#### **Project Brief**

# Analyzing Food Price Dynamics and Affordability: A Case Study of the World Food Programme Price Monitoring

Using the WFP food price database to investigate how price and affordability of staple foods change across countries over time and their relationship with a country's economic development, share of undernourished populations, and food availability.

#### **Motivation:**

"I can't believe how expensive everything has become these days!" You've probably uttered this phrase at least once this week. The increasing cost of food is perhaps the most noticeable sign of

ReliefWeb

# Food affordability in conflict-torn Yemen in light of the Ukraine war 2023 - Yemen

Analysis in English on Yemen and 1 other country about Agriculture and Food and Nutrition; published on 22 Jun 2023 by ACAPS, FAO and 3count...

22 Jun 2023

#### The New York Times

#### Heat, War and Trade Protections Raise Uncertainty for Food Prices

As the rate of food price inflation eases in the United States and Europe, analysts are warning of a new era of volatility in global food...

1 month ago

#### --- BB0

# Ukraine grain deal: What has happened to food prices since it ended?

Turkey is trying to persuade Russia to restart the deal that lets Ukraine export its grain by sea.

1 week ago

world's most vulnerable regions.

economic and political instability, and it's something that causes us considerable concern.

Our most recent food price crisis began in February 2022 when Russia initiated a war in Ukraine. With two of the world's largest exporters of wheat and other essential crops involved in conflict, numerous countries, particularly those already vulnerable, now grapple with heightened food insecurity and a rapid surge in food prices. The constant topic of conversation these days is the rising cost of food.

This project seeks to provide a broader perspective on this pressing issue by analyzing the dynamics of food prices and affordability across various countries over several years, with a particular focus on the

Currently, there is no major data provider that would routinely measure and collect data on food affordability across various countries. Therefore, this project combines multiple data sources in an attempt to understand the global context of food price dynamics and highlight the major weaknesses in the existing monitoring system.

## **Project Objectives:**

- 1. Examine the evolution of staple food prices and affordability across various countries over time.
- 2. Uncover the connections between food affordability, a country's economic development, and overall food security (share of undernourished people).
- 3. Evaluate the strengths and weaknesses of the data monitoring system employed by the UN World Food Programme and assess the overall quality of the collected data.

#### **Data Sourcing:**

#### 1) World Food Programme: Food price monitoring data

The UN World Food Programme (WFP) plays a vital role in providing food assistance during emergencies and collaborates with communities to enhance nutrition and bolster resilience. What sets WFP's food price data apart is its unique origin—gathered by dedicated personnel on the ground, right at food markets across the world. As a result, these values authentically reflect the actual prices people pay for their food.

The WFP Price Database keeps track of the prices of essential everyday foods in 99 countries, covering more than 3000 local markets. The programme is mainly focused on helping the poorest and most vulnerable countries and communities, so the data for wealthier countries like the US, UK, Germany, and many European Union countries is not being collected.

Most of the data in this database is updated on a monthly basis, allowing us to see how prices change over time. While some countries have data going all the way back to 1992, many countries started reporting their data in 2003 or later. The information is collected through surveys conducted by local partners, which helps ensure it reflects the real prices people are paying for food.

The UN World Food Programme is a globally recognized organization and generally considered a reliable source. However, when it comes to the external data collected by the organization, it's essential to approach it with a critical perspective. In the UN World Food Programme Price Database, the data is organized and downloadable at the country level. Maintaining a uniform data collection methodology across diverse countries is a significant challenge, which can introduce biases and manual errors into the data.

Additionally, data collection across countries occurs over varying time periods and encompasses different numbers of markets. The use of measurement units is not standardized, making it complicated to calculate prices per unit. The names of individual food products are also inconsistent and may include additional notes, further complicating the interpretation and

comparison of the data. Furthermore, different types of prices (such as retail, wholesale, producer, farm, etc.) are collected in different countries without a clear system. All of these factors make data cleaning and global-level comparisons of food prices a complex endeavor.

This research aims to examine food price dynamics on a global scale. To construct a consolidated dataset, I employed web scraping techniques to locate and acquire each of the 99 individual data sets from the <u>OCHA Services</u> website using the information found on <u>Kaggle</u>. See details in 'Data Scraping. Global food price data monitoring.ipynb'

#### 2) International Labour Organization(ILO): Average annual earnings by country

To determine food affordability, I'm using historical data on average annual earnings from 184 countries. This valuable information is sourced from International Labour Organization, a reputable organization offering comprehensive international data on various labor-related subjects. ILO employs three primary data collection methods: microdata processing, automated data collection, and an annual questionnaire. In addition, ILO also provides modeled estimates and projections for specific indicators.

While it's important to acknowledge that data collected through the annual questionnaire may be susceptible to potential biases, I trust the organization's ability to maintain the quality of their data collection processes, making them a reliable source for my analysis.

3) Food and agriculture organisation in the UN: Number of undernourisched people by country I'll be using data on the number of undernourished individuals by country to identify those countries facing the greatest vulnerability in terms of food security. Additionally, I'll use this data to examine the connections between price change dynamics and the percentage of undernourished people.

The Food and Agriculture Organization of the United Nations (FAO) is responsible for collecting data from national sources, ensuring their quality and compatibility with applicable standards and classifications, and disseminating data at the global level. As a part of the UN structure, it can be considered a trustworthy source of data.

#### 4) The World Bank: Annual consumer price inflation

I'll be using the annual consumer price inflation data to put the price growth into a more general economic context. The World Bank can be considered a trustworthy source of data on various economic and social issues. I trust the authority of the organization to ensure the highest quality of the data publicly accessible in their database.

#### 5) The World Bank: GDP per capita

The GDP per capita data will be used to put the price growth into a more general economic context. The World Bank can be considered a trustworthy source of data on various economic and social

issues. I trust the authority of the organization to ensure the highest quality of the data publicly accessible in their database.

#### 6) The World Bank: Population by country

The population data will be used to calculate the percentage of undernourished people by country and put the price growth into a more general economic context. The World Bank can be considered a trustworthy source of data on various economic and social issues. I trust the authority of the organization to ensure the highest quality of the data publicly accessible in their database.

## Data profiling, understanding and preparation

#### World Food Programme: Food price monitoring data

99 data sets combined. See details in 'Data Scraping. Global food price data monitoring.ipynb'

Column name	Data description	Data preparation steps
index	Extra index column created	Dropped
	Time-invariant/Structured/ Quantitative/ Discrete	
date	Observation year and month	Changed into datetime data type
	Time-invariant/Structured/ Quantitative/ Discrete	
admin1	City where observation was made	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
admin2	City where observation was made	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
market	City/market where observation was made	Dropped.
	Time-invariant/Structured/ Qualitative/ Nominal	In some cases observations were made in the same month in various locations. Once markets were removed, prices for certain products and observation dates were aggreged using average.
latitude	Market location latitude	Dropped
	Time-invariant/Structured/ Quantitative/ Discrete	

longitude	Market location longtitude	Dropped
	Time-invariant/Structured/ Quantitative/ Discrete	
category	Type of food	Non-food category was removed
	Time-invariant/Structured/ Qualitative/ Nominal	
commodity	Food name and description  Time-invariant/Structured/ Qualitative/ Nominal	Column Split: The original column containing both food name and description was divided into two separate columns, with the description being removed.  Grouping by Products: The records were then grouped together based on the product name.  Price Aggregation: Within each product group, the prices were aggregated using the average to compute a representative price for that particular product.
unit	Unit of measurement  Time-invariant/Structured/ Qualitative/ Nominal	Column Split: The original column, which contained various measures and units, was split into two separate columns: one for the measure and another for the measure unit.
		Unit Standardization: To ensure uniformity and ease of comparison, all the different measure units were converted into three standard units: Kilograms (KG), Liters (L), and Units (representing countable items).
		Recalculation of Measures: Following the unit standardization, the measures were recalculated as needed to maintain accurate and consistent data representation based on the chosen units (KG, L, or Units).
priceflag	Type of price observation (actual or forecasted)	Forecasted prices were removed from the data set.
	Time-invariant/Structured/ Qualitative/ Ordinal	
pricetype	Type of price (retail, wholesale, etc.)	All other price types but retail and wholesale were removed.
	Time-invariant/Structured/ Qualitative/ Ordinal	
currency	Currency name	
	Time-invariant/Structured/ Qualitative/ Nominal	
price	Price in local currency	Was utilized to calculate price per unit.
	Time-variant/Structured/	

	Quantitative/ Continuous	
usdprice	Price in usd	Was utilized to calculate usdprice per unit.
	Time-variant/Structured/ Quantitative/ Continuous	
iso	ISO country code	
	Time-invariant/Structured/ Qualitative/ Nominal	

#### **Basic statistic:**

	index	latitude	longitude	price	usdprice
count	3542751.00000	3515876.00000	3515876.00000	3542751.00000	3538809.00000
mean	49728.05970	13.59380	37.25309	6791.21714	13.54921
std	50759.71417	16.61378	46.51168	83441.09058	1075.81118
min	1.00000	-34.61000	-107.38600	0.00000	0.00000
25%	13118.00000	1.72680	8.68138	1.54000	0.16780
50%	33592.00000	12.32634	34.25617	130.50000	0.74070
75%	67029.00000	27.65266	71.55583	1200.00000	1.99500
max	250774.00000	59.93000	179.37736	17250000.00000	599999.99110

# International Labour Organization(ILO): Average monthly earnings by country

Column name	Data description	Data preparation steps
ref_area.label	Country name	Renamed
	Time-invariant/Structured/ Qualitative/ Nominal	
indicator.label	Type of observations	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
source.label	Source info	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
sex.label	Type of data by gender: total	Dropped
	ime-invariant/Structured/	

	Qualitative/ Ordinal	
classif1.label	Type of data by activity: total	Dropped
	ime-invariant/Structured/ Qualitative/ Ordinal	
classif2.label	Currency label	Dropped
	Time-invariant/Structured/ Qualitative/ Ordinal	
time	Year	Renamed
	Time-invariant/Structured/ Quantitative/ Discrete	
obs_value	Average monthly earning in local currency	Renamed
	Time-variant/Structured/ Quantitative/ Continuous	
obs_status.label	Status label	Dropped
	Time-invariant/Structured/ Qualitative/ Ordinal	
note_classif.label	Additional information	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
note_indicator.label	Local currency	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
note_source.label	Additional information	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	

	time	obs_value	obs_status.label
count	3084.00000	3084.00000	0.00000
mean	2002.41440	45400014.29387	nan
std	13.86877	1699840905.60512	nan
min	1969.00000	0.00000	nan
25%	1992.00000	783.51750	nan
50%	2005.00000	2835.19000	nan
75%	2014.00000	14191.63000	nan
max	2022.00000	87400000000 00000	nan

# Food and agriculture organization in the UN: Number of undernourished people by country

Column name	Data description	Data preparation steps
Domain Code	Domain code	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
Domain	Domain	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
Area Code (M49)	Area code	Dropped
	Time-invariant/Structured/ Quantitative/ Discrete	
Area	Country	Renamed
	Time-invariant/Structured/ Qualitative/ Nominal	
Element Code	Type of data code	Dropped
	Time-invariant/Structured/ Quantitative/ Discrete	
Element	Type of data	Dropped
	Time-invariant/Structured/ Qualitative/ Ordinal	
Item Code (SDG)	Item code	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
Item	Name of the observation	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
Year Code	Year of observation	Dropped
	Time-invariant/Structured/ Quantitative/ Discrete	
Year	Year of observation	Rename

	Time-invariant/Structured/ Quantitative/ Discrete	
Unit	Measure unit	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	
Value	Number of people	Rename
	Time-variant/Structured/ Quantitative/ Continuous	
Flag	Flag	Dropped
	Time-invariant/Structured/ Qualitative/ Ordinal	
Flag Description	Flag description	Dropped
	Time-invariant/Structured/ Qualitative/ Ordinal	
Note	Note	Dropped
	Time-invariant/Structured/ Qualitative/ Nominal	

	Area Code (M49)	Element Code	Year Code	Year
count	5186.00000	5186.00000	5186.00000	5186.00000
mean	438.90841	6132.00000	2010.95970	2010.95970
std	251.85184	0.00000	6.03686	6.03686
min	4.00000	6132.00000	2001.00000	2001.00000
25%	226.00000	6132.00000	2006.00000	2006.00000
50%	440.00000	6132.00000	2011.00000	2011.00000
75%	659.00000	6132.00000	2016.00000	2016.00000
max	894.00000	6132.00000	2021.00000	2021.00000

# The World Bank: Annual consumer price inflation

Dataframe has been unpivoted using pd.melt()

Column name	Data description	Data preparation steps
Country name	Country name	Renamed
	Time-invariant/Structured/ Qualitative/ Nominal	
Country code	Country code	Rename
	Time-invariant/Structured/ Qualitative/ Nominal	
year	Year of observation  Time-invariant/Structured/ Quantitative/ Discrete	Originally, the data set contained observation from 1960 until 2023. Years 1960-1990 were removed.
inflation	Inflation value	
	Time-variant/Structured/ Quantitative/ Continuous	

	year	inflation
count	16758.000000	10773.000000
mean	1991.000000	20.035454
std	18.184785	291.483500
min	1960.000000	-17.640424
25%	1975.000000	2.378528
50%	1991.000000	4.905209
75%	2007.000000	9.722193
max	2022.000000	23773.131770

# The World Bank: GDP per capita

Dataframe has been unpivoted using pd.melt()

Column name	Data description	Data preparation steps
Country name	Country name	Renamed
	Time-invariant/Structured/ Qualitative/ Nominal	
Country code	Country code	Renamed
	Time-invariant/Structured/ Qualitative/ Nominal	
year	Year of observation  Time-invariant/Structured/ Quantitative/ Discrete	Originally, the data set contained observation from 1960 until 2023. Years 1960-1990 were removed.
gdp_pcapita	Inflation value	
	Time-variant/Structured/ Quantitative/ Continuous	

	year	gdp_pcapita
count	16758.000000	13365.000000
mean	1991.000000	8403.025438
std	18.184785	16823.777596
min	1960.000000	12.786964
25%	1975.000000	565.809775
50%	1991.000000	1916.255899
<b>75</b> %	2007.000000	7805.611873
max	2022.000000	234317.084800

# The World Bank: Population by country

Dataframe has been unpivoted using pd.melt()

Column name	Data description	Data preparation steps
Country Name	Country name	Renamed
	Time-invariant/Structured/ Qualitative/ Nominal	
<b>Country Code</b>	Country code	Renamed
	Time-invariant/Structured/ Qualitative/ Nominal	
year	Year of observation  Time-invariant/Structured/ Quantitative/ Discrete	Originally, the data set contained observation from 1960 until 2023. Years 1960-1990 were removed.
population	Population count	
	Time-variant/Structured/ Quantitative/ Continuous	

	year	population
count	7020.000000	6.890000e+03
mean	2009.230769	2.792443e+08
std	8.049977	8.812321e+08
min	1990.000000	9.182000e+03
25%	2003.000000	1.411245e+06
50%	2009.500000	9.374909e+06
75%	2016.000000	5.832222e+07
max	2022.000000	7.951150e+09

#### **Privacy and Ethics concerns:**

All of the data used in this project has been sourced from official channels, made openly available by the rightful data owners. It's important to note that this dataset does not encompass any sensitive or private information. Consequently, I have full confidence in the ethical and privacy aspects of this research.

#### **Key Research Questions:**

- 1. What are the most commonly tracked staple foods in the World Food Programme database?
- 2. Which staple products have experienced the highest and lowest price growth over the years?
- 3. How does the affordability for staple foods relate to the general economic situation (GDP per capita) and share of the undernourished population in various countries?
- 4. Is there a difference in price dynamics in country capitals compared to other cities?
- 5. Is there a correlation between changes in food price and share of undernourished population?
- 6. Does food affordability correlate with GDP per capita and inflation rate?
- 7. How does the size of the World Food Programme's basic staple foods basket vary across different countries?
- 8. What are the main flaws of the WFP price monitoring system?

# **Glossary:**

**Annual Price Change:** This represents the percentage difference between the first and last recorded prices for a given product within one year.

**Staple Food:** These are the most basic food products that are commonly consumed by local citizens and are included in the monitoring conducted by the World Food Programme.

**Product Affordability Index:** This index is calculated by dividing the average wage by the price of the product. It quantifies how many units of a particular product a person can afford based on their income.