

10

IMPACT
SERIES

Global food systems under mounting pressure

 BARCLAYS





War and weather take further toll on food security

Foreword

Welcome to the 10th Impact Series report from our Research team, in which the analysts turn their lens on one of the most pressing issues of our times: food insecurity.

10 January 2023

A range of factors has converged to bring food insecurity to a new level globally - war, energy crises, supply chain failures and extreme weather events.

The war in Ukraine – a country celebrated as one of the breadbaskets of the world – has been devastating. Not only has it reduced the food available for export from both Russia and Ukraine, but the war also has a direct role in the soaring price of energy, which is increasing the cost of producing and transporting food.

The war shows how a localised shock can cascade through international supply chains. About a quarter of all agricultural production is exported across international borders, and international trade has therefore become key to food security. Cross-border trade was already severely hampered by the COVID-19 pandemic. Ukraine's difficulties in growing, harvesting and exporting food, combined with trade restrictions on Russia, has made matters worse.

It comes at a time when an increase in extreme weather events such as droughts and floods is also contributing to reduced crops and higher food prices.

In this report, our Research analysts ask whether the current global food system is broken. It is an important question: some countries have, over time, become almost entirely dependent on others for even their most basic food needs, which makes their citizens increasingly vulnerable when things go wrong.

With extreme weather events coinciding with trade restrictions and conflict, years of positive progress in reducing hunger and poverty could be reversed.

In the near term, these factors will likely contribute to elevated prices, rising food insecurity, human displacement and migration to neighbouring regions as people escape famine in the most vulnerable countries. In the long term, the food crisis will likely cause new waves of migration to Europe and other developed countries and undermine efforts to move agriculture toward sustainable practices. Moreover, the short-term response by many countries to increase domestic resiliency and introduce food protectionism will likely hamper efforts at the global level to improve food security – and could widen gaps between regions even further.

We hope this far-reaching analysis will contribute to the debate on possible solutions to improve the food system.



C.S. Venkatakrishnan
Group Chief Executive Officer, Barclays



The causes of current food shortages and higher prices

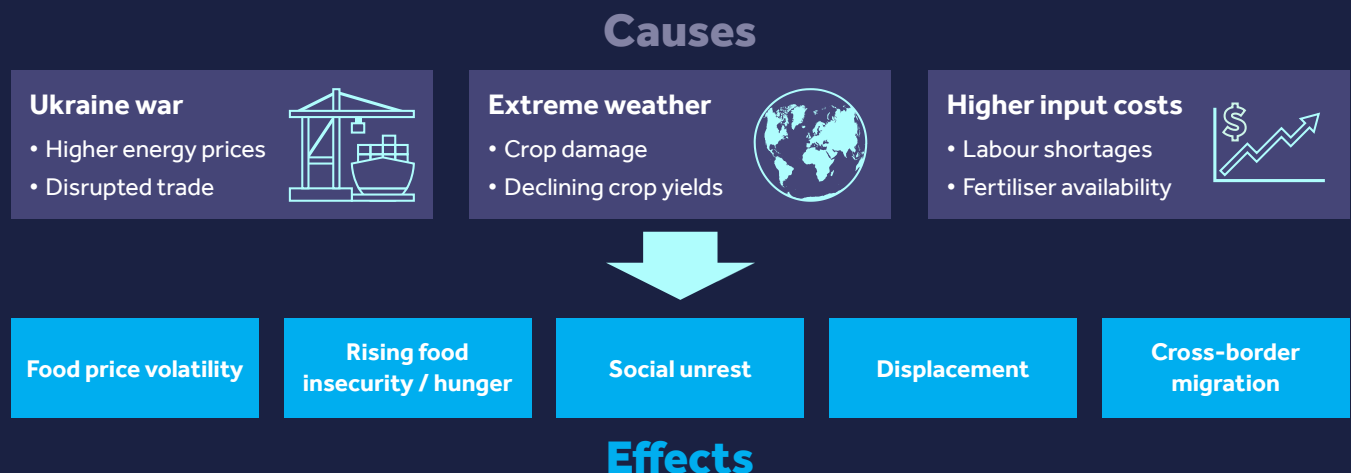
A number of factors have converged over the last 24 months, resulting in the further tightening of food supplies, which were already under pressure as a result of the COVID-19 pandemic. The war in Ukraine has dramatically worsened the outlook for already inflated global food prices. At the same time, increasingly severe and frequent weather events are having a devastating impact on food production across the world. In 2022 alone, droughts in Africa and Europe, as well as floods in

countries such as Pakistan, significantly reduced crop production.

We have identified three main causes of the current predicament: the war in Ukraine, extreme weather and rising input costs. These have created inflationary pressures, with the food price volatility further exposing the fragility of our global food system: rising food insecurity, social unrest, human displacement and migration are all possible effects.

FIGURE 1

The impact of war, weather and input costs



The war in Ukraine

The war in Ukraine is affecting global food supplies on three levels.

Disrupting exports

Russia and Ukraine are both major exporters of agricultural products, ranking among the top five globally for wheat, barley, maize and sunflower oil. In 2021, 36 out of 55 countries with food crises depended on Ukraine and Russia for more than 10% of their total wheat imports, while some obtained almost the entirety of their wheat from them¹.

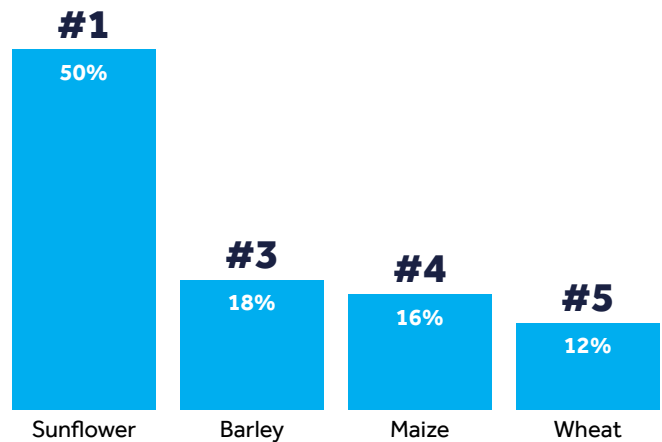
The ongoing conflict is constraining the growing, harvesting and exporting of crops. Ukraine is hampered by the war on its soil, and Russia by export restrictions. This means that many countries cannot obtain sufficient quantities of staple foods and have to look elsewhere, often at inflated prices.

Initially, much of Ukraine's current export grain was stuck in the country because of damage to rail infrastructure, closed ports and the Russian blockades in the Black Sea. That region

is an important supplier of grains and oilseeds, with Russian and Ukrainian exports accounting for 12% of the total calories traded in the world². Many importing countries, particularly in North Africa and the Middle East, rely on this trading route and were significantly disrupted.

FIGURE 2

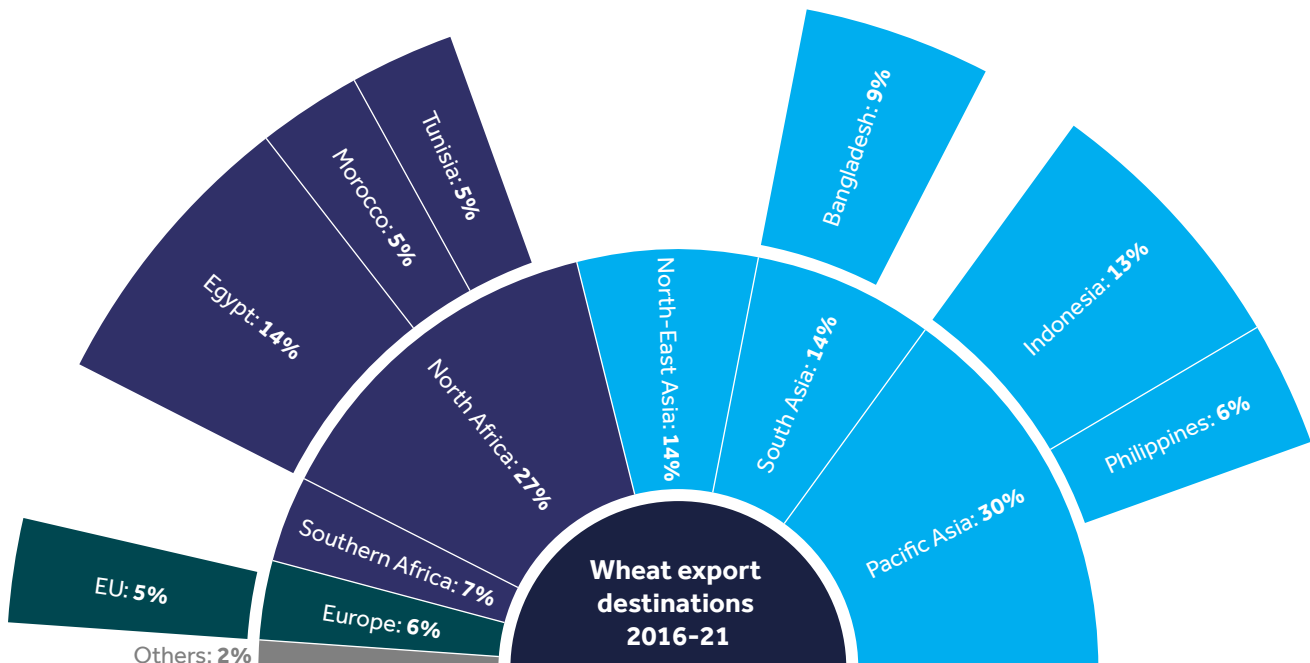
Ukraine's share of global exports and rank in the world before the Russian invasion



Source: European Council (2022)

FIGURE 3

Where do Ukraine's wheat exports go?



Source: European Council (2022)

1 Source: Global Network Against Food Crises, 2022.

2 Source: International Food Policy Research Institute, 2022.

Before the war started, Ukraine was exporting 6 million tonnes of grains and oilseeds a month on average, which dwindled to 3.5 million tonnes between March and November 2022 following Russia's invasion according to data from Ukraine's Ministry of Agrarian Policy and Food. An international agreement – facilitated by the UN and Turkey – in July 2022 allowed trade to resume, but it is unclear whether the trapped grain from prior harvests will get out in time. It also remains uncertain to what extent the Black Sea grain deal will continue in 2023, given prior renewal negotiations have been disrupted by the ongoing war. For example, in October 2022 Russia briefly suspended its participation in the agreement in response to a drone attack by Ukraine.

Timing is critical amid concerns over levels of storage available for the next harvest. One of every six Ukrainian crop storage facilities, such as grain silos and elevators, has been destroyed, damaged or controlled by Russia since the invasion (Yale, September 2022). This represents approximately 15% of Ukraine's total crop storage capacity in tonnage. Expanding storage capabilities has attracted a great deal of interest internationally, with Canada and Japan providing financial support.

Soaring energy prices

Restrictions on the import of oil and gas from Russia (a key supplier) have led to soaring energy prices, pushing up the cost of harvesting and transporting food. Russia is a major oil

and gas provider. It has the world's largest natural gas reserves and supplies 40% of Europe's gas and a quarter of its oil, although the European Union is taking steps to dramatically reduce its reliance on Russia by maximising generation from renewable energy and alternative sources. Energy sanctions have led to soaring prices as countries compete for reduced reserves. Rising fuel costs also contribute to higher food prices as food production and transport becomes more expensive.

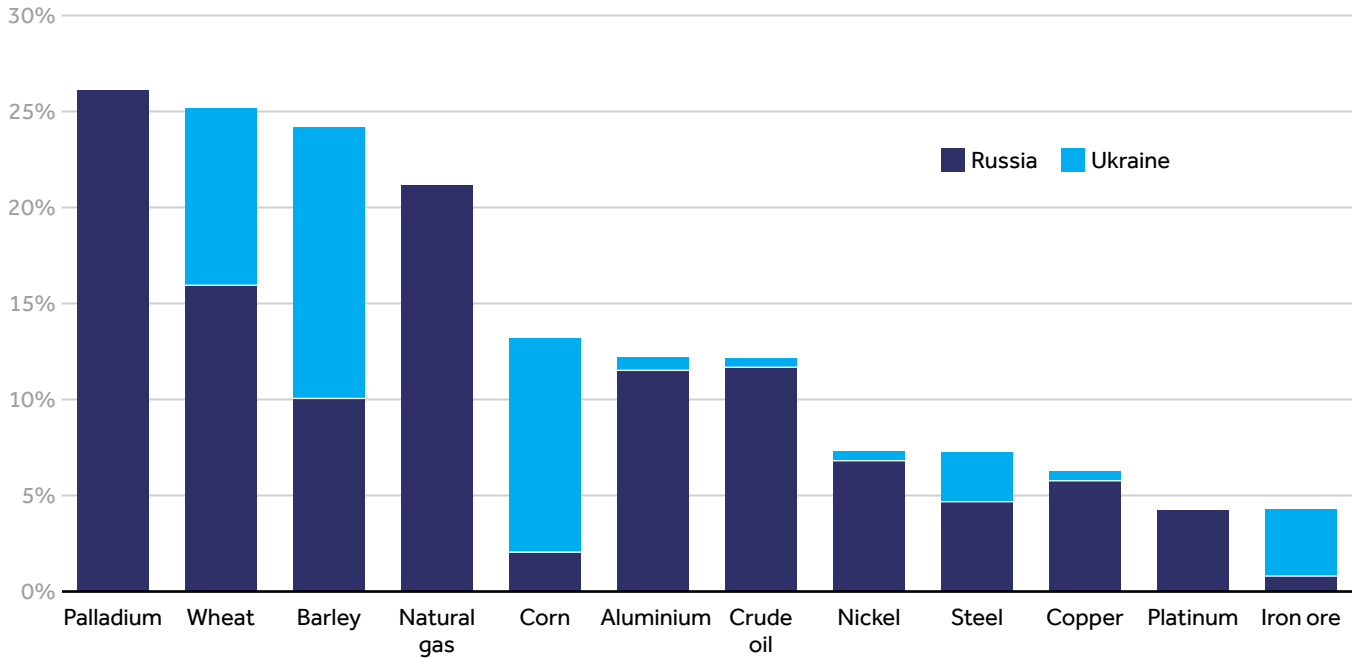
Russia at the epicentre of the fertiliser market

Russia is a key producer of the ingredients needed for fertilisers – in 2019, it accounted for 19% of potassium, 15% of nitrogen and 14% of phosphorous fertiliser exports, according to the United Nations Food and Agriculture Organization (FAO). Natural gas (another Russian product subject to export restriction) is also required to make fertilisers. This means fertiliser prices have increased significantly, with supply further constrained by logistical issues caused by the war, resulting in the likelihood of fewer crops being planted by low-income farmers.

For example, Mexico and Brazil receive more than 25% of their fertiliser imports from Russia and Belarus. Export restrictions, economic sanctions and disruptions relating to the Black Sea trading routes have all negatively impacted fertiliser supply, highlighting the degree of regional concentration.

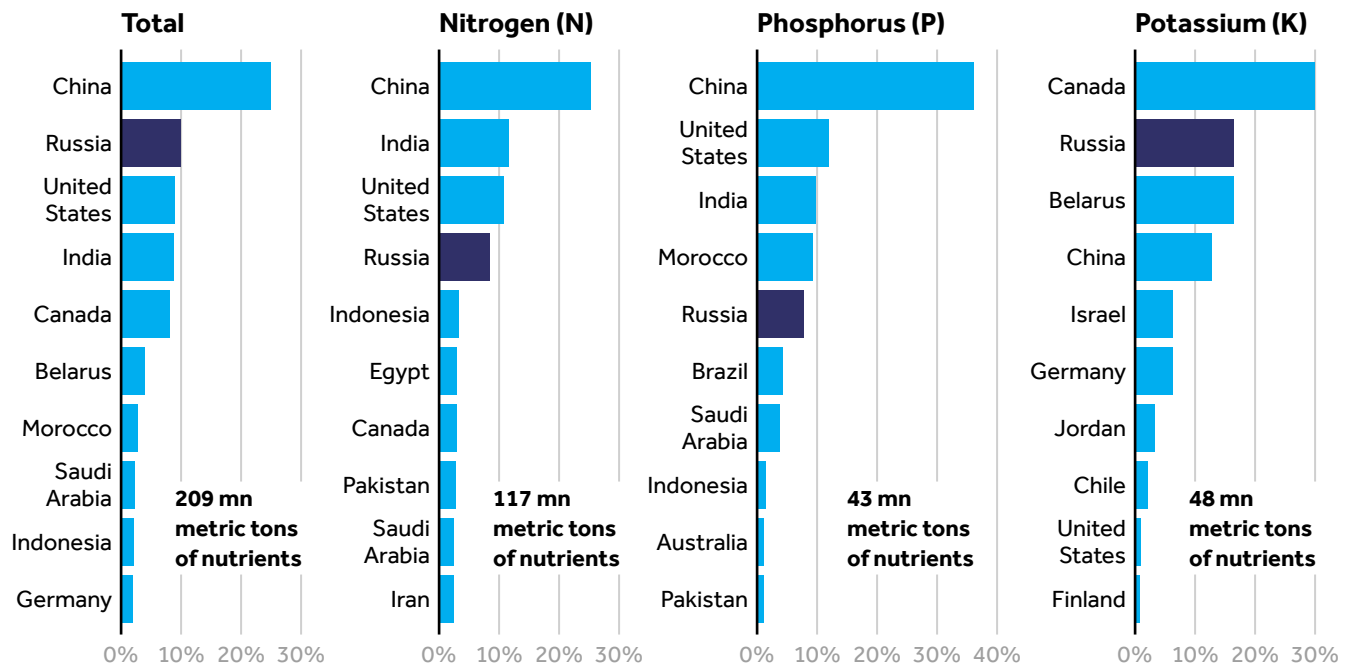


FIGURE 4
Black Sea % of global commodity exports



Source: CIBC (2022)

FIGURE 5
Global fertiliser suppliers – China, Russia, US, India and Canada produce more than 60% of the world’s fertilisers nutrients



Source: IFASTAT, 2017-2019 average

The role of extreme weather

Record temperatures – in both directions – and prolonged droughts in 2022 will lead to sharply reduced crop yields in many regions, with the impact likely to extend through 2023. 'Heatflation' has already become part of the agricultural vernacular, describing how higher temperatures lead to smaller harvests and higher prices. But it is not only extreme heat that hurts crop yields – increased and more severe flooding, more frequent landslides and unexpected frost also damage crops. Vulnerability will vary by region, depending on the timing of the crop cycle.

Extreme weather leads to crop damage

Agriculture is especially vulnerable to the increased frequency and intensity of extreme weather-related and climate-induced events. With examples on most continents in 2022, some stand out: the devastating floods in Pakistan from July to October inundated a third of the country and washed away nearly half its crops, at an estimated cost of \$2.3bn. Vegetable prices initially spiked by 500% (Carbon Brief, 2022). The drought in the Horn of Africa (Ethiopia, Somalia, Djibouti and Eritrea) has led millions of people to move from the stricken areas in search of food. In Egypt, extreme heat during the

summer and extreme cold in the winter have hurt the Nile delta's agricultural output, which is the main source of such production for the North African nation. China, the largest food producer but also the largest food importer to feed its 1.4bn people, experienced extreme heat and month-long drought during the rainy season in the south, threatening the domestic autumn crops.

The agricultural sector often faces long-lasting consequences of disasters such as the deterioration of animal health, contamination of water facilities, loss of harvests, outbreaks of disease or destruction of irrigation systems and other infrastructure. According to the FAO, 63% of the damage and loss from disasters occurring between 2008-2018 were felt by the agriculture sector, relative to industry, commerce and tourism.

Countries where agriculture represents a significant share of the overall GDP are likely to be the most vulnerable through lower-than-expected production. Between 2008-2018, disaster-related losses recorded in crop and livestock production were \$280bn. In the poorest countries, which accounted for almost half that, the lost production translated to 7 trillion kilocalories per year – the annual intake of 7 million adults.

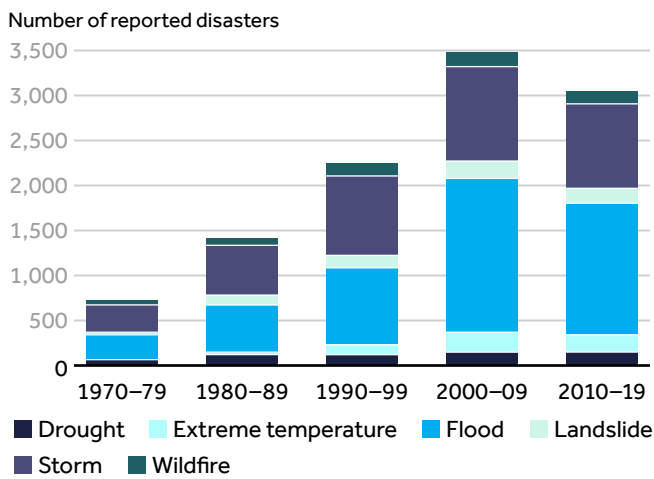


Rice production in danger

We see rice as one of the crops most exposed to drought and extreme heat. Rice is one of the most widely consumed foods in the world, especially in developing countries. Driven by the lack of rainfall, many exporting countries such as India and China have indicated low crop yields in 2022-23. To secure domestic supply, India - the world's largest rice exporter -

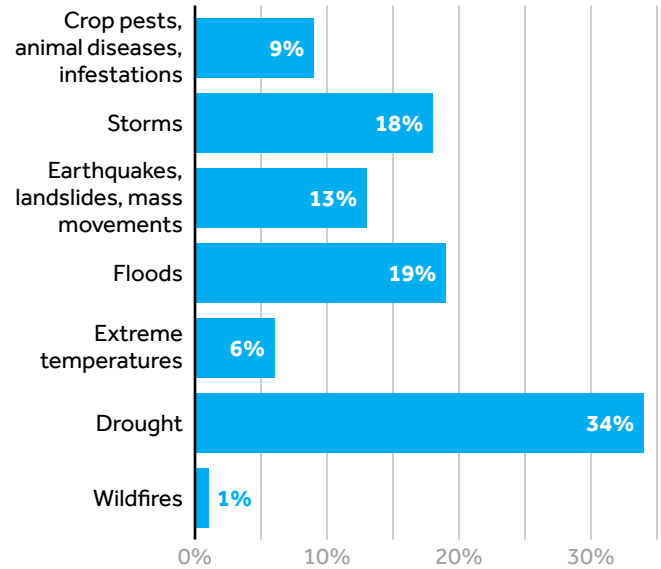
restricted exports of broken rice between September and November 2022. This affected many regions, including Africa given the high demand for broken rice for human consumption.

FIGURE 6
Extreme weather events have increased more than five-fold since the 1970s



Source: World Meteorological Organization (WMO)

FIGURE 7
Total crop and livestock production loss by disaster type (2008-2018)



Source: FAO. Note: Data for LDCs (Least-Developed Country) and LMICs (Lower-Middle-Income Country).



Case study:

Europe's summer heatwaves lead to declining crop yields

In July 2022, many parts of Europe were affected by record-breaking heatwaves, with temperatures above 40 degrees Celsius in the UK, France, Italy, Spain and Germany. It coincided with the flowering stage, threatening to reduce overall harvests with a decline in crop yields likely to be felt for many months.

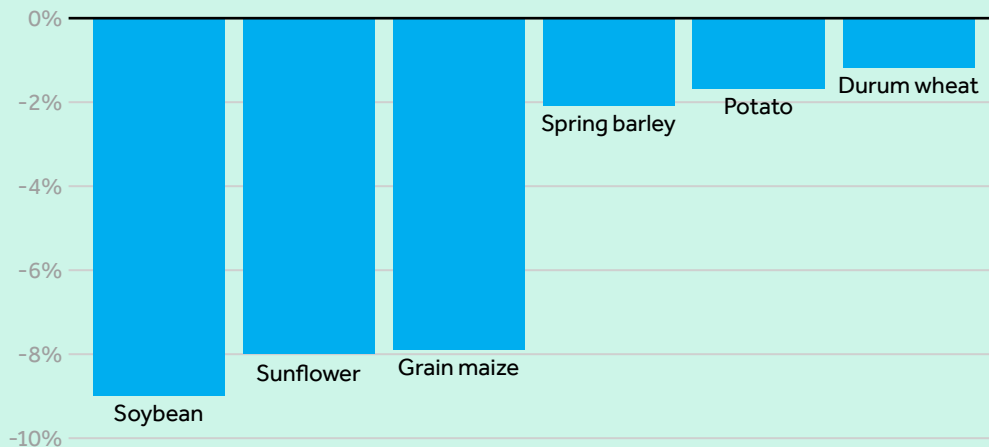
The European Commission substantially reduced the yield outlook for EU summer crops. The most pronounced reductions (by 8% to 9%) were for maize, sunflower and soybeans, for which the yield forecasts are now well below the 5-year average.

With heatwaves becoming more frequent, growing products that are more resistant to extreme heat and drought could help to offset yield declines, such as new crop varieties that thrive in warmer conditions. However, research from the University of Leeds suggests the climate is changing faster than new crops are being developed. Genetically modified crops could also be an option, if properly regulated, but have proved controversial so far, notably because of mistrust in a technology controlled by a small number of manufacturers.

FIGURE 8

July 2022: Forecasted crop yields for summer crops were substantially reduced, driven by the heatwave

% difference between the March 2022 and June 2022 yield forecast



Source: European Commission – JRC MARS Bulletin (July 2022)

Higher input costs

Labour shortages are driving input costs

In addition to fuel prices, another rising input cost for farmers has been labour. Since the pandemic, labour shortages have been prevalent in many parts of the world, driven by changes to immigration laws, restrictions on seasonal work visas and declining interest in agricultural employment. In Ukraine, the war has displaced farm workers, leading to doubts that crops can be harvested. In certain countries, including the UK, ongoing labour shortages, driven by an increasing number of people becoming economically inactive or foreign workers returning to their home countries during the COVID-19 pandemic, have led to unharvested crops spoiling, leading to even higher food prices and more food imports. Ageing populations in Asia and Western Europe are also contributing to shortages as it becomes increasingly difficult to replace retiring agricultural workers.

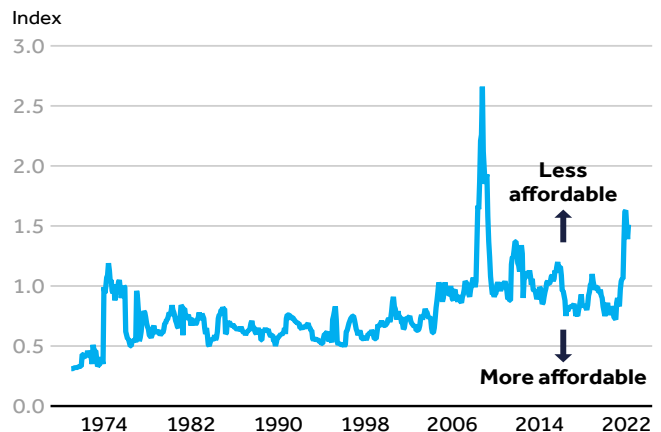
Fertiliser affordability affects crop yields

The availability and rising cost of synthetic fertilisers are also key to food shortages. Fertiliser prices were already rising before 2022, driven by supply disruptions and export restrictions. Such increases have been amplified by the war in Ukraine, driven by the price of natural gas – a key ingredient in fertiliser manufacturing.

Fertilisers account for about 35% of a farmer's operating costs for corn and wheat, according to the US Department of Agriculture. Many are likely to offset the price rises by using less fertiliser which could lower production volumes, reducing crop yields.

FIGURE 9

Fertiliser affordability – 2022 price increases are reminiscent of the great recession in 2008



Source: World Bank. Note: Ratio of World Bank's fertiliser price index to food price index. A higher ratio represents lower fertiliser affordability, and vice versa. Last observation is April 2022.

Time to move away from synthetic fertilisers?

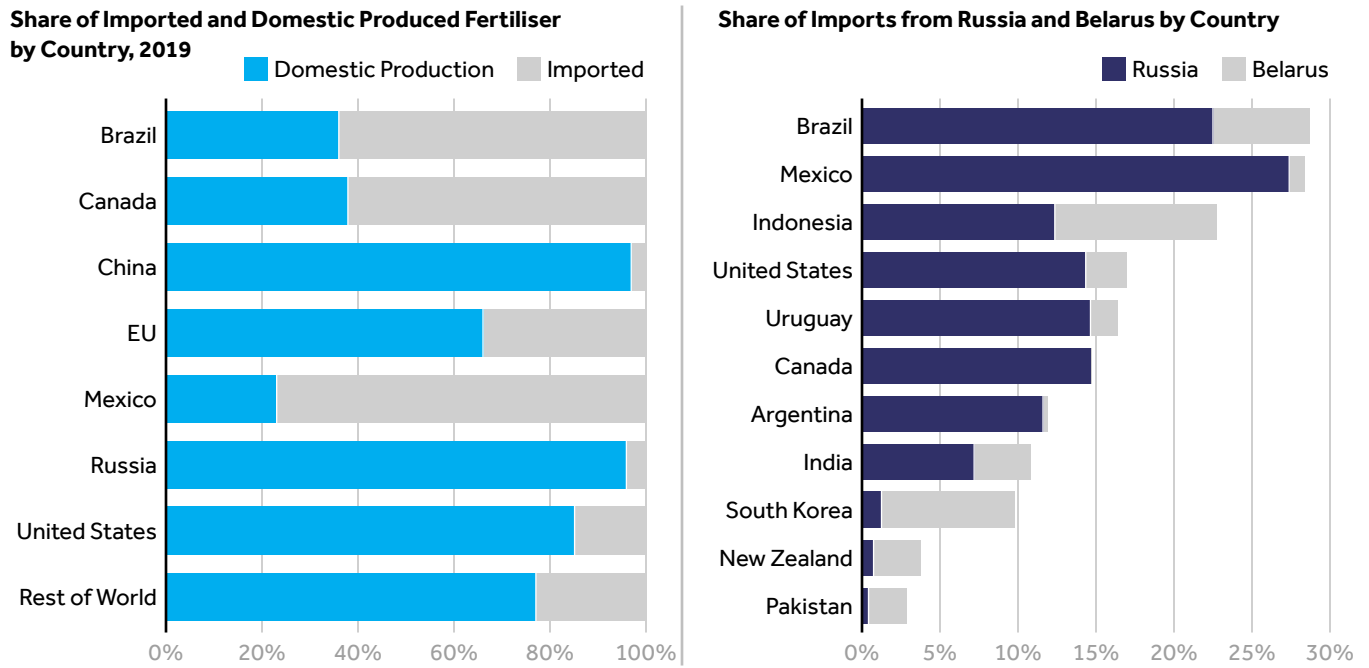
The use of synthetic fertilisers remains a double-edged sword. They support food security by producing higher yields (and therefore less land use), but their overuse can also cause excess nutrients to leach into the natural environment, leading to biodiversity loss and soil degradation. Many view crop yields and environmental pollution as an unavoidable trade-off, but academic research suggests there is the potential for countries to reduce the level of pollution without reducing yield (Wuepper et al., 2020). The research shows China, Brazil and Thailand could reduce fertiliser use without significantly affecting crop yields compared to neighbouring regions.

“It is not just the war and extreme weather that have impacted food security. Other structural trends relating to demographics and logistics have also contributed to higher food prices in recent years.”

– Hiral Patel, Head of Sustainable & Thematic Research

FIGURE 10

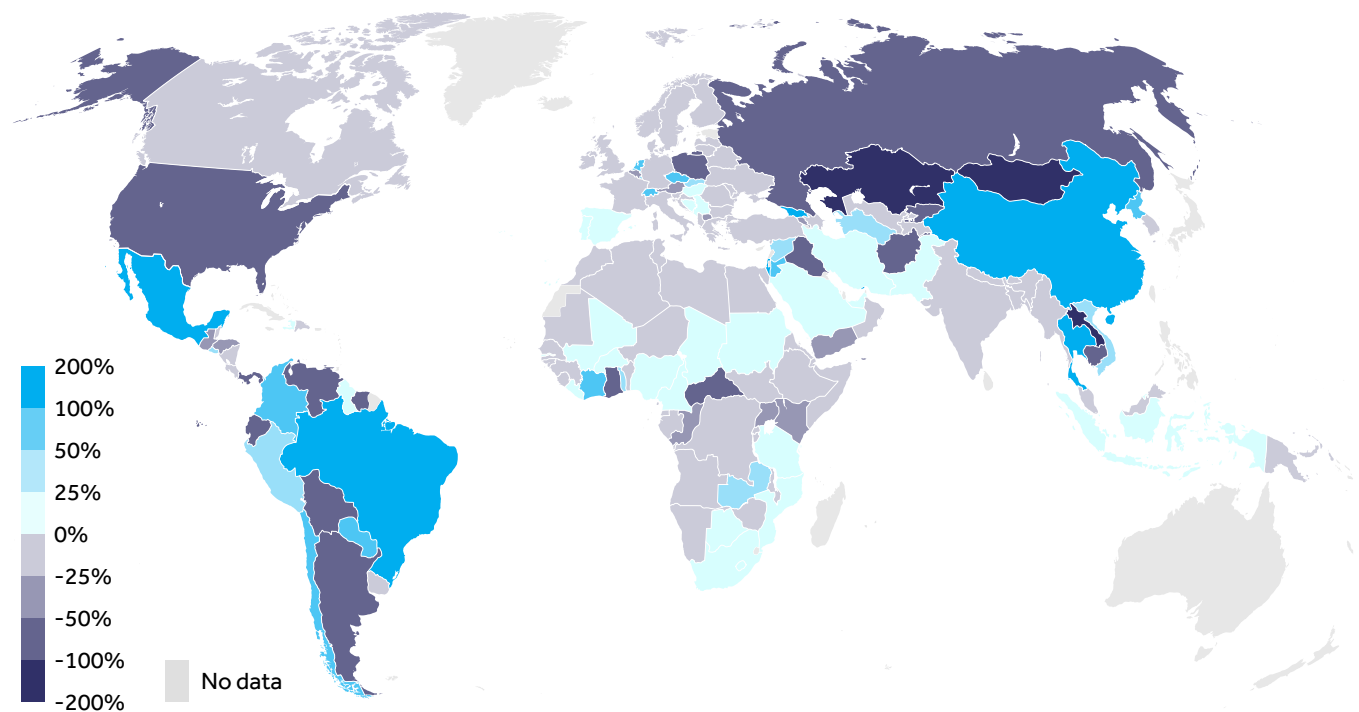
Fertiliser import dependence



Source: FAO

FIGURE 11

Which countries are overapplying nitrogen without gains in crop yields?



Shown is how much nitrogen pollution countries are causing compared with how much they reduce their yield gaps relative to directly neighbouring countries. Positive values (cyan to purple) indicate a country is overapplying nitrogen without gains in yield.

Source: Wuepper et al. (2020), Our World in Data.



Near-term outlook: food price fluctuations, human displacement, migration, rising hunger

Food prices likely to stay high

While food prices have fallen relative to their all-time highs in March 2022, they remain higher compared with 2019–20. Even as some of the factors behind food inflation have eased – such as the ability of Ukraine to resume exports – others, such as higher input costs and extreme weather continue to exert pressure. Energy prices have come down somewhat from their peaks in early 2022, helping ease some of the input inflation, but they

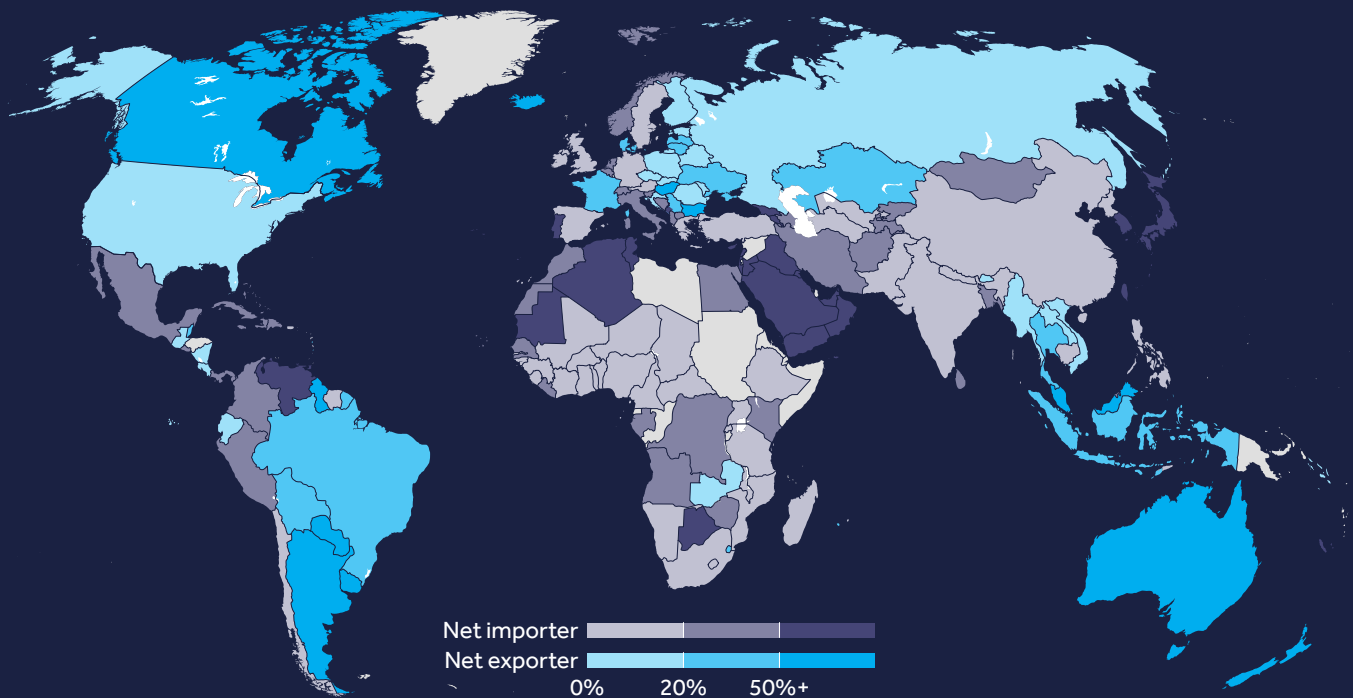
could rise again as the war continues. And energy prices are a major determinant of food prices: natural gas is a key input in fertilisers such as nitrogen; fuel costs matter in planting, harvesting, transporting and cooking food. Transportation costs in particular can weigh heavily on food prices as an integrated world relies on food imports. About one-quarter of agricultural production moves across international borders.

Dependency on food imports

Food production is concentrated in just a few key regions, which means that many countries are heavily reliant on food imports and vulnerable to supply chain shocks. Most of the exposed countries are concentrated in Africa, the Middle East, East Asia, Latin America and the Caribbean, where many countries have low levels of income and food security and struggle to pass on the shock to their trade partners. This problem is acute for African countries, whose inhabitants make up one-third of those suffering from malnutrition globally. Intense competition for food and key inputs such as fertiliser increases the risk that supplies may be diverted away from poorer countries to richer ones.

FIGURE 12

Import vs. export dependency



Source: Farm Policy News based on UN's FAO Global Perspectives Studies, Barclays Research.

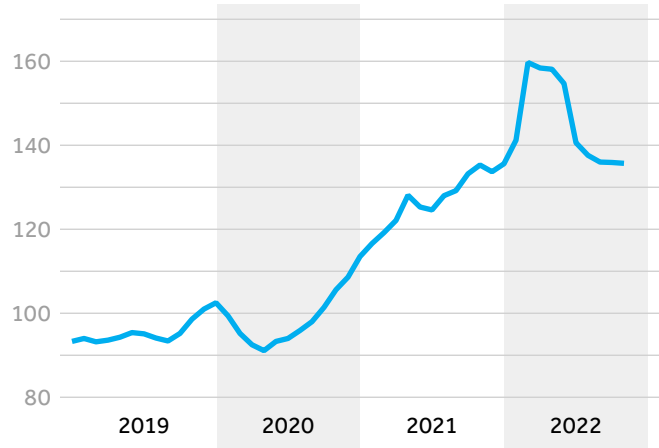
We therefore expect food prices to remain at elevated levels and the risk of renewed price spikes to be high in the next 12 months. Higher prices are often an important signal to producers to plant more crops. However, higher fertiliser and transportation costs – a direct result of higher energy prices – may negatively affect planted acreage and potential yields. It is difficult to quantify to what extent the prospects for spring planting and winter crop harvesting will impact the level of production. Given the potential lower volumes from the next harvest season, tightness is likely to extend through 2023.

As the most recent events suggest, extreme weather's impact on food prices will continue unabated. Drought has caused the Mississippi river to experience record low water levels, threatening US exports of grains. The US is the biggest food exporter in the world, and the river is one of the main arteries to get the country's food to ships that will carry them to the rest of the world. The low water levels have created bottlenecks and barges running aground. Shipping costs on the river have surged, which can contribute to food inflation globally in coming months.

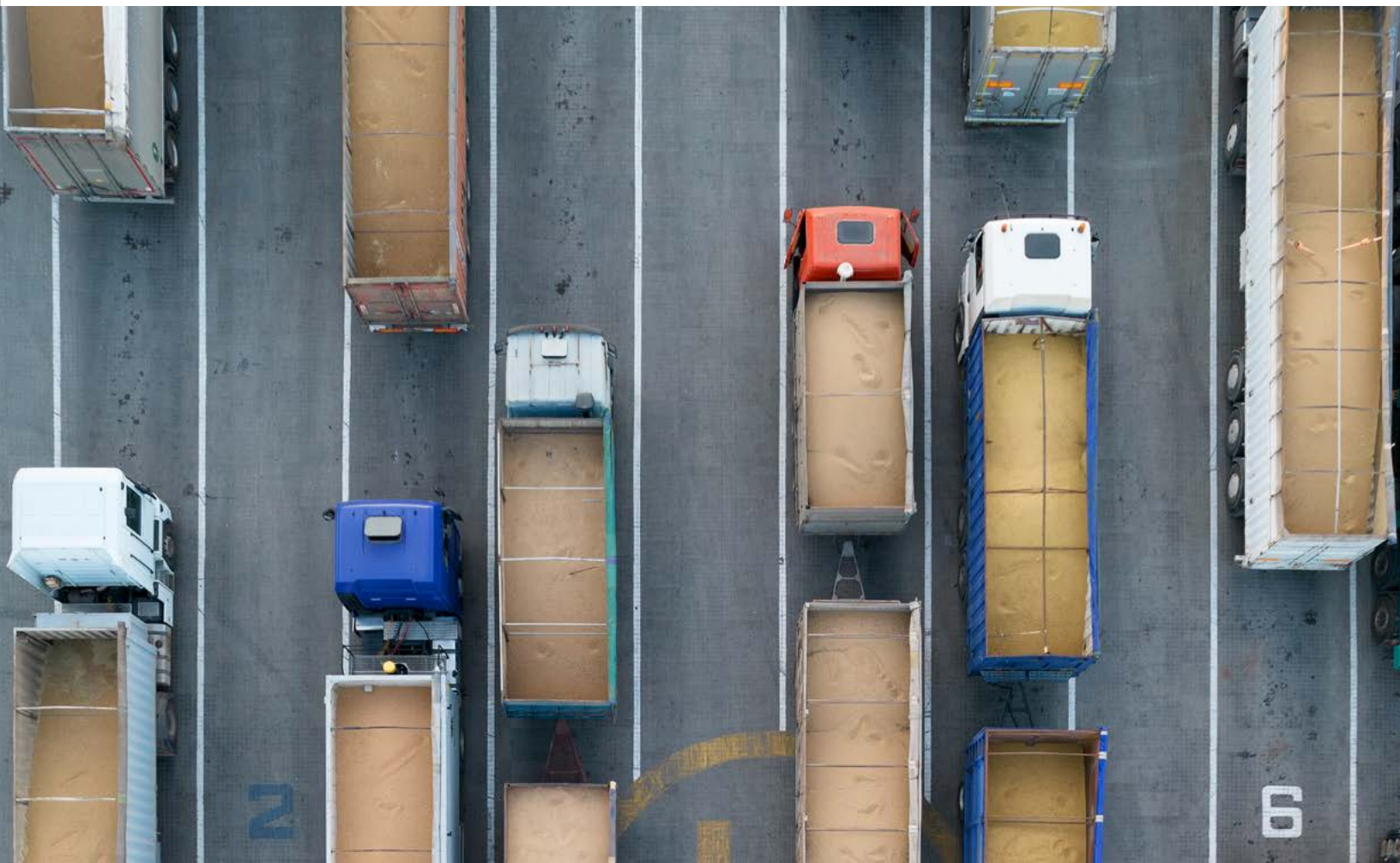
FIGURE 13

Despite some recent moderation, food prices remain elevated

2014–2016=100



Source: UN – FAO (Food Price Index)



Dependency on maritime trading

Global dependence on maritime chokepoints, narrow channels connecting two bodies of water along widely used sea routes, has increased since 2000, driven largely by the growth in wheat and maize supplied by Black Sea producers to China. Poor infrastructure quality and lack of investment are constraining operations in six critical coastal and inland chokepoints. Located in Brazil, the US and the Black Sea region, these connect major crop-producing regions to global markets. They lie along transnational routes linking major grain and fertiliser exporters, transit centres and importers. According to Chatham House, 55% of internationally traded maize, wheat, rice and soybean is shipped through at least one maritime chokepoint. As such, they are deemed critical in maintaining food security and price stability.

FIGURE 14

Key maritime, coastal and inland chokepoints within the global food market



Source: Bailey, R. and Wellesley, L. (2017), Chokepoints and Vulnerabilities in Global Food Trade, Chatham House Report, London: Royal Institute of International Affairs.

Food security: a bleak outlook

The food crisis is getting worse

Higher food prices are leading to an increase in food insecurity, especially in some vulnerable regions. The FAO and the World Food Programme (WFP) estimate that up to 222 million people in 53 countries and territories likely suffered acute food insecurity last year, up from a predicted 193 million in 2021.

Countries that depend on food imports are the most vulnerable when food does not arrive as expected. Regions including the Middle East, East Asia, Latin America and the Caribbean are at risk, with many countries characterised by low levels of income and food security, but the problem is most acute in Africa, which makes up one-third of the population suffering from malnutrition globally.

Amid intense competition for food and key inputs such as fertilisers, there is also the risk that supplies may be diverted away from poorer countries to richer ones. Poorer countries are also less able to absorb the shock of other events that interrupt food supplies. The war in Ethiopia's Tigray region, for example, has led to food shortages, with the WFP estimating that 90% of Tigray's population is food insecure. Similarly, the UN's refugee agency UNHCR estimates that

the worst drought in 40 years in Somalia has displaced nearly 1 million people in search of food.

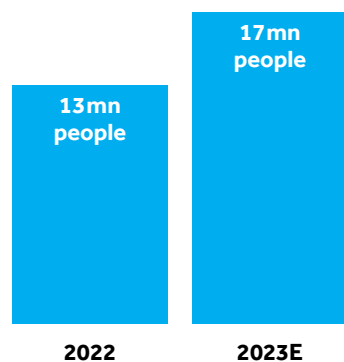
The risk of social unrest remains high, with famine and starvation potentially driving new forms of migration; in Sri Lanka recently, where food and fuel shortages led to protests over higher food prices.

Many governments have indicated the current food crisis could trigger a new wave of social protests, internal displacement and migration to neighbouring regions. This is not a new dynamic, with the lack of food being the source of many conflicts. According to the WFP, each 1% increase in food insecurity in a country compels 2% more people to migrate – with 0.5% more likely to flee a country for each additional year of conflict. **Higher prices and food insecurity will inevitably cause social unrest in the near future, with the risk of human displacement and migration to increase gradually over time.** The threat of multiple famines is most acute in Africa and the Middle East, with the potential in 2023 for migration into Europe from countries highly dependent on food imports, including Egypt, Sudan and Libya.

FIGURE 15

Rising food insecurity and poverty

Deepening global food insecurity



Potential increase in the number of undernourished people as a consequence of the Ukrainian war (FAO)

Vulnerability to extreme poverty



For every 1% point increase in food prices, an additional 10mn people are expected to fall into extreme poverty (World Bank)

Source: Barclays Research

Social unrest

Countries such as Egypt and Sri Lanka have already seen instances of social unrest related to higher food prices.

In Egypt, the government's bread subsidies are critical to sustaining the situation in the near term and preventing the unrest from getting to more dangerous levels. A complex system of land ownership and limited capabilities for local production can partially explain why countries in Africa are more reliant on the import of wheat and other grains. For example, Egypt is one of the largest importers of wheat globally, with 85% of its supply provided by Russia and Ukraine. For many years, bread has been viewed as a key staple food for a vast majority of the population, with the word for bread in Egyptian Arabic "eish" translating as "life". The nation consumes between 150kg and 180kg of bread per person per year, well above the global average of 70kg to 80kg.

Egypt's relationship with bread can be partly explained by the government's subsidies that allow eligible Egyptians to receive five loaves of bread a day at significantly lower prices, which have changed little since the 1980s. Attempts in the past to remove or lessen subsidies have been met with resistance, with any talks of a potential increase in the price likely to harm social stability. Attempts to boost domestic food production are limited by water shortages.

In Sri Lanka, food insecurity is likely to worsen amid the ongoing economic crisis, which has led to spikes in the prices of essential products, including fuel and agricultural inputs. According to the UN, nearly 30% of the population is experiencing food insecurity, and that will likely deteriorate further unless urgent humanitarian assistance is provided. This has fuelled various political and social protests throughout 2022, with an increased risk of migration to neighbouring countries such as India and Australia.



Rising migration and displacement

Food insecurity is an important determinant of both the desire and the decision to migrate³. Policymakers will have to consider this in their response to both regulated and unregulated migration, particularly in the European Union, where the IMF has warned of increased migration. Monitoring the levels of migration into Egypt from other neighbouring countries will be critical in 2023, given its proximity to Europe. There has been an ongoing increase due to prolonged instability, with 9 million international migrants currently residing in Egypt – 9% of the Egyptian population⁴.

Which countries are most at risk?

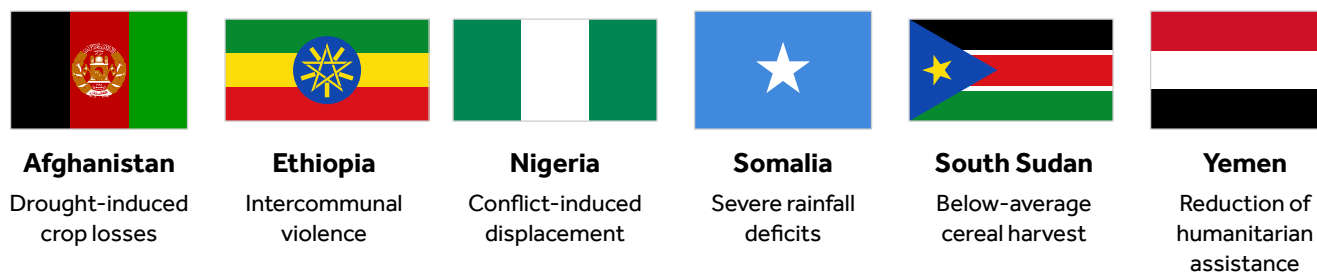
The FAO and the WFP warn that acute food insecurity is likely to deteriorate further in 19 countries – called hunger hotspots – from October 2022 to January 2023. The drivers

behind acute food insecurity often overlap, including organised violence and conflict, economic shocks, weather extremes and climate variability.

Afghanistan, Ethiopia, Nigeria, Somalia, South Sudan and Yemen remain at ‘highest alert’ as countries with catastrophic conditions where targeted action is critical to prevent further starvation and death. Sri Lanka, Pakistan and Zimbabwe were also recently added to the list of hotspot countries, joining Angola, Lebanon and Mozambique. A particular concern in 2023 is the ongoing drought in the Horn of Africa, which is highly likely to worsen further as the region faces a fifth consecutive poor rainy season. Given the broader macroeconomic outlook, humanitarian assistance is likely to fail, which could spark multiple waves of migration in 2023. It is still unclear where the migrants will go, but Egypt and Europe are likely destinations.

FIGURE 16

Mutually reinforcing drivers affecting acute food insecurity – Countries with the highest concern



Source: FAO/WFP (October 2022 - January 2023 Outlook)

³ Source: Sadiddin et al., 2019.

⁴ Source: International Organization for Migration, 2022.



Case study:

Somalia – famine is looming

As Somalia enters its fifth consecutive season without enough rain, severe drought and desert locust infestations are destroying crops and driving up the cost of food, made worse by the Ukrainian war. Domestic food prices are already approaching levels of the 2011 famine and are expected to continue to rise due to the limited availability of food and the dependency on wheat imports from Russia and Ukraine.

According to the UN, 7 million people in Somalia – nearly half of the country's population – now face acute food insecurity, with almost 250,000 at risk of imminent starvation. International governments, non-governmental organisations and charities have pledged humanitarian aid, but it is unclear how long-term investments in food production will be funded, particularly relating to critical infrastructure and climate change. An official declaration of famine would help bring in more outside support, but might be politically challenging for the newly elected government, fearful of the potential negative impact on foreign direct investment in the country and on broader development efforts.

Long-term outlook: rising food protectionism, more food insecurity

Increased trade protectionism – the new norm?

To protect local markets, many countries responded to the war by imposing restrictions on food exports, including additional taxes and outright bans, which resulted in additional disruption to international trade. More than 40 new export bans and licensing requirements were introduced between the beginning of the war and May 2022, according to the International Food Policy Research Institute (IFPRI). In April 2022, for example, Indonesia banned most exports of palm oil to protect domestic supplies after prices increased by +40%. It has since lifted the ban, however exports are still expected to remain low. In May 2022, India introduced export restrictions on wheat and sugar.

Such measures may ease domestic pressures in the near term but are likely to hamper efforts at the global level to improve food security – and could make the situation worse for some. Poor countries that cannot become self-sufficient will suffer

even more in a segregated global food market where each has to fend for its own. Historically, many parts of the developing world relied on outside financing to support domestic supply when unable to rely on food imports to feed their populations. That level of support, both financially and politically, will likely be harder to access, given humanitarian aid and foreign support may be restricted in light of broader macroeconomic challenges the world is facing.

Efforts to protect domestic food supplies could also signal a step back from sustainable farming practices. Faced with reduced crop yields, societal pressure and rising prices, governments are more inclined to introduce measures that support domestic resilience rather than agricultural sustainability. This could mean that many global targets aimed at promoting fair and sustainable food and agricultural practices could be missed or delayed. This will raise concerns, given that food production accounts for over a third of overall greenhouse gas emissions.



Growing hunger

The world is falling further behind in its effort to end hunger and food insecurity. The United Nations forecasts 670 million people – 8% of the world's population – will be facing hunger in eight years' time, the same level as in 2015 when the UN set its Sustainable Development Goals (SDGs) for 2030, which included the aim to reach Zero Hunger. As of 2021, an estimated 29% of the global population has been classified as moderately or severely food insecure by the UN World Food Programme (WFP), compared with 25% before the COVID pandemic.



Is the food system broken?

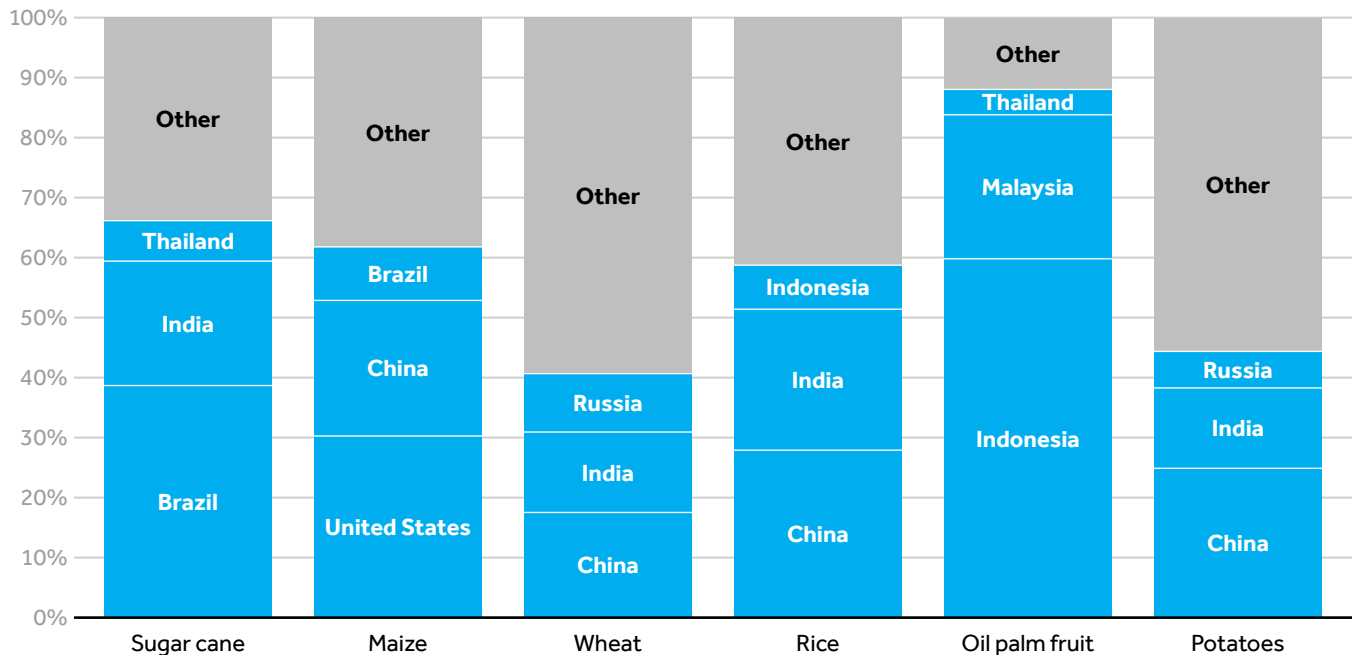
Currently, the food system is set up around the fact that most of the available agricultural land is based in a few concentrated areas. More than 40% of the world’s calorie intake comes from just three crops – wheat, corn and rice – that are produced in just a few countries, with a scant few participants dominating each step of the value chain.

This concentration means importing countries are reliant on complex trading relationships and routes to obtain food and are therefore vulnerable when issues arise. Climate change and population growth make the outlook even starker, unless meaningful action is taken to reconfigure the global food system.

What could that entail? In the long term, new farming methods and technologies, including regenerative agriculture (a greater focus on soil health and satellite imagery), should make some countries more sustainable and self-sufficient in their food production, but progress is likely to be overshadowed by governments having to respond to immediate geopolitical risks. In the short term, it would make sense for countries to build resilience to war, weather events and other shocks by diversifying trade and ‘friend-shoring’ (economic agreements with like-minded countries). A complementary relationship between sustainability and resilience is crucial, but it is too early to tell whether it is a likely outcome.

FIGURE 17

World production of main primary crops by main producers (2019)



Source: FAOSTAT

How do food systems work?

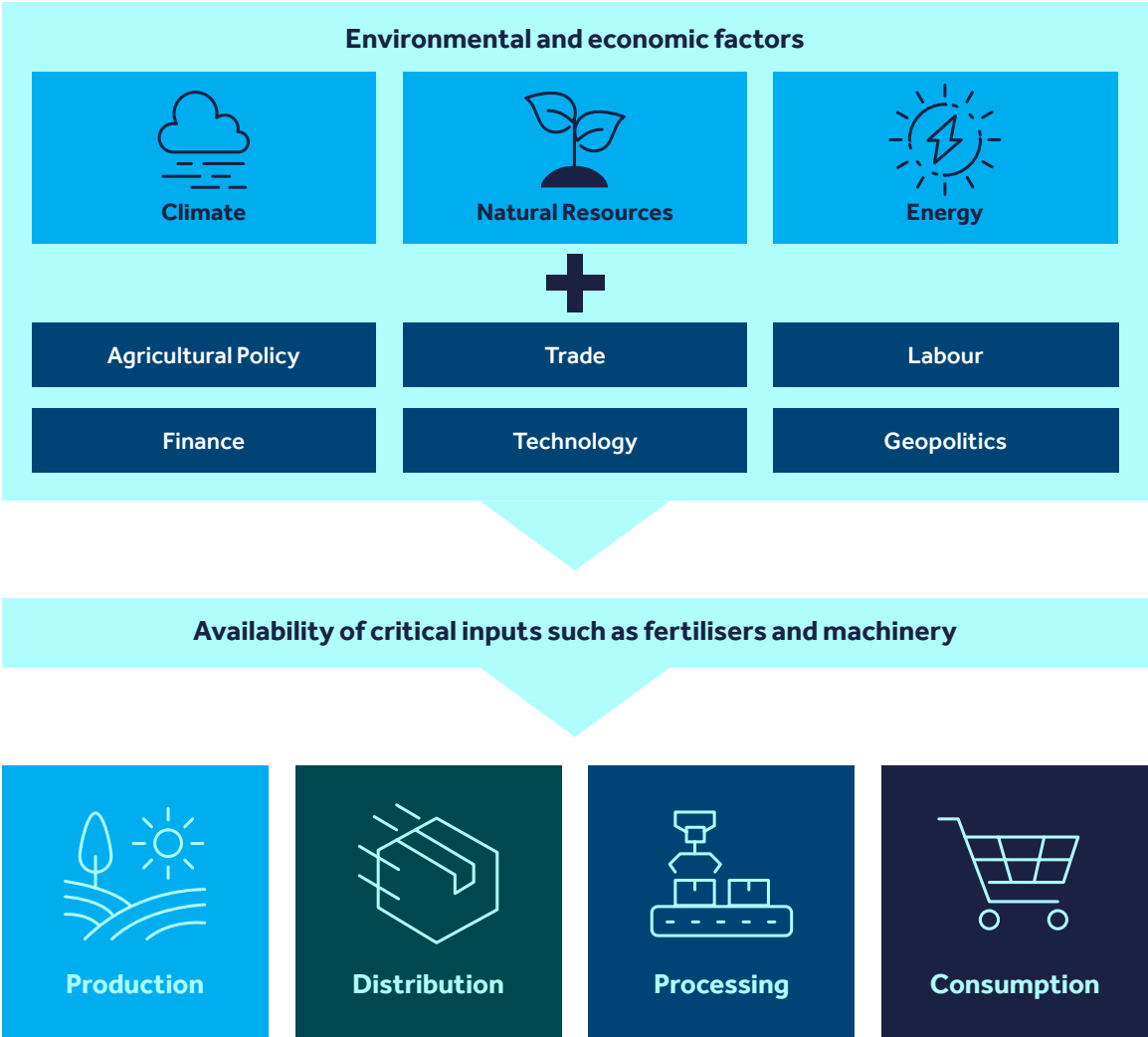
Regional food systems have become heavily interconnected, with a growing reliance on international trade to meet the demands of a rising world population. The Ukraine war shows how a localised shock can cascade through international supply chains, with vulnerability significantly varying by region.

It will probably take many years for our food systems to adapt to the increased frequency and intensity of environmental shocks such as climate change and extreme weather.

Governments around the world have worked to improve domestic resilience, but many countries (particularly in Africa and Asia) are unlikely to have the resources to become self-sufficient. The risk is that individual attempts to address domestic resilience will be unable to deliver an incremental improvement globally, with the gap between regions widening as a result.

FIGURE 18

The functioning of the global food system



Source: Barclays Research

Agriculture: time to change the status quo?

Countries with the natural resources to produce more food have an advantage (and power) over those that do not, but it is becoming clear that the power balance needs to change. Supply chains can be made more resilient through, for example, introducing inventory buffers (essentially storing more food than is normally required) and increasing domestic food production with the help of agritech, such as the use of drones and robotics, precision and vertical farming, and hydroponics. However, such efforts have been met with mixed responses from the likes of policy makers and trade unions.

This is partially explained by the political importance of the agricultural sector, where land rights are heavily protected and subsidies are commonplace. Entrenched agricultural labour rights also limit the ability to change what is viewed as a traditional industry. This level of safeguarding has further protected agriculture's role in society, contributing to both employment and GDP.

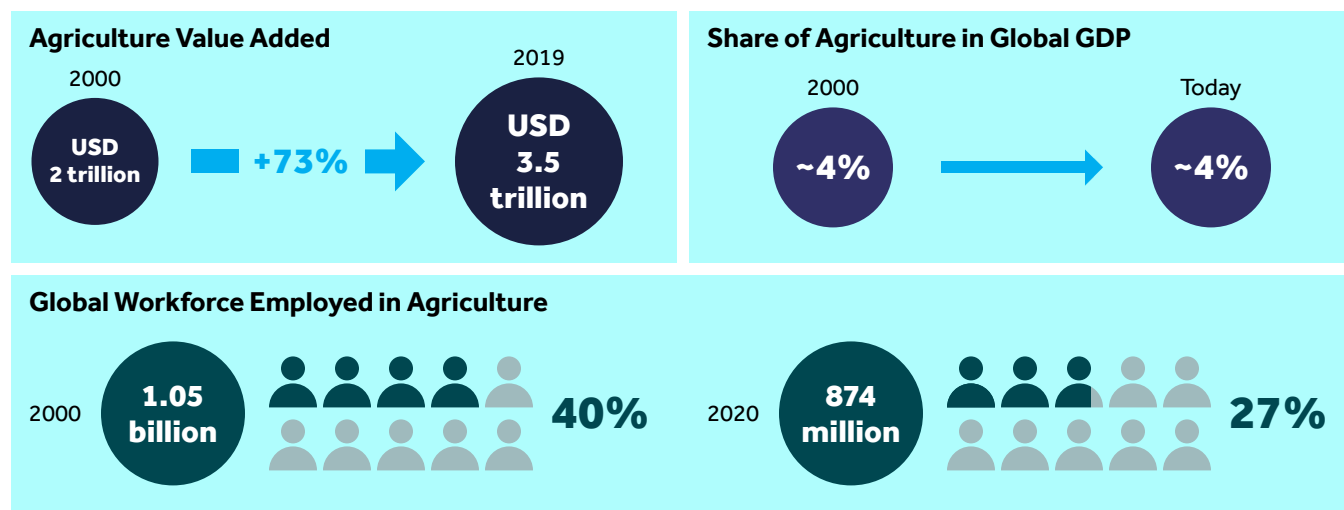
Vulnerabilities in global food trade

Due to the fact that most of the world relies on imported food, international trade has become a key determinant of food security and plays a crucial role in the transmission of shocks, both natural and man-made. International trade can hedge countries against the risk of unexpected decline in domestic production, but it has also led to many regions becoming very reliant on imports, leaving them more vulnerable to supply chain shocks. This was starkly illustrated during the COVID-19 pandemic, which severely impacted global trade when the shipment of food was restricted.

According to UN data, Africa imported 85% of its food between 2016-18, amounting to \$35bn – expected to reach \$110bn by 2025. While some African countries are self-sufficient and others are major exporters of cash crops such as coffee, tea and cotton, others rely heavily on imports of crops such as soybeans, wheat and rice.

FIGURE 19

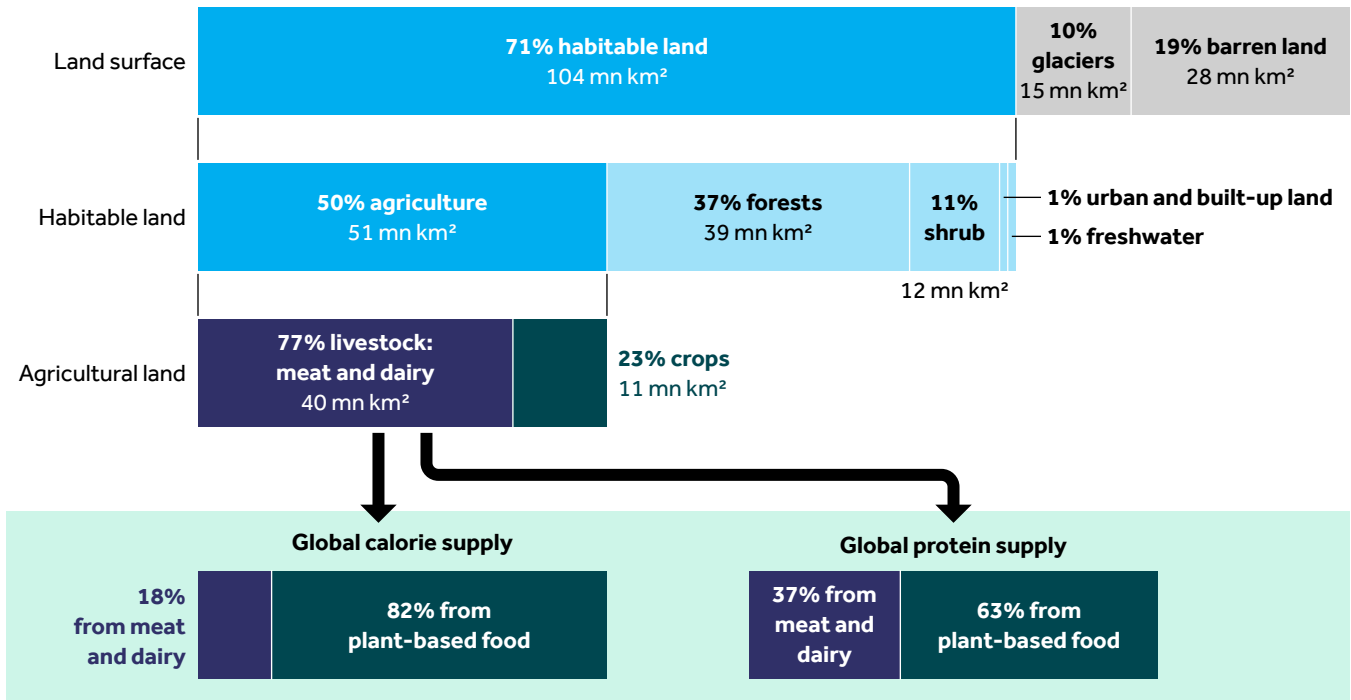
Role of agriculture in the global economy



Source: FAO

FIGURE 20

Global land use for food production



Source: UN FAO, Our World in Data

Global land use – key factors influencing crop production

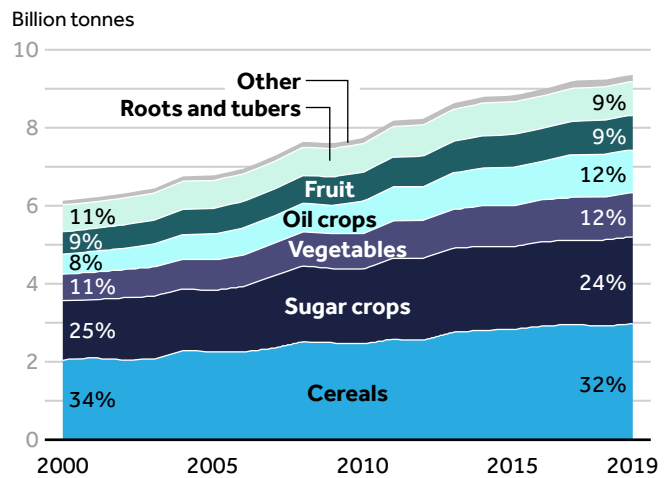
The ability to export agricultural products depends on several factors, with the unequal distribution of natural resources and land use being key. While half of the world’s habitable land is used for agriculture, more than three-quarters of this is used for livestock production. However, meat and dairy represent a smaller share of the world’s protein and calorie supply.

Cereals account for one-third of global crop production

The growing role for primary crops globally is likely to continue, with production increasing more than 50% since 2000, driven mainly by the increased use of critical inputs such as irrigation, pesticides and fertilisers. With slightly less than one-third of the total, cereals were the main crops produced in 2019 (including maize, wheat and rice). This was followed by sugar crops (24%) and vegetables and oil crops (12% each). Fruit and roots and tubers each accounted for 9% of the total production.

FIGURE 21

World production of crops by commodity group (2019)



Source: FAOSTAT

Water, water everywhere: the rising tide of irrigation

The introduction of irrigation is one aspect of agriculture intensification that has allowed total production to grow much faster than the cultivated area. The global land area equipped for irrigation reached 342m hectares in 2019, (18% up on 2000) according to the FAO. The vast majority is located in Asia (70%), where irrigation was a key component of the green revolution, which brought modern agricultural methods to the region at great speed. The Americas account for 16% and Europe for 8% of the world total. Irrigated agriculture land refers to the area equipped to provide water via artificial means (sprinkler, drip, micro-irrigation etc.) compared with land that relies on rain.

One third of the total agricultural land in 2019 was cropland (land used for food production) and the largest share of global cropland was in Asia (38%), followed by the Americas (24%), Europe (19%), Africa (18%), and Oceania (2%). By country, it was India (11%), followed by the United States of America (10%) and China (9%).

However, cropland area per capita decreased in all regions between 2000 and 2019 as populations increase faster. The world average declined by 17% in 2019; the decrease was the largest in Africa (-26%), followed by the Americas (-18%) and Asia (-15%). The increase in agricultural production over the same period indicates higher efficiency in feeding the population with limited land resources.



Food insecurity is a symptom of an existing problem

The current food crisis is one of many that have taken place in recent years and feeds into the broader concern about food insecurity.

Food insecurity continues to affect people disproportionately – countries where food comprises over 40% of household spending suffer more. Even if new technology or policy incentives were introduced, it would take many years for it to enable meaningful, global change.

Any hope to address food insecurity will be met with the reality of a complex interconnectedness between population growth, sustainable development and climate change. A discussion on how to deliver food security would be incomplete without considering the distinction between access vs. availability, and how intertwined some of the underlying challenges of poverty, hunger and malnutrition are.



What is food security?

People are food insecure when they lack regular access to enough safe and nutritious food for normal growth and development and an active and healthy life. This may be due to unavailability and insufficient quantity of food and/or lack of resources to obtain a sufficient quality of food.

There are various levels of food insecurity

The FAO measures it using the Food Insecurity Experience Scale (FIES), which is an estimate of the percentage of a country's population that faces difficulties in accessing enough safe and nutritious food for normal growth and development and an active and healthy life.

29% of the global population was moderately or severely food insecure in 2021

In 2021, an estimated 29.3% of the global population – 2.3 billion people – was moderately or severely food insecure, according to the FAO. Although the number remained relatively stable between 2020 and 2021, over 350 million more people were affected by moderate or severe food insecurity in 2021 vs. 2019 (before the COVID-19 pandemic).

Close to 40% of people affected by moderate or severe food insecurity in the world were facing food insecurity at severe levels. The prevalence of severe food insecurity increased from 9.3% in 2019 to 11.7% in 2021 – the equivalent of 207 million more people in two years. Globally, the gender gap in the prevalence of moderate or severe food insecurity grew larger during the pandemic.

Food security has worsened primarily in Africa and Latin America

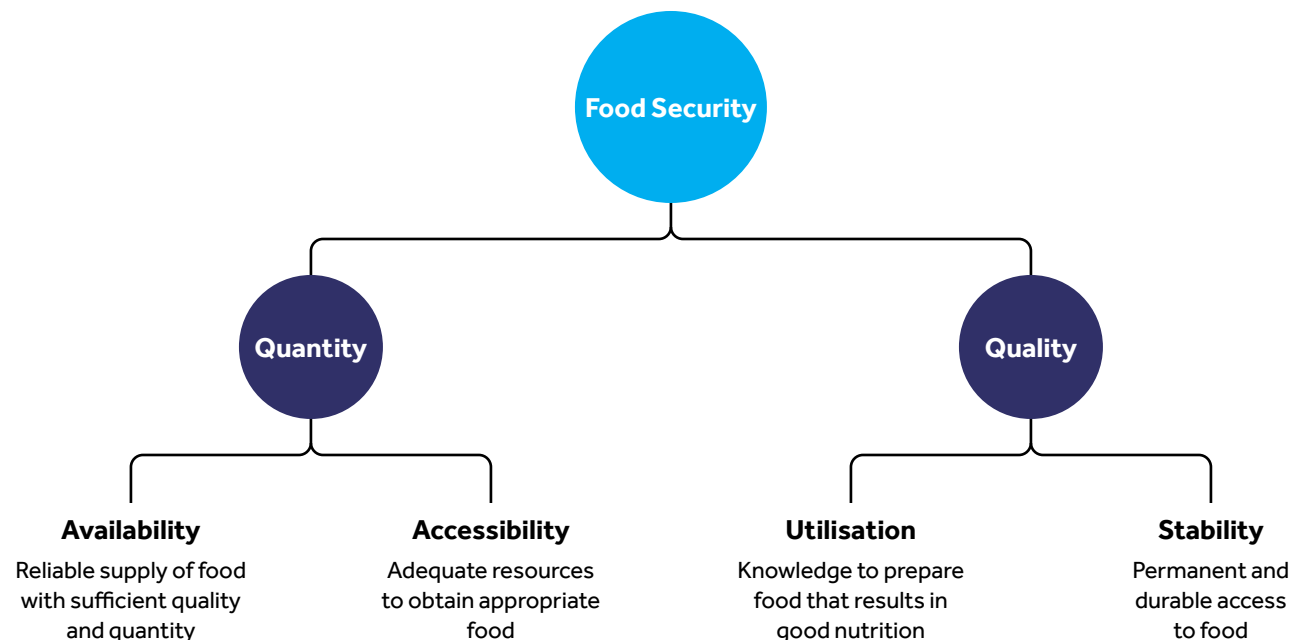
Between 2020 and 2021, moderate or severe food insecurity increased the most in Africa (reaching 57.9%), driven primarily by Sub-Saharan Africa. The food security situation also continued to worsen in Latin America and the Caribbean (reaching 40.6% in 2021), driven largely by an increase in South America.

Improvement in Asia

The combined prevalence of moderate and severe food insecurity decreased slightly in 2021 to 24.6% (vs 25.8% in 2020). However, given the sheer size of its population, Asia still accounts for half the people facing moderate or severe food insecurity in the world – more than 1.15 billion. South Asia has the highest levels at 40.6% (6 percentage points higher than 2019, but 2.6pp lower than 2020).

FIGURE 22

The four pillars of food security



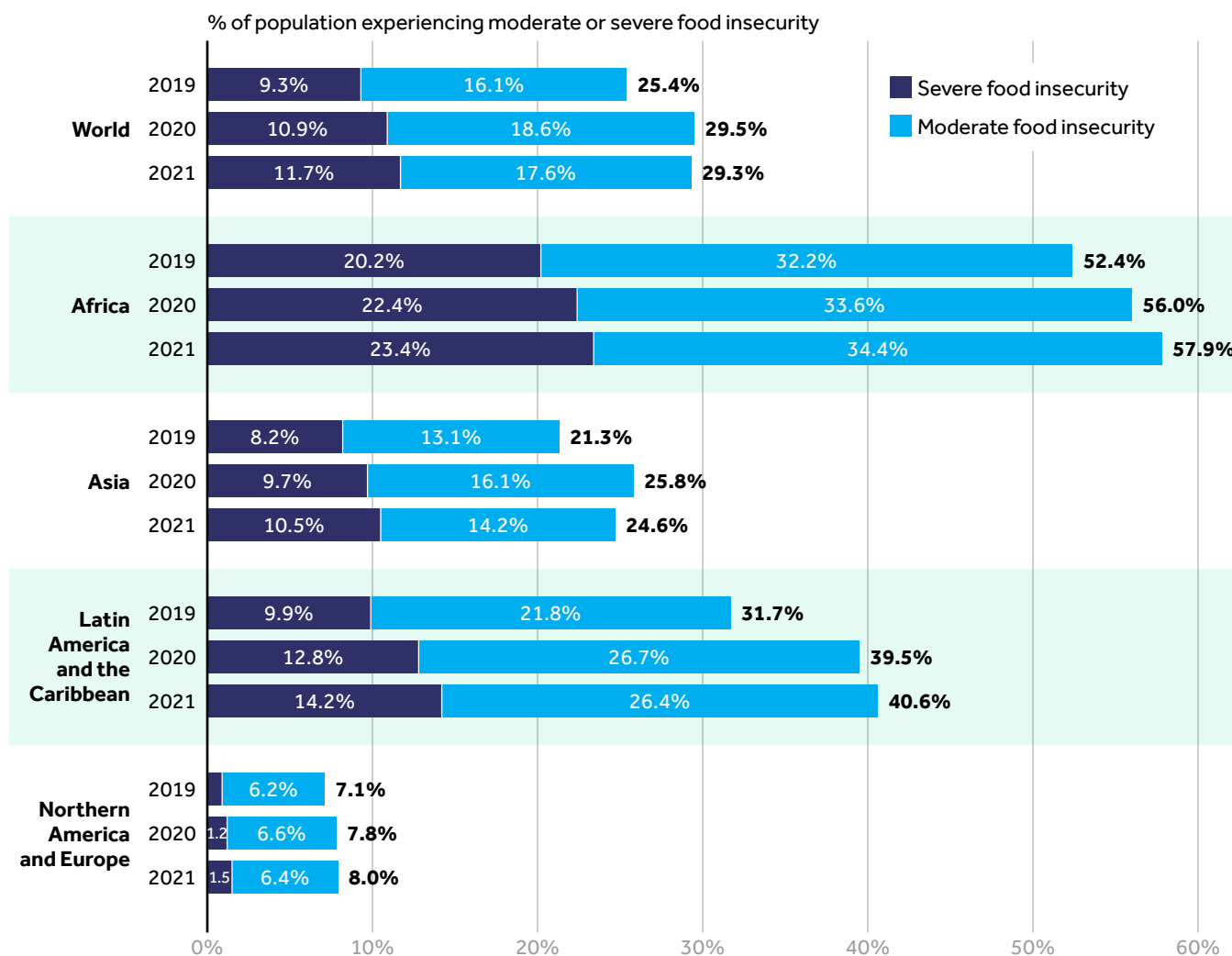
Source: Barclays Research, IAR Journal of Humanities and Social Science (2021)

FIGURE 23
Stages of food insecurity



Source: FAO

FIGURE 24
Concentration and distribution of food insecurity differ greatly across the world



Source: FAO

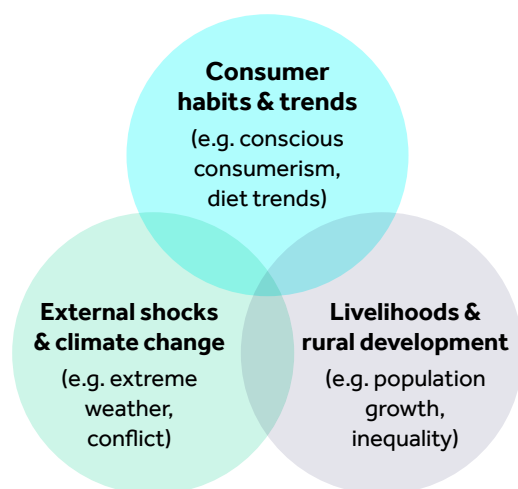
Why is food insecurity an ongoing problem?

One of the main issues with managing food security is that the drivers and outcomes are all incredibly interlinked.

With so many moving parts (and ongoing external shocks), solving food insecurity is almost impossible. There are methods to help reduce or slow the spread of insecurity, but there will always be parts of the world with unacceptable levels of food insecurity.

FIGURE 25

Factors affecting food security



Source: Barclays Research

Drivers of food insecurity

Extreme weather: Extreme weather patterns are having a detrimental impact on agriculture industry, with flooding, water stress and extreme heat all impacting crop cultivation and food production. With production of the four major crops

concentrated in a few regions (Asia, Latin America), food supply chains are particularly vulnerable to unpredictable weather patterns or natural disasters.

Geopolitical instability: War can have wide-reaching effects on global food supply chains. Russia's invasion of Ukraine in 2022 dramatically worsened the outlook for already inflated global food prices, given both countries are significant exporters of key food commodities such as wheat and sunflower oil.

Poverty, inequality and lack of education: Nutritious diets are typically unaffordable for the poor. Food insecurity and malnutrition in all its forms are made worse by high and persistent levels of inequality – in terms of income, productive assets and basic services such as health and education.

Population growth: With the population expected to reach 10bn by 2050, methods to produce food more efficiently are pivotal to preventing the food security issue from getting worse. Plus, more than half of the projected increase in global population up to 2050 will be concentrated in just eight countries, including Ethiopia, India, Nigeria, Pakistan and the Philippines – several of which are currently experiencing extreme hunger.

Ageing agricultural workforce: The UN estimates that 16% of the global population will be aged 65 years or over by 2050, with this percentage being significantly higher in some regions (particularly Western Europe and Asia).

Higher cost of nutritious diets: The high cost of food relative to disposal income is a critical impediment to accessing nutritious foods essential for a healthy life. In 2020, more than 3bn people globally could not afford even the average cost of the cheapest healthy diet, according to the FAO. The cost of a healthy diet is likely to continue to rise given persistent inflation.

Hunger, undernourishment and food security are all interlinked

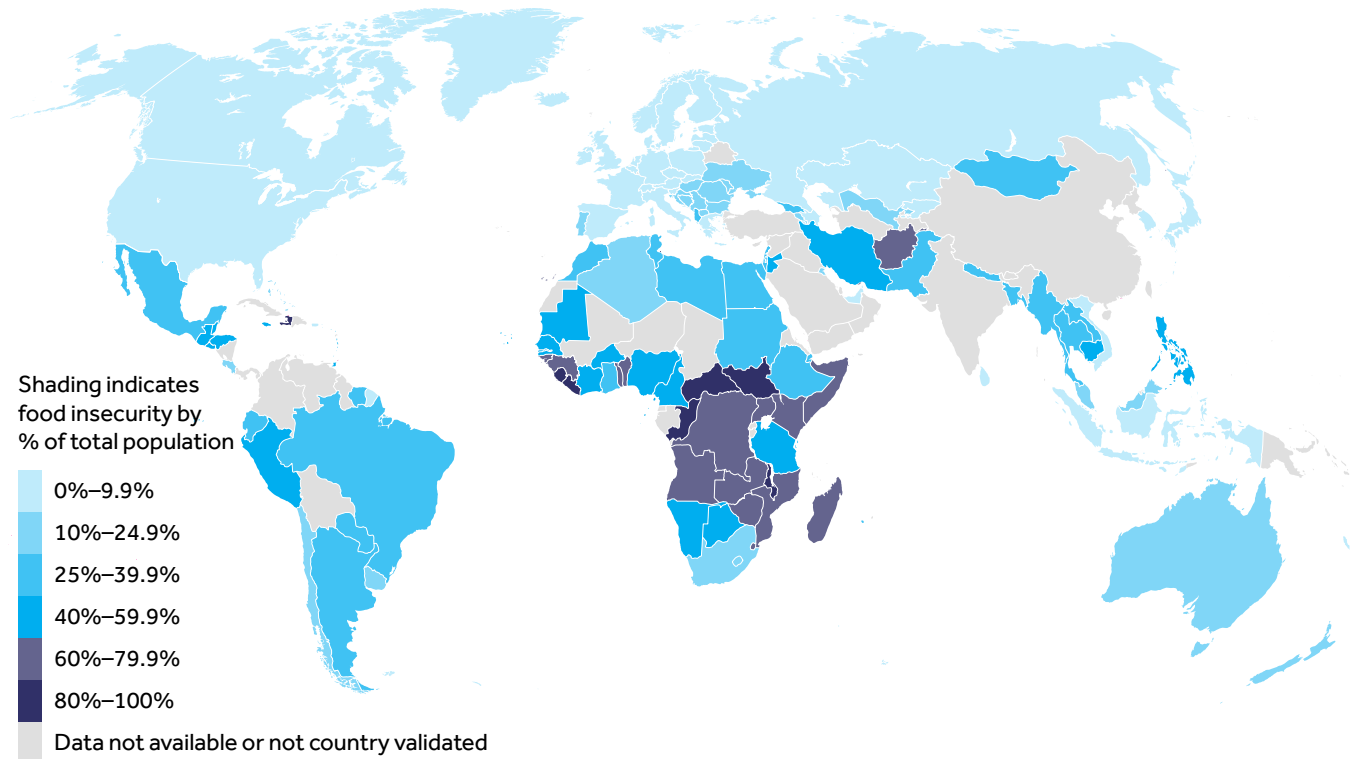
The interconnections between population growth, food security, nutrition and sustainable development involve more than just providing sufficient calories for everyone. Generating long-term food security will mean ensuring access to nutritious diets globally in an equitable and sustainable way. Even before the war, 55 countries, mostly in Africa and Asia, were already in acute hunger crises, emergency or famine conditions. Russia's aggression against Ukraine is compounding these threats.

Hunger is caused by an insufficient consumption of dietary energy and becomes chronic when the person does not consume a sufficient amount of calories on a regular basis.

According to the FAO, the number of people affected by hunger globally increased to 828mn in 2021, an increase of 46mn since 2020 and 150mn since the outbreak of the COVID-19 pandemic. The further increase in global hunger in 2021 reflects exacerbated inequalities across and within countries due to an unequal pattern of economic recovery.

FIGURE 26

Mapping food insecurity



Source: FAO

Conclusion: Time to reconfigure

Food shortages are likely to be felt this year and beyond, given the combined effect of the Ukrainian war, extreme weather and fertiliser availability.

Addressing food insecurity transcends issues of hunger

Understanding how and why various forms of malnutrition (including hunger and undernourishment as well as obesity and micronutrient deficiencies) coexist is central to addressing food insecurity. The combination of economic, financial and social risks that surround the food insecurity debate suggests it will require a shift in how society values the supply and production of food. The global food system is largely geared to producing low-priced and highly processed food. Any attempt to address food insecurity will have to shift the focus to producing nutritious products in a sustainable, environmentally friendly way.

The cost of inaction is climbing

The current food crisis is arguably the worst in over a decade. Extreme weather coupled with trade restrictions and conflict

mean that years of positive progress in hunger and poverty are being quickly reversed. Food insecurity levels as well as hunger and undernourishment are forecasted to remain at unacceptable levels. As such, we believe there is an urgent need to structurally reconfigure our global food systems, rooted in sustainability and resilience. Whether both principles can coexist within the food supply chain is uncertain.

Food protectionism will make food insecurity even worse

Action at the consumer level will be required, including reducing the level of food waste and accelerating the adoption of alternative proteins. The combination of emerging technology, diversification and the shift to domestic production sounds promising, but it's easier said than done, given the many structural limitations relating to climate and the availability of land and labour. Ongoing geopolitical tensions are likely to deepen, with measures to address food security offset by the harsh reality of increased food protectionism.



About the author

Hiral Patel is the Global Head of Sustainable & Thematic research at Barclays. Hiral and team aim to identify multi-sector thematic trends that could shape the business environment, with the investment opportunities spanning both public and private companies. Hiral has developed a thematic framework known as the '2030 Thematic Roadmap:

150 Trends' and has published on various topics relating to emerging technology, sustainability and demographic change. Recent publications include Social Inclusion, Electronic Waste, Cultured Meat and Green Data Centers, including a variety of investor tools (trend momentum scores, UN SDG mapping, company revenue tagging).

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