



Food and Agriculture Organization  
of the United Nations

# Food price inflation nowcasting and monitoring

**Second technical workshop on nowcasting in international  
organizations (UNIDO/CCS-UN), May 25-26, 2022**

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## Structure of the presentation

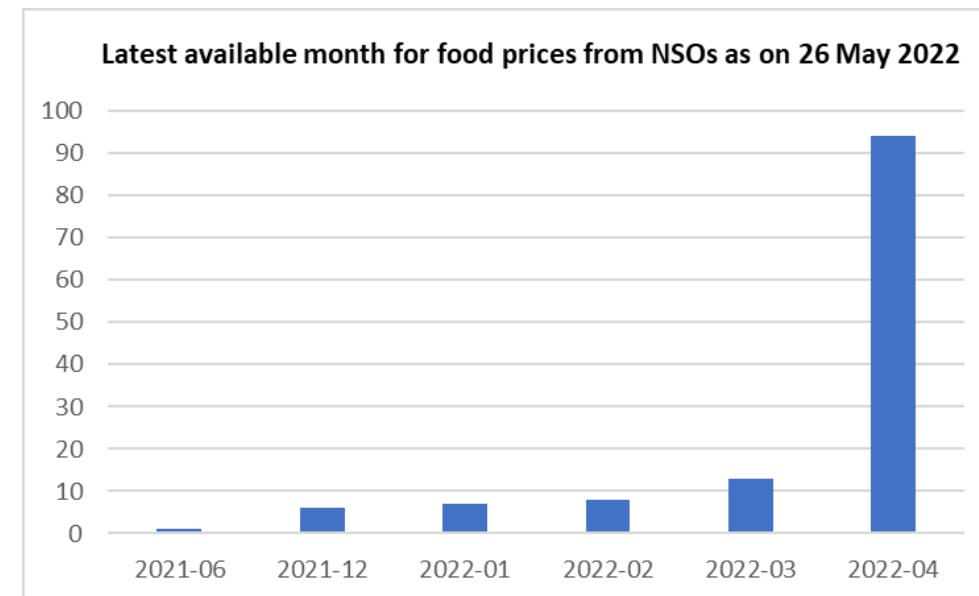
- Some context (FAO's Data Lab and why we are in this business)
- Data
- Some technicalities
- Methodology
- Overview of the dashboard
- Brief *live* demo of the dashboard
- Limitations/improvements

## FAO's Data Lab

- Created at the end of 2019 with the aim to modernise the statistical process within FAO's Statistics Division (ESS) by the use of new methodologies and data sources
- As Covid-19 appeared, **timeliness of data** as well as the capacity to **quickly and automatically draw insights from data for policy making** became an essential issue
- This has generated an increased need for timely, **possibly real-time**, information from **non-conventional sources** and its automated analysis
- Current methods adopted:
  - Scraping data from the web and literature (e.g., news articles from media outlets, data from NSOs, literature-mining for food loss and waste)
  - Text analytics (e.g., topic modelling, sentiment computation)
  - Statistical modelling (“standard” and new methodologies)
- The team is currently composed by seven people (statisticians, data scientists, IT), and it is growing

## Why we are nowcasting food prices?

- Information on food-related indicators is a crucial element for FAO (Food and Agriculture Organization)
- The Organization has a “control room” where a series of country-specific indicators (food prices included) are displayed in specific dashboards with the aim of providing a general overview of the most recent situation in a country
- FAOSTAT’s prices domain is updated every three months and usually shows some time lag as data is standardised/validated
- National Statistical Offices provide information with at least one month lag  (35 countries with info up to March, 94 up to April)
- Given that we want “current” information, we generate nowcasts to assess actual/potential trends

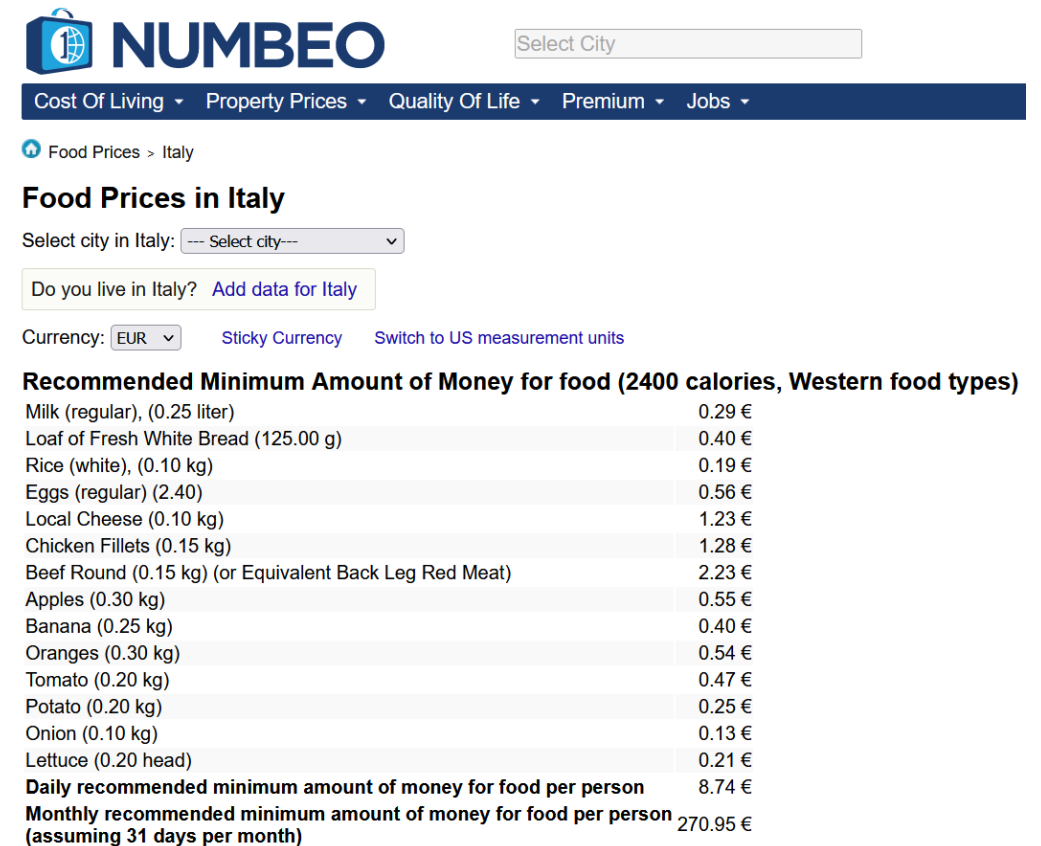


## Data

- For food price inflation we use data from FAOSTAT: <https://www.fao.org/faostat/en/#data/CP>  
(to fill recent gaps, we use *Trading Economics*: <https://tradingeconomics.com/country-list/food-inflation>)
  
- “Real-time” (or current) information we use:
  - the LCU/USD exchange rate
  - the average price of oil (Brent/WTI)
  
  - price of the 14 food items obtained from a crowdsourced database (more on this later)
  - sentiment index from Twitter (more on this later)
  
  - Period starts on April 2020 (when we started collecting prices)

## Prices from a crowdsourced database

- We use Numbeo's Food Prices dataset: <https://www.numbeo.com/food-prices/>
- It contains information on 14 commodities and are entered by users ("crowdsourced") and manually collected data from authoritative sources (websites of supermarkets, taxi company websites, governmental institutions, newspaper articles, other surveys, etc.)
- Information is available also by (main) city, but we use the national average
- Numbeo performs automatic and semi-automatic filters to remove *noise* data



**NUMBEO**

Cost Of Living ▾ Property Prices ▾ Quality Of Life ▾ Premium ▾ Jobs ▾

📍 Food Prices > Italy

**Food Prices in Italy**

Select city in Italy:

Do you live in Italy? [Add data for Italy](#)

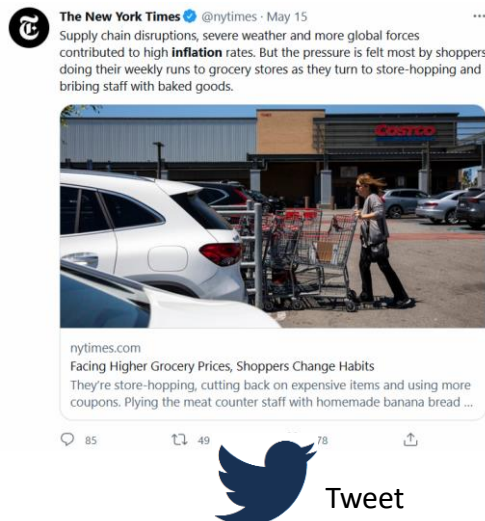
Currency:  [Sticky Currency](#) [Switch to US measurement units](#)

**Recommended Minimum Amount of Money for food (2400 calories, Western food types)**

Milk (regular), (0.25 liter)	0.29 €
Loaf of Fresh White Bread (125.00 g)	0.40 €
Rice (white), (0.10 kg)	0.19 €
Eggs (regular) (2.40)	0.56 €
Local Cheese (0.10 kg)	1.23 €
Chicken Fillets (0.15 kg)	1.28 €
Beef Round (0.15 kg) (or Equivalent Back Leg Red Meat)	2.23 €
Apples (0.30 kg)	0.55 €
Banana (0.25 kg)	0.40 €
Oranges (0.30 kg)	0.54 €
Tomato (0.20 kg)	0.47 €
Potato (0.20 kg)	0.25 €
Onion (0.10 kg)	0.13 €
Lettuce (0.20 head)	0.21 €
<b>Daily recommended minimum amount of money for food per person</b>	<b>8.74 €</b>
<b>Monthly recommended minimum amount of money for food per person (assuming 31 days per month)</b>	<b>270.95 €</b>

## Twitter sentiment index

- We collect daily all tweets posted by 504 news outlets around the world: 189 countries, almost 3 accounts on average for each country
- The links posted on each tweet get saved and the article is extracted
- Sentiment is calculated on the article as  $PW / (PW + NW) \times 100$  where  $PW$  and  $NW$  are all the positive and negative words found in the article, respectively (the index goes from 0 to 100)



### Facing Higher Grocery Prices, Shoppers Change Habits

Maria Cramer, Christine Hauser, Livia Albeck-Ripka

2 minutes

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Article

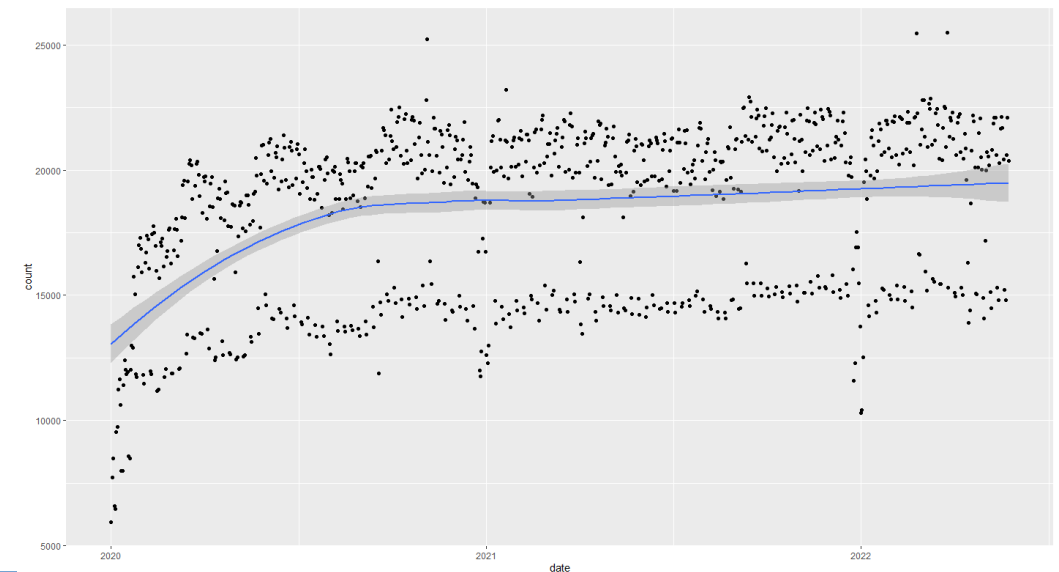
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Sentiment index

## Technicalities

- Daily cron jobs collect:
  - *Trading Economic* prices, which as of today make a PostgreSQL table of 68,595 data points for 171 countries (we take the latest data for each month)
  - Numbeo daily prices, which as of today are
  - Exchange rates, from Yahoo! Finance and PACIFIC Exchange Rate Service (<https://fx.sauder.ubc.ca/>)
  - Oil prices, from PACIFIC Exchange Rate Service
  - Tweets (and articles), which are currently nearly 16 million since Jan. 2020 of almost 20k per day; these are stored in a NoSQL database (solr), where more information is added (sentiment, topic, etc.)





## Methodology (nowcasts)

- The model is built as a fixed effects dynamic panel model:

$$\tilde{F}_{i,t} = \alpha + \beta_1 \tilde{F}_{i,t-1} + \beta_2 \tilde{P}_{i,t} + \beta_3 \tilde{E}_{i,t} + \beta_4 S_{i,t} + \delta_r \tilde{C}_t + \varepsilon_{i,t}$$

where:

- a tilde over a variable (e.g.,  $\tilde{X}$ ) indicates the monthly variation of the variable
- $\tilde{F}_{i,t}$  is the food consumer price index for country  $i$  at time  $t$
- $\tilde{P}_{i,t}$  is the average price of the 14 food items obtained from a crowdsourced database (more on this later) and aggregated by using the share of availability of the items (item  $i$  over sum of items)
- $\tilde{E}_{i,t}$  is the LCU/USD exchange rate
- $S_{i,t}$  is the Twitter sentiment index (more on this later)
- $\tilde{C}_t$  is the average crude oil price (WTI and Brent; note: this enters as region  $r$  effect)

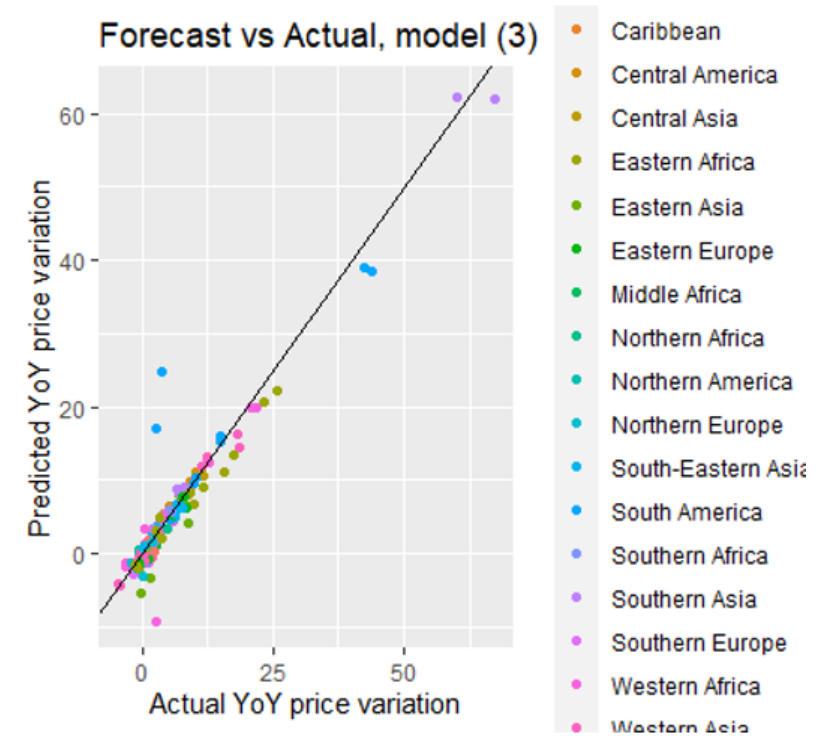
## Checks on model

- We carried out standard tests to check whether the model behaves better than benchmark models (only autoregressive): (1) country-fixed effects; (2) region-fixed effects

model	MAE	rel_1	rel_2
(1)	1.86	0.0%	19.2%
(2)	1.56	-16.1%	0.0%
(3)	1.34	-28.0%	-14.1%

results show that there is indeed some improvement (rel\_1 and rel\_2 are MAEs relative to (1) and (2) respectively; (3) is the final model)

- Comparing forecasts made by using a model for which the last 3 months were removed to actual values indicate that there is a relatively good match of forecasts



## Methodology (food prices acceleration; by Luís Silva e Silva)

- The methodology is adapted from Baquedano (2015) “Developing a price warning indicator as an early warning tool - a compound growth approach”: <https://www.fao.org/giews/food-prices/research/detail/en/c/235685/>
- The idea is to compute a “normal” growth rate for prices and then check whether current growth deviates from it
- What “normal” inflation means is a 30-day compound growth:

$$CGR_t = \left( \frac{P_{t_n}}{P_{t_0}} \right)^{1/(t_n - t_0)} - 1$$

- This is then standardised (see box) and deviations define whether there are abnormal variations:

- **Regular:** less than 0.5 standard-deviation
- **Moderate:** between 0.5 and 1.0 standard-deviation
- **Watch:** between 1 and 2.5 standard-deviation
- **High:** greater than 2.5 standard-deviation

$$CGR_t^z = \frac{CGR_t - \widetilde{CGR}_{t_0;t_n}}{\tilde{\sigma}_{CGR_{t_0;t_n}}}$$

$$\tilde{\sigma}_{CGR_{t_0;t_n}} = 1.486 \times MAD$$

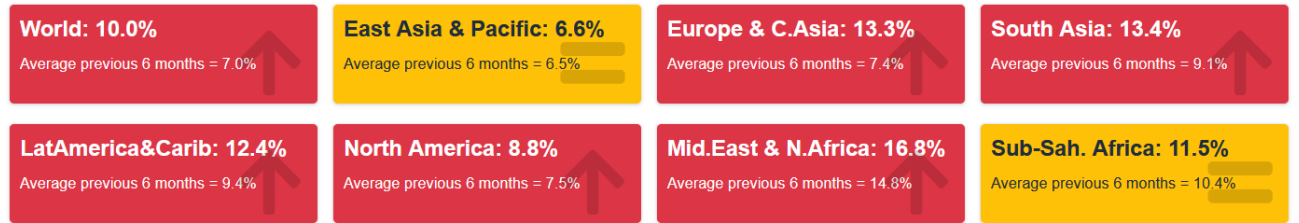
## Online application (nowcasting)

Regional aggregation of food inflation →

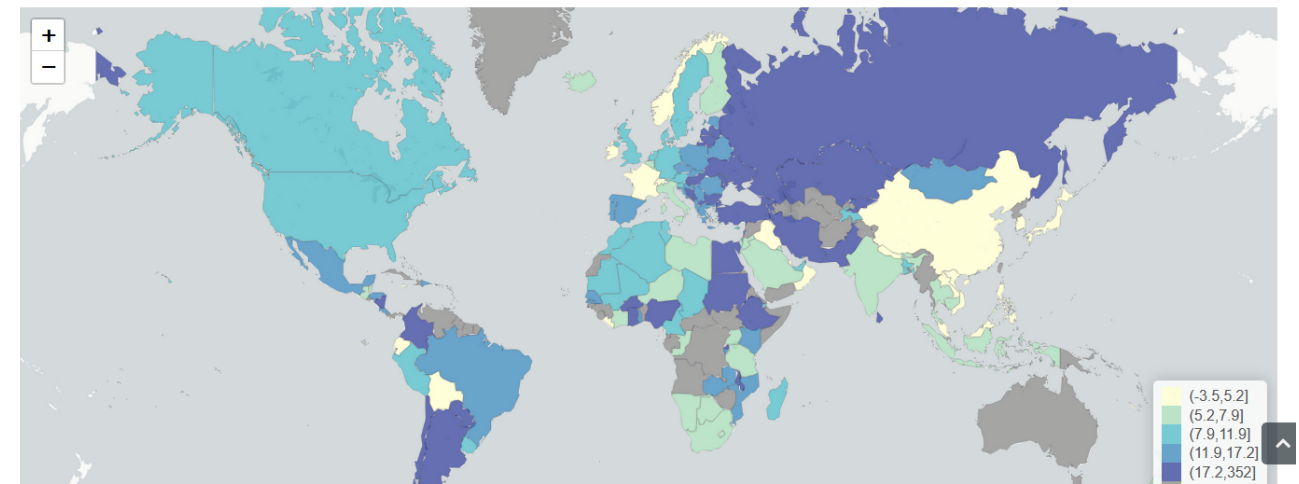
Interactive map with nowcasts →

Table with details →

Regional Food Consumer Price Index average variations



Expected Year-over-Year Food Prices Variations Map

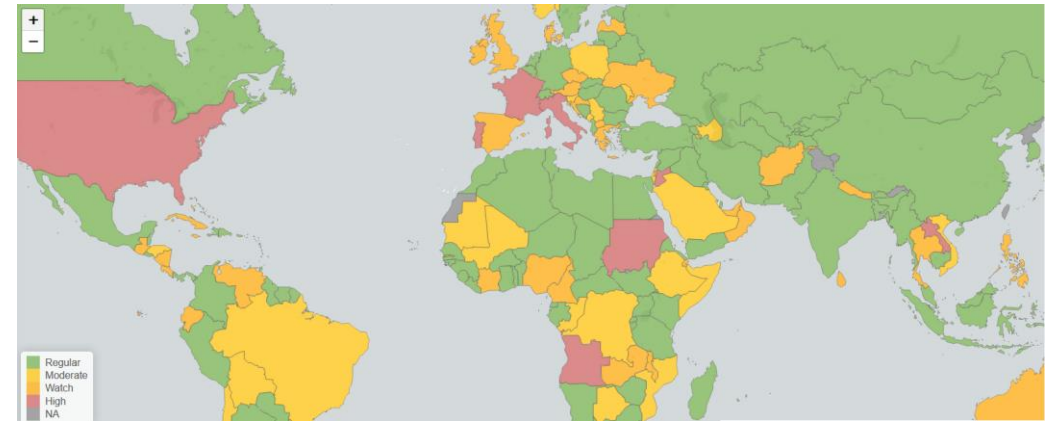


Country	Region	Nowcasts			Moving mean
		point	lower	upper	
Albania	Europe & Central Asia	14.27	14.10	14.44	7.37
Algeria	Middle East & North Africa	8.53	7.12	9.95	8.57
Antigua and Barbuda	Latin America & Caribbean	7.92	6.72	9.13	6.55
Argentina	Latin America & Caribbean	63.13	62.78	63.49	54.82
Armenia	Europe & Central Asia	18.30	18.10	18.50	13.42
Aruba	Latin America & Caribbean	7.52	6.81	8.25	5.64
Austria	Europe & Central Asia	9.38	9.20	9.56	4.45
Bahrain	Middle East & North Africa	10.39	9.77	11.00	7.19
Bangladesh	South Asia	11.24	11.07	11.42	5.87
Barbados	Latin America & Caribbean	9.16	6.37	12.02	2.81

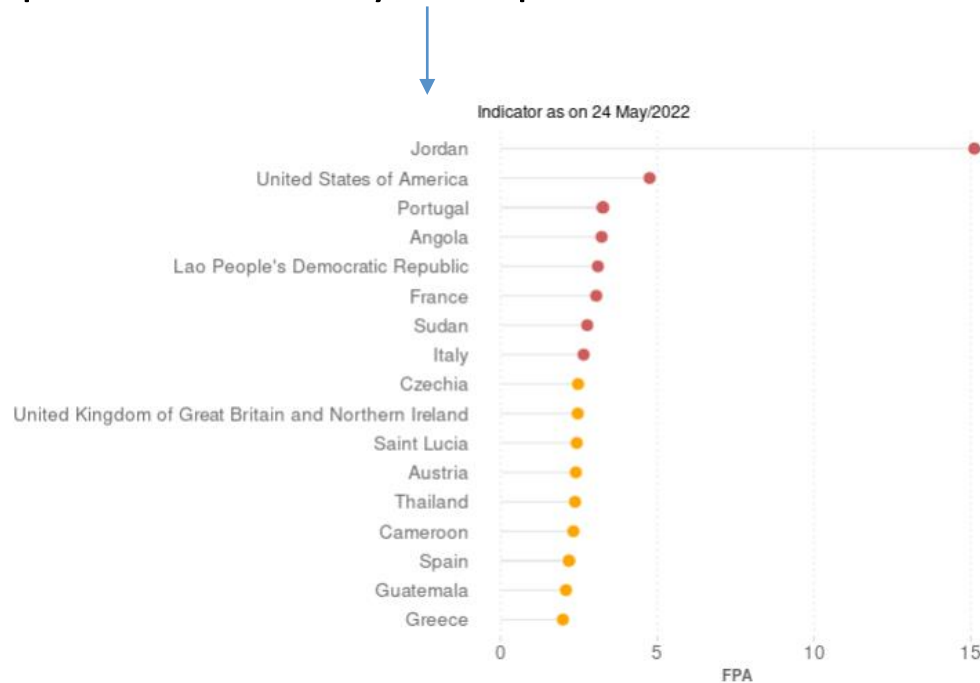
(clicking on maps/table shows more info)

## Online application (food prices acceleration)

Interactive map with food price acceleration →



Top 20 countries by food prices acceleration ↓



All data →

	Country	FPA	FPA Label
1	Aruba	0.00	Regular
2	Afghanistan	1.89	Watch
3	Angola	3.22	High
4	Aland Islands	0.00	Regular
5	Albania	-0.05	Regular
6	Andorra	0.00	Regular
7	United Arab Emirates	1.97	Watch
8	Argentina	-0.43	Regular
9	Armenia	-1.43	Regular
10	French Southern Territories	0.00	Regular

Showing 1 to 10 of 217 entries

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## The two methods are available in a public dashboard

- From FAO's Data Lab website:

<https://www.fao.org/datalab/website/web/food-prices>

- Or directly from the Shiny server:

[https://foodandagricultureorganization.shinyapps.io/dl\\_foodprices/](https://foodandagricultureorganization.shinyapps.io/dl_foodprices/)

(the former contains an iframe to the latter)

- They are updated daily by nightly cron jobs
- The output in the dashboard is in the process of being shared with the control room by means of API calls to the server and are integrated into “cards” in country-specific pages

## Limitations (to see possible improvements)

- Modeling:
  - For nowcasts, we are currently using a relatively standard, or traditional, model, and thus not exploiting new methodological advances in the field (though, sometimes simple is good)
- Numbeo:
  - The methodology to “filter out noise data” is not available (though, we use either the monthly average or a smoothed version of the daily index)
  - Crowdsourced prices may reflect more urban (or, eventually, touristic) areas, thus may not be representative of more rural countries (where internet access is lower)
  - For a similar reason, prices for countries with conflicts or natural catastrophes may be biased
- Twitter sentiment:
  - A somehow basic approach to extract sentiment (we are reviewing it)
  - It uses a general-use dictionary; we may need to use a domain-specific dictionary (we are on it)

Thanks!

<https://www.fao.org/datalab>

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