

# THE IMPACT OF WEATHER ON LOCAL FOOD PRICES

## RESEARCH QUESTION

WHAT IS THE IMPACT OF INTERNATIONAL AND LOCAL VARIABLES ON FOOD PRICES IN COUNTRIES THAT SUFFER FROM FOOD INSECURITY?

### GOAL

Analyzing the non-linear relationship between weather and local food prices and other local and global variables that are behind the price formations for markets located in Africa, South Asia and Latin America

### RELEVANCE

- Food security still remains an issue in developing countries
  - ➡ Mainly a lack of access to food *due to rising food prices* that contributes to global undernutrition (FAO, 2018)
- FAO (2018): *"Climate variability and [climate] extremes are a key driver behind the recent rises in global hunger and one of the leading causes of severe food crises"*
- Importance of understanding the size and magnitude of local and global variables to advice public policies that focus, for example, on the mitigation of unfavorable weather effects

### MODEL

$$\Delta p_{it} = \mu_i + \alpha_1(p_{i,t-1} - p_{t-1}^e) + \underbrace{\beta_1 \Delta p_t^e + \beta_2 \Delta p_t^o}_{\text{External drivers}} + \underbrace{\beta_3 \Delta CPI_{it} + \beta_4 NDVI_{it} + \beta_5 \sin(\frac{2\pi t}{12})_i + \beta_6 \cos(\frac{2\pi t}{12})_i + \epsilon_{it}}_{\text{Domestic drivers}} \quad \text{if } |p_{i,t-1} - p_{t-1}^e| \geq \gamma$$

$$\Delta p_{it} = \mu_i + \alpha_2(p_{i,t-1} - p_{t-1}^e) + \beta_1' \Delta p_t^e + \beta_2' \Delta p_t^o + \beta_3' \Delta CPI_{it} + \beta_4' NDVI_{it} + \beta_5' \sin(\frac{2\pi t}{12}) + \beta_6' \cos(\frac{2\pi t}{12})_i + \epsilon_{it} \quad \text{if } |p_{i,t-1} - p_{t-1}^e| < \gamma$$

$\mu_i$ : Market fixed effects

$p_{it}$ : Logarithm of food price in market  $i$  at time  $t$

$p_t^e$ : Logarithm of external food price (either international food price or regional market food price) at time  $t$

$p_t^o$ : Logarithm of global crude oil price at time  $t$

$CPI_{it}$ : Logarithm of consumer price index of country where market  $i$  is located in at time  $t$

$NDVI_{it}$ : Normalized Difference Vegetation Index anomaly (measured at administrative level 1 or 2 where market  $i$  is located in) at time  $t$

$\cos(\frac{2\pi t}{12})_i, \sin(\frac{2\pi t}{12})_i$ : Trigonometric terms to measure seasonality in market  $i$  at time  $t$

$\gamma$ : threshold value

We allow for heterogeneity based on different market types:

Surplus – connected market	Deficit – connected market
Surplus – deficit market	Deficit – remote market

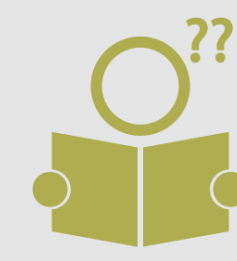
### CONTRIBUTION

#### Methodological

- Error-correction model (ECM)
  - **Threshold cointegration** to account for transaction costs
  - **Asymmetric short-run effects** in local and global variables

#### Conceptual

- Use of **Normalized Difference Vegetation Index (NDVI)**



= Satellite-derived vegetation index that combines rainfall + temperature impacts on biomass → shown to be related to crop productivity

= depends on the amount of light that is reflected in the red portion (RED) of the electromagnetic spectrum and in the near-infrared (NIR)

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

### DATA

- Monthly food prices of major crops in countries with high food insecurity (e.g. maize, wheat, sorghum, millet.) (Source: VAM (WFP))
- NDVI data (Source: VAM (WFP))
- International food prices and crude oil prices (Source: World Bank)
- Crop calendars to make harvest cycles (Source: GIEWS (FAO))
- Production and Trade Flow Maps to determine surplus and deficit markets (Source: GIEWS (FAO))
- Network Maps (road, port and railway) to determine connected and remote markets (Source: LCA)

### METHODOLOGY

- Panel unit root tests
- Selection of appropriate external market based on long-run relationship
- Testing for threshold cointegration (Balke and Fomby, 1997)
- Testing and estimation of threshold effects in short-run effects (Hansen, 1999)

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