FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION

DEPARTMENT OF ECONOMICS, GHENT UNIVERSITY

Yasmine Meerschaut & Gerdie Everaert

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 migitation of unfavorable weather effects

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 producitvity

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

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

MODEL

$$\Delta p_{it} = \mu_i + \alpha_1(p_{i,t-1} - p^e_{t-1}) + \underbrace{\beta_1 \Delta p^e_t + \beta_2 \Delta p^o_t}_{\text{External drivers}}$$

$$+ \underbrace{\beta_3 \Delta CPI_{it} + \beta_4 NDVI_{it} + \beta_5 \sin(\frac{2\pi t}{12})_i + \beta_6 \cos(\frac{2\pi t}{12})_i}_{\text{Domestic drivers}} + \epsilon_{it} \quad \text{if } |p_{it-1} - p^e_{t-1}| \geq \gamma$$

$$\Delta p_{it} = \mu_i + \alpha_2(p_{i,t-1} - p^e_{t-1}) + \beta_1' \Delta p^e_t + \beta_2' \Delta p^o_t$$

$$+ \beta_3' \Delta CPI_{it} + \beta_4' NDVI_{it} + \beta_5' \sin(\frac{2\pi t}{12}) + \beta_6' \cos(\frac{2\pi t}{12})_i + \epsilon_{it} \quad \text{if } |p_{it-1} - p^e_{t-1}| < \gamma$$

μ_i: Market fixed effects

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

p^e_t: Logarithm of external food price (either international food price or regional market food price) at time t

p^o_t: 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

γ: threshold value

We allow for heterogeneity based on different market types:

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

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)

Contact: Yasmine Meerschaut

yasmine.meerschaut@ugent.be

Universiteit Gent

@ugent

Ghent University

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