



Breaking the Cycle of Hunger

Addressing Gender and Economic
Inequality in the Face of Climate Change

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COXICA
Honoreando a Resiliencia de la
Mujer de Alta y Baja Fructificación
Mientras se Adapta al Cambio Climático

Abstract

The persistent challenges of gender and economic inequality, exacerbated by climate change, pose significant threats to global food security. This study investigates the intricate relationships between these inequalities and food insecurity across 28 low- and middle-income countries (LMICs). Utilizing data from the 2021 Gallup World Poll, including the FAO Food Insecurity Experience Scale (FIES) and World Risk Poll (WRP), the study investigates individual-level food insecurity, demographics and country characteristics, experiences of severe weather events, and perceived disaster preparedness. The findings reveal that both men and women in countries with high gender inequality are more

likely to experience food insecurity. Furthermore, economic growth in the absence of equality can worsen hunger rather than alleviate it, with higher GDP growth per capita correlating with increased individual food insecurity in countries with high income inequality. It also found direct links between individual food insecurity and exposure to extreme weather events and disasters up to five years ago. These findings underscore the importance of addressing gender and economic disparities to achieve sustainable food security and resilience against climate change impacts. The research advocates for a shift from growth-centric policies to those prioritizing equality and sustainability for lasting hunger eradication.

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

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Contents

Introduction	4
Literature Review	7
Economic Growth, Inequalities, and Food Insecurity	7
Gender Inequality, Climate Change, and Food Insecurity.....	8
Methodology	10
Data and Variables	10
Empirical Model.....	12
Results.....	12
Gender and income inequality, economic growth and food insecurity	15
Severe weather events, preparedness, and food insecurity	19
Limitations	19
Implications of this research	20
Gender Inequality.....	20
Income inequality	20
Extreme weather events and disasters.....	21
References	23

Closing the gender gap in food systems would reduce the number of food insecure people by **45 million**.



Introduction

According to the 2024 Global Report on Food Crises, 281.6 million people, or 21.5 percent of the analyzed population faced high levels of acute food insecurity in 59 food-crisis countries or territories in 2023, which is 24 million more people than in 2022 (FSIN & Global Network Against Food Crises, 2024).

While food insecurity is a global issue, its impact varies significantly among different populations.

Disproportionately high levels of food insecurity were seen among populations in Africa, South Asia, and the Caribbean (FAO et al., 2022). Within countries, certain groups—including women, people with disabilities, Indigenous peoples, ethnic minorities, transgender and non-conforming gender groups, and those living in poverty—are more severely affected by food insecurity and malnutrition (HLPE, 2023). Addressing systemic socioeconomic inequalities that intersect with other drivers of food insecurity is essential for improving food security and nutrition outcomes for everyone (HLPE, 2023).

Food insecurity affects women more than men in every region of the world due to persistent structural gender inequalities. Globally, 84.2 million more women and girls are food insecure than men and boys in 2023 (Janoch, 2023). In 2021, 31.9% of women were moderately or severely food insecure, compared to 27.6% of men (FAO et al., 2022).

Gender inequality is not merely a “women’s issue”; it is a crucial Sustainable Development Goals (SDGs) issue. Addressing gender inequalities and empowering women is key to achieve zero hunger for all.

Women constitute 43 percent of the global agricultural labor force (FAO, 2018b). In sub-Saharan Africa, 66 percent of women’s employment is in agrifood systems, compared with 60 percent of men’s (FAO, 2023). In southern Asia, 71 percent of women work in agrifood systems, versus 47 percent of men (FAO, 2023).

However, female-headed households exhibit lower agricultural productivity than male-headed households due to women’s lack of access, control, and ownership of productive resources (especially land), and the discriminatory social norms that burden women with unequal unpaid care work and limit their work opportunities outside the home (FAO, 2023; Donald et al., 2020; Gebre et al., 2021; Abdisa et al., 2024). For instance, as of 2024, in 21 economies, women still do not have equal administrative power and ownership rights over immovable property, such as land (World Bank, 2024). The share of women among all agricultural landowners or secure right holders ranges between 6.6 percent in Pakistan (in 2018) and 57.8 percent in Malawi (in 2020) (FAO, 2023). In every one in three countries, at least 70 percent of all landowners or holders of secure tenure rights are men (FAO 2023). The FAO (2023) further estimates that closing the gender gap in farm productivity and the wage gap in agrifood system employment could increase the world’s GDP by 1 percent and reduce the number of food-insecure people by 45 million.

Empowered women are better able to improve food security in their households because they are more likely than men to reinvest their income back into their family’s nutrition, health, and education (Feed the Future, 2022).

In Bangladesh, Sraboni et al. (2014) found that the Women’s Empowerment in Agriculture Index (WEAI) is positively associated with household dietary diversity, per capita calorie availability, and adult body mass index (BMI), utilizing data from the 2012 Bangladesh Integrated Household Survey (BIHS). Similarly, in Ethiopia, an increase in WEAI was found to

correlate with improvements in household food insecurity indicators, including food consumption scores, dietary diversity, and calorie availability (Jemaneh & Shibeshi, 2023). In Ghana, Asitik & Abu (2020) also found that when women participate in crop and livestock decision-making in the household and have access to cultivable lands, their households have lower probabilities of being severely or moderately hungry, based on the Feed the Future survey data.

Systematic inequalities in food security are exacerbated by climate change that disproportionately affects already vulnerable groups.

Women, particularly, are at a heightened risk of food insecurity due to climate change, not because they are inherently more vulnerable to climate change itself, but because existing structural gender inequalities exacerbate their challenges.

Discriminatory social norms that assign women a greater burden of unpaid care work, restrict their mobility and limit their access to information, technology, financial services, land, and other productive resources make adaptation more challenging for them (IPCC, 2014; IPCC, 2022; FAO, 2023; FAO, 2024; Djoudi et al., 2016; Bryan et al., 2023). For example, FAO (2024) reports that female-headed households annually incur 8 percentage points more loss in income due to heat stress and 3 percentage points more loss due to flooding, compared to male-headed households. The World Bank Group (2023) found that droughts have a stronger impact on the mortality rates of girls than boys in places with son preference and other gender biases, especially in poorer households.

When women participate in decision making and can get land, their households are less likely to be hungry.

Droughts can result in reduced resources that can lead to sex-selective abortions, malnutrition, and neglect of girls due to son preference (World Bank Group, 2023). In South Africa, Tibesigwa et al. (2015) found that weather-related crop failure affects per capita consumption levels for both male-headed and female-headed households in almost equal proportions. Nevertheless, female-headed households are more likely to be food insecure than male-headed ones because they are more dependent on agriculture and natural resources that fail during extreme weather events.

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Despite the increased recognition that women are among the most food insecure and most vulnerable to climate change impacts, and that overcoming gender inequality is a crucial step in achieving climate-resilient development and eradicating hunger for all, there has not been a systemic change in the current food security and climate action paradigm (FAO, 2023; Visser & Wangu, 2021). “The climate change debate has been shaped by stereotypically masculinist discourses that work to ‘invisibilize’ and alienate women and their concerns” (MacGregor, 2010, p. 5). Of global reports proposing solutions to the 2022 hunger crisis, 28% do not refer to women and girls at all, and only 35% reports propose concrete actions to resolve gender inequalities (CARE, 2022).

Therefore, this study aims to provide empirical and rigorous evidence on the direct link between gender and economic inequality and food insecurity in the context of climate change, by using sex-disaggregated individual-level data in 28 low- and middle-income countries (LMICs) from the Food Insecurity Experience Scale (FIES) and the World Risk Poll (WRP) in 2021. Similar to the HLPE report (2023), this study adopts an intersectional lens to investigate the linkages between inequality and hunger, especially in the context of escalating challenges posed by climate change. While this study may not establish a causal link between gender and economic inequalities on food insecurity, it finds that both men and women in countries with

high gender inequality are more likely to be food insecure.

Furthermore, the study provides compelling evidence that economic growth without income equality may exacerbate hunger rather than alleviate it. Despite decades of economic growth in low- and middle-income countries, hunger and food insecurity have been rising, even though global food production is sufficient to feed everyone (Wilmoth et al., 2023).

As noted in “Growth is Not Enough,” a high prevalence of food insecurity at the country level is associated with economic growth, controlling other socioeconomic variables (Santos et al., 2023). Meanwhile, the HLPE report (2023) noted, “...although there is some indicative evidence on the intuitive notion that high-income inequality worsens food insecurity and malnutrition, the evidence base is surprisingly thin, and this is an important area for future research (Alao et al., 2021).” With individual-level data, this study demonstrates that in countries with high income inequality, increasing GDP per capita correlates with a higher likelihood of individual food insecurity.

In countries with high income inequality, increasing GDP per capita correlates with a higher likelihood of individual food insecurity.

At a time when climate change is causing more frequent and severe weather events and disasters, our findings reveal direct links between these disasters, national and local disaster preparedness, and food insecurity. This paper contributes to the growing call to move beyond an obsession with economic growth at the expense of equality and the planet, and towards alternative pathways for sustainable development that can end hunger.



Literature Review

Economic Growth, Inequalities, and Food Insecurity

Economic growth alone is not enough to solve the global hunger crisis. At the country level, Santos et al. (2023) found that in countries with high economic and gender inequalities, economic growth may exacerbate national food insecurity, especially during the COVID-19 pandemic. Similarly, at the individual level, Holleman & Conti (2020) found that an increase in GDP is associated with an increase in individual food insecurity, both in terms of severe and moderate or severe food insecurity, using data from the 2014 FIES in 75 LMICs.

This counterintuitive negative relationship arises because aggregate economic growth does not always lead to a decrease in poverty or an increase in household income among food-insecure groups, thus failing to translate into improved food security and nutrition (see Abbasi et al., 2016; Babatunde et al., 2007; Babatunde & Qaim, 2010; Owusu et al., 2011). In examining global economic inequality from 1820 to 2020, Chancel et al. (2021) found that global income inequality has consistently been extremely large. The top 10% of income earners have consistently received 50-60% of global income, while the bottom 50% have generally

received around or below 10% (Chancel et al., 2021). This trend has persisted over the last two centuries, despite numerous economic and political changes during that period. They also found that inequality between countries kept increasing between 1910-1980 then it started to decline from 1980-2020. In stark contrast, inequality *within* countries dropped between 1910-1980 and increased between 1980-2000 and as a consequence of this, inequality today involves similar levels of inequality as early 20th century colonial capitalism (Chancel et al., 2021).

If economic growth is accompanied by an increase in income inequality, the poor do not benefit from the increased national income and continue to struggle to access food (Holleman & Conti, 2020).

This scenario is common, as Agyemang (2015) found that economic growth led to increased income inequality in the LAC and OECD regions, resulting in limited poverty reduction. Similar positive relationships between economic growth and income inequality were also observed in the United States (Partridge, 1997), Brazil (Rangel

et al., 2008), South Africa (Bhorat & van der Westhuizen, 2008), and many other countries. Therefore, when there is both income growth and high inequality in income distribution, inequality in food insecurity within a country may also grow and the likelihood of individual food insecurity may increase (HLPE, 2023). For example, Holleman & Conti (2020) found that individuals living in countries with high income inequality are more likely to experience food insecurity than those in countries with low-income inequality. Income inequality undercuts the benefits of higher GDP per capita in reducing individual food insecurity (Holleman & Conti, 2020). Similarly, Smith & Wesselbaum (2023) also found that individual food insecurity is significantly and positively correlated with well-being inequality using Gallup World Poll from 135 countries between 2010 and 2014. In India, state income inequality was also found to adversely affected the risk of being underweight as well as pre-overweight, overweight, and obesity (Subramanian et al., 2007). Similarly, economic inequality had a deleterious effect on child stunting in Ecuador (Larrea & Kawachi, 2005) and on self-reported health in Chile (Subramanian et al., 2003).

Gender Inequality, Climate Change, and Food Insecurity

Apart from ongoing conflicts and economic shocks, weather extremes were the main driver for the high levels of acute food insecurity in 18 countries, affecting over 72 million people in 2023 (FSIN & Global Network Against Food Crises, 2024). Climate change is exacerbating food insecurity and malnutrition by adversely impacting food productivity, access, utilization, and stability (IPCC, 2022; IPCC, 2014). Empirically, a 1 °C increase in temperature anomaly results in a 1.58% increase in global moderate or severe food insecurity in 2014 and a 2.14% increase in 2019 (Dasgupta & Robinson, 2022). However, the impact of climate change

is not evenly distributed across populations; the poor and the most vulnerable communities endure the brunt of climate change-related impacts disproportionately (IPCC, 2022).

Vulnerability to climate change is a function of exposure, sensitivity, and adaptive capacity (IPCC, 2001). In IPCC’s words, exposure is “the nature and degree to which a system is exposed to significant climatic variations” (IPCC, 2001, p. 987), sensitivity is “the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli” (IPCC, 2001, p. 6), and adaptive capacity is “the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences” (IPCC, 2001, p. 6).

Structural inequalities such as gender, race, ethnicity, age, disability, and income deepen vulnerability to climate change by influencing exposure to climate shocks and stressors, changing the sensitivity of the exposure, and limiting adaptive capacity (IPCC, 2022; FAO, 2023).

Climate change impacts women and men differently. Women are more exposed to climate risks in some cases. For example, in Mexico, women who exchange canned fruit and pickled vegetable products to sustain their social networks—which function as their safety nets—are more vulnerable because climate change reduces community cohesion when floods diminish fruit and vegetable production (Buechler, 2009). In the Philippines, cultural norms require women to wear saris, which hinder swimming, and social prejudice against women learning to swim results in only 51% of women reporting swimming skills, compared to 87% of men (Hunter et al., 2016). This places women in a more vulnerable situation during tsunamis (Hunter et al., 2016).

Main causes of Food Insecurity



Economic Shocks



Conflict



Weather Extremes

(FSIN & Global Network Against Food Crises, 2024)

Evidence also suggests that **women are more sensitive to climate shocks in certain contexts**. For instance, Alston & Akhter (2016) found that in Bangladesh, during food shortages, women and girls consume less than men and boys to ensure there is more food for the rest of the family. This “hungry season” which can last up to 6 months, makes it harder for them to adapt to additional shocks (Alston & Akhter, 2016). Additionally, a systematic review by Thurston et al. (2021) found that violence against women and girls tend to increase after disasters. This increase is associated with factors such as the lack of privacy in shelters and displacement camps, post-disaster economic insecurity, and men struggling with poor mental health conditions (Thurston et al., 2021).

Women often lack access to and control over critical resources such as land, technology, information, and other productive means necessary to respond to climate crises.

For example, women are unable to use the land to invest in lasting adaptation measures to deal with climate variabilities because of their limited

access to land (Kabaseke, 2020). In Uganda, activities such as constructing trenches for water management and mulching in banana and coffee fields are more likely to be practiced by men, attributed to women’s limited access to labor and cash for necessary inputs (Jost et al., 2016). Otiemo et al. (2021) found that gender norms restrict women’s access to formal seed sectors, limiting their use of improved seeds to adapt to climate shocks. Furthermore, discriminatory cultural norms hinder women’s mobility and their ability to access extension services and climate information. In Cameroon, Nkengla-Asi et al. (2017) found that women rarely participate in extension meetings organized by the national government, often held at inconvenient locations and times. The long travel distances and the burden of unpaid care work leave them with limited time, resulting in a poor understanding of weather data, new technology, and adaptation strategies (Nkengla-Asi et al., 2017). Moreover, the structural gender gap in financial inclusion restricts women’s ability to invest in climate change adaptation solutions. Despite being more predisposed than men to invest in these solutions, women have lower access to credit or loans, which hampers their agricultural activities (Acosta et al., 2019).





Methodology

Data and Variables

We utilized data from the 2021 wave of the Gallup World Poll (GWP), which included the 2021 FAO Food Insecurity Experience Scale (FIES) data and the 2021 World Risk Poll data. Since 2006, the GWP has conducted surveys in over 140 countries, representing 95% of the world's adult population, using randomly selected, nationally representative samples annually in more than 160 countries (Gallup, 2008). The survey collects data on various topics, including labor force involvement, income levels, educational achievements, food insecurity, and mental health. Typically, the GWP surveys 1,000 individuals aged 15 years and older per country, ensuring national representation through weighting. For medium- and high-income countries with at least 80 percent telephone coverage, the interviews are conducted via telephone, while face-to-face interviews are predominantly used in developing countries (Gallup, 2008).

Food Insecurity. The FIES survey module (FIES-SM) was first incorporated as a client module in the GWP in 2014. FIES-SM poses eight questions about behaviors and experiences related to food insecurity, requiring participants to respond with a simple 'yes' or 'no'. In this study, we employed the probability of moderate or severe food insecurity to

measure individual-level food insecurity, which is estimated using the one-parameter logistic Item Response Theory model (the Rasch model) based on participants' responses (FAO, 2018a). FIES survey questions probe if participants have experienced situations in the past 12 months such as worrying about not having enough food, being unable to eat healthy and nutritious food, consuming only a few kinds of foods, skipping meals, eating less than they should, running out of food, being hungry but not eating, and going without food for a whole day due to a lack of money or other resources (FAO, 2018a).

Severe Weather Events. In 2019 and 2021, the World Risk Poll was included as a module within the Gallup World Poll. The World Risk Poll conducted approximately 125,000 interviews in 121 countries during 2021, focusing on respondents' perceived risks to safety (Lloyd's Register Foundation & Gallup, 2022). This study included questions on personal experiences and perceptions of severe weather events and disasters, such as concerns about severe weather causing serious harm, experiences of harm from severe weather in the past two years, and experiences of disasters in the past five years. It also examined perceptions of local and national government preparedness for disasters.

Demographic Characteristics. Demographic information collected included sex, age, education level, employment status, place of residence (rural/urban), household income level, and the number of children and adults in each household, which were found to be the determinants of individual food insecurity by previous research (see Brunelli et al., 2014; Smith et al, 2017a; Smith et al., 2017b; Grimaccia & Naccarato, 2022; Kota et al., 2023).

Country Characteristics. GDP growth rate per capita, population growth rate, Gender Inequality Index (GII) developed by UNDP, Gini coefficient index, and World Risk Index (WRI) developed by the Institute for International Law of Peace and Armed Conflict (IFHV) in the year of 2021 were also included in our model.

The 2021 Gallup World Poll included data from over 125,000 interviews conducted in 121

countries. We merged the 2021 FIES dataset and the 2021 WRP dataset using participants' unique identification numbers and retained only those observations where respondents completed both surveys and are from low- and middle-income countries (LMICs). The total final dataset comprises 11,075 observations from 28 LMICs. The countries included in our sample are Nepal, Peru, Iran, Islamic Rep, Cambodia, Congo, Dem. Rep, Honduras, Afghanistan, Tunisia, Argentina, Jordan, Guinea, El Salvador, Uzbekistan, Moldova, Ukraine, Georgia, Mauritius, Romania, Albania, Myanmar, North Macedonia, Mongolia, Bosnia and Herzegovina, Brazil, Serbia, Jamaica, Thailand, and Bulgaria. **Table 1** summarizes the minimum, maximum, mean, and standard deviation for all the variables included in our model. The mean probability of moderate or severe food insecurity is 58.37%.

TABLE 1. SUMMARY OF VARIABLES

VARIABLES	DUMMY VARIABLE	MAX	MIN	MEAN	STD. DEV.
Food Insecurity					
Probability of moderate or severe food insecurity	No	99.94	1.63	58.37	39.81
Demographic Characteristics					
Female	Yes	1	0	.53	.50
Age 15-29	Yes	1	0	.30	.46
Age 30-49	Yes	1	0	.41	.49
Age 50-64	Yes	1	0	.20	.40
Age >=65	Yes	1	0	.10	.30
Elementary school or less	Yes	1	0	.35	.48
Secondary education	Yes	1	0	.50	.50
Colledge education	Yes	1	0	.15	.36
Urban	Yes	1	0	.41	.49
Per capita income (poorest 20%)	Yes	1	0	.20	.40
Per capita income (second 20%)	Yes	1	0	.20	.40
Per capita income (middle 20%)	Yes	1	0	.21	.41
Per capita income (forth 20%)	Yes	1	0	.20	.40
Per capita Income (richest 20%)	Yes	1	0	.20	.40
Number of adults in the household	No	10	1	2.51	1.86
Number of children under 15 in the household	No	11	0	1.44	2.08
Employed	Yes	1	0	.59	.49
Severe Weather Events					
Very worried that severe weather event could cause serious harm	Yes	1	0	.46	.50
Somewhat worried that severe weather event could cause serious harm	Yes	1	0	.31	.46

VARIABLES	DUMMY VARIABLE	MAX	MIN	MEAN	STD. DEV.
Not worried that severe weather event could cause serious harm	Yes	1	0	.23	.42
Did not experience harm from severe weather event in the past two years	Yes	1	0	.67	.47
Personally experienced harm from severe weather event in the past two years	Yes	1	0	.10	.30
Know someone who experienced harm from severe weather event in the past two years	Yes	1	0	.19	.39
Personally experienced and know someone who experienced harm from severe weather event in the past two years	Yes	1	0	.05	.21
Have experienced a disaster in the past five years	Yes	1	0	.32	.47
National government is well-prepared to deal with a disaster	Yes	1	0	.38	.49
Local government is well-prepared to deal with a disaster	Yes	1	0	.35	.48
Country Characteristics					
GDP per capita growth rate	No	14.81	-22.97	3.10	9.09
Gender Inequality Index	No	.68	.13	.38	.15
Population growth rate	No	3.22	-1.44	.92	1.26
Gini index coefficient	No	53.40	25.70	36.75	6.37
World Risk Index	No	35.92	1.32	10.07	9.14

Empirical Model

Individual food security has a clustered, multi-level structure. It is influenced by individual and household characteristics, broader socio-economic factors, community resources, and national policies. Ignoring these multi-level relationships could potentially lead to correlated error terms violating the assumptions of ordinary least squares (OLS), potentially resulting in underestimated standard errors of the coefficients and overestimated statistical significance (Cameron & Trivedi, 2005; Goldstein, 2011; Garson, 2013).

The study, therefore, employed a linear mixed effects model (LMM) to incorporate both individual-level and country-level variables. This type of model captures both fixed effects of individual-level predictors and random effects of country-level variability, allowing for the estimation of coefficients that represent not only the average effect expected across the entire dataset but also account for variations across different levels within the data hierarchy (Garson, 2013).

$$Y_{ic} = \beta X_{ic} + \alpha S'_{ic} + \gamma Z'_c + v_i + \varepsilon_{ic}$$

where Y_{ic} is the probability for an individual to be moderate or severe food insecure and i and c are indices for individuals and countries. X_{ic} consists of demographic characteristics, S'_{ic}

consists of severe weather events variables, Z'_c consists of country characteristics. v_i is the random effect at the country level, ε_{ic} represents the unobserved individual heterogeneity. We assume that the two error terms are independent from each other and that they are distributed as Gaussian with means of zero.

The use of the mixed effects model is justified by the likelihood ratio test compared to a linear model ($p < 0.01$). The test results indicate that the mixed effects model provides a significantly better fit to the data than a simpler linear regression model that assumes independence of observations and ignores the grouping structure within the data. In addition, the significant variance for the random intercepts across the country grouping suggests substantial differences in the baseline levels of food insecurity across countries that are not captured by the observed variables alone and justifies the use of a mixed effects model that allows for the incorporation of random effects.

Results

Difference in means t-tests were conducted to determine if significant gender differences exist among the variables included in the study. As shown in **Table 2**, females in our sample are slightly more likely to experience moderate or severe food insecurity than males in our

sample (1.3 percent more), but this difference is statistically significant. There are several other statistically significant characteristics between male and females in our sample: females are significantly more likely to have only an elementary school education or less, statistically more likely to belong to the poorest 20% and less likely to belong to the richest 20% based household income per capita, and less

likely to be employed, with only 50% of females employed compared to 69% of males. Regarding perceptions and experiences of severe weather events, females are more likely to report being very concerned about the harm caused by such events. However, they are less likely to report having experienced severe weather events in the past two years or having experienced a disaster in the past five years.

TABLE 2. DIFFERENCE IN MEANS FOR FEMALES AND MALES

VARIABLES	MEAN (FEMALES)	MEAN (MALES)	DIFFERENCE IN MEANS
Food Insecurity			
Probability of moderate or severe food insecurity	58.98	57.70	1.282* (.76)
Demographic Characteristics			
Age	40.89	40.74	.146 (.31)
Elementary school or less	.37	.32	.043*** (.01)
Secondary education	.48	.52	-.045*** (.01)
College education	.16	.15	.002 (.01)
Urban	.006	.007	-.00058 (.009)
Per capita income (poorest 20%)	.21	.18	.030*** (.008)
Per capita income (second 20%)	.21	.19	.0175** (.008)
Per capita income (middle 20%)	.22	.20	.0170** (.008)
Per capita income (forth 20%)	.20	.20	.0027 (.008)
Per capita Income (richest 20%)	.16	.23	-.067*** (.008)
Number of adults in the household	2.34	2.70	-.357*** (.035)
Number of children under 15 in the household	1.33	1.56	-.234*** (.039)
Employed	.51	.69	-.180*** (.009)
Severe Weather Events			
Very worried that severe weather event could cause serious harm	.50	.42	.078*** (.009)
Somewhat worried that severe weather event could cause serious harm	.30	.31	-.015* (.009)
Not worried that severe weather event could cause serious harm	.20	.27	-.064*** (.008)
Did not experience harm from severe weather event in the past two years	.69	.65	.041*** (.009)
Personally experienced harm from severe weather event in the past two years	.09	.11	-.013** (.006)
Know someone who experienced harm from severe weather event in the past two years	.18	.20	-.020*** (.007)
Personally experienced and know someone who experienced harm from severe weather event in the past two years	.04	.05	-.007* (.004)

VARIABLES	MEAN (FEMALES)	MEAN (MALES)	DIFFERENCE IN MEANS
Have experienced a disaster in the past five years	.31	.33	-.021** (.009)
National government is well-prepared to deal with a disaster	.38	.38	-.003 (.009)
Local government is well-prepared to deal with a disaster	.35	.35	-.004 (.009)
Country Characteristics			
GDP per capita growth rate	4.16	1.93	-2.237*** (.172)
Gender Inequality Index	.37	.39	-.027*** (.003)
Population growth rate	.84	1.01	-.178*** (.024)
Gini index coefficient	37.11	36.35	.753*** (.121)
World Risk Index	10.22	9.91	.314* (.174)

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

Table 3 below reports the determinants of moderate or severe food insecurity using linear mixed effects model. The first column represents the model without the interaction between the high Gini index coefficient and GDP per capita growth rate for all participants; the second column includes the interaction. The third and fourth columns present the results for female respondents only, without and with the high Gini and GDP per capita growth rate interaction term, respectively. The fifth and sixth columns present the results for male respondents only, without and with the high Gini and GDP per capita growth rate interaction term, respectively.

People in the poorest income bracket are 21 percentage points more likely to be food insecure than people in the richest income bracket.

Individual and Household level determinants of food insecurity. Results from columns 1 and 2 show that individuals who are aged between 30 and 64, have lower educational attainment, live in urban areas, have lower household per capita income, have fewer adults and more children in their household, and are unemployed are more likely to be food insecure.¹

¹ Age groups in this sample included: 15-29 years old; 30-49; 50-64; 65+

Smith et al. (2017a) and Smith et al. (2017b) found that the likelihood of experiencing food insecurity and severe food insecurity seem to increase with age but it appears to stabilize or decrease in old age. Having a secondary education and a college education are associated with 8 and 15 percentage points less food insecurity risk respectively, compared to those with primary education for both male and female. The pathways linking education to food insecurity are likely through access to skilled employment and livelihoods, and increased income. Per capita income is a major determinant, with the likelihood of being food insecure being less and less as per capita income tier increases, with up to 21 percentage points difference in the likelihood of being food insecure between the 20% richest in per capita income versus the bottom 20%, holding all other variables constant. These results are consistent with a worldwide study by Smith, Rabbitt, and Coleman-Jensen (2017b) that also found low household income, low education level, and unemployment to be linked to higher risk of food insecurity, irrespective of the country's income level classification. Notably, the number of children in the household is correlated to higher likelihood of food insecurity for females but not for males, which suggests that women eat less and/or eat after men when there's a food shortage at home. Smith et al. ((2017a) also found similar results that having more children appears to increase food insecurity among women in Latin America.

Having more children at home means **women eat less**, but doesn't impact how much men eat.



Gender and food insecurity. While women are significantly more likely to experience moderate or severe food insecurity than men based on the difference in means results (see Table 2), being female is not a statistically significant factor of food insecurity, when controlling for socio-economic characteristics, exposure to severe weather events, and country variables. In other words, women are not intrinsically more food insecure than men.

Women are not intrinsically more food insecure than men—structural inequality puts women at risk in many ways, including hunger.”

Because women are more likely to have only an elementary education or less, more likely to belong to the poorest 20% in terms of per capita income, less likely to belong to the richest 20%, and less likely to be employed, they are more likely to experience moderate or severe food insecurity than their counterparts. In other words, when women have the same education level, employment status, income level, and other socio-economic characteristics linked to food security as men, the probability that they experience moderate or severe food insecurity is the same as men.

The results are consistent with the findings of the research conducted by Brunelli et al. (2014), which showed that being female is associated with food insecurity when not controlling for other variable. However, this association becomes insignificant after controlling for socio-economic variables using FIES data in Malawi.

Gender and income inequality, economic growth and food insecurity

Gender Inequality. In all the model specifications, as gender inequality increases, the likelihood of individual food insecurity increases. This is

true even for the male sample only in Column 5, indicating that the higher the gender inequality in a country, the higher the likelihood that not only women, but men are more food insecure. Hypothetically, if a perfectly gender-unequal country becomes perfectly gender-equal, we could expect the probability of moderate or severe food insecurity for either females or males to decrease by 43 percentage points, with all other factors held constant (see Column 2).

In our sampled countries, the lowest GII is in Serbia at 0.13, and the highest GII is in Afghanistan at 0.68. Based on model 2, this means that an individual from Afghanistan is 24 percentage points more likely to be food insecure than an individual from Serbia, holding all other factors constant. These results suggest that gender inequality negatively and significantly impacts everyone's food security.

The pathways to this may be due to women's central role in food systems in developing countries both as primary producers of food and as primary caretakers of the household (Visser and Wangyu, 2021). While men are primarily focused in the production of cash crops, women in LMIC's often manage the production of food crops, which are more directly linked to household food security (Garcia, 2013) Women around the world are also main caretakers and primary food providers in their households, and tend to allot a higher proportion of their income on food and health expenses for their household (e.g. Quisumbing et al., 1996).

Visser and Wangyu (2021) argued that food systems policies and practices require a stronger gender lens as women are critical to agriculture and food systems' sustainability and resilience and these findings provide empirical support to this contention.

Income Inequality and Economic Growth. Model 1 (column 1) shows that the higher the GDP per capita growth rate in a country, the higher the probability of moderate or severe food insecurity, but this significant association disappears in Model 2 (column 2) with the introduction of the interaction variable between high gini and GDP per capita growth rate.

Instead, we see that the GDP growth rate is not statistically significant across all countries. However, for individuals living in highly unequal countries with a growing economy, the likelihood of food insecurity increases (compared to individuals living in more economically equitable countries). These results suggest that a growing economy doesn't improve individual food security and it may even make it worse when there's high income inequality.

These results hold when considering only females (see column 4) or only males (column 6). These results are consistent with other research which found that economic growth is not enough, and it may even exacerbate food insecurity if economic inequality exists because the benefits of economic growth are not evenly distributed across the population (Holleman & Conti, 2020; Santos et al., 2023).

TABLE 3. DETERMINANTS OF MODERATE OR SEVERE FOOD INSECURITY IN LMICS

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	ALL PARTICIPANTS		FEMALES		MALES	
Demographic Characteristics						
Female	0.11 (0.71)	0.09 (0.71)				
Age 30-49	2.06** (0.85)	2.06** (0.85)	1.64 (1.16)	1.65 (1.16)	2.78** (1.25)	2.78** (1.25)
Age 50-64	2.05** (1.03)	2.06** (1.03)	2.53* (1.43)	2.56* (1.43)	1.67 (1.51)	1.66 (1.51)
Age 65+	-1.74 (1.33)	-1.73 (1.33)	-0.99 (1.85)	-0.96 (1.85)	-2.62 (1.93)	-2.61 (1.93)
Secondary education	-7.91*** (0.87)	-7.93*** (0.86)	-8.08*** (1.21)	-8.13*** (1.21)	-7.58*** (1.24)	-7.60*** (1.24)
College education	-15.14*** (1.21)	-15.14*** (1.21)	-15.55*** (1.72)	-15.58*** (1.71)	-14.74*** (1.73)	-14.73*** (1.73)
Urban	2.12*** (0.75)	2.13*** (0.75)	1.19 (1.03)	1.22 (1.03)	3.13*** (1.09)	3.16*** (1.09)
Per capita income (second 20%)	-3.69*** (1.07)	-3.69*** (1.07)	-3.59** (1.44)	-3.61** (1.44)	-3.91** (1.62)	-3.90** (1.62)
Per capita income (middle 20%)	-9.85*** (1.08)	-9.85*** (1.08)	-9.85*** (1.44)	-9.86*** (1.44)	-10.10*** (1.62)	-10.08*** (1.62)
Per capita income (forth 20%)	-14.14*** (1.11)	-14.14*** (1.11)	-14.02*** (1.49)	-14.01*** (1.49)	-14.18*** (1.65)	-14.18*** (1.65)
Per capita Income (richest 20%)	-21.06*** (1.16)	-21.04*** (1.16)	-20.78*** (1.63)	-20.74*** (1.63)	-21.12*** (1.68)	-21.11*** (1.68)
Number of adults in the household	-1.53*** (0.24)	-1.53*** (0.24)	-1.33*** (0.35)	-1.33*** (0.35)	-1.58*** (0.34)	-1.59*** (0.34)
Number of children under 15 in the household	0.49* (0.28)	0.51* (0.28)	0.67* (0.41)	0.71* (0.40)	0.54 (0.37)	0.57 (0.37)
Employed	-2.57*** (0.75)	-2.55*** (0.75)	-1.55 (1.01)	-1.51 (1.01)	-4.02*** (1.14)	-4.00*** (1.14)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	ALL PARTICIPANTS		FEMALES		MALES	
Severe Weather Events						
Very worried that severe weather event could cause serious harm	7.02*** (0.94)	7.03*** (0.94)	7.76*** (1.32)	7.79*** (1.32)	6.17*** (1.33)	6.17*** (1.33)
Somewhat worried that severe weather event could cause serious harm	2.45** (0.96)	2.44** (0.96)	2.97** (1.38)	2.96** (1.38)	1.89 (1.34)	1.89 (1.34)
Personally experienced harm from severe weather event in the past two years	6.65*** (1.25)	6.63*** (1.25)	5.83*** (1.75)	5.79*** (1.75)	7.38*** (1.78)	7.33*** (1.78)
Know someone who experienced harm from severe weather event in the past two years	4.92*** (0.93)	4.91*** (0.93)	2.67** (1.29)	2.66** (1.29)	7.03*** (1.34)	7.01*** (1.34)
Personally experienced and know someone who experienced harm from severe weather event in the past two years	8.34*** (1.72)	8.36*** (1.71)	8.02*** (2.44)	8.05*** (2.44)	8.65*** (2.41)	8.67*** (2.41)
Have experienced a disaster in the past five years	4.29*** (0.81)	4.31*** (0.81)	3.14*** (1.12)	3.17*** (1.12)	5.26*** (1.17)	5.29*** (1.17)
National government is well-prepared to deal with a disaster	-3.80*** (0.95)	-3.78*** (0.95)	-4.65*** (1.31)	-4.62*** (1.31)	-2.58* (1.39)	-2.55* (1.39)
Local government is well-prepared to deal with a disaster	-1.09 (0.96)	-1.06 (0.96)	1.38 (1.31)	1.42 (1.31)	-3.81*** (1.40)	-3.75*** (1.40)
Country Characteristics						
GDP per capita growth rate	0.48* (0.27)	0.25 (0.28)	0.39 (0.28)	0.13 (0.28)	0.58** (0.29)	0.37 (0.30)
Gender Inequality Index	51.41** (21.30)	43.22** (20.17)	50.65** (21.84)	41.84** (20.43)	51.54** (22.77)	44.07** (22.01)
Population growth rate	4.04* (2.13)	4.94** (2.03)	3.71* (2.19)	4.62** (2.05)	4.33* (2.29)	5.15** (2.22)
Gini index coefficient	0.01 (0.29)	-0.28 (0.30)	0.20 (0.30)	-0.11 (0.30)	-0.18 (0.31)	-0.44 (0.33)
World Risk Index	-0.10 (0.20)	-0.18 (0.19)	-0.19 (0.20)	-0.27 (0.19)	-0.02 (0.21)	-0.09 (0.20)
High Gini index X GDP per capita growth rate		0.99** (0.47)		1.08** (0.48)		0.92* (0.51)
cons	47.85*** (10.32)	58.56*** (10.88)	41.48*** (10.68)	52.99*** (11.10)	53.82*** (11.11)	63.66*** (11.92)
Random Intercept Variance for Country	56.22 (15.97)	48.05 (13.78)	56.01 (16.70)	46.08 (14.11)	60.24 (18.28)	53.45 (16.39)
Residual Variance	1253.26 (16.86)	1253.26 (16.86)	1244.06 (23.11)	1244.09 (23.11)	1253.59 (24.53)	1253.56 (24.53)
Log Likelihood	-55256.72	-	-	-	-	-
		-55254.66	-29046.99	-29044.65	-26211.81	-26210.28
Number of Observations	11,075	11,075	5,824	5,824	5,251	5,251
Number of Countries	28	28	28	28	28	28

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



A 40-year-old man, with secondary education, employed, middle income, and living in a rural area with his wife and one child. He has personally experienced a disaster in the past five years, and he is very worried about severe weather events.

**GINI
& GII**

**Food Insecurity
Probability**

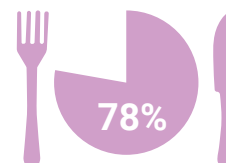
If he lives in Honduras – which has high income inequality with a Gini¹ of 48.2 and high gender inequality with a GII² of 0.431 – his probability of moderate or severe food insecurity is 87%. In the words of one man in Honduras, **“You no longer eat what you want, but what you can.”**

**GINI 48.2
GII 0.431**



Moving to a place with better gender equality, although still high, would increase his chances of getting the food he needs. If he lives in Brazil (high income inequality with a Gini of 53.4, high gender inequality with a GII of 0.39), his probability of moderate or severe food insecurity is 78%. **That’s true even though income inequality is higher in his new context.**

**GINI 53.4
GII 0.39**



Going to a place that has better gender equality and better income equality is the best outcome of all. If the same man lives in Albania – which has a relatively low income inequality with a Gini of 33.2 and low gender inequality with a GII of 0.144 – **his probability of moderate or severe food insecurity is 55%.**

**GINI 33.2
GII 0.144**



¹ The Gini Index is a measure of income inequality within a country. <https://data.worldbank.org/indicator/SI.POV.GINI?skipRedirect=true&view=map>

² Gender Inequality Index <https://hdr.undp.org/data-center/thematic-composite-indices/gender-inequality-index#/indicies/GII>

Severe weather events, preparedness, and food insecurity

Individuals who personally experienced and/or know someone who experienced harm from severe weather events in the past two years are more likely to be food insecure than those who have not. Similarly, those who experienced a disaster in the past five years are more likely to be food insecure compared to those who have not.

The drop in food security due to a severe weather shock lasts for up to 5 years after the shock.

These variables are statistically significant across all 6 models. These results seem to suggest that the road to recovery from disasters is long and years after the event, individuals—women and men alike—could still be food insecure. This suggests that on top of the immediate effects on health and safety, there are long term negative effects on food security. Even those who expressed being very worried that severe weather events could cause serious harm are more likely to be food insecure across all models while being somewhat worried is also associated with food insecurity across the pooled and all female models. Worrying about the serious harm from extreme weather events is likely a proxy for individual’s vulnerability such as their perceived exposure to disasters and their perceived lack of disaster preparedness, planning, coping and adaptation.

Interestingly, females in this data were statistically more likely to express being very worried about the harm caused by extreme weather events even though they were statistically less likely to report having experienced severe weather events in two years or disasters in the past 5 years.

Across the board, individuals who expressed that the national government is well-prepared to deal with a disaster are less likely to be food insecure than those who didn’t believe their national governments were disaster ready. This direct link between individual food security and national disaster preparedness has potentially significant policy implications. Furthermore, countries that



have contributed the most to climate change are both the least impacted and the most capable of adaptation (Bruckner *et al.*, 2022), suggesting further transboundary and global equity and justice implications.

Belief that their local government is well prepared to deal with a disaster did not turn out to be statistically significant except on the all-male regression models.

This suggests that local government disaster preparedness only prioritizes men and could be marginalizing women, leading to a null positive impact on food security overall.

Limitations

First, these results cannot claim causality because we do not attempt to correct for the potential endogeneity of the determinants of individual food insecurity. However, the findings demonstrate strong linkages between these individual, household, and country variables and food insecurity and the results – they are robust to various model specifications and consistent with studies that explored the same questions.

Second, the analyses are limited to countries and individuals where we can match FIES data and World Risk Poll data from the Gallup World Poll. Similarly, the variables we can utilize are limited to those in these datasets, limiting our ability to test additional variables that can influence food insecurity.

Closing the gender gap in food systems, education, livelihoods, and income not only **reduces the gender food gap, but also **directly decreases food insecurity for all.****



Implications of this research

Gender Inequality

These findings support the large body of evidence that addressing structural inequality will ultimately lead to millions of women and girls being more food insecure. When we close the gaps in income, education, and livelihood opportunities, and address prohibitive social norms women face, we also mitigate the heightened risk of food insecurity they experience.

Closing the gender gap would contribute to billions to the global economy and feed millions more people – men, women, boys and girls.

Income inequality

Despite a steady decline in global poverty since 1990, the Global Report on Food Crises (2024) reported millions more people are facing the worst forms of starvation today than there have

been in this report's 8-year history. According to the report, an additional 23.8 million people faced high levels of acute food insecurity between 2022 and 2023 (WFP, 2024). This suggests that growing GDP and increasing average incomes is simply not enough. Yet, the prevailing narrative to drive economic growth remains in place. Santos et al. (2023) found that economic growth has an adverse impact on food security, especially post pandemic, while gender inequality and income inequality are consistent drivers of the prevalence of food insecurity in a country. These findings show the same dynamics at the individual level and add to the understudied linkages between food insecurity and economic inequality. Development actors need to double efforts to advocate for equity-sensitive policies and actions.

Overall, these suggest that applying a rights-based approach to policies and programs is not only the moral approach but a highly effective and lasting approach to development.

For development and humanitarian practitioners, the findings add to evidence that consistent **determinants** of individual food insecurity are: low levels of education, low individual/household income, and unemployment. While not tested in these findings, other literature also found weak social networks and less social capital as consistent determinants of food insecurity (e.g. Smith et al. (2017b)). All these factors often intersect with gender and correlate to being a woman in many settings. In addition, these findings suggest that in a household with more children, women are more likely to be food insecure but the same is not true for men, likely due to existing gender norms that women eat less and after men when there's a food crisis (Silva et al., 2023).

Solving food insecurity in the long run means looking into other areas such as education, economic empowerment, and broader economic and gender equality work, including addressing gender norms, because food insecurity is ultimately shaped by factors outside of the food system. Projects such as CARE Burundi's Win-Win Project demonstrate a better approach to implementing agricultural initiatives. Win-Win, which focused on transforming gender norms alongside livelihood skills, nutrition education, and market access (meeting CARE's criteria for a gender transformative approach), achieved significant improvements in food security and wealth. It also recorded the highest women's empowerment score, with an 84% increase from baseline to endline (Africa Centre for Gender, Social Research, and Impact Assessment, 2021). Win-Win which employed gender transformative approaches had a benefit-cost ratio of 5:1, compared to 3:1 for a version with the typical gender mainstreamed approach in the agriculture sector and 2:1 for the control group where only the livelihood activities were implemented (Africa Centre for Gender, Social Research, and Impact Assessment, 2021). This evaluation showed that while approaches that address underlying inequalities may cost more, they yield greater and more sustainable impact for women and men.

While approaches that address underlying inequalities may cost more, they yield greater and more sustainable impact for women and men.

Extreme weather events and disasters

Our findings show a direct relationship between food insecurity and extreme weather events and disasters. More importantly, those effects are not solely immediate, but can persist over the long term. As climate change exacerbates the frequency and severity of disasters and extreme weather events, the risk of both immediate hunger and chronic food insecurity escalates. On the other hand, our results also show that emergency preparedness is directly and negatively correlated with food insecurity, underscoring the significance of adaptation, emergency preparedness, and implementing sustainable recovery measures.

Emergency preparedness is directly and negatively correlated with food insecurity.

CARE's Where the Rain Falls (WtRF) program in Bangladesh, India, and Thailand from 2011 – 2020 analyzed gender roles in agriculture and created a community Gender Action Plan. Within 9 months, equal labor sharing rose from 22% to 67%, and women in WtRF groups freed up 2 to 4 hours a day, which they committed to agriculture, increasing household food security. (CARE 2023). Anticipatory Action is also gaining substantial momentum and traction among humanitarian actors to mitigate the impacts of disasters and extreme weather events. It is crucial to ensure that this emerging approach is not gender-blind and that women and vulnerable groups are engaged from the onset. In Niger, CARE's Hamzari project successfully engaged 77% of female food producers to use climate information and implement risk-reducing measures to enhance their resilience to climate change (CARE 2023). Participatory Scenario Planning at the local level—when done in an inclusive way that brings together community members, women, and young people with scientists and government officials—results in a \$4 return for every \$1 invested in planning for climate events (CARE 2015).

Considering that the results highlight the importance of national preparedness in food security while local preparedness only positively affects men but not women, this calls for empowering women to lead in times of crises and extreme weather events. There are several promising models such as CARE's Women Lead in Emergencies (WLiE) initiative, which highlights the pivotal role of women in emergency situations and that women have remarkable resilience and resourcefulness during a crisis when they are empowered. This approach centers around supporting community-based women's groups to take the lead in responding to a crises that affect them and their communities. The initiative also aims to put resources and influence in the hands of women to meaningfully lead and participate in public discussions. Savings groups are one powerful tool to promote women's public participation. 78% of women report being more engaged in public decisions

after being in savings groups. That number is 61% for savings groups alone, and 98% for savings groups that include some training and support on advocacy and leadership (Whipkey et al., 2021).

Lastly, women's rights organizations (WROs) need to be present in local and national disaster preparedness. Broadening the involvement of WRO's beyond narrowly defined agendas (e.g. involving them when it's deemed to be a "women's rights issue") is crucial for comprehensive disaster resilience. Amplifying the voices of women's rights organizations across various sectors, including health and infrastructure, governments can develop more inclusive disaster preparedness frameworks (Schneider et al., 2019).

Participatory Scenario Planning at the local level—when it's inclusive—results in a \$4 return for every \$1 invested in planning for climate events.



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