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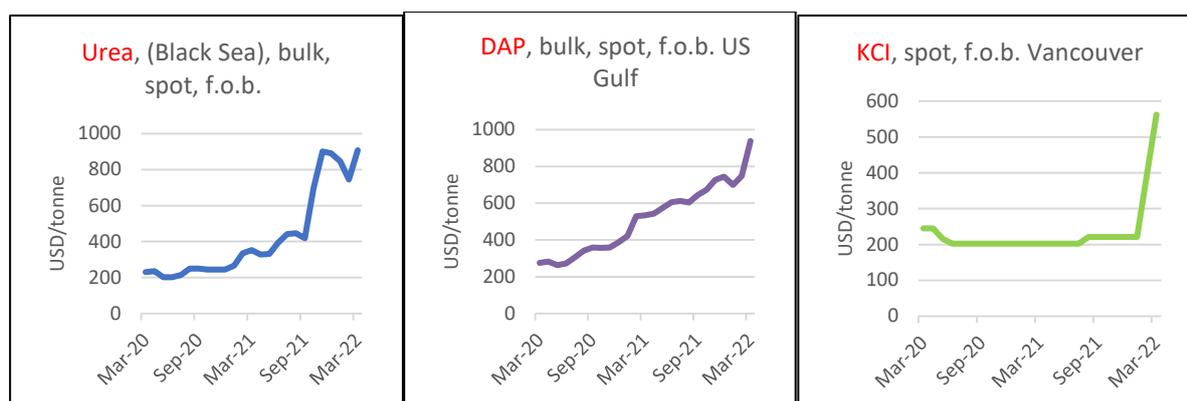
DEVELOPMENTS IN GLOBAL FERTILIZER MARKETS

I. SETTING THE SCENE: SOARING FERTILIZER PRICES CONTINUE THEIR TRAJECTORY FROM 2021 INTO 2022

1. International fertilizer benchmark prices, which began soaring in late 2021 have continued their trend in 2022, with many quotations reaching all-time highs month after month. The most notable increases have been registered for nitrogen (N) fertilizer, with prices of urea having risen almost fourfold over the past two years – nominal Black Sea spot prices (bulk) were quoted at USD 231/tonne in March 2020 and then at USD 908/tonne in March 2022 (Figure 1).

2. Prices for phosphorous fertilizer (P) have risen in tandem. Those for diammonium phosphate, or DAP, a key composite P fertilizer, have more than trebled from USD 276/t to USD 938/t over the same period (Figure 1). While the price increase for DAP fertilizer reflects higher prices for its N-component, there was also an equal effect from higher P-fertilizer prices, which is estimated to have accounted for about 50 percent of the overall increase in DAP quotations. On the other hand, prices for potash (K-fertilizer), remained less affected until the beginning of 2022, i.e. the spot price of Potassium Chloride (KCI) slightly decreased from USD 245/tonne in March 2020 to USD 221/tonne in January 2022, and over the last two months, the benchmark price surged to USD 563/tonne in March 2022 (Figure 1).

Figure 1: Spot price trends for key N, P and K fertilizer, March 2020 to March 2022



II. WHY HIGH FERTILIZER PRICES MATTER

3. Fertilizers, through appropriate N-P-K nutrient ratios applied to the soil, are instrumental in raising crop productivity and hence profitability in the farming sector in normal times. By maintaining the commercial viability of the sector against a long-term secular decline in real (inflation-adjusted) food prices, they have been pivotal to feeding the world for much of our history.

4. To illustrate their importance, Table 1¹ provides an example of how a complete lack of nitrogen (N) fertilizer can contribute to yield declines for key staple crops in the United States of America.

¹ Source: Stewart, W.M., Dibb, D.W., Johnston, A.E. and Smyth, T.J. (2005), The Contribution of Commercial Fertilizer Nutrients to Food Production. *Agron. J.*, 97: 1-6. <https://doi.org/10.2134/agronj2005.0001>

Table 1: Estimated effect of N fertilizer on selected crop yields. *Baseline yields are from USDA (1987)

Crop	Baseline*	Without N fertilizer	Reduction (%)
Maize	7.65	4.52	41
Rice	6.16	4.48	27
Barley	2.53	2.04	19
Sorghum	4.64	3.76	19
Wheat	2.15	1.81	16
Soybeans	2.28	2.28	0

5. The highest impacts are for maize, in which yields are estimated to decline by 41 percent without N fertilizer, or in other words, nitrogen is responsible for 41 percent of maize yield. At the other end of the spectrum lies Soybeans, in which N plays no part in yield reduction, which is primarily due to the inherent nitrogen-fixing properties of the plant. Of course, had the effects of other nutrient inputs such as P and K been accounted for, estimated yield reductions in all crops would have been much greater. A caveat of the Table is that measuring yield responses depends on other factors such as variable soil fertility levels, climatic conditions, crop rotations and changes in production practices that affect nutrient use efficiency.

6. Against the backdrop of rising fertilizer prices, Table 1 is also indicative in understanding how farmers' decision-making is influenced, i.e. what crops to grow, how much to grow and the extent of fertilizer application. Driven by profit maximisation, their decisions have huge potential implications for global food security.

III. UNDERSTANDING THE DRIVERS OF FERTILIZER MARKETS AND PRICE DEVELOPMENTS

7. As in all commodity markets, fertilizer prices are determined by the interplay of supply and demand. On the supply side, (i) high and rising energy prices; (ii) disruptions in trade and high transportation costs, (iii) export restriction, while on the demand side (iv) (implicit) import subsidies and high crop prices and hence high affordability.

High and volatile energy prices: Natural gas plays a primary role in the production of N-fertilizer. Prices for natural gas underwent a sharp increase in 2021, which continued into 2022, reflecting a host of reasons. For instance, adverse weather conditions around the world hampered renewable energy production, leading to higher gas demand and hence prices. To compensate for a fall in gas supplies from the Russian Federation (a major exporter), Europe has begun importing large quantities of Liquefied Natural Gas (LNG) from the United States of America², easing supply tightness in natural gas markets and contributing to a drop in gas prices in December 2021, January 2022 and March 2022 (Figure 2).

² <https://www.bruegel.org/publications/datasets/european-natural-gas-imports/>

Figure 2: Natural gas futures in USA and Europe³

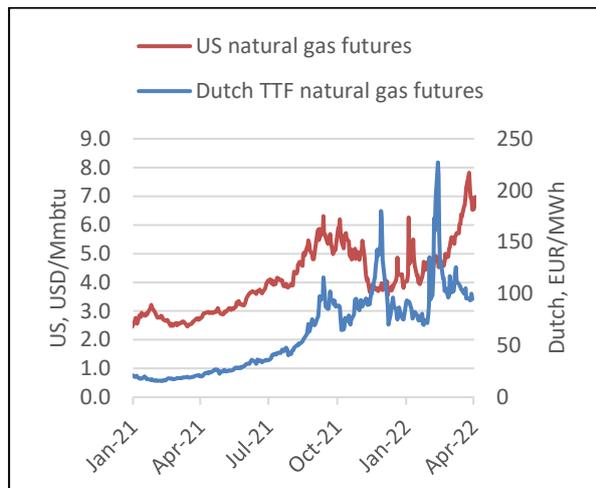
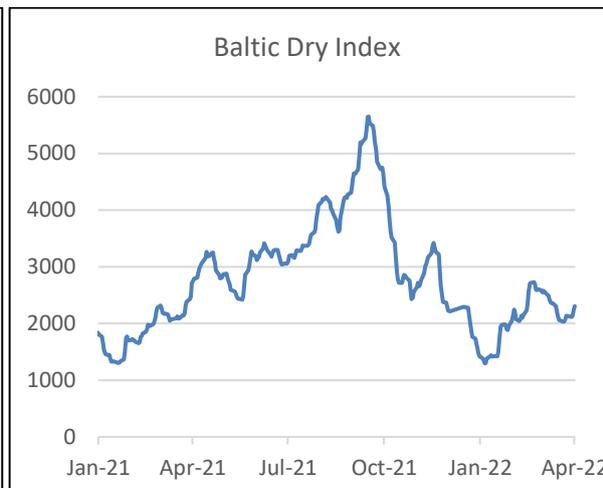


Figure 3: The BDI is back to its January 2021 level

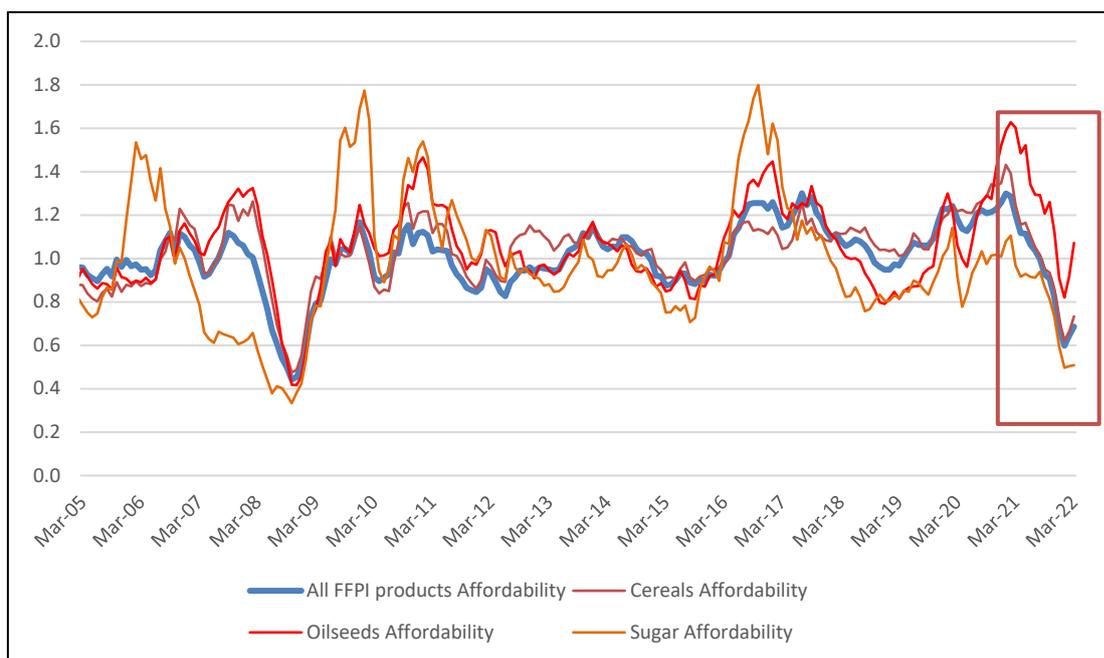


8. **Trade policies and higher transportation costs:** In response to rising global demand for fertilizers and rising domestic prices, a number of key suppliers have responded with export restrictions placing further upward pressure on international fertilizer prices (especially in late 2021). Concerning transportation costs, the COVID-19 pandemic has caused widespread disruptions in international supply chains, resulting in higher freight costs and longer transit times. In an exceptionally volatile freight market, prices for bulk and container shipments saw marked increases until September 2021 (Figure 3) but now they appear to have reverted to April 2021 levels.

9. **High crop prices and high affordability⁴:** Output prices also reached all-time highs in March 2022. According to the FAO Food Price Index (FFPI), international food commodity prices rose from 113.5 to 134.1 index points between January and December 2021, and then in 2022, to 159.3, its highest level since the inception of the index in 1990. In 2021, the rapid rise in fertilizer prices lowered affordability at different speeds and extents. Commodity-wise, while affordability of fertilizers for cereals and sugar production declined to levels seen in 2020, it remained higher for oils and oilseeds (Figure 4).

³ <https://investing.com>

⁴ Affordability here is simply defined as the ratio of outputs (i.e., fertilizer) to input prices (i.e., the FFPI)

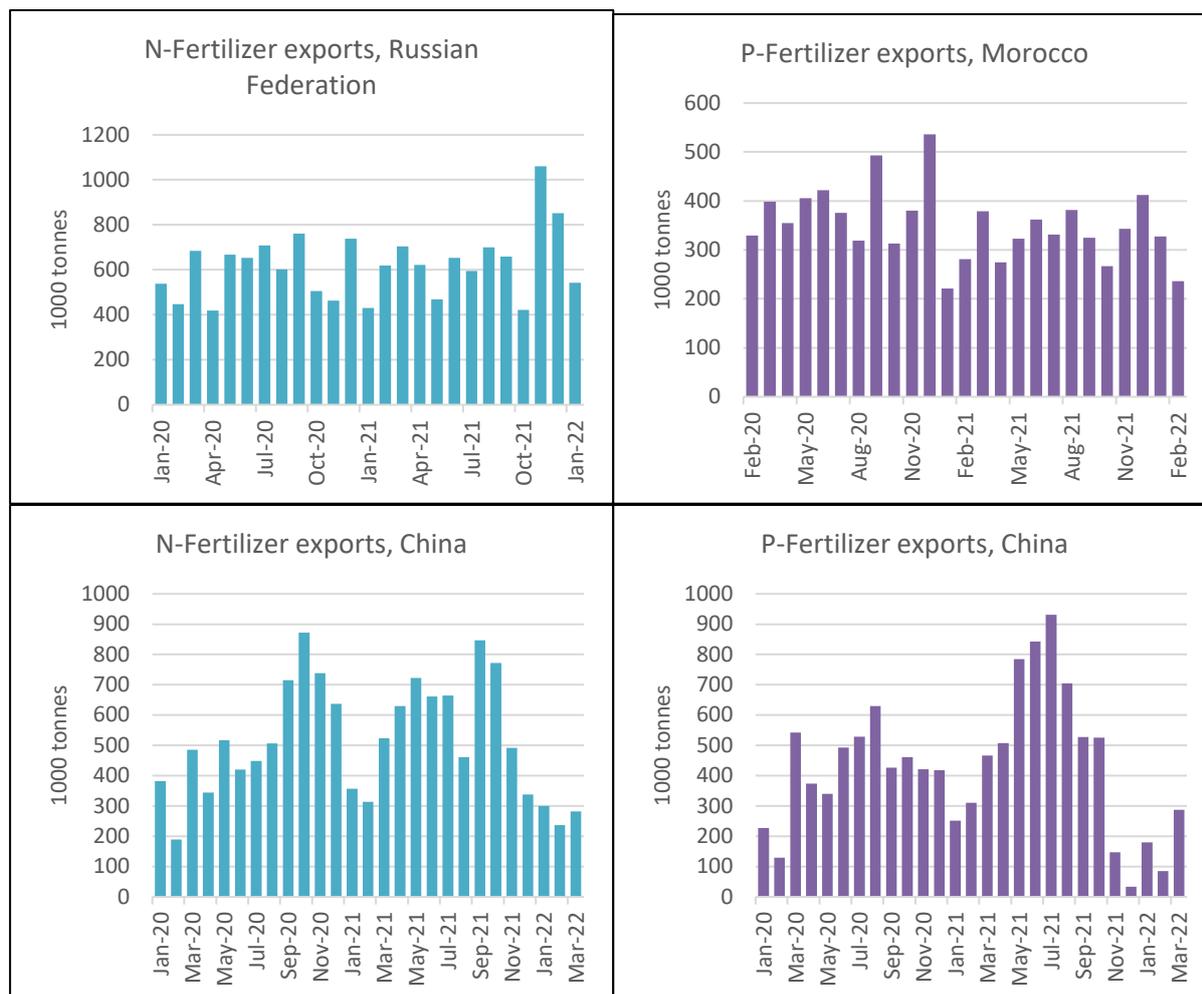
Figure 4: Overall fertilizer affordability and differences across groups of crops

IV. WHAT ARE THE PROSPECTS FOR 2022/23?

10. High and volatile fertilizer prices have given rise to concerns about low fertilizer availability in 2022/23, with potentially adverse effects on food production and food security. And, while the most recent declines in gas prices could be a harbinger of a notable relaxation of a still tight market situation, given the northern hemisphere is entering spring (lower demand for heating), international fertilizer supplies remain restricted, stocks are low, and geopolitical tensions could spark additional supply restrictions at short notice. This is particularly true for Russian fertilizer supplies. While exempt (along with food) from international sanctions, it has been reported⁵ that shipping companies are refusing to enter the Black Sea because of safety concerns from the conflict, notwithstanding the exceptionally high insurance premia being imposed on vessels. Furthermore, the Russian Federation may ban food and fertilizer exports in retaliation against wider economic sanctions.

11. These uncertainties make forecasts for fertilizer use in 2022/23 extremely difficult. Until more timely official trade data are made available, this assessment will therefore remain at a qualitative level, explaining how higher fertilizer prices could affect input use and food production in the current crop year.

⁵ See for example [Russian Ministry Recommends Suspending Fertilizer Exports \(wsj.com\)](#) and [As sanctions bite Russia, fertilizer shortage imperils world food supply | Reuters](#)

Figure 5: Drop in fertilizer exports for selected major suppliers

A. Immediate effects

12. Some immediate effects of current fertilizer shortages are already manifest. Apart from generally high prices, fertilizers were simply no longer available in the market as numerous production plants, faced with negative margins, had to stop production. Not only were gas prices too high to profitably operate urea plants, they were also too high to operate heating in greenhouses, particularly in Europe⁶, which could weigh on fruit and vegetable supplies in the first semester of 2022. Prices for these products are expected to remain high or even rise further, adding to already manifest food inflationary pressures.

B. Prospects for the remainder of 2022/23

13. Overall lower fertilizer affordability in 2021/22 suggests lower fertilizer use in 2022/23. The International Fertilizer Industry Association (IFA), for instance, estimates an initial decline of total fertilizer use of 3 percent in 2022/23. If materialised, this would be a rather modest reduction compared to the contractions in the high price episodes of the past. For instance, when P-fertilizer prices rose steeply in 2008/09, global average P-fertilizer application declined by 8 percent relative to 2007, those for K-potash by even 16 percent⁷. Unlike for N-fertilizer, a reduction in P and K fertilizer

⁶ <https://www.bloomberg.com/news/articles/2021-09-30/your-tomatoes-may-cost-more-as-gas-prices-hit-dutch-greenhouses>

⁷ In terms of nutrients, based on FAOSTAT

use, if limited to one season, may not necessarily result in major yield losses. Both P and K may therefore face significantly lower demand in 2022/23, if prices remain high and affordability stays low⁸. Lower levels of N-fertilizer applications, however, would steepen lower output and quality of food production (see Table 1). Particularly in developed countries, farmers invariably try to maintain high fertilizer use levels, even when prices soar. In 2008, for instance, global N-fertilizer applications declined by less than 1 percent relative to those prevailing in 2007.

14. In poorer countries, fertilizer use could decline faster, including the all-important N-fertilizer. Given that past experience shows that farmers in developed countries are rather unresponsive to increases in N-fertilizer prices, by contrast, farmers in developing countries would face lower availabilities and be forced to reduce applications. This occurred in 2009, for instance, when the use of N-fertilizer in Africa declined by 13 percent relative to 2008.

15. Added price pressure could arise from the growing need of N and P ingredients in non-agricultural use. For example, concerning N, industrial grade ammonia is now used in large quantities in catalytic converters of diesel engines. The rise in ammonia prices has already resulted in a near ubiquitous shortage of the required additive (“AdBlue”). Similarly, the use of P to manufacture lithium-ion batteries could mean that an increasing amount of the ingredient will be siphoned off from the fertilizer market.

16. Yet, there are also factors suggesting that farmers can use fertilizer more flexibly and will be hence more responsive to price changes. Unlike in the past, they now have tools to rationalize application levels without necessarily compromising output. Such tools include variable-rate application methods, precision agriculture and greater access to finance in acquiring inputs. There are also larger quantities of organic fertilizer made available and farmers have improved capacities to apply them in a more accurate, methodical and timely manner. Moreover, there is a growing number of markets and exchanges providing trading possibilities, so that organic fertilizer can be bought and sold within a given region, potentially helping to offset local deficits of mineral fertilizer supplies.

V. WHAT CAN BE DONE TO AVERT NEGATIVE IMPACTS ON GLOBAL FOOD PRODUCTION AND FOOD SECURITY?

A. In the short-term

17. **Keep trade open.** Arguably the most important contribution would be to lift export restrictions so as to satisfy demands in the global marketplace.

18. **Avoid ad hoc producer protection.** Likewise, all measures to make domestic fertilizer more affordable must be carefully weighed against their potentially detrimental effect on international markets. For instance, while short-term reductions in import tariffs will help improve access for domestic farmers, they will inevitably also add to the upward pressure on international prices. Likewise, increasing subsidies for domestic use will increase fertilizer applications at home, but will lower availability abroad and add pressure on international prices. Finally, subsidies to resource-poor farmers must be weighed against their potentially negative global food production effects. If subsidies shift fertilizer use from efficient to inefficient farmers, overall food production could fall, particularly in view of the low short-term responsiveness of fertilizer supply.

19. **Establish a Food Import Financing Facility (FIFF).** FAO has presented a proposal for a facility to help poor net food importers access international food markets. The facility would be limited to net food importers in the low-income and lower-middle-income groups of the World Bank classification, providing them with credit to purchase food on global markets. Those potential

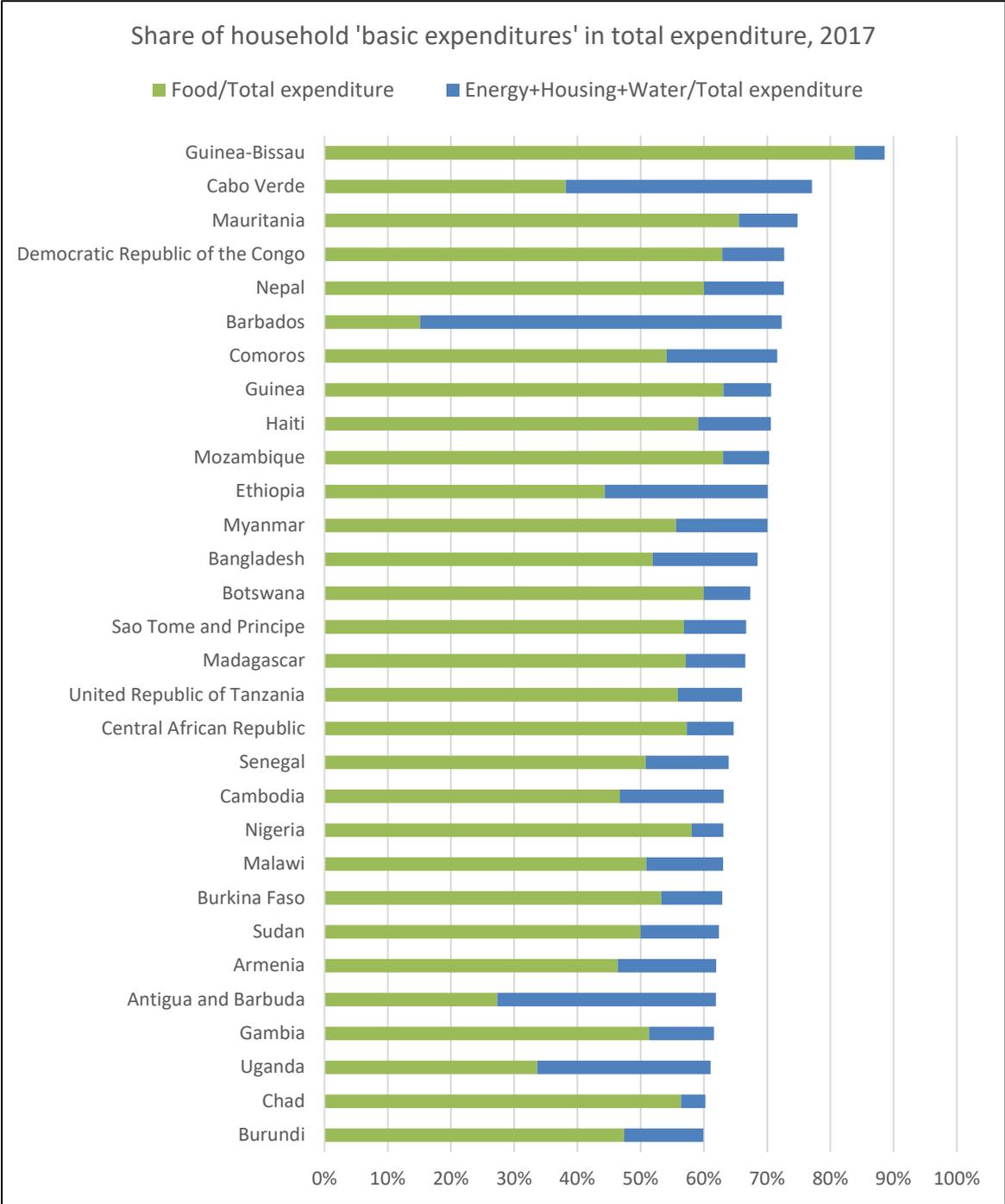
⁸ FAO encourages farmers to examine available P and K levels in their soils and rationalize the nutrient applications based on the results of these tests on a field-by-field basis.

beneficiaries would commit themselves to investing in sustainable agricultural productivity, thereby reducing their future food import needs (an automatic stabilizer). The facility has already been stress-tested, the results of which suggest that added world market price effects would not exceed a maximum of 15-20 percent, even at its maximum use level of USD 25.3 billion. Vulnerable food-import-dependent countries could mitigate long-lasting adverse impacts on their agrifood systems, improve resilience to external shocks and reduce future food import bills.

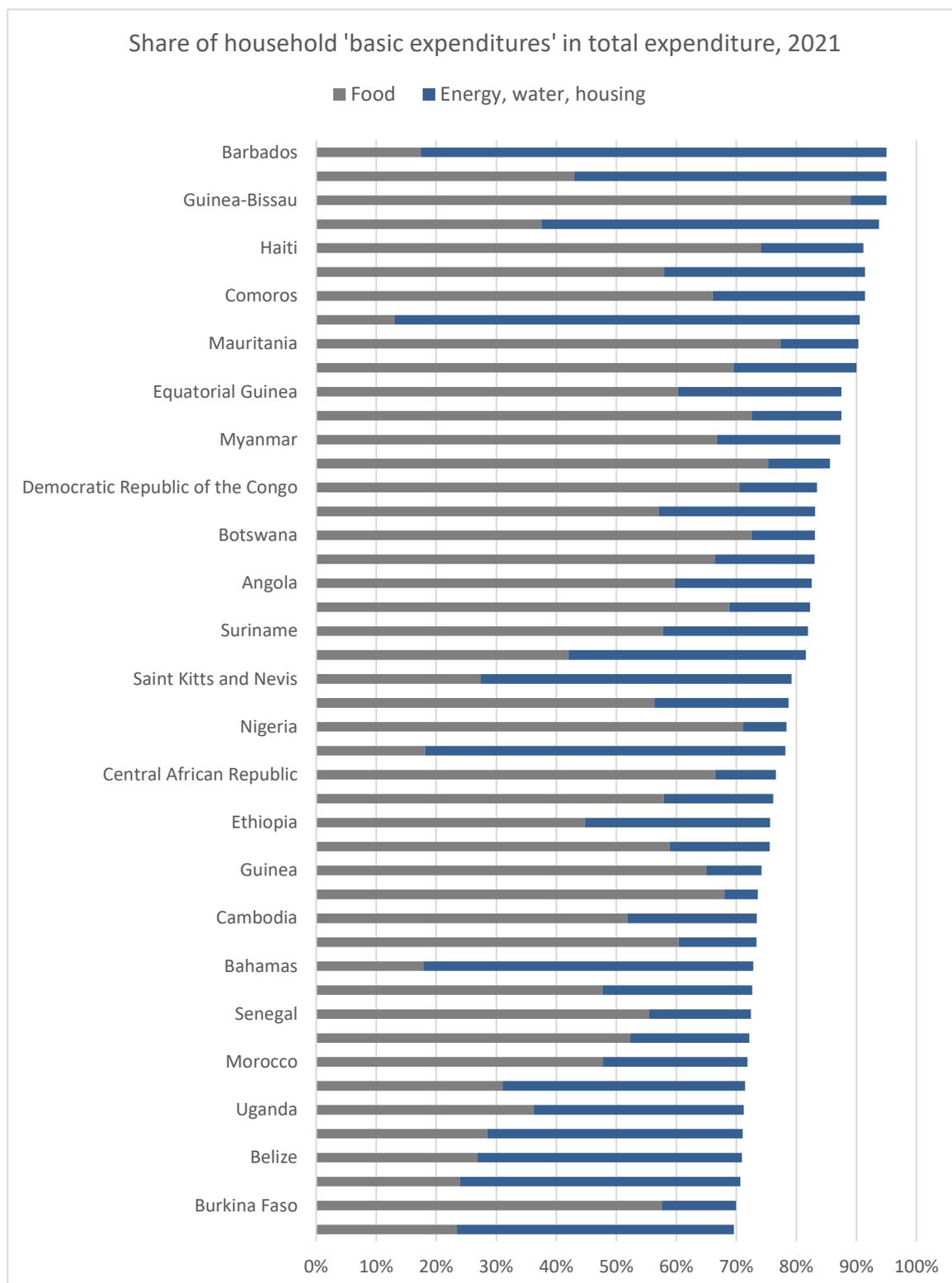
20. **Support poor consumers.** High prices of food and energy are regressive on poor consumers. Figure 6 and 7 rank consumer spending on food, as well as fuel, water and housing across the most exposed countries to large expenditure shares in these categories, in 2017 and 2021 respectively. Even the rather low food and fuel prices of 2017, households in 30 countries spent 60 percent or more of their incomes on these necessities. Preliminary estimates for 2021 suggest that another 23 countries have joined this group and that the average household expenditure shares in these 53 countries (30 plus 23 new ones in 2021) have risen from 62 percent in 2017 to 69 percent in 2021. For many consumers, this may mean either lower quantities or nutritional qualities of food consumption, or both, and hence more hunger and malnutrition, or less money for other necessities such as health and education. Curtailing such important expenditures could send communities into a vicious cycle of deepening food insecurity and poverty, with potentially irreversible effects.

21. **Improve market transparency.** At the 20th Session of the Global Food Market Information Group of the Agricultural Market Information System (AMIS), several country focal points expressed interest in analysing input costs, their composition, impacts of changes on margins for producers, and more generally, the profitability of different agricultural activities. In view of the current conditions in international energy and fertilizer markets, the initial focus was placed on collecting and compiling supply-utilization balances for the N-fertilizer market. Based on this prospective information, the Secretariat will attempt to assess the levels and distribution of fertilizer stocks and calculate early warning indicators such as stock-to-use ratios and stock-to-disappearance ratios in fertilizer markets. These can provide useful signals to indicate impending market tightness and possible price hikes that could transcend to global food markets, putting in jeopardy global food security.

Figure 6: Share of household 'basic expenditures' in total expenditure, 2017⁹



⁹ FAO Food Outlook, November 2021

Figure 7: Share of household 'basic expenditure' in total expenditure, 2021**B. In the longer term**

22. Affordable and greener fertilizer production, based on renewable energy. Promote green fertilizer production, notably green ammonia, replacing traditional energy feedstocks such as gas and coal with solar, wind and hydrogen.

23. Understand policy trade-offs. There is a need to recognize that policy-induced higher fossil fuel prices for climate change mitigation also means higher food prices for poor consumers. Channel back proceeds from carbon taxes to resource-poor consumers.

24. Review and repurpose fertilizer subsidies to promote fertilizer and manure use efficiency. Fertilizer subsidies are still the policy tool of choice to boost food production and improve food security, particularly in food deficit countries. These subsidies help increase the profitability of production, and foster rises in food production swiftly and substantially. Apart from the high fiscal burden, these subsidies often result in sub-optimal fertilizer use efficiency and can lead to environmental problems (e.g., pollution of surface and groundwater, soil and air, as well as increased greenhouse gas (GHG) emissions). No doubt, some of these subsidies may need to be maintained to ensure sufficient food production; there may, however, also be scope to repurpose some of these subsidies to promote measures that help improve fertilizer use efficiency and restore environmental assets that have been degraded from past fertilizer use.