

Poverty measurement and the cost of healthy diets

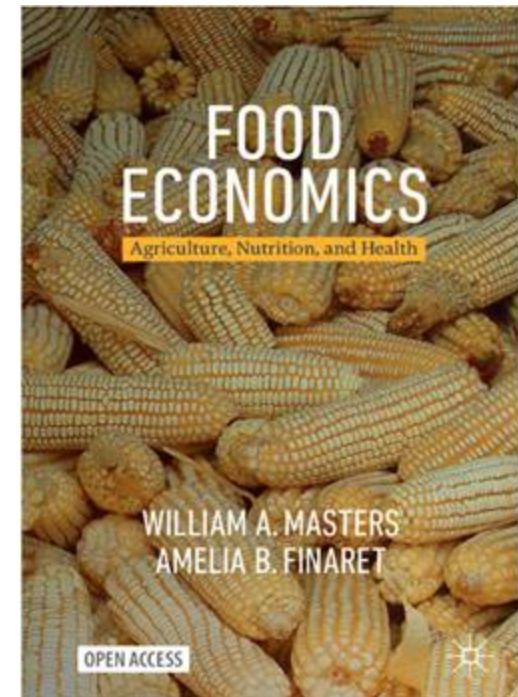
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ABCDE panel on agricultural markets and nutrition
Birdsall House, Center for Global Development
July 25th, 2025



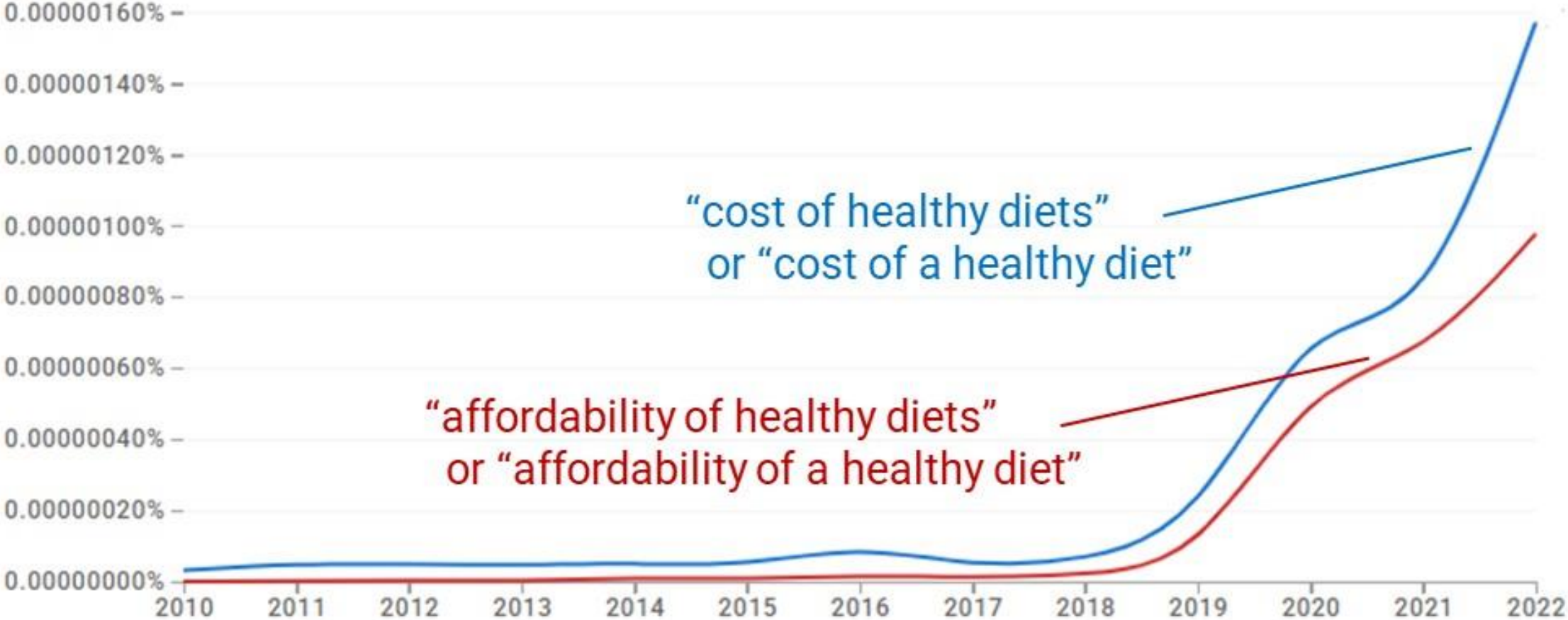
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bit.ly/FoodEconBook

Poverty debates have long focused on access to a fixed quantity of basic foods, in addition to nonfood needs

- **Early ideas about wages and poverty used fixed quantities of food, and also nonfood needs**
 - Rice Vaugh (1675): To set wages, *“The hire of labourers and servants carrieth with it a resultance of the prices of all things generally necessary for a man’s life”*
 - William Fleetwood (1707): To update Oxford student fellowships, *“how much of the modern money will be requisite to purchase the same quantity of corn, meat, drink, or cloth now-a-days”*
 - Adam Smith (1776): For income effects, *“The rich man consumes no more food than his poor neighbour. In quality it may be very different, and to select and prepare it may require more labour and art; but in quantity it is very nearly the same.”*
- **Modern poverty lines specify food and nonfood needs differently**
 - Mollie Orshanski (1965): enough money for the USDA’s “economy food plan” to be one-third of household spending, using a least-cost nutritionally defined diet and national average budget shares, published as [Counting the Poor](#) in 1965
 - Martin Ravallion (1990s): low-income countries’ national poverty lines at PPP prices, which are often based on sufficient calories of local foods eaten by the poor, plus nonfood spending of low-income people (now \$3.00/day in 2021PPP\$)
 - Robert Allen (2017): more food spending to reach nutrient adequacy, plus targets for housing, fuel, lighting, clothing, soap
- **In this talk: how measuring access to a *healthy* diet is informed by poverty measurement (and vice-versa), in new data: <https://databank.worldbank.org/source/food-prices-for-nutrition>**

New data can change the conversation

Frequency of selected phrases in English-language books and documents, 2010–2022



Source: Google ngrams data, in W.A. Masters (2025), Tracking the affordability of least-cost healthy diets helps guide intervention for food security and improved nutrition. [Food Policy](#) 137: 102913.

New data on Cost of Healthy Diets (CoHD) was developed to help guide food and agriculture to meet *health* needs

- **Prior price indexes for consumption, trade and production lack health information**
 - Consumer Price Indexes use all foods weighted by actual expenditure
 - Global food price indexes and producer price indexes use bulk commodities, not retail items
- **Prior food security metrics use the mix of foods actually consumed, not a healthy diet**
 - Since 1974, the FAO has used its “Prevalence of Undernourishment” metric for the prevalence of hunger, based on national food balance sheets if distributed lognormally relative to estimated dietary energy requirements
 - Now c. 9% of the world population (0.7 billion people) are undernourished in this sense
 - Since 1995, the USDA (and then FAO since 2014) have used “Experience of Food Insecurity” for the number of people who went to bed hungry, skipped meals, ate less or other foods etc. due to lack of resources to buy their usual diets
 - Now c. 25% of the world population (2 billion people) are food insecure in this sense
- **Our new price indexes track least-cost items by food group for a healthy diet, in \$/day**
 - Since 2020 the World Bank, FAO and various governments have adopted this as a new food security metric, combining diet costs with income and nonfood spending data to measure Cost and Affordability of Healthy Diets (CoAHD)
 - Now c. 34% of the world population (2.8 billion people) cannot afford a healthy diet in this sense
 - CoAHD is a diagnostic metric to guide intervention, by distinguishing among three causes of unhealthy diets:
 - **High prices:** if healthy foods are unusually expensive, need to invest in production and distribution to lower cost
 - **Low incomes:** if people lack enough money to buy a healthy diet, need higher earnings or assistance
 - **Displacement of a healthy diet by other options,** due to taste, convenience, aspirations and marketing, etc.

Our benchmark least cost healthy diets use locally available items that meet national food-based dietary guidelines

Dietary guidelines define healthy diets in terms of food groups

- To allow substitution within food groups, we convert volume and weight to energy shares

Food group targets can differ and change over time

- For SOFI 2020, used median cost of 10 quantified guidelines from all UN regions
- For SOFI 2022, introduced the Healthy Diet Basket from 31 guidelines with food guides
- For SOFI 2024, use updated price and income data but same health criteria
- In Jan. 2024, Nigeria became first country to publish national statistics using global HDB
- Now Malawi also uses HDB, while Ethiopia, Ghana & Pakistan use their own dietary guidelines



Definition of the global Healthy Diet Basket

Food group	Number of items	Dietary energy (kcal/day)	Energy shares	Quantities of typical items	
				Typical weight (grams)	Typical volume (plate share)
1. Starchy staples	2	1,160	50%	322g dry rice	25%
2. Vegetables	3	110	5%	270-400g veg.	25%
3. Fruits	2	160	7%	230-300g fruits	25%
4. Animal-source foods	2	300	13%	210g egg	
5. Legumes, nuts & seeds	1	300	13%	85g dry bean	25%
6. Oils and fats	1	300	13%	34g oil	

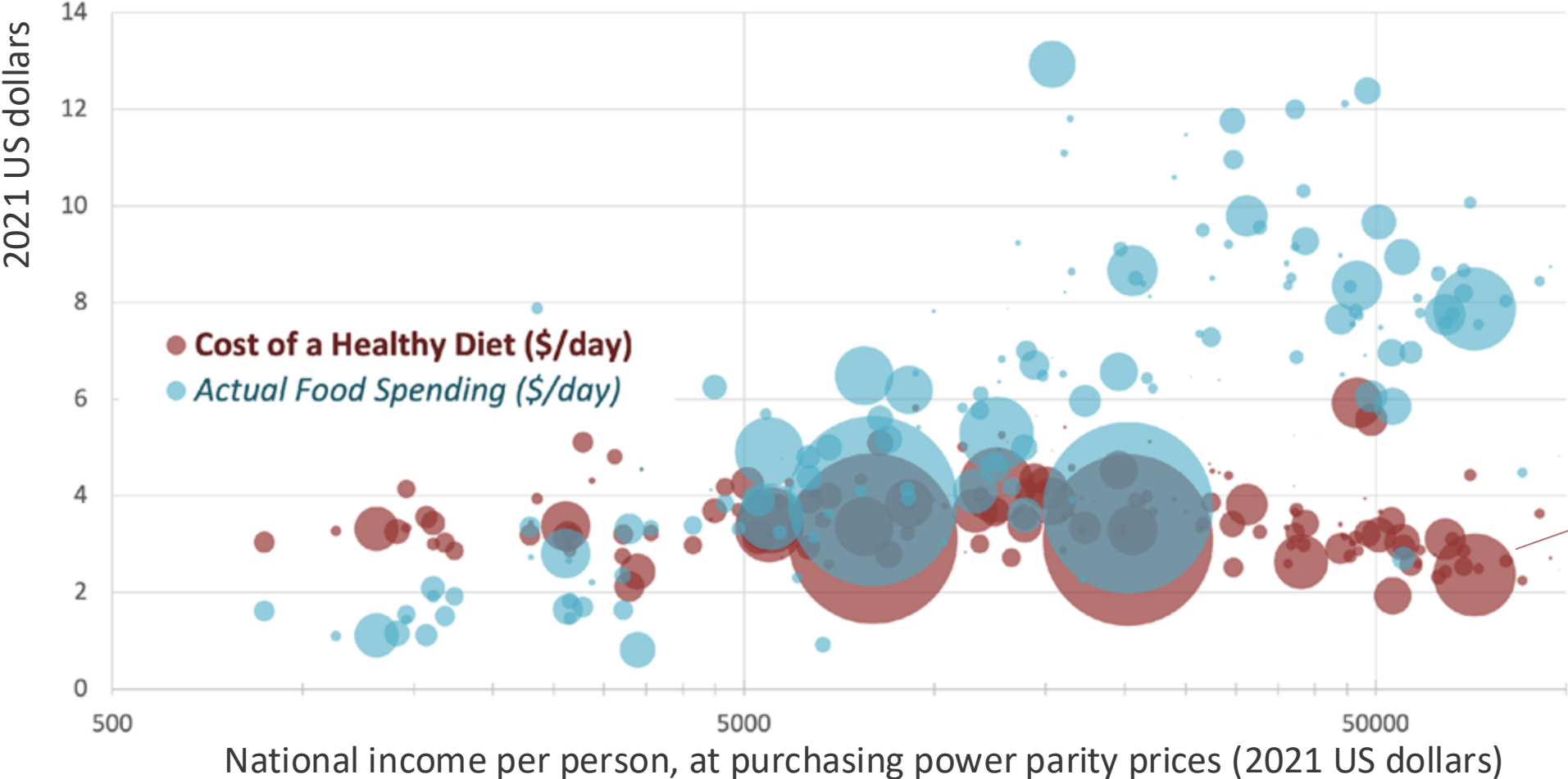
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2,330

Note the global Healthy Diet Basket is just the most basic food groups -- U.S. dietary guidelines include other recommendations!

Our discovery is that the least-cost locally available items in sufficient quantities for a healthy diet cost about **\$3-4/day**

National average cost of a healthy diet and actual food spending by level of national income per capita, baseline estimates for 2021



This cost level for 2021 buys only the global Healthy Diet Basket. In 2025 the USDA's Thrifty Food Plan is around \$8.20/day for an adult woman

Source: FAO and World Bank, 2024. The latest Cost of a Healthy Diet data are at <https://www.fao.org/faostat/en/#data/CAHD>, and published simultaneously alongside actual food spending at <https://databank.worldbank.org/source/food-prices-for-nutrition>. Circles are proportional to population size, and countries are arrayed by level of national income using World Development Indicators data.

To track affordability, we compare the least-cost healthy diet in each country to household income, minus non-food needs

The new affordability method used by FAO and the World Bank for global monitoring in SOFI 2024 allows for higher non-food needs in higher-income countries

TABLE S2.3 CALCULATION OF THE COMPONENT OF THE COST THRESHOLD THAT CORRESPONDS TO ESSENTIAL NON-FOOD GOODS AND SERVICES

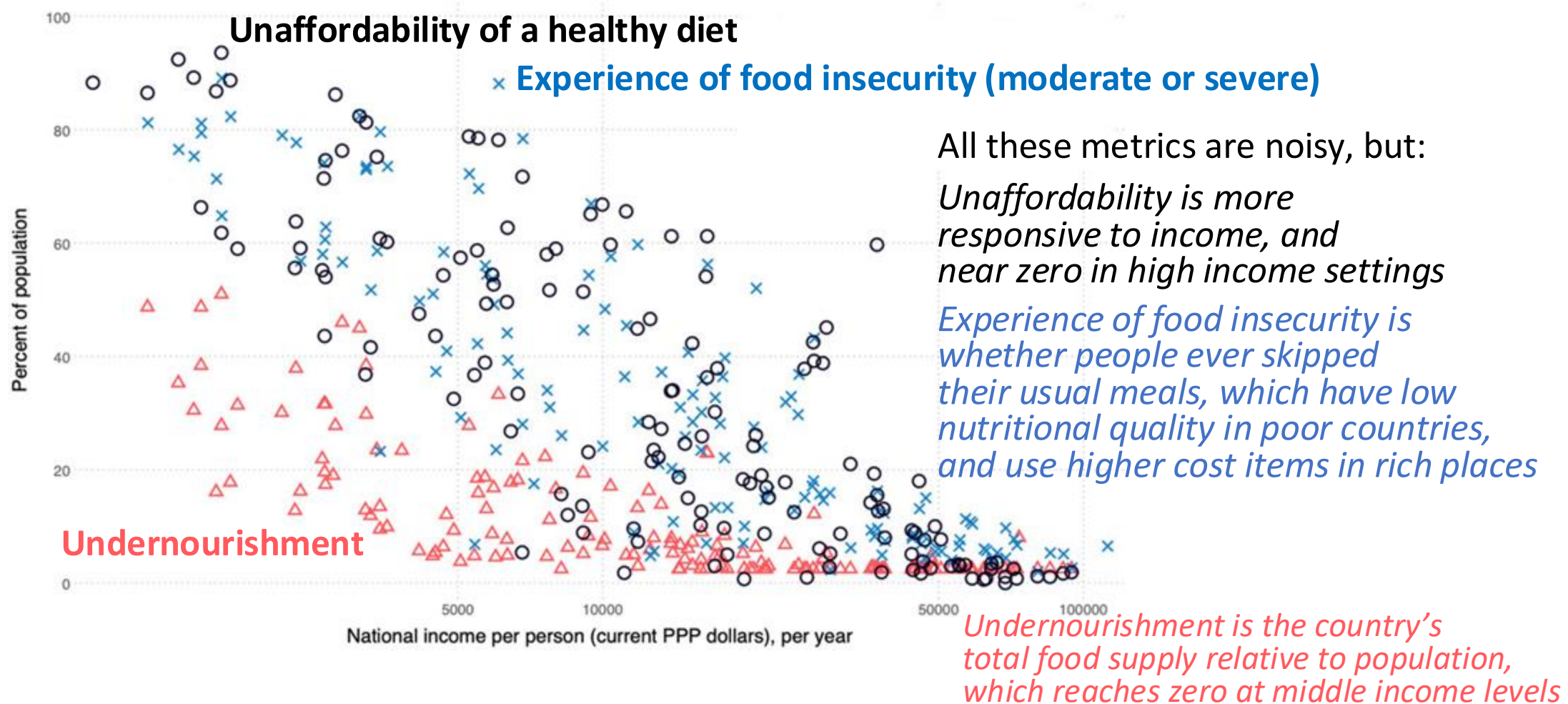
	International poverty line (a)	Non-food expenditure share (b)	Cost of basic non-food (a) × (b)
(2017 PPP dollars per person per day)			
Low-income countries	2.15	0.37	0.80
Lower-middle-income countries	3.65	0.44	1.61
Upper-middle-income countries	6.85	0.54	3.70
High-income countries	24.36	0.54	13.20

NOTE: PPP = purchasing power parity.
 SOURCE: Bai, Y., Herforth, A., Cafiero, C., Conti, V., Rissanen, M.O., Masters, W.A. & Rosero Moncayo, J. (forthcoming). *Methods for monitoring the affordability of a healthy diet*. FAO Statistics Division Working Paper. Rome, FAO.

WB poverty lines, based on average of governments' lines in each income group × *Average of poorer residents' spending on nonfood goods & services in each income group* = *Required nonfood spending used to obtain income available for food*

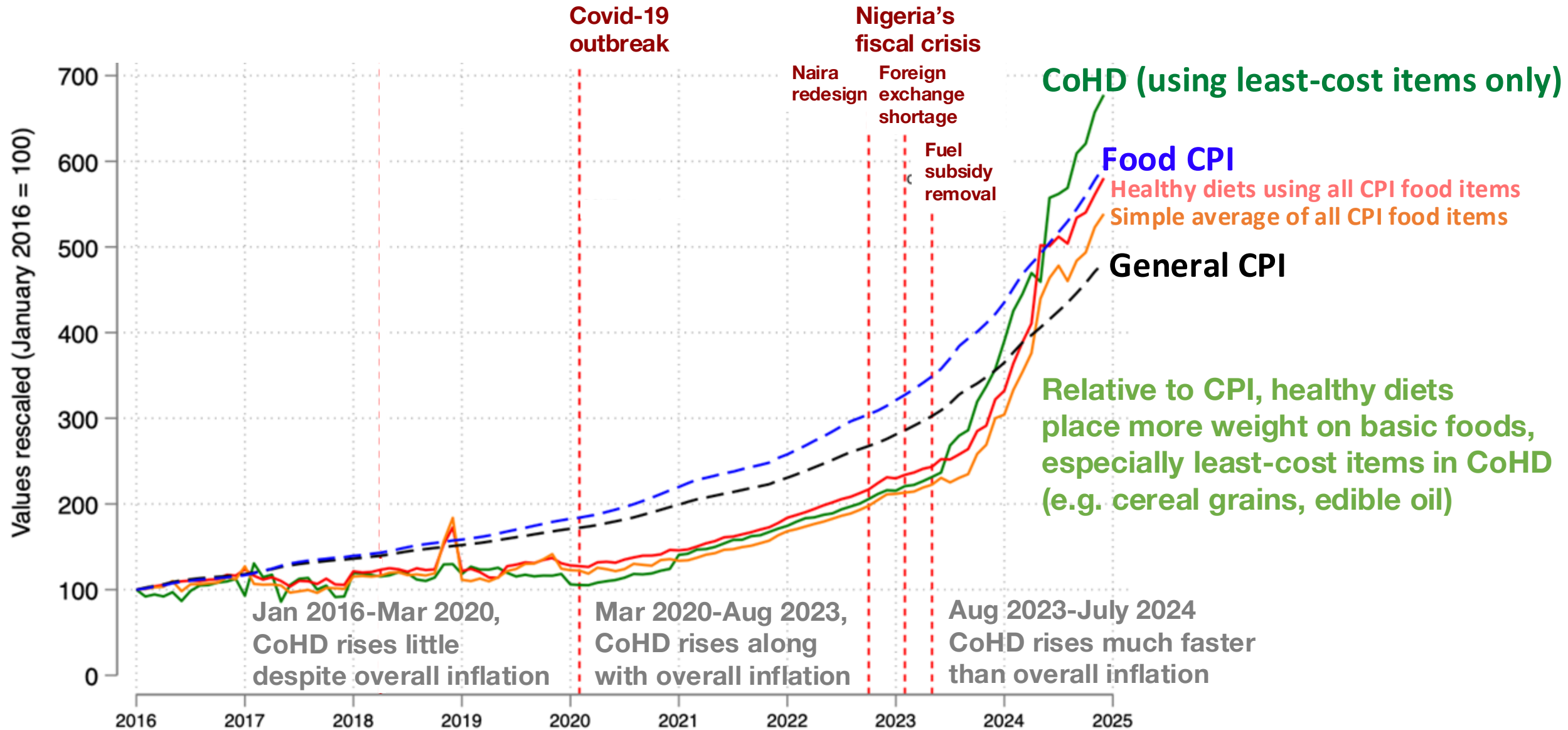
Affordability of healthy diets differs from other food security data

Prevalence of three main food insecurity metrics in 2021



Source: Reproduced from Figure 5 of W.A. Masters, J.K. Wallingford, A.W. Herforth and Y. Bai, 2025. Measuring Food Access as Affordability of Least-Cost Healthy Diets Worldwide. *Agricultural Economics*.

Nigeria data shows how the lowest cost of a healthy diet can have different inflation dynamics than other price indexes



Source: Food Prices for Nutrition analysis of Nigeria NBS data, June 2025.

Nigeria's CoHD data is published monthly and widely cited in local policy debates



NATIONAL BUREAU OF STATISTICS

COST OF A HEALTHY DIET

Published since Jan. 2024

Items most often found in Nigeria's CoHD

Food group	Item and frequency
Starchy staples	Millet (whole grain) 32%
	Maize (white grain) 15%
Oils	Palm oil 80%
	Groundnut oil 8%
Fruits	Coconut 42%
	Date palm fruit 30%
Vegetables	Okra (dried) 25%
	Bitter leaf 25%
Legumes, nuts and seeds	Groundnut (shelled) 58%
	Soya beans 20%
Animal source foods	Crayfish (small white) 36%
	Shrimps (red dried) 10%

Note: Data shown are for December 2024



NBS launches new "cost healthy diet" indicator to assess Nigeria's food affordability

By Jimisayo Opanuga Date: 31 Jan 2024

Six Key Insights from the Cost of a Healthy Diet (CoHD) Reports



Living vs minimum wage: Labour's fresh push for salary increase

Bunmi Bailey - June 13, 2024

Nigeria more than doubles the minimum wage for government workers after strikes and negotiations



BY DYEPKAZAH SHIBAYAN July 19, 2024

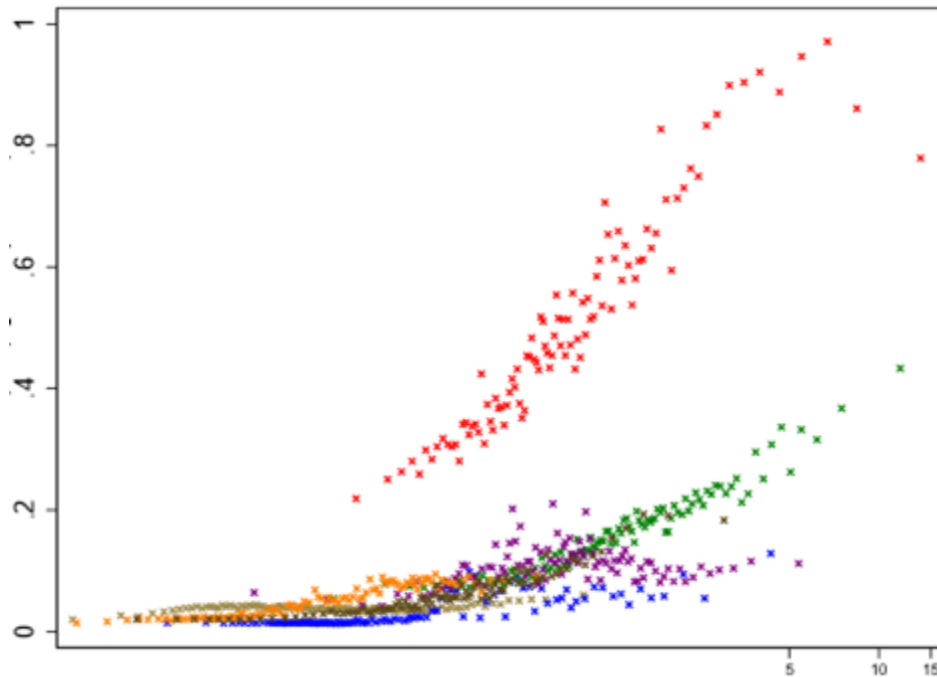
Within each food group, lower cost items usually have less CO2-equivalent emissions...but can be healthier

...so for measuring access to healthy *and* sustainable diets, we can use the lowest-cost items in each food group

Emissions

(kg of CO2-eq./100 kcal)

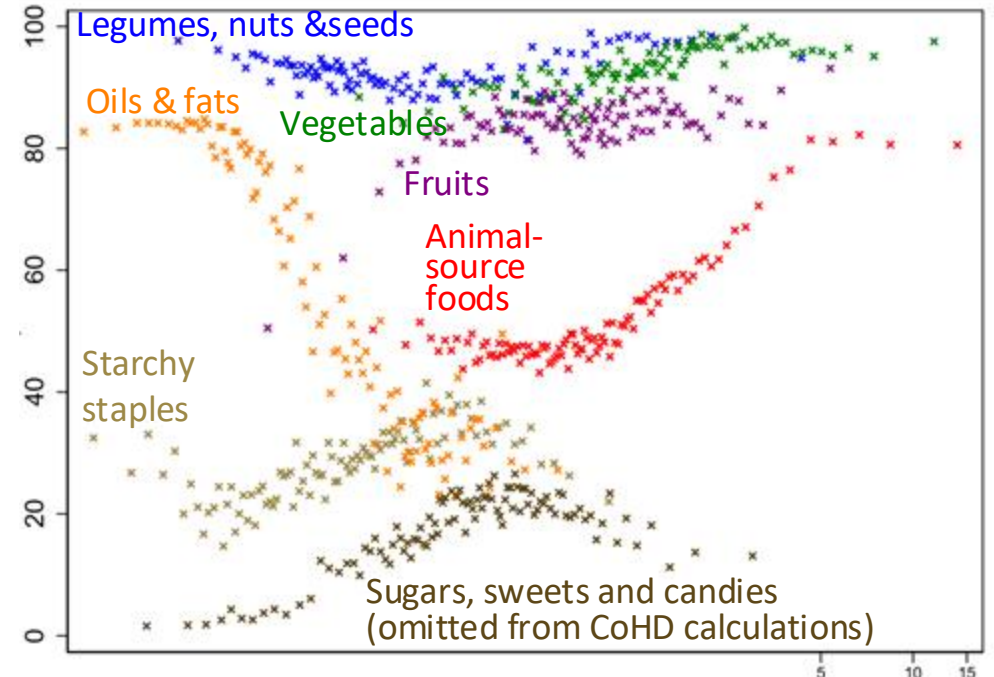
- Animal-source foods
- Legumes, nuts & seeds
- Fruits
- Vegetables
- Oils & fats
- Sugars, sweets & candies
- Starchy staples



Cost of each food item (\$/100 kcal, log scale)

Nutritional profile

(Food Compass score/100 kcal - higher is healthier)



Cost of each food item (\$/100 kcal, log scale)

Source: Elena Martinez, "Market and non-market costs of affordable, healthy diets." PhD dissertation, Friedman School of Nutrition, Tufts University. Prices shown are for n=811 food items in 181 countries observed in 2011 and 2017, reported by national statistical agencies through the International Comparison Program (ICP), matched to climate and water footprint estimates from Petersson et al. (2021). Figures are binned scatter plots, where each food group is represented by 100 data points, each of which is the mean value of the y-axis variable at the mean level of the x-axis variable across 100 equal-sized bins.

Conclusion:

Monitoring the lowest cost healthy diets in each country shows how to bring healthy, sustainable diets within reach

- **For about 2.8 b. people (34% of the world), healthy diets remain unaffordable**
 - Nutrient-rich foods are more costly to grow and ship than starchy staples, vegetable oil & sugar
 - Most unaffordability is due to low incomes, so healthier diets requires higher income or safety nets
- **Even if healthy diets are affordable, they are often displaced by less healthy items**
 - Many factors beyond health drive food choice, as people transition from inadequacy to excess
 - overshooting on animal-source foods, sweeteners and oils, even for home-cooked meals
 - switching to food service and packaged items, leading to excess salt, refined grains etc.
- **Calculating benchmark modeled diets identifies the frontier of potentially affordable foods**
 - Reveals role of income, safety nets and nonfood spending in unaffordability of healthy diets
 - Reveals role of innovation in lowering product cost per unit of each food
 - product cost is closely correlated with emissions (lower cost -> lower emissions, but not always)
 - product cost has varied correlations with nutritional value (depends on product category)
 - In many settings, poor diet quality is caused by factors other than income and price
 - displacement of low-cost healthy options due to attributes such as taste, convenience, and aspirations

=> for poverty measurement in richer countries, may need even more expensive diet quality standards



Thank you!

We are grateful to many price data collectors, analysts and project collaborators, and to the Bill & Melinda Gates Foundation and the UKAid government for funding

BILL & MELINDA
GATES *foundation*



Foreign, Commonwealth
& Development Office

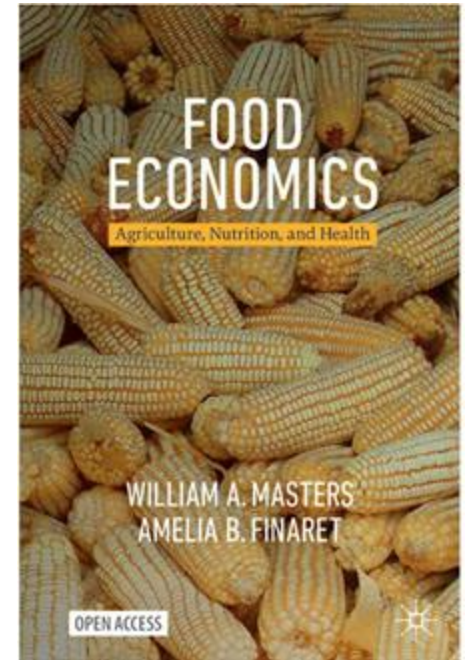
...and there's more:

Open-access textbook at
<https://bit.ly/FoodEconBook>

Global monitoring is done jointly by the FAO and the World Bank, with the new data through 2023 to be released next week on July 28th



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Other slides

Diet costs use local availability and price data, matched to food composition and health needs

We find a ladder of diet costs, from the cheapest energy source to higher-priced foods
...so we can now compare low-cost healthy diet benchmarks to actual food choice

SOFI 2024 updated the price data to items observed in 2021, and updated the income data & method to compute unaffordability

SOFI 2022 introduced the Cost of a Healthy Diet (CoHD) based on the “Healthy Diet Basket” of each country’s 11 least-cost items in 6 food groups

SOFI 2020 used 10 national guidelines for the Cost of Recommended Diets (CoRD)

Food preferences, convenience

Our 2018 journal article introduced a Cost of Diet Diversity (CoDD) metric and we have many other studies analyzing other aspects of diet costs



Healthy diets
 Meets national dietary guidelines by food group
Global ave. in 2021 = \$3.56/day

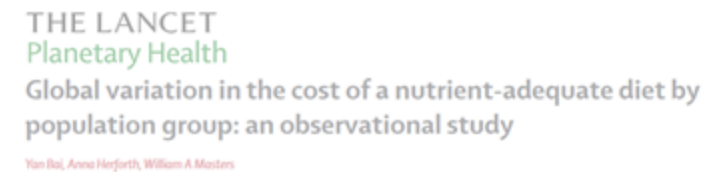
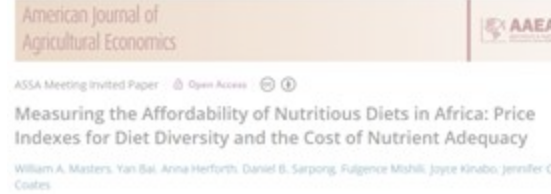
Nutrient adequacy
 Avoids deficiency or excess of essential macro- and micronutrients
Global average in 2021 = \$2.45/day

Daily energy
 Meets only calorie needs, for short-term survival and physical work
Global average in 2021 = \$0.93/day

Methods and options to monitor the cost and affordability of a healthy diet globally

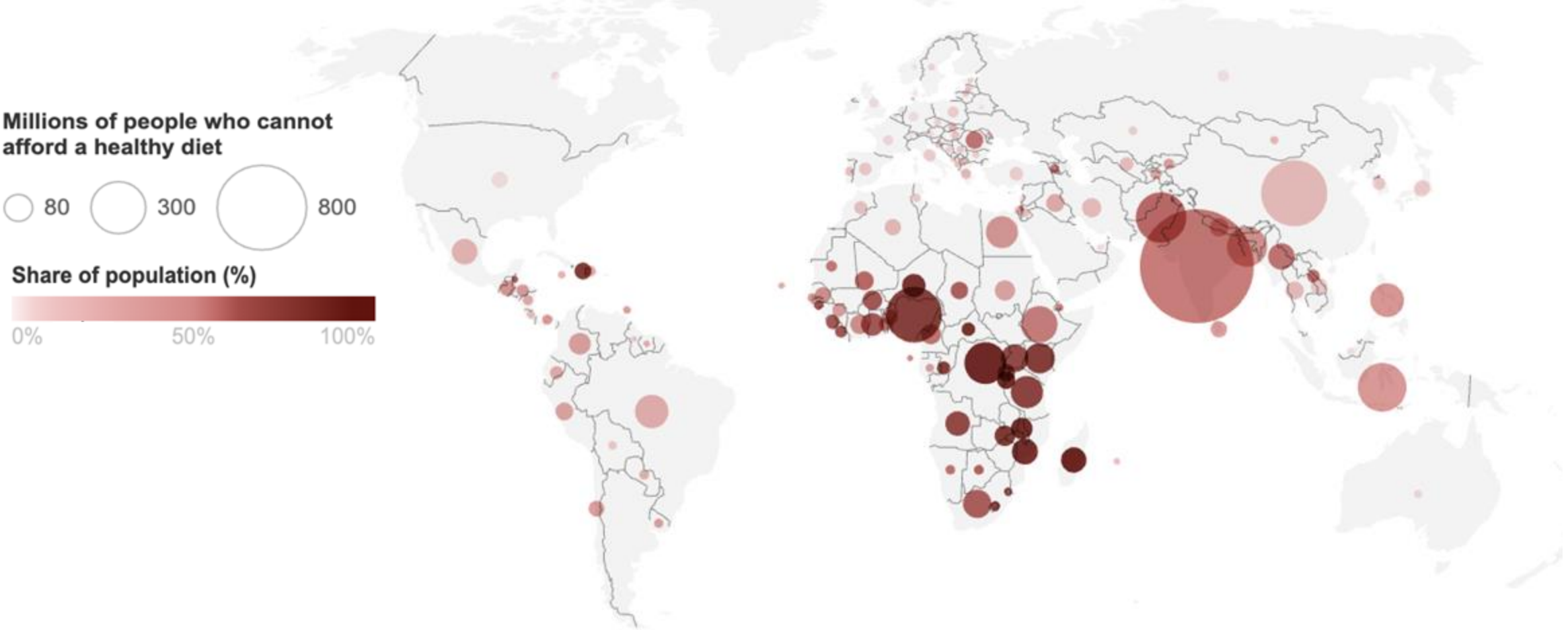


Background paper for *The State of Food Security and Nutrition in the World 2022*



The latest UN estimate is that 2.8 billion people (34% of the world) could not afford a healthy diet in 2022

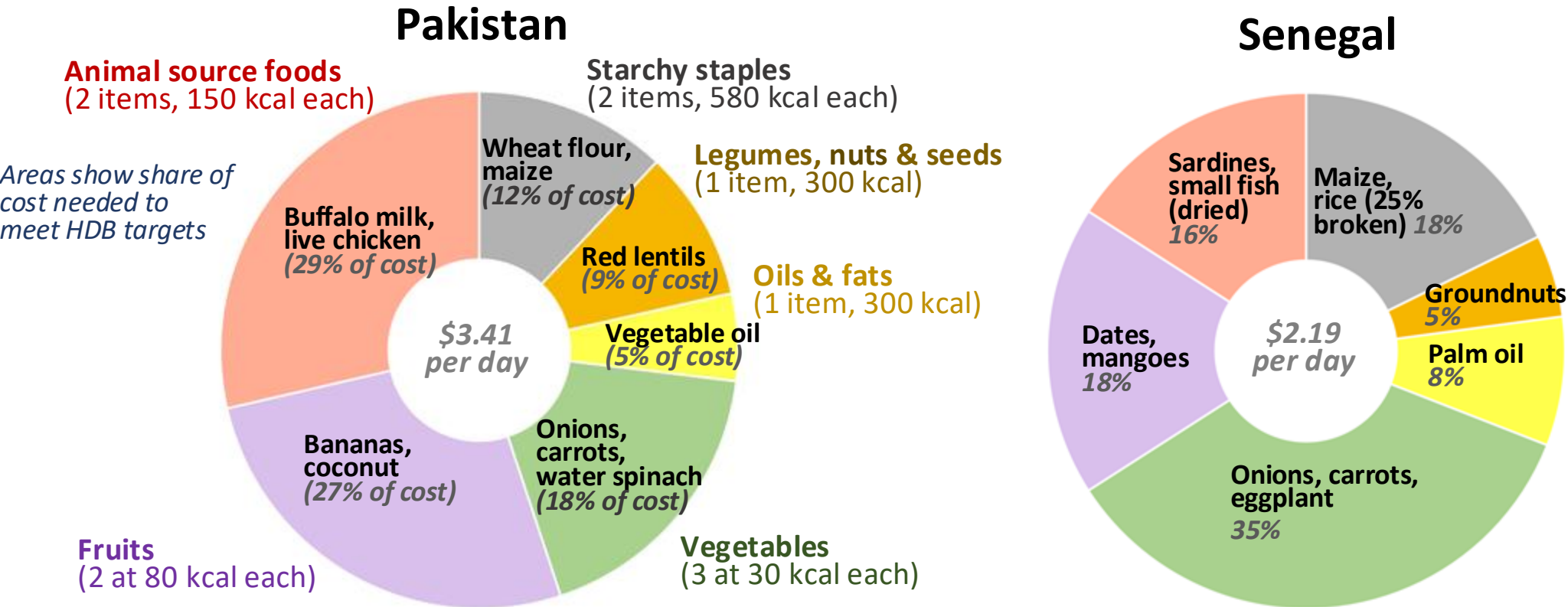
Number and proportion of people who cannot afford a healthy diet



Note: Data shown are based on 2021 item prices projected forward to 2022, relative to income data in 2022.
Source: FAO and World Bank, 2024. The latest data are at <https://www.fao.org/faostat/en/#data/CAHD> and <https://www.worldbank.org/foodpricesfornutrition>.

Identifying least-cost healthy options reveals whether poor diets are due to high cost, low incomes, or food choice

The benchmark Cost of a Healthy Diet is the least expensive Healthy Diet Basket of 11 items in 6 food groups using data reported by each country about the availability and price of locally consumed foods

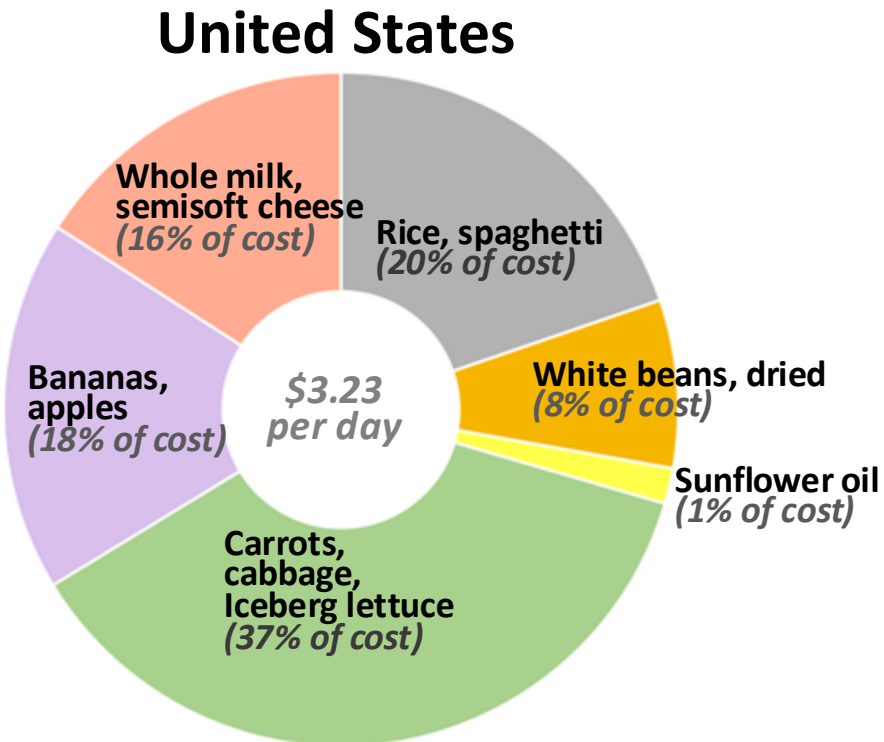
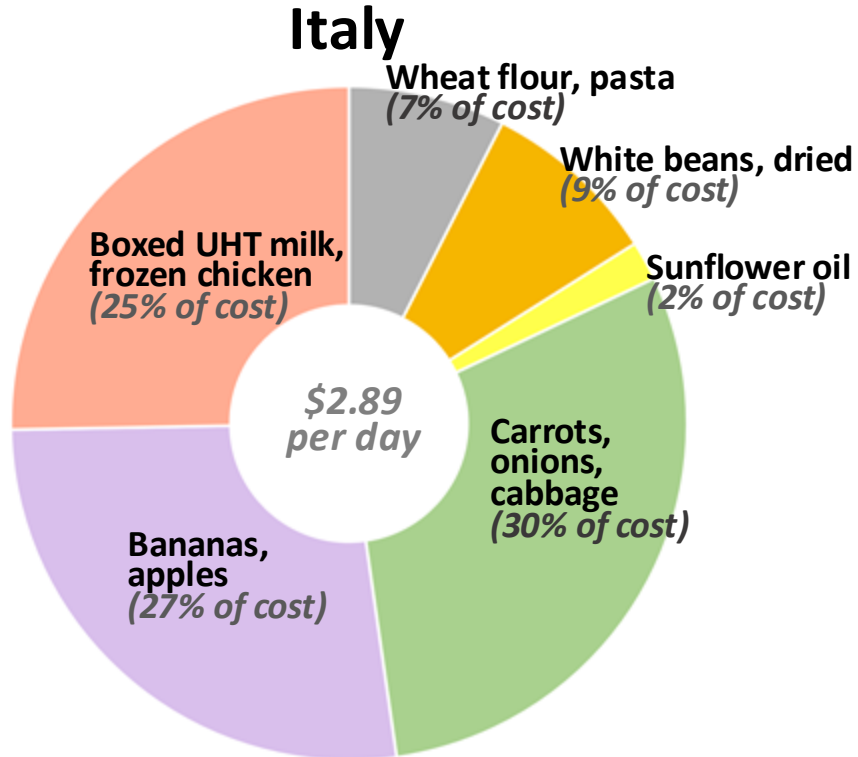


Note: Each item's cost is for a sufficient weight or volume to meet the HDB targets, based on matching item descriptions to food composition data. In food groups requiring multiple items, the lowest-cost foods are listed first. Item descriptions are standardized across countries, with its availability and national average price reported by each country's statistical agency to the International Comparison Program (ICP) for 2017. Cost levels are as published by FAO and the World Bank with methods detailed at Food Prices for Nutrition (2022). <https://sites.tufts.edu/foodpricesfornutrition>

Identifying least-cost healthy options reveals whether poor diets are due to high cost, low incomes, or food choice

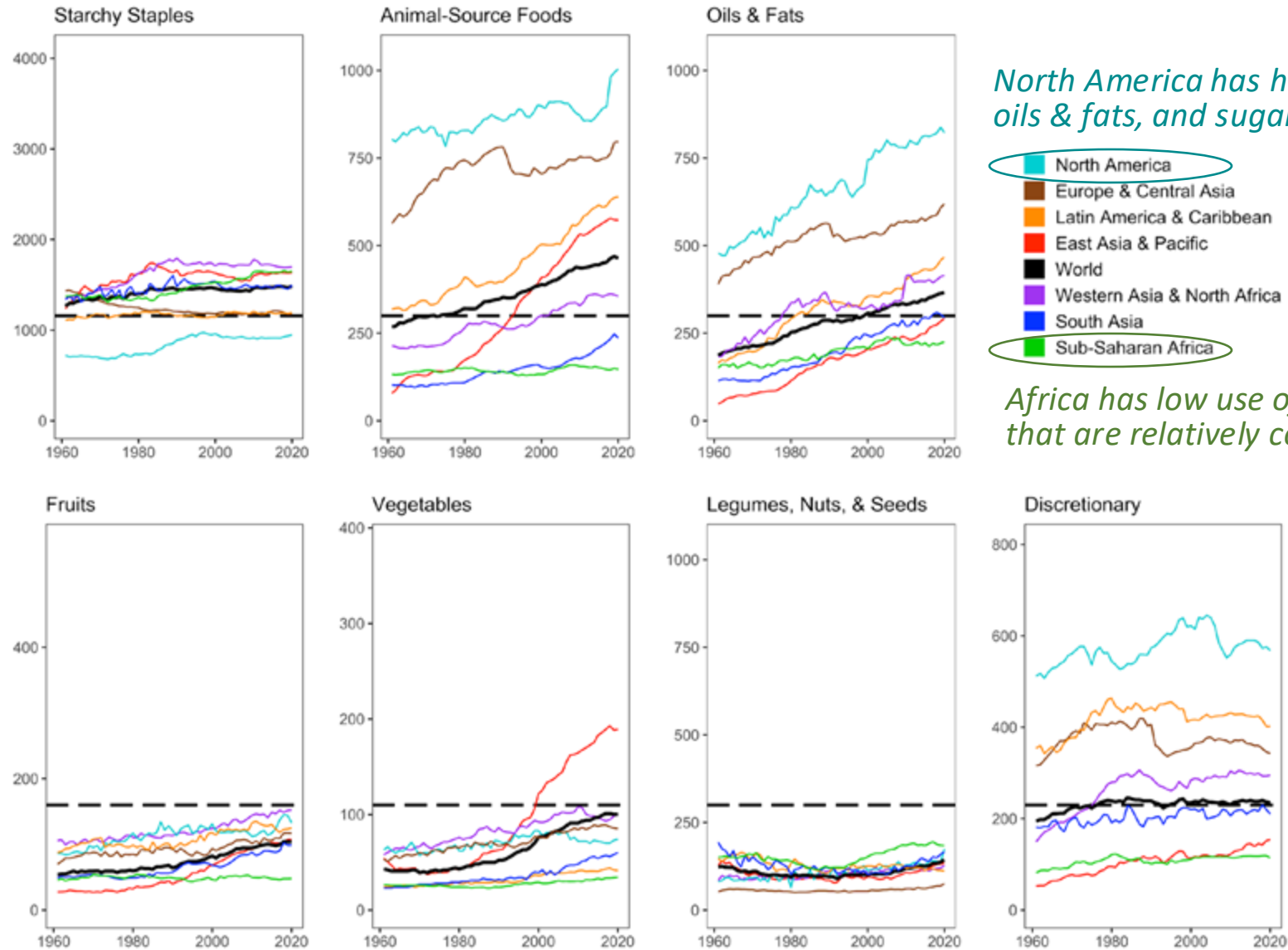
The benchmark Cost of a Healthy Diet is the least expensive Healthy Diet Basket of 11 items in 6 food groups using data reported by each country about the availability and price of locally consumed foods

This is a much cheaper diet than would actually be recommended; Remember that as of Jan. 2025, the USDA's Thrifty Food Plan guiding SNAP benefits is \$8.15/day for an adult woman



Note: Each item's cost is for a sufficient weight or volume to meet the HDB targets, based on matching item descriptions to food composition data. In food groups requiring multiple items, the lowest-cost foods are listed first. Item descriptions are standardized across countries, with its availability and national average price reported by each country's statistical agency to the International Comparison Program (ICP) for 2017. Cost levels are as published by FAO and the World Bank with methods detailed at Food Prices for Nutrition (2022). <https://sites.tufts.edu/foodpricesfornutrition>

Globally, actual food use is far from Healthy Diet Basket targets in ways that differ by region and over time



North America has highest use of animal foods, oils & fats, and sugar



Africa has low use of all food groups that are relatively costly per calorie

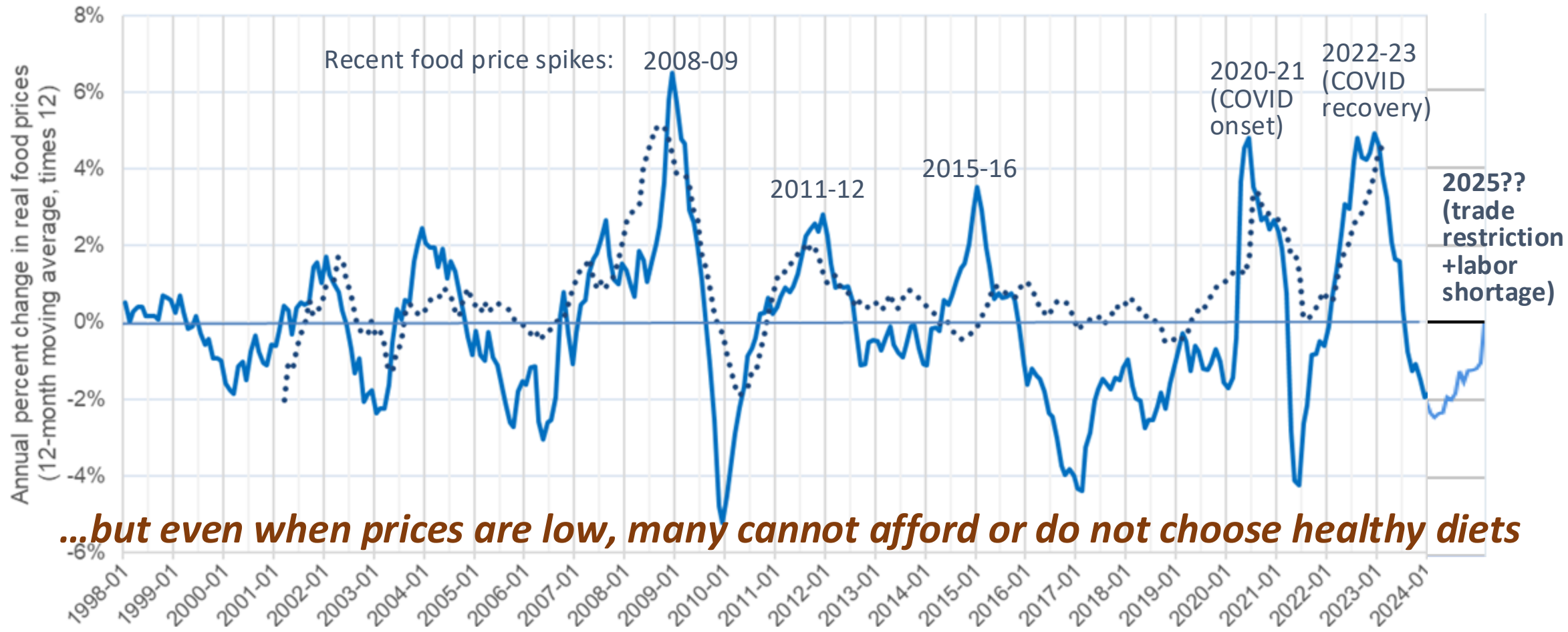
Source: Leah Costlow, doctoral dissertation in progress, Friedman School of Nutrition, Tufts University.

Data shown are from FAO Food Balance Sheet data, for total daily kilocalories available per capita in each region aggregated by HDB food group.

Reproduced in Masters & Finaret (2024), *Food Economics: Agriculture, Nutrition and Health*. Palgrave MacMillan, open access at <https://link.springer.com/book/9783031538391>.

How do food prices limit affordability of healthy diets?

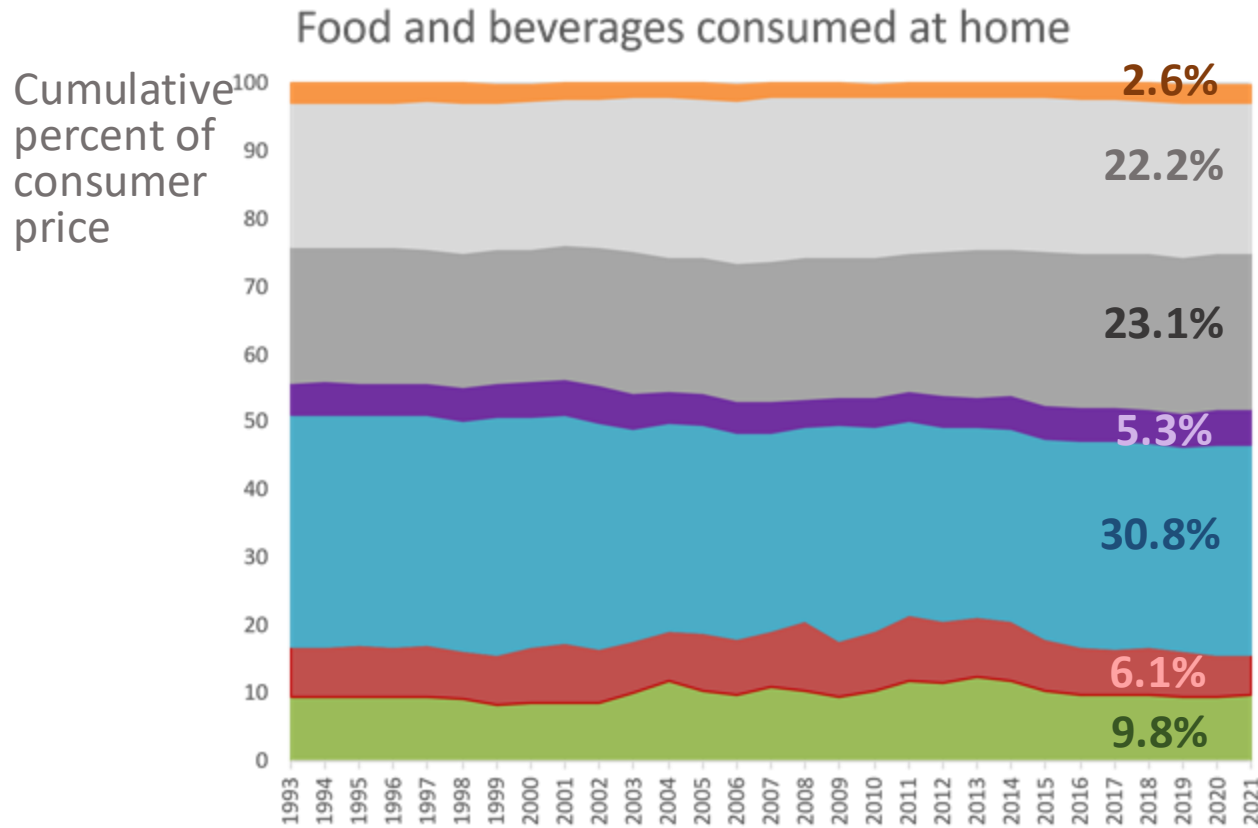
Average rise in retail food prices relative to all other goods and services over previous 12 months in the U.S. and worldwide, Jan. 1998 - Mar 2025



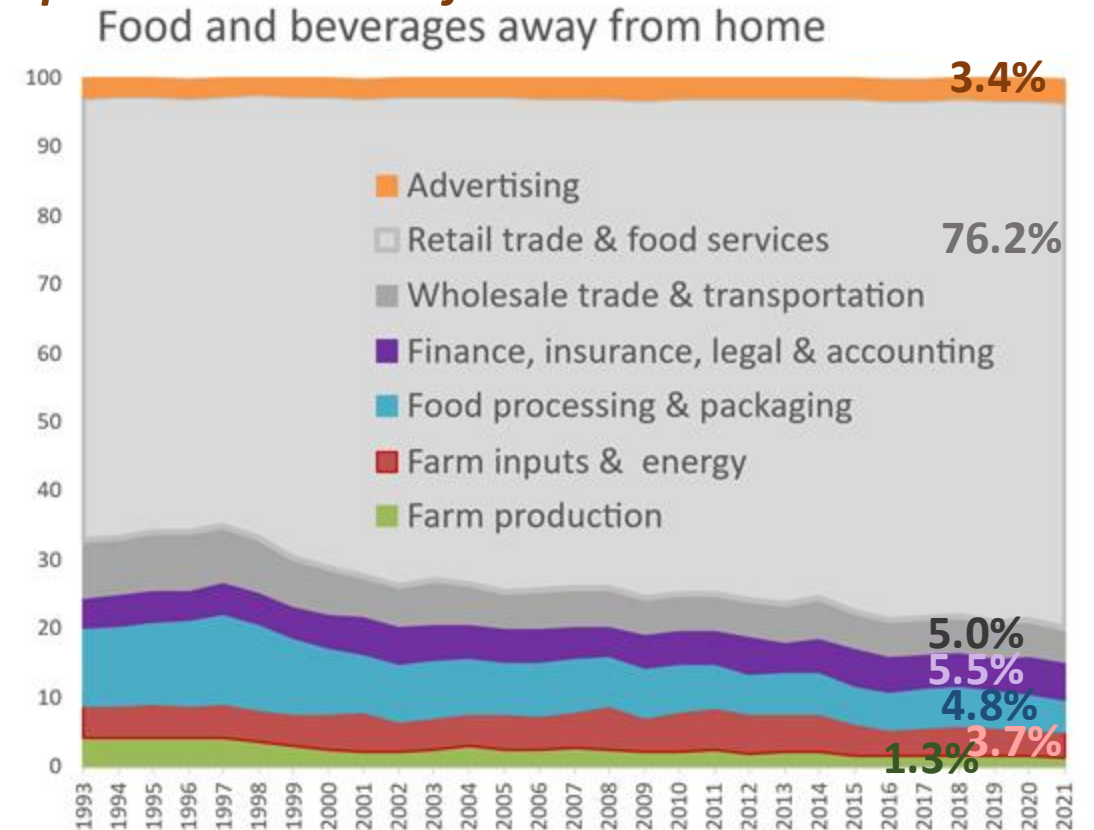
Note: Updated from Figure 7.1 in Masters & Finaret, [Food Economics](#) (2024). U.S. data are from the Bureau of Labor Statistics (<https://fred.stlouisfed.org/graph/?g=12Myr>). Global data are from the IMF, averaging up to 138 countries reporting monthly consumer price indexes (CPI) for food and for all goods and services, Jan. 2000 through Dec. 2022. Each observation is the average monthly rise over the previous 12 months, times 12 to obtain an annualized value. Number of countries rises from 51 in Jan 2000 to 95 in 2005 and then 138 from 2015 onwards. Raw data for all countries are at <https://data.imf.org>.

When we buy food, what are we paying for?

Cost of food by stage of value added in the United States, 1993 – 2021



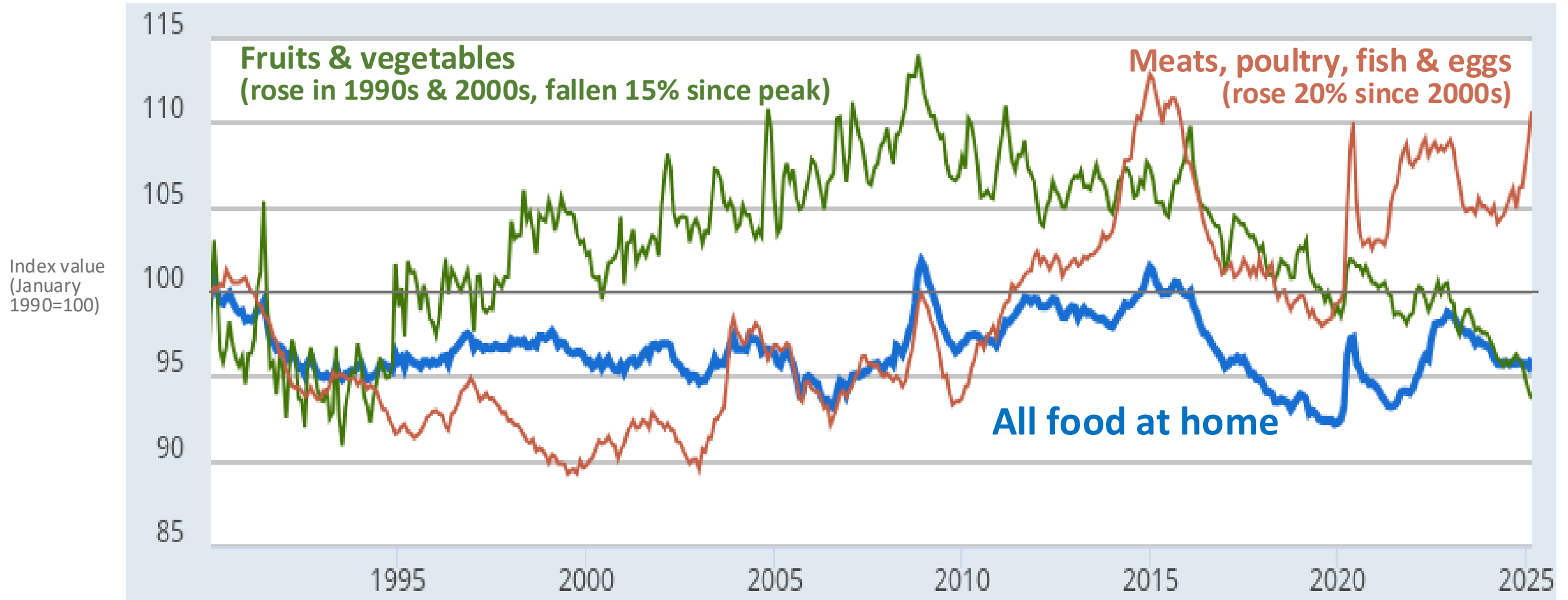
What consumers pay for is mostly post-harvest transformation and services



Note: Author's calculations. Data shown are from the USDA Economic Research Service (2023), *Food Dollar Series*. Last updated Feb. 15, 2023, available at <https://www.ers.usda.gov/data-products/food-dollar-series>. Implied total spending on food advertising is roughly \$60 billion per year, more than the NIH and CDC budgets combined. Total food spending per person is about \$4,000 at home and \$3,000 away from home (excl. alcohol), in contrast to \$1,800 in prescription drugs.

Price variation differs by type of food

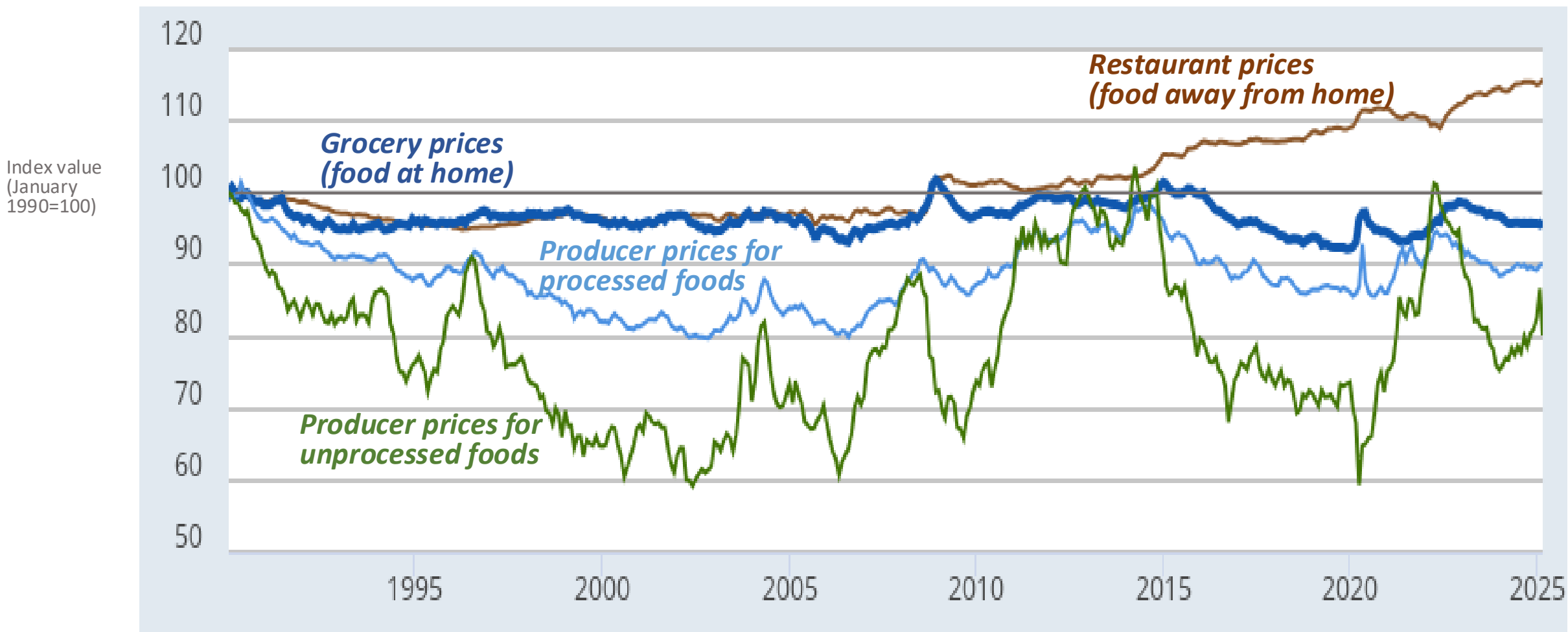
Price level for major nutrient-rich food groups in the U.S., January 1990 – March 2025



Note: Author's calculations. Data shown are from the US Bureau of Labor Statistics, as the average for each category relative to the overall U.S. consumer price index for all goods and services. Fruits and vegetables may be fresh, frozen or canned. Updated values can be obtained at <https://fred.stlouisfed.org/graph/?g=1ITZO>.

Price variation differs by stage of the value chain

Consumer prices versus wholesale producer prices in the U.S., January 1990 – March 2025



Note: Author's calculations. Data shown are from the US Bureau of Labor Statistics, as the average for each category relative to the overall U.S. consumer price index for all goods and services. Fruits and vegetables may be fresh, frozen or canned. Updated values can be obtained from <https://fred.stlouisfed.org/graph/?g=12MMI>.