# Growth is not enough:

## Solving the Global Hunger Crisis Requires Investments in Gender Equality

## Executive Summary

The escalating global hunger crisis, exacerbated by ongoing conflicts, economic shocks, and the climate crisis, demands comprehensive and effective solutions. Since limited research has explored the interplay between income inequality, gender inequality, and economic growth in relation to a country's food insecurity prevalence, this study seeks to bridge this knowledge gap. Using country-level data from 113 countries in both pre- and post-pandemic periods and employing the Seemingly Unrelated Regression (SUR) model, this study provides empirical evidence, highlighting the significant roles of gender inequality and income inequality in addressing food insecurity. The study found that both gender inequality and income inequality correlate positively with food insecurity. Intriguingly, our results indicate that economic growth can exacerbate food insecurity, particularly in the post-pandemic context. This suggests that mere economic growth is insufficient to combat food insecurity if gender and economic inequalities persist. Therefore, responses from countries and agricultural interventions to the global hunger crisis should shift focus from macro- and micro-economic instruments that are blind to gender inequality, towards adopting a gender-transformative approach.

*Keywords:* food insecurity, gender inequality, economic inequality, economic growth

*Authors:* Florence Santos, Yingxin Zhang, Dr. Cesar Escalante, and Emily Janoch

# Introduction

In 2022, more than 735 million people in the world were hungry (FAO, 2023). This translates to 1 in 11 people worldwide and an increase of 121 million more people hungry than before the COVID-19 crisis (FAO, 2023). Although some progress has been made in Asia and Latin America, hunger continued to rise throughout Africa, Western Asia, and the Caribbean regions in 2022 (FAO, 2023). Conflict and economic shocks are the two main drivers of food insecurity. The ongoing war in Ukraine resulted in reduced output and trade of staple food commodities, which in turn led to increased prices for crops, oil, and fertilizers, making food access more difficult for vulnerable groups and exacerbating malnutrition (Arndt et al., 2022). Economic shocks, stemming from both the repercussions of the war in Ukraine and the lockdowns and job losses during the COVID-19 pandemic, eroded the resilience of poor countries and further aggravated the food insecurity situation (FSIN, 2023). Added to the ongoing climate crisis which is widely believed to reduce crop yield and livestock productivity, many people are not only struggling to put food on the table now but are also unsure what the future of food security looks like for them (World Bank, 2022).

In response to the increasing global hunger crisis, the World Bank Group is allocating up to $30 billion to support projects that strengthen agricultural development worldwide (World Bank, 2023). The Global Agriculture and Food Security Program (GAFSP) is also providing funds to smallholder farmers and agribusinesses in low- and middle-income countries (LMICs) to build a more resilient food system (GAFSP, 2023). G7 countries pledged to mobilize additional billions of dollars to fight the global food crisis. Additionally, humanitarian organizations are mobilizing and responding to provide life-saving relief. CARE has launched a $250 million comprehensive response to the crisis. This initiative aims to provide immediate food supplies and cash transfers to the most vulnerable, build resilience within food systems, and advocate for government actions to prevent recurring crises (CARE, 2023). Meanwhile, following the war in Ukraine, a growing number of countries put food trade restrictions in place in an effort to increase domestic supply and reduce prices, partially further driving the ongoing food crisis (World Bank, 2023).

A more comprehensive and long-lasting solution is needed. Past and current responses to the food crisis have not been enough to avert or effectively address the current crisis. Because of gender inequality, the global hunger crisis disproportionately affects women and girls as well as the rural populations. An estimated 84.2 million more women and girls are food insecure than men and boys in 2022 (Janoch, 2023). While the global gender food gap average narrowed in 2022, the gap continues to grow in many regions. In addition, 33.3% of rural populations as opposed to 26% of urban populations experienced moderate or severe food insecurity in 2022 (FAO, 2023). The 2008 global food crisis has shown that global policies at that time focused on macro-level instruments such as production support and import tariffs, and minimal food safety net programs, many of which do not target women or mention any gender dimension (Quisumbing et al., 2011). There is a high risk of perpetuating and worsening existing gender inequalities as the world responds to this crisis. Well-meaning crisis response that is blind to its gender impacts could drive more women and girls to further hunger and further increase the gender gap (Bryan & Ringler, 2023).

Aside from the disproportionate impact of the crisis on women and girls, and the high risk of widening gender inequality as a response to the global crisis, there is also a substantial body of research showing that advancing gender equality is an important and effective tool to enhance food security. Selva & Janoch (2022) found a strong correlation between gender equality and food security across 109 countries, using compiled data from the Gender Inequality Index (GII) of 2019 (UNDP) and the Food Security Index of 2021 (The Economist). Numerous studies have also found a relationship between women's empowerment and children's nutrition. For example, Smith & Haddad (2000) identified a strong correlation between women's education and children's nutritional status, estimating that women's education accounted for 43% of the total reduction in children's malnutrition from 1970 to 1995. Similarly, a positive correlation between women's status and children's nutrition has also been found by using household-level survey data from 36 countries in South Asia (SA), Sub-Saharan Africa (SSA), and Latin America and the Caribbean (LAC) between 1990 and 1998 (Smith et al., 2003).

Women play a central role in the agrifood system as producers. However, due to women's high unpaid domestic and care work burden, overrepresentation in less-lucrative value chains, and limited access to assets (especially land), their agricultural productivity is around 24 percent less than that of men (FAO, 2023b). Closing the gender gap in farm productivity and the wage gap in agrifood-system employment would increase global gross domestic product by 1 percentage point (or nearly USD 1 trillion) and reduce global food insecurity by about 2 percentage points, equating to 45 million fewer food-insecure people in the world (FAO, 2023b).

This study examines how gender inequality and economic inequality play a role in the global hunger crisis against the backdrop of socio-political, economic, and climate shocks. Very little empirical research focuses on national-level food security and its linkages with gender inequality, economic inequality, and major macroeconomic factors like agricultural production and economic growth. This research attempts to explore these linkages and how the dynamics are changing during the pre- and post-pandemic periods.

# Food Insecurity, Economic Growth and (Gender) Inequality

## Economic Growth and Economic Inequality

Despite economic growth in the emerging world in recent decades and a decrease in global inequality between countries, inequalities have significantly increased within countries (Chancel et al., 2022). The global income shares of the bottom 50% remains historically low, with the richest 10% of the global population now capturing 52% of global income, while the poorest half of the population earns just 8.5% of it (Chancel et al., 2022).

Mainstream economics suggests that sustainable economic growth is essential for ensuring global food security. However, there is surprisingly limited empirical evidence on the effects of economic growth on food insecurity (e.g., Warr, 2014; Świetlik, 2018). To our knowledge, there is only one available study that extends the analysis to explore these effects in the context of economic inequality (Holleman & Conti, 2020). Holleman & Conti (2020) found that while increases in GDP per capita generally correlate with declines in individual food insecurity, income inequality undermines these positive effects.

Increasingly, there is recognition that while income growth is necessary for food security, more equitable growth is likely to result in greater improvements in global food security. Timmer (2000) theorized the impact of a growth and redistribution strategy on global food security: by doubling per capita income and the incomes of the poorest 20% of the population, both poverty and famine could be eradicated, even in the face of price inflation. In line with this perspective, the 2016 OECD publication *Better Policies for Sustainable Development* underscores the prevailing macroeconomic focus on economic growth, while increasingly acknowledging the role of inequality in the context of the Sustainable Development Goals (SDGs):

"The application of a policy coherence lens to global food security shows that the main challenge of ensuring food security is to raise the incomes of the poor, and that agricultural development and rural diversification are needed to foster economic growth and job opportunities. Increased productivity to close the yield gap including from the private sector and farmers themselves. Trade will also have an increasingly important role to play in ensuring global food security."

Numerous studies have empirically shown how income inequality shapes the way economic growth translates to poverty reduction, which is crucial for advancing food accessibility (Kalwij & Verschoor, 2007; Agyemang, 2015; Fosu, 2017). Kalwij & Verschoor (2007) discovered that while variations in poverty reduction across regions are primarily attributed to differences in income growth rates, changes in the Gini coefficient also play a significant role, particularly in Eastern Europe and Central Asia. Agyemang (2015) further observed that economic growth led to an increase in income inequality in the LAC and OECD regions, resulting in limited poverty reduction. Fosu (2017) determined that countries with low inequality and high income were better able to convert economic growth into poverty reduction.

In the post-pandemic period, the global state of the economy, the state of hunger, and inequality have worsened and fundamentally shifted, warranting the need to (re)investigate these linkages and their applicability at this time in solving the current hunger crisis and preventing future ones.

## Gender Inequality and Food Insecurity

The COVID-19 pandemic widened the food insecurity gap between men and women, from 1.7% prior to the pandemic, reaching as high as 4.3% in 2021, to 2.4% in 2022 (FAO, 2023). The links among gender inequality, food insecurity, malnutrition, and the pathways in which this plays out at the household level are well-studied. There is overwhelming evidence that structural gender inequalities from low decision-making power within the household (WFP India, 2022; Uraguchi, 2010), to deeply uneven access, control, and ownership of productive assets (such as land, credit, inputs, and technology) between men and women (ADB, 2013; Peterman et al., 2014), unequal burden in unpaid care work (FAO, 2023b), and many other inequalities contribute to the gender food gap and overall global food insecurity.

In particular, extensive research indicates that yields for women and men would be similar if both had equal access to resources. In southern Ethiopia in 2018, male-headed households had 44.3 percent higher maize productivity than female-headed households (Gebre et al., 2021). However, if female-headed households were afforded the same return on their resources as male-headed households, their productivity would increase by 42.3 percentage points (Gebre et al., 2021). Horrell & Krishnan (2007) noted that female-headed households in Zimbabwe faced various forms of poverty that hindered their ability to improve agricultural productivity. Still, once inputs, including labor, assets, etc., were accounted for, female-headed households had higher productivity on maize and groundnuts compared to male-headed households. Schling & Pazos (2021) found evidence in Peru that a female farmer owning at least one plot of land increased her household's likelihood of being food secure by 20 percentage points. Therefore, if women were granted equal access to productive resources as men, agricultural productivity could increase, therefore, contributing to enhanced food and nutrition security. FAO (2023) also conservatively estimates that closing the gender gap in farm productivity and the wage gap in agrifood system employment would increase the world's GDP by 1 percent, equivalent to USD 1 trillion. This translates to reducing food-insecure people by 45 million. This suggests that gender inequality is highly linked to food insecurity.

However, this review found no recent macroeconomic literature that links economic growth, income inequality, and gender inequality with the prevalence of a country's food insecurity; and the global responses to the current hunger crisis at both macro and micro levels seem to mirror the disconnect. For instance, the prevailing response of governments around the world to the ongoing global hunger crisis is still highly skewed toward production, export restrictions, import tariffs, and growing GDP as an indicator of spurring economic growth. According to *Rising Global Food Insecurity: Assessing Policy Responses*, a report published by FAO et al. (2023), from 2013 to 2018, global support for food and agriculture averaged almost USD 630 billion annually, with 70% directed towards production. Among the interventions and policies to advance food security, import tariffs are the most commonly used border measure to protect domestic producers from competition, particularly for staple foods like rice, wheat, and maize. In terms of micro-level global responses, Bizikova et al. (2020) identified three types of agricultural interventions from 66 publications: enhancing value chains, applying input subsidies (making inputs such as seeds and fertilizers accessible to farmers), and providing extension services (e.g., training and capacity building). While these interventions have led to improved food security outcomes, the vast majority of them focus solely on food production, overlooking the role of inequality in the agri-food system (Bizikova et al., 2020).

# Methodology

## Data and Variables

We relied on publicly available datasets to explore the relationships between global food insecurity, gender inequality, broader economic inequality, and macroeconomic factors, including some agricultural economic indicators, under the context of global disruptions in the global food systems, pre and during the COVID-19 pandemic. We have included a list of variables, their descriptions, and descriptive statistics in Table 1.

### Key Variables:

*Food insecurity.* This study uses SDG indicator 2.1.2 or the prevalence of moderate or severe food insecurity to measure the level of food insecurity by country. This indicator, developed by FAO, provides internationally comparable estimates of the percentage of people in the population who have experienced food insecurity at moderate or severe levels under the food insecurity experience scale (FIES) developed by FAO (FAO, 2022). Since the indicator is calculated at the country level as a three-year average, this study employs the 2016 to 2018 and 2020 to 2022 averages to capture food insecurity conditions before and during the COVID-19 Pandemic, respectively.

*Inequalities.* We use the Gender Inequality Index (GII) developed by UNDP in 2017 and 2021 as an indicator of country gender inequality before and during COVID respectively. This index reflects gender-based disadvantages in reproductive health (measured by maternal mortality ratio and adolescent birth rate), empowerment (measured by female and male population with at least secondary education and female and male shares of parliament seats), and the labor market (measured by female and male labor force participation rates). The index ranges from 0 to 1, with a higher value indicating higher inequality between females and males in the country. Our model also accounts for income inequality measured by adding the most recent Gini index coefficient on both the pre-COVID and during-COVID models.

*Macroeconomic factors.* Our model also controls for other major macroeconomic factors that were postulated or found to be relevant determinants of food insecurity and malnutrition from previous empirical studies such as GDP growth rate, population growth rate, and proportion of arable land.

*Consumer side.* The model accounted for food consumer price inflation deduced from price data extracted from the World Bank's Global Database of Inflation. We hypothesize that food price increases have a significantly high impact on food insecurity, with disproportionate effects among women.

*Production side.* The models also partly capture production and trade response dynamics on staple grains: maize, rice, and wheat. The crop production independence variables for the years 2017 and 2021 for maize, rice, and wheat indicate a country's self-sufficiency and capability to supply its own consumption needs for each commodity, which translates to less dependence on commodity imports. International prices of maize, rice, and wheat were retrieved from the FAOSTAT database.

Women's empowerment in agriculture is represented by a proxy variable that captures the gender gap in farm business revenue receipts. This variable measures the disparity between male and female respondents' receipt of payments from any source for the sale of agricultural products, crops, produce, or livestock in the past year. The data was retrieved from 2017 and 2021 World Bank Global Findex Database country-level data. A higher value for this variable indicates a wider gender gap in farm business revenue receipts, hence, suggesting the lack of women's empowerment in agriculture in this economy.

The models include a total of 113 countries with complete publicly available data for both periods. Of the total sample, 40 are high-income countries and 73 are low- and middle-income countries (LMICs). This study applied the World Bank's (2023) definition of income groups: low-income economies are defined as those with a GNI per capita of $1,085 or less in 2021; lower-middle-income economies are those with a GNI per capita between $1,086 and $4,255; upper-middle-income economies are those with a GNI per capita between $4,256 and $13,205; high-income economies are those with a GNI per capita of $13,205 or more. All

explanatory variables are lagged one year to account for endogeneity, except for the Gini index coefficient and arable land (available in the year 2020).

**Table 1.** Variable Descriptions and Summary Statistics

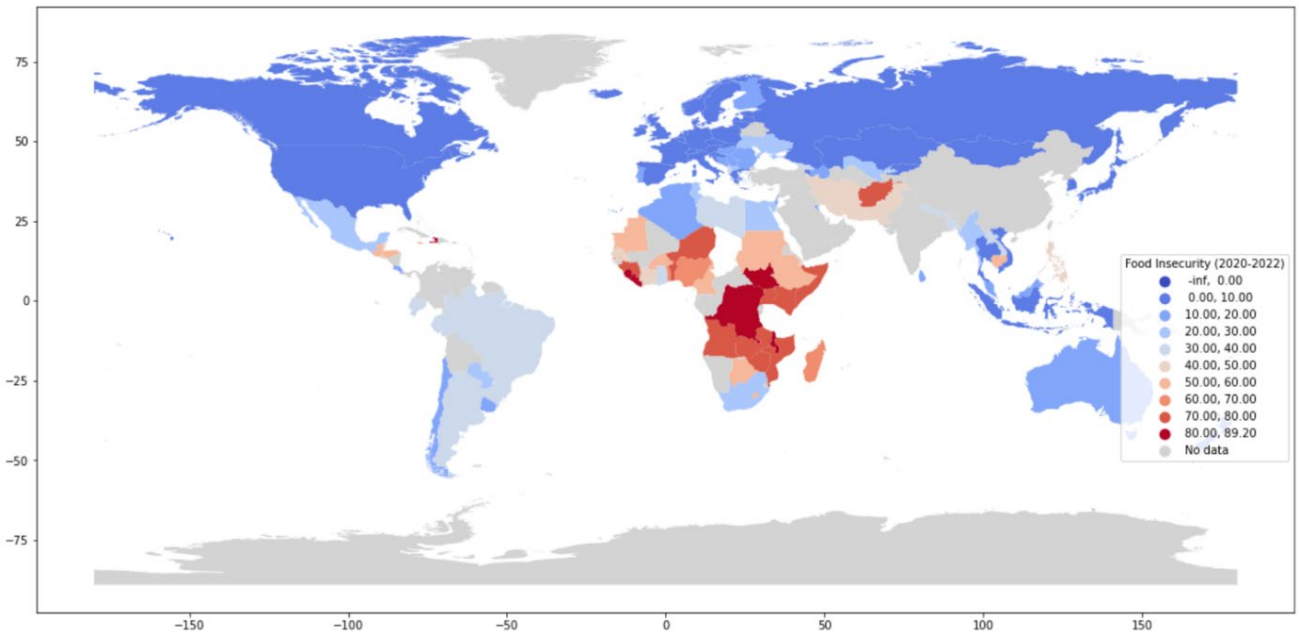
| Variables and Descriptions | Mean | St.dev. |
|---|---|---|
| ***2016-2018 Model*** | | |
| Prevalence of moderate or severe food insecurity (%) (2016-2018)<br>The percentage of people in the population that has experienced food insecurity at moderate or severe levels | 25.31 | 20.92 |
| Gender Inequality Index 2017<br>Gender inequality in reproductive health (measured by maternal mortality ratio and adolescent birth rate)<br>Gender inequality in empowerment (measured by female and male population with at least secondary education and female and male shares of parliament seats)<br>Gender inequality in the labor market (measured by female and male labor force participation rates) | 0.32 | 0.19 |
| Gender gap of farm business revenue receipts (%) 2017<br>Disparity between male and female respondents' receipt of payments from any source for the sale of agricultural products, crops, produce, or livestock in the past year | 3.18 | 4.43 |
| GDP per capita growth rate (%) 2017 | 2.53 | 2.57 |
| Population growth rate (%) 2017 | 1.10 | 1.20 |
| Arable land (%) 2017 | 17.15 | 13.68 |
| Domestic maize independence (%) 2017<br>Country's maize domestic production to the aggregate number of available maize for consumption (estimated as the sum of domestic production and total imports) | 59.50 | 40.21 |
| Domestic wheat independence (%) 2017<br>Country's wheat domestic production to the aggregate number of available wheat for consumption (estimated as the sum of domestic production and total imports) | 40.24 | 40.15 |
| Domestic rice independence (%) 2017<br>Country's rice domestic production to the aggregate number of available rice for consumption (estimated as the sum of domestic production and total imports) | 52.45 | 47.31 |
| Maize International price (I$) 2017 | 177.08 | 420.41 |
| Wheat International price (I$) 2017 | 122.11 | 139.98 |
| Rice International price (I$) 2017 | 166.99 | 316.35 |
| Food consumer price inflation (%) 2017 | 5.19 | 7.31 |
| Gini index coefficient (%) | 37.40 | 7.92 |
| ***2020-2022 Model*** | | |
| Prevalence of moderate or severe food insecurity (%) (2020-2022)<br>The percentage of people in the population that has experienced food insecurity at moderate or severe levels | 28.84 | 24.11 |
| Gender Inequality Index 2021<br>Gender inequality in reproductive health (measured by maternal mortality ratio and adolescent birth rate)<br>Gender inequality in empowerment (measured by female and male population with at least secondary education and female and male shares of parliament seats)<br>Gender inequality in the labor market (measured by female and male labor force participation rates) | 0.31 | 0.20 |
| Gender gap of farm business revenue receipts (%) 2021 | 2.77 | 4.20 |

| | | |
|---|---|---|
| Disparity between male and female respondents' receipt of payments from any source for the sale of agricultural products, crops, produce, or livestock in the past year | | |
| GDP per capita growth rate (%) 2021 | 3.93 | 4.62 |
| Population growth rate (%) 2021 | 0.82 | 1.30 |
| Arable land (%) 2020 | 17.16 | 13.73 |
| Domestic maize independence (%) 2021<br>Country's maize domestic production to the aggregate number of available maize for consumption (estimated as the sum of domestic production and total imports) | 58.15 | 40.49 |
| Domestic wheat independence (%) 2021<br>Country's wheat domestic production to the aggregate number of available wheat for consumption (estimated as the sum of domestic production and total imports) | 39.30 | 39.47 |
| Domestic rice independence (%) 2021<br>Country's rice domestic production to the aggregate number of available rice for consumption (estimated as the sum of domestic production and total imports) | 52.95 | 48.04 |
| Maize International price (I$) 2021 | 193.86 | 584.71 |
| Wheat International price (I$) 2021 | 130.56 | 178.84 |
| Rice International price (I$) 2021 | 195.30 | 524.19 |
| Food consumer price inflation (%) 2021 | 12.37 | 38.60 |
| Gini index coefficient (%) | 37.40 | 7.92 |

As shown in Table 1, the mean prevalence of moderate or severe food insecurity increased from 25.31% in 2016-2018 to 28.84% in 2020-2022, meaning that food insecurity has become more prevalent at the country level during the COVID-19 pandemic. A map of worldwide food insecurity from 2020 to 2022 presented in Figure 1 shows 11 countries with a prevalence of moderate or severe food insecurity higher than 70%. Figure 2 compares the average food insecurity across regions pre- and post-pandemic. All regions had an increased prevalence of food insecurity on average except East Asia and the Pacific. Food insecurity is most severe in Sub-Saharan Africa with an average of 55% moderate to severe food insecurity pre-pandemic and 62% post-pandemic. South Asia on the other hand experienced the highest increase from 27% pre-pandemic to 40% post-pandemic prevalence of moderate to severe food insecurity on average.

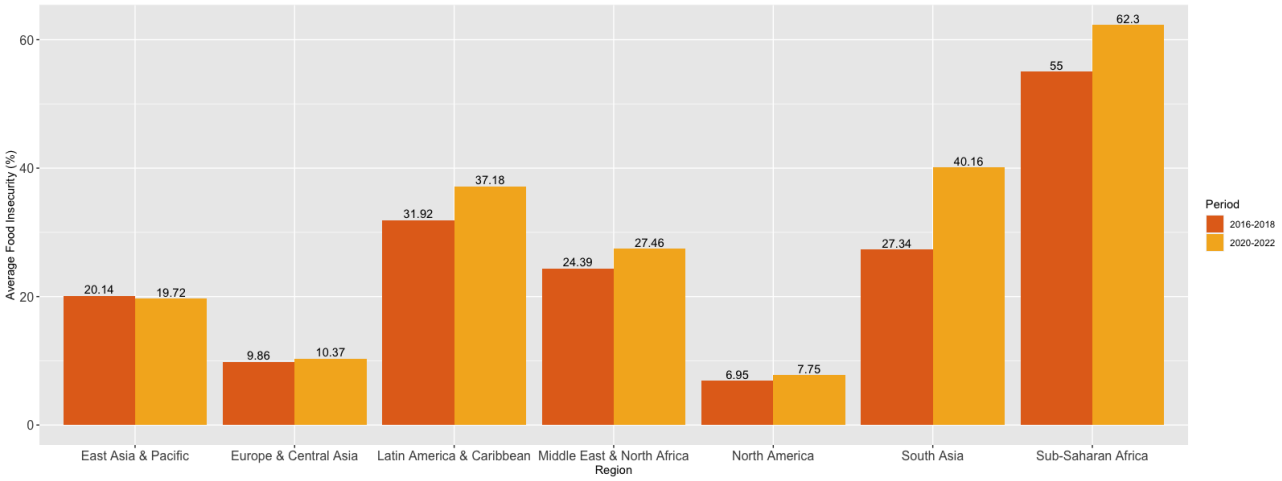
The mean GII decreased from 0.32 to 0.31 globally, though regional differences tell a different story. Food consumer price inflation had a sharp increase from 5.19% pre-pandemic to 12.37% by 2021, a change that can be attributed to the COVID-19 Pandemic and Russia's invasion of Ukraine.

**Figure 1.** Prevalence of Food Insecurity (2020-2022) World Map




*Notes:* A world map showing food insecurity conditions at the country level. Food insecurity is measured by the prevalence of moderate or severe food insecurity developed by FAO. Warmer colors indicate a more severe food insecurity condition in the country.

**Figure 2.** Prevalence of Food Insecurity for Each Region (2016-2018 vs. 2020-2022)




*Notes:* A bar chart comparing average food insecurity across regions. Food insecurity is measured by the prevalence of moderate or severe food insecurity developed by FAO.

## Empirical Model

This study employed Seemingly Unrelated Regression (SUR) estimation techniques to understand the linkages between country-level food insecurity conditions and a host of economic, demographic, and structural factors, including gender inequality, which is a major variable of interest in this study. The SUR modeling approach allows for the simultaneous estimation of a system of equations (rather than stand-alone, separate estimations using Ordinary Least Squares estimation, among alternatives) when there is a non-zero covariance among the equations' error terms. The latter condition is validated by a significant Breusch Pagan independence test statistic. Breusch-Pagan tests of independence for the 4 models produce p-values significant at the 5% confidence level, thus indicating that we can reject the null hypothesis that the error terms are not correlated with each other. Therefore, there is evidence of related equations and correlated error terms in the five equations, thereby providing justification for our use of the SUR modeling approach for these analyses.

The following defines the system of equations estimated in this study using the SUR method:

$$m2sfi = \beta_1 + \beta_2 genineq + \beta_3 gdpgrowth + \beta_4 popgrowth + \beta_5 arableland + \beta_6 mzindep + \beta_7 whtindep + \beta_8 rcindep + \beta_9 foodcpi + \beta_{10} gini + \epsilon_1 \quad (1)$$

$$whtindep = \alpha_1 + \alpha_2 rcindep + \alpha_3 mzindep + \alpha_4 buspmtgap + \alpha_5 whtprc + \alpha_6 foodcpi + \epsilon_2 \quad (2)$$

$$mzindep = \gamma_1 + \gamma_2 whtindep + \gamma_3 rcindep + \gamma_4 buspmtgap + \gamma_5 mzprc + \gamma_6 foodcpi + \epsilon_3 \quad (3)$$

$$rcindep = \delta_1 + \delta_2 whtindep + \delta_3 mzindep + \delta_4 buspmtgap + \delta_5 rcprc + \delta_6 foodcpi + \epsilon_4 \quad (4)$$

$$genineq = \zeta_1 + \zeta_2 buspmtgap + \zeta_3 gini + \zeta_4 foodcpi + \epsilon_5 \quad (5)$$

where m2sfi denotes prevalence of moderate or severe food insecurity, genineq denotes GII, gdpgrowth denotes GDP per capita growth rate, popgrowth denotes population growth rate, arableland denotes arable land, mzindep denotes maize domestic independence, whtindep denotes wheat domestic independence, rcindep denotes rice domestic independence, foodcpi denotes food consumer price inflation rate, gini denotes Gini index coefficient, buspmtgap denotes gender gap of farm business revenue receipts, whtprc denotes the International price for wheat, mzprc denotes the International price for maize, rcprc denotes the International price for rice. The β, α, γ, δ, and ζ terms represent the coefficients that are to be estimated, and the ϵ terms are the error terms for each equation, which are assumed to be correlated with each other across the equations.

# Findings

Table 2 highlights the results of our analysis of the association between gender inequality, economic inequality, and food insecurity. Models 1 and 3 include 113 countries, regardless of their income group classification, while Models 2 and 4 exclude high-income countries. Moreover, data for Models 1 and 2 are from 2016 to 2018 and can therefore reflect the economic, agricultural, and structural conditions before the COVID-19 outbreak. Models 3 and 4 employ data from 2020 to 2022 to capture the conditions during & post the COVID-19 pandemic.

Results in Table 2 show a highly significant and positive relationship between GII and the prevalence of moderate or severe food insecurity across all 4 models: pre- and post-pandemic time periods, across all countries and across LMICs only. As gender inequality in a country increases, the prevalence of moderate or severe food insecurity also increases, which is consistent with previous literature (Selva & Janoch, 2022; Smith & Haddad, 2000; FAO, 2023). Specifically, for the LMICs in the time period of 2020 to 2022, the GII coefficient estimate is 82.293 ($p < 0.01$). This means that when perfectly gender-unequal countries are compared with perfectly gender-equal ones, we could expect the prevalence of moderate or severe food insecurity in LMICs to increase by 82.293 percentage points (with all other factors held constant) between 2020 and 2022.

Furthermore, the robust positive relationship between gender inequality and food insecurity became stronger during the COVID-19 pandemic and the global disruption of agrifood systems due to the invasion of Ukraine (2020-2022), regardless of countries' income groups. The results suggest that societies with higher gender inequality are less resilient to external shocks. This is consistent with findings in the literature (e.g., Uraguchi, 2010) showing that entrenched vulnerabilities where women often have limited access to productive resources, face constraints to participate in the labor market, and have low household decision-making authority, experience exacerbated food insecurity during crises.

**Table 2.** Summary of Estimated Coefficients: Gender Inequality, Economic Inequality, and Food Insecurity

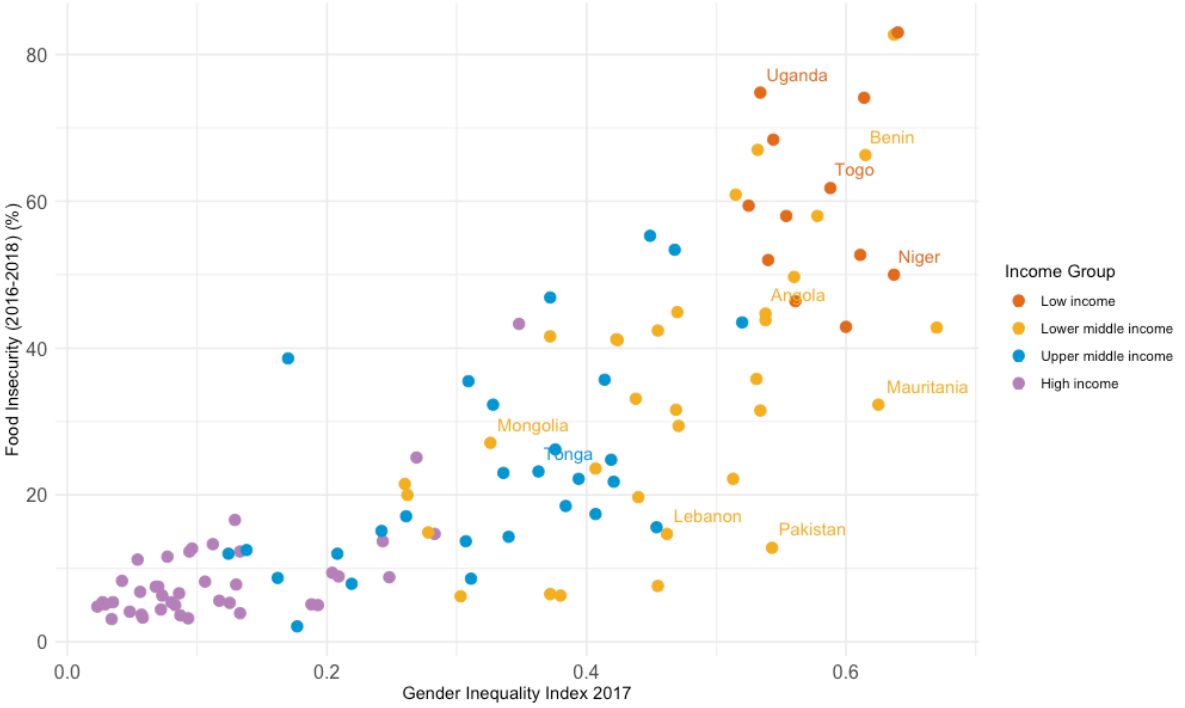
| | **Model 1: World Countries (2016-2018)** | **Model 2: LMICs (2016-2018)** | **Model 3: World Countries (2020-2022)** | **Model 4: LMICs (2020-2022)** |
|---|---|---|---|---|
| ***Food Insecurity*** | | | | |
| Gender Inequality Index | 64.613*** | 75.511*** | 70.216*** | 82.293*** |
| | (9.313) | (17.051) | (10.340) | (20.842) |
| GDP per capita growth rate | -0.129 | 1.220* | 0.771*** | 0.952*** |
| | (0.471) | (0.711) | (0.282) | (0.365) |
| Population growth rate | 3.302*** | 6.009*** | 4.516*** | 6.387*** |
| | (1.168) | (1.943) | (1.168) | (2.231) |
| Arable land | 0.136 | 0.329* | 0.089 | 0.157 |
| | (0.088) | (0.128) | (0.089) | (0.136) |
| Domestic maize independence | 0.011 | 0.034 | 0.062 | 0.094 |
| | (0.035) | (0.050) | (0.038) | (0.058) |
| Domestic wheat independence | -0.024 | 0.003 | -0.052 | -0.042 |
| | (0.033) | (0.046) | (0.036) | (0.053) |
| Domestic rice independence | -0.032 | -0.139*** | -0.039 | -0.077 |
| | (0.029) | (0.048) | (0.030) | (0.051) |
| Food consumer price inflation | 0.217 | 0.367* | 0.063** | 0.070** |
| | (0.165) | (0.194) | (0.030) | (0.035) |
| Gini index coefficient | 0.453*** | 0.744*** | 0.500*** | 0.515** |
| | (0.176) | (0.226) | (0.172) | (0.223) |
| cons | -17.033** | -40.700*** | -20.045*** | -30.461*** |
| | (7.471) | (12.237) | (6.618) | (10.336) |
| ***Domestic Maize Independence*** | | | | |
| Domestic wheat independence | 0.387*** | 0.208** | 0.480*** | 0.287*** |
| | (0.073) | (0.091) | (0.067) | (0.084) |
| Domestic rice independence | 0.608*** | 0.660*** | 0.629*** | 0.689*** |
| | (0.057) | (0.069) | (0.050) | (0.060) |
| Gender gap of farm business revenue receipts | 1.344* | 0.432 | 2.280*** | 1.450** |
| | (0.698) | (0.715) | (0.674) | (0.668) |
| Maize International Price | -0.001 | -0.005 | -0.003 | -0.004 |
| | (0.006) | (0.006) | (0.004) | (0.003) |
| Food consumer price inflation | 0.156 | -0.246 | 0.007 | -0.021 |
| | (0.421) | (0.412) | (0.071) | (0.066) |
| cons | 7.164 | 22.218*** | 0.087 | 10.339* |
| | (6.043) | (7.375) | (5.158) | (6.113) |
| ***Domestic Wheat Independence*** | | | | |
| Domestic maize independence | 0.575*** | 0.390*** | 0.801*** | 0.664*** |
| | (0.098) | (0.125) | (0.091) | (0.119) |
| Domestic rice independence | -0.255*** | -0.019 | -0.418*** | -0.273*** |
| | (0.083) | (0.105) | (0.073) | (0.096) |
| Gender gap of farm business revenue receipts | -1.361 | 0.320 | -2.568*** | -0.888 |
| | (0.830) | (0.862) | (0.793) | (0.819) |
| Wheat International price | 0.062*** | 0.066*** | 0.055*** | 0.057*** |

| | | | | |
|---|---|---|---|---|
| | (0.024) | (0.024) | (0.016) | (0.018) |
| Food consumer price inflation | -0.281 | 0.192 | -0.037 | 0.051 |
| | (0.493) | (0.496) | (0.081) | (0.079) |
| cons | 17.641** | -6.216 | 15.244** | -1.890 |
| | (7.365) | (9.681) | (6.135) | (7.801) |
| ***Domestic Rice Independence*** | | | | |
| Domestic maize independence | 0.899*** | 0.908*** | 1.065*** | 1.078*** |
| | (0.075) | (0.087) | (0.073) | (0.083) |
| Domestic wheat independence | -0.299*** | -0.118 | -0.456*** | -0.256*** |
| | (0.081) | (0.098) | (0.078) | (0.096) |
| Gender gap of farm business revenue receipts | -0.237 | -0.197 | -1.275 | -1.239 |
| | (0.791) | (0.813) | (0.821) | (0.805) |
| Rice International price | 0.028*** | 0.024** | 0.016*** | 0.013** |
| | (0.008) | (0.011) | (0.005) | (0.005) |
| Food consumer price inflation | 0.426 | 0.502 | -0.025 | -0.024 |
| | (0.470) | (0.466) | (0.083) | (0.078) |
| cons | 4.908 | -2.722 | 9.628 | 2.163 |
| | (6.717) | (8.342) | (6.056) | (7.279) |
| ***Gender Inequality Index*** | | | | |
| Gender gap of farm business revenue receipts | 0.016*** | 0.005* | 0.015*** | 0.000 |
| | (0.003) | (0.003) | (0.004) | (0.004) |
| Gini index coefficient | 0.006*** | 0.002 | 0.007*** | 0.003 |
| | (0.001) | (0.001) | (0.002) | (0.002) |
| Food consumer price inflation | 0.008*** | 0.003* | 0.001*** | 0.000 |
| | (0.002) | (0.002) | (0.000) | (0.000) |
| cons | 0.001 | 0.310*** | -0.024 | 0.308*** |
| | (0.056) | (0.065) | (0.064) | (0.074) |
| N | 113 | 73 | 113 | 73 |
| Breusch-Pagan test of independence (p-value) | 0.000 | 0.000 | 0.000 | 0.000 |

*Notes:* *** p<0.01, ** p<0.05, * p<0.1. The figures in brackets are standard errors.

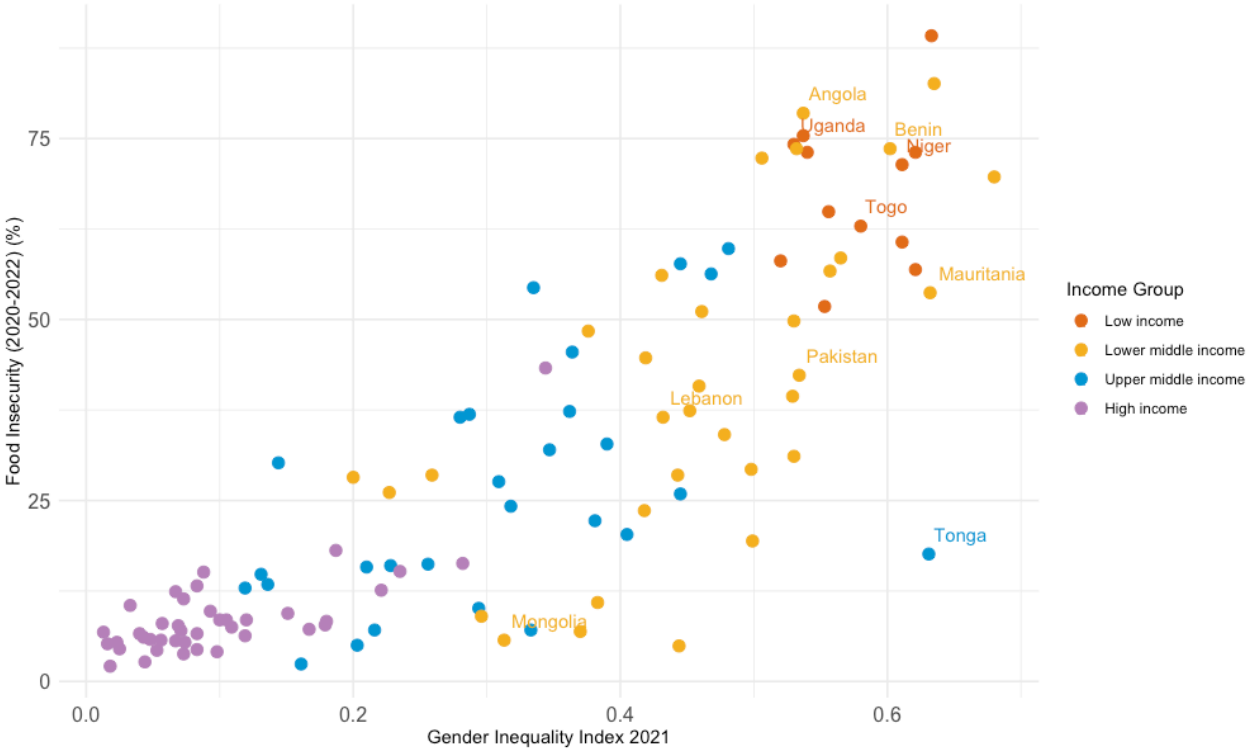
Figures 3 and 4 visually show the strong association between gender inequality and food insecurity pre-pandemic (2016-2018) and during the pandemic (2020-2022), layered with the countries' income classification. The upper left quadrant captures the combination of higher gender inequality (to the left in the graphs) and higher food insecurity (upward in the graphs). During the relatively more stable period pre-pandemic, Figure 3 seems to visually indicate what we would expect: high-income countries are concentrated on the left and bottom sections of the scatterplot, implying a combination of low gender inequality and low food insecurity. Conversely, low-income countries are concentrated in the right and upper parts of the scatterplot, implying a combination of high gender inequality and high food insecurity. Lower and upper middle income countries lie somewhere in the middle. However, during the pandemic period in Figure 4, the picture shifted and the countries at different income brackets seem to spread out more across the four quadrants, indicating widening food insecurity and widening gender inequality. In particular, more upper and lower middle income countries are experiencing more food insecurity and more gender inequality.

**Figure 3.** Scatterplot of Gender Inequality and Food Insecurity (2016-2018)




*Notes:* Scatterplot showing the correlation between the Gender Inequality Index of 2017 on the X-axis and the prevalence of moderate or severe food insecurity on the Y-axis in the time period between 2016 and 2018, at a country-level, worldwide.

**Figure 4.** Scatterplot of Gender Inequality and Food Insecurity (2020-2022)




*Notes:* Scatterplot showing the correlation between the Gender Inequality Index of 2021 on the X-axis and the prevalence of moderate or severe food insecurity on the Y-axis in the time period between 2020 and 2022, at a country-level, worldwide.

After controlling for both gender and economic inequality, our results show that the pre-pandemic GDP per capita growth rate shows a positive but weak association with the prevalence of food insecurity in a country (see model 2). However, post-pandemic, this positive correlation became highly significant (see models 3 & 4), thus suggesting that the higher GDP per capita growth rate, the higher the population share experiencing moderate or severe food insecurity in a country. The results are surprising and contrast the prevailing belief supported by the existing body of evidence, which suggests that GDP growth plays a pivotal role in mitigating the global hunger crisis (FAO, 2012; Warr, 2014). The only study on the interactions of economic inequality and economic growth on individual food insecurity by Holleman & Conti (2020) gives partial insight, though this study did not account for gender inequality. In the study, Holleman & Conti (2020) also found that in countries with high income inequality, an increase in GDP per capita is associated with higher individual food insecurity but they found the expected opposite results among countries with low income inequality.

Two primary factors might underpin these results. Firstly, economic growth does not guarantee that the benefits of this growth are distributed evenly across the population. In some cases, rapid economic growth can accentuate income inequalities, which in turn can amplify food insecurity among the poor (Naguib, 2015). This theory aligns with our findings, as we identified a consistently positive and significant correlation between the Gini index coefficient and food insecurity across all models (coefficient = 0.453, $p < 0.01$; coefficient = 0.744, $p < 0.01$; coefficient = 0.500, $p < 0.01$; coefficient = 0.515, $p < 0.05$). The regression outcomes imply that even as GDP grows, the intensification of income disparity might be a key factor aggravating food security issues and supports the earlier findings of Holleman & Conti (2020). In many cases, GDP growth is concentrating wealth for the richest people, and not making it available to people who are facing food insecurity, or who are right on the cusp of it. Secondly, economic growth can sometimes lead to inflation, which poses a threat to food security (Mallik & Chowdhury, 2001; Gazdar & Mallah, 2013). Our results show a statistically significant relationship between increases in food consumer price inflation with increases in food insecurity, especially post-pandemic (see Table 2, models 3 & 4). This echoes the contentions of previous studies, which postulated that reduced accessibility to food - potentially attributable to rising costs of food supplies - serves as a driving force behind food insecurity (FAO, 2008; Warr, 2014). If food prices escalate more rapidly than the incomes of the vulnerable groups, a trend we have seen particularly pronounced post-pandemic, food becomes less accessible and affordable, leading to increased food insecurity (Sasmal, 2015). Moreover, our results suggest that food price inflation is also correlated with gender inequality, pre- and post-pandemic, signaling that food inflation is hitting women especially hard. With inflation, women are experiencing increasing gender inequality and higher food insecurity.

Our model is at the macro-level and does not capture individual, household and sub-country heterogeneity but the macro-level results could indicate a possible fundamental shift in the dimensions and mechanisms of these economic and gender disparities in the post-pandemic period. Current disparities may be so extreme and highly embedded within traditional ways economies grow that post-pandemic economic growth is associated with high food insecurity. There is a growing consensus, especially from the rights-based space, that GDP per capita is an extremely inadequate and inappropriate proxy for economic growth, as it ignores crucial areas of our economies where women have the highest contributions (such as unpaid care work) and ignores harm to the environment (Parvez Butt et al, 2023). Such factors have been shown to have direct links to food insecurity (Rockefeller Foundation, 2021). Economic growth based on GDP may be more predictive of higher or lower human development in stable times, but during major shocks, when coping mechanisms and responses are not adequately captured by goods and services produced and traded in the marketplace, equality tends to matter more.

Consistent with prior research (Hall et al., 2017), we found a positive and statistically significant association between population growth rate and food insecurity pre- and post-pandemic. The association is stronger for LMICs only.

In the post-pandemic period, we did not find a statistically significant correlation between a country's domestic (in)dependence on wheat, rice, or corn on the prevalence of food insecurity. The availability of arable land is also statistically insignificant. This implies that emphasizing either domestic production or

importing large quantities of food will not solve the problem. The results indicate that the distribution mechanisms or systems for these major grains play a more crucial role than sheer availability.

Overall, our results show that economic growth based on GDP or food production will not solve the global food crisis unless we can also solve the rising inequalities crisis.

## Conclusion and Recommendations

This study finds that gender inequality and income inequality, along with population growth, are the most consistent predictors of food insecurity, pre- and post-pandemic and considering all economies or excluding high income countries. Meanwhile, production independence of staple crops (wheat, rice, corn), a goal and a strategy that an increasing number of countries strive for especially during the current food crisis, is weakly associated with food (in)security. Our findings also show that economic growth has an adverse impact on food security, especially post pandemic. This is contrary to mainstream economic belief, and we postulate that in the face of extreme and sustained crises (such as the global COVID-19 pandemic and the war in Ukraine), the positive impact of economic growth on food security is not enough if there is persistent and extreme inequality. Food inflation is also significantly associated with food insecurity, especially post-pandemic, and also correlated with gender inequality, adding to evidence that food inflation is hitting women especially hard.

Overall, our study shows that mainstream and traditional macro-economic instruments and interventions are not enough and can potentially lead to higher prevalence of food insecurity, unless gender and income inequalities are addressed. This is especially true during the COVID-19 pandemic and the crises in Ukraine. This challenges every assumption that we must focus on economic growth and food supplies first in a crisis and think about equality later because there are more important issues to handle. Focusing resources on women and girls is an effective strategy to abate the food crisis and to prevent future ones.

Moreover, while this research shows that economic growth without equality is not enough to address the hunger crisis, we know that equality can stimulate economic growth. Gender equality in the global workforce could contribute $28 trillion to economic growth (Woetzel et al., 2015). Closing the gap for women entrepreneurs, especially in terms of access to finance, could add $5 trillion to the global economy (Unnikrishnan & Blair, 2019). In emerging markets, bridging the finance gap for women-run enterprises could enhance incomes by an average of 12% (IFC, 2022). If even half of the smallholder producers were to access women's empowerment programming, incomes would rise for 58 million people, and 235 million individuals would become more resilient (FAO, 2023).

This necessitates moving beyond an exclusive focus on growth to consider both equality and growth.

At the policy level, global strategies, national policies, and funding plans need to set targets for equality in economic growth - not solely for GDP growth or income improvements. The goals measure who benefits from growth, and not growth alone. In addition, programming approaches that address both humanitarian emergencies and long-term development plans should incorporate women's voices and leadership in emergencies to ensure that crisis response efforts - including responses to the global hunger crisis - also promote gender equality. While policies championing gender equality are essential, they alone cannot guarantee change for the broader population. The implementation of policy changes should be paired with shifts in social norms.

At the execution level, agriculture development and extension plans should employ proven tools and approaches to narrow gaps between women and men in the agriculture and food systems. Evidence undeniably reveals that running programs which champion equality, diminish gender disparities, and uplift those currently left out of economic growth is not only feasible but also cost-effective. For example, in Burundi, agriculture programs focusing on gender equality create $5 of return for every $1 invested,

compared to a $2 return for every dollar invested in agriculture programs that did not look at equality (CARE Burundi, 2021).

Regarding measurement, it is crucial to capture the nuances of equality and understand who truly benefits from policies; mere sex-disaggregation is just the starting point. Both public and private entities, along with donors, should embrace more comprehensive data collection methodologies to ensure that quantitative data accurately reflects people's lived experiences. Furthermore, success metrics ought to encompass food security, equality, and economic growth, rather than solely emphasizing economic growth. These metrics should also account for the tradeoffs related to climate change and prioritize long-term sustainability. Moving beyond the numbers, there is a pressing need to invest in methods that genuinely capture women's voices. Including the experiences of those witnessing a rise in food insecurity is vital in crafting solutions that are truly effective.

***Limitations and recommendations for further research***

This study has several limitations and recommendations for further research. First, this study employed country level data and does not capture individual, household and sub-country heterogeneity to fully explain these trends. Expanding this research by adding more granular datasets and deeper case studies are recommended to fully understand these dynamics and their implications for food security policy in different countries. Second, this study did not incorporate climate change variables. Climate change, a paramount challenge facing humanity and vital to sustainable development, significantly impacts all four dimensions of food insecurity: food availability, food accessibility, food utilization, and food stability (El Bilali et al., 2020). Third, further investigation is needed to explore the interactions between GDP growth with income inequality, GDP growth with gender inequality, and possibly, GDP growth with climate inequality - to better understand to what extent these inequalities affect the presumed impact of economic growth to food insecurity, especially post-pandemic. Fourth, intersectionality was not incorporated in this study due to data unavailability. As only sex-disaggregated data is available in country-level databases, we need more efforts to consider how gender intersects with age, disability, race, ethnicity, class, and sexuality in the data collection process. Lastly, there is a need to evaluate, conduct meta-analysis, and communicate promising interventions and strategies that can reduce food insecurity and gender inequalities, as well as evaluations of strategies to better integrate gender into agricultural interventions. This can inform context-specific modifications and bridge the divide between micro or community level interventions with a strong gender focus and macro-level interventions to address the food crisis that pay little attention to gender dynamics.

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**Florence Santos**
**Director, Impact Measurement and Analysis**
**CARE USA**
**florence.santos@care.org**

**Emily Janoch**
**Associate Vice President, Thought Leadership and Design**
**CARE USA**
**Emily.janoch@care.org**