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COVID-19 Working Paper: The COVID-19 Pandemic and Food Security in Low- and Middle-Income Countries: A Review of the Emerging Microeconomic Literature

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Abstract

This paper reviews preliminary findings from the emerging microeconomic literature on observed changes in food insecurity associated with the COVID-19 pandemic. The review complements existing macroeconomic projections of food insecurity, based on expected changes in income and prices, by providing discussions of local-level, microeconomic differences in food insecurity. The review focuses on studies conducted in low- and middle-income countries that include household survey data, measuring food insecurity, collected both before and after the onset of the COVID-19 pandemic. In total, the authors review eight studies—seven from countries in Sub-Saharan Africa and one from India. The authors discuss findings and limitations in this emerging literature, with the goal of informing responses to the COVID-19 pandemic. A key takeaway is that—although most studies in the review find evidence of increasing food insecurity amid the COVID-19 pandemic, there is also evidence of resilience (at least in terms of food security) among some subpopulations.

Keywords: COVID-19, Coronavirus pandemic, food security, income shocks, markets, trade

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Summary

What Is the Issue?

The Coronavirus (COVID-19) pandemic led to dramatic shocks to income, employment, and production on a global scale. These shocks are expected to lead to widespread increases in global food insecurity. The USDA, Economic Research Service (ERS) International Food Security Assessment (IFSA) (along with complementary reports by the United Nations Food and Agricultural Organization (FAO) and the International Food Policy Research Institute (IFPRI)) projects regional and global changes in food insecurity associated with the COVID-19 pandemic based on macroeconomic expectations. This report complements these macroeconomic projections with discussions of the emerging microeconomic literature on changes in food insecurity associated with the COVID-19 pandemic.

What Did the Study Find?

The microeconomic literature highlights the importance of local-level characteristics in assessing changes in food insecurity associated with the COVID-19 pandemic. Although most studies in this review found evidence of increasing food insecurity amid the pandemic, some studies found evidence of resilience—at least in terms of food security—among some subpopulations. The current microeconomic literature showed mixed evidence on how changes in food insecurity associated with the COVID-19 pandemic differ between rural and urban areas and across socioeconomic groups. Some studies also found that local social protection programs seemed to help mitigate adverse changes in food insecurity associated with the pandemic. We highlight some shortcomings in the emerging literature which include: the limited availability of microeconomic panel data, the relatively short time frame of each of these studies, the global scale of pandemic-related economic and social disruptions, and noncomparable measures of food insecurity across studies.

How Was the Study Conducted?

ERS researchers reviewed the literature on changes in food insecurity associated with the COVID-19 pandemic by applying two key inclusion criteria. First, the review was restricted to studies in low- and middle-income countries, which complements the existing macroeconomic projections of the IFSA model that includes 76 low- and middle-income countries. Second, the researchers focused on studies analyzing microeconomic survey data that measure food insecurity from both before and after the onset of the pandemic, enabling assessment of changes in food insecurity associated with the COVID-19 pandemic. Finally, due to the relatively new literature and the lags inherent in academic publishing, many of the studies meeting these inclusion criteria have not yet been added to traditional databases of published research. In order to include such studies, the researchers monitored Google Scholar alerts and working paper series for “COVID-19” or “Coronavirus” research. ERS researchers reviewed all the studies meeting the two inclusion criteria through July 2021.

Introduction

The COVID-19 pandemic has led to widespread economic and social disruptions around the world. In addition to potential exposure to a contagious and deadly virus, job losses and reductions in earned income persist for a large share of the world's population. Global poverty projections (based on the World Bank's PovcalNet and International Monetary Fund (IMF) data) suggest that, in 2020, the number of people living below the $1.90 per day poverty line increased by at least 68 million and the number living below the $3.20 per day poverty line increased by at least 140 million (Valensisi, 2020).[1] Compared to pre-pandemic projections, expected gross domestic product (GDP) growth rates completely reversed, declining from an expected expansion of 5.1 percent in the countries covered by the USDA, Economic Research Service's (ERS) International Food Security Assessment (IFSA) report to a contraction of -5.1 percent (Baquedano et al., 2021a).

The ERS food security projections further highlight a large increase in the number of people experiencing food insecurity around the world due to the COVID-19 pandemic (Baquedano et al., 2020; 2021). The IFSA model projects per capita food demand—based on expected changes to income, prices, and food supply—and compares this projection with a nutritional target of 2,100 calories per person per day (the United Nations Food and Agriculture Organization's (FAO, 2014) stated caloric level necessary to sustain a healthy and active lifestyle). The IFSA projection provides estimated levels of food security and nutritional intake in 76 low- and middle-income countries. In a follow-up article to the 2020 IFSA report, Baquedano et al. (2021) update the 2020–30 projections of global food security associated with the COVID-19 pandemic. These updates estimate that (in 2020) the number of food-insecure people reached 921 million, an increase of 160 million from pre-pandemic projections. The 2021 IFSA report projects the prevalence of food insecurity in 2021 will increase by nearly 291 million people (Baquedano et al., 2021b).

The IFSA macroeconomic projections help define the scale of the global consequences of the COVID-19 pandemic on food insecurity. The projections indicate a potential setback in recent global progress towards meeting the United Nation's Sustainable Development Goals and highlight a distinct challenge to ending hunger and achieving food security for all people by 2030 (Hoy and Sumner, 2020; Ravallion, 2020). These macroeconomic projections, however, are only designed to predict global, regional, and country-level changes in food insecurity; the projections are unable to provide insight into more nuanced, local-level, and within-country changes in food insecurity associated with the COVID-19 pandemic.

[1] More information about the World Bank's PovcalNet is available on the World Bank's website.

This working paper includes a review of microeconomic studies of local-level differences in food insecurity that are not captured by the larger scale macroeconomic projections. These insights include assessments of pandemic-related market disruptions, rural-urban differences, variations across socioeconomic groups, and the effectiveness of social projection programs. The emerging microeconomic literature, however, is limited in geographic scope as detailed microeconomic data are only available in a small share of countries around the world. Taken together, insights from macroeconomic projections and the emerging microeconomic literature complement each other and inform public and private decision makers about rapidly developing changes in international food insecurity associated with the COVID-19 pandemic.

This review includes two inclusion criteria. First, the authors have restricted the review to studies in low- and middle-income countries for two reasons: (1) to complement the existing projections of the IFSA model, which includes 76 such countries, and (2) because, while much has been written about food insecurity during the COVID-19 pandemic in the United States and other high-income countries (Ahn and Norwood, 2020; Gundersen et al., 2020; Santeramo and Dominguez, 2021; Zeballos and Sinclair, 2020; Ziliak, 2020), relatively little is known about changes in food insecurity in low- and middle-income countries, despite widespread concern (Arndt et al., 2020; FAO, 2020; Laborde et al., 2020; Reardon et al., 2020). Second, the authors focus on studies that analyze survey data measuring food insecurity from both before and after the onset of the pandemic. The studies included are either recently published—such as in the *American Journal of Agricultural Economics, Food Policy*, and *World Development*—or currently posted in the National Bureau of Economic Research (NBER) or International Food Policy Research Institute (IFPRI) working paper series. The existing studies that meet these inclusion criteria are listed and summarized in table 1 (Abay et al., 2020; Adjognon et al., 2021; Aggarwall et al., 2020; Amare et al., 2020; Ceballos et al., 2020; Hirvonen et al., 2020; Kansiime et al., 2020; Mahmud and Riley, 2020). Other relevant studies that fall outside of these inclusion criteria are also discussed and help contextualize and explain the findings in this emerging literature. The authors have attempted to provide as detailed an understanding of the immediate and short-term changes in food insecurity amid the COVID-19 pandemic as possible at the time of writing this review.

Six Preliminary Lessons

There are six lessons from the emerging microeconomic literature on changes in food insecurity associated with the COVID-19 pandemic. Throughout this review of studies, the authors refer to specific parts of table 1, which provides the background and key findings of the eight studies that meet the inclusion criteria. For each study, table 1 summarizes information about: (a) The geographic area and timeframe, (b) the data source, (c) the outcome variable measuring food insecurity, (d) the empirical method used, and (e) the key finding of the research. There are also four questions assessing if certain conclusions can be drawn from the study. The questions ask—in addition to whether pandemic-related disruptions explain the results—whether results differ by urban versus rural location, economic status, or access to social support.

Table 1
Summary of studies on the COVID-19 pandemic and food insecurity

	Abay et al. (2020)	Adjognon et al. (2021)	Aggarwall et al. (2020)	Amare et al. (2020)	Ceballos et al. (2020)	Kansiime et al. (2020)	Mahmud and Riley (2020)	Hirvonen et al. (2020)
A: Published?	IFPRI Discus-sion Paper	Food Policy	NBER Working Paper	IFPRI Discussion Paper	World Develop-ment	World Develop-ment	World Develop-ment	American Journal of Agricultural Economics
B: Geographic area	Rural Ethiopia	Mali	Rural Liberia and rural Malawi	Nigeria	Haryana and Odisha, India	Kenya and Uganda	Rural Uganda	Addis Ababa, Ethiopia
C: Geographically representative?	No	Yes	No	Yes	No	No	No	Yes
D: Data source	Phone survey from ongoing project	LSMS and follow-up phone survey[i]	Phone survey from ongoing project	LSMS and follow-up phone survey	Phone survey from ongoing project	Online survey	Phone survey from ongoing project	Phone survey from ongoing project
E: Pre-survey date	March - August 2019	October 2018 - July 2019	January 2020	July 2018 – February 2019	April 2020	Pre-pandemic recall	March 2020	August – September 2019
F: Post-survey date	June 2020	May - June 2020	August 2020	April - May 2020	May 2020	April 2020	May 2020	May - August 2020
G: Short-term results?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H: Empirical method	Differ-ence-in-differ-ences[ii]	Pre-post compari-son and differ-ence-in-differ-ences	Panel data with fixed effects	Differ-ence-in-differ-ences	Pre-post comparison	Pre-post compar-ison	Pre-post compar-ison	Pre-post comparison and difference-in-differences

I: Outcome variable	Food gap[iii]	Food Insecurity Experience Scale (FIES)[iv]	Diet diversity, hunger scale, and food consumption	Partial Food Insecurity Experience Scale (FIES)	Food availability and access indicators	Food Insecurity Experience Scale (FIES)	Food expenditures per adult equivalent	Food consumption and diet diversity
J: Key finding	*Increase* in food insecurity	*Increase* in food insecurity	*No change* in food insecurity	*Increase* in food insecurity	*Mixed* results	*Increase* in food insecurity	*Decrease* in food expenditures	*No change* in food insecurity
K: Do pandemic-related disruptions explain the result?[v]	Yes	Yes	N/A, markets disrupted, but food insecurity remained stable	Yes	Yes	Yes	Yes	N/A, income and job loss, but food consumption remained stable
L: Do results differ in urban versus rural areas?	N/A	Yes	N/A	No	N/A	N/A	N/A	N/A
M: Do results differ by socio-economic status?	N/A	N/A	N/A	Yes, more adverse changes for poorer households	N/A	N/A	Yes, more adverse changes for wealthier households	N/A
N: Do results differ by access to social support?	Yes, Productive Safety Net Program (PSNP)	N/A	Yes, cash transfers	N/A	N/A	N/A	N/A	N/A

Notes: This list includes the authors' tabulation of studies that analyze an outcome variable measuring some dimension of food insecurity over time, with measures pre-dating the pandemic and measures collected after the onset of the pandemic. Many studies, which we discuss in this article, do not meet these criteria.

[i]The Living Standards Measurement Study (LSMS) is a series of household surveys conducted by the World Bank.

[ii] A difference-in-difference regression specification is like a pre-post comparison, but the pre-post difference is combined with a difference across two groups.

[iii]The "food gap" is the number of months the household was not able to satisfy its food needs (Berhane et al., 2014). [iv]The Food Insecurity Experience Scale (FIES) is a measurement tool used to estimate the extent of the multidimensional experience of food insecurity (Smith et al., 2017).

[v]Pandemic-related disruptions can include government-mandated lockdowns or individual behavior change due to fear of contracting COVID-19.

Source: USDA, Economic Research Service.

Food Insecurity Increases Amid the COVID-19 Pandemic

The key finding for each of the studies that meet our inclusion criteria is summarized in row J of table 1. Five studies find evidence of increasing food insecurity associated with the COVID-19 pandemic (Abay et al., 2020; Adjognon et al., 2020; Amare et al., 2020; Kansiime et al., 2020; Mahmud and Riley, 2020). Two studies find no

evidence of changes in food insecurity associated with the COVID-19 pandemic (Aggarwal et al., 2020; Hirvonen et al., 2020).

The existence or absence of food security is a multidimensional concept. Commonly, food security is considered to have been achieved when each of four interrelated components are met: Availability (a physical supply of food at a local or national level); access (affordable food in sufficient quantity); utilization (the meeting of all nutritional needs); and stability (uninterrupted ability to meet food needs) (Thome et al., 2019). The following discussion highlights the food security findings of these studies and notes the specific dimension(s) of food security measured by each study.

First, studying rural households in the highland regions of Ethiopia, Abay et al. (2020) used phone survey data from an ongoing project and found that, compared to survey responses in March-August 2019, the fraction of households reporting the inability to satisfy their food needs had increased by June 2020. In addition, Abay et al. (2020) found that these households reported an increase in the number of months in which the households had been unable to satisfy their food needs amid the COVID-19 pandemic. As this measure of food security lets the households define their food needs, the change in food insecurity cannot be attributed to a specific food security dimension. Abay et al. (2020) also showed that this adverse change in food insecurity is virtually offset by participation in Ethiopia's Productive Safety Net Program. This change is discussed in more detail in section 2.6.

Second, using nationally representative data from Mali, Adjognon et al. (2021) found that moderate food insecurity—as measured using the Food Insecurity Experience Scale (FIES)—increased between a pre-pandemic household survey and a phone survey implemented three months after the first recorded cases of COVID-19 in Mali.[2] The FIES is specifically designed to measure the food access dimension of food security (Ballard et al., 2013). In reviewing differences between changes observed in rural and urban areas, Adjognon et al. (2021) found that the measured change in food insecurity was almost entirely driven by changes within urban areas (with very little change observed in rural areas). Adjognon et al. (2021) further noted that these contrasting changes in food insecurity could be plausibly explained by the presence of deeper and more dramatic initial pandemic-related disruptions in Mali's urban areas than its rural areas.

[2] The Food Insecurity Experience Scale (FIES) is a survey tool developed by the Food and Agriculture Organization of the United Nations to measure food insecurity, based on the direct experiences of people relating to food security (Ballard et al., 2013; Smith et al., 2017; Cafiero et al., 2018). This experience-based measure of food insecurity offers greater precision than other measures that rely on country-level food supply estimates (Coates, 2013; Smith et al., 2017).

Third, in a related study, Amare et al. (2020) used nationally representative data from Nigeria and compared changes over time in food insecurity, measured with an abbreviated FIES scale, between geographic areas with high versus low pandemic-related disruptions.[3] Amare et al. (2020) found that households in areas with relatively high levels of pandemic-related disruptions were more likely to experience food insecurity. Amare et al. (2020) directly investigate the role of pandemic-related disruptions in influencing observed changes in food insecurity associated with the COVID-19 pandemic. The authors found that Nigerian states with higher recorded COVID-19 case counts, and stricter lockdowns, experienced larger adverse changes in food insecurity associated with the pandemic than other Nigerian states.

Fourth, using nonrepresentative data from an online survey in Kenya and Uganda, Kansiime et al. (2020) estimated that food insecurity—specifically the food access dimension as measured using the FIES—worsened in the first 2 months of the COVID-19 pandemic, compared to recall data from before the pandemic. Kansiime et al.'s (2020) results were, perhaps, more limited than other studies reviewed due to their use of recall data and nonrepresentative data from an online survey to record pre-pandemic information.

Finally, using data collected in May 2020, Mahmud and Riley (2020) followed up with in-person interviews in rural households in Uganda (in March 2020) to examine short-term changes in livelihood indicators associated with the pandemic. Mahmud and Riley found evidence of a substantial decline in nonfarm income, which households responded to by reducing their food expenditures. This expenditure-based measure relates to the access dimension of food security.

Two studies found no evidence of changes in food insecurity associated with the COVID-19 pandemic, despite finding evidence of dramatic disruptions to incomes and agricultural markets (Aggarwal et al., 2020; Hirvonen et al., 2020). Both studies used a combination of food security measures that cover the access and utilization dimensions of food security. First, following up on rural households that were participants in a cash transfer experiment in both Liberia and Malawi, Aggarwal et al. (2020) found no evidence of changes in food insecurity, as measured with a household dietary diversity score, a household hunger scale, and household food consumption associated with the COVID-19 pandemic.

[3] Specifically, Amare et al. (2020) used the following three indicators of food insecurity from the FIES: "Household members had to skip a meal because there was not enough money or other resources to get food;" "Household members ran out of food because there was not enough money or other resources to get food;" and "Household members have not eaten all day because of a lack of money or other resources." As in other studies that use FIES, these indicators focused on the food access dimension of food security.

However, Aggarwall et al. (2020) found that the receipt of cash transfers—an increasingly popular social protection program in low- and middle-income countries—improved the food security of rural households in both Liberia and Malawi. Second, using panel data of urban households in Addis Ababa, Ethiopia, Hirvonen et al. (2020) also found no evidence of changes in food insecurity—as measured with a household dietary diversity scale and household food consumption—associated with the COVID-19 pandemic. In contrast to other countries in the region, Ethiopia did not enforce as strict a pandemic-motivated lockdown. Ethiopia's relatively stable food security measure provides some evidence that relatively greater lockdown restrictions have a negative impact on food security.

Ceballos et al. (2020) found mixed results across the two Indian states, Haryana and Odisha. Studying households in these two Indian states, Ceballos et al. (2020) found that households in Haryana experienced large adverse changes in food insecurity—measured by asking respondents if food was sufficiently available and affordable—while households in Odisha experienced no measurable increases in food insecurity associated with the COVID-19 pandemic. These findings, which focus on the availability and access dimensions of food security, highlight how microeconomic analyses can help complement macroeconomic projections. As the results found by Ceballos et al. (2020) make clear, changes in food insecurity associated with the COVID-19 pandemic may show geographic variation within countries.

Pandemic-Related Disruptions in Food Markets and Earned Income

Rows J and K in table 1 show that all the studies that found evidence of increased food insecurity also found evidence that pandemic-related disruptions plausibly explain the measured increase. These disruptions were often caused by efforts of national or local governments to slow the spread of the COVID-19 virus. Josephson et al. (2021) used the nationally representative data from the Living Standard Measurement Study (LSMS), collected by the World Bank, to calculate statistics documenting public knowledge of COVID-19 containment policies and of personal behaviors that can reduce the risk of contracting the virus. Public knowledge of national COVID-19 virus containment policies is relatively high in Ethiopia, Nigeria, and Uganda but low in Malawi (Josephson et al., 2021).

Of all the studies summarized in table 1, Amare et al. (2020) performed the most in-depth analysis of how pandemic-related disruptions influence changes in food insecurity associated with the COVID-19 pandemic. The authors estimated changes over time and between states with high levels versus low levels of recorded COVID-19 cases. In an alternative set of analyses, the authors also estimated changes over time between states with high levels of lockdown measures versus states with low levels, which the authors validated with Google mobility data. In both sets of analyses, Amare et al. (2020) found that changes in food insecurity are more dramatic both in states with more COVID-19 cases and those with higher levels of lockdown measures.

In a similar study, Adjognon et al. (2021) found that pandemic-related disruptions—as measured by recorded COVID-19 case and death counts, Google mobility data, and self-reported behavior—were much more dramatic in Mali's urban areas than its rural areas. Consistent with the idea that the measured changes in food insecurity are associated with the intensity of pandemic-related disruptions, Adjognon et al. (2021) found that households in urban areas of Mali experienced larger changes (on average) in food insecurity than households in rural areas. The other studies finding evidence of increasing food insecurity associated with the COVID-19 pandemic also found evidence that pandemic-related disruptions may plausibly explain these changes (Abay et al., 2020; Ceballos et al., 2020; Kansiime et al., 2020; Mahmud and Riley, 2020).

The mixed results found by Ceballos et al. (2020) can also be plausibly explained by the presence of pandemic-related disruptions in food supply chains and markets. The authors found that households in Haryana, India experienced an increase in food insecurity while households in Odisha, India did not. This difference in food insecurity changes, before and during the COVID-19 pandemic, coincided with a larger observed shock to the food supply in Haryana than in Odisha.

Based on these findings, strictly enforced lockdown measures may influence food insecurity via disruptions to the supply of food and their associated price effects. India's national lockdown, beginning on March 24, 2020, and extending for 21 days, was one of the most strictly enforced national lockdowns in the world. Narayanan and Saha (2020) examined price data of 22 commodities from more than 100 market centers in India and document rising prices since the country's lockdown, reversing a declining pre-pandemic price trend. Narayanan and Saha (2020) also surveyed 50 food retailers who reported operational challenges associated with sourcing inventory. In addition, Lowe et al. (2020) found that food arrivals in India's food wholesale markets fell and food wholesale prices increased in the three weeks following India's national lockdown. Six weeks after India's lockdown, however, food arrivals and prices had fully recovered and reverted to pre-pandemic levels. The evidence documented by Narayanan and Saha (2020) and Lowe et al. (2020) highlight how a strict lockdown like the one implemented by India can lead to deep short-term changes in food supply and food prices. However, Lowe et al. (2020) showed that, even in the case of India's strict lockdown, the food supply chain was relatively resilient after an initial disruption.

Some Evidence of Resiliency

Even in studies that did not find any change in food insecurity associated with the COVID-19 pandemic (Aggarwall et al., 2020; Hirvonen et al., 2020), there is evidence of substantial pandemic-related disruptions (table 1, rows J and K). This implies that some subpopulations have been relatively resistant, at least in terms of food security, to the adverse shocks to earned income and prices associated with the COVID-19 pandemic.

In particular—although Aggarwall et al. (2020) found no evidence of changes in food insecurity associated with the COVID-19 pandemic among rural households from Liberia and Malawi, they did find evidence that the

pandemic severely disrupted market activity, resulting in relatively large declines in income among market vendors. Similarly, although Hirvonen et al. (2020) found no evidence of changes in food insecurity associated with the COVID-19 pandemic among urban households in Addis Ababa, Ethiopia, they did find evidence of dramatic reductions in income and job losses associated with the pandemic.

In contrast to many other East African countries, Ethiopia never implemented a strict lockdown. Therefore, despite job losses and income reductions, the food supply chain in Addis Ababa remained resilient throughout the first 3 months of the COVID-19 pandemic. Taken together, these results highlight a caveat to existing macroeconomic projections for estimating an increase in the number of food insecure people, based on expected changes to income and prices; specifically, the relationship between earned income and food security is not the same for all people within a given country. Among some subpopulations in some countries, despite dramatic reductions in earned income associated with the COVID-19 pandemic, food security has remained resilient. There are several factors that influence the relationship between income and food security that are not easily incorporated into macroeconomic projections, which highlights the value of complementing existing macroeconomic projections with microeconomic analysis.

Differences Between Rural and Urban Areas

There is conflicting evidence on potential food insecurity differences between urban and rural areas (table 1, row L). On the one hand, Adjognon et al. (2021) used nationally representative data from Mali and found that changes in food insecurity associated with the COVID-19 pandemic are much larger in urban than rural areas. On the other hand, Amare et al. (2020) used nationally representative data from Nigeria and did not find any difference between urban and rural areas in food insecurity associated with the COVID-19 pandemic.

Potential differences in changes in food insecurity associated with the COVID-19 pandemic (between urban and rural areas) may be related to differences in how urban and rural households experience market disruptions. For instance, Narayanan and Saha (2020), Lowe et al. (2020), and Wiseman (2020) documented changes in food supply and increased food prices associated with market disruptions from the COVID-19 pandemic. These changes may have differing implications for food insecurity, depending on whether households are net-buyers or net-sellers of food.[4] For instance, Josephson et al.'s (2021) analysis of data from Ethiopia, Malawi, Nigeria, and Uganda shows only weak evidence of more reductions of income in urban areas than in rural areas. However,

[4]In agricultural economics, a net-buyer of food is a household that buys more food than it produces or sells. A net-seller of food is a household that produces or sells more food than it buys.

coupling this finding with increased prices facing net-buyers of food highlights the potential for more dramatic changes in food insecurity associated with the COVID-19 pandemic in urban areas than in rural areas.

Adjognon et al. (2021) focused on Mali and documented three observations suggesting that disruptions driven by the pandemic may have been more intense in urban areas—particularly Mali's capital city of Bamako—compared to rural areas. First, recorded COVID-19 case and death counts are dramatically skewed toward Bamako. Although these statistics almost certainly underestimate the true incidence of COVID-19 infections and deaths in Mali, COVID-19 case and death counts are indicators that influence containment policy efforts and motivate concern among individuals of contracting the virus within Bamako. Second, Google mobility data showed that individuals in Bamako reduced their time spent at grocery stores, parks, retail stores, transportation stations and workplaces more than individuals in Mali as a whole. Finally, urban respondents to phone surveys were more likely to report making pandemic-related health choices—such as washing hands more than usual, avoiding gatherings with physical contact, and avoiding gatherings with more than 10 people—than rural respondents. Taken together, these details may partially explain why Mali's urban areas may have had larger changes in food insecurity associated with the COVID-19 pandemic than Mali's rural areas. Mali is a country with already high levels of food insecurity, particularly in rural areas. As such, in the relative short term, the COVID-19 pandemic may have reduced the rural-urban food insecurity gap by being disproportionately more disruptive in urban areas than rural areas.

Additional evidence of differential changes between urban and rural areas in food insecurity associated with the COVID-19 pandemic comes from contrasting the results of Hirvonen et al. (2020) and Abay et al. (2020), who both studied households in Ethiopia. Although Hirvonen et al. (2020) found no change in food consumption and diet diversity among urban households in Addis Ababa, Ethiopia, Abay et al. (2020) found a decrease in the food gap—an indicator of food shortfall at the household level—among rural households in Ethiopia.

Comparing these two results suggests that declines in food insecurity associated with the COVID-19 pandemic may be larger in Ethiopia's rural areas compared to Ethiopia's capital city of Addis Ababa. This conclusion contrasts with the findings of Adjognon et al. (2020) from Mali and could be driven by several factors. First, the food supply chain in Addis Ababa, Ethiopia may be more resilient than the food supply chain in Bamako, Mali, and this supply issue may indicate potential differences across geographic areas. Second, the population studied by Abay et al. (2020), covering particularly drought-prone rural regions of Ethiopia, may represent a particularly vulnerable population that is more prone to large, adverse changes in food insecurity. Finally, these differences could be driven by variations in the outcome variables measuring food insecurity in each study: food consumption and diet diversity by Hirvonen et al. (2020), food gaps by Abay et al. (2020), and food access using FIES by Adjognon et al. (2020).

Narratives about differential changes in food insecurity associated with the COVID-19 pandemic must confront existing nuance about the role of geographic location-specific features that influence food insecurity. Differential changes in food insecurity between urban and rural areas associated with the COVID-19 pandemic remain difficult to predict across countries. In addition to the research already discussed, Aggarwal et al. (2020) found no change in diet diversity—using a household hunger scale—or food consumption among households in the rural areas of Liberia and Malawi. Similarly, Hirvonen et al. (2020) found no change in food consumption and diet diversity among urban households in Addis Ababa, Ethiopia. Abay et al. (2020) found an increase in food insecurity, measured by the food gap, among a selected sample of rural households in Ethiopia. Additionally, Mahmud and Riley (2020) found evidence of a decrease in food expenditures among rural households in Uganda. The mixed evidence on changes in food insecurity between urban and rural areas associated with the COVID-19 pandemic may also relate to the changing dynamics of the spread of the COVID-19 virus. For example, in the United States, the consequences of the pandemic seemed to first materialize in major metropolitan areas, perhaps due to population density and propensity for travel. Over time, the effects tended to spread into rural areas, which by some measures, ended up being even more deeply disruptive (Dobis and McGranaham, 2021).

Differences by Socioeconomic Status

Amare et al. (2020) and Mahmud and Riley (2020) found evidence of differential changes in food insecurity associated with the COVID-19 pandemic by socioeconomic status (table 1, row M). These studies, however, do not lead to a clear narrative about how changes in food insecurity (associated with the pandemic) may vary across socioeconomic groups.

As the COVID-19 virus began to spread around the world, many researchers and analysts predicted the consequences of the pandemic may depend critically on household characteristics, such as existing vulnerabilities to income shocks and food insecurity (Amjath-Babu et al., 2020; Bene, 2020; Devereux et al., 2020). Conceptually, however, it is not clear how different levels of socioeconomic status may influence changes in food insecurity associated with the COVID-19 pandemic. On one hand, it may seem plausible that poorer households are more vulnerable, due to limited access to financial safety nets and less ability to guard themselves from pandemic-induced disruptions. On the other hand, wealthier households may be more integrated into the national or global economic system and more directly affected by pandemic-related disruptions.

Three studies highlight that—at least in the short-term—there is mixed evidence on whether the poorest households experience the largest adverse changes in food insecurity associated with the COVID-19 pandemic (Aggarwall et al., 2020; Mahmud and Riley, 2020; Amare et al. 2020). As noted earlier, Aggarwal et al. (2020) found no evidence of worsening food insecurity associated with the pandemic in either rural Liberia or rural Malawi. In fact, the authors found a modest decrease in food insecurity measures in rural Malawi that may be due to the fortunate timing of the harvest season coinciding with the COVID-19 pandemic. Therefore, the households

observed by Aggarwal et al. seem to be more insulated from any market disruptions, and as a result, did not experience an increase in food insecurity.

By contrast, market vendors in Malawi saw relatively large declines in their income in the first few months of the COVID-19 pandemic (Aggarwal et al., 2020). Second, analysis by Mahmud and Riley (2020) found that households that are more reliant on nonfarm income (such as enterprise or salaried income) experienced larger declines in income and were more likely to report skipping a meal. This finding emphasizes that the changes in food insecurity associated with the COVID-19 pandemic are not necessarily largest for the poorest households. In the context of rural Uganda, Mahmud and Riley (2020) noted that the relatively wealthy households experienced the largest increases in food insecurity associated with the COVID-19 pandemic. Finally, and to the contrary, Amare et al. (2020) showed that pandemic-related shutdown policies implemented in Nigeria were associated with larger changes in food insecurity among those who lived in more remote regions, in areas with relatively high levels of conflict, and poorer households.

A clear assessment of how the effect of the COVID-19 pandemic differs across individuals and households in different socioeconomic groups is lacking in the emerging literature. Future research to fill this gap can attempt to disentangle competing factors mediating the role of poverty between the COVID-19 pandemic and food insecurity. On one hand, due to a less-robust financial safety net, households living in poverty will typically be more vulnerable to food insecurity in the aftermath of negative shocks to income and employment driven by the pandemic. On the other hand, as shown by Bargain and Aminjonov (2020), individuals living in poverty in low- and middle-income countries may be less likely to undergo reduced mobility for work-related activities. These individuals may also be less connected economically to negative global income shocks and also less likely to experience income declines.

The Role of Social Protection Programs

Abay et al. (2020) and Aggarwall et al. (2020) estimated the role of a specific social protection program in mitigating any diverse change in food insecurity associated with the COVID-19 pandemic. Both studies found evidence suggesting these social protection programs—Ethiopia's Productive Safety Net Program (Abay et al., 2020) and cash transfers in rural Liberia and Malawi (Aggarwall et al., 2020)—help mitigate the increase in food insecurity observed among these subpopulations (table 1, row N).

Studying rural households in Ethiopia, Abay et al. (2020) provided evidence supporting the protective role of social safety net programs amidst the COVID-19 pandemic. The authors showed that participation in Ethiopia's Productive Safety Net Program, a rural food security program based on cash and in-kind food payments, offsets most of the adverse change in food insecurity associated with the pandemic. Similarly, studying rural households in Liberia and Malawi, Aggarwall et al. (2020) found households who received cash transfers experienced

improved food security—measured with a dietary diversity scale and with a food consumption score—amid the pandemic. Cash transfer programs, however, do not appear to be a panacea.

Gentilini et al. (2020) provided a global review of social protection measures implemented thus far and note that although informal sector workers tended to be a main target of cash transfer programs implemented in response to the COVID-19 pandemic, not all of these workers received this financial assistance. Furthermore, while countries' pandemic-related cash transfer programs tended to be large relative to pre-pandemic levels, the programs also tended to be of relatively short duration. Providing effective social and economic support for households that experience the deepest and most dramatic consequences of the COVID-19 pandemic will need to overcome a host of design, targeting, and implementation challenges (Gerard et al., 2020).

In the face of adverse economic shocks and the absence of effective policy responses, households typically seek to limit the consequences with a suite of coping strategies. These strategies include reliance on savings or borrowing, informal sector work, selling of assets, and migration. The 2008 financial crisis highlighted some of the ways that households and individuals use existing formal mechanisms (e.g., credit and insurance from financial institutions) and informal mechanisms (e.g., social insurance from family, friends, and community-based organizations) to cope with adverse shocks (Heltberg et al., 2011). Although the pre-existence of these coping mechanisms may enable resiliency among some subpopulations, the health and economic shocks associated with the COVID-19 pandemic are far reaching.

Unlike the 2008 financial crisis and similar widespread macroeconomic shocks, pandemic-related income reductions may not allow for some of these common coping strategies. For instance, government policies to curtail the spread of COVID-19 through mobility restrictions (e.g., lockdowns), along with personal best practices to reduce exposure risk (e.g., social distancing) may make informal sector work and migration infeasible (Gerard et al., 2020). These strategies could be particularly consequential in low- and middle-income countries. In these contexts, the informal sector as a major source of employment or migration to urban settings to seek informal employment is common in response to economic shocks (Fiess et al., 2010; Loayza and Rigolini, 2011; Gunther and Launov, 2012). In Kenya and Uganda, for example, more than three-quarters of urban and rural employment is in the informal sector (Kansiime et al., 2020).

In the case of Uganda, which implemented strict lockdown measures, Mahmud and Riley (2020) found that rural households tended to respond to the adverse income shock of the pandemic in three ways. First, households reduced food consumption. Mahmud and Riley found that food expenditures per adult fell by around 40 percent and the percentage of households that reported missing at least one meal a month rose from 30 to 52 percent. Second, households used up available savings and borrowed more, but avoided liquidating fixed assets and selling livestock. Third, households focused their available home labor supply on their own crop and livestock activities.

Mahmud and Riley argued that, taken together, their findings suggest these households are reducing consumption and are relying on savings and borrowing to prevent irreversible economic consequences from the COVID-19 pandemic. Selling off productive assets could more fully alleviate food insecurity concerns in the short term, but at the expense of future asset accumulation and a weakened ability to respond to future shocks. A greater reliance on on-farm activities further suggests an increase in subsistence-based agriculture, as well as a reduction in off-farm opportunities. These households face a dilemma. Reducing short-term food consumption creates health consequences that worsen the longer the strategy persists. Nevertheless, selling limited assets to allow for greater food consumption in the short-term may leave households even more vulnerable in the long-term.

Points of Caution

There are four points of caution for extrapolating insights from the microeconomic studies concerning changes in food insecurity associated with the COVID-19 pandemic. These points identify gaps in the emerging literature: (1) the geographic scope of each study, (2) the study timeframe, (3) the empirical methods used, and (4) the key outcome variable measuring food insecurity. Table 1 provides information on these variables for each study.

Limited Geographic Scope

The geographical scope of the data used by each of the studies that met our inclusion criteria is shared in row C of table 1. Given the limited availability of detailed microeconomic panel data collected amid a global pandemic, the geographic scope of the emerging microeconomic literature is extremely limited.[5] Only one of the studies examines a geographic area outside of Sub-Saharan Africa (Ceballos et al., 2020). Among the remaining studies, all of which focus on a specific country within Sub-Saharan African, only two—Adjognon et al. (2020) in Mali and Amare et al. (2020) in Nigeria—use a nationally representative data source. The rest of the studies focus on subpopulations in specific subregions of countries, such as rural areas of Liberia and Malawi (Aggarwal et al., 2020), rural Uganda (Mahmud and Riley, 2020), rural Ethiopia (Abay et al., 2020), and Addis Ababa, Ethiopia (Hirvonen et al., 2020), or report findings using nonrepresentative data (Kansiime et al., 2020).

The limited geographic scope of available microeconomic data that collects panel data on measures of food insecurity, both before and after the onset of the COVID-19 pandemic, limits our knowledge of how food

[5] A limited geographic scope is not unique to the emerging microeconomic literature on changes in food insecurity associated with the COVID-19 pandemic. Indeed, existing macroeconomic projections fill in missing data by interpolating and predicting data based on the available data and historic trends (Jerven, 2013). Additionally, more than half of the papers presented at the 2017 Northeast Universities Development Conference used microeconomic data from just four countries (Evans, 2017), an observation that persists at other leading academic conferences and in academic journals that publish development economics research.

insecurity changed in association with the pandemic. This limited geographic scope is problematic because important differences in food insecurity exist across countries. Although more than 60 percent of the population of Eritrea are estimated to be food insecure (based on the macroeconomic projections from the IFSA model (Baquedano et al., 2021b)), the more nuanced, local-level patterns of changes in food insecurity associated with the COVID-19 pandemic in this country are not known. Similarly, although updates to the macroeconomic income and price data did not increase the projected level of food insecurity in both the Republic of the Congo and Senegal (based on the macroeconomic projections from the IFSA model (Baquedano et al., 2021b)), the specific reasons that food security remain resilient within these countries—at least on average—is not known.

Only Short-Term Evidence to Date

The emerging literature is only able to investigate immediate and short-term changes in food insecurity associated with the COVID-19 pandemic. Beyond long-term macroeconomic projections, very little is known about any changes in food insecurity in the longer term. In fact, it is likely that the changes in food insecurity discussed in the studies reviewed in this article will not persist in the medium and long term.

Along with changes in the spread and intensity of the pandemic, policy responses and household coping strategies will also evolve over time. For example, Adjognon et al. (2021) found that the increases in food insecurity are larger in urban areas compared to rural areas in Mali. This increase likely represents the more dramatic short-term disruption of the pandemic in Mali's urban areas, compared to rural areas. As already observed in the United States, as the pandemic progresses, some pandemic-related disruptions may become more dramatic in rural areas than urban areas (Dobis and McGranaham, 2021). This observation suggests that short-term effects are not necessarily indicative of the medium- or long-term effects.

At present, very little is known about the specific pattern that pandemic-related consequences will take in the medium or long term. For example, some evidence using antibody COVID-19 tests suggests that in countries such as Kenya, Malawi, and Mozambique, large shares of the population have already been exposed to the COVID-19 virus (Nordling, 2020). However, data limitations in these studies weaken the conclusion that the worst of any pandemic-related consequences are in the past anywhere in the world. As the short-term changes in food insecurity associated with the pandemic carry into the medium and even the long term, future research will need to similarly shift to longer-term outcomes.

Methodological Challenges

The empirical method used by each of the studies examined here is reported in row H of table 1. These methods range from simple pre-post comparisons, using panel data, to more sophisticated difference-in-differences

regression specifications.[6] Due to the nature of the COVID-19 pandemic, which influenced the entire world to some extent, credible identification of the impact of the pandemic on food insecurity—among its many other effects—is particularly challenging. There is no obvious comparison in the data to any group of people that has not experienced some form of disruption from the COVID-19 pandemic, and the disruptions are still ongoing. This is a limitation of all studies in this emerging literature (and of studies on the economic consequences of the COVID-19 pandemic) (Goodman-Bacon and Marcus, 2020). Without reliable data on COVID-19 infection rates, it is difficult to understand the overall extent of the spread of the virus, the timing of local surges in COVID-19 cases, and which geographical areas and communities have been most deeply affected by the pandemic. This lack of information limits anyone's ability to disentangle the effect of the pandemic from, for example, the effects of seasonality or within-country variations such as rainfall, temperature, or conflict. Despite these limitations, analysis of changes in food insecurity associated with the COVID-19 pandemic provide useful insights that policy makers around the world can use in the short-, medium, and longer-term aftermath of the pandemic.

Different Measures of Food Insecurity Across Studies

The primary outcome variable (or variables) used to measure food insecurity in each of the studies that meet our inclusion criteria is given in row I of table 1. Three studies use the Food Insecurity Experience Scale (FIES), which asks a series of questions to elicit a household's experience with food insecurity (Adjognon et al., 2021; Amare et al., 2020; Kansiime et al., 2020). The other studies use a variety of indicators as a proxy for food insecurity, such as the amount of dietary diversity and food consumption (Aggarwal et al., 2020; Hirvonen et al., 2020), food expenditures (Mahmud and Riley, 2020), the food gap (Abay et al., 2020), and food access (Ceballos et al., 2020). The variety of survey tools used to measure food insecurity make clear comparisons between studies challenging.

Food security is a complex concept that often looks different in various geographical parts of the world. The FAO uses a broad definition of food security that highlights the multidimensional nature of the concept. According to the FAO, food security exists when, "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy lifestyle" (FAO, 1996; FAO, 2009). Although this definition of food security is widely accepted, challenges persist in consistently measuring food security across time and space (Carletto et al., 2013). Despite this challenge, it remains possible to learn lessons from the emerging literature if researchers take care to avoid

[6] A difference-in-difference regression specification is like a pre-post comparison, but the pre-post difference is combined with a difference across two groups.

unfounded comparisons across studies of the magnitude of changes in food insecurity associated with the pandemic. The direction of such changes is more reasonably comparable across the studies than the magnitudes of the changes.

Concluding Thoughts

This report reviews the emerging microeconomic literature on changes in food insecurity associated with the COVID-19 pandemic in low- and middle-income countries. Our review focuses on eight studies that complement the macroeconomic projections in the USDA, ERS International Food Security Assessment with microeconomic survey data collected in low- or middle-income countries during the pandemic, with at least one wave of survey data collected prior to the onset of the pandemic.

First, our review leads to 10 key takeaways, including 6 preliminary lessons and 4 points of caution, each of which is presented in table 1. The six lessons are as follows:

1. Most, but not all, studies found evidence of increasing food insecurity amid the COVID-19 pandemic (row J in table 1).
2. Increased food insecurity appears to be associated with pandemic-related disruptions in food markets and earned income (row K).
3. Despite evidence of pandemic-related disruptions across all studies (row K), there is evidence of resilience, at least in terms of food security, among some subpopulations (row J).
4. Studies that compare changes in food insecurity over time between rural and urban areas find conflicting results (row L).
5. Studies that compare changes in food insecurity over time between socioeconomic groups find conflicting results (row M).
6. Studies that examine the role of social protection programs find these programs help mitigate any observed adverse change in food insecurity associated with the COVID-19 pandemic (row N).

Second, the four points of caution are as follows:

1. Existing microeconomic data are limited in geographic scope. Two studies use nationally representative data and one study uses data representative of a large urban area. The remaining studies use data from specific subpopulations within a geographical area (row C).
2. All of the studies that meet our inclusion criteria examine only immediate or short-term changes in food insecurity associated with the COVID-19 pandemic (rows E, F, and G).
3. Most studies use cutting-edge empirical methods that remain limited, as the widespread consequences of the COVID-19 pandemic make it difficult to find a valid comparison group within the available data (row H).

4. The outcome variable measuring food insecurity differs among studies, complicating direct comparisons across studies (row I).

It is not the intention of this report to provide a final analysis on the relationship between the COVID-19 pandemic and food insecurity. As discussed throughout this review, although this emerging literature makes several contributions, many questions remain. Filling the gaps in the existing literature will require considerable effort and commitment from researchers across academic disciplines, but doing so is necessary in order to understand the potential consequences of the COVID-19 pandemic that contribute to food insecurity and hunger

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