

# **How are we going to feed the world?**



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**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

# Global Food Crisis



## WFP scales up to support the most vulnerable in global food crisis

The World Food Programme (WFP) is leveraging its global presence, capabilities, and partnerships to mitigate the global food crisis fuelled by conflict, climate shocks and COVID-19, compounded by the ripple effects of the war in Ukraine.

WFP is responding to the global food crisis by:

- **Stepping up direct food and nutrition assistance to save lives and livelihoods**
- **Providing technical assistance and services to support national social protection systems**

- **Leveraging partnerships, services and programmes to strengthen food systems.**

WFP requires US\$22.2 billion to deliver on its operational plan this year and save millions of people from disaster. WFP is very grateful to its donors, including the United States as its biggest single donor, who are stepping up their funding to confront this massive threat. More contributions however are vital as needs are growing and deeper risks lie ahead.

July 2022



## WAR IN UKRAINE DRIVES GLOBAL FOOD CRISIS

Hungry world at critical crossroads

A global food crisis fuelled by conflict, climate shocks and the COVID-19 pandemic is growing because of the ripple effects of the war in Ukraine driving rising prices of food, fuel and fertilizer. Millions of people across the world are at risk of being driven into starvation unless action is taken now to respond together and at scale.

There is now a very real risk that global food and nutrition needs across the globe may soon outstrip the capacity of the United Nations World Food

Programme (WFP) or any organization's ability to respond.

WFP therefore is calling for coordinated action to address its funding gap, build an all-inclusive multi-stakeholder approach in partnership with governments and food systems actors, ensure trade is open, invest in strategic development solutions and commit to political solutions to secure stability and peace.

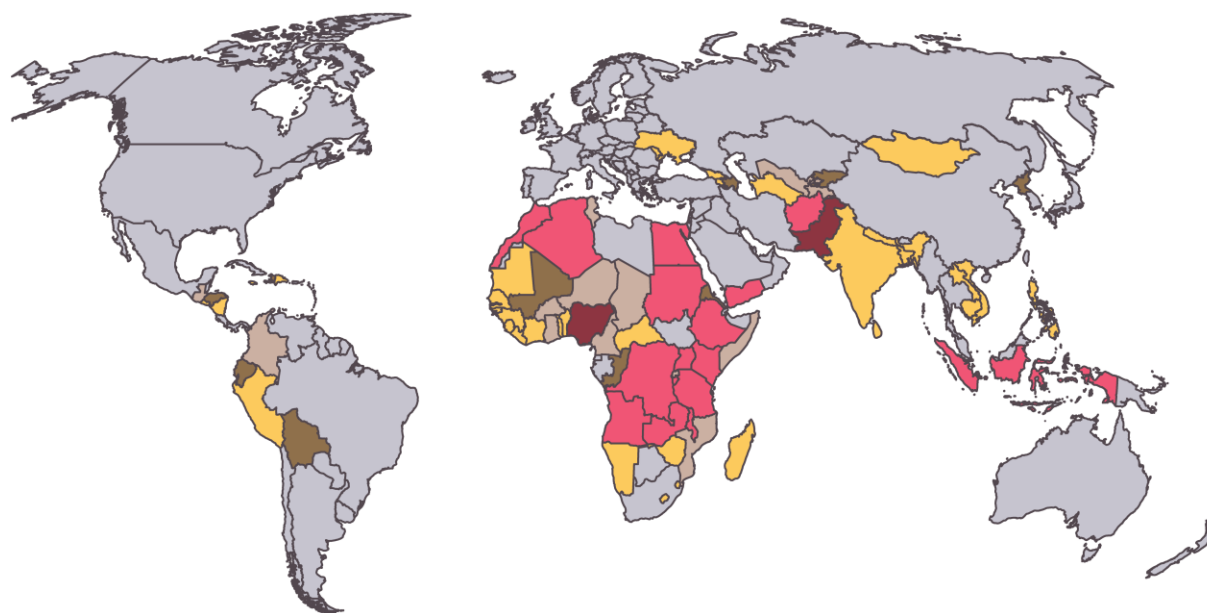
# Global Food Insecurity

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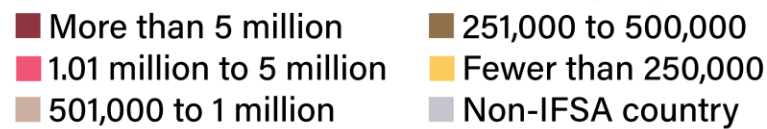
- ◆ **Food insecurity: lack of access to sufficient, safe, and nutritious food (FAO)**
- ◆ **Number of food insecure people in 2022 estimated at 1.3 billion, up 10% from 2021 (USDA/ERS)**
- ◆ **Physical and financial access to food a challenge in low and middle-income countries**
- ◆ **Current crisis driven by civil conflict, climate shocks, and COVID-19 pandemic, intensified by:**
  - **Ripple effect of Russian invasion of Ukraine**
  - **Rising global food, fuel and fertilizer prices**

# Global Food Insecurity

The number of people in low- and middle-income countries experiencing food insecurity increased by a total 118.7 million in 2022 from 2021



## Number of additional food-insecure people in 2022



Notes: **IFSA** = International Food Security Assessment report. The report analyzes food security in 77 low- and medium-income countries.

Source: USDA, Economic Research Service.

# Global Food Price Spike

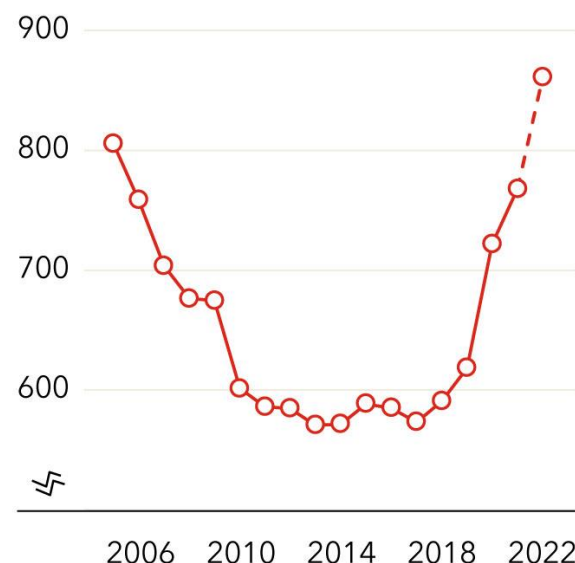
## Going hungry

Millions more people face hunger globally as food prices spike.

**Real food price index**  
(2014-2016 = 100)



**Global food insecurity**  
(millions of undernourished people)



Source: United Nations Food and Agriculture Organization.

Notes: Undernourishment means that a person is not able to acquire enough food to meet the daily minimum dietary energy requirements, over a period of one year.

# **Global Food Prices**

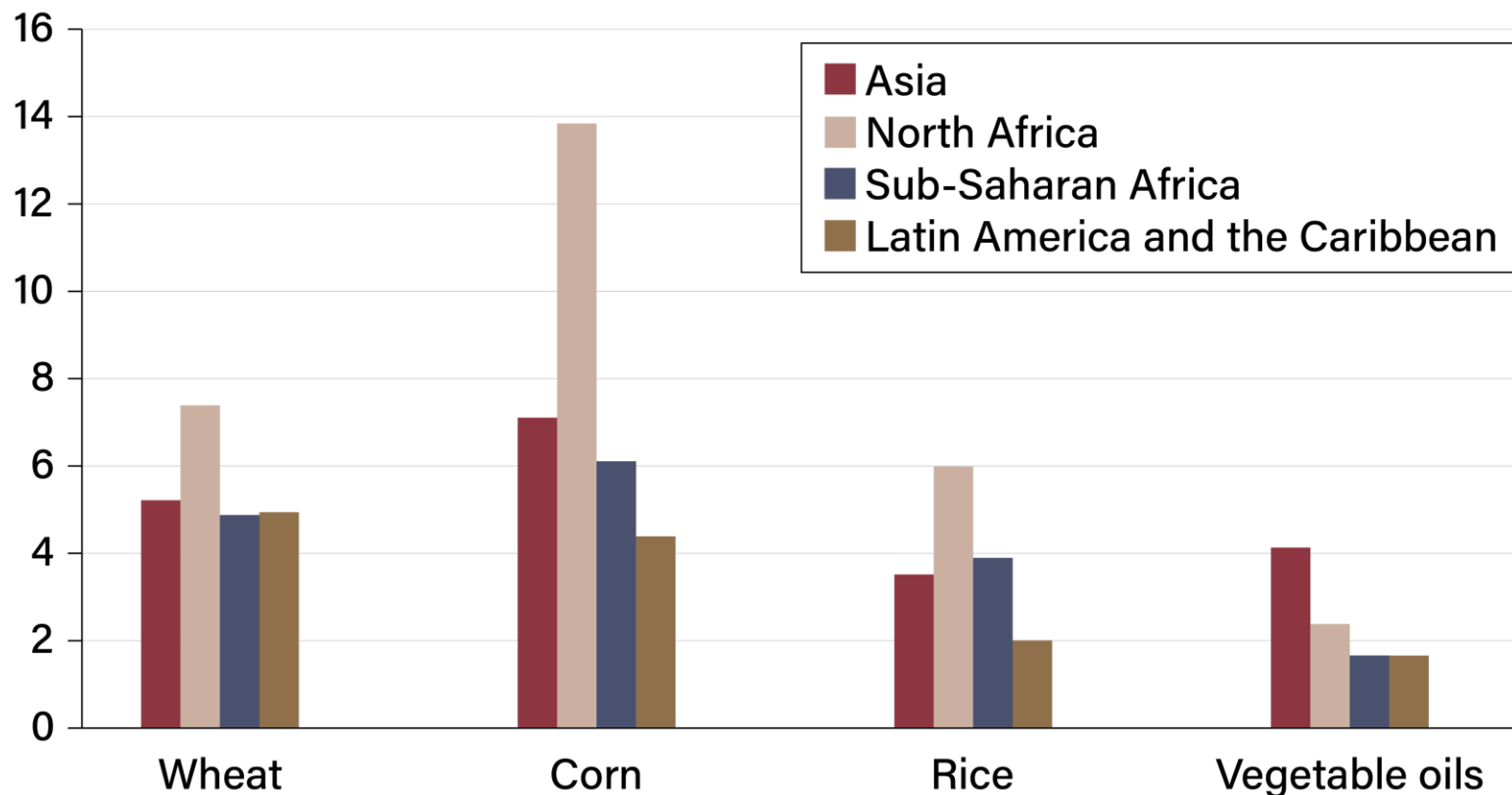
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- ◆ **Commodity prices increased rapidly in 2021:**
  - **Increased global demand for feed/food grains**
  - **Drought in South America**
  - **Supply chain disruptions**
  - **Higher energy/fertilizer prices**
- ◆ **Price increases of wheat, coarse grains, and vegetable oils intensified in 2022 following Russian invasion of Ukraine**
- ◆ **North Africa, Middle East and Asia most affected regions – highly dependent on Russia and Ukraine for grain imports**

# Global Food Prices

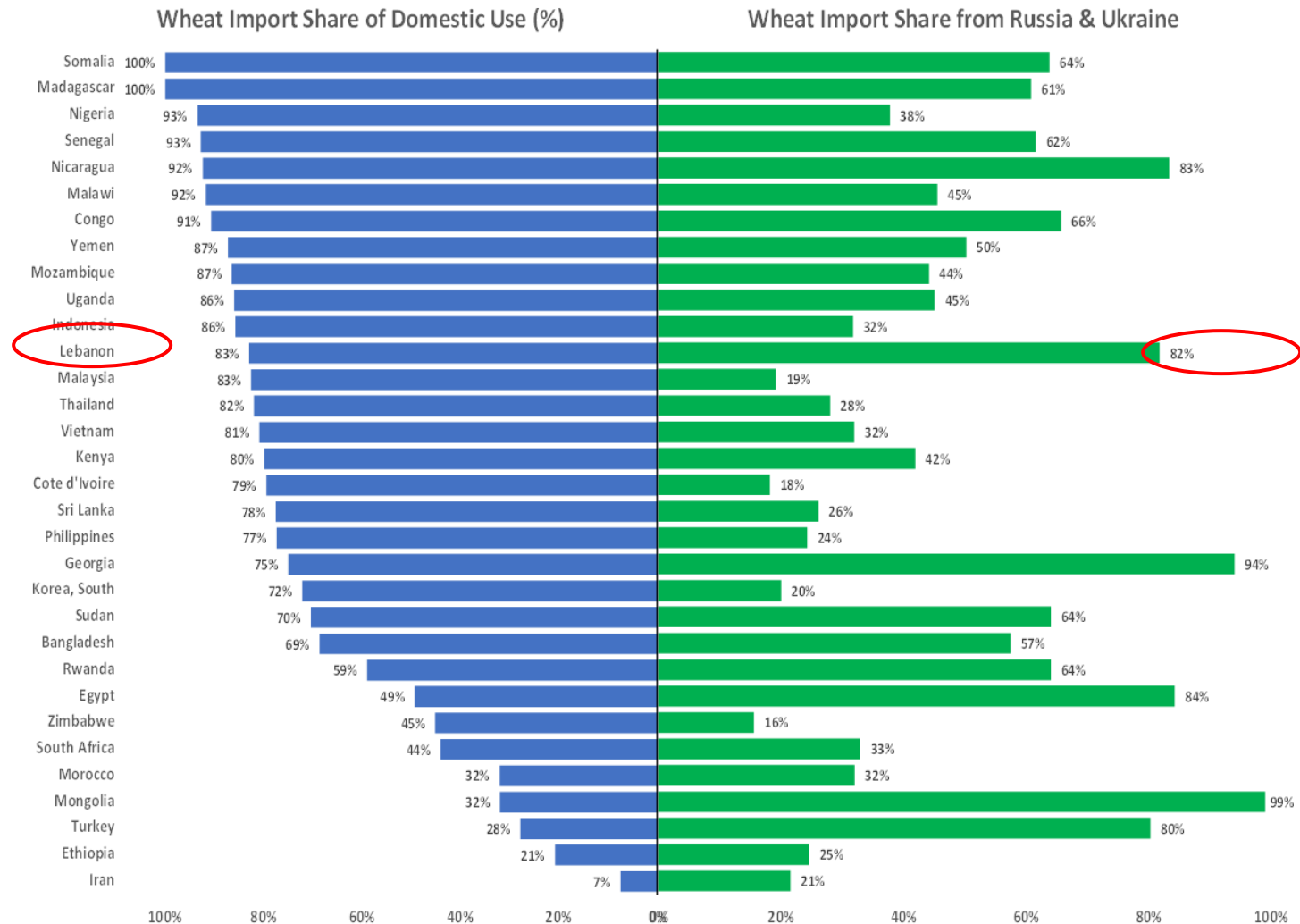
**International commodity prices are estimated to increase across all regions in 2022, especially in North Africa**

Price increase (percent)



Source: USDA, Economic Research Service.

# Importance of Russia/Ukraine



Source: Grant *et al.*, 2023



# Global Food Prices

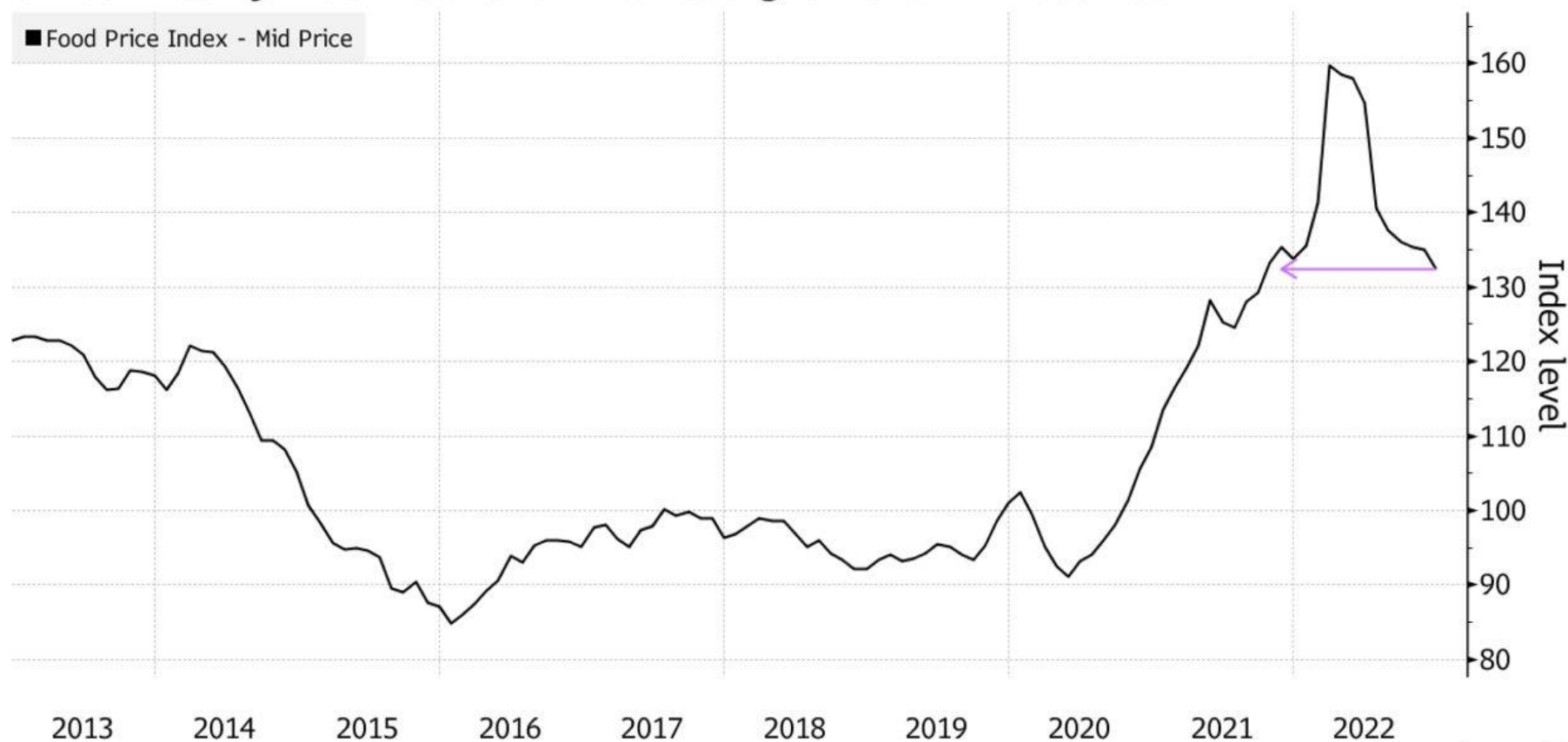
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- ◆ **Commodity prices have corrected to pre-invasion levels due to improved supply conditions, Ukrainian grain export deal, and macroeconomic factors**
- ◆ **Outlook uncertain – price risk still on upside:**
  - **Stability of Ukrainian grain export deal**
  - **Potential for export restrictions**
  - **Continued drought/weather conditions**
  - **Tight stocks**
  - **Passthrough of fertilizer prices**

# Global Food Price Correction

## World Food Prices End 2022 Just Below Where They Started

UN commodity index fell for a ninth straight month in December

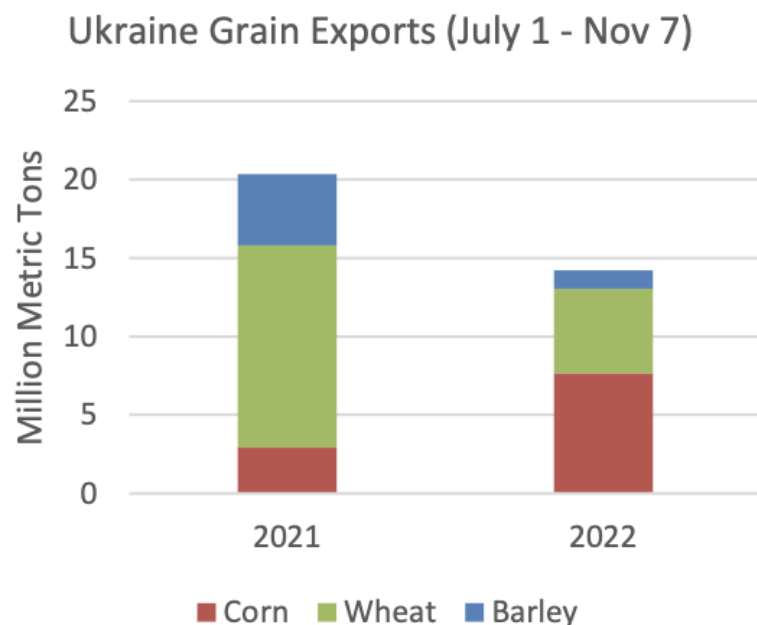


Source: UN's FAO

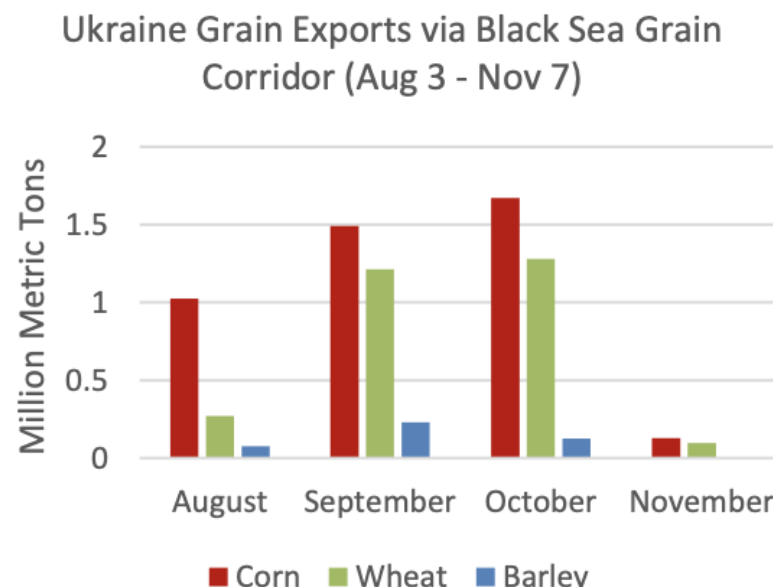
Bloomberg

# Grain Export Deal

## Ukraine Grain Exports Expand via Grain Corridor but Still Lower than Prior Year



Source: Ukraine Ministry of Agriculture

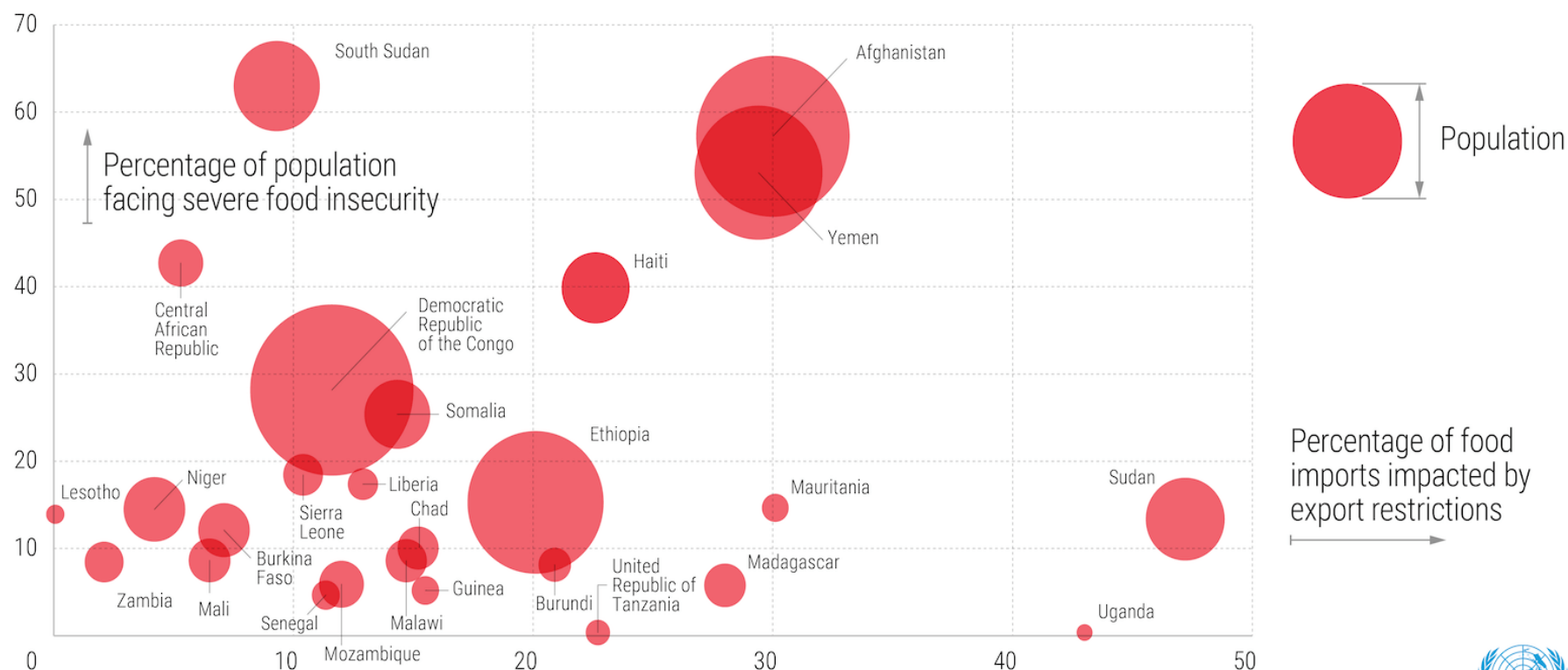


Source: Black Sea Grain Initiative website

# Beggar-Thy-Neighbor Policies



## Trade restrictions affect food-insecure countries



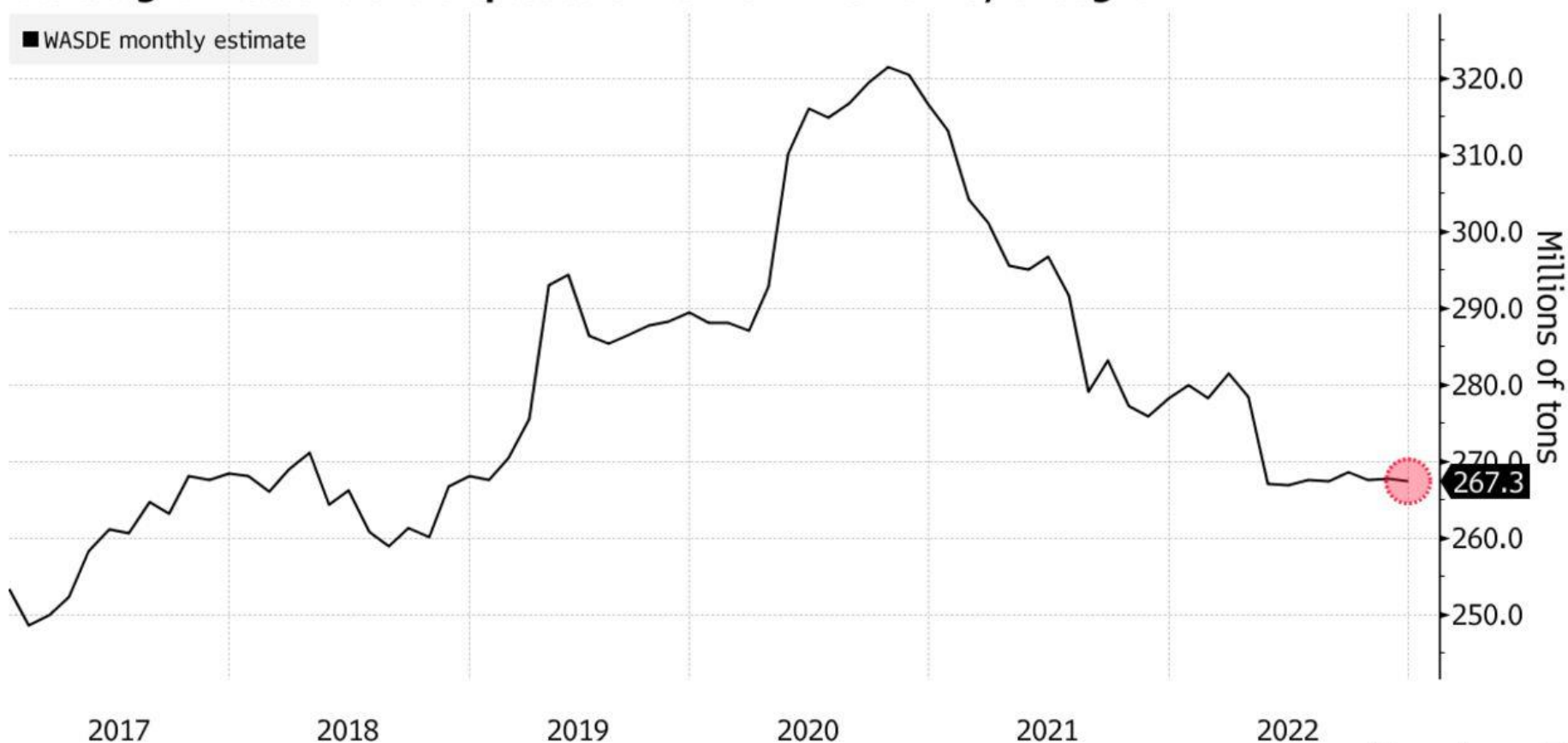
Source: UNCTAD calculations based on (1) David Laborde and Abdullah Mamun (2022). Food Export and Fertilizer Restrictions Tracker. (2) FAO (2022). Global Information and Early Warning System on Food and Agriculture (GIEWS). (3) United Nations (2019). World Population Prospects 2019. [Accessed May 2022]

# Tight Stocks

## Less Wheat

Global grain stocks are depleted amid war in Ukraine, drought

■ WASDE monthly estimate



Source: US Department of Agriculture

Bloomberg

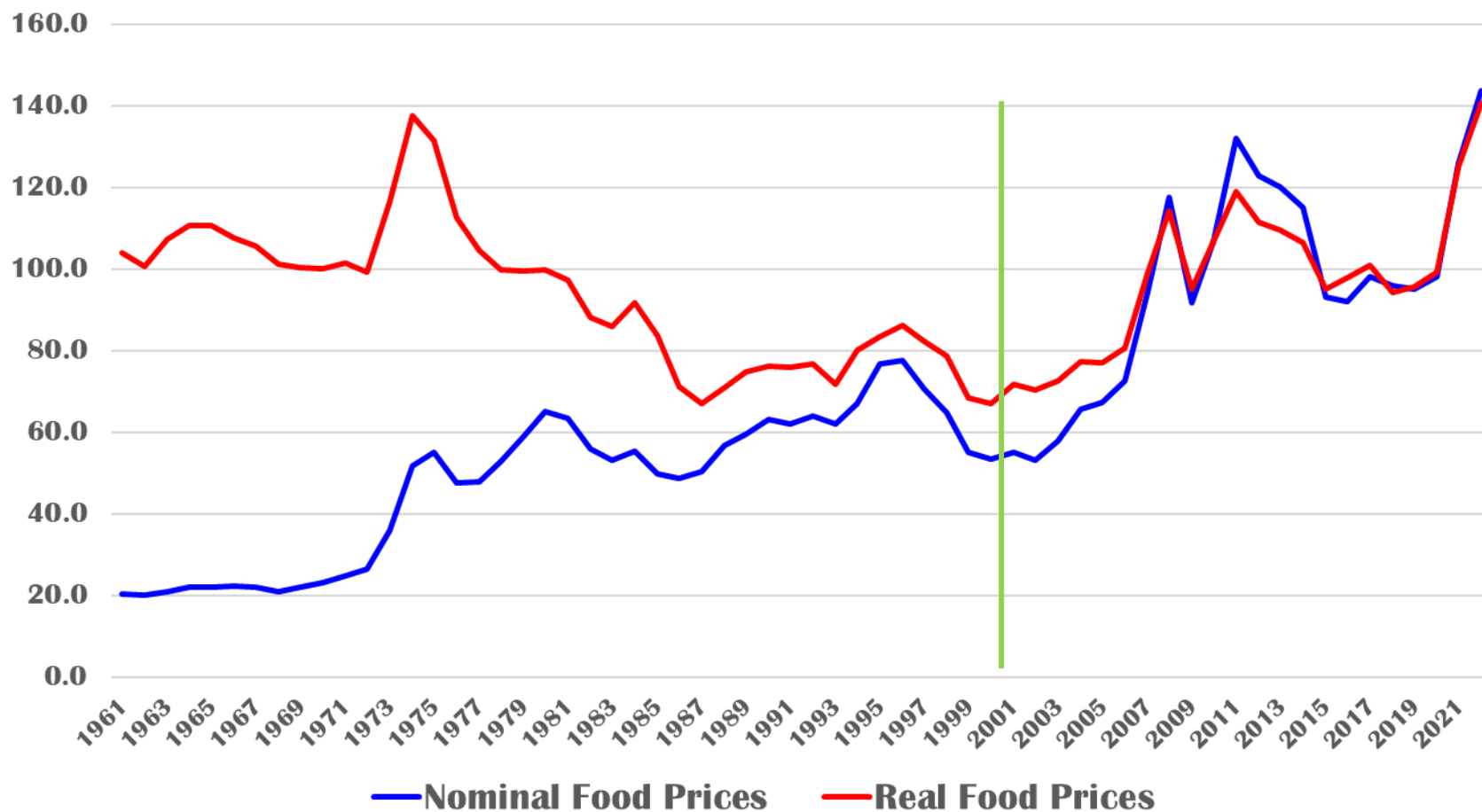
# Long-Run Food Prices

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- ◆ **1900-2010, real food prices fell on average by 1%/year while population increased by 5.3 billion**
- ◆ **Malthusian crisis did not occur due to:**
  - **Income-inelastic demand for food (Engel's Law)**
  - **Improved agricultural productivity**
- ◆ **Since 2001, real food prices have been rising, with two major spikes prior to 2021/22**
- ◆ **Renewed concerns about pace of agricultural productivity growth (Fuglie and Wang, 2012)**

# Long-Run Food Prices

2014-16 = 100



Source: FAO

# Consumption-Yield Gap

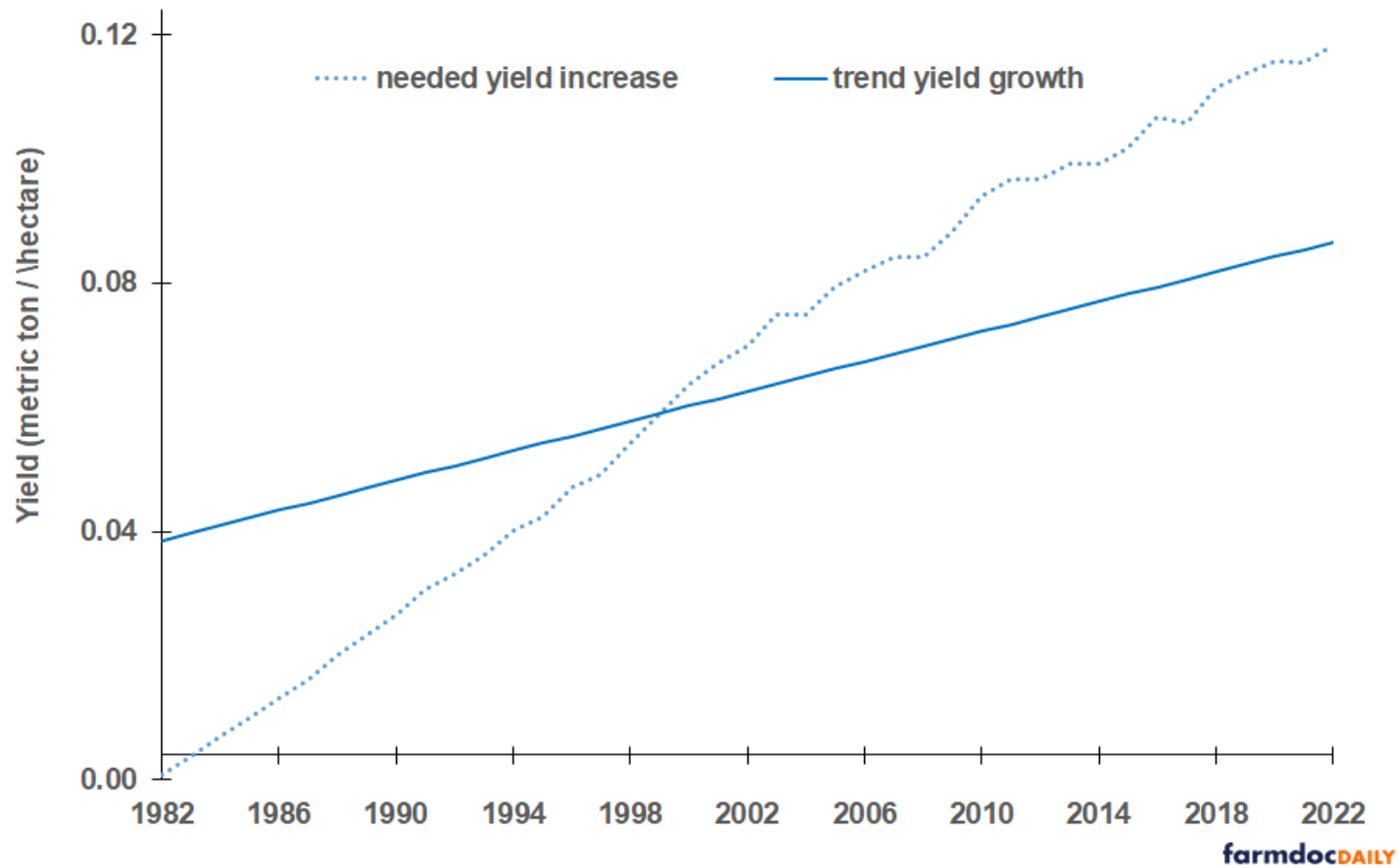
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- ❖ **Demand forecast to rise 60% by 2050 (FAO, 2012)**
- ❖ **Increasing gap between consumption growth and yield of feed/food grains and oilseeds (Zulauf, 2022)**
- ❖ **16 million acres/year required to satisfy consumption (Zulauf, 2022)**
- ❖ **Increased supply likely to come at intensive (yield/cropping intensity) not extensive margin (land expansion)**
- ❖ **Without increased land conversion, and stable yield growth – higher food prices to ration supply**



# Required Yield Increase

Figure 3. Yield Comparison, World Feed Grains, 1982-2022



# **Output Growth and Productivity**

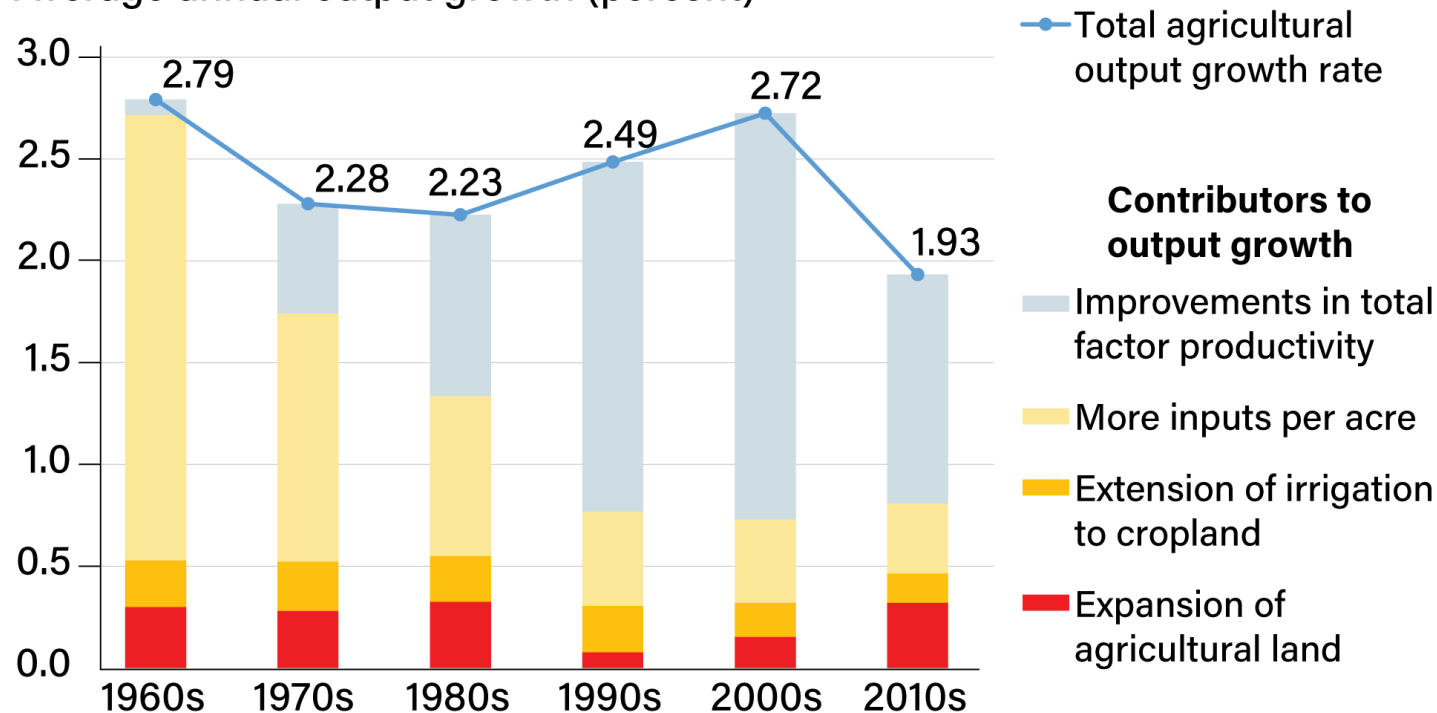
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- ◇ **Output growth at lowest level in 2010s since 1960s**
- ◇ **Total factor productivity (TFP) growth also declined over same period – TFP is overall efficiency with which agricultural inputs are combined**
- ◇ **1960s/70s, input intensification and R&D drove output growth, after which TFP growth accelerated**
- ◇ **Slowing TFP growth has been key factor weighing on output growth in 2010s**
- ◇ **Slowdown in productivity growth means farmers will either need to use more land and/or apply inputs more intensively**

# Agricultural Output Growth

**Global agricultural output growth rate slowed over the past decade along with declines in agricultural productivity growth**

Average annual output growth (percent)



Source: USDA, Economic Research Service (ERS) using data from the ERS International Agricultural Productivity data product.

# Where's the Slowdown?

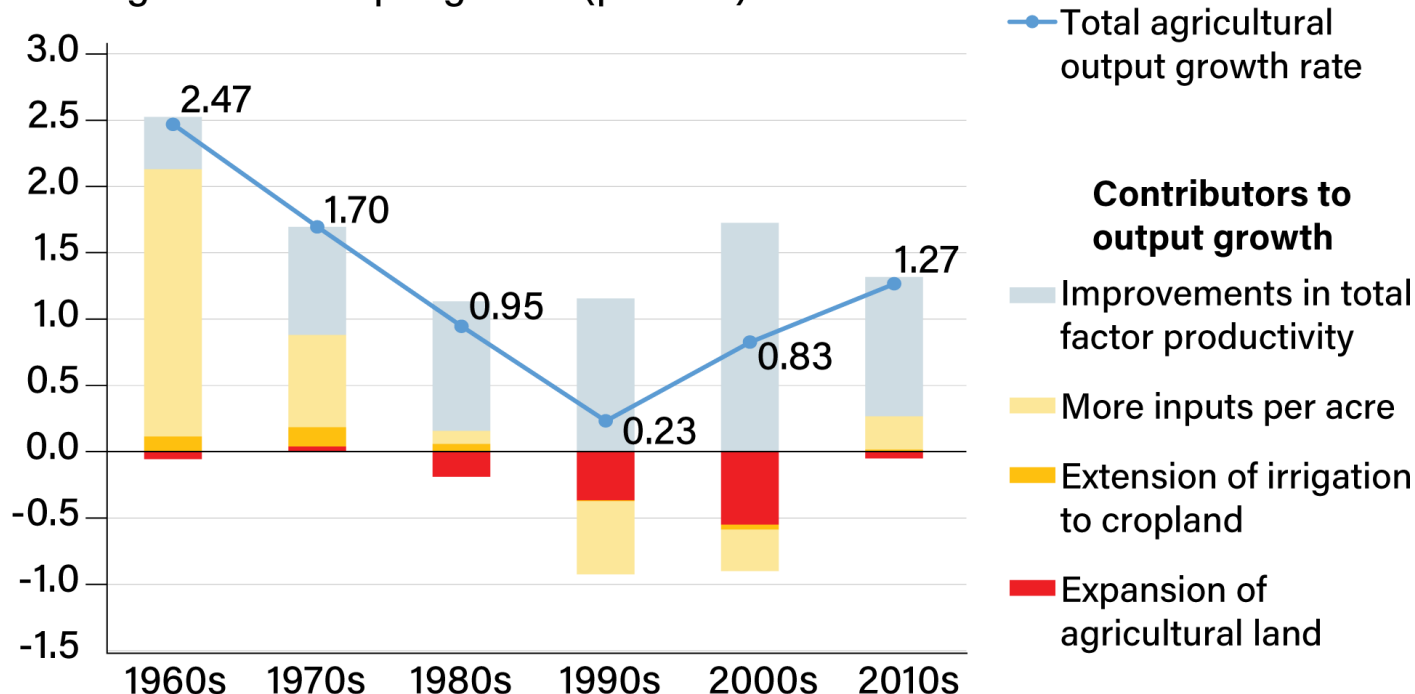
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- ❖ **Output growth accelerated in developed countries over past two decades – TFP growth being largest component**
- ❖ **In developing countries, output growth has declined as rate of TFP growth has declined**
- ❖ **Varies across countries – TFP growing fast in Brazil, China, Mexico, and Ukraine, but negative TFP growth in Africa**
- ❖ **Negative TFP growth due to expansion into less productive land, degradation of natural resources, and climate change**

# Developed Countries

## Developed countries: Growth of agricultural output and productivity both increased in the 2010s

Average annual output growth (percent)

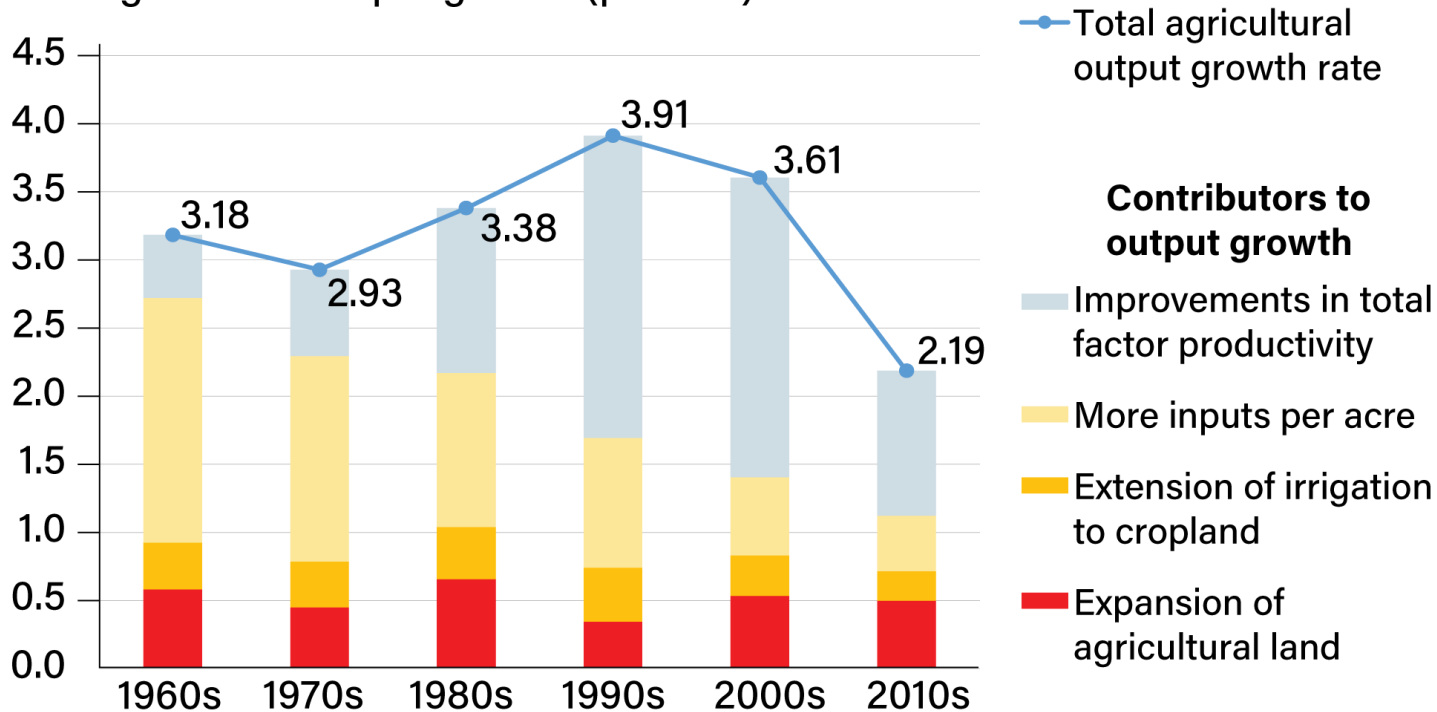


Source: USDA, Economic Research Service (ERS) using data from the ERS International Agricultural Productivity data product.

# Developing Countries

## Developing countries: Agricultural output slowed in the 2010s as the rate of productivity growth declined

Average annual output growth (percent)



Source: USDA, Economic Research Service (ERS) using data from the ERS International Agricultural Productivity data product.

# Why the Slowdown?

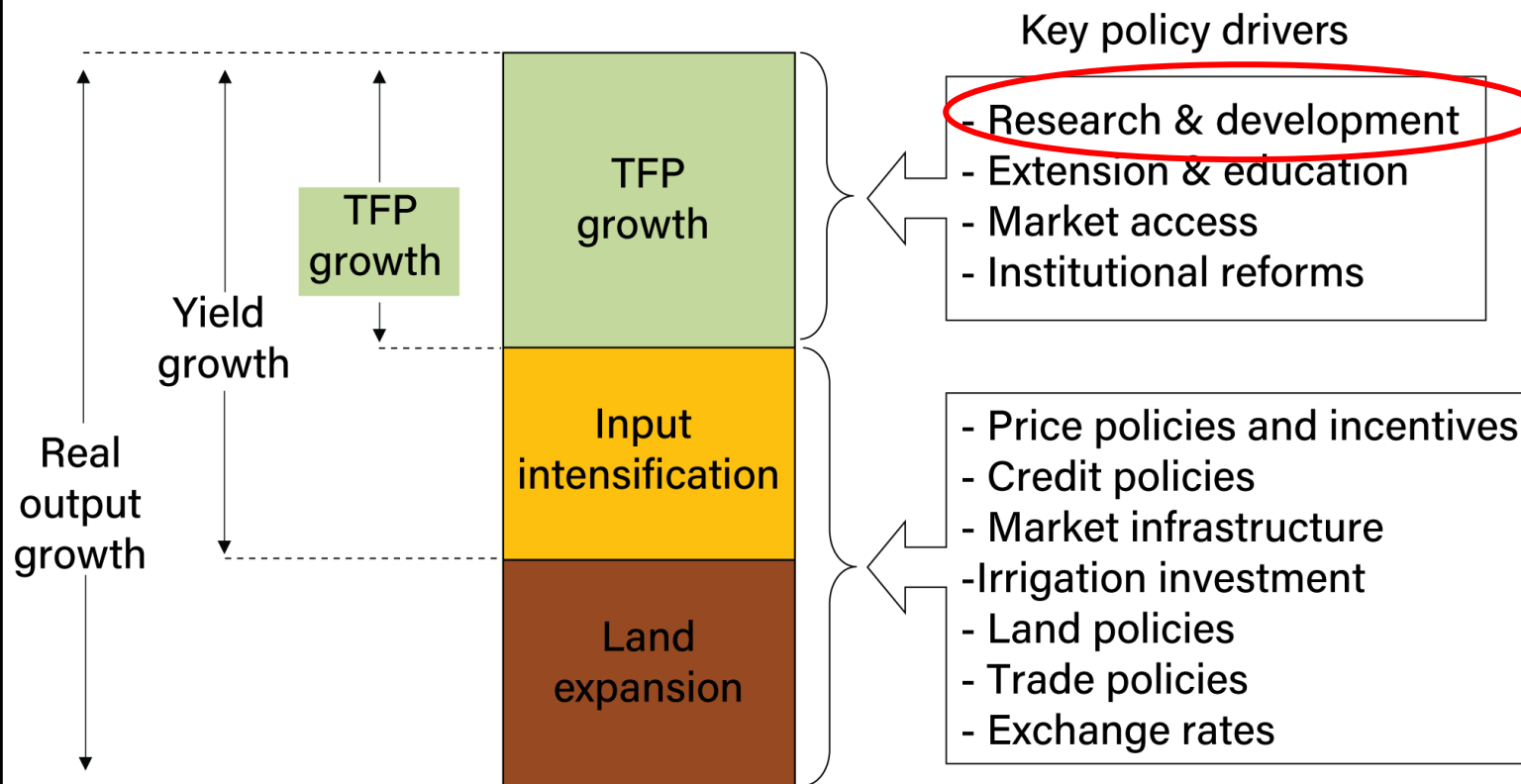
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## ◆ Several factors linked to slowdown:

- **Weather shocks associated with climate change**
- **Emergence of new/resistant crop diseases/pests**
- **Slow diffusion of technologies – especially in developing countries**
- **Less innovation and insufficient investment in agricultural R&D**
- **Trade and other barriers limiting technology transfer**

# Key Policy Drivers

Total factor production (TFP) contributes to total agricultural output growth



Source: USDA, Economic Research Service

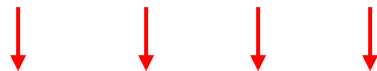


# R&D and TFP Growth

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## ◇ Agricultural production function:

$$Q_t = A_t(R_t)[X_t]$$



**Output    TFP    R&D    Inputs**

## ◇ Over time output growth split into:

- (i) Technological change
- (ii) Input accumulation

## ◇ During 20<sup>th</sup> Century – shift from (ii) to (i) in driving global output growth, main exception being low-income countries, notably in Africa

# **Investment in Agricultural R&D**

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- ◆ **Public-good nature of R&D capital – key role for government in spending on agricultural R&D (75% of global total in 2011)**
- ◆ **Public investment consistent driver of TFP growth, but spending has slowed (Alston and Pardey, 2014)**
- ◆ **Total R&D investment has to grow faster than desired rate of output growth:**
  - **Limits on technology-transfer across agro-ecologies**
  - **Need for “maintenance” R&D to stop productivity falling, i.e., knowledge stock depreciates**
- ◆ **R&D systems in developing countries (China) need to become more sophisticated to generate large spillovers**