



Spatial and Regression Analyses of Climate Shocks and Household Food Insecurity in Ghana

Nkechi S. Owoo

University of Ghana

6th June 2024

Outline

- Motivation and brief review of literature
- Data and Methodology
- Results
 - Spatial and regression analyses
- Concluding remarks

Motivation and Literature Review

- Food security important for a country's human capital development through influences on health outcomes, labour force productivity and earnings, and poverty
- Unique individual, household, community, and national factors play a role in determining family's food security status
- Threats posed by climatic change and climate-related shocks e.g., floods, drought, wildfires, heatwaves, rising sea levels, among others, have ability to disrupt food systems and increase food insecurity
- How?

Motivation and Literature Review

- Affect food production directly through changes in agroecological conditions (Schmidhuber and Tubiello, 2007; Gornall et al., 2010; Fanzo et al., 2018).
- Food prices may rise with disruptions to food production, leading to increased malnourishment numbers (Reilly et al., 1996; Solaymani, 2018).
- Increase food waste as the higher temperatures lead to faster food spoilage; high humidity leads to fungal infestations on food; and floods cause toxic mold to develop on crops (Ziska et al., 2018).
- Forced migration of people from their original habitation where they engaged in food production and other economic activities, thus making them susceptible to food insecurity (Ogbo et al., 2019).

Motivation and Literature Review

- Evidence of climate change and disaster events affecting food insecurity across the continent
 - In South Africa, a drought led to rises in food prices with devastating effects on food availability for households (Drysdale et al., 2021)
 - Floods in Nigeria also saw households switching to less nutritious foods (Akukwe et al., 2020).
 - Gendered effects of climate shocks on food insecurity- in Nigeria, female-headed households experienced worse food insecurity outcomes than their male counterparts after a drought, given their lower access to farmlands and gender norms which made it difficult to seek other employment opportunities outside of their farms (Ajaero, 2017).
 - Adesete et al. (2022) and Affoh et al. (2022) used changes in greenhouse gas emissions and other climate variables in Sub-Saharan African countries and found negative effects of climate change on food security outcomes.
 - In countries in the horn of Africa (i.e., Djibouti, Ethiopia, Eritrea, Kenya, and Somalia), Bedasa and Bedemo (2022) showed that climate change led to food insecurity through reduced food availability.

Motivation and Literature Review

- Why Ghana?
 - Between 1968 and 2019, almost 100 major natural disasters have been reported in the country, with the majority happening in the past decade alone (World Bank, 2022).
 - The most common disaster is flooding
 - According to the Ghana Statistical Service's 2022 Annual Household Income and Expenditure Survey (AHIES), close to half the populations of Ghanaians (about 15.1 million people) experienced some form of food insecurity in early 2022
 - 12.3% of Ghanaians experienced severe food insecurity
 - Research on linkages between climate shocks and food security in Ghana is growing but not yet adequate.

Motivation and Literature Review

- Research evidence on Ghana?
 - General dearth in access to climate shocks data has led to small, localized explorations, with implications for wider inference (Atitsogbey et al., 2018; Atanga and Tankpa, 2021)
 - Limited nationally representative data on food insecurity indicators, crop production often used as a proxy for food security (Tetteh et al., 2022; Abdul Rahaman and Owusu Sekyere, 2017; Adu-Boahen et al., 2019).
 - One does not necessarily imply the other- a country may have low agricultural production but still be food secure if food importation is high; while another may be food insecure despite food production being high if access/distribution is inequitable.

Motivation and Literature Review

- Research Questions
 - What is the spatial nature of climate shocks and food insecurity in Ghana?
 - How are climate shocks associated with mild, moderate, and severe food insecurity in Ghana?
 - Does household poverty moderate the relationship between climate shocks and food insecurity in Ghana?

Motivation and Literature Review

- Contributions to existing studies
 - First attempt at country-wide analyses of the linkages between climate shocks and food insecurity using nationally representative data (Geocoded Disasters (GDIS) dataset + 2017 Ghana Living Standards Survey)
 - Use of (mild, moderate and severe) food security indicators rather than food production/productivity as proxies
 - Examination of moderating effects of poverty
 - Spatial analyses to present visual illustrations of food insecurity across the country, as well as explore bivariate spatial relationships in climate shocks and food insecurity across districts of the country

Data

- 2017 Ghana Living Standards Survey
 - Nationally representative survey on 14,000 households and more than 60,000 individuals.
 - Information was also collected on food insecurity, using the Food Insecurity Experience Scale (FIES)
- Data on climate shocks obtained from the Geocoded Disasters (GDIS) dataset from the International Disasters Database (EM-DAT).
 - Ten (10) or more people reported killed;
 - hundred (100) or more people reported affected;
 - there must have been a declaration of a state of emergency;
 - a call for international assistance.

	During the last 12 MONTHS:	Insecurity domains
1	Was there a time when you or others in your household <u>worried about not having enough food to eat</u> because of a lack of money or other resources?"	Mild
2	Was there a time when you or others in your household <u>were unable to eat healthy and nutritious food</u> because of a lack of money or other resources? (Yes/No)	Mild
3	Was there a time when you or others in your household <u>ate only a few kinds of foods because</u> of a lack of money or other resources? (Yes/No)	Mild
4	Was there a time when <u>you or others in your household had to skip a meal</u> because there was not enough money or other resources to get food? (Yes/No)	Moderate
5	Still thinking about the last 12 MONTHS, was there a time when <u>you or others in your household ate less than you thought you should</u> because of a lack of money or other resources? (Yes/No)	Moderate
6	Was there a time when <u>your household ran out of food</u> because of a lack of money or other resources? (Yes/No)	Moderate
7	Was there a time when <u>you or others in your household were hungry but did not eat</u> because there was not enough money or other resources for food? (Yes/No)	Severe
8	Was there a time when <u>you or others in your household went without eating for a whole day</u> because of a lack of money or other resources?	Severe

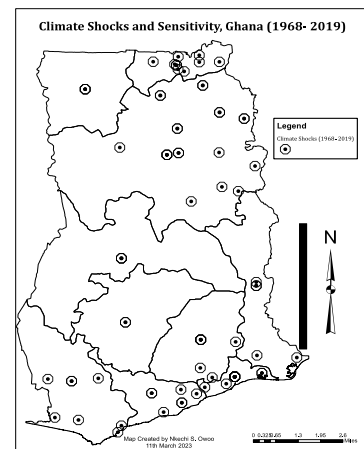
Data and Variable construction- household level

Food Insecurity

1. Weighted average of YES (=1) or NO (=0) responses for each household for each domain (mild, moderate and severe).
 - index takes a value between 0 and 1 with higher scores indicative of greater food insecurity
2. Sum up responses for different vulnerability indicators for each household for each domain
 - index takes a value from 0 (vulnerable in none of the indicators) to 3 for mild and moderate insecurity, and to 2 for severe food insecurity
3. Overall intensity (scores ranging from 0-8)

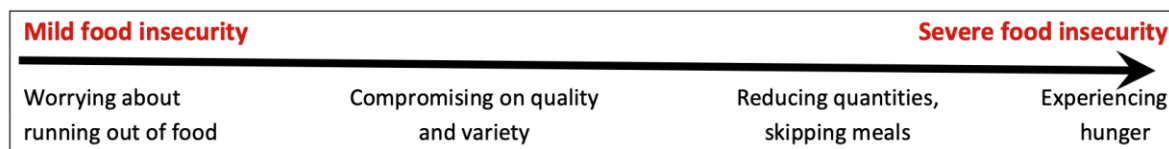
Climate Shocks

- Number of events in household members' districts in the three years preceding and including GLSS VII (Benabderrazik et al. 2022)
- Other studies used a 5-year window (Niles and Salerno, 2018)



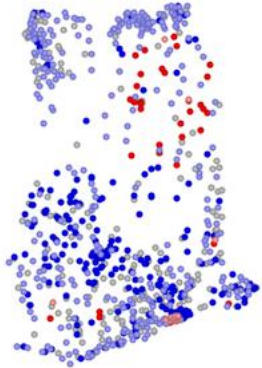
Methodological strategy

- Spatial analyses
 - Bivariate Local Indicators of Spatial Autocorrelation (LISA) to indicate the nature of the relationship between climate shocks in a neighborhood and food insecurity indicators in the same area
- Regression analyses
 - OLS regressions (average food insecurity scores/index)
 - Ordinal logit model (sum of food insecurity scores- by domain and overall)

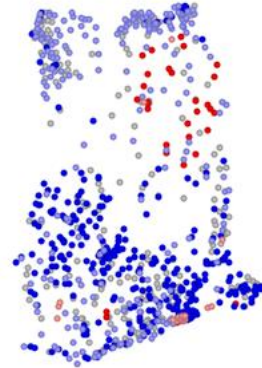


Results of Spatial analyses

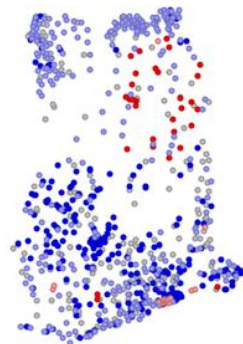
Worry about food
(mild)



Hungry but did not eat
(high)



Skip meals
(moderate)



- Using excerpts of indicators from different domains, interesting spatial patterns observed
 - positive locational relationship between climate shocks and food insecurity in Ghana (North vs. South)
 - Evidence of negative spatial autocorrelation at localized levels as well
 - Along the coast, households with shocks are in neighbourhoods with low food insecurity (pink)
 - Other households without climate shocks are located in areas with high food insecurity (purple)
 - This suggests the presence of other factors that may explain the prevalence of food insecurity in an area, beyond just spatial factors and climate shocks.

Results of Regression Analyses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Intensity of food insecurity (ordinal logit)				Average food insecurity (OLS)			
	Mild	Moderate	Severe	Overall	Mild	Moderate	Severe	Overall
Climate shocks	2.067***	1.926***	1.399***	1.756***	0.120***	0.105***	0.035***	0.093***
	(8.80)	(8.08)	(3.97)	(8.02)	(9.14)	(8.04)	(3.45)	(8.55)
All controls	YES	YES	YES	YES	YES	YES	YES	YES
N	12,674	12,666	12,666	12,674	12,674	12,666	12,666	12,674

Controls- gender and age of household head, education, religion, household size, employment status, farm, fishing and livestock rearing activity, household poverty, rural/urban location, regions of residence

Odds ratios reported for ordinal logit regressions

t statistics in parentheses: * p<0.10, ** p<0.05, *** p<0.01

Robust standard errors reported

Results of Regression Analyses (Moderation analyses)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Intensity of food insecurity (ordinal logit)				Average food insecurity (OLS)			
	Mild	Moderate	Severe	All	Mild	Moderate	Severe	All
Climate shocks	2.138*** (8.57)	2.132*** (8.40)	1.586*** (4.55)	2.021*** (8.70)	0.141*** (9.23)	0.122*** (8.25)	0.037*** (3.45)	0.108*** (8.77)
Poor	1.606*** (7.83)	1.685*** (8.91)	1.443*** (5.88)	1.569*** (8.48)	0.103*** (9.13)	0.116*** (9.83)	0.056*** (5.82)	0.096*** (9.97)
Climate shocks*Poor	0.812 (-1.07)	0.642*** (-2.76)	0.717** (-2.39)	0.600*** (-3.98)	-0.089*** (-3.75)	-0.072*** (-2.83)	-0.006 (-0.23)	-0.064*** (-3.02)
All controls	YES (2.95)	YES (2.11)	YES (0.20)	YES (1.92)	YES (3.32)	YES (2.29)	YES (-0.23)	YES (2.51)
N	12,674	12,666	12,666	12,674	12,674	12,666	12,666	12,674

Controls- gender and age of household head, education, religion, household size, employment status, farm, fishing and livestock rearing activity, household poverty, rural/urban location, regions of residence

Odds ratios reported for ordinal logit regressions

t statistics in parentheses: * p<0.10, ** p<0.05, *** p<0.01

Robust standard errors reported

Summary of results

- Spatial analyses showed that food insecurity is correlated with geographical locations of climate shock events
- Controlling for other variables, this positive relationship between households' experiences of shocks and related food insecurity is still present
 - Resilience factors comprise male household headship and education.
 - Risk factors for food insecurity in Ghana include large household sizes, unemployment, involvement in fishing and farming activities, as well as poverty.
- The effects of climate shocks on poorer households' food insecurity is lower, compared to non-poor households
 - Availability of social safety nets like the LEAP programme

Thank you for your attention!

nkechi.owoo@gmail.com

nowoo@ug.edu.gh