Rainfall Shocks and Intra-Annual food Insecurity in Uganda: Insights from a High-Frequency Phone Survey

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The Pulse of Progress: Harnessing High-Frequency Survey Data for Development Research in the Polycrisis Era

Motivation

- Increase in frequency and intensity of climate change induced weather shocks with severe negative consequences for food security in Sub-Saharan Africa (Kubik and May, 2018)
- In Uganda, studies have shown changes in the starting month and length of rain seasons (Mubiru et al., 2018, Nsubuga and Rautenbach, 2018)
- These changes might increase agricultural production volatility and affect food availability, increasing food insecurity
- Household surveys conducted annually might not be able to capture the impacts of changes in starting time and length of seasons on food insecurity
- High-frequency surveys have not been exploited to analyze the impact of rainfall shocks on food insecurity

Research Question

- How do rainfall shocks affect food insecurity in Uganda across the year?
- Are there differences in impacts when shocks occur during the rainy or dry seasons?

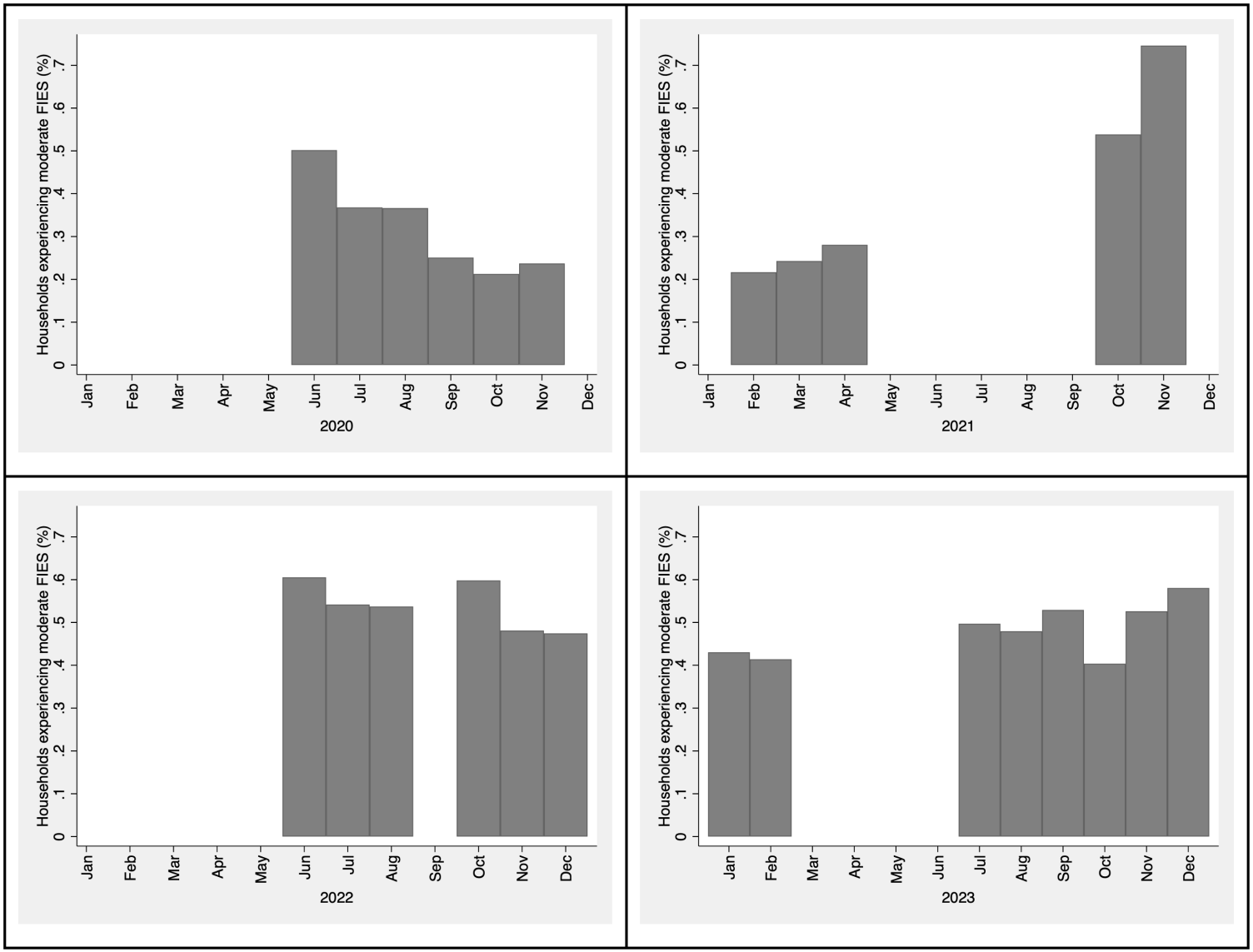
Data

- We use 17 rounds of the Ugandan High Frequency Phone Survey (HFPS) data collected between June 2020 and February 2024
- 24,215 observations and 2,475 households
- The Food Insecurity Experience Scale (FIES) is collected in all rounds
- We define two dummy household food insecurity variables: moderate and severe food insecurity, based on the FIES
- 41.7% of households in the sample experience moderate food insecurity and 20.0% experienced severe food insecurity

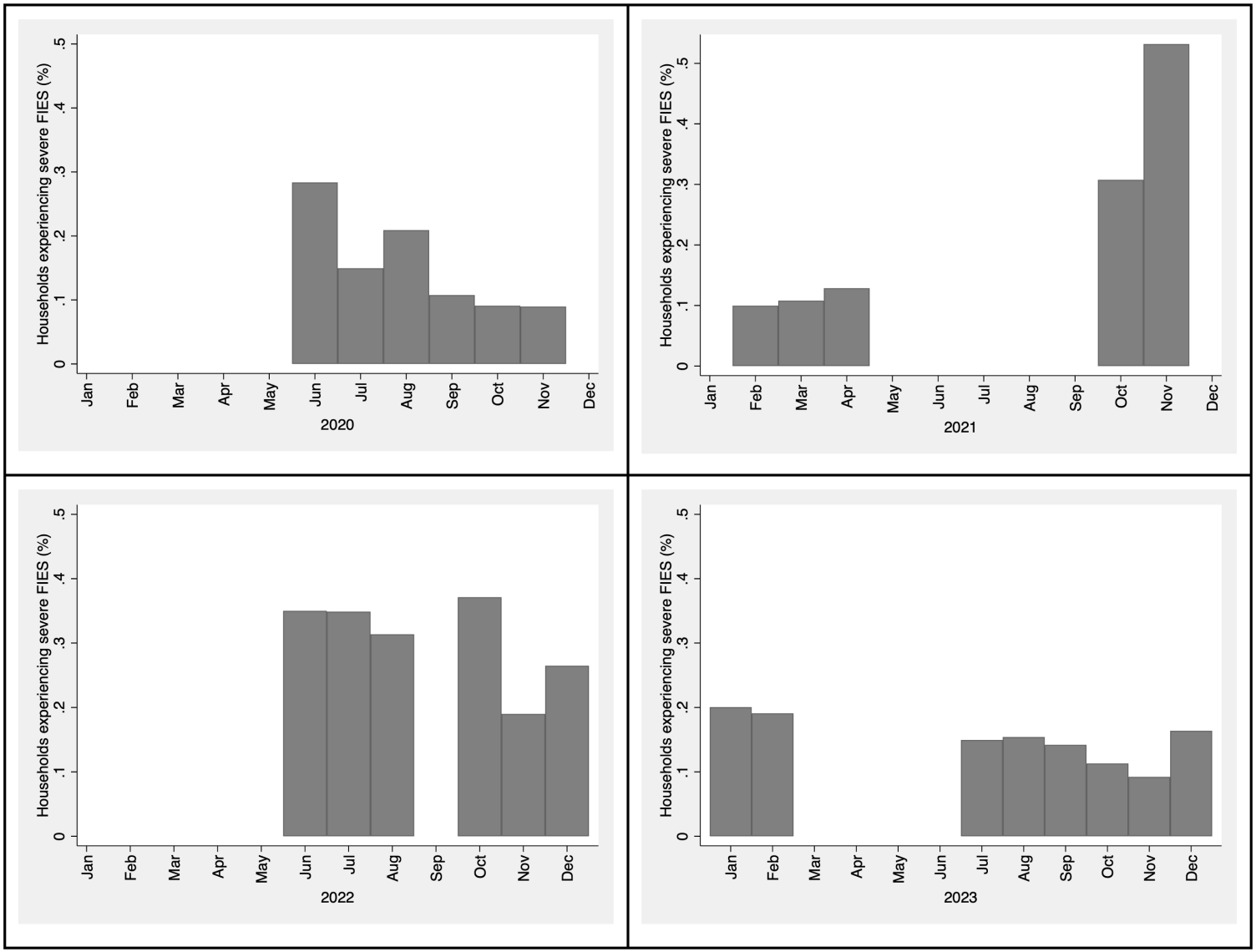
Data

- The Food Insecurity Experience Scale (FIES) consists of eight questions. Specifically, if during the last 30 days, was there a time when the respondent or others in their household:
  1. were worried about not having enough food to eat because of lack of money or other resources?
  2. were unable to eat healthy and nutritious/preferred foods because of a lack of money or other resources?
  3. ate only a few kinds of foods because of a lack of money or other resources?
  4. had to skip a meal because there was not enough money or other resources to get food?
  5. ate less than you thought you should because of a lack of money or other resources?
  6. ran out of food because of a lack of money or other resources?
  7. were hungry but did not eat because there was not enough money or other resources for food?
  8. went without eating for a whole day because of a lack of money or other resources?

Moderate FIES



Severe FIES


Households experiencing severe FIES (%)
0
.1
.2
.3
.4
.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2020
2021
2022
2023

Data

- Rainfall shocks (droughts and floods) are constructed using 0.005° resolution monthly rainfall data from the Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) (Funk et al. 2014)
- We average rainfall data at the sub-county level, weighting by sub-county area, and merge it with the HFPS's sub-county (where a household lives) for each the interview month
- Thus, we construct drought and flood dummy variables at the sub-county level
- Specifically, we construct the rainfall z-score, with respect to the long-run rainfall mean and standard deviation, for each sub-county and each month of the survey
- A drought occurs if the rainfall z-score is below -1.5 and a floor occurs if it is above 1.5

Data

- 8.7% of households experienced a flood and 6.0% experienced a drought in the month they were surveyed
- **1.5%** of households experienced a **drought** during the **traditional rainy season**, while 11.4% experienced a drought during the dry season
- **7.8%** of households experienced a **flood** during the **traditional dry season**, while 9.5% experienced a flood during the rainy season

Estimation Strategy

- Two-Way Fixed Effects (TWFE) with month-year and household fixed effects

$$Y_{it} = \alpha + \beta_1 RainfallShock_{st} + \beta_1 X_i + \gamma_i + \theta_t + \varepsilon_{it}$$

  - Y_{it} is the experience of severe (or moderate) food insecurity in the last 30 days by household i in month-year t
  - $RainfallShock_{st}$ denotes the occurrence of a drought (or a flood) in sub-county s in month-year t
  - X_i is a vector of covariates: rural, rainy season, region (Northern, Central, Eastern, and Western)
  - γ_i are the household fixed effects
  - θ_t are the month-year fixed effects
  - ε_{it} is the remaining error

Results

Drought occurrence and Severe food insecurity

	(1)	(2)
Sub-county experienced a drought in current month (=1)	-0.008	0.030
	(0.013)	(0.035)
Dry season (=1)	0.042*	0.042*
	(0.024)	(0.024)
Sub-county experienced a drought in current month and during the Dry season (=1)		-0.045
		(0.037)
R-squared	0.076	0.076
Observations	24,215	24,215
Households	2,475	2,475

Notes: All regressions include month-year and household fixed effects, standard errors clustered at the household level, and control for living in rural areas (=1) and region (Central, Eastern and Western). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results

Flood occurrence and Severe food insecurity

	(1)	(2)
Sub-county experienced a flood in current month (=1)	0.035***	0.080***
	(0.010)	(0.017)
Rainy season (=1)	-0.046*	-0.040*
	(0.024)	(0.024)
Sub-county experienced a flood in current month and during the Rainy season (=1)		-0.082***
		(0.020)
R-squared	0.076	0.077
Observations	24,215	24,215
Households	2,475	2,475

Notes: All regressions include month-year and household fixed effects, standard errors clustered at the household level, and control for living in rural areas (=1) and region (Central, Eastern and Western). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results

Drought occurrence and Moderate food insecurity

	(1)	(2)
Sub-county experienced a drought in current month (=1)	0.028*	0.114***
	(0.015)	(0.037)
Dry season (=1)	-0.079***	-0.078***
	(0.018)	(0.018)
Sub-county experienced a drought in current month and during the Dry season (=1)		-0.104**
		(0.041)
R-squared	0.102	0.103
Observations	24,215	24,215
Households	2,475	2,475

Notes: All regressions include month-year and household fixed effects, standard errors clustered at the household level, and control for living in rural areas (=1) and region (Central, Eastern and Western). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results

Flood occurrence and Moderate food insecurity

	(1)	(2)
Sub-county experienced a flood in current month (=1)	0.044***	0.080***
	(0.011)	(0.018)
Rainy season (=1)	0.069***	0.074***
	(0.018)	(0.018)
Sub-county experienced a flood in current month and during the Rainy season (=1)		-0.065***
		(0.024)
R-squared	0.103	0.103
Observations	24,215	24,215
Households	2,475	2,475

Notes: All regressions include month-year and household fixed effects, standard errors clustered at the household level, and control for living in rural areas (=1) and region (Central, Eastern and Western). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Conclusions

- Food insecurity continues to be a challenge, especially in sub-Saharan Africa. With the changing agricultural seasons, understanding intra-annual food security is critical to designing relevant interventions
- Our results suggest that if a rainfall shock occurs when it is expected (a drought during the dry season, or a flood during the rainy season), households can mitigate their impacts on food security
- But if the rainfall shocks occur outside the expected window, food insecurity seems to be more affected
- Moreover, worse levels of food security occur during floods (when they are not expected), a more common event due to global warming

Thank you!

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