8098	0.445	0.8101	0.3642	1	
Centre-Sud	0.8946	0.9741	0.9946	0.5213	0.978	0.9255	0.9877	0.9876	0.8159	0.9951	0.7259	0.8593	1

Table A2: Impact of regional food price increase on food insecurity in the short run after dropping areas most affected by conflict

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Food price increase	0.260***	0.328***	0.124	0.102	0.304***
	(0.071)	(0.091)	(0.076)	(0.078)	(0.071)
Covid-19 cases/100,000	-0.003***	-0.004***	-0.002**	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	6,793	6,790	6,784	6,786	6,779
Number of households	1,742	1,742	1,742	1,742	1,742

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of food	Went hungry but did not eat	Went without eating for a whole day
Food price increase	0.225***	0.222***	0.150***	0.150***
	(0.056)	(0.052)	(0.052)	(0.040)
Covid-19 cases/100,000	-0.002**	-0.000	-0.001**	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	6,786	6,781	6,720	6,776
Number of households	1,742	1,742	1,742	1,742

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table A3: Impact of regional food price increase on food insecurity in rural areas

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Food price increase	0.428***	0.459***	0.385***	0.341***	0.378***
	(0.084)	(0.110)	(0.095)	(0.104)	(0.087)
Covid-19 cases/100,000	-0.006***	-0.008***	-0.005***	-0.005***	-0.007***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
No of observations	2,660	2,659	2,658	2,659	2,655
Number of households	684	684	684	684	684

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of food	Went hungry but did not eat	Went without eating for a whole day
Food price increase	0.279***	0.316***	0.257***	0.140***
	(0.071)	(0.069)	(0.069)	(0.043)
Covid-19 cases/100,000	-0.004***	-0.001*	-0.003***	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	2,657	2,654	2,639	2,655
Number of households	684	684	684	684

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table A4: Impact of changes in food price indices on food insecurity in the short run

	(1)	(2)	(3)	(4)	(5)
Outcome variables:	Any food insecurity	Worry about not having enough food to eat	Unable to eat healthy and nutritious food	Had to eat only a few kinds of food	Ate less than they thought they should
Change in food price indices	0.020***	0.031***	0.012**	0.009*	0.021***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
Covid-19 cases/100,000	-0.007***	-0.008***	-0.005***	-0.005***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,776	7,773	7,767	7,769	7,762
Number of households	1,995	1,995	1,995	1,995	1,995

	(6)	(7)	(8)	(9)
Outcome variables:	Had to skip a meal	Ran out of food	Went hungry but did not eat	Went without eating for a whole day
Change in food price indices	0.017***	0.010***	0.006*	0.007***
	(0.004)	(0.003)	(0.004)	(0.002)
Covid-19 cases/100,000	-0.004***	-0.003***	-0.003***	-0.001***
	(0.001)	(0.000)	(0.001)	(0.000)
No of observations	7,769	7,763	7,702	7,758
Number of households	1,995	1,995	1,995	1,995

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.

Table A5: Impact of regional food price increase on food insecurity after controlling for other potential shocks

Outcome variables:	(1) Any food insecurity	(2) Worry about not having enough food to eat	(3) Unable to eat healthy and nutritious food	(4) Had to eat only a few kinds of food	(5) Ate less than they thought they should
Food price increase	0.352***	0.285***	0.293***	0.257***	0.299***
	(0.067)	(0.084)	(0.076)	(0.081)	(0.068)
Illness of an earning member	0.038	0.013	0.073***	0.037	-0.000
	(0.024)	(0.030)	(0.027)	(0.027)	(0.031)
Job loss	0.094**	0.184***	0.144***	0.065	0.157***
	(0.040)	(0.050)	(0.048)	(0.055)	(0.049)
Bankruptcy of a non-ag. busines	0.120***	0.245***	0.143***	0.140***	0.180***
	(0.035)	(0.049)	(0.044)	(0.040)	(0.050)
Poor harvest due to lack of labor	0.107**	0.055	-0.016	0.004	0.085
	(0.043)	(0.062)	(0.042)	(0.044)	(0.062)
Covid-19 cases/100,000	-0.004***	-0.005***	-0.002**	-0.003***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,776	7,773	7,767	7,769	7,762
Number of households	1,995	1,995	1,995	1,995	1,995

Outcome variables:	(6) Had to skip a meal	(7) Ran out of food	(8) Went hungry but did not eat	(9) Went without eating for a whole day
Food price increase	0.244***	0.253***	0.183***	0.134***
	(0.055)	(0.052)	(0.051)	(0.035)
Illness of an earning member	-0.002	0.024	0.006	-0.010
	(0.026)	(0.021)	(0.027)	(0.016)
Job loss	0.079	0.152***	0.157***	0.036
	(0.061)	(0.047)	(0.054)	(0.036)
Bankruptcy of a non-ag. busines	0.205***	0.176***	0.230***	0.092***
	(0.057)	(0.050)	(0.056)	(0.033)
Poor harvest due to lack of manp	0.051	0.057	-0.000	0.021
	(0.043)	(0.042)	(0.043)	(0.034)
Covid-19 cases/100,000	-0.002**	-0.001	-0.002**	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
No of observations	7,769	7,763	7,702	7,758
Number of households	1,995	1,995	1,995	1,995

Note: Linear Model with household fixed effects. Standard errors are in parentheses. *** indicates significance at 1% level; ** at 5%; * at 10%. All dependent variables are dummy variables.