An overview assessment of the COVID-19 pandemic on the UK food and nutrition security

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Further Information: Other publications produced by the project are available here:
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Summary

This report details an assessment of how the COVID-19 pandemic has impacted the UK's food and nutrition security. It considers how the various parts of the food system have been impacted and what the consequences have been. An overview perspective has been taken.

- The food system has been able to function during the pandemic shock in that it has maintained food availability and prices have remained relatively stable.
- In respect of the four pillars of food security (availability, access, utilisation and stability), economic access due to reduced or lost income has been the key driver of increased food insecurity, exacerbating already large inequalities:
    - **Availability:** Food production levels, reserves and food system supply chain infrastructure have so far remained stable and able to meet demand. Most key food types have remained available.
    - **Access:**
        - **Economic access:** People already on low incomes and those who have experienced loss of income have experienced severe economic and physical access difficulties. Hunger and malnutrition are more strongly related to job loss and income reduction than with food supply chain disruptions.
            - » This has been more evident in later waves of the pandemic as economic impacts have worsened.
            - » Foodbanks increased activities and allowed physical and economic access for vulnerable people and large numbers of new users but are not able to meet all needs. Free school meal provision has increased by 300,000 in a year according to the Department for Education. A lack of coordination, contingency plans and preparedness from Government for food provision was largely balanced by civil society activities.
            - » Government financial support responses (Plan for Jobs) helped protect income for c. 11 million people, helping to reduce the numbers exposed to food insecurity.
            - » Food prices remained relatively stable after an initial increase on groceries inflation after March 2020. However, indications are that UK and global prices are increasing (July 2021).
        - **Physical access:** difficulties due to the need for social distancing and movement restrictions have meant the most vulnerable, particularly those with illnesses and disabilities have experienced greater difficulties in accessing food and nutrition.
    - **Utilization:** food purchase, preparation and consumption behaviors have changed during the pandemic: evidence indicates both improvement in diet in some parts of society, but a deterioration in others, particularly those already on poor quality diets.
        - Significant changes during Covid-19 were reported in where and how people prepared and ate food and in the types of food eaten.
        - The restrictions on hospitality meant a large shift to more home consumption and less consumption away from home, with substantial impacts on supply chains.
        - Significantly more people became anxious about having enough food to meet their needs during Covid-19.
    - **Stability:** The immediate prospects for continued stable availability are reasonable, but there are increasing risks from lack of economic access for low-income people.
        - The duration of a shock is a key aspect of the threat to stability: at the time of writing 13 months had elapsed since the start of the pandemic and availability of food has remained stable. However, continued duration and the risk of additional shocks (i.e., due to climate impacts) will exacerbate an already stressed food system.

- Primary production in 2020 in the UK experienced a substantial decrease in yield due to exception weather conditions (wettest February, sunniest May and dry spring, Storms Ciara, Dennis and Jorge resulting in flooding).

- **Has the UK become food insecure?**
  - Our assessment is that as a whole the UK has not been food insecure during the pandemic, **however** a substantial segment of the population have experienced food and nutrition insecurity, primarily through loss of income restricting economic access to food.
- The pandemic has exacerbated an already large inequality in food and nutrition security and diet quality within the UK, risking the development of a two-tier food system and further increasing inequalities.
  - There have also been inequalities in impact in respect of the scale, type and location of food businesses, with some local supermarkets, on-line and takeaway businesses experiencing gains whilst rural and urban eat-in small businesses having losses.
- Disruption caused severe impacts on some food businesses and their processes, operations and financial viability, but not to the extent to risk severe national food and nutrition insecurity:
  - Disruptions to the availability of food in the first wave of the pandemic were primarily due to changes in demand and readjustment of logistics within the supply chain.
  - There have been large variations in impacts between different food producers and sectors within the food system.
  - Primary production experienced disruptions due to labour availability limitations.
  - Initial price inflation occurred due to reductions in retail discounts.
- Supply chains:
  - The transport and logistics sector was able to adapt to enable continued functioning of the supply chains, despite severe labour and practise restrictions.
  - There was a shortage of warehousing space due to an imbalance between outbound non-essential goods slowing or stopping, whilst inbound flows from imports to the UK continued.
  - Significant changes in purchasing behaviour during Covid-19 compared with before included ways in which people obtained food, sources of buying food, frequency and types of food purchased.
  - Shortening supply chains connecting local producers to local consumers was facilitated by civil society activities, helping to alleviate some pressures on low-income consumers.

Outlook

- There are indications of sustained food prices increasing globally, which coupled with economic downturn, will exacerbate existing inequalities between being food secure and insecure, both in the UK and globally.
  - Those people already experiencing food and nutrition insecurity in the UK due to economic access difficulties are likely to be even more at risk if prices continue to increase relative to income support.
- Differences in vaccination rates between countries and emerging new coronavirus variants may mean a potential phase of further COVID-19 waves in countries exporting food to the UK, which may increase shortages and exacerbate food price increases.
- The global food system has thus far been able to adapt to the pandemic, but care is needed to avoid entrenchment in a system that is not resilient to the long-term threats from climate change, biodiversity loss and ecosystem degradation.

Risk Assessment – conclusions

- Food production globally in 2021 currently has a stable outlook (in the absence of any other type of shock), hence food availability may not be reduced. **However**, economic access for an increasing number of people is likely to worsen leading to greater levels of food insecurity and

wider inequalities both in the UK and globally.

- In developing response strategies to the pandemic impacts on the food system, governments and key food system actors need to avoid the risk of exacerbating the problems associated with the cheap food paradigm (push for efficiency and cheap food without including health and environment externalities costs) in aiming to make food more affordable for people on low incomes.
- Under the definitions of food and nutrition security, the pandemic is a relatively short-duration shock (as opposed to long-term threats such as climate change) hence the response to COVID-19 is an indicator of short-term food system resilience. **However**, this does not imply that the food system is resilient and sustainable to other types of shock (i.e. climate extremes) or long-term deterioration (i.e. ecosystem degradation). The system (in the UK) has adapted and coped to enable food and nutrition availability, but this should not be seen as a sign of overall food and nutrition security resilience.

Recommendations

UK Government support for vulnerable people:

- Income support for people on low-income is more likely to reduce risks of increasing food and nutrition insecurity given the potential rise in global food prices.
    - Improved schemes are needed to ensure guaranteed access to sufficient food for a healthy diet.
    - Support physical access by the most vulnerable.
- The role of the Third Sector needs to be supported more to help ensure those most exposed to food insecurity are better protected.
- There is need to develop strategies to manage how and when reductions in retailer promotions (withdrawn) are implemented, as this can influence grocery inflation rates and limit access to cheaper food by those on low incomes.

UK Government preparedness:

- Improve awareness of types of vulnerabilities, sources of threats and understanding of risks.
- Invest in capabilities to improve foresight and response preparation.
- Improve the culture of contingency planning and preparedness within governance to plan for single and multiple synchronous extreme events as well as long-term change.
    - The level of preparedness needs to be commensurate with the scale of risk and severity of potential impacts.
    - Utilise scenario planning and modelling to explore cascading risks and opportunities for mitigation.
- Work with key stakeholders to develop adaptable contingency plans and associated required actions that can be rapidly implemented to minimise impacts.
- Communicate preparation and response strategies in advance to help facilitate rapid implementation.

Global and UK Government and business strategic responses to post-pandemic recovery:

- Aim to achieve improved food and nutrition security alongside long-term food system benefits for human health and environmental sustainability. This requires an improved rebalancing from the current focus on efficiency to one of resilience. A sole focus on only efficiency or resilience will be problematic: there is a clear need for efficiency but not at the expense of resilience.
    - Increase the diversity of food types and food systems rather than rely on a small number of crops, facilitate more diverse food markets including localised systems, diversify farm systems for multi-functional landscapes.
    - Buffer the food system to shocks by reducing dependency on the 'just-in-time' strategy and incorporate greater redundancy (i.e. through greater storage capacity) and flexibility (ability to switch between suppliers, food types).
    - Improve UK diets for human health that also benefit the environment, with greater use of plant-based proteins, whole grains and less meat and highly processed calories.
    - Develop low waste systems and circular economy-based use of residuals.

- Care is needed to ensure post-Brexit trade deals do not exploit food exporting countries where slow vaccination programmes mean potential further COVID-19 waves.
    - Need to ensure trust in trade is maintained in case of further global food price rises.
        - Improve transparency i.e. AMIS trade reporting.
    - Aim for environmental standards equivalence to reduce ecosystem impacts, i.e. through the Trade and Agriculture Commission.
- Maintain international cooperation on trade to prevent export restrictions.
- Integrate food system realignment for human health and environmental sustainability goals to with parallel objectives of the Sustainable Development Goals, including poverty reduction, greenhouse gas emissions reduction, ecosystem restoration and biodiversity enhancement.

Global and UK Government and research to improve knowledge:

- Improved and integrated climate-crop response, disease outbreak monitoring and modelling to identify production shock risks early (i.e. assessing teleconnection impacts of El Niño - La Niña events and other phenomena).
- Improve integration of global and UK datasets on production and trade (imports and exports) and forecasts to provide clearer real time indicators of production, stocks, demands and prices. The current emphasis of statistics presentation is on economic value, not food and nutrition security functional value.
    - There is need for better data on the nutritional functional value of food trade, rather than on monetary value and volume. Make available nutritional value data, including micro- and macro-nutrients.
    - Improved monitoring of food production, reserves and supply globally will help identify risks, bottlenecks and pressure points.

Food System Sector Summary

The overall food system has shown itself to have adapted and coped with the pandemic shock, though there are many exception examples where businesses, particular food types and parts of the food system have been severely impacted.

- **Producers:**
    - Overall supply (UK and international) has managed to meet demand.
    - Labour shortages impacted production and ability of businesses to function whilst labour costs increased.
    - Changes in demand (closure of hospitality, type of produce consumed) required readjustment of business models, to which the sector was adaptable.
- **Processors:**
    - Food processing industry has managed to meet changing demands by accessing new markets (e.g., online) and creating new strategies (e.g., adapting packaging to retail)
    - The sector was severely impacted by outbreaks which incurred considerable costs and changes to procedures.
    - Labour shortages were reported and a disproportionate number of low-income employees exposed to risks.
- **Retailers:**
    - Consumer behaviour led to increased sales of food and some retailer revenues.
    - Initial reductions in discounts by supermarkets led to price inflation.
    - Hospitality restrictions have threatened many businesses and changed current consumer behaviour.
    - Original advanced preparation by retailers for potential shortages due to Brexit helped reduce pandemic impacts.
- **Logistics and transport:**
    - Movement and storage of goods was severely impacted due to disruptions because of labour and warehousing

shortages and cross-border restrictions.

- Airfreight decreased initially but increased due to restrictions on shipping, road and rail.
- Despite severe impacts, the logistics and transport infrastructure has helped to maintain food availability.

- **Upstream supply chains (production facilitation):**
  - The provision of supplies and services (fertilisers, veterinary etc.) to enable primary food production was able to continue with limited impact on primary production.
  - Changes in public consumer food demand and behaviour had little immediate impact on the pre-production up-stream sector.
  - On-farm practices often use lone-working approaches so less impacted by social distancing restrictions.
- **Research and academic perspective:**
  - Highlighted the vulnerabilities of the 'just in time', economic efficiency driven food system.
  - The pandemic has confirmed the already identified flaws in the food system in respect of inequalities and lack of inclusion of externality costs (health and environment).
  - Whilst the food system may have adapted and coped with the pandemic shock (in the UK), this shouldn't be seen as a sign of system resilience.
- **Policy and food system governance:**
  - Job retention (c. 9.9 million) and other employment protection schemes favoured those already in employment and limited the number of people exposed to loss of income, hence reducing exposure to food and nutrition insecurity. However, many self-employed or on zero-hour contracts were ineligible for support and many of those reliant on social provision have found support to be insufficient.
  - The need for lock down policies has resulted in various business sectors shutting down or closing and hence large numbers of people losing income so exposing them to food insecurity.
  - Measures focussed on the food system have generally enabled it to function, including recognising people producing and distributing food as key workers.
- **Third sector:**
  - Civil society has been crucial in helping to alleviate pandemic impacts on food and nutrition security, at a time when there was already a substantial reliance on third sector support, through food banks, dissemination of information, coordination of efforts and support to industry.
  - Charities and NGO's have had to adapt rapidly to cope with the impacts but have often experienced great difficulties in the ability to operate and secure funding support.
  - The pandemic has highlighted weaknesses in the food system, particularly in relation to the number of people vulnerable to food insecurity, that the third sector had already made clear.
- **Food System Finance:**
  - Compared to other areas of the economy, overall the food sector has been less impacted financially (with the exception of hospitality businesses) due to continued demand and ability of the production, logistics and transport, processing and retail sectors to operate.
  - A high percentage of self-employed within the agriculture, forestry and fishing sector (AFFS) meant c. £80 million claim value in the UK under the Self Employment Income Support Scheme. The number of people furloughed in the AFFS was similar to the whole UK economy.

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Introduction

The COVID-19 pandemic is a public health crisis that has resulted in over 3 million deaths globally and in excess of 152,000 in the UK, and still rising. The economic cost, from lost consumption may be over $5 trillion in 2020-21 (The Economist January 2021). It has had a substantial impact on all aspects of life and affected everyone, not least in respect of our food and nutrition security and relationships with food. The pandemic has highlighted both strengths and weaknesses in the global food system. The key strengths can be described as centred on people and their resilience and the infrastructure within which they operate: the ability of food producers and those in the production supply chain to maintain food *availability*; those in logistics, transport and retail to facilitate *access*; and the public in their ability to adapt (*utilisation*).

In understanding the weaknesses, it is useful to recognised that the pre-pandemic food system was fundamentally flawed both globally and in the UK (Lang, 2020), particularly in respect of food and nutrition security inequalities within society, poor diet and nutrition and lack of environmental sustainability (where damages are non-costed externalities). There have been calls for radically transforming the global food system to achieve a resilient food system before (Poore and Nemecek, 2018, Willett and Rockstrom, 2019, Hawkes, 2020), and during the pandemic (Stordalen and Rockström, 2020).

The pandemic has exacerbated the issues of inequalities in food security whilst impacts on sustainability are yet to be determined. Recovery, however, is an opportunity to address to flaws in the food system and help address other threats such as climate change and biodiversity loss. Our hope is that this report will help inform discussion in a post-Brexit trade agreement and pandemic recovery adaptation period of how an equitable, resilient and sustainable food system can be developed.

About this report

The aim of this report is to contribute responses to the question "How is the COVID-19 pandemic impacting the UK's food and nutrition security?". The research has taken a broad perspective of the overall food system, given that it is complex and influenced by many drivers (Béné et al., 2020). It considers direct pandemic driven issues and additional influences including: environmental conditions affecting production (weather etc.); upstream supply chain (agro-chemical, machinery, agricultural services) impacts; ability of primary production, food processing, transport and logistics and retail to function and meet supply side needs; how the impacts have affected different sections of society; issues of governance and financing of the food system.

The report is an output from the Economic and Social Research Council funded project "**UK food and nutrition security during and after the COVID-19 pandemic**" (Grant ES/V004433/1). Details of the project are available in Rivington et al (2021). The overall project context is to assess the pandemic impact on food and nutrition security *during* the pandemic, and for the future *after* it. The research assesses options for alternative approaches to food production in the UK and subsequently explores what lessons can be learned in respect of addressing other risks, particularly from climate change, biodiversity loss and ecosystem degradation. This UK focussed report builds on one produced by Chatham House on the early international impacts of COVID-19 on the global food systems (King and Wellesley, 2020) and an update to March 2021 (King, 2021).

The pandemic situation has been a rapidly evolving one, presenting challenges in identifying and using relevant and up to date information. The report aims to capture both the latest information available and that produced from the onset to capture the overall state of food and nutrition security, using web-based literature reviews. Given the speed of change in the global situation some older material may be less relevant than at the time of citation.

The overall rationale for this project is to learn lessons from the COVID-19 pandemic impacts and how these can be used to develop more robust responses to future shocks and build resilience in the food system to more long-term risks from climate change, biodiversity loss and ecosystem degradation.

Defining Food and Nutrition Security

The UN Food and Agriculture Organisation defines food security as '*when all people, at all times, have*

physical, economic and social access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO, 2009, p. 1). This definition uses key aspects, referred to as the four pillars (or dimensions) of food security (FAO, 2008):

Availability	This includes the supply side of food production, reserve stocks and net trade.
Access	The ability of people to access food, separated into: • Physical: ability to travel, access shops and markets and store food. • Economic: ability to acquire food by purchase or trade.
Utilisation	How the body utilises nutrients, with sufficient energy and nutrient intake being connected with feeding behaviours, preparation practices, diversity of diet and distribution within households.
Stability	The stability of the other three pillars, when periods of reduction in them can lead to a deterioration in nutritional status.

For food and nutrition security to be realised, all four pillars must be fulfilled simultaneously. Beyond these pillars, it is also necessary to consider other aspects, including the relationships between diet and health (malnourished or overweight and obesity), and factors that limit or inhibit nutrient uptake. A further set of issues include: the practical, economic and moral dimensions of food waste: over-consumption; and nutritional value loss through conversion of primary production into other food products.

A key concern for food and nutrition security in the UK is the inequalities that the food system causes, and now how the pandemic is accentuating the differentiated impacts between sections of society.

In the context of the current COVID-19 pandemic, a further dimension is the duration of insecurity: whether long-term and / or persistent (chronic insecurity); or short-term and temporary (transitory insecurity). A key concern for this project, of which this report is an initial step, is to better understand whether the pandemic impact is part of a wider development of risk to food security arising from other drivers, particularly climate change, biodiversity loss and ecosystem degradation. The aim of this report is to help better understand risk, which is a function of vulnerability, exposure and threats to the food system and its ability to fulfil the four pillars of food and nutrition security.

The Food System

In a simple representation, the food system consists of production, processing, transport and logistics, retail and consumption. It is however a highly complex system where key issues include: the sustainability and stability of food production; resilience; economics; power relations of who influences the governance of food production, distribution and retail and how; inequalities of access; diet and how it relates to health; waste and environmental impacts of production. It is a system therefore with many complex inter-relationships and dependencies. In assessing the impacts of COVID-19 on the UK's food and nutrition security, it is useful to expand on the food system and its complexity to better understand the pandemic impacts and consequences. The food system components include:

- Ecosystems: the wide range of natural processes (ecosystem services) provided via physical mediums (soils, water, biodiversity, ecosystems) that enable terrestrial and aquatic primary and secondary production of food.
- Up-stream supply chains and infrastructure to facilitate primary production (e.g. manufacturing of agriculture machinery, agri-chemicals; supplying services, training and extension, veterinary).
- Primary production: the cultivation and harvesting of food and the social and cultural diversity that interacts with the ecosystem services to produce food.
- Processing, logistics and transport and supply chains: processing and packaging; storage and distribution; wholesale and retailing (shops, markets, hospitality), advertising and marketing.
- Consumption: how individuals utilise food and are nourished.
- A key common factor in the food system is Human labour and skill, thus people are essential in respect of the ability of the food system to function, hence concerns due to disruptions to the ability of people to continue their roles within multiple sections of the food supply chain because of the pandemic.

For a more comprehensive visualisation of the food system see: https://www.foodsecurity.ac.uk/uk-food-mapping/

The food system pre- COVID-19

In understanding the consequences of the COVID-19 pandemic on the food system and hence food and nutrition security, and in the context of the overall project, it is important to recognise some key features, strengths and flaws of the system. The global food system had to evolve to post-second world war and rising population demands creating a productionist, industrial focus. This has come under criticism, with calls for re-aligning it to address current multiple issues (Poore and Nemecek, 2018, Willett and Rockstrom, 2019 Hawkes, 2020, Lang, 2020) including malnutrition, obesity, social inequality and the environmental damage it causes (greenhouse gas emissions, biodiversity and habitat loss, soil degradation, depleted fish stocks etc. (Dasgupta, 2021, Benton et al., 2020). Whilst the measurable value of the global food system in 2019 was estimated to be c. $8 trillion, or 10% of the $80 trillion global economy, the economics of the food system does not include externalities such as the cost of health caused by poor diets or damage to the environmental, estimated to be $6 trillion (World Bank, 2019).

The development of the food system has led to several key features:

- The post second world war policies and subsequent industrialisation of the food system focussed attention on production efficiencies rather than resilience and sustainability.
- Nearly 2 billion people are still considered to be food insecure whilst 820 million do not have enough to eat (FAO, 2020a).
- There are large inequalities in diet quality and food security, with both under- and malnourished people and others with high energy but low nutrition diets, both leading to different health problems.
- Policies and economic drivers have led to the cheaper food paradigm, producing more food at lower costs, but without accounting for the costs of externalities.
- The concentration of food products is dependent on a small number of crops (wheat, rice, maize, soya).
- There is global scale exposure to price volatility due to national and regional scale risks (e.g. the 2008-9 food price spikes, extreme climate events).
- Agriculture accounts for a small percentage of the value of the food system. Only a small percentage of the cost of food to consumers can be accounted for by agriculture, the rest being spread across the supply chain (in the UK and US this is approximately 10 and 11% respectively) (World Bank, 2019).

However, global trade in food is an important stabilising aspect in international relations, creates employment and wealth. In respect of the evolution of the food system and hence the pre-COVID-19 state (and how the pandemic impacted it), the high value of the food system led to the development of a complex, skilled and in places technically advanced infrastructure (often with a high labour dependency) capable of moving large quantities of food quickly and cheaply over long distances. This can be seen as a strength in respect of the capacity to supply large numbers of people with food.

For the UK, this capacity (as well as many other economic, policy and cultural developments) has led to a heavy reliance on imports with almost half (45%) of what we consume coming from outside the UK (UK Gov. National Statistics 2020). The value of imports in 2018 was £46.8 billion, whilst exports were only £22.5 billion (Lang, 2020).

- This has resulted in an agricultural land use pattern and infrastructure that is not focussed on those food types that would mean greater self-reliance.
- Prior to the pandemic, around 8-10% of households in the UK were estimated to have been moderately or severely food insecure in recent years, whilst 1-2% had used food banks in 2018/19. For households with children, around 11% of children under 16 lived in food insecure households (approximately 1.4 million children) (Trussell Trust, 2019). A lack of official measurement means that the number of people affected by household food security in the UK is unknown (Tait, 2015). Estimates suggest that only around 1/3rd of food insecure households access emergency food aid via food banks (Douglas et al., 2015a) meaning that access to emergency food aid via food banks is a poor measure of the true extent of household food insecurity.

Global Assessment of the Pandemic

The global context of the pandemic on food and nutrition security is covered in two parallel reports available from Chatham House, the first cover the period to November 2020 available here: https://resourcetrade.earth/publications/covid-19-uk-food-nutrition-security and the second updating to March 2021 here: https://resourcetrade.earth/publications/covid-19-uk-food-nutrition-security-update

In Summary:

- Prior to the pandemic, the UK food system was in a state of readjustment due to Brexit. Since January 2021 the food system has had to adjust to new trade conditions.
- Initially UK imports of food, drink, animal feed and agrochemical inputs largely remained stable throughout the pandemic though air-freighted fruit and vegetable imports experienced greater disruptions in the first lockdown, but less so in subsequent ones. Overall international supply remained robust.
    - In the last quarter of 2020 the value and volumes of food, feed and drink imported to the UK followed similar patterns to the previous two years, despite the acute stresses caused by short-term border closures just prior to Christmas.
- Global food prices remained relatively stable during the first few months of the pandemic (see below) compared to previous price shocks in 2008 and 2010, but as of early 2021, global food prices had been experiencing the sharpest and most sustained increases since the 2010-11 food price crisis and by January 2021 had reached the highest monthly average value since mid-2014 – up 11 per cent from a year earlier. Although pandemic-related factors are at play, they do not appear to be the primary drivers of food price rises. Although the value of £ Sterling relative to the Euro declined by 10% from February 2020 to March 2020, subsequently the value of £ Sterling to the Euro remained relatively stable during the rest of the pandemic in 2020 as both the UK and EU faced similar challenges.
    - These price rises and other concerns about different vaccination rates, uneven economic recoveries and Brexit trade readjustments, plus risks of other forms of shocks (e.g. climate impacts) indicates that food and nutrition security in the UK, and globally, may remain at risk.
    - If the COVID-19 responses in the UK and Europe diverge, this may affect exchange rates and thereby the profitability of UK farm production. Strengthening £ Sterling to the Euro in Spring 2021 may dampen UK farm prices.
- UK food exports remained relatively unaffected in terms of both value and volume in the last quarter of 2020. New trade and customs arrangements at the end of the Brexit transition period caused complications and delays to supply chains, and impacted fresh foods (horticultural and fish particularly), especially for Northern Ireland.
- Agricultural input prices remained largely stable during 2020, suggesting few supply constraints.
- Farmgate prices rose for arable goods but contracted initially for meat suggesting suppressed demand and market uncertainty, but with a subsequent increase. Consumer price data suggests food price inflation from April to May 2020 following the first lockdown and deflation thereafter until the end of the year, with the trend reversing in January 2021.
- Globally, the pandemic has affected countries in different ways in terms of COVID-19 cases and responses and how these have impacted production, exports / imports and exchange rates. While there were some concerning supply-chain constraints in some countries, and some significant price rises in some markets, generally food supply remained plentiful, and impacts have mostly been the result of demand contractions.
- Some countries have implemented food and agriculture trade measures, generally to restrict exports and liberalize imports, but these have been nothing like as severe or harmful as the unilateral measures adopted during the 2007-08 and 2010-12 food price crises.
- Economic pressures resulting from COVID-19 could yet cause major crises around the world if people are unable to afford nutritious food.

While impacts to date have been relatively mild, there is little evidence that this is the result of effective or coordinated interventions.

- The global impacts of the pandemic, particularly the economic effects, will likely affect the food and nutrition security of segments of the UK population, particularly those on low income for some years. It is likely that the full scale of the impacts is yet to be fully realized.

Since the initial report was published in November 2020, in general, fewer supply-side disruptions have been observed in the second wave of the pandemic because governments have been able to more effectively respond than they did in the spring of 2020 (Giertz, 2020).

Global Food Prices:

The FAO Food Price Index (FPI) has remained stable since 2015 but declined in the early stages of the pandemic (February- May 2020) but subsequently increased from June 2020, along with all commodity types now on an upward trend (except meat) (Figure 1). As of January 2021, the FPI reached a six-year high and was 11% higher than at the same time in 2020. However, the change in FPI during the pandemic is less than that which occurred following the 2008-9 financial crisis.

Despite the disruptions, global trade in food products has remained relatively stable, with some developing countries managing to increase export revenues. The overall global food import bill may be greater than 2019 but with a noticeable shift away from high value products to staples (FAO, 2020b).

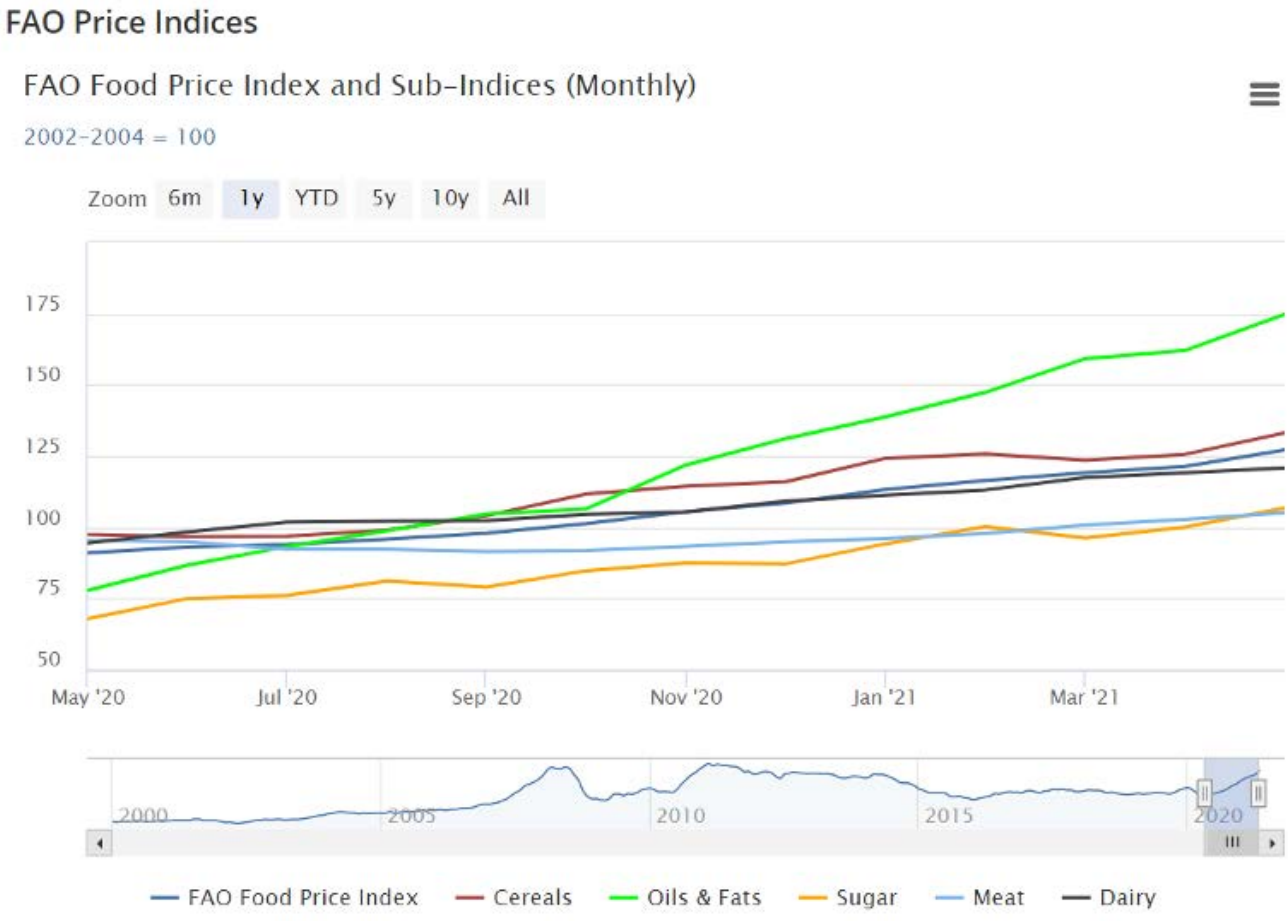


Figure 1. Monthly Food and Agriculture Organisation (FAO) Food Price Index and Sub-Indices from July 2019 to January 2021. Note: Index is 2002-2004 = 100 (Source: AMIS - http://www.amis-outlook.org/indicators/prices/en/)

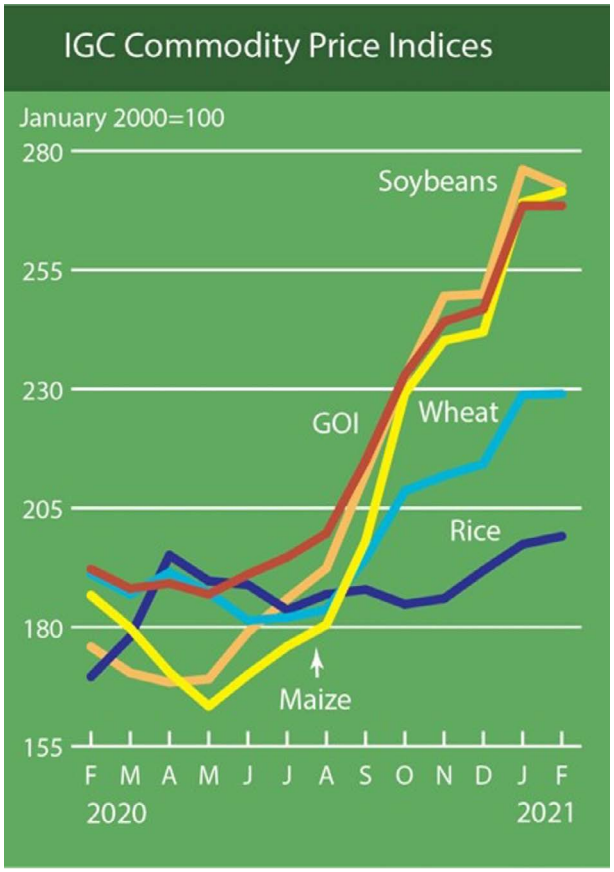


Figure 2. International Grain Council Commodity Price Index (GOI = Grains and Oilseeds Index).

The Grain Commodity Index shows a consistent increase in all grains except rice since May 2020 due to continued brisk trade activity and strong demand that has kept international prices generally elevated but may be stabilising since the start of 2021.

Wheat production in 2020 was up 1.7% year on year to a new record high. Global inventories of stock indicate a rise of 5.4% and 2021 forecast indicate an increase in wheat production due to increased planted area (AMIS March 2021).

UK and European Union Agricultural Income

Preliminary estimates for the EU 27 (excluding the UK) from the EUROSTAT economic accounts for agriculture (Eurostat, 2020) indicate that the overall agricultural sector in the EU has remained relatively resilient in 2020. There was a small decrease in EU agricultural output (1.6% less compared to 2019) but overall was up on the average for the previous three years (0.3%). These figures reflect the value of agricultural produce rather than the quantity and availability of food, but reassuringly indicate in terms of the food system resilience to immediate and global shocks that the primary production side has been able to maintain supply. However, farm (entrepreneurial) income declined significantly by 7.9% compared to 2019 (absolute reduction of €7.5 billion, which is accounted for by the drop in value of agricultural output of €7.5 billion).

There was large variation between EU Member States and the UK in respect of national agricultural output and income (see Table 1), with some seeing large percentage increases in income from 2019 (e.g. Lithuania 30.8%, Ireland 16.1%) whilst others experienced large decreases, most notably Germany (-28.5%), Romania (-56.6%), Netherlands (-15.5%) and the UK (-17.6%). These positive and negative figures indicate that no general negative effect on EU agriculture due to the pandemic is visible, but more detailed analysis is required to better understand the differences between states in respect of variations in output, income, policies and financial support provided. The role of EU policies and changes in subsidies following the introduction of the Temporary Framework for State Aid influencing the overall agricultural accounts in not yet clear (Matthews, 2021).

Table 1. EU Member State changes in agricultural output and income between 2019 and 2020 (million € and % change). (Source: Matthews (2021) http://capreform.eu/covid-19-leaves-limited-traces-in-preliminary-2020-agricultural-accounts/).

	Agricultural output			Entrepreneurial income		
	2019	2020	Per cent change	2019	2020	Per cent change
Belgium	8,713.23	8,723.26	0.1%	1,076.65	948.20	-11.9%
Bulgaria	4,321.47	3,964.61	-8.3%	1,284.80	1,204.23	-6.3%
Czechia	5,497.72	5,666.02	3.1%	670.58	745.69	11.2%
Denmark	11,067.37	11,072.07	0.0%	690.01	709.26	2.8%
Germany	58,527.78	56,307.30	-3.8%	8,509.20	6,081.25	-28.5%
Estonia	997.64	980.60	-1.7%	121.37	109.51	-9.8%
Ireland	8,521.68	8,942.77	4.9%	2,666.72	3,095.63	16.1%
Greece	11,880.09	11,740.83	-1.2%	5,577.80	5,685.17	1.9%
Spain	51,668.68	52,991.15	2.6%	21,678.32	23,074.01	6.4%
France	77,023.61	75,428.14	-2.1%	16,953.14	15,038.80	-11.3%
Croatia	2,423.46	2,536.80	4.7%	1,072.10	1,182.24	10.3%
Italy	57,828.71	56,118.06	-3.0%	16,496.99	15,137.02	-8.2%
Cyprus	756.04	770.98	2.0%	244.53	243.20	-0.5%
Latvia	1,628.68	1,695.44	4.1%	450.20	485.92	7.9%
Lithuania	3,209.39	3,337.57	4.0%	521.94	682.47	30.8%
Luxembourg	442.43	435.26	-1.6%	42.24	40.18	-4.9%
Hungary	8,721.55	9,078.33	4.1%	2,166.42	2,488.15	14.9%
Malta	126.40	127.01	0.5%	74.65	75.71	1.4%
Netherlands	29,138.34	28,125.11	-3.5%	3,260.97	2,756.43	-15.5%
Austria	7,471.58	7,689.28	2.9%	1,817.18	1,906.61	4.9%
Poland	26,357.72	26,829.81	1.8%	10,224.70	9,420.99	-7.9%
Portugal	8,084.46	7,859.63	-2.8%	1,841.91	1,694.39	-8.0%
Romania	18,963.83	16,327.74	-13.9%	6,857.38	2,976.58	-56.6%
Slovenia	1,325.17	1,347.36	1.7%	410.99	451.62	9.9%
Slovakia	2,261.12	2,276.61	0.7%	127.10	133.42	5.0%
Finland	4,745.42	4,456.93	-6.1%	1,061.96	1,075.03	1.2%
Sweden	5,998.63	6,074.26	1.3%	726.90	772.95	6.3%
United Kingdom	30,825.12	29,504.21	-4.3%	7,288.12	6,002.85	-17.6%

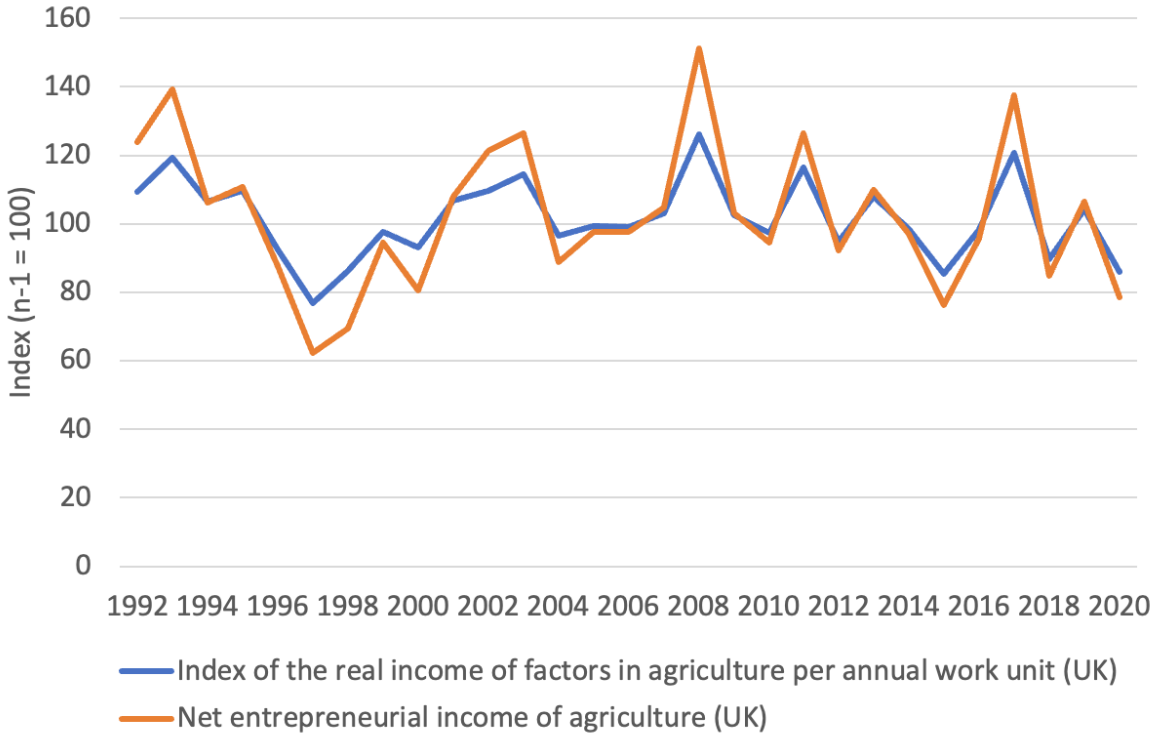


Figure 3. Indicators of UK real income and net farm (entrepreneurial) income from agriculture. (Note: unit of measure is *n*-1 = 100, where *n* is 1974 to 2020). Source: EUROSTAT [AACT_EAA06] https://ec.europa.eu/eurostat/databrowser/view/aact_eaa06/default/table?lang=en accessed 16/12/2020.

Whilst the UK has experienced a substantial decrease in farm income in relation to the real net value added at factor cost of agriculture per total annual work unit (AWU) in 2020, the scale is comparable in size to recent years (e.g. 2015, 2018) seen in Figure 3. This may be due to a number of factors including the pandemic but also arising from reduced total production of staples such as wheat, barley, oats and oilseed rape (see Table 2, section Food Availability) due to climatic influences (see section 'UK Food agricultural production during the pandemic'). The UK agricultural sector has been seen to be relatively less impacted than others in the UK economy, but the loss of farm income in 2020 and potential economic slowdown and reduced consumer spending in 2021 may impact the ability of food producers to invest and apply adaptations necessitated by the Brexit trade agreement, new Agriculture and Environment Bills (and devolved government equivalents), whilst also responding to new market conditions.

Future supply, demand and price outlook

Whilst there are views that the international food market (as indicated by wheat, rice, maize and soybeans) has thus far shown strong resilience and trends indicate an increase in demand hence driving up prices, there are concerns that this may not last due to the economic impact of the pandemic (AMIS, 2020a). The FAO currently forecast a record production high for cereals (1.9% higher than 2019), with world trade in 2020/21 estimated to rise 3.4% from last year. Favourable grain prices (Figure 2) have led to increased area planting in major production countries (AMIS March 2021). However, cereal stocks whilst currently sufficient are forecast to decline, and China may increase use of maize and sorghum for animal feed whilst also building reserves, indicating the potential for continued Food Price Index increases. Whilst supplies (production and reserves) remain adequate and trade flows continue, declining consumer purchasing power due to the

economic downturn and increasing international prices will likely impact economic access and weaken food security, particularly in low-income food deficit countries (AMIS, 2020b). This may be further compounded in 2021 by the emerging moderate to strong La Niña event (WMO, 2020) impacting primary production in many parts of the world due to changed precipitation anomalies that are geographically highly diverse (wetter or drier). The FAO indicates that the forecast cereal stock to use ratio, whilst estimated to be a five-year low, is still at a relatively comfortable level.

The pandemic has presented an unprecedented set of circumstances which implies markets did not respond in the same way, in respect of decision making, to previous crises. The combined effect of multiple drivers on food values and eventual retail prices, even under normal circumstances, is difficult to predict, hence the increased uncertainty associated with response decision making makes future projections of prices difficult. Previous food commodity price spike crises, as in 2007–2008 and 2011, had relatively well understood drivers and uncertainties. The current pandemic, however, makes future projections of price responses difficult, in part due to uncertainties in how different compensating (or offsetting) factors affecting food prices may interact. The pandemic may potentially have limited effects on the consumer price of food in the UK, largely due to the off-setting direction of changes in the drivers of food inflation (Lin et al., 2021). However, continuous FAO Food Price Index rises since April 2020, increasing more rapidly since the start of 2021 indicate that pressures will increase on global and UK food prices.

UK Food Export and Import Values

This section considers the value of food imports to and exports from the UK compared to 2019. It is important to point out that responses to these were a function of not just the pandemic, but pre- and post-Brexit (and associated changes in tariffs and regulations) and transition period market positioning, and terms of trade in respect of regionally variable global production, markets and currency rate variations (see Figure 4). These, coupled with highly altered demand side responses, means it is beyond the scope of this study to disentangle these different factors. However, given that economic access has been shown to be the primary impact on food and nutrition insecurity, results are presented in terms of values of major food types, rather than quantities, to illustrate pandemic impacts.

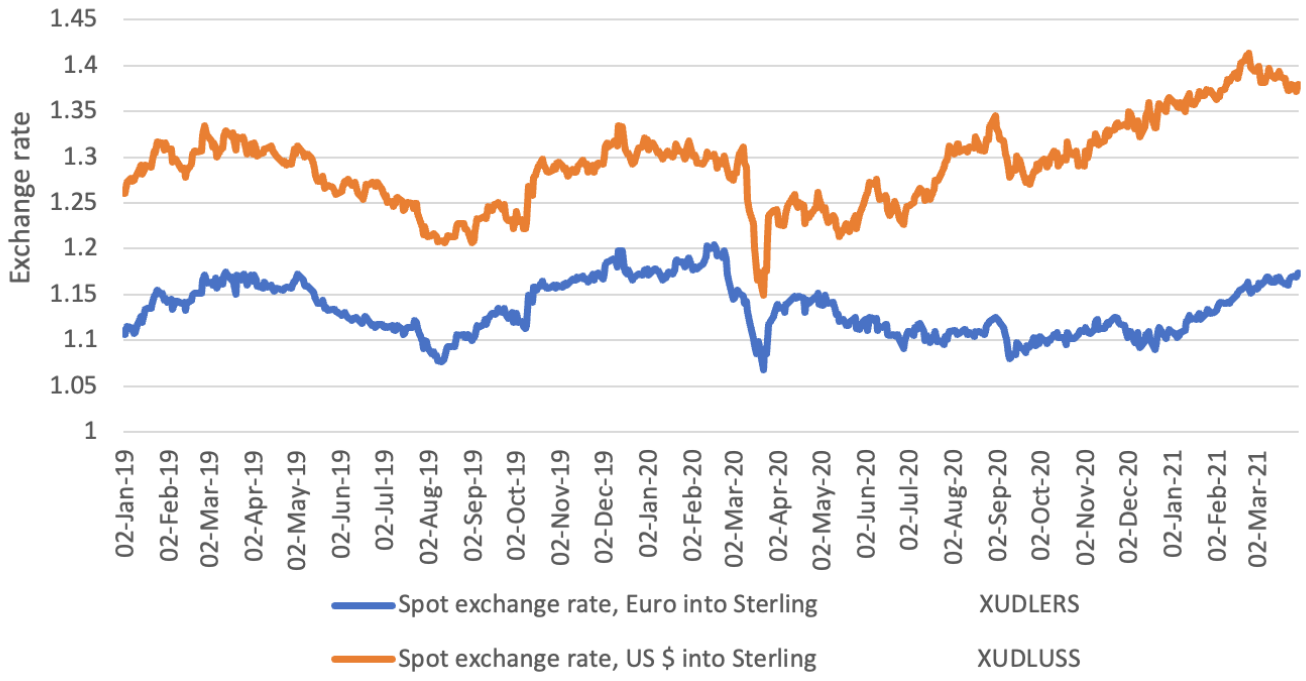


Figure 4. Exchange rates of Euros and US Dollars to Pound Sterling 1st January 2019 to 30th March 2020.

As a general rule, a weakening of Sterling against other currencies causes the price of imported goods to rise. This pushes up the price of produce and leads to rises in domestic prices to the same level as imported goods. Goods exported from the UK become more competitive when sterling is weaker. Other factors determining the retail price of food include the costs of energy. As the pandemic took hold in early 2020 the cost of crude oil plummeted (Figure 5), even to the extent of briefly going negative. However, as economic recovery commences, energy use is likely to increase 0.5% above 2019 levels (IEA 2021), which may lead to an increase in oil and other energy prices that are transferred to the costs of food.

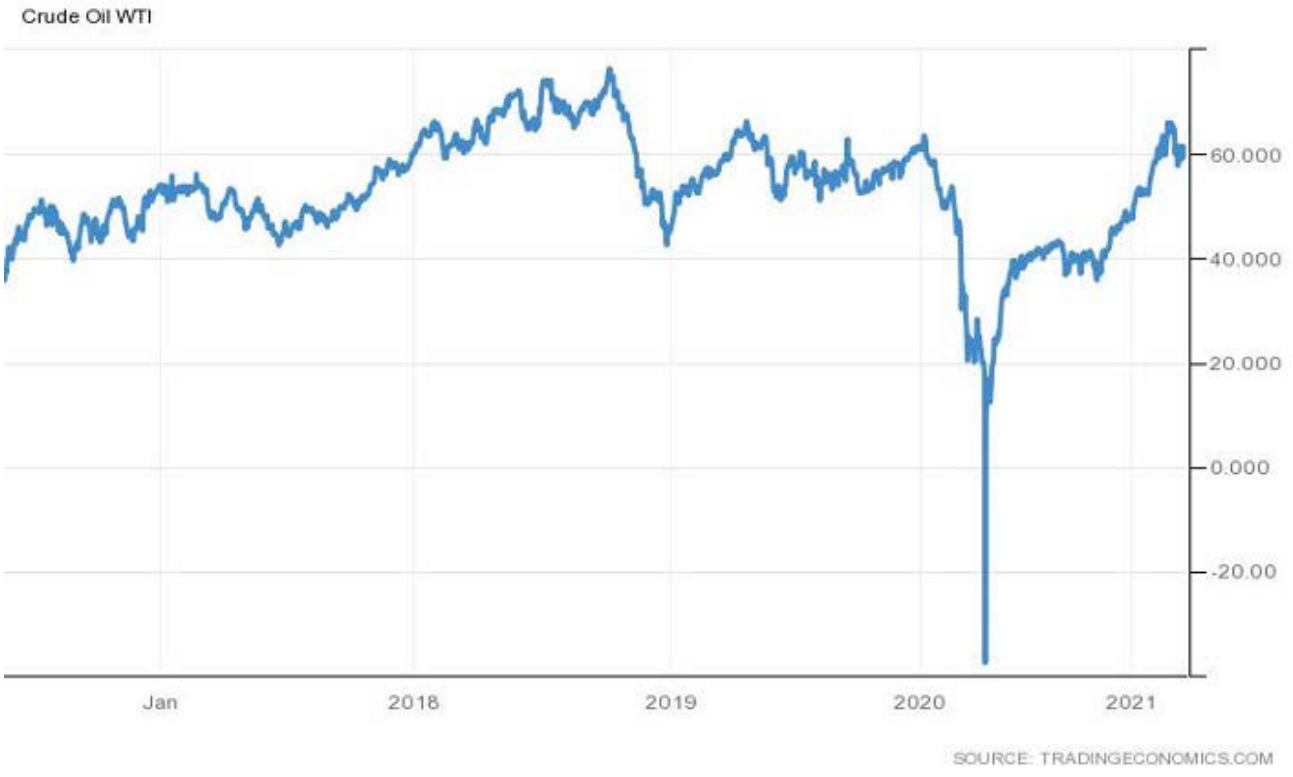


Figure 5. Crude oil price (West Texas Intermediate) US Dollars per barrel from April 2016 to April 2021. (source: https://tradingeconomics.com/commodity/crude-oil)

The following sets out the values of food type imports and export differences between 2019 and 2020 and are not adjusted for exchange rate variations.

Cereals: The value of UK cereals exports to the EU in 2020 (£0.333 billion) was considerably lower (£187 million) than in 2019 (£0.520 billion) particularly noticeable in the post-harvest period (Figure 6), which may also be a function of the greatly reduced overall yield (see Table 2). The total value of UK cereals exports to the EU in 2020 was £333,367,000 compared to £520,319,000 in 2019. UK exports to non-EU countries in 2020 remained similar to those of 2019. Correspondingly there was a substantial increase in cereals imported from the EU (approximately £200 million), and to a lesser extent, from non-EU origins. These aggregate values presented here however do not enable identification of true country of origin as they reflect exporting EU sources which in turn may have imported from outside the EU (i.e. soy from South America for animal feed routed via The Netherlands).

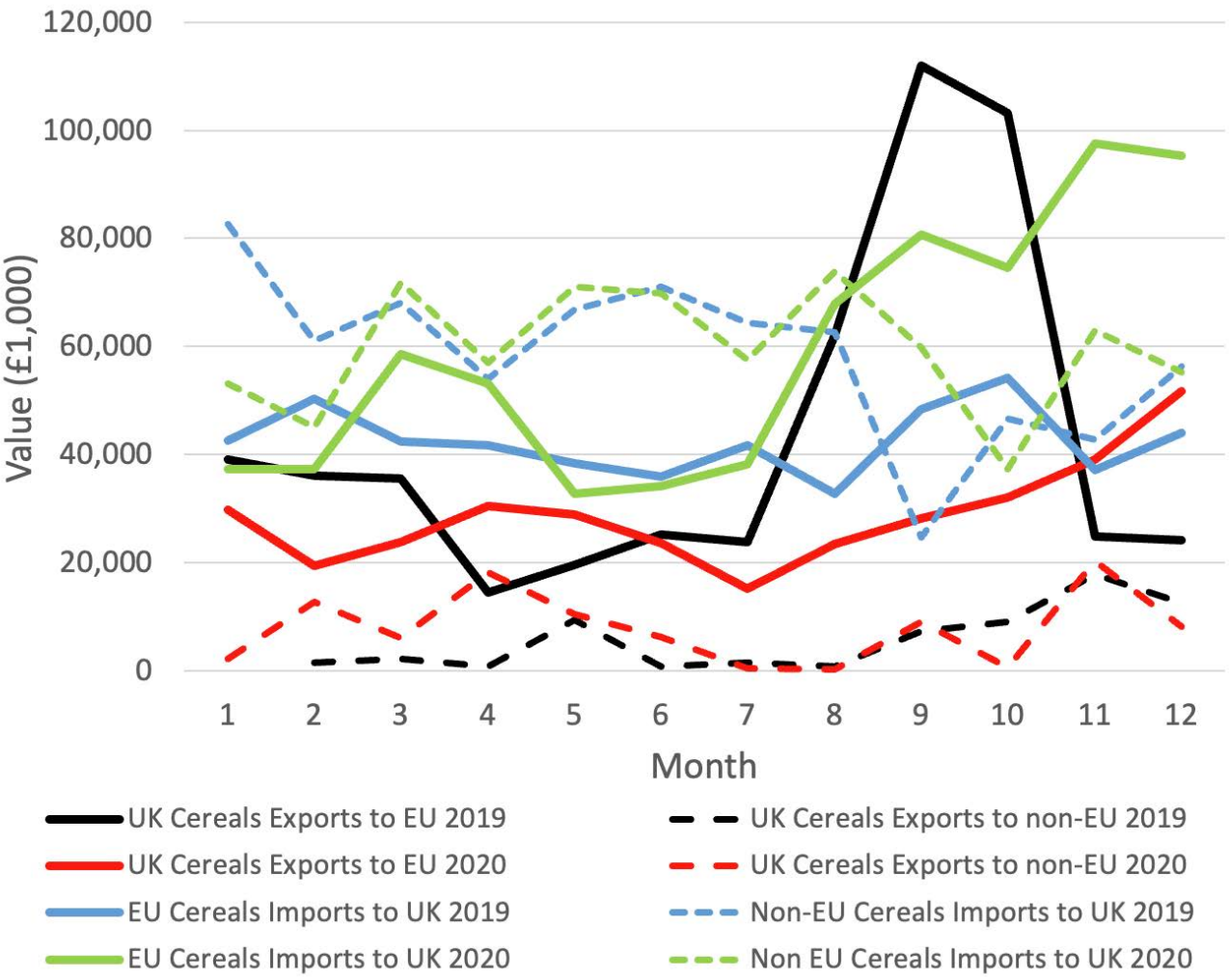


Figure 6. Value of cereal exports to and imports from EU and non-EU countries per month in 2019 and 2020. Sources: https://www.uktradeinfo.com/trade-data/overseas/2019/ and https://www.uktradeinfo.com/trade-data/overseas/2020/

Vegetables: Imports of vegetables from the EU to the UK, in terms of value, where higher than in 2019 at the start of the pandemic (Figure 7). This however reversed slightly in the second half of 2020. Imports from non-EU countries remained similar compared to 2019. Exports of vegetables to the EU was marginally lower in 2020, but approximately the same to non-EU countries. The value of imports to the UK from the EU in 2019 was £2.571 billion compared to £2.545 billion in 2020.

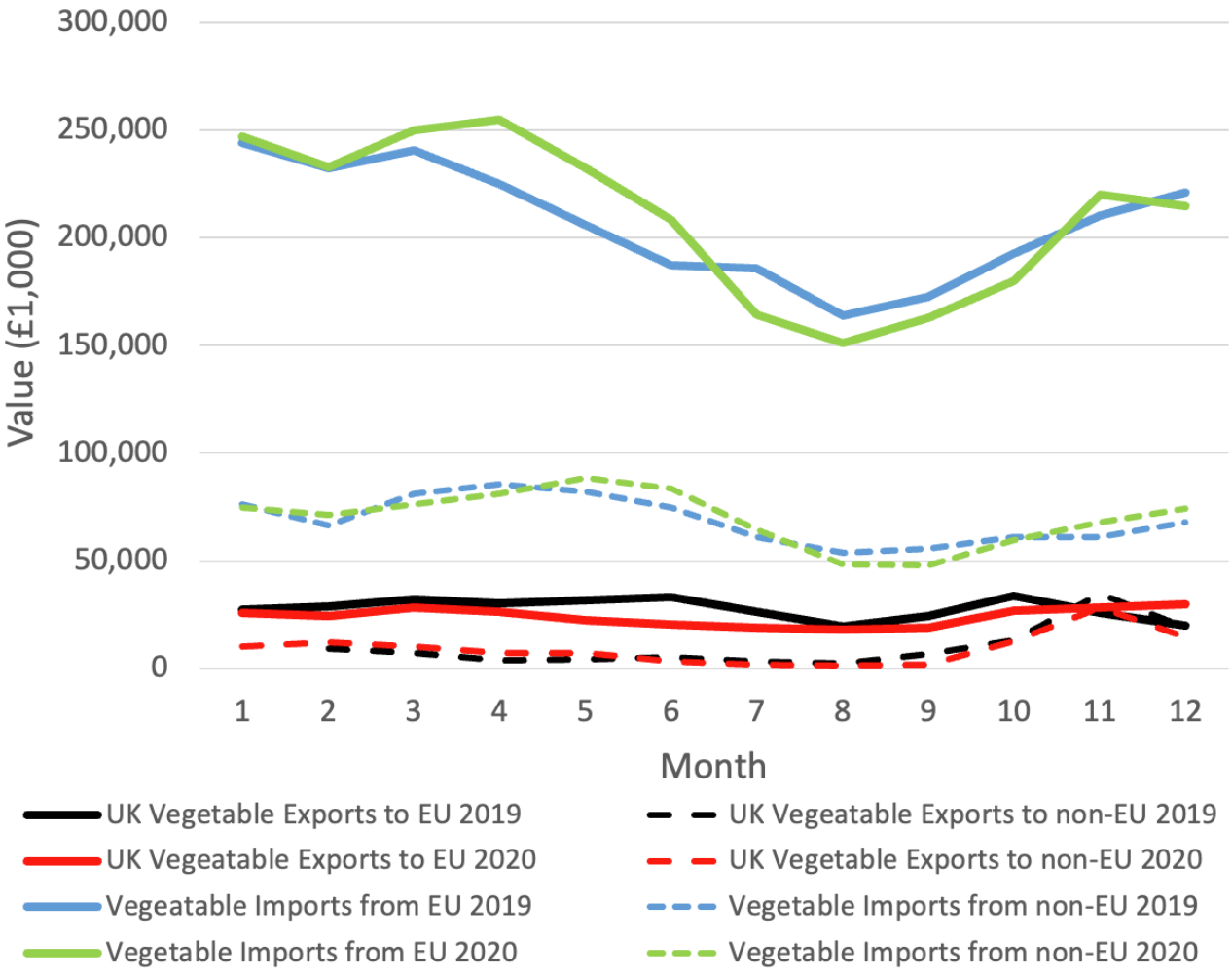
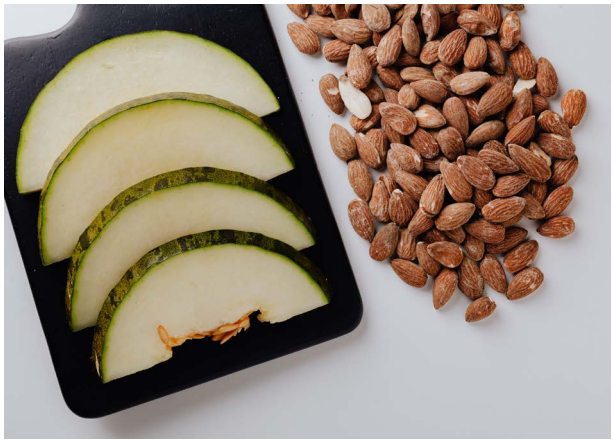


Figure 7. Value of vegetable exports to and imports from EU and non-EU countries per month in 2019 and 2020. Sources: https://www.uktradeinfo.com/trade-data/overseas/2019/ and https://www.uktradeinfo.com/trade-data/overseas/2020/

Fruit and nuts: In the first half of 2020 the UK imported £172 million more fruit and nuts from the EU than in 2019, though imports from non-EU countries remained similar (Figure 8), though it is not clear from this analysis why there was a large decline in non-EU imports between June and July 2020. The end of year total values were £2.085 billion in 2019 and £2.155 billion in 2020. UK Exports remained comparable between the two years.



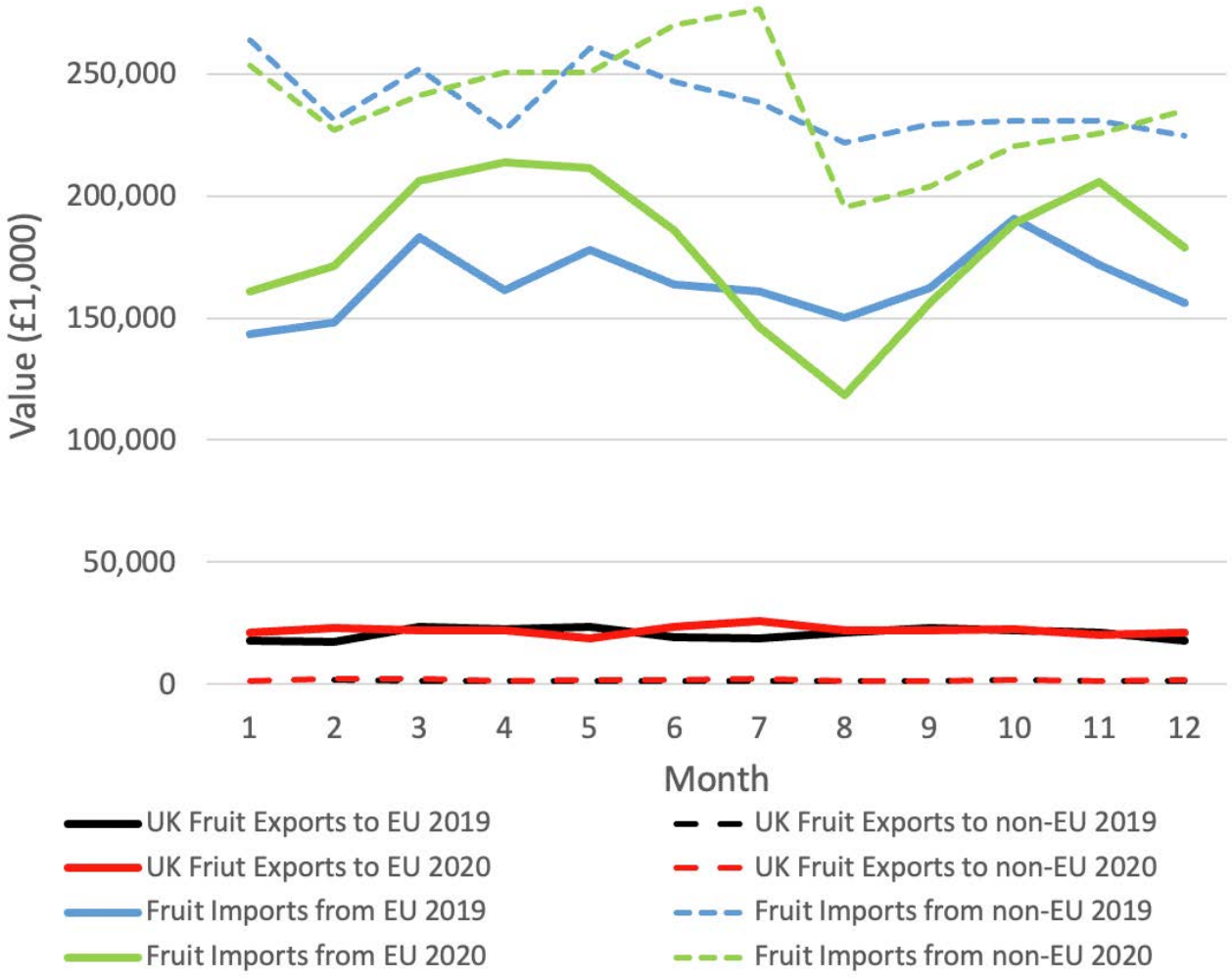


Figure 8. Value of fruit and nuts exports to and imports from EU and non-EU countries per month in 2019 and 2020. Sources: https://www.uktradeinfo.com/trade-data/overseas/2019/ and https://www.uktradeinfo.com/trade-data/overseas/2020/

Meat (and edible offal): The UK imported approximately £300 million less meat in 2020 (£3.459 billion) than in 2019 (£3.759 billion) from the EU and similarly £50 million less from non-EU countries. Imports declined sharply in March 2020 and remained less than the previous year, despite following similar patterns of imports (Figure 9). The UK exported £107 million less meat to the EU in 2020. This implies that a larger proportion of the UK's meat consumption came from

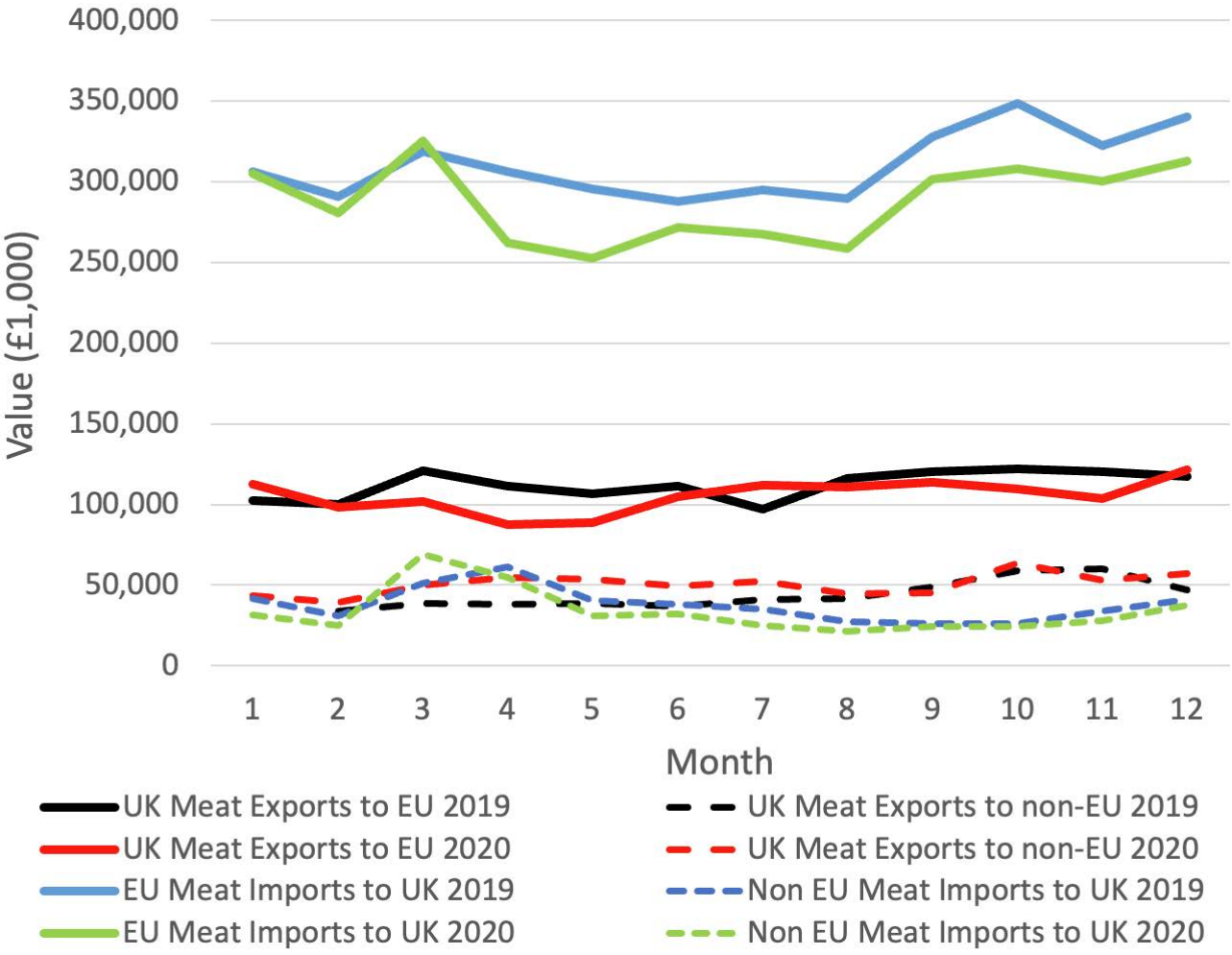


Figure 9. Value of meat exports to and imports from EU and non-EU countries per month in 2019 and 2020. Sources: https://www.uktradeinfo.com/trade-data/overseas/2019/ and https://www.uktradeinfo.com/trade-data/overseas/2020/

Live Animals: The EU exported approximately £13 million worth more live animals in 2020 (£0.494 billion) than in 2019 (£0.482 billion). The UK exported approximately £29 million worth of live animals more to the EU in 2020 than in 2019 (Figure 10).

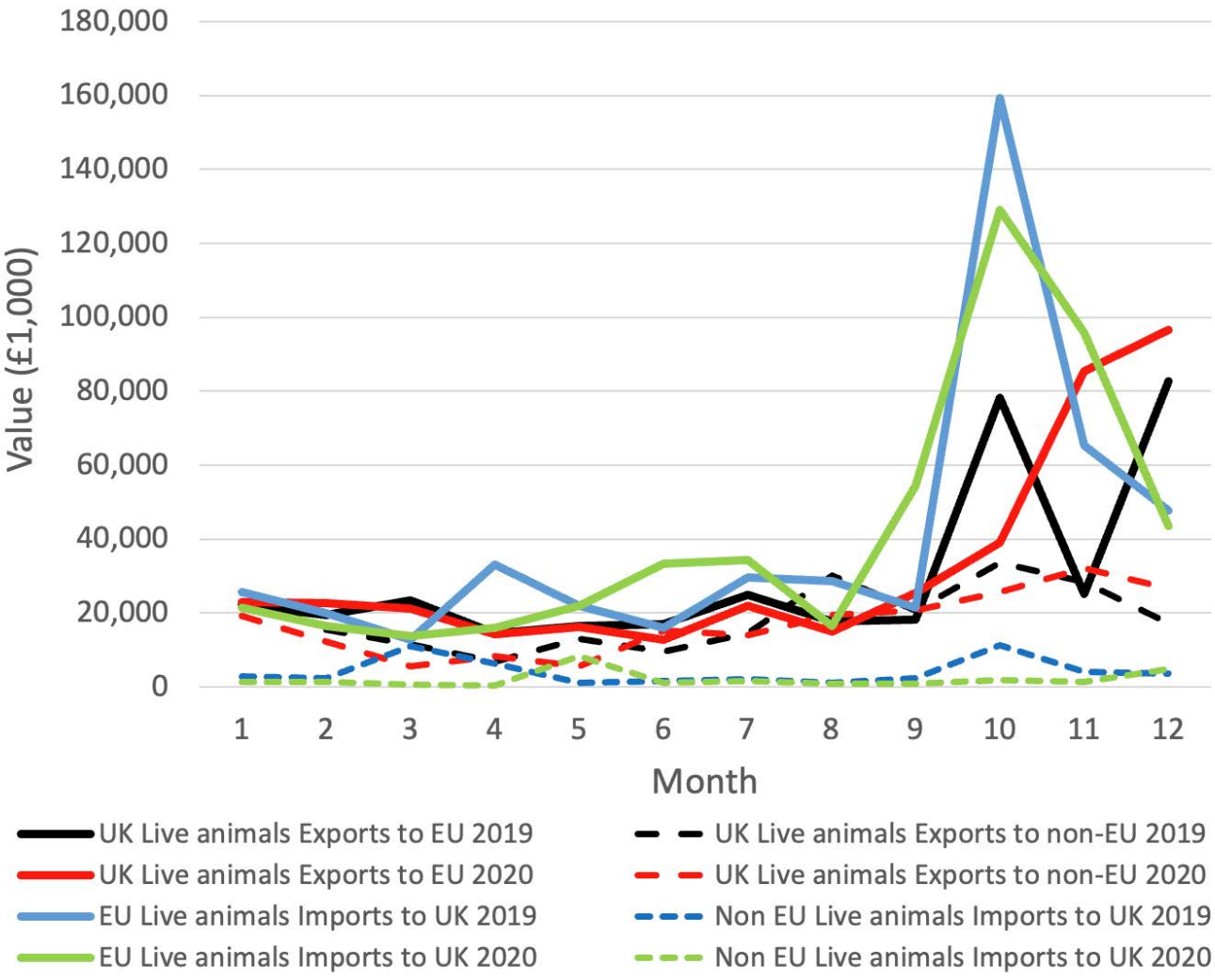


Figure 10. Value of live animal exports to and imports from EU and non-EU countries per month in 2019 and 2020. Sources: https://www.uktradeinfo.com/trade-data/overseas/2019/ and https://www.uktradeinfo.com/trade-data/overseas/2020/

Fish and Crustaceans: Exports of fish and crustaceans to the EU were initially lower in 2020 but recovered to similar levels in the second half of the year. However, exports to non-EU countries in 2020 (£0.361 billion) was £217 million less in value than 2019 (£0.578 billion) (Figure 11). From January to July 2020, the value of all fish landed by the UK fleet (into the UK and abroad) was £401 million, a 23 per cent reduction on the same period in 2019 (MMO 2020). The value of fish landed by UK vessels has remained constantly lower in 2020 compared to 2019 (Figure 12), and by December 2020 was 21% down on the previous year.

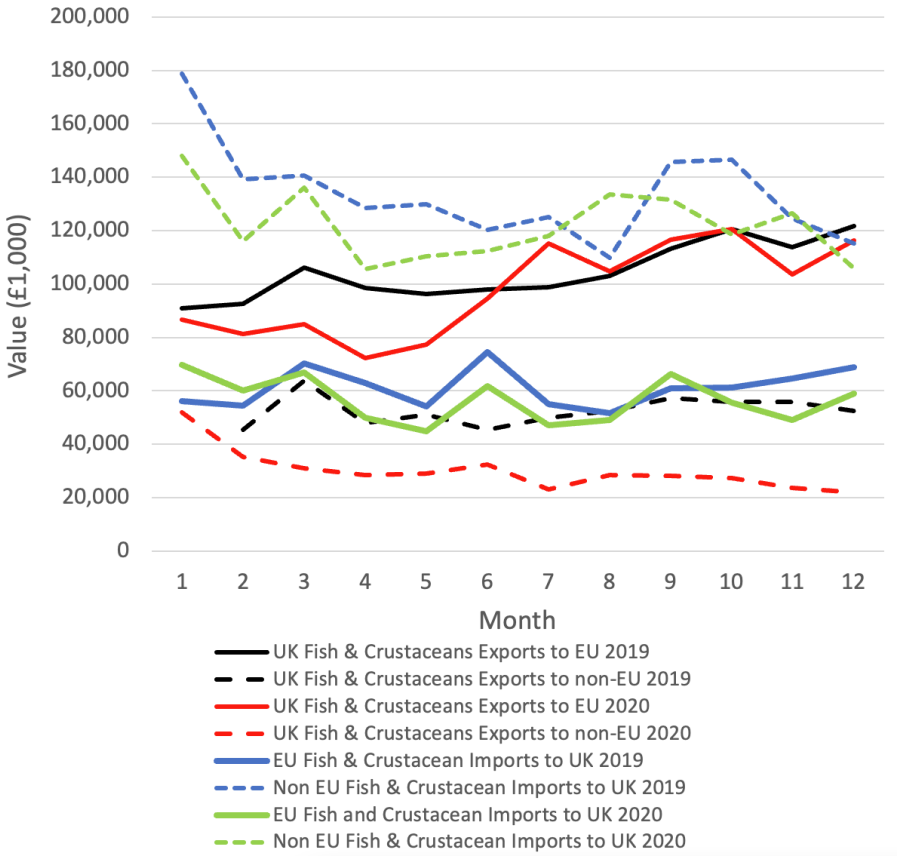


Figure 11. Value of fish and crustacean exports and imports per month to and from EU and non-EU countries in 2019 and 2020. Sources: https://www.uktradeinfo.com/trade-data/overseas/2019/ and https://www.uktradeinfo.com/trade-data/overseas/2020/

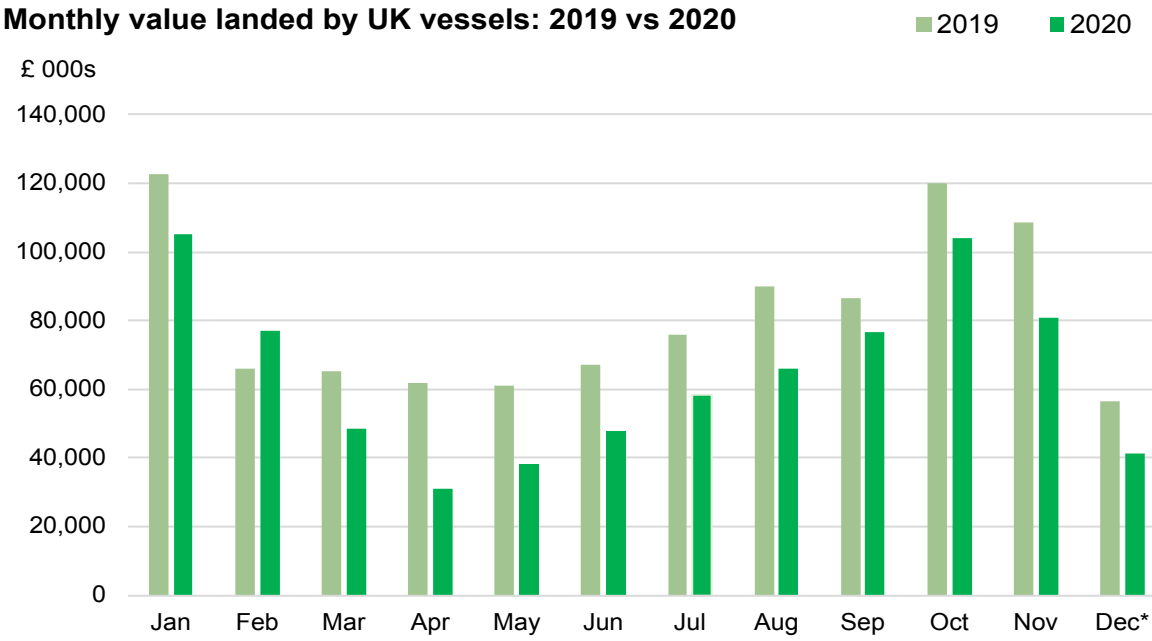


Figure 12. Monthly value (£ 000s) landed by UK vessels in 2020 compared to 2019. (source: Marine Management Organisation https://www.gov.uk/government/statistics/ad-hoc-statistical-release-uk-sea-fisheries-statistics-december-2020).

Fertilisers: Though not directly indicative of food availability and value, the value of fertiliser is also influenced by energy costs and exchange rates and so also provides information on the balance of trade between imports and exports relative to the food system. Figure 13 shows that in 2020 the UK imported from the EU approximately £160 million less value of fertiliser than in 2019, though there had been a steady declining trend in 2019. Approximately £34 million more fertiliser imports came from non-EU countries in 2020.

In summary: the balance of trade between food imports and exports continued to be variable, driven by multiple economic factors, of which the pandemic was important but variable between key food types. The pandemic has clearly altered the monetary value of imports and exports; however this basic analysis does not take into account the relationships between quantities produced (see next section), production costs and exchange rate factors, or changes in demand and consumption. The indications are that the market has been able to adjust, i.e. increased utilisation of nationally produced goods, such as meat, but there may be a future cost to primary producers of food from an overall reduction in export value and increase in imports.

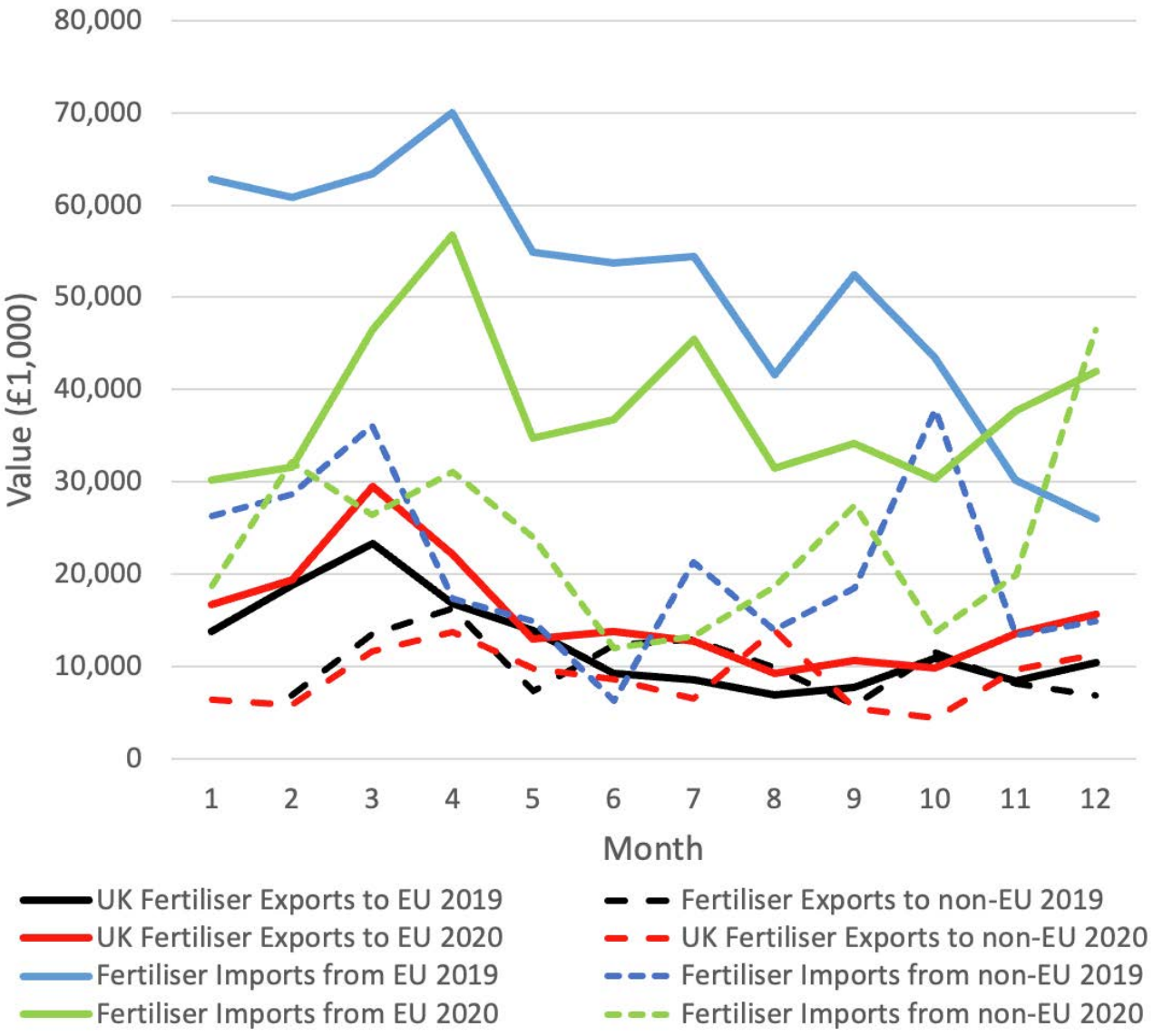


Figure 13. Value of fertiliser exports and imports per month to EU and non-EU countries in 2019 and 2020. Sources: https://www.uktradeinfo.com/trade-data/overseas/2019/ and https://www.uktradeinfo.com/trade-data/overseas/2020/

Food Availability

UK Food production during the pandemic

This section assesses the UK primary production of food in 2020 from agriculture and fishing. Further details are available in the section Food Producers.

Agriculture

Primary production in 2020 was considerably lower than the average, for example wheat yields may be the lowest since 1981. The National Farmers Union annual crop survey indicates winter wheat and barley yields down 18%, spring barley and oilseed rape down 6% and 15% respectively. The decrease in production has in part been due to variable weather conditions, ranging from the wettest February on record (UKMO, 2020a) (restricting field access for pre-sowing preparation and sowing) to an exceptionally dry spring with May being the sunniest on record (UKMO, 2020b). Hence despite large increases in planted areas for some crops, e.g. spring barley up 54%, there was little net gain on 2019 yields.

Arable and Horticulture

Results for 2020 show lower yields for cereal and oilseed crops when compared with the higher yields and above average production seen in 2019.

The total utilised agricultural area (UAA) in the UK decreased slightly in 2020, to just under 17.5 million hectares. The area of total crops and permanent grassland also saw decreases, whereas uncropped arable land had a 57% increase.

The AHDB's Early Bird Survey shows the wheat area has rebounded by about 28% for the 2021 crop (Harris 2021).

Livestock

- UK prime cattle (steers, heifers and young bulls) slaughterings in February 2021 were down 1.4% on February 2020 at 160,000 head. Beef and veal production was 73,000 tonnes, 1.6% lower than in February 2020.
- UK clean sheep slaughterings were down 7.9% on February 2020 at 766,000 head. Mutton and lamb production was 18,000 tonnes, 9.3% lower than in February 2020.
- UK clean pig slaughterings were 5.2% higher than in February 2020 at 905,000 head. Pigmeat production was 85,000 tonnes, 9.5% higher than in February 2020.

(Source: DEFRA 2021)

The total number of cattle and calves in the UK fell by 1.3% in 2020 to 9.6 million. The female breeding herd accounts for over a third of the total cattle and stands at 3.4 million head in 2020.

Table 2. Estimated provisional crop and horticultural yields and planted areas for 2020. (Source: DEFRA 8/10/20)

Crop	Production change (%)	2019 yield (M tonnes)	2020 yield (M tonnes)	Notes
Wheat	↓38	16.2	10.1	2020 yield of 7.2 t/ha is lower than the five-year average of 8.4 tonnes.
Barley	↑3.9	8.0	8.4	Increase due to additional Spring barley planted area (up 54%), from 710 thousand hectares in 2019 to 1.1 million hectares in 2020. Winter barley production decreased by 43% in 2020, while spring barley production increased by 41 %.
Oats	↓19		1.0	Planted area increased by 16% to 211 thousand hectares. The UK yield decreased by 19% to 4.8 t/ha resulting in an estimated production decrease of 5.5% to 1.0 million tonnes in 2020.
Oilseed rape	↓38		1.1	Decrease due to a 27% reduction in planted area and drop of 3.3 t/ha in 2019 to 2.8t/ha in 2020 (0.7 t/ha below the 5-year average).
Horticultural	The total area of horticultural crops increased by 3.7% to 169 thousand hectares. Vegetables and salad for human consumption make up the majority (72%) of this area and increased by 6.2% to 122 thousand hectares in 2020			

The female pig breeding herd in 2020 saw a decrease of 2.6%, falling to 403 thousand. Fattening pigs saw very little change, remaining at just under 4.6 million head. The total number of pigs remained similar to previous years, estimated at 5.1 million head, a small decrease of 0.1%.

The number of lambs in the UK remained almost unchanged at 16.7 million and the female breeding flock decreased by 1.6%. This led to a total UK sheep and lamb population of 33.3 million, a decrease of 0.8% compared to 2019.

Fishing and Aquaculture

The quantity of fish landed in 2020 by UK vessels was only 2% less than in 2019 (Figure 14), however the cumulative value of the catch was down 21%.

Food Availability Conclusions

Despite the global nature of the impacts of the pandemic causing considerable disruption, some limitations on cross-border trade (due to physical virus controls and export restrictions), individual cases of impacts on particular food type availability (i.e. demand for flour after the first lockdown) and poor harvest yields in the UK, overall food availability did not decrease to levels that threatened food insecurity in the UK from the food access perspective. Primary agricultural production was able to maintain supply sufficiently well enough to enable global trade to continue and meet demand. Food production within the EU, as the UK's primary source of imports, has remained stable as well. Decreases in agricultural output and reduction in farm income have been observed but the scale of these is comparable with previous years (excluding considerations of the climatic impacts on UK primary production), indicating the reasonable potential for agricultural sector recovery.

Food Access

This is a key aspect of real-time food security (as opposed to future vulnerabilities due to limitations in availability). The previous sections of this report have indicated that food production and availability have remained relatively stable. However, COVID-19 threatens access to food mainly through losses of income and assets that prejudice ability to buy food (Laborde et al., 2020). This section assesses food access from the perspective of food and feed prices, economic (affordability) and physical access.

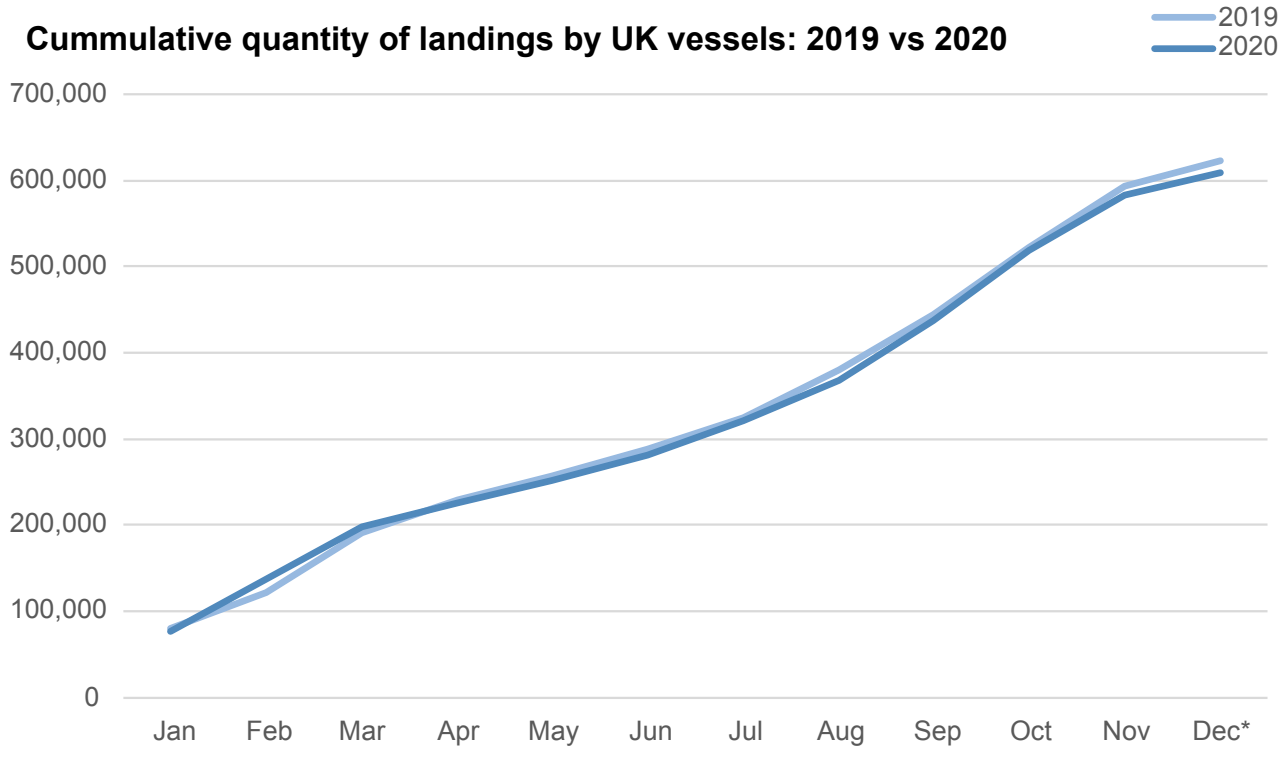


Figure 14. The cumulative quantity (tonnes live weight) of fish landings by UK vessels in 2020 compared to 2019.

Food Prices

In the first month of the initial March 2020 lockdown there was a 2.5% groceries inflation increase, which declined to 0.5% above the January start of year value (as of August 2020). This increase was seen more so in the larger supermarkets (Tesco, Sainsburys etc) than discount shops (Aldi, Lidl etc.). There was gradual deflation in the summer, partly due to promotions returning to normal levels. The number of unique products purchased decreased by 8% in the first week of the lockdown, with this reduction in product variety persisting through to August. The inflationary spike at the beginning of lockdown was experienced by households across the income distribution but was larger for better-off households. However, the gap in inflation experience across different income levels has since closed.

There was a 70% increase in online grocery shopping by August 2020 compared with 2019 (Jaravel and O'Connell, 2020a). The reductions in available promotions at the start of the initial lockdown impacted those low-income people who would normally rely on discounted products.

Table 3 (below) indicates that for those food items assessed within the Consumer Price Index (CPI), since February 2020 there was little overall change up until December. The prices of imported food products have also remained stable, though this evidence does not incorporate indications of quantity or quality. However, for the 12 months since October 2019, the Producer Price Index (PPI) indicated that manufactured food products were contributing to increases in inflation (0.8%). For October 2020, there was evidence of a small negative downward contribution to inflation (0.2) (ONS, 2020a). The CPI 12-month rate was 0.3% in November 2020, down from 0.7% in October (ONS, 2020b).

Table 3. Consumer Price Index average prices per month, for a range of food types. Change is indicated by October minus February prices (red = increase, green = decrease). Source: ONS https://www.ons.gov.uk/economy/inflationandpriceindices

		Average price per month (£) in 2020											Change
Food type		Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	(Dec-Feb)
Flour	Large Loaf White unsliced (800g)	1.16	1.16	1.17	1.16	1.17	1.17	1.14	1.16	1.19	1.19	1.15	-0.01
	Wholemeal sliced loaf branded (800g)	1.06	1.06	1.06	1.05	1.05	1.04	1.06	1.05	1.06	1.06	1.06	0.00
	Flour self-raising (1.5kg)	0.68	0.69	0.69	0.70	0.70	0.72	0.69	0.69	0.69	0.69	0.66	-0.02
	Dry spaghetti or pasta (500g)	0.66	0.72	0.71	0.70	0.70	0.71	0.69	0.67	0.67	0.67	0.65	-0.01
Meat	Home killed beef lean mince (kg)	6.61	6.62	6.46	6.43	6.53	6.46	6.62	6.36	6.37	6.15	6.15	-0.46
	Home Killed Beef Rump Steak/popes eye steak (kg)	14.50	14.60	14.64	14.49	15.30	15.03	14.53	14.62	14.53	14.35	14.47	-0.03
	Frozen Beefburgers (pack of 4 specify burger weight)	2.11	2.13	2.23	2.22	2.27	2.10	2.21	2.27	2.30	2.23	2.23	0.12
	Fresh boneless chicken breast (kg)	6.52	6.53	6.58	6.60	6.61	6.62	6.53	6.48	6.45	6.38	6.37	-0.15
Drinks	Tea bags-2; packet of 240 (approx 750g)	3.71	3.63	3.63	3.94	3.55	4.02	3.72	3.75	3.67	3.85	3.67	-0.04
	Coffee Instant (100g jar)	2.77	2.96	2.68	2.91	2.79	2.99	2.58	2.69	2.58	2.60	2.76	-0.01
	Fresh/chilled orange juice e.g. tropicana (1 litre)	2.03	1.96	1.83	1.87	1.83	1.79	2.05	1.98	1.97	1.91	1.82	-0.21
Vegetables	Potatoes: New, loose or pre-packed (Kg)	1.37	1.32	1.34	1.34	1.36	1.37	1.36	1.31	1.34	1.30	1.29	-0.08
	Cauliflower (each)	1.02	0.98	1.01	0.99	0.99	0.98	0.96	0.93	0.92	0.86	0.73	-0.29
	Cucumber (whole)	0.64	0.62	0.62	0.54	0.56	0.56	0.56	0.53	0.51	0.51	0.50	-0.14
	Lettuce Iceberg (each)	0.68	0.67	0.68	0.66	0.57	0.57	0.55	0.51	0.50	0.51	0.49	-0.19
	Tomatoes (kg)	2.07	2.08	2.13	2.18	2.15	2.13	2.13	2.15	2.17	2.25	2.25	0.18
	Cabbage (each)	0.76	0.71	0.71	0.78	0.77	0.77	0.71	0.70	0.68	0.66	0.65	-0.11
	Carrots (kg)	0.61	0.59	0.60	0.60	0.59	0.60	0.57	0.52	0.51	0.49	0.49	-0.12
	Onions (kg)	0.73	0.73	0.79	0.81	0.81	0.82	0.81	0.82	0.80	0.80	0.78	0.05
	Mushrooms (kg)	3.11	3.00	2.95	3.07	3.05	2.94	2.98	2.98	3.03	3.08	3.02	-0.09
	Broccoli (kg)	1.93	1.90	1.87	1.85	1.84	1.82	1.85	1.76	1.76	1.65	1.67	-0.26
	Courgette (kg)	2.14	2.12	2.12	2.14	2.11	2.04	2.13	2.16	2.15	2.18	2.18	0.04
	Peppers (each)	0.60	0.61	0.62	0.61	0.59	0.59	0.59	0.60	0.59	0.58	0.59	-0.01
	Sweet Potato (kg)	1.27	1.27	1.28	1.25	1.24	1.24	1.27	1.27	1.24	1.21	1.19	-0.08
	Pre-packed salad (100-250g)	1.25	1.24	1.27	1.27	1.28	1.29	1.24	1.29	1.27	1.31	1.31	0.06
	Frozen garden peas (800g-1kg)	1.43	1.40	1.40	1.44	1.43	1.41	1.26	1.22	1.20	1.20	1.20	-0.23

Table 3 (continued). Consumer Price Index average prices per month, for a range of food types. Change is indicated by October minus February prices (red = increase, green = decrease). Source: ONS https://www.ons.gov.uk/economy/inflationandpriceindices

		Average price per month (£) in 2020											Change
Food type		Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	(Dec-Feb)
Fruits	Oranges-class 1 (each)	0.36	0.36	0.36	0.36	0.38	0.38	0.38	0.37	0.36	0.33	0.34	-0.02
	Avocado pear (each)	1.11	1.09	1.07	1.02	1.05	1.02	1.00	0.99	1.00	1.00	1.01	-0.10
	Kiwi Fruit (each)	0.25	0.25	0.25	0.27	0.27	0.31	0.30	0.30	0.30	0.28	0.28	0.03
	Grapefruit (each)	0.55	0.53	0.56	0.54	0.54	0.54	0.56	0.56	0.55	0.57	0.57	0.02
	Apples-dessert (kg)	1.94	1.92	1.98	2.01	2.01	2.01	2.12	2.00	1.96	1.95	1.95	0.01
	Pears-dessert (kg)	2.02	2.01	1.96	1.97	2.05	1.99	2.22	2.16	2.15	1.95	1.95	-0.07
	Bananas (kg)	0.92	0.89	0.87	0.86	0.84	0.84	0.84	0.83	0.84	0.83	0.83	-0.09
	Strawberries	7.59	5.53	5.31	5.43	5.60	5.72	5.25	5.37	6.46	7.42	7.91	0.32
	Grapes (kg)	3.94	3.92	3.92	3.92	3.87	3.79	3.78	3.50	3.66	3.86	3.83	-0.11
	Pineapple (each)	1.40	1.24	1.28	1.35	1.28	1.24	1.33	1.27	1.22	1.23	1.24	-0.16
	Lemon (each)	0.30	0.30	0.33	0.33	0.32	0.33	0.31	0.31	0.31	0.29	0.29	-0.01
Diary	Butter (250g)	1.79	1.78	1.80	1.79	1.79	1.80	1.78	1.74	1.73	1.75	1.72	-0.07
	Fresh double cream (284ml-300ml)	1.09	1.09	1.09	1.09	1.09	1.09	1.08	1.09	1.08	1.09	1.06	-0.03
	Shop Milk (whole milk) (4pt/2ltr container)	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	0.00
Cans	Tomatoes (390-400g)	0.48	0.47	0.53	0.53	0.53	0.53	0.51	0.50	0.49	0.50	0.45	-0.03
	Baked Beans (400-420g tin)	0.62	0.62	0.63	0.63	0.62	0.62	0.62	0.63	0.63	0.63	0.63	0.01
	Sweetcorn (198-340g)	0.75	0.75	0.74	0.74	0.74	0.73	0.75	0.75	0.75	0.75	0.75	0.00

Impacts

Despite concerns during the early stages of the pandemic of a food crisis emerging alongside the health one, an across-society food price crisis has not materialised, yet. However, large sections of society have experienced increased economic difficulties in accessing sufficient nutritious food for their needs due to a combination of loss of income, delivery of work-age benefits, benefit caps, rising debt, poor or insecure employment and health problems (Trussell Trust, 2020a). After initial concerns arising from panic buying and stockpiling, demand stabilised and supply of most commodities, including from imports, has kept pace with demand.

During the first months of lockdown, inflation of 2.5% in grocery prices occurred. Half of the inflationary spike was due to a 15% fall in frequency of promotions which happened more in full-line supermarkets (Tesco, Sainsbury's etc) than in discount supermarkets (Lidl, Aldi etc.). In summer, prices promotion returned to their normal levels, gradually creating a deflation (Jaravel and O'Connell, 2020a). However, changes in shopping behaviour may have played a minor role in driving higher inflation during lockdown (Jaravel and O'Connell, 2020b).

Responses

In March the British Government responded to ensure security of food supplies to protect consumers through abandonment of the Competition Act allowing retailers to collaborate (Barling, 2020). Competition law aims at protecting consumer welfare from unfair practices by firms such as monopoly collusion resulting in market distortions raising the cost of products to consumers. In the UK relaxing of competition law, known as "public policy exclusion order", is a tool used to allow collaboration when needed. In 2000 it was implemented with the Food Industry Sustainability strategy to set collaborative actions to reduce carbon emissions, water use, waste and packaging (*Ibid*). For Covid-19 supermarkets and other grocery businesses shared information to coordinate actions. Main supermarkets shared information about stocks, shortages, information about logistics, labour shortage, store hours and ways to protect vulnerable consumers. This was also the case in the dairy industry. Information about surplus milk quantities, stock levels and costumer demand were shared during the period of disruption in demand for dairy produce (Gov.UK, 2020a).

Physical access

Impacts

Lockdown restrictions have limited people's ability to shop in ways they would do in normal circumstances. Initially, supermarkets revised shop opening times and limited quantities of certain products individuals could purchase. Consumer behaviors have changed, with people generally visiting shops less frequently and purchasing more on each visit (see Text Box 1). Concerns of using public transport and reduced services have limited lower-income people's ability to travel to purchase food. This has been of most relevance to those in rural areas on low-income. The elderly, those have been required to shield and those experiencing mobility issues have also been most impacted. People required to self-isolate have also experienced access problems.

The UK largely relies on supermarket chains which have more than 95% grocery market share mainly between Tesco (27%), Sainsbury's (15.3%) and Asda (14.4%) (Kantar, 2020). These corporate retailers' growing power in the buyer-supplier relationship is regulated to prohibit unfair trading practices between large grocery retailers and their suppliers (Barling, 2020).

Significantly more people grew their own food during Covid-19 compared with before Covid-19 (EU Food-COVID Network 2021). Across all food categories (fresh fruit and vegetables, other fresh food such as meat, fish and dairy, and non-fresh food) people purchased more food online and/or from local producers, while less people purchased food at supermarkets or discount stores.

Responses

Initial panic-buying and stockpiling were some of the responses from costumers concerned about shortages, but this was short-lived.

Grocery businesses offering online sales and home deliveries saw a large increase in demand. An increase of 70% in shares of groceries bought online was registered up to August 2020 compared with the same period in 2019 (Jaravel and O'Connell, 2020a). For others, these services were new to their grocery business model. For instance, discounting stores Aldi and Lidl did not offer these services for groceries because of the costs incurred. However, since the pandemic and because online shopping and grocery home delivery are thought to endure beyond the coronavirus crisis, these businesses are changing

their models and looking for low-cost alternatives (Thomasson and Davey, 2020).

Some of the responses from farmers, producers and fishermen have been a rapid move to online selling; adapting and shortening the supply chain by bringing home deliveries; the use of vending machines technology to sell their and other local products.

Small-boat fishermen, for instance, have been selling their catches directly to local shops and communities. This has arguably led to a reduction in supply chain length and more resilient local food security (Balfour, 2020). Along the same line, local abattoirs providers have been selling more, and doing so locally as well as regionally, as larger facilities have been shut down.

Shortening the supply chain by consuming local products has been supported by many stakeholders during the crisis. For some, the success of local consumption depends on regulations being relaxed and/or altered to permit new functionality to be achieved. The growth in local providers also requires a change in how auditing and reporting are carried out, and financial support needs to be provided to allow local suppliers to make the transition (Perry, M. 2020).

In this sense, civil society through NGOs have played an important role in shortening the supply chain and moving to more sustainable food systems. Their strategies have varied but some of them have been sharing information to connect sellers and buyers and organising events to create markets to help farmers and producers to overcome the pandemic. Some NGOs have been more proactive by proposing a whole sustainable food system. For instance, Bristol City's 'Going For Gold' campaign, in which sustainable food networks are enhanced. The campaign brings individuals and communities, food businesses and different organisations to build a better food system for Bristol. The pandemic has forced plans to be adjusted but shortened supply chains and localised routes to market have developed in ways that were not anticipated (McKessar, 2020).

Economic access

Impacts

Economic access is the clearest cause of food and nutrition insecurity in the UK, given that supply and prices generally remained stable in 2020 and the infrastructure enabling the food system to function has remained operational. Economists are calling this era the *Great Lockdown* (IMF, 2020) with the most severe economic contractions since the Great Depression and likely to have long-lasting effects (OECD, 2020). The Impacts of the pandemic on food security through economic access are multi-layered and complex, often existing alongside other challenges (including debt, job insecurity or loss of employment, health and mental health, care responsibilities etc.):

- Loss of income has exacerbated existing food insecurity and other vulnerabilities. The poorest households spent a higher proportion of income on food and so are more vulnerable to income shocks and food insecurity.
    - Pre-existing food insecurity has increased for those on low income, income support, zero-hour contracts or without reliable salaries / self-employed, people with existing physical or mental health problems.
    - Social food sharing opportunities (e.g. through family meals) have been reduced.
    - Those working in sectors that were unable to work remotely and / or had caring responsibilities, particularly women.
- Whilst furlough and income support (Universal Credit, mortgage / debt holidays etc.) have helped many people, large gaps have remained in people's ability to access safety nets.
    - There remains a stigma about using food banks.
- Changed physical access has restricted opportunities to acquire food from lower cost outlets.
- Changes in diets to reduce costs: vulnerable people have reverted to low-quality and less varied diets. This exacerbates malnutrition, stress and anxiety.
    - Compromising on food safety, by stretching 'use by' data advice.
- Costs of home delivery fee (which becomes a large proportion of the weekly overall food budget) or lack available delivery slots from providers.
- Low-income people may be taking on more debt to survive the current situation, reducing their ability to break the poverty trap.

(Connors et al., 2020)

Reduced individual and household income due to loss of employment, reduced salaries and difficulties accessing income support are the main reasons affecting access to food. This condition is either chronic or temporary. The pandemic has greatly increased the number of people exposed to temporary economic and physical access issues (approximately 1 month after the initial lockdown in March 2020, the number of adults who were food insecure in the Britain is estimated to have quadrupled. Loopstra, 2020).

It is useful to note that, up to August 2020, changes in shopping behaviours played only a minor role in driving higher inflation during lockdown; higher prices were the main cause, in particular through a reduced frequency of promotions by retailers (Jaravel and O'Connell, 2020b).

In the UK, an estimated of 5.86 million small and medium-sized enterprises are in a financially precarious position and their 60% or 16.6 million jobs contribution to all private sector employees is at risk (Stephan, Zbierowski and Hanard, 2020). In Europe, it is predicted that poverty and inequalities will increase with poor workers losing 16% of their income (Rodriguez and Sebastian, 2020).

Temporal income loss can be related to the Covid-19 crisis which in turn can become a long-term new condition. Chronical difficulties in food access due to low income or no-income are the result of previous inequalities which have been accentuated during the Covid-19 crisis.

Responses

The UK Government introduced the Coronavirus Job Retention Scheme, Bounce Back Loans and the Self-Employment Income Support Scheme. As of March 2021, Job Retention, whereby the government pays 80% of furloughed workers' wages, will continue until September 2021 while businesses were given until the end of March to access the range of Bounce Back Loan Schemes. As of February 15, 2021, approximately 11.2 million jobs, from 1.3 million different employers were furloughed in the United Kingdom as part of the government's job retention scheme (Statista, 2021a), but this has varied during the different waves of infection rates. As of March 15, 2021 the overall cost of the United Kingdom's job retention scheme was 57.7 billion (Statista 2021b). An additional £20 per week on Universal Credit has been extended to September 2021. Beyond government support, food banks and government programs such as food vouchers and food boxes have been the main responses to halt food insecurity and hunger during the Covid-19 crisis. Civil society and NGO's have been unprecedently working to halt food insecurity during the crisis. The Pears Foundation has given £1 million to the Trussell Trust to raise incomes and tackle food insecurity. The Trust warns of mass unemployment and increased foodbank demand by the end of 2020. The money from the Pears Foundation will specifically go towards a national programme of benefits advice, sustainable services and information resources. It will also be used for strengthening foodbanks and improved advocacy efforts (Trussell Trust, 2020b).

Food banks at Trussell Trust network registered a 47% increase in need during the pandemic. From April to September 2020, more than 1.2 million emergency food parcels were given to people struggling to afford essentials. On average, 2600 emergency food parcels were provided for children every day. In response to this and to mitigate malnutrition the Government implemented school vouchers and, in June 2020, allocated £63 million to local authorities to assist those struggling to afford food (House of Commons, 2020).

Inequalities and distribution

Access to nutritious food can be expensive. Access to healthy diets is not about keeping food prices low, but rather requires increased incomes (Tait, 2015). According to the Trussell Trust (2020c), low income is the primary reason for using food banks (39% of users).

Long term, structural problems of inequality in the UK have come into the spotlight with the pandemic. Hunger and malnutrition are more strongly related to job loss and income reduction than with food supply chain disruptions, not only in the UK but also worldwide. In the UK, almost a third of agriculture and fishing workers and 38% of food retail and wholesale workers are paid below the living wage (Shveda, n. d.).

COVID-19 has implications for socio-economic inequalities in access to food in the UK. The COVID-19 pandemic has sharpened the profound insecurity of large segments of the UK population, an insecurity itself the product of a decade of 'austerity' policies. Increased unemployment, reduced hours, and enforced self-isolation for multiple

vulnerable groups is likely to lead to an increase in UK food insecurity, exacerbating diet-related health inequalities (Power et al., 2020).

Inequalities also rose amongst producers. According to the Sustainable Food Trust the pandemic has increased supermarket sales and hit local suppliers hard as the restaurants and cafe sector has collapsed. For instance, local cheese makers have been greatly affected and, in some cases, have been forced to give away their entire stock. Their response was to call for citizen action in purchasing locally and sustainably, to support small producers and suppliers (Holden, 2020a)

Food Utilisation

The pandemic has had a fundamental impact on food utilisation, with lock down rules creating new social dynamics and household organisation. Eating out has reduced considerably and the number of meals at home tripled in some cases. The pandemic initially led to fundamental changes in purchase, consumption and food waste behaviors (Roe, Bender and Qi, 2020).

Eating, physical activity and other weight-related lifestyle behaviours have been impacted by the COVID-19 crisis and people with obesity may be disproportionately affected. During April-May 2020, large numbers of UK adults (n=2002) reported negative changes in eating and physical activity behaviour (e.g. 56% reported snacking more frequently) and experiencing barriers to weight management (e.g. problems with motivation and control around food) compared to before lockdown. These trends were particularly pronounced among participants with higher Body Mass Index (BMI). The COVID-19 crisis may have had a disproportionately large and negative influence on weight-related behaviours among adults with higher BMI (Robinson et al., 2021). People with existing eating disorders have experienced increased difficulties in regulating eating, increased preoccupation with food, exercise thoughts and behaviours and concern about appearance (Robertson et al., 2021).

Food types purchased have also changed. 'Comfort foods' and baking have increased prior to the start of the second national lockdown, with The Grover reporting sales of sugar up 74% in the first week of November compared to the same week in 2019 (Nott and Quinn, 2020). Premier Foods, the owners of Mr. Kipling cakes and Ambrosia Custard, gained over a million new customers over the past six months (from November 2020), with "exceptional" demand resulting in profits for the six months to September up 50% at £47.7m (Marston, 2020).

Whilst initially there was concern about panic and bulk buying leading to food shortages, evidence indicates that modest extra procurement better describes behaviour during the lockdowns (Benker, 2021).

In the US, consumer spending at restaurants and hotels declined by more than 60% with the onset of COVID-19, whilst grocery spending spiked at a 70% increase during mid-March compared to pre-COVID levels and continued a sustained increase of around 10% through April, May, and June of 2020 (Chetty et al., 2020). Globally, due to reduced demand from cafes, restaurants and canteens, alongside over production of food and price decreases in the early phase of the pandemic, there has been cases of increased food waste (which also leads to increases in methane emissions) (Charlton, 2020).

For some people more time at home was an opportunity to cook more, for others it was time to think about the quality of our food as some mentioned "*We understand now that food supply chains are not just about lorries and ports and supermarket distribution hubs. These supply chains are also the links between deforestation and climate change, biodiversity loss to us, to the microbiomes in our guts, the resilience of our immune systems and of our communities*" (Steavenson, 2020).

In addition to panic-buying and stockpiling, there was scarcity for some products that highlight changes in costumer's consumption. One of these was flour with a surge in demand during the pandemic in the UK and in other countries. Before the pandemic retail demand for flour was 4% of the consumption (The conversation, 2020). Baking at home was more popular and demand for flour increased by 92% (Lawford, 2020). From the beginning of the lockdown reduction of 8% on the range of grocery products bought by households suggests a cut in consumer choice (Jaravel and O'Connell, 2020a).

In addition to these direct consumer consumption choices, other behavioral changes were related to food management. Some of these changes were: checking date labels and on-pack storage guidance,

Text Box 1 Pandemic impacts on consumer behaviours.

Our relationships with food during the COVID-19 pandemic: early results from a European Union scale survey of behaviours (https://www.food-covid-19.org/). Acknowledgements: Liz Dinnie, The James Hutton Institute.

Pandemic impacts on food behaviours

An online survey was developed by an EU consortium of partners to understand the impacts of the Covid-19 pandemic on food behaviours before and during the first wave of lockdown restrictions across Europe in the spring and summer of 2020. The survey was translated into 16 languages. In total there were more than 7,500 responses. This report gives the results of the UK responses (n=314).

The survey asked about food-related behaviours before and during Covid-19 including:

- Where and what kinds of food were bought
- Household practices of growing, cooking, eating and throwing away
- Food poverty

The survey also asked about respondents' socio-economic status and demographics.

Results in Progress (https://www.food-covid-19.org/results-in-progress)

The findings indicate that the pandemic had significant impacts on food behaviours, including:

- Ways of obtaining food
  - Significantly more respondents grow their own food and/or use other ways to obtain food during Covid-19 compared to before Covid-19
  - Significantly less respondents choose to purchase their own food during Covid-19 compared with before.
- Main sources of buying food
  - Significantly less respondents shop in big supermarkets, supermarkets, discount shops during Covid-19 compared with before Covid-19.
  - Significantly more respondents shop directly from the producer and use home delivery than before Covid-19
- Frequency of obtaining food
  - Respondents obtained food significantly less frequently during Covid-19 compared with before Covid-19
- Preparing and eating food
  - Significantly more respondents prepare and eat breakfast, midday meal and snacks at home during Covid-19 compared with preparing and eating those meals at home before Covid-19.
  - During Covid-19 significantly less respondents use take-away shops, supermarkets take-aways and ready cooked meals as main ways of food preparation compared with before Covid-19.
- Types of food eaten
  - During Covid-19 respondents eat fresh meat, fresh fish and ready-made meals significantly less than before Covid-19. Respondents eat canned food, cakes and biscuits, chocolate and alcohol significantly more than before Covid-19.
- Self-assessment of household food behaviour change
  - Respondents reported that they eat significantly more food, spend significantly more money on food, obtain more unpackaged food, obtain more food from local producers, eat more varied food, plan meals more, use more recipes, consider food more important and consume more alcohol during Covid-19 than before.
- Household food security
  - There was no significance difference in the frequency of meals missed before and during Covid-19. There was, however, a significant difference in the frequency of people being anxious about obtaining enough food during Covid-19 compared with before Covid-19.
- Expectation of continued change after Covid-19
  - Respondents expect changes in types of shops used, purchasing frequency, money spent on food, growing own food, types of food, food waste, preparing food, obtaining from local producers and overall attitudes towards food to continue even after other aspects of household daily life return to what they were before Covid-19.

The next phase of analysis will look at the power of these significant behaviour changes, and the implications of changes for long term trends in health and nutrition, local food economies, sustainability, household food security and the circular economy, should cyclical lockdown restrictions become a feature of managing the pandemic.

using up leftovers, freezing items and checking the fridge before shopping. However, food preparation behaviors – such as cooking creatively, making a meal by combining random ingredients and batch cooking – appear to be under more pressure (Wrap, 2020a). The latter might be due also to cultural aspects anchored in the history of eating and preparing food in the UK.

Diet and Health

The obesity pandemic is the result of food environments where it is difficult not to overconsume calories. *"The global food industry produces and extensively promotes cheap, sugar sweetened beverages and ultra-processed foods high in salt, sugar and saturated fat that provide only a transient sensation o fullness"* (Tan, He and MacGregor, 2020, Editorials).

Within this broader issue, access to nutritious food constitutes a health concern with a negative feedback loop when it comes to Covid-10 co-morbidity. In England 64% of adults were overweight or obese (NHS, 2018). Obesity related to other health problems already triggered an increased expenditure in the NHS system before the pandemic and now directly contributes to the number of life-threatening cases of Covid-19.

Waste

There appears to be large differences between households in terms of changes in amount and type of food waste, but amongst self-reported food waste has stabilised at levels estimated for June 2020, which were well below pre-lockdown levels. Food waste increased amongst those households with people returning to work or school, and where time pressures had returned. Food management behaviours during lockdown, such as checking date labels and guidance, using or freezing left-overs, checking fridges for stock etc. have endured (Wrap, 2020a). 70% of food waste comes from households (post-farm gate), which is associated with more than 20 million tonnes of GHG emissions yearly and valued at £14 billion a year.

There are also concerns that plastic waste associated with single use items has increased whilst government efforts to reduce plastic use have stalled (Perry, F. 2020).

Gender and inequalities

The pandemic has affected male and females differently: hunger and food bank use affect women disproportionately, as they tend to be the 'shock absorbers' of poverty among children: One study found they were twice as likely as men to be food insecure because they were more likely to skip meals so their children could eat (Ruxton and Burrell, 2020, p.38). Also, violence against women has increased for several reasons including job losses by men and the 'stay at home' guidance, closure of hospitality.

The work done by women and minority groups in food systems also puts them at a higher risk of exposure to COVID-19 (Forsythe et al., 2020). In the UK, women make up 55% of the food and accommodation sector (ONS, Oct-Dec 2019). People from Black and Minority Ethnic and LGBTQ+ groups in the UK are also overrepresented in public-facing roles in the food sector (e.g., in restaurants and supermarkets)(BBC 2020c).

Stability

Food stability integrates the other three pillars of food and nutrition security (availability, access and utilisation) to consider the ability to obtain food over time.

The FAO states "*Even if a persons' food intake is adequate today, they are still considered to be food insecure if they have inadequate access to food on a periodic basis, risking a deterioration of their nutritional status. Adverse weather conditions, political instability, or economic factors (unemployment, rising food prices) may have an impact on a persons' food security status*" (adapted from FAO 2008).

A key factor is thus the further dimension of the duration of exposure to threats of food and nutrition insecurity. Chronic insecurity is long-term and persistent and occurs when people are unable to meet their minimum food requirements over a sustained period of time. Chronic states arise from extended periods of poverty, lack of assets and inadequate access to productive or financial resources. Transitory insecurity is short-term and temporary and arises when there is a sudden drop in the ability to produce or access enough food to maintain a good nutritional status. Transitory states arise from short-term shocks and fluctuations in food

Text Box 2: Other UKRI COVID-19 Food Security Projects

The UKRI has funded several projects assessing COVID-19 and the food system. These cover a range of aspects of the food system and scales of focus. In the interests of increasing the value of the UKRI COVID-19 focussed research, the details of the projects are provided here.

Food system impacts of COVID-19. Centre for Rural Policy Research, University of Exeter. About the project | Food system impacts of COVID-19 (exeter.ac.uk)

The local as a site of food security resilience in the times of pandemic. Institute for Sustainable Foo, University of Sheffield. The local as a site of food security resilience in the times of pandemic | Institute for Sustainable Food | The University of Sheffield

Resilience of the UK seafood system to COVID-19 disruption (RiseUp), Scottish Association for Marine Science. RiseUp — The Scottish Association for Marine Science, Oban UK (sams.ac.uk)

Feeding the nation: seasonal migrant workers and food security during covid-19 pandemic, University of Leeds. https://feedingthenation.leeds.ac.uk/

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availability and food access, including year-to-year variations in domestic food production, food prices and household incomes.

Under these definitions, our assessment is that the UK has not experienced chronic insecurity thus far in the pandemic. However, the extent to which the UK has avoided more widespread issues of transitory insecurity remains to be seen as the global impacts of the pandemic on availability and access, and subsequent utilisation, are still unfolding.

Prior to the pandemic, there were already a substantial number of people experiencing either chronic or transitory food insecurity in the UK. The difficulties arising from worsened economic access has meant significantly more people have experienced transitory insecurity. Quantifying these numbers is problematic but it is clear that those who were already vulnerable to income loss have been those directly impacted.

Assessment of the Food System Sectors

The following sections details the impacts and consequences on the key components of the UK food system: food production, processing and retail, logistics and transport, and upstream supply chains. Further sections consider issues from the perspectives of research and academia, policy and

food system governance and the role of the Third Sector.

Food Producers

Accurate forecasts for food production have become especially challenging due to key domestic and global market uncertainties, which are compounded by COVID-19 impacts, BREXIT, and even rising impacts of dietary changes towards 'plant based' food and organically or sustainably sourced food products. The complex and highly interconnected nature of the global food production network makes it difficult to separate the direct impacts of the pandemic from other drivers influencing the food production sector. Despite this, some clear trends in global markets and local drivers or barriers to production are evident, impacting UK food producers during 2020 and into 2021.

Closure of parts of the catering sector and the lack of agility in redistributing supplies from this sector to retail outlets or the food donation/charity sector, due to challenges in packaging availability, logistics and labelling requirements, lead to an increase in food loss. Agricultural food producers and the wider supply chain incurred significant losses as a result.

Arable: The weather in 2020 also had a substantial negative impact on arable production (see Table 2). Production in 2021 is expected to decline only slightly (to 7.25 mT), but this overall average disguises large declines in oilseed rape (OSR) production (by almost 20% from 2020 levels), an important source of animal feed. Low domestic production of high-protein animal feedstocks will therefore continue to be bolstered by imports. To an extent, increased domestic wheat production will compensate for the OSR decline and is expected to recover from 2020 levels which were the lowest since the 1980s. Prices and volumes of domestic wheat supplies are also protected (by exporters) by expected high demands due to reduced feed-maize yields in South America. Though, it is noted that high protein grain legume crop yields are double that originally estimated, and this may perturb such expectations. UK feed-barley remains sizable and unchanged, and prices are limited to maintain competitiveness in export markets. Growers and processors hold increasingly higher levels of potato stocks (at Nov 2020) due to a decline in demand for processed products (e.g. French fries) with the closure of fast-food outlets and cancellation of sporting and cultural events. This, together with EU-trade and phytosanitary uncertainties for seed

potato production will likely contribute to the contraction in cultivated areas in 2021.

It may be argued that the biggest threats to production came from skilled labour shortages, not only due to closed borders and travel restrictions for temporary workers (ONS statistics estimates that the UK agricultural sector employs 64,000 seasonal migrant workers), but also through COVID-19 related illness, self-isolation and social distancing requirements affecting farm staff and associated businesses (e.g. equipment repair, farm auditing, inspector visits and animal testing). This impact extends beyond the often-discussed demands of fruit and vegetable growers and includes those of animal husbandry and management of grain crops in mixed- and arable-sectors too. To some extent, farmers self-help networks and associations have alleviated the impacts of labour shortages, along with the "Pick for Britain" scheme designed to support the agricultural sector in reducing the impact of labour shortages, along with other measures such as permitting charter flights from Eastern Europe to bring migrant workers into the UK. However, the long-term neglect of the agricultural skills market is clear and the lack of investment in skills and training of farmed staff has been exacerbated by COVID-19, with arable and mixed farms often unable to source skilled and experienced workers. Additionally, the percentages of Covid-related employment cost increases may range from 6% as the lowest to 15% as the highest estimates (examples for asparagus, strawberries, lettuce and apple packing, not including the April 2020 National Living Wage increase) (Pelham 2020). Hence increases in labour costs and loss of productivity through inexperienced labour may reduce already low profit margins for food producers even further. As a future adaptation and mitigation measure, training should extend precision and digital tools to improve efficiency (and further reduce labour dependency) and could be linked to greater use of satellite monitoring (by governments) to supply affordable, real-time crop cultivation and growth data.

This need for more efficient production technology with lower turnaround time in order to maintain productivity despite the labour shortages, has led to greater demand on the agricultural equipment market. However, despite generous government subsidies which have scaled up this demand, the equipment market has slumped during the pandemic due to its own labour shortages and disrupted supply chains. Many equipment dealers were closed during lockdown and credit lines switched off making machinery purchase difficult for growers. However, the uptake of hire- and contract services increased over this period, especially those which enable reduced dependency on manual labour and lower processing time. Though here again, the lack of sufficiently high levels of farm profitability and availability of staff trained in modern advanced agriculture equipment use, diminishes the mitigation and adaptation potential across mixed, arable- and livestock-only sectors.

In addition, farms which had diversified into the holiday/tourist sector to maintain economic viability have been seriously affected, exacerbating the impact on farm businesses. Similarly, farms selling directly to the public via farm shops and local markets have also suffered reduced footfall and in many cases, failed to compete with the increase in on-line food shopping.

Nevertheless, despite these impacts of COVID-19 on farming, food production seems to be affected more by the usual global markets, than from COVID-19 impacts per se. However, economic impacts may take longer to transpire. Although food service markets have declined significantly, increased demand to retail (supermarkets), is not guaranteed, may be location dependent and even if available may take a significant period to be realised. To avoid potential future consequences of global pandemics on UK food production, intervention strategies are required for logistic bottlenecks (e.g. through shorter and regionalised value chains not only for production and processing, but also for the required technological, biological and chemical inputs. In addition, good-management interventions are needed, e.g. crop diversification and safeguarding of soil qualities and nutrient use efficiently (minimise losses), for increased crop and food system resilience (see associated project reports here: COVID-19 Food and nutrition security | The James Hutton Institute.

Horticulture: One of the major problems identified in the fruit production sector was the lack of connection between wholesale and retails. From 80m tonnes of fresh fruit and vegetables produced in the EU every year, around 25m tonnes were consumed in the hospitality sector. Redirection of this production into new channels of the supply chain was not achievable (Knowles, 2020).

In the UK, Reynolds, one of the biggest suppliers of

fresh products lost 95% of the business overnight. To overcome the crises in March, Reynolds furloughed 85% of its 1300 staff and laid off 400 of them. In spring £2m worth of goods were written off and in the second lockdown in November £200k were either donated or wasted. In April the company lost an estimated of £500k in wasted stock of the £210m turnover. To buffer the shock the company also has launched a direct consumers business (Sandercock, 2020a). In the period end of February and mid-April 2020, national sales of vegetable box schemes increased 111% (Wheeler, 2020).

The UK employs 70,000 seasonal migrant workers for the fruit, vegetables and salads producer sector which was affected by travel and movement restrictions. Responses to this labour shortage have been farms and recruiters chartered flights; (Corker, 2020) with increasing costs for which it was not clear who will cover them, in some cases these have been passed on to workers (Evans, 2000), recruitment of local UK workers under the "land army" and "Feed Our Nation" campaigns was implemented by UK growers; (BBC, 2020a) also furloughed employees were asked to pick fruits to save harvest.

Other responses to the labour shortage caused by the pandemic has come from associations in

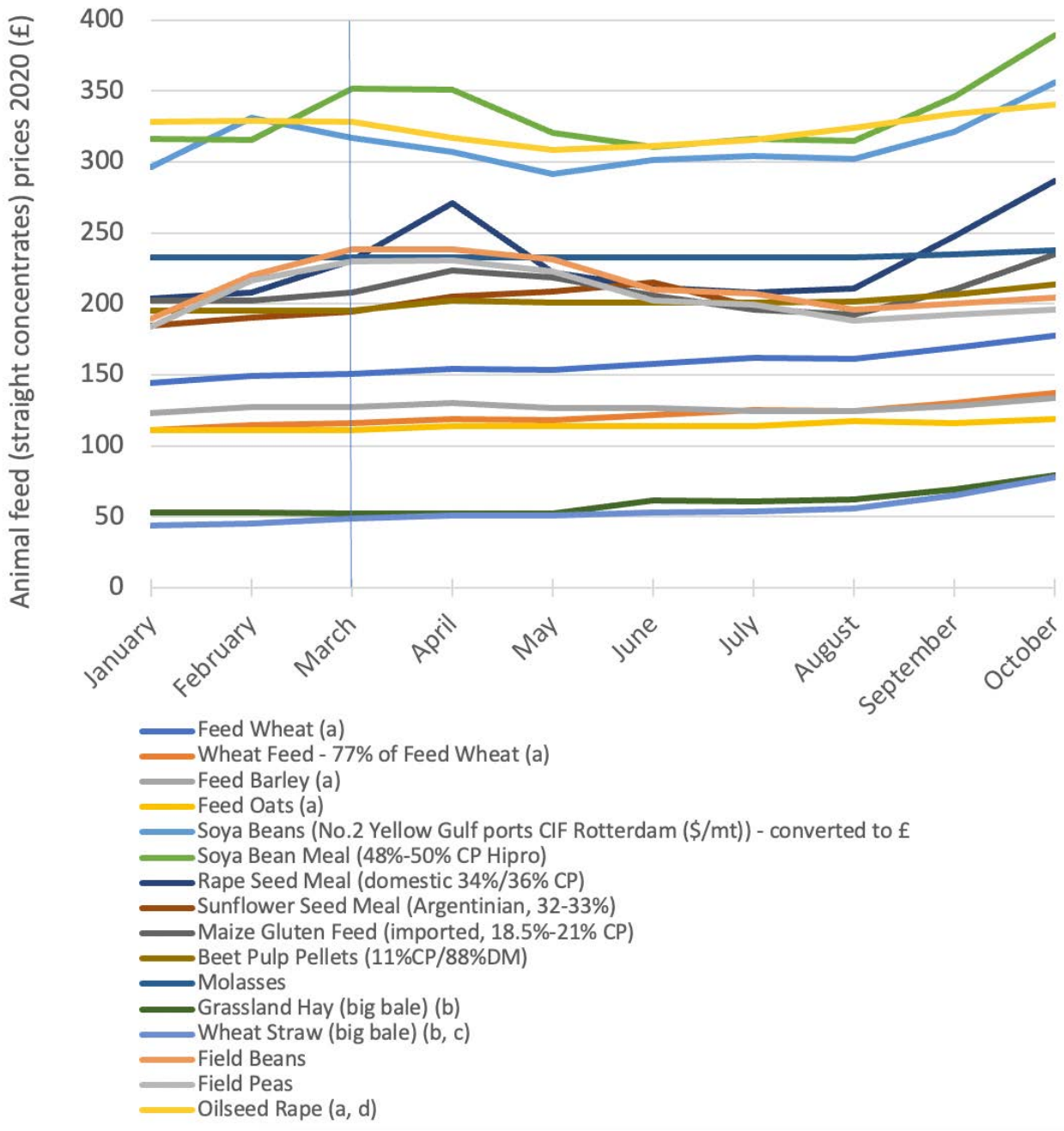


Figure 15. Animal feed prices for 2020 (£, straight concentrates). Source: DEFRA.

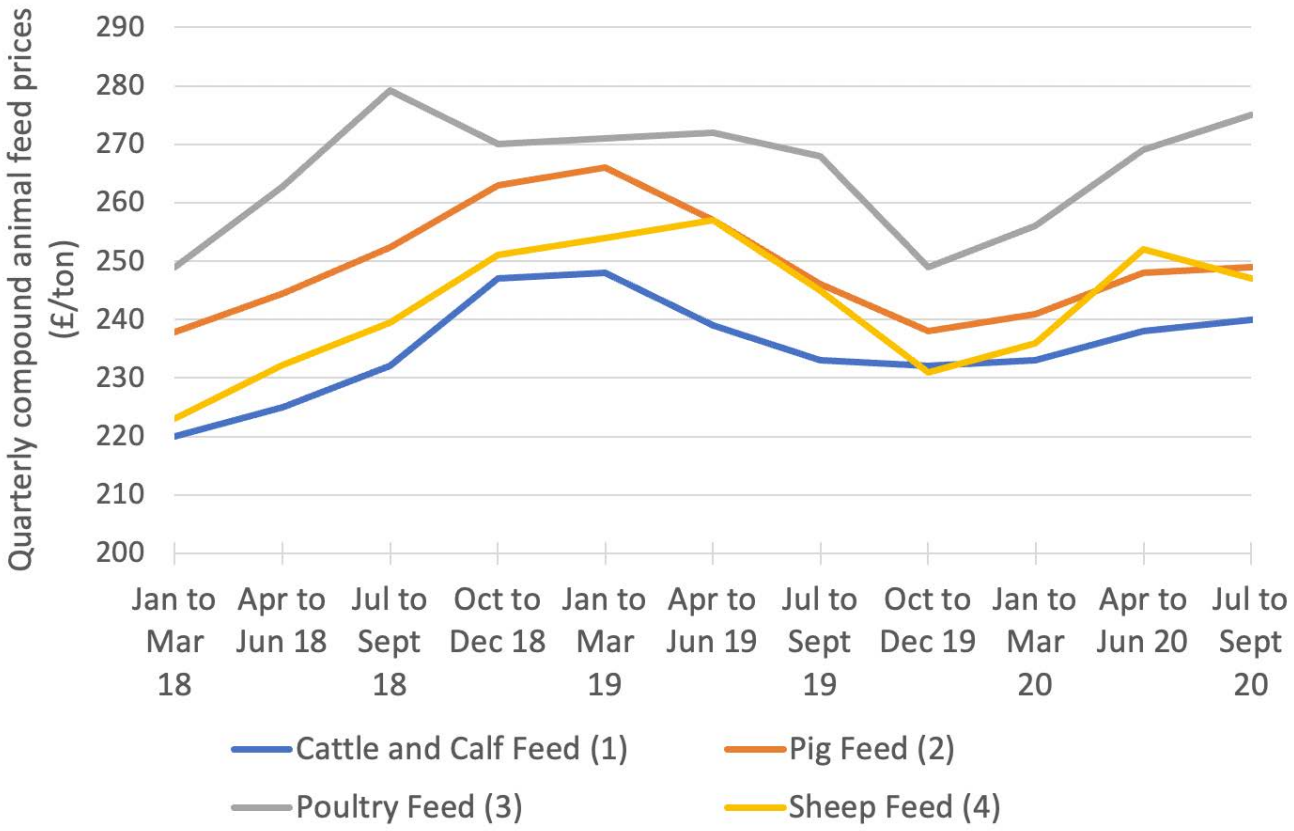


Figure 16 Quarterly compound feed prices (£/ton) per main livestock categories (Jan-March 2018 to July-Sept 2020). Source: DEFRA.

the agricultural producers and growers' sector. To mention some, the farmers network created the Farm Labour Emergency Support Scheme (FLESS), with the aim to help farmers in Cumbria and Yorkshire to locate and secure workers for keyworker tasks (The Farmer Network, 2020). The Association of Labour Providers developed a tool called "Spare Worker Available Portal" (SWAP) to support workers displaced by the coronavirus to transfer them to where work was available (ALP, 2020).

Livestock and Poultry: The change in food trends from eating out to preparing food at home also resulted in a shift in demand, increasing the demand for beef, pork, lamb and potatoes. This demand is predicted to decline into 2021 as restrictions ease. In terms of production, beef and lamb meat production is also expected to decline (by 5 and 4% respectively) in 2021, the former (beef) being due a limitation in cattle availability as more and older cattle were slaughtered in 2020 to meet the increased demand. Imports of beef and lamb are expected to rise and exports fall as a result of this drop in UK production (Harris 2021).

Pig meat production, in contrast, is expected to increase (by 4%) and represents UKs highest ever production (1 mT) (FarmingUK 2021), though this is mainly due to carry over of pigs which were not slaughtered in 2020. Due to such high domestic supply levels of pig meat, imports are expected to decline (7%). This general trend of decreasing production, exports and imports is also underpinned by a decrease in consumption of meat. Some price support may be realised by global markets due to limited supply. The rapid closure of the UK catering sector and schools left many of the UK's 10,000 dairy farms operating at a significant loss, resulting in the need for government support to cover lost income. While milk production remains static, ongoing threats of COVID-19 will continue to impact on production (and prices), confounded by logistical issues for short shelf-life products due to new Brexit trade agreements. In these contexts, the main bottleneck is trade and the importance of animal feed for which prices are rising due to an increasingly competitive and demanding international market (see Figure 15).

There were small decreases in the national livestock numbers but at this stage it is not possible to differentiate between pandemic impacts and those of normal variation. Disruption caused by closure of

the hospitality sector led to dislocation of dedicated supplies to these outlets. High price cuts of beef were converted into cheap mince beef portions. Adaptation to demand by numbers and size has been a response to prognosticated changes in demand due to the pandemic. Such is the case of the turkey chicks that famers are rearing for Christmas, predicting that social distance will influence on the number of people gathering and the size of the turkeys to be demanded. Some are reducing the numbers of production by 20% and others the size of the turkey by slaughtering at an earlier time (Donovan, 2020).

Livestock and poultry industries have been impacted by outbreaks in slaughterhouses and by shortage of migrant workers. The livestock industry recruits 75% of essential abattoir workers from overseas and 90% of veterinarians come from EU (BSAS, 2020). Highly skilled turkey pluckers and butchers come from the EU to work for 2 months contracts. According to the British Poultry Council (BPC), without these non-UK workers the sector cannot survive. BPC asked for exempting quarantine restrictions for these seasonal workers to ensure Christmas supply (Smithers, 2020). Disruption caused by closure of the hospitality sector led to dislocation of dedicated supplies to these outlets. High price cuts of beef were converted into cheap mince beef portions.

Animal Feed

The price of animal feed remained relatively stable even after the start of the pandemic up until August. Since August there was an increase across all feed types (except molasses) (see Figure 15). The picture for 2019 indicated there was generally a slight decline in most feed prices during the year.

Animal feed prices for the main livestock categories have seen increases and decreases over the last three years (Figure 16) against a background of seasonal variation and economic fluctuations. Prices started to increase from the end of 2019 and have continued with the exception of sheep feed.

Dairy

The dairy industry has been impacted by closure of the hospitality sector and shortage of migrant workers. Milk accounted for 16.85% of total agricultural output in the UK in 2018.

In the UK, the dairy industry (Gooderham and Clayton, 2020) has been hit hard resulting, amongst others, in milk dumping (Evans, 2000; Mustoe, 2021) price reduction for 5,200 of estimated 9,200 dairy farmers, and 2,200 of these being asked to reduce output and collections being cancelled (Gooderham and Clayton, 2020). The dairy industry was also affected by a shortage of workers (Martin, 2020). Disruption caused by closure of hospitality sector, led to milk being poured away with a costly time lag before some degree of transfer to other supply chains. A 12-week public-private collaborative campaign worth £1 million, was set to encourage higher milk and dairy products consumption (AHDB, n.d.). In England Competition laws were temporally relaxed to allow the dairy industry to work together and avoid waste and maintaining productive capacity (Gov.UK, 2020b).

Dairy farmers were able to access DEFRA's funding to cover 70% (up to £10 000) of their income lost during April and May, to ensure they can continue to operate without impacts on animal welfare (Gov.UK, 2020c). COVID-19 has created a financial pressure on the specialist cheesemaker sector across the country, which sells products to restaurants (Specialist Cheese Makers, n.d.) . This niche market sector is worth £100m a year compared to the industrial cheesemakers sector worth £3 billion (Russell, 2000).

Fishing and aquaculture

Contractions on international trade, notably exports, have heavily affected the seafood industry (Seafish, 2020) in the UK. Scottish fishermen are responsible for more than half of the UK fishing industry, 70% of its catch is exported (McVeigh, 2020). As this outlet was blocked during lockdown, resulting in a severe loss of income, with some fishermen needing to turn to food banks.

There have been regional differences in responses to provide support fishing and aquaculture. In Scotland:

Fishing industry - £9.5 million to support fishing businesses that have encountered hardship. £6 million Sea Fisheries Intervention Fund to support over 600 under 12 metres fishing vessels with a payment of 50% of two months' average earnings. £3.5 million grant funding to support fishing vessels over 12 metres in length.

Seafood processing - Seafood Business Resilience Fund scheme saw 128 applications processed

successfully to a value of £5.6 million helping to support most vulnerable processors.

Aquaculture – £3 million to support aquaculture businesses most at risk of immediate financial ruin (Scottish Government, 2020a).

In England a fund of £9 million called the Fisheries Response Fund (FRF), will directly contribute towards the fixed business costs of over 1000 catching and aquaculture businesses that have been adversely impacted by the downturn of export and domestic markets for fish and shellfish (re. COVID-19) (Gov.UK, 2020d).

Food Processors

The effects of the pandemic on the food processing industry have been variable since March 2020 depending on different policies and lockdowns. The levels of operating uncertainty have been amplified by Brexit and have varied significantly depending on the scale of the business.

Impacts related to the supply chain

Initial impacts to the food processing industry were associated to COVID related shortages due to supply and demand dynamics. From pasta to tomato cans, a considerable number of supermarket shelves were empty during the first few weeks of the pandemic. These shortages were mostly attributed to a surge in demand driven by panic-buying and stockpiling, together with a lag in supply chains geared to provide just enough product to stores to avoid storing bulky inventory. An increase uptake of home baking by the millions of Britons stuck at home caused a particular boom in the flour business, from small artisan businesses to bigger mills (Busicchia, 2020). The cause for this is also enrooted in the structure of a concentrated food distribution system geared to supply commercial rather than retail demand, and it raised questions of how the inflexibility of those channels challenge food security. According to the UK Flour Millers Association (former NABIM) “as it became clear that capacity to pack small bags was limiting supplies to retailers, we took the step of creating a map of wholesalers and other outlets also able to supply flour, albeit in larger bags and non-standard packaging, in order to help meet the peak of consumer demand in April and May.” (UK Flour Millers, 2021).

Main impacts to the seafood processing industry highlighted by Seafish, the UK public body supporting the seafood industry, have been a volatile foodservice market, temporary shutdowns due to hospitality closures under lockdown, full cold stores following excess supply from strong 2019

landings, and unpredictable changes in international demand and restrictions (Seafish, 2020a, 2020b, 2021) The sector quickly adapted by making changes in labour & production (77% of businesses made such changes, e.g., shift patterns and production lines), in sales and distribution (51% of businesses, e.g., direct sales and deliveries), in markets (23% of businesses, e.g., moving from international to domestic and local, including online), and in sourcing (12% of businesses, e.g., changing sources for their raw material) (Seafish, 2020b). Policies such as the furlough scheme and 'eat out to help out' scheme have been considered helpful by the sector.

Seafood processing businesses supplying export markets on the continent faced additional challenges at the end of 2020. On top of managing COVID-19 impacts they were trying to plan for an at the time unknown relationship with the EU and the financial impacts of the new restrictions were considered worse than the spring lockdown because of these concurrent factors. Some businesses selling to or through Northern Ireland sent more material that usual before the end of the year to create a buffer ahead of the end of the transition period and any potential disruption. Processors reliant on product from the Northern Irish fleet faced issues with continuity of supply in October and November when up to half of the Northern Irish nephrops (lobster) fleet reportedly took part in a tie-up scheme. This made it difficult for some processors to source enough raw material to meet demand (the Northern Irish fleet accounted for 23% of all UK nephrops landings, by weight, in 2019). It also highlighted the knock-on impact that interventions can have elsewhere in the wider supply chain (Seafish, 2021).

Impacts to the poultry sector included a soaring demand in eggs (Leach, 2020) that led to surplus eggs from the food service sector being reallocated where possible into the retail sector which meant availability of packaging was under pressure. The industry set a limited number of egg pack sizes available in order to maximise production in the manufacturing process and had to make some changes in the types of packaging materials being used, for example more recyclable plastic, due to the lack in availability of pulp packaging. In response to sudden changes in food supply chains as a result of the COVID-19 pandemic, the FSA and Defra agreed that in exceptional circumstances, where safety and authenticity were not compromised, local authority enforcement officers could give food businesses temporary flexibility on certain rules on food labelling (NFU).

Impacts to the potato processing sector regarding decreasing sales to hospitality were counteracted by the Government implementing several emergency mechanisms to support the sector in response to the crisis. This included a temporary exemption to EU competition law for a period of six months for farmers in the processed potato sector, and the relaxation of the Maximum Residue level permitted for the sprout suppressant CIPC to allow potatoes normally destined for the processing sector to access the fresh sales and retail markets (House of Commons, 2020).

At the beginning of lockdown meat processing businesses reported that cold stores were almost full to capacity with more expensive cuts of meat, for which there were no market. Most retailers were still avoiding ordering other cuts in favour of buying more mince. The result was that meat processors were sitting on an unsustainable amount of fresh meat that will have to be frozen and therefore de-valued in the hope that food service demand will come back at some point in the future. (Allen, 2020).

Food safety

Despite early reassurance from bodies including the UK Food Standards Agency that the risk of coronavirus cross-contamination to food and food packaging is very low (Food Standards Agency, 2020b) and the World Health Organization stating that "as food has not been implicated in the transmission of Covid-19, imported food should be subjected to the same import controls as before the pandemic" (World Health Organization, 2020), food safety has remained a concern in 2021 for countries like China which has banned imports from UK meat plants that have suffered COVID-19 outbreaks (Financial Times, 2021). With China being the world's largest pork market, this measure has affected pork processing plants the most. Chinese consumers relish parts of the pig, such as trotters and heads, that are unpopular in the UK, so selling them to China had helped maintain profitability in the UK's £1.6bn pig sector. The industry estimates 1m pig carcasses have been affected by the suspension and is seeking up to £15m of UK government support after China halted imports of meat (Financial Times, 2021).

The UK government agreed with China last year that meat factories undergoing outbreaks would voluntarily suspend their export licences, according

to people in the UK briefed on the situation. But the process of reinstating licences after outbreaks had been eradicated had slowed, Zoe Davies, chief executive of the National Pig Association, said the pressures on the industry had led some farmers to quit: about 15 to 20 farmers with about 10,000 sows in total had recently left the sector. About three-quarters of pig farmers are operating at a loss, Davies added (Financial Times, 2021).

Scotland and Northern Ireland both announced funding in March 2021 for pig farmers affected by coronavirus outbreaks in processing plants. Processors in the two devolved nations had already deducted £15 from the price paid to farmers for each pig that could not be part-sold into China, so the hardship funds were paid entirely to farmers. But processors have not levied this charge in England, so any government support for them would potentially be paid direct (Financial Times, 2021).

COVID-19 outbreaks and impacts on Health & Safety procedures

The UK meat processing industry was heavily affected by COVID-outbreaks (Reuben, 2020) with workers being exposed to the virus more than other similar labour intensive roles due to the cold and damp working environment enabling dispersion in droplets and difficulties in distancing. Across the food processing industry, there have been concerns of substantial under-reporting of COVID-19 cases (Martin 2020), primarily due to companies being required to “make a judgement, based on the information available, as to whether or not a confirmed diagnosis of COVID-19 is likely to have been caused by an occupational exposure” (Health and Safety Executive 2020). A survey of 150 meat processing workers indicates they attended work while unwell because they cannot afford to lose pay. Also points to issues with migrant workers who do not get sick pay "meat processing factories ... do not provide staff that need to self-isolate with company sick pay or any other form of financial support" (United the Union, 2020a).

Some incidences of Covid-19 cases were reported at seafood processing factories across the UK. At smaller sites, positive Covid-19 tests forced some businesses to close temporarily. Larger processing businesses that had to manage Covid-19 cases amongst staff were generally able to do so safely without reducing production capacity (Seafish, 2021). Lack of testing in some areas made it difficult for employees and employers to distinguish between Covid-19 and other illnesses common in winter (Seafish, 2021). According to Seafish, businesses that continued to operate during lockdown had to adapt to ensure social distancing and to ensure risks were managed and minimised (Seafish, 2020a, 2021). This affected shift patterns, production lines, ride share arrangements, and canteen facilities. These changes reduced operating efficiency and, in many cases, increased production cost per unit. (Seafish, 2020a). Adaptations to become covid-safe included social distancing, more personal protective equipment (PPE), staggering shifts, redesigning workspaces, moving training online, cohorting, rapid testing, incident management and risk assessments. Some large scale Covid-19 testing and risk management initiatives emerged during this period. Defra invited English seafood processing businesses to take part in a pilot Covid-19 testing scheme starting in December. This scheme was part of the Government’s COVID-19 Winter Plan (UK Government, 2020) and aimed to routinely test asymptomatic employees to prevent transmission (Seafish, 2021). Following an outbreak of community transmissions affecting seafood processors in northeast Scotland in mid-November, an Incident Management Team was quickly formed. It included representatives from industry, Food Standards Scotland, Scottish Seafood Association, Seafish, Seafood Scotland, the NHS and environmental health officers (Seafish, 2021).

To help track and manage outbreaks, the Health and Safety Executive (HSE) and environmental health officers increased their inspections of food processing sites. These visits were designed to help businesses minimise the risks of transmission and improve health and safety protocols.

Towards the end of 2020 the Department for Health and Social Care (DHSC), supported by the Department for the Environment, Food, and Rural Affairs (Defra) approached food sectors with the idea of trialling mass testing using rapid-test lateral flow devices (LFD) to help manage the spread of Covid within workplaces. Many British Poultry Council members took up the offer and there is consensus that mass testing has been a considerable help in understanding and managing Covid-19 in the workplace while there were some initial concerns (e.g., there was a fear that some workers would not participate and would see it as a threat to their income if they could not work). In February 2021, businesses biggest concern was the impending

increase of cost when Government planned to stop providing the tests the following month (two test per week for large workforces and given that approximately 30,000 people work in poultry slaughterhouses and further processing plants across the sector it would represent a significant cost at a time when production is under immense pressure to deliver affordable food). This 'Covid-mode' that businesses have been in since the last year is not sustainable and cannot be absorbed indefinitely by companies (British Poultry Council, 2021a).

At the end of 2020, meat processing businesses in the UK called for Covid-19 vaccine priority after the severe impact of factory outbreaks (Sandercock, 2020b). In February 2021 there were still calls from the food processing industry to prioritise their workers (e.g., McDougal, 2021) and the British Poultry Council stated that the strategy for continued roll-out was still opaque and that it would have been helpful to know for businesses to adapt their continuity and contingency planning (British Poultry Council, 2021a).

Labour shortages

Seafood processing businesses reported staffing problems linked to illness or patchy availability of Covid-19 testing for workers with symptoms (Seafish, 2021). In addition, concerns were raised across the supply chain around a replacement for the Job Retention Scheme (the 'furlough scheme'). Processing businesses were concerned around the cost of maintaining staff levels while sales volumes were reduced, and keen to avoid having to make redundancies only to be faced with potential recruitment issues and costs when sales picked up again. (Seafish, 2020b). The reintroduction of more stringent restrictions in September brought a heightened risk of redundancies. Foodservice and hospitality were considered to be at particularly high risk (Seafish, 2020b).

Shane Brennan, the chief executive of the Cold Chain Federation, which represent frozen and chilled transport and warehousing firms, said the shortage of workers was being felt in packaging, production facilities and warehouses. With many foreign workers having returned home during the pandemic and Britain's exit from the EU discouraging new arrivals, competition for domestic labour has become intense, and many employers are unable to fill posts. (Topham, 2021)

According to the NFU there was initial concern that if agricultural and horticultural workers were not classified as key workers then there may be further staff shortages due to, in some cases, existing staff needing to take care of childcare requirements. On 19 March 2020 the government confirmed that those involved in food production were included as key workers, meaning that they would be eligible for childcare support, and this helped the sector (The Guardian, 2020).

The British Meat Processors Association stated in June 2021 that the sector was "heading for a brick wall" on labour shortages. It said production capacity was down 10% because people and skills were unavailable in the UK. Nick Allen, the chief executive, said: "Our problems started with Brexit and Covid has made them worse. And the pubs and hotels opening up has increased the demand for labour. The whole food industry is really struggling at the moment." (Topham, 2021)

Disproportionate impact on workers from minority groups

The food processing sector is one of the largest employers in the UK employing approximately 430,000 people, many of whom are low-wage agency or migrant workers (c.106,000). During the pandemic they were classed as essential workers, due to their key roles in maintaining food supply chains.

Migrant workers are more likely to be employed in key worker roles, making up more than 40 per cent of workers in food manufacturing, therefore more likely to be affected by COVID-19 (Public Health England, 2020) The UK Government Department of Agriculture, Environment and Rural Affairs, in 2017, estimated 24,328 employees employed in the food and drinks processing sector. Of these an estimated 40 per cent, 9,767 employees, were citizens of Other EU countries (EU excluding the UK and Ireland) and 3.5 per cent, 850 employees, were citizens of the Rest of the World (DAERA, 2018). Similarly, a survey among its members by the Scottish Association of Meat Wholesalers (SAMW) showed a significant dependence on migrant labour. Non-UK labour has been an important part of the meat processing sector workforce for several years and a number of non-UK employees have progressed to supervisory and management roles (Quality Meat Scotland, 2017). Similarly, 60% of poultry meat workers (22,800 people) are EU nationals according to the British Poultry Council (2021b).

The Scottish red meat processing sector provides

direct employment for approximately 2,700 people. The Scottish Association of Meat Wholesalers has estimated that 50 percent of the workforce in some of Scotland's abattoirs and meat processing plants are non-UK workers. The Road Haulage Association has estimated that 60,000 HGV drivers from other EU states are working in the UK haulage industry and in addition there is a shortfall of 45,000 drivers. The UK Points Based System (PBS) does not currently provide access to the workers needed for food processing or road haulage. Tier 3 should be opened, and the Shortage Occupation List amended to provide such access (NFUS, 2019)

An increased exploitation of migrant workers has been highlighted (United the Union, 2020a). A survey of 150 meat processing workers representing 20 per cent of the workforce at a Covid-19 impacted meat processing plant staffed overwhelmingly by migrant workers points to issues with these workers not getting sick pay: "meat processing factories ... do not provide staff that need to self-isolate with company sick pay or any other form of financial support" (United the Union, 2020a).

Food Retailers

The demand-side covid-19 shock that impacted food retailers yielded two divergent outcomes, economic and infrastructure, driven primarily by consumer behaviour and perception.

Across the UK food retail sector (supermarkets, convenience stores and online retailers), food sales increased during the pandemic. Driven by stockpiling due to perceived supply chain weakness and to minimise the need to shop frequently (INS Markit, 2020; Steavenson, 2020, Eley, 2020a). In the first 12 weeks of the pandemic to 12 July 2020, take-home grocery sales rose by 16.9%, the fastest growth rate since 1994 with supermarket sales in March 2020 at point of the first national lockdown comparable to typical Christmas sales, for which retailers usually make significant advanced preparations. Total sales during this 12-week period reached a record £31.6 billion. This level of sales disrupted the just-in-time supply chains first adopted by supermarkets in the 1980s (Lee, 2020), and resulted in empty shelves in many stores throughout the country for the first time since World War II rationing ended in 1954 (IHS Markit, 2020), associated with certain products, e.g. dry pasta, rice, toilet rolls. For example, year on year UK sales for week ending 8 March 2020 for dry pasta and toilet roll were up 55 and 60%, respectively (Kantar, 2020a). Faced with empty shelves and concerns about shortages promulgated by both conventional and social media, consumers tended to stock up on what they could when they could which exaggerated the demand-side shock. Even though most consumers only added a few extra items to their basket, at the aggregate level, this amounted to a substantial daily demand-side increase. This increase in demand was exacerbated by the replacement of workplace food (e.g. office worker lunches) with food/meals taken out of the home bought through retail as workplace canteens had either restricted access or were closed (IHS Markit, 2020).

To mitigate product shortages, where possible, manufacturers increased production of goods that were in high demand; retailers increased supply or reduced their product portfolio and focussed on essential high demand products; and the UK Government relaxed competition law and restrictions on delivery driver's hours. The response was in part possible due to advanced preparations that retailers had made for a potential no deal Brexit, including the identification of alternative suppliers and ways to mitigate expected supply chain bottlenecks (IHS Markit, 2020). However, restoring supplies of some products, e.g. flour, was more problematic for structural reasons.

Throughout the pandemic to date, in terms of volume, conventional food retail has increased between 3-10 % through March to November 2020 compared with February 2020 (ONS, 2020c), with an overall year on year increase of 4.3 % to December 2020 (ONS, 2020d). However, this pattern of monthly increases was arrested in December 2020 with a reduction of 1.6 and 1.4 percentage points for the amount spent and quantity of food bought, respectively at conventional food stores (ONS, 2020d). However, in stark contrast, the online food retail sector was the only sector to report a monthly increase in online sales during December of 2.6% with feedback from retailers suggesting a significant increase in click and collect orders over the Christmas period (ONS, 2020d). This contributed to a year-on-year increase in sales volume to December 2020 of 126.4 % for the online food retail sector (ONS, 2020d). This increase in online volume was also reflected in an annual increase of the value of online food sales by 79.3%, the largest increase of any online UK retail sector (ONS, 2020d). In part, this

has been facilitated with the disruptive intervention of actors from the consumer packaged goods sector that has expanded the competition base (Deloitte, 2020).

Convenience stores have reported a 39% increase in sales during the pandemic, with market share increasing from 12.4% to 16.3% (Lee, M. 2020). This shift in consumer behaviour is anticipated to be sustained for the period when physical distancing, and work-from-home advice is mandated. There is potential that in the longer-term an increased proportion of people homeworking post pandemic may provide an opportunity for urban planners to support the increased use and development of the local food retail sector, thus reducing the reliance on supermarket multinationals, and shrinking supply chains (Cummins et al., 2020). While in general covid-19 has had a positive economic impact on the food retail sector, by November 2020 3.4 % of UK food retail businesses had permanently ceased trading (ONS, 2020d).

The pandemic has influenced consumer choice with a general move to healthier product categories such as yoghurts, vitamins, disinfectant, healthcare products similar to that previously experienced in China during SARS though offset with an uptick in alcohol sales; a desire for local food provenance and fresh food due to concerns of health and welfare in the supermarket environment; and a rise of private labels and portfolio consolidation by large food retailers (Deloitte, 2020).

The juxtaposition of the increase in food retail sales is that levels of food insecurity up to and including November 2020 increased by 12-19 % during the pandemic with financial reasons, a short-term shortage of basic foods and an inability to access shops because of self–isolation being cited as the main non-exclusive drivers for reducing the number of daily meals taken by the less affluent sectors of society (Barker and Russell, 2020; Ipsos Mori and Food Standards Agency, 2020; Loopstra, 2020). Food insecurity is a particular issue for younger age groups, being experienced by 38% of 16-24 year olds in November 2020 (Ipsos Mori and Food Standards Agency, 2020). There continues to be a particularly steep age differential in reported food bank or food charity usage, with 26% of 16-24 year olds reporting accessing food in this way in November 2020 but only 3% of those aged 45-54.

The impact of covid-19 has exposed the over-reliance on single suppliers and single-country supply routes for many food retailers, leading to consideration of supplier diversification and dual-sourcing to ensure supply continuity. This reliance on single suppliers has been compounded with supplier-side labour issues regarding safety concerns and covid-19 working practices; availability due to illness necessitating the temporary shutdown of food processing and manufacturing sites and logistic chains; and government covid-19 restrictions such as social distancing (Garnett et al., 2020) adding a supply-side shock to the food retail system (IHS Markit, 2020). Almost 70% of retailers surveyed (Alvarez & Marsal, 2020) had conducted a review of their supply chains as a direct result of covid-19. Agri-food supply chains were considered more flexible for switching suppliers and sourcing countries. Nevertheless, the sudden and severe impact on supply chains forced more than half (55%) to diversify several of their supply chains. Other measures included reducing product ranges (30%), near-shoring (23%), diversifying sourcing countries (15%), on-shoring (14%) and increasing inventories (5%).

Equally, suppliers of the traditional out-of-home sector such as restaurants have sought to find new markets, one of which has been to sell direct to consumers (Eley, 2020b). Further reimagining of retail infrastructure is ongoing by food retailers with a concerted move to develop “click’n’collect” hubs, introduce cashier less payment points and explore the use of so-called dark stores (Deloitte, 2020). Though there is some pushback through safety concerns associated with digital wallets, contactless payments and a general perception of an acceleration towards a cashless society (Deloitte, 2020).

It is anticipated that in the medium-term as covid-19 continues to impact the labour market with elevated unemployment rates reducing household budgets that this could weaken demand for some foodstuffs decreasing volumes closer to pre-pandemic levels, although demand for essentials will remain (IHS Markit, 2020). Notwithstanding a potential decline in the current level of food sales, food retailers need to be cognisant of household food behaviours that have altered in response to the covid-19 pandemic. Current sentiment (Ipsos Mori and Fand Food Standards Agency, 2020) indicates that increased home-cooking, food sharing and attention to diet is being maintained. Furthermore, Wrap (2020a)

has reported that a broad spectrum of positive food management strategies (6.7 behaviours on average) have been adopted by consumers. Adoption and uptake have been highest among younger consumers (18-44s), those with children at home, and those whose work pattern has been impacted by covid-19 (e.g. furloughed, reduced hours, home-working). By June 2020, such food behaviours were enduring with 70% of consumers aspiring to continue their modified food behaviours post-lockdown. For example, 91% of consumers who checked date labelling more often during lockdown continued to do so, including 22% who said they were doing this more than during the first lockdown. A similar pattern was true across all food behaviours, particularly so for using up leftovers, freezing food, checking the fridge before shopping and checking labelling for storage advice. While the majority (74%) of those UK consumers who cooked creatively during lockdown have continued, 22% were finding it more difficult and 4% have already stopped.

Thus, food retailers not only need to reshape and redefine supply chains to ensure robust product availability but be sufficiently agile to take account into different consumer behaviours, demands and pressures driven by the covid-19 pandemic and resultant government societal interventions.

Panic-buying and changes in consumers' choices also impacted the retail industry - rapid adaptation by the latter has been a key to overcoming lockdown. "*…there was an extraordinary surge in online orders from home consumers — people sitting in their kitchens, worried they would never be able to buy flour again or realising they had time on their hands — they were furloughed and could start cooking*" (Steavenson, 2020).

Adaptation and innovation for small businesses have been essential, examples include quick changes to online sales and the use of vending machines technology (Case, 2020; Harvey, 2020). Adaptation to high online shopping demands for small and big businesses has been a challenge (Steavenson, 2020; Shveda, n.d.), requiring rationalisation (Thomasson and Davey, 2020; Davey and Martinez, 2020).

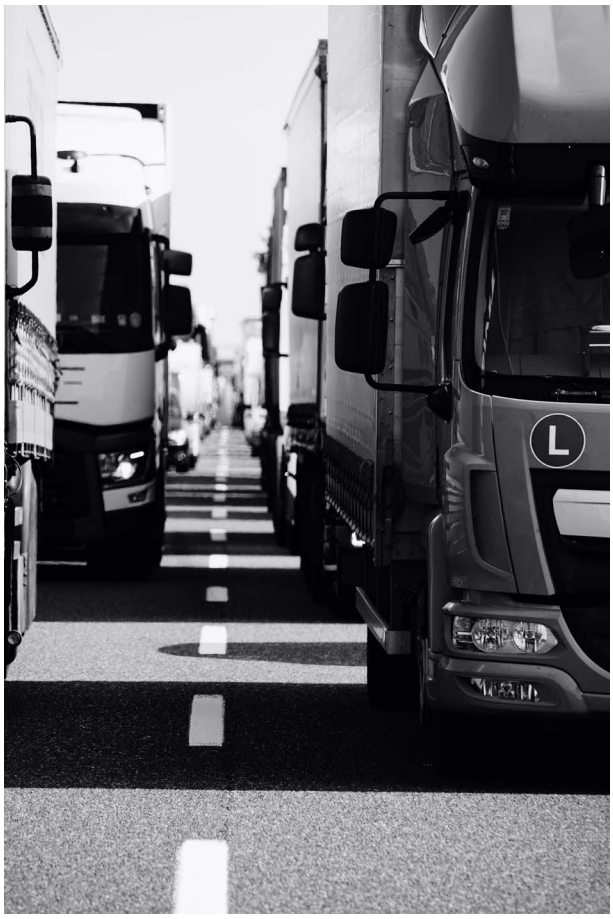
Supermarkets were dealing with a 20% increase in demand as consumers were stockpiling (1 billion pounds extra of food) already one month before the actual lockdown on March 23rd 2020. In April 2020, demand continued to increase, and supermarkets had additional pressure to control social distance through restricted opening hours and numbers of costumers allowed inside the shops. During lockdown, with the closure of the hospitality sector, 30% of the nation's food consumption went back to stores and at the same time, supermarkets had to cope with 15-20% absenteeism of staff during lockdown (Davey, 2020).

The Food Supply chain team of NFU helped to provide additional volumes into shops to make up for the drop in demand from food services by linking up food service businesses with the retail supply chain.

Logistics and Transport

At the onset of COVID-19 lockdowns, both the demand-side shocks related to consumer behaviour and the supply-side shocks of human capital mobility restrictions deadlocked many of the complex supply chain networks responsible for providing food to the UK. This had severe implications for the logistics, transportation and warehousing sectors (Saul, Dowsett and Baertlein, 2020). Supply chain disruptions have led to delivery delays, congestion in the warehousing sector and higher freight and transportation costs (Twinn et al., 2020).

In the early days of the pandemic China's lockdown



meant there was an international shortage of refrigerated shipping containers (Saul, 2020). A United Kingdom Warehousing Association (UKWA) survey of logistics and warehousing operations revealed a lack of available warehousing space in the face of COVID-19 restrictions. Ninety percent of respondents confirmed that they were totally full, suggesting that the market has just 10% pallet space availability and that there is a high potential of reaching zero capacity within weeks (date not known). This shortage of warehousing space was due to an imbalance between outbound non-essential goods slowing or stopping but continued inbound flows from imports to the UK (UKWA, n.d.-a). In response to this, the UKWA established a COVID-19 Emergency Space Register to help coordinate storage (UKWA, n.d.-b).

The Office of National Statistics' Business Impact of Coronavirus Survey (BICS) saw 72% of exporting businesses reporting fewer exports than normal and 59% of importing businesses reporting fewer imports than normal, for the period from the 20th of April to the 3rd of May 2020. Only 20% of exporting businesses and 29% of importing businesses reported no discernible effect from COVID-19. Businesses in the transportation and warehousing sectors were most effected, reporting 80% reduced importing and exporting (ONS, 2020e).

Ocean freight is typically about 90% of global trade volume, shipping the equivalent of 1.5 tons of freight per person per year globally (International Chamber of Shipping, n.d.). Due to disruptions from cross-border restrictions and coronavirus lockdowns at ports and harbours, an 11% decline in global demand for goods shipped by ocean freight reduced available shipping capacity by more than 13% (Fitch Ratings, 2020). Marine freighters had no option but to leave crewed ships at sea for over six months. There are an estimated 400,000 merchant sailors experiencing impacts, which according to one investor poses "a humanitarian tragedy as well as a major supply chain risk for many companies" (Aljazeera, 2021). By September the deadlock had eased and demand for freight was on the rise again. The shipping industry began reporting a staggering 40% increase in transpacific freight costs from previous historical highs (BIFA, 2020).

The global economic slowdown in April saw air freight volume decline by almost 28% year on year. Air cargo demand, however, has only been increasing due to strains on ocean freight and closed borders to road freight. Declines in passenger flights due to COVID-19 travel restrictions caused airlines to reconfigure passenger planes to cargo-only flights (Morrison, 2020). Doncaster Sheffield Airport, for example, announced a planned increase in the number of flights of perishable goods. The airport will be handling 700 tonnes per week in food freight, up from 300 tonnes per week. The airport reports a general increase in air freight traffic since the pandemic began in March by around 40% year on year (Russon, 2020).

Stockpiling of goods by British consumers has required an additional 35% capacity increase on deliveries from the EU to keep up with demand. Travel restrictions, border closures, air travel cancellations and quarantining ships for two weeks have all contributed to a lockup in the supply chain (Saul, Dowsett and Baertlein, 2020).

The road freight and haulage sector has also suffered due to heightened restrictions in response to COVID-19. The Road Haulage Association (RHA) said in April that 46% of the UK's truck fleet was not operating with 25% of drivers were furloughed due to the crisis, and without support from the government, hauliers were facing collapse and insolvency (RHA, 2020a). In May, the UK government announced a new flexible furlough scheme which provided greater flexibility to get their furloughed staff back to work on a part-time basis (RHA, 2020b).

Lockdown rules worldwide and in the UK included the closure of the hospitality sector, resulting in a significant drop in demand from restaurants and for specific types of food. Challenges in packaging availability and labelling requirements highlighted the lack of agility in the need to redistribute supplies from the restaurant and catering sectors to retail outlets (Wentworth, 2020). Thus, cold storage warehouses were at 90% of full capacity in April 2020 (Cavale, 2020; UKWA n.d.-a) and resulted in increases in food waste (Mustoe, 2021).

Investment in cold storage facilities in the UK has increased dramatically following the strains on existing cold storage, due not only to increased demand in frozen food goods but also the use of the spaces as temporary morgues. As an example, Cardiff Council reported spending £2,527,000 from April to September on two temporary morgues. A budget monitoring report showed 'body storage' costing the council £809,000 in September alone (Pyke, 2021).

In April, the UK government announced a trilateral

agreement along with the French and Irish governments to keeping freight routes open and supply chains moving (Gov.UK, 2020e). In May, the UK government signed an agreement with six freight operators to invest up to £35 million to ensure there is enough freight capacity to ship goods such as food and medical supplies. The most important routes covering the UK were designated as Public Service Obligation routes for nine weeks (Gov.UK, 2020f).

The UK has operated a 'just-in-time' (JiT) supply chain for about 40 years. This includes the use of regional distribution centres, a switch to a smaller number of suppliers and minimised retail store inventories. This has reduced consumer prices but has led to a system that is vulnerable to disruption. Panic buying at the beginning of lockdown disrupted these JiT supply chains. As a result, the government relaxed competition law and restrictions on drivers' hours and manufacturers increased production of goods in high demand (IHS Markit, 2020).

Some of the responses from policy to support the road freight industry were the relaxation of rules for HGV drivers around working hours and, on the need, to provide 'fit to drive' medical certification broadly supported by trade unions representing transport industry workers as being essential to keeping transportation of goods going.

Transport disruption and restrictions on migrant seasonal workers' mobility also affected the UK fruit and vegetables industry which normally recruits 70,000 to 80,000 migrant workers (Evans, 2020). This tendency was also noticed in other countries (FAO, 2020c). Producers and farmers suddenly did not have a connection to the supply chain, due to transport disruptions, forcing them to search for alternative options to reroute their produce. Farmers in various countries moved their businesses online to shorten value chains and avoid supply chain disruption because they are unable to access the same markets they accessed pre-COVID-19 (Trompiz, de La Hamaide and Walljasper, 2020). On 6th January 2021, the UK Department for Transport confirmed that employees in the logistics sector were 'essential workers' (UKWA, n.d.-c).

Other impacts on the transport industry were related to work redundancies and COVID-19 being used as the reason for laying off staff. Various trade union report companies using COVID- 19 'as an excuse' to lay off staff. It is not clear whether these staff layoffs would have happened anyway, however.

DFDS Seaways was said to be using COVID-19 as an excuse for job cuts at their Immingham site (Unite the Union, 2020b). DHL closed their Tradeteam Ltd. depot in Sheffield and downgrading its site at Ebbw Vale resulted in 250 jobs being lost (Unite the Union, 2020c). Along the same lines, Unite the Union claim Goldstar Transport is using the crisis as a reason to close one of their depots (Unite the Union, 2020d). For some of these companies, public furlough money was used before the closure of the depot sites allowing the company "to avoid paying wages of the respective workforces during this period" (Unite the Union, 2020c).

As in other industries, such as the slaughterhouses, in some cases employees preferred to go to work whilst unwell because they could not afford the reduction or income loss. Statutory sick pay was insufficient and could lead low-paid workers (especially) to turn up to work when ill. In some key workplaces in the system (processors, warehouses, etc.) this can lead to the entire site having issues.

The COVID-19 crisis has exposed vulnerabilities in the UK's reliance on international trade and on a vast number of seasonal workers who help gather produce as it ripens; it has also revealed how low-paid, 'precarious' work can lead to people acting against government advice intended for their own wellbeing, and that of society in general. News reports in March and April told stories of how locked-in supply chain relationships led to fresh produce being destroyed across upstream and downstream supply chains. General reductions of imports and exports had direct impacts on food availability, food waste and retail prices. Businesses throughout the supply chain started to adapt, diversifying suppliers and customer base, and moving business online. DHL reports its customers have begun to diversify sources of supply as an adaptation strategy to reduce dependency on one country or production site (Reuters, 2020b).

Upstream supply chains in the food system

This section considers the pandemic impacts on upstream parts of the supply chain that enable food production activities. Few if any formal assessments have been made on the upstream supply chain for food production so an assessment is reliant on farming industry trade popular publications and anecdotal comments from the farming community.

Over 50% of global food production depends on mineral fertiliser inputs. The NPK Fertilizers Market is estimated to grow by 1.7% (88.7 B USD by 2021) reflecting increased dependency on crop fertilizers to maintain yield, mainly for rising animal feed demand. The global fertiliser supply chain is complex, requiring large quantities of raw material to be transported world-wide. As a net importer of fertiliser (import value of 1.2 billion USD compared to 0.34 billion exported), significant risks were therefore expected for the UK, posed by COVID-19-induced logistics bottlenecks, shortage of labour, reduced operating rates and lockdowns in major global fertiliser and pesticide producing centres. For example, fertiliser from the Hubei province accounts for 60-65% of Chinese phosphate production, therefore likely to have a major impact on global supply. Asia Pacific is the largest contributor to the global pesticide and agrochemical market (27%) followed by South America (24%), both suffering severe COVID-19 restrictions and closures during 2020.

Despite these fears, and among the more highly-industrialised countries of the global north, there appears no shortage of agrichemical inputs and machinery, though going forward there are concerns that reduced supply and/or increased prices may still jeopardise production in 2021. These risks and vulnerabilities, though they may not have been realised in the short-term, have highlighted the lack of resilience in the global food production system and are driving the development of alternative solutions, e.g. technological advances such as nanotechnology as an alternative to pesticide inputs, or agronomic approaches such as regenerative farm systems that are less reliant on agrochemical inputs to maintain production.

The drive for more efficient production technology with lower turnaround time in order to maintain productivity despite the labour shortages, has led to greater demand on the agricultural equipment market. However, despite generous government subsidies which have scaled up this demand, the equipment market has slumped during the pandemic due to its own labour shortages and disrupted supply chains. Many equipment dealers were closed during lockdown and credit lines switched off making machinery purchase difficult for growers. However, the uptake of hire- and contract services increased over this period, especially those which enable reduced dependency on manual labour and lower processing time. Though here again, the lack of sufficiently high levels of farm profitability and availability of staff trained in modern advanced

agriculture equipment use, diminishes the mitigation and adaptation potential across mixed, arable- and livestock-only sectors.

In general UK farm life has been little affected compared with most other areas, and many of the issues identified were more likely due to changes in Brexit, trade, currency, climate/weather etc. Even working practices were less affected than many issues due to the high level of lone-working. One farmer comment perhaps sums up the situation: "I think farming on the whole hasn't been impacted too bad, if at all in some cases and with government grants available for business interruptions there will be plenty of farmers maybe even better off".

Some impacts identified included:

- Training courses booked for staff (e.g. telescopic forklift, vehicle & trailer and zero turn mower) were postponed, many with no re-scheduled dates.
- Farm audit (e.g. SQC) done remotely.
- Farm audits (e.g. Red Tractor and LEAF) were not organised.
- Alternative self-assessment audits (e.g. LEAF) were substituted.
- Calibrations postponed (e.g. grain moisture meters) with alternative instructions made (e.g. Red Tractor).

However, 'BASIS' (pesticide industry continuous professional development) has been much easier to attain via the many virtual platforms and portals which have become available this year. Furthermore, schemes relaxed the points tally to be achieved.

Agricultural event cancellation was the norm, with some going online to a degree. This is a loss difficult to evaluate as there is a view amongst farmers that something lost in not being able to visit/speak to exhibitors and advisors. Farmers were unable to see trial and experimental plots up close and to get a 'feel' for the crop such as the standability of a new variety, grain size, canopy, disease resistance, or the effect of a new chemical for example. There is only so much that can be caught on camera or that an exhibitor would wish to show, but this might be balanced by more virtual content from timepoints and locations not normally accessible. Agricultural events such as Cereals 2020 and Royal Highland Show where suppliers and dealers for agricultural equipment and supplies normally show their wares and get orders did not happen (see below). Some had an on-line version, but this was not likely to substitute for this market.

An example of where COVID-19 was probably not the primary cause of changes is grain markets: during 2020 malting barley price per tonne was worth less than higher-yielding feed barley which may have been due to several things including the wet autumn of 2019 resulting in farmers sowing more spring crops instead. A big part of this price impact was seen in the downstream demand side supply chain due to the way lockdown impacted the hospitality trade with less alcohol being consumed.

Nitrogen fertiliser price dropped dramatically for 2020 but this was linked with the drop in the oil price, with prices coming in below £200/t for the first time in years. Much of this can be attributed to the oil price war, which was occurring between Russia and the Saudi Arabia, but some could be linked to reduced activity due to COVID-19 (AHDB, 2020a; Fletcher, 2020).

In respect of undertaking practical management, the impact on the upstream supply chain most noticeable at the beginning of lockdown was the difficulty in sourcing PPE for chemical handling during the busiest part of the growing season, as it was prioritised for the NHS.

Access to seasonal workers has been a major issue for business continuity in soft fruit production. The 'feed the nation' scheme encouraging furloughed workers to pick fruit was well intentioned but not very successful. Reports such as that from a farm near Coupar Angus indicated that of the 60 staff given a trial, only 6 turned up for a second day, and this appears to be typical. A report jointly funded by the NFU, British Apples and Pears, British Summer Fruits and the British Growers Association has stated that COVID-19 has resulted in labour costs increasing by up to 15%, which is in addition to a 34% rise in labour costs over the past 5 years (Pelham, 2020).

The rapid closure of the UK catering sector left many of the UK's c. 10,000 dairy farms operating at a significant loss when much milk had to be disposed of without any cost recovery (Evans, 2020b). It also affected many other markets as demand switched from the hospitality industry to the supermarket sector. However, the upstream effects were short-term as crops and livestock supply chains the requirements for inputs remained largely similar.

Tractor sales were hit dramatically during the first two months of lockdown as there was no confidence to buy nor dealerships open to continue and the factories themselves had closed down – around a 50% drop in trade and slow to pick up again. In value terms, sales of tractors, plus parts and accessories, account for almost one half of farmers' total spend on equipment, which again makes this data series a prime indicator. However, some EU regulations requiring safety updates were also relaxed or postponed for practical reasons (Farminguk, 2020a and 2020b, Mark, Mowbray and Andrews, 2020, CEMA, 2020).

Organisations such as the National Farmers Union (NFU) in all the UK nations have provided their members with much advice on all aspects of farming associated with practically continuing business, particularly with respect to managing risks (NFU, 2020).

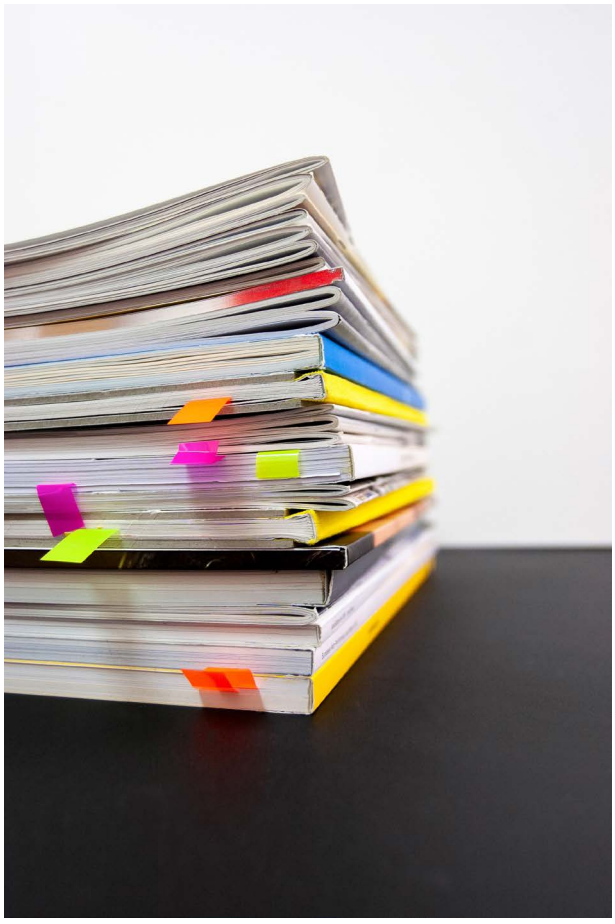
Overall, the impact of COVID-19 on the farming upstream supply chain has been low compared with most industries. The long-term implications of the restrictions to the training, evaluation and social aspects of farming are much harder to evaluate but could be considerable. This implies that there will be a need for research and assessment of the farming sector in respect of delayed impacts on physical and mental health, reduced knowledge accumulation and overall economic consequences.

Research and Academia

For some researchers, supply chain disruption combined with the "just-in-time" logic of economic efficiency have created a vulnerable food system in the UK. During the past 20 years, in the UK, supermarkets have reduced the diversity of their suppliers. This reduced supplier base created an inability to provide the diverse sets of resources required by complex supply-chain networks which in turn can lead to large parts of the supply chain becoming deadlocked (Garnett, Doherty and Heron, 2020). Relying on supermarket chains, which have more than a 95% grocery market share in the UK (Kantar, 2020), means that their products use a narrow range of ingredients based on crops and varieties that grow the fastest or are the most efficient to produce in large quantities. Industrial agriculture causes environmental degradation and relies on monocultures which are susceptible to disease. And the whole system tends to support low wages and temporary jobs (Shveda, n.d.). The very fragile just-in-time supply chain could collapse, affecting a depleted agricultural sector and leaving us at the mercy of the international markets and production methods which are damaging the environment and human health (Rayner, 2020).

For other researchers, the resilience of the UK food system has been tested but supermarket power could buffer shocks, healthy profit margins enabling retailers to bear higher costs and to maintain food supply in times of crisis. Globalised supply chains have the benefit of diverse product lines that come at the cost of potential vulnerability to regional supply shocks (Moran et al., 2020).

For others, there is need to change the food system paradigm. Debating that typical food supply chains are large, vertically integrated, and owned by multinational public and private corporations with a high degree of product diversity. This has also led to "bottlenecks" in the food chain that might be problematic from a resilience perspective. One can see a "bottleneck" appearing in supermarkets/ suppliers with a relatively small number of organisations controlling a large part of the foods consumed. Further to this bottleneck, more than 80% of food is delivered through the global supply



chain with a major focus on low cost and high efficiency (Bakalis et al., 2020).

Researchers argue that three interrelated dimensions are revealed by the pandemic. These are the role that the state has in supporting and enabling the supply chain; collaboration needed for a resilient food supply; and the key role of the labour force (Barling, 2020)

A transversal aspect to the impact of Covid-19 on the food system highlighted by research is the issue of coordination. The Government's necessary responses to the COVID-threat disrupted the food supply system in the UK, which in turn required checks and balances such as adapting regulation, increased supply of school meals, pressure on key workers etc. raising new issues of insufficient cross-Government coordination (UK Parliament, 2020a). Government responses have been criticised for being rather reactive and not proactive, for isolated decision-making and for policies targeting different parts of the food system while affecting others (Parson and Barling, 2020). cliv This reveals structural, long-term concerns about UK food and nutrition security. The lockdown measures implemented by the Government without anticipating food supply chain disruption highlighted a lack of coordination and preparedness for shocks of this magnitude. The pandemic, therefore, offers an opportunity to visualise the fragility of the food supply chain as it is established now.

Coordination implies recognition of the food system's interconnections with economics, politics, the environment, health, and society and how it shapes and is shaped by these dimensions (Parsons, Hawkes and Well, 2019). Covid-19 has evidenced these interconnections and the consequences of lacking recognition of the same.

For other researchers, lessons from Covid-19 are especially important because they could potentially inform new Brexit-related rules and regulations. An example of this relates to health and on-going developments of the new agricultural bill to prepare the UK for Brexit. Although health is not a priority of the agricultural bill, lack of coordination and decisions taken in the agricultural bill will impact the food system, which at the same time has direct consequences on health (Shanks, van Schalkwyk and McKee, 2020). Other examples are new seasonal migrant work regulations and fishing trade negotiations with the EU just to mention some. Other views expressed by researchers were in relation to what Covid-19 can teach us about responding to climate change (Herrero and Thornton, 2020).

Both the critics and advocates of the current dominant food system recognise the scope to create national food policies aligning nutrition with social and environmental goals (Moran et al., 2020).

Coordination and interconnection could make the difference to managing food system shocks by joining goals, horizontally across government departments and vertically at different government levels and between state and non-state actors (Wentworth, 2020). "Government gaps" (Parsons and Barling, 2020) can exacerbate crises and hinder other entities' actions.

Another concern in the academic arena is the development of a two-tier system, as underlined for instance in a report of lived experiences of food insecurity under Covid-19, based on qualitative research with 20 UK citizens conducted in June 2020. Income loss has rapidly exacerbated existing insecurity and vulnerabilities. Impacts of food insecurity under Covid-19 were multi-layered and complex (Connors, 2020).

The food system has shown both strengths and weaknesses. With the pandemic, in addition to short-term responses, there are new proposals as how the UK should rebuild it back as a whole food system. One of these is to increase local production (Garnett, Doherty and Heron, 2020; Shveda, n.d.) and addressing food insecurity through coordination. For some this is to be achieved through technology intense production with robots, vertical farming as mentioned in the report for Future of Food 2040 (NFU, n.d.). Others proposed a 'food democracy' model to strengthen the agri-food system, (Petetin, 2020) further research defines food system resilience covering COVID-19 and other drivers and threats (Climate, ecosystem degradation) and points towards an 'ideal food system' (Llanos and Border, 2020).

A research effort overseen by the Royal Botanic Gardens at Kew (2020) proposes to address the challenge of feeding the world population, without increasing pressure on land, water resources and the environment /. They found that from the 7093 edible plants species documented in Kew's dataset of useful plants, only 15 are used for the bulk of food energy intake (without really counting on the potential of fungi). A proposition of using the expanding

knowledge in genetics to these natural resources to develop new foods, medicines and other products is detailed in the publication (Antonelli et al., 2020).

Reports, research, and opinion papers from civil society have informed government actions and researchers about activities carried out on the frontline. Some of these reports found:

- The Trussell Trust produced a report on the impact of the pandemic on food banks. Their main findings are (i) a massive increase in demand on food banks, (ii) the number of children needing support has more than doubled, (iii) children are needing disproportionately more support during this crisis. The Trust has become heavily involved in the development of local support networks. They also highlight that policy differences between the UK's four countries have driven different responses from NGOs (Trussell Trust, 2020c).
- The Scottish Council for Voluntary Organisations has highlighted the two-way development of both 'charity as an arm of government response' and 'governance/coordination/ control of national infrastructure components by charities' (Carruthers et al., 2020). They have been advocating for increased coordination between charitable organisations and local/ national government and are pushing for this conversation to be developed.
- The Poverty and Inequality Commission found that greatly increased demand for support, particularly among vulnerable people; lack of strategic coordination of emergency food provision and lack of access to information; fragmentary funding from multiple sources. The report makes strong recommendations regarding Scottish Government policy and action required (Poverty and Inequality Commission, n.d.).
- Nourish Scotland published several articles relating to food and food supply governance and have been advocating in these articles for radical reform to the UK's food supply system (Nourish Scotland, n.d.).
- Sustainable Food Trust highlights insecurities in the UK's food supply chains, identifying centralised systems and economies of scale as cost-effective but ultimately unstable and unable to cope with pandemic situations. It has been pointed out that our current food supply system is 'profitable for retailers but fails to serve the public interest in almost every other respect (Holden, 2020b).
- The Community Food Initiatives Northeast found that most of their foodbank users were female and had children at home, which is a change from normal. A large number were also new users. The research has enabled CFINE to adjust their activities to fit requirements, including increasing their food delivery service (Community Food Initiatives, n.d.).

Policy and Food System Governance

UK Government focus over the duration of the COVID-19 pandemic can be usefully considered in four key policy contexts in terms of impacts upon UK Food and Nutrition Security. Firstly, in the sphere of public health, there has been a major exercise in which the government has acted to control the spread of the virus through a series of lockdown and workplace safety measures. Secondly, the government has attempted to offset the negative impacts of the pandemic on the wider economy, including the adverse consequences of lockdown measures, through fiscal stimuli. Thirdly, existing food insecurity and related vulnerabilities have been exacerbated by the pandemic with increasing numbers of people using food banks putting the third sector under considerable strain. This has prompted a number of policies designed to alleviate food insecurity. Fourthly, the COVID-19 pandemic has put the food system under the spotlight with questions about food as a public good emerging to challenge the existing productivist paradigm. The policy discourse is shifting in response with proposals for future policies designed to improve food system resilience, make agriculture greener (part of the so-called Green Recovery) and to develop more sustainable and nutritious outcomes all rising up the political agenda. This section will confine itself to a brief overview of these diverse policy responses to the pandemic as they have related to Food and Nutrition Security in the UK.

Public Health responses: The major instrument deployed by the UK Government to deal with the pandemic with a major bearing on food and nutrition security has been the imposition of lockdown measures designed to reduce social interaction. Following the arrival of the COVID-19 pandemic in the UK in March 2020 the government

imposed a national lockdown seeking to reduce transmission rates and control the spread of the virus by restricting the movement of citizens. The move followed the example of most other European countries where the pandemic had arrived earlier.

The lockdown has had different degrees of severity or different tiers during the course of the pandemic with tightening and relaxation decisions intended to limit the transmission rate of the virus while protecting the economy. The highest level has been a national lockdown severely restricting the movements of individuals, excepting only essential workers, and the closure of non-essential businesses, and was imposed during March to July 2020 and again in January 2021 as the transmission rate (R rate) again increased to greater than 1. Lower levels have been applied when the R number has indicated that the number of cases has been decreasing i.e., lower than 1. Significantly different lockdown restrictions have been applied to the devolved nations that comprise the UK and many commentators have argued that this has degraded the clarity of messaging and public confidence in related COVID-19 public policy. However, there is, as yet no clear evidence that this has led to different outcomes in terms of food and nutrition security.

Lockdown meant the closure of workplaces other than those deemed essential, and this has inevitably had a major impact on the economy with trade and commerce seriously affected. To offset negative impacts on the food system comprehensive exceptions have been made ensuring that essential workers and business throughout the supply chain continued to provide food for the nation regardless of the level of lockdown in operation. Measures such as relaxing key regulations to support food supply on driver hours, delivery times, advice on food labelling and on competition law for key sectors have been implemented (Gov.UK, 2020a, UK Parliament, 2020b) including relaxing the rules on medicals for HGV drivers while 'fit-to-drive' medicals (needed for drivers aged 45+) were unavailable (Unite the Union, 2020e). Food producers, suppliers and retailers have therefore largely remained open for business with the exception of hospitality which has been deemed non-essential and a key pathway for transmission.

Although measures have generally allowed the smooth operation of the food system, there have been adverse impacts around some food items. Immediately following the first national lockdown gaps appeared on supermarket shelves most notably for flour and tins of tomatoes. Initially, shortages were attributed to panic buying with shoppers said to be stocking-up and creating distortions in the availability of certain products. As further analysis took place a more sophisticated understanding

of cascading effects within the food supply chain emerged. Flour normally supplied for commercial bakeries, often in restaurants and other outlets that had suddenly closed, could not be repackaged and diverted in a retail format without some delay and with people increasingly self-catering there was increased demand in shops. In the case of tomatoes around half of all the fresh produce goes to restaurants, independent groceries and hospitality businesses in normal times. The closure of these businesses caused tomato growers to delay production which in turn increased both demand and the price of canned tomatoes. These direct effects of lockdown policy in terms of availability were, however, limited and supermarkets in the UK alongside their supply chains performed reasonably well to limit the disruption after initial shortages.

Other adverse impacts beyond availability have been reported. Food standards were a cause for concern during lockdown with the Food Standards Agency anxious about public health caused by reduced ability to deliver existing inspection and enforcement activities potentially leading to food crime and risks to consumers (Food Standards Agency, 2020a). International evidence suggests these fears are justified, for example successful prosecutions in France (Interpol, 2020). Health and safety policy has also needed to respond to pandemic challenges. Essential businesses that have remained open and those that have reopened under restrictions have had to adapt and follow a whole tranche of new guidelines which have been developed to cover different sectors and circumstances. In general terms, advice and regulation around social distancing, hygiene and personal protective equipment (PPE) have been issued on a regular basis by the Department for Business, Energy & Industrial Strategy, and the Health and Safety Executive (Health and Safety Executive, 2020). Particular vulnerabilities have been experienced in abattoirs and meat processing plants (Health and Safety Executive, 2021), by no means confined to the UK, however failure to protect UK workers in these high-risk environments has had a negative effect on the meat supply chain with major disruptions to plants in Anglesey, Aberdeenshire, Angus and Cornwall.

From a business perspective, many food retailers such as supermarkets have actually experienced an uplift in food sales albeit partly offset by their increased costs around making premises COVID-secure (e.g., additional staff, PPE, protective screens, hand sanitizer), and lower fuel and clothing sales. The uplift was so significant that over 1.8 billion in COVID-19 Business Rates Relief made available to retailers was repaid to the treasury by firms including Sainsbury's, Asda, B&M, Aldi, Tesco and Morrisons (Wood and Kollewe, 2020). There was a similar uplift in the sales of local, short supply chain businesses for example local fishmongers thought to be driven by increased home cooking and customers being confined to their local area and attracted to smaller, neighbourhood shops. In contrast, there has been a devastating downturn in the hospitality sector that has faced tough restrictions throughout. Government agencies have issued guidance encouraging some businesses to reopen and adapt in safe ways (Food Standards Agency, 2020a) however it is clear that government policy has directly impacted the food trade creating winners and losers albeit unintentionally.

Protecting the economy: To offset the damage that movement restrictions would inflict on the economy, the centrepiece of UK government fiscal policy was to deploy a Plan for Jobs (HM Treasury, 2020). The plan contains several policy instruments including the Coronavirus Job Retention Scheme, Bounce Back Loans and the Self-Employment Income Support Scheme. At the time of writing, Job Retention, whereby the government pays 80% of furloughed workers' wages, will continue until the end of April 2021 while businesses will be given until the end of March to access the range of Bounce Back Loan Schemes. As of March 15, 2021, the overall cost of the United Kingdom's job retention scheme was 57.7 billion (Statista 2021b). A parallel scheme for the self-employed called the Self-Employed Income Support Scheme (SEISS) has been operational as of March 2020. Besides broad policy responses aiming to support the UK economy, other government schemes targeted highly affected parts of the food system. These included the seafood industry, dairy and the hospitality sector. The UK government set up a scheme to help seafood businesses in England adversely affected by the downturn in export markets, to increase the supply of local seafood to domestic markets by funding grants to projects that help to increase the supply of local seafood to domestic markets and help to increase consumption of locally caught seafood in the UK (whether live, fresh, landed and/or processed in England). An alternative provision was made by Scottish government (Scottish Government, 2020b).

While supermarket sales increased, the hospitality sector has experienced a severe downturn. Considered to be a pathway for community transmission of the virus, hospitality businesses have either been closed completely for extended periods or subject to a range of restrictions intended to minimise person to person contacts. A broad-based UK Government support scheme was introduced to stimulate (kick-start) the food hospitality sector re-opening. The scheme, promoted as 'Eat Out to Help Out' (EOHO) offered a 50% discount on food and non-alcoholic drinks bought to eat in, up to a maximum of £10 per person and was available all day every Monday, Tuesday and Wednesday between 3rd and 31st August. Takeaway food was ineligible. The discount was available during August and September 2020 and resulted in £849 million worth of claims. Over half the claims were made for restaurant meals (54.8%) with pubs and licensed clubs representing 27.6%, accommodation 8.2%, retail 3.6%, sports, amusement and recreation 1.2% and other sectors 4.6% (HM Revenue and Customs, 2020). It is difficult to assess the overall impact of the scheme in terms of Food and Nutrition Security. There is evidence that confidence was increased amongst participants, perhaps in a counter-productive manner given that the infection rate subsequently increased, and it seems likely that hospitality businesses gained a short-term financial benefit with the jobs of many low paid workers temporarily supported (Phillips, 2020), however further analysis is required and perhaps a rerun of the scheme, currently under consideration, may enable the policy to be thoroughly evaluated.

Helping the food insecure: Many commentators characterize the UK government fiscal strategy as strongly focused on job retention. By furloughing workers, the government has effectively shielded approximately 11 million people from unemployment and subsequent food insecurity. Despite the scale and unprecedented cost of furlough (c. £57 billion) there remain criticisms that everyone is not adequately sheltered from the economic downturn. The central jobs retention scheme favours the employed over the newly or existing unemployed with the self-employed and those on the margins of regular employment, for example people working zero hours contracts being ineligible for job retention payments. Consequently, concerns have been focused elsewhere on the underlying support mechanisms for the low paid, unemployed and those reliant on social provision more widely. For many of these people, there has been a £20 per week uplift to the universal credit standard allowance.

Another government scheme targeting the most vulnerable children in society to mitigate malnutrition comprised a school food voucher scheme whereby, in June 2020, central government allocated £63 million to local authorities to assist those struggling to afford food (House of Commons, 2020). A popular campaign led by the footballer Marcus Rashford resulted in further provision of lunch parcels, local vouchers or the Department for Education's national voucher scheme, for school aged children, a scheme that has been recently restored after criticism when it ended in early January.

Despite these temporary policy interventions, there is evidence including qualitative research into the lived experiences of food insecurity under COVID-19 (Connors et al., 2020), that income loss has rapidly exacerbated existing insecurity and vulnerabilities. What have been described as "empirical and ethical implications of COVID-19 for socio-economic inequalities in access to food in the UK" (Power et al., 2020) driven by factors including increased unemployment, reduced hours, and enforced self-isolation for multiple vulnerable groups have been linked to diet-related health inequalities.

Another dimension to the socioeconomic situation has been the fragility of the system evidenced through the growing utilization of food banks, where rapidly increasing demand coinciding with reduced volunteer numbers and falling donations, has undermined many food charities operational capabilities, especially independent food banks. Even many of those in work appear increasingly under pressure with multiple reports about low salaries and insufficient statutory sick calling for government help to protect ill workers from the necessity of going to work and the subsequent risk of spreading the virus. Several trade unions press releases focused on issues related to statutory sick pay for self-isolating workers. The £95.85 weekly statutory sick pay is insufficient to live on, it is claimed, and promotes presenteeism in the workplace (Unite the Union, 2020f, Unite the Union, 2020g) with other disincentives to self-isolate within the employment terms of the most vulnerable workers. Other organizations have proposed regulatory reform to protect keyworkers, including increasing the minimum wage, ending zero-hours contracts and

introducing a much higher rate of statutory sick pay (£320 per week instead of £95 or so currently) (United the Road Transport Union, 2020).

Future food policy: The pandemic has brought to the fore critiques of current food and agriculture policy raising wider questions about the sort of food system required to deal with the multiple challenges faced in post pandemic Britain. Critics argue that the current supply chain is inherently fragile in multiple ways. Over the last two decades, supermarkets have systematically reduced their supplier base whilst implementing just-in-time processes, both strategies adopted to optimize their operations in the face of fierce competition. This has created vulnerabilities such as an increased risk of a single point of failure, for example around the critical Dover Strait and Channel Tunnel routes, a danger further heightened due to Brexit and evidenced in new post Brexit customs arrangements affecting both UK seafood exports crossing the English Channel and general food imports to Northern Ireland crossing the Irish Sea. Alongside this supply route consolidation, agricultural growing areas for the UK's fruit and vegetable imports have become equally increasingly concentrated in recent decades with a high degree of reliance on just two countries, Spain and the Netherlands, for the bulk of the UK's fruit and vegetable supply. The pandemic coupled with Brexit has highlighted many of these issues and there is a fear that any further shock (such as climate related harvest failures) will be catastrophic. A comprehensive policy rethink is required with more domestic food production supported and greater diversity in both production and processing in combination with stronger international safeguards against protectionism ensured through greater international policy coordination (Garnett, Doherty and Heron, 2020).

At home, Britain's food system is over reliant on a temporary, largely immigrant and low paid labour force. The estimated need is 70–80,000 workers annually just for the fruit and vegetable harvesting and processing, not including the immigrant workforces in the meat slaughterhouses and processing plants (Barling, 2020). The government launched an initiative to steer furloughed workers into vacancies created by travel restrictions on migrant workers (Gov.UK, 2020g) and has extended the Seasonal Workers Pilot (SAWS) for 2021 (Gov.UK, 2020h). The extension has been seen as a response to a survey by the Association of Labour Providers (ALP) in November reporting that 92% of food growers and manufacturers believed there would be too few skilled workers to meet the UK food supply chain's needs in 2021. The plight of seasonal and other food sector employees during the pandemic has also increased the volume of calls for greater fairness to be placed above narrower economic values in our food system.

Processing has been the topic of additional critical review with its concentration in large single site facilities raising alarm bells. At the time of writing Scotland's only pig abattoir is closed after an outbreak of COVID-19 infecting 19 workers. The disruption to the supply chain is serious and follows both closures of large abattoirs due to outbreaks and general reductions in abattoir capacity as a result of social distancing measures impacting their operations. Similar patterns have been seen around the world, for example in the U.S. (The Global Voice of the U.S. Pork Industry, 2020). Cascading effects put pressure on livestock farmers. Modern livestock farming systems are highly geared to supply animals of precise specifications for automated production lines in abattoirs and for onward processing. Even a few weeks delay can render livestock unusable in the regular supply chain, particularly pork and poultry, and farmers can be left with little option other than to reduce production with many facing bankruptcy. A return to more decentralized, state subsidized slaughtering including mobile abattoirs has long been on the agenda (All Party Parliamentary Group for Animal Welfare, 2020) and COVID-19 has advanced the cause.

Alongside logistical and operational fragilities the shock to the food system has encouraged reformists pushing for more sustainable food and agriculture. The twin disruptions of COVID-19 and Brexit have advanced the reform agenda with replacements for current farm subsidy arrangements (based on the Common Agricultural Policy) urgently needed. Some advocate greater food democracy by decentralizing characteristics of food systems to reduce some of the vulnerabilities that lead to insecurity. A food democracy policy framework for food systems, it is argued, offers the opportunity to redesign the food supply chain around greater sustainability and local and regional production by building stronger direct links between retailers and local farms (Petetin, 2020). A Green Recovery is also heralded as a route whereby the country can build its way out of a COVID induced recession with high environmental

values at the heart of food and agriculture policy. Questions about our future policy direction abound with the sense that we are at a critical juncture with, on the one side an opportunity to put people and the planet's well-being at its heart and on the other a return to unfair, unhealthy and unsustainable practices in the name of economic recovery at any cost (Benton, 2020).

Third Sector

Civil society has been significantly important to buffer the crisis for the most vulnerable groups of society. Support activities by charities, associations and other NGOs have been very varied but some of the areas of work are presented here.

Food security and food banks.

There are a number of charities and organisations in the UK which mainly focus on food security and stopping hunger through food banks and other activities. For the literature reviewed here, the use of food banks has been rapidly increasing in the last decade and since the pandemic the demand has been growing steeply and so have the activities of charities.

The Trussell Trust, which runs about 60% of food banks in the UK, reported an increase of 74% in the last 5 years on the use of the charity food bank network (Trussell Trust, n.d.). Lack of governmental responsibility for households' food security and public health has been increasingly transferred over to individuals, charities and businesses (Tait, 2015). Households using food banks were in financial vulnerability with an average income of £319.43 per month (Loopstra and Lalor, 2017) "…*food banks are no longer just an emergency source of food and have become a regular supplement for some people experiencing severe food insecurity"* (Loopstra, 2018).

From April 2019 to March 2020 the Trussell Trust distributed 1.9 million three-day emergency boxes, an 18% increase from previous the year. The Independent Food Aid Network (IFAN) reported an increase of 177% from May 2019 to May 2020 in the number of emergency 3-day food parcels distributed by 191 independent food banks (IFAN, 2020).

Other charities also reported intensive activity during the pandemic. The Country Food Trust, (n.d.) Food Power (n.d.) and Cyrenians have ramped up charity appeals, foodbank activities, food distributions, increased their local community activity. The Larder and Cyrenians both increased the preparation and delivery of meals, the latest through converting their Community Cook School into a kitchen, producing over 5000 meals a week (Scottish Housing News, 2020; The Larder, 2020). The Leith Community Crops in Pots restructured to set up a system of over

70 volunteers who grew, prepared and delivered healthy food to vulnerable people in the community (Leith Community Crops in Pots, n.d.).

Other charities, Feeding Britain for instance, have opened a number of social supermarkets, where low-cost food and other essentials are available for local communities (Feeding Britain, n.d.).

Trussell Trust forecasts a 61% increase in food parcels needed across the UK from October to December 2020. Massive unemployment and increase in poverty with 6,700,000 additional people classed as destitute and unable to afford essentials of housing, energy and food translates into more need for food banks and Government support. This is starting to be evident in food bank with the arrival of middle-income families, these are the "newly hungry" who have been forced to use food banks (Butler, 2020).

Children and Young people support.

Different organisations have been ensuring that vulnerable children have food. In August, UNICEF, in partnership with the Food Power programme, launched their first ever domestic emergency response programme in the UK, to provide food support for vulnerable children. They coordinated local responses and ensured that the support systems of vulnerable children are bolstered (UNICEF, 2020).

Support for this action has been significant. Edinburgh Community Food has set up specific services to provide food to children during school holidays (Edinburgh Community Food, n.d.). Magic Breakfast have launched a massive fundraising campaign 'Keep Breakfast Going' (May 2020).

In written evidence to Parliament, the First Steps Nutrition Trust highlighted that food for babies and infants had not been protected sufficiently, exacerbating the poor support for breastfeeding mothers in the UK. They also argued that the food supply chain should not be left simply to market forces as this results in malnutrition for disadvantaged children (UK Parliament, n.d.-a).

The Soil Association, LACA and Bite Back called on the government to extend free school meals through the school holidays (Laca, n.d.). They also called for fundamental change to the UK food supply chain as part of national recovery (Bite Back, 2020). Bite Back also launched the Hungry for Change campaign [clxxxii] and called for free school meals to be provided year-round and for food voucher systems for low-income families (Bite Back, n.d., UK Parliament, n.d.-b).

Shortening the supply chain.

Another important role played by civil society has been shortening the supply chain by enabling direct contact between producers and buyers and supporting locally sourced food. A number of organisations have included training for social media marketing and production under lockdown webinars, which helped to build resilience. Some examples of that are the work by Sustainable Food Trust about producing information on networks of local and sustainable food suppliers, to accelerate localisation of food production and distribution (Sustainable Food Trust, n.d.). Food Power acted to connect local communities with suppliers, coordinate local responses and share best practices and information resources (Food Power, n.d.). The Sustain alliance, in addition to food distribution, has formed networks of farmers, growers and markets and supply chain information (online lists of markets, shops and suppliers who can connect with one another) (Sustain, n.d.).

Capital Growth, London's largest food growing network, has increased their level of coordination and information sharing amongst and between growers (Capital Growth, n.d.). The Soil Association Scotland bridges information on direct sellers of produce and small to large customers (including local authorities) who have been sourcing food more locally (Soils Association Scotland, n.d.). Open Food Network has bridged growers and customers, incorporating direct pick-up and delivery using a fleet of vehicles (Open Food Network UK, n.d.).

Representing Society.

NGOs are managed by and for civil society. In this sense, some charities have strongly criticised the food system and its capacity to feed nutritiously the Nation without damaging producers and the environment.

Some of these organisations and charities such as Sustainable Food Trust which will strengthen their insistence towards the promotion of local supply chains and circular farming systems, argue against increased agricultural intensification because it raises the risk of diseases, soil erosion, and reduced animal welfare (Holden, 2020c, Rowe, 2020). The Food Climate Research Network, which "conducts, synthesises, and communicates research at the intersection of food, climate, and broader sustainability issues", created new metrics that the

food industry should be using to track sustainable and healthy food systems. They have assessed different retailers and dining chains (Table, 2020).

First Steps Nutrition Trust argued that the food supply chain should not be left simply to market forces as this results in malnutrition for disadvantaged children. The Trust has adopted a more vocal stance in response to Government policies and actions/inactions during the pandemic (UK Parliament, n.d.-a). Along the same lines, the Food Foundation published information that obliquely or directly criticises political responses to the pandemic's support for feeding children during the school holidays or providing financial support for food banks (Food Foundation, n.d.). The Bite Back charity released a report that challenges the government to improve our food supply and to ensure healthy food to all young people (UK Parliament, n.d.-b). The Soil Association published a resilience road map to make farming and food distribution more resilient, environmentally sustainable and equitable (Soil Association, n.d.).

NGO's support to industry.

Other organisations' purposes are to help producers and the food industry. For example, Seafarers UK created a COVID-19 emergency fund of £2 million of which 25% was dedicated to support the UK coastal fishing fleets so as to assist fishing communities across Britain (Seafarers Charity, n.d., May, 2020a). The National Beef Association has been working to produce evidence on how to help UK beef producers, and also has been integrating this evidence into reports and public statements calling on the UK government to adopt better practices to provide support and improve national food security (National Beef Association, n.d.). The Royal Academy of Culinary Arts supported businesses, communities and individuals operating in the hospitality industries (Royal academy of culinary arts, n.d.). Also, the Institute of Grocery Distribution, a research and training charity in the food and grocery industry, helped with COVID-related news and information sources (IGD, n.d.).

Dissemination of Information

During crises, facilitating, digesting, disseminating and bridging information are essential to help society to develop strategies and buffer shocks. In this sense, charities are a trustable source of information to many people. During the pandemic, charities recollected, passed on and bridged information amongst the different stockholders. Some examples are: Red Cross-FareShare, The Catholic Church and Inter faith Network have been carrying out research and disseminating information (The inter faith network, n.d.); Edinburgh Community Food (n.d.) facilitated information about government vouchers, other schemes and food preparation and healthy eating; Urban Roots developed a map of where free food parcels and free meals could be obtained in Glasgow, and information about financial support (Urban roots, n.d.). Feeding Britain informed about a large sum of money meant to provide free school meals to disadvantaged children (over £88 million) that were missing, much of which appeared to have been retained by local authorities and private catering companies (Feeding Britain, n.d.).

NGOs' adaptation during the pandemic.

Charities and food bank organisations have been working hard to realign their systems and operations to keep up with demand, and to provide support as needed. Some of the issues were closures and being short-staffed (many volunteers are elderly), but most have been able to adjust their operations to stay active (Trussell Trust, 2020a). Charities appealed for additional volunteers to cope with increased demand on their services and seeking volunteers from the furloughed workforce when this was in place (Bread and butter thing, n.d., BBC, 2020b). Adaptation to new conditions and to following rules of lockdown have forced charities to adopt new ways to work such as e-referral systems and new delivery systems to allow people to follow social distancing guidelines while receiving support (Trussell trust, 2020a).

Some food companies have traditionally provided charitable support but have had to reduce this due to closures of their own outlets. For example, The Pret Foundation in partnership with FareShare has provided surplus food for 25 years. As a result of many Pret a Manger outlets closing during the pandemic, the Foundation has launched a major fundraising campaign to cover the shortfall of food supply. This issue may also be seen in other cases where a business's charity arm suffers due to the loss of income from the main company (FareShare, 2020a). The Pret Foundation has set up contactless charity donation devices in several Pret A Manger shops. This has been done in collaboration with GoodBox, a company that provides charities with digital fundraising tools. Several charities have taken advantage of GoodBox services to adjust their donation systems during the pandemic, particularly

as the number of people going into shops has dropped. Islamic Relief have developed guidance on how to provide food support to vulnerable people in local communities (Islamic relief, n.d).

Finally, charities and other organisations coordinated their activities in order to respond to food demands. For instance, the Bread And Butter Thing provides members with greatly discounted food supplies, through donations and volunteer activities. They have been coordinating with other local charities such as food suppliers to provide a more integrated service, including home delivery and voucher systems (Bread and butter thing, n.d.). FareShare has signed up 25% more food-related businesses than before (150 new organisations) to coordinate the donation, transport and provision of surplus food to charitable organisations. Their coordination efforts have been greatly increased during the pandemic (FareShare, 2020b). The National Emergencies Trust (Red Cross) signed up 80,000 new volunteers and in May partnered with FareShare to coordinate food deliveries and other support. The Catholic Church coordinated Catholic schools to set up emergency food relief schemes (ICN, 2020). The North Glasgow Community Food Initiative secured funding for the Scottish Government Supporting Communities scheme and increased coordination with other community organisations to respond to demand (Glen, 2020). Coordination was also increased between charities and private businesses. The Iceland Foods Charitable Foundation have set up pandemic-specific appeals and joined The London Funders from across sectors to sign a joint statement pledging to offer support to civil society groups affected by the coronavirus outbreak. This highlights some of the higher-level coordination that is taking place alongside traditional government roles in supporting the population.

Food System Finance

Business and industry support

As of December 2020, the Office for Budget Responsibility (OBR) reported an estimated £280 billion of support under different policy and support options available during the pandemic (https://obr.uk/box/the-rising-cost-of-the-coronavirus-policy-response/). Support has been reported in 6 main categories: welfare spending, business support, loan and guarantees, employment support, public services, other tax support (Figure 17).

Analysis of the uptake of the Coronavirus Job Retention Scheme (CJRS) within the agriculture, forestry and fishing sector (AFFS) until June 2020 shows that £86 million has been claimed (Figure 18). Claims had been made by 9,400 employers, with a take up rate of 28%, equating to ~35,800

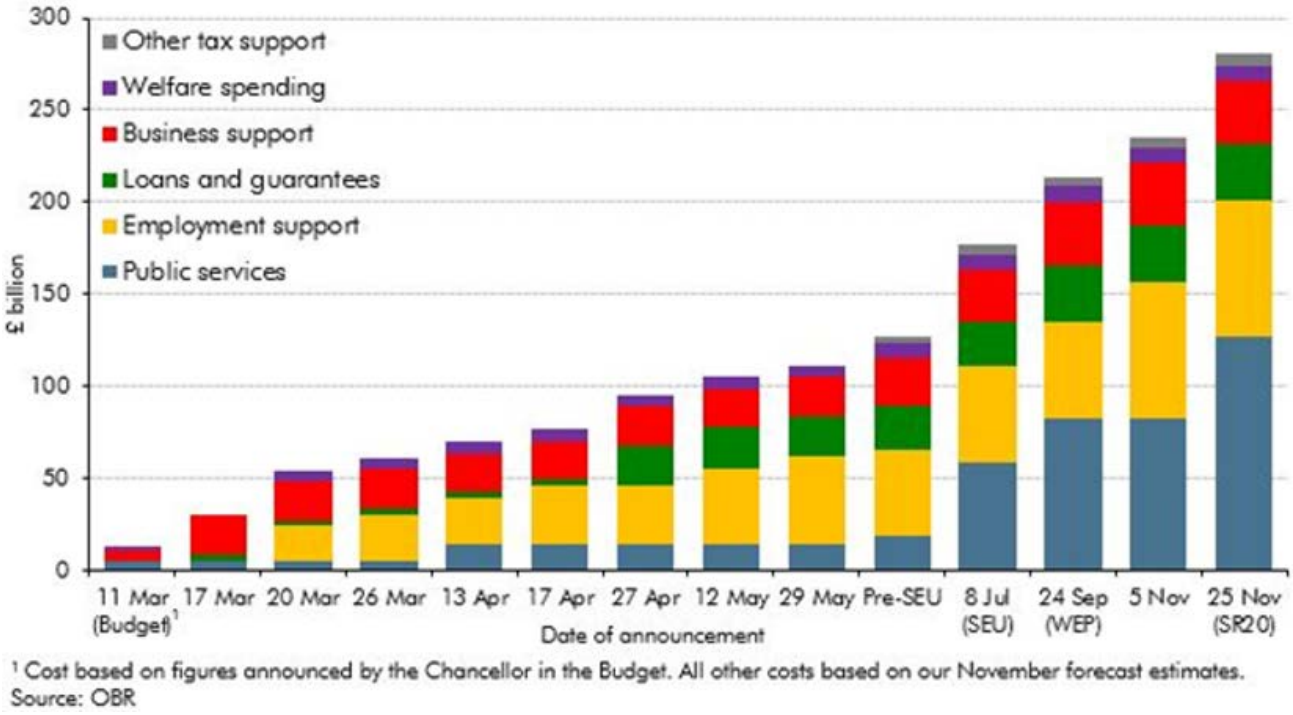


Figure 17. Types of support, and value, across the UK provided in response to Covid-19 (to December 2020).

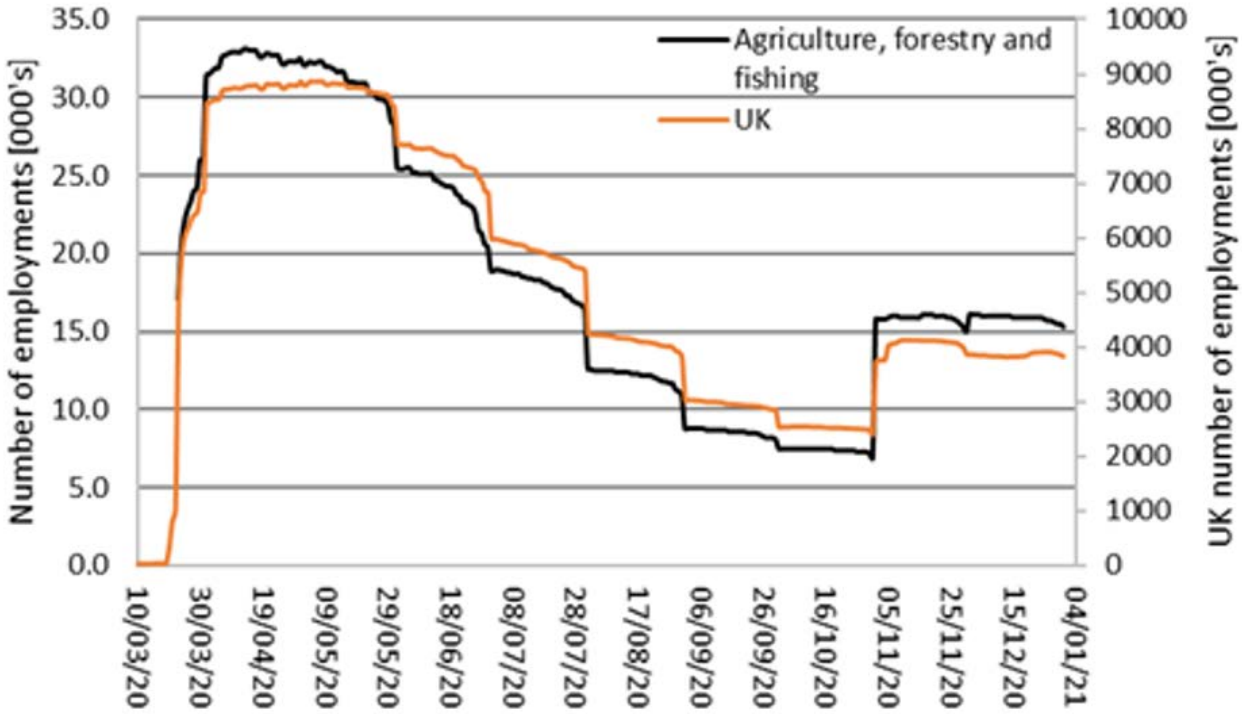


Figure 18. Daily number of employments furloughed across the UK (right axis) and in the agriculture, forestry and fishing sector (left axis).

employments (https://www.gov.uk/government/publications/coronavirus-job-retention-scheme-statistics-july-2020/coronavirus-job-retention-scheme-statistics-july-2020).

Approximately 238,000 people within the AFFS were eligible for support through the Self Employment Income Support Scheme (SEISS). From those eligible 26,000 made claims up to the 31st December 2020 with a total value of £80 million and an average claim of £3,000. Distribution of the £80 million across the UK saw ~61% claimed in England, ~11% in Wales, ~14% in Scotland, and 14% in Northern Ireland (Table 4).

In addition to the job retention schemes other national and regional government schemes allowed access to loans and grants (Table 5). Financial support schemes fell into 2 categories, general support (such as the Coronavirus Business Interruption loans) or sector specific support (dairy, agriculture etc.). Support varied significantly

Table 4. Claims from the agriculture, forestry and fishery sector under the self-employment income support scheme across the UK (Figures from UK Government SEISS scheme statistics, January 2021).

Region	Total potentially eligible	Number of claims	Value of claims (£)	Average claim value (£)
England	**67,100**	**15,900**	**48,700,000**	**3,100**
North East	3,400	900	2,900,000	3,100
North West	9,000	2,100	6,000,000	2,900
Yorkshire and Humber	8,300	1,900	5,800,000	3,100
East Midlands	7,000	1,500	4,600,000	3,100
West Midlands	8,700	2,000	6,000,000	3,000
East of England	6,700	1,500	4,900,000	3,300
London	1,000	500	1,600,000	2,900
South East	7,000	1,900	5,800,000	3,100
South West	15,800	3,600	11,000,000	3,100
Wales	**12,900**	**3,500**	**9,200,000**	**2,600**
Scotland	**13,700**	**3,100**	**10,900,000**	**3,600**
Northern Ireland	**13,200**	**3,900**	**11,100,000**	**2,800**

Table 5. Financial support available to food producers and processors within the United Kingdom.			
Country	**Sector**	**Support value**	**Notes**
United Kingdom	All	-	Coronavirus Business Interruption Loan Scheme – Loans to small and medium sized businesses of up to £5 million
		-	Coronavirus bounce back loan – aimed at small to medium sized businesses (loans of between £2,000 and maximum of £50,000 (loan can be no more than 25% of turnover)
England	Dairy	-	Dairy Hardship Fund – Access up to £10,000 (cover lost income in April and May 2020)
Northern Ireland [1]	Dairy	£11 million	
	Beef	£7 million	
	Sheep	£232,000	
	Potato	£1.6 million	
	Ornamental horticulture	£1.6 million	
	RESERVES	£3.6 million	Held in reserve to address additional issues and challenges that COVID-19 may present in the future
Scotland [2]	Fishing	£9 million	Support businesses that have encountered hardship
	Seafood processing	£5.6 million	128 applications from vulnerable processors
	Aquaculture	£3 million	Support those at financial risk
Wales	All		Changes to Rural Payments Wales service
	Farming and food manufacture	Economic Resilience Fund – Phase 1	Total of £47.7 million awarded: Farming received ~£199,000; Food and drink manufacturing ~£621,000 [3]
		Economic Resilience Fund – Phase 2	Total of £42.4 million awarded: Farming received £80,000; Food and drink manufacturing £298,000 [4]

[1] https://www.daera-ni.gov.uk/publications/covid-19-schemes-agriculture-and-horticulture-sectors

[2] (Scottish Government, 2020a)

[3] (Welsh Government, n.d.-a)

[4] (Welsh Government, n.d-b)

between regional governments with Northern Ireland specifically supporting 5 sectors compared, more than other regions (Table 5).

Public support specific to food

In addition to the financial support provided to the business sector through the SEISS and the CJRS other funding was made available for those struggling to feed themselves. Financial support to front-line food aid charities in England of up to £100,000 was opened on the 11th May 2020 with a total value of £3.45 million however due to the demand was closed on the 16th June. Applications were assessed by the Department for Environment, Food and Rural Affairs (DEFRA) with funding aimed at easing the demand from vulnerable people for food, following assessment of the applications 65 charities were supported through this (Gov.UK, 2020i).

A further aspect in terms of primary food production security is that many farming communities also rely on secondary incomes from additional employment, particularly in tourism, to support their business incomes. The loss of revenue from secondary incomes may have longer-term consequences on the ability of farm businesses to invest.

Commentary

The pandemic and its many and varied impacts on the food system present challenges in respect of how we view food and nutrition security in the future and how it is defined in a developed country such as the UK, and hence how policies may be developed to reduce risks of insecurity. Clearly there has been a substantial increase in those who have experienced food insecurity, against a backdrop of a society where many others have not. Nationally produced and imported supplies and food prices have remained relatively stable (compared to previous price spikes in 2008 and 2010), despite the difficulties presented by the pandemic, hence national food insecurity has not been threatened

by availability issues. What we have seen is a demand side shock set against a disrupted but still functioning supply side.

We have an overall food systems strategy based on efficiency and cheapness, with the objective of providing food profitably to those businesses providing it, and yet affordable to as many people as possible. Here we need to distinguish between food supply and nutrition, given the clear problems associated with poor diet and highly processed foods. The pandemic shock has highlighted the pre-existing vulnerabilities for those on low incomes and facing risks of food insecurity, even when cheap food is available. The pandemic should have taught use the real value of food, but there is a real risk that the shock has not been severe enough to cause a large-scale change in the food system. The ability of the global food system to maintain food availability, and for some people continued ease of economic access, during the pandemic poses a dilemma: evidence of the ability of the system to continue indicates that it is resilient, yet the original concerns about it in respect of inequalities, lack of accounting for environmental and health costs remain. How we define resilience of the food system is therefore essential. The food system, and therefore national food and nutrition security in the UK, has been resilient to the pandemic thus far and hence in the short-term, but that does not mean it will remain resilient in the long-term to other pressures, particularly climate change, biodiversity loss and ecosystem degradation.

There will be increasing pressures on food production sources that enables the UK's food security, including domestically additional land use competition for food, biofuels, carbon sequestration (woodlands), protected area status and urban expansion, or over-exploitation of marine resources, set against a changing climate and increasing global demand. The pandemic has presented a unique occasion to pause and reflect on the food system structure and future challenges, hence a rare opportunity to re-think the structure and purpose of the food system and how we re-align it to emerging needs and future production realities.

Conclusions on UK Food and Nutrition Security

The UK overall has remained relatively food and nutrition secure this far into the pandemic (June 2021) with production and imports maintaining supply sufficiently well enough to prevent availability issues. However, there has been a substantial difference within society in respect of physical and economic access to food. The proportion of those experiencing food and nutrition insecurity has greatly increased due to loss of income from people being made redundant, lack of employment opportunities and increased care responsibilities. Those already on low income or with mobility difficulties have experienced increased food and nutrition insecurity. Thus with adequate supply having been maintained, it has been the affordability of food and difficulties in physically accessing it that have increased the numbers of those who are food insecure.

The main conclusions are:

- The food system has been able to function during the pandemic shock in that it has maintained food availability and prices have remained relatively stable.
- In respect of the four pillars of food security (availability, access, utilisation and stability), economic access due to reduced or lost income has been the key driver of increased food insecurity, exacerbating already large inequalities:
    - **Availability:** Food production levels, reserves and food system supply chain infrastructure have so far remained stable and able to meet demand. Most key food types have remained available.
    - **Access:**
        - **Economic access:** People already on low incomes and those who have experienced loss of income have experienced severe economic and physical access difficulties. Hunger and malnutrition are more strongly related to job loss and income reduction than with food supply chain disruptions.

        - » This has been more evident in later waves of the pandemic as economic impacts have worsened.
        - » Foodbanks increased activities and allowed physical and economic access for vulnerable people and large numbers of new users, but are not able to meet all needs. Free school meal provision has increased by 300,000 in a year according to the Department for Education. A lack of coordination, contingency plans and preparedness from Government for food provision was largely balanced by civil society activities.
        - » Government financial support responses (Plan for Jobs) helped protect income for c. 11 million people, helping to reduce the numbers exposed to food insecurity.
        - » Food prices remained relatively stable after an initial increase on groceries inflation after March 2020. However, indications are that UK and global prices are increasing (April 2021).
    - **Physical access:** difficulties due to the need for social distancing and movement restrictions have meant the most vulnerable, particularly those with illnesses and disabilities have experienced greater difficulties in accessing food and nutrition.
- **Utilization:** food purchase, preparation and consumption behaviors have changed during the pandemic: evidence indicates both improvement in diet in some parts of society, but a deterioration in others, particularly those already on poor quality diets.
    - Significant changes during Covid-19 were reported in where and how people prepared and ate food and in the types of food eaten.
    - The restrictions on hospitality meant a large shift to more home consumption and less consumption away from home, with substantial impacts on supply chains.
    - Significantly more people became anxious about having enough food to meet their needs during Covid-19.
- **Stability:** The immediate prospects for continued stable availability are reasonable, but there are increasing risks from lack of economic access for low-income people.
    - The duration of a shock is a key aspect of the threat to stability: at the time of writing 13 months had elapsed since the start of the pandemic and availability of food has remained stable. However, continued duration and the risk of additional shocks (i.e., due to climate impacts) will exacerbate an already stressed food system.
    - Primary production in 2020 in the UK experienced a substantial decrease in yield due to exception weather conditions (wettest February, sunniest May and dry spring, Storms Ciara, Dennis and Jorge resulting in flooding).

- Has the UK become food insecure?
    - Our assessment is that as a whole the UK has not been food insecure during the pandemic, **however** a substantial segment of the population have experienced food and nutrition insecurity, primarily through loss of income restricting economic access to food.
- The pandemic has exacerbated an already large inequality in food and nutrition security and diet quality within the UK, risking the development of a two-tier food system and further increasing inequalities.
    - There have also been inequalities in impact in respect of the scale, type and location of food businesses, with some local supermarkets, on-line and takeaway businesses experiencing gains whilst rural and urban eat-in small businesses having losses.
- Disruption caused severe impacts on some food businesses and their processes, operations and financial viability, but not to the extent to risk severe national food and nutrition insecurity:
    - Disruptions to the availability of food in the first wave of the pandemic were primarily due to changes in demand and readjustment of logistics within the supply chain.

- There have been large variations in impacts between different food producers and sectors within the food system.
- Primary production experienced disruptions due to labour availability limitations.
- Initial price inflation occurred due to reductions in retail discounts.

- Supply chains:
  - The transport and logistics sector was able to adapt to enable continued functioning of the supply chains, despite severe labour and practise restrictions.
  - There was a shortage of warehousing space due to an imbalance between outbound non-essential goods slowing or stopping, whilst inbound flows from imports to the UK continued.
  - Significant changes in purchasing behaviour during Covid-19 compared with before included ways in which people obtained food, sources of buying food, frequency and types of food purchased.
  - Shortening supply chains connecting local producers to local consumers was facilitated by civil society activities, helping to alleviate some pressures on low-income consumers.

Outlook

- There are indications of sustained food prices increasing globally, which coupled with economic downturn, will exacerbate existing inequalities between being food secure and insecure, both in the UK and globally.
  - Those people already experiencing food and nutrition insecurity in the UK due to economic access difficulties are likely to be even more at risk if prices continue to increase relative to income support.
- Differences in vaccination rates between countries and emerging new coronavirus variants may mean a potential phase of further COVID-19 waves in countries exporting food to the UK, which may increase shortages and exacerbate food price increases.
- The global food system has thus far been able to adapt to the pandemic, but care is needed to avoid entrenchment in a system that is not resilient to the long-term threats from climate change, biodiversity loss and ecosystem degradation.

Risk Assessment – conclusions

- Food production globally in 2021 currently has a stable outlook (in the absence of any other type of shock), hence food availability may not be reduced. **However**, economic access for an increasing number of people is likely to worsen leading to greater levels of food insecurity and wider inequalities both in the UK and globally.
- In developing response strategies to the pandemic impacts on the food system, governments and key food system actors need to avoid the risk of exacerbating the problems associated with the cheap food paradigm (push for efficiency and cheap food without including health and environment externalities costs) in aiming to make food more affordable for people on low incomes.
- Under the definitions of food and nutrition security, the pandemic is a relatively short-duration shock (as opposed to long-term threats such as climate change) hence the response to COVID-19 is an indicator of short-term food system resilience. **However**, this does not imply that the food system is resilient and sustainable to other types of shock (i.e. climate extremes) or long-term deterioration (i.e. ecosystem degradation). The system (in the UK) has adapted and coped to enable food and nutrition availability, but this should not be seen as a sign of overall food and nutrition security resilience.

Recommendations

UK Government support for vulnerable people:

- Income support for people on low-income is more likely to reduce risks of increasing food and nutrition insecurity given the potential rise in global food prices.
  - Improved schemes are needed to ensure guaranteed access to sufficient food for a healthy diet.
  - Support physical access by the most vulnerable.
- The role of the Third Sector needs to be

supported more to help ensure those most exposed to food insecurity are better protected.

- There is need to develop strategies to manage how and when reductions in retailer promotions (withdrawn) are implemented, as this can influence grocery inflation rates and limit access to cheaper food by those on low incomes.

UK Government preparedness:

- Improve awareness of types of vulnerabilities, sources of threats and understanding of risks.
- Invest in capabilities to improve foresight and response preparation.
- Improve the culture of contingency planning and preparedness within governance to plan for single and multiple synchronous extreme events as well as long-term change.
    - The level of preparedness needs to be commensurate with the scale of risk and severity of potential impacts.
    - Utilise scenario planning and modelling to explore cascading risks and opportunities for mitigation.
- Work with key stakeholders to develop adaptable contingency plans and associated required actions that can be rapidly implemented to minimise impacts.
- Communicate preparation and response strategies in advance to help facilitate rapid implementation.

Global and UK Government and business strategic responses to post-pandemic recovery:

- Aim to achieve improved food and nutrition security alongside long-term food system benefits for human health and environmental sustainability. This requires an improved rebalancing from the current focus on efficiency to one of resilience. A sole focus on only efficiency or resilience will be problematic: there is a clear need for efficiency but not at the expense of resilience.
    - Increase the diversity of food types and food systems rather than rely on a small number of crops, facilitate more diverse food markets including localised systems, diversify farm systems for multi-functional landscapes.
    - Buffer the food system to shocks by reducing dependency on the 'just-in-time' strategy and incorporate greater redundancy (i.e. through greater storage capacity) and flexibility (ability to switch between suppliers, food types).
    - Improve UK diets for human health that also benefit the environment, with greater use of plant-based proteins, whole grains and less meat and highly processed calories.
    - Develop low waste systems and circular economy-based use of residuals.
- Care is needed to ensure post-Brexit trade deals do not exploit food exporting countries where slow vaccination programmes mean potential further COVID-19 waves.
    - Need to ensure trust in trade is maintained in case of further global food price rises.
        - Improve transparency i.e. AMIS trade reporting.
    - Aim for environmental standards equivalence to reduce ecosystem impacts, i.e. through the Trade and Agriculture Commission.
- Maintain international cooperation on trade to prevent export restrictions.
- Integrate food system realignment for human health and environmental sustainability goals to with parallel objectives of the Sustainable Development Goals, including poverty reduction, greenhouse gas emissions reduction, ecosystem restoration and biodiversity enhancement.

Global and UK Government and research to improve knowledge:

- Improved and integrated climate-crop response, disease outbreak monitoring and modelling to identify production shock risks early (i.e. assessing teleconnection impacts of El Niño - La Niña events and other phenomena).
- Improve integration of global and UK datasets on production and trade (imports and exports) and forecasts to provide clearer real time indicators of production, stocks, demands and prices. The current emphasis of statistics presentation is on economic value, not food and nutrition security functional value.
    - There is need for better data on the nutritional functional value of food trade, rather than on monetary value and volume.

Make available nutritional value data, including micro- and macro-nutrients.

- Improved monitoring of food production, reserves and supply globally will help identify risks, bottlenecks and pressure points.

Food System Sector Summary

The overall food system has shown itself to have adapted and coped with the pandemic shock, though there are many exception examples where businesses, particular food types and parts of the food system have been severely impacted.

- **Producers:**
  - Overall supply (UK and international) has managed to meet demand.
  - Labour shortages impacted production and ability of businesses to function whilst labour costs increased.
  - Changes in demand (closure of hospitality, type of produce consumed) required readjustment of business models, to which the sector was adaptable.
- **Processors:**
  - Food processing industry has managed to meet changing demands by accessing new markets (e.g., online) and creating new strategies (e.g., adapting packaging to retail)
  - The sector was severely impacted by outbreaks which incurred considerable costs and changes to procedures.
  - Labour shortages were reported and a disproportionate number of low-income employees exposed to risks.
- **Retailers:**
  - Consumer behaviour led to increased sales of food and some retailer revenues.
  - Initial reductions in discounts by supermarkets led to price inflation.
  - Hospitality restrictions have threatened many businesses and changed current consumer behaviour.
  - Original advanced preparation by retailers for potential shortages due to Brexit helped reduce pandemic impacts.
- **Logistics and transport:**
  - Movement and storage of goods was severely impacted due to disruptions because of labour and warehousing shortages and cross-border restrictions.
  - Airfreight decreased initially but increased due to restrictions on shipping, road and rail.
  - Despite severe impacts, the logistics and transport infrastructure has helped to maintain food availability.
- **Upstream supply chains (production facilitation):**
  - The provision of supplies and services (fertilisers, veterinary etc.) to enable primary food production was able to continue with limited impact on primary production.
  - Changes in public consumer food demand and behaviour had little immediate impact on the pre-production up-stream sector.
  - On-farm practices often use lone-working approaches so less impacted by social distancing restrictions.
- **Research and academic perspective:**
  - Highlighted the vulnerabilities of the 'just in time', economic efficiency driven food system.
  - The pandemic has confirmed the already identified flaws in the food system in respect of inequalities and lack of inclusion of externality costs (health and environment).
  - Whilst the food system may have adapted and coped with the pandemic shock (in the UK), this shouldn't be seen as a sign of system resilience.
- **Policy and food system governance:**
  - Job retention (c. 9.9 million) and other employment protection schemes favoured those already in employment and limited the number of people exposed to loss of income, hence reducing exposure to food and nutrition insecurity. However, many self-employed or on zero-hour contracts were ineligible for support and many of those reliant on social provision have found support to be insufficient.

- The need for lock down policies has resulted in various business sectors shutting down or closing and hence large numbers of people losing income so exposing them to food insecurity.
- Measures focussed on the food system have generally enabled it to function, including recognising people producing and distributing food as key workers.

- **Third sector:**
  - Civil society has been crucial in helping to alleviate pandemic impacts on food and nutrition security, at a time when there was already a substantial reliance on third sector support, through food banks, dissemination of information, coordination of efforts and support to industry.
  - Charities and NGO's have had to adapt rapidly to cope with the impacts but have often experienced great difficulties in the ability to operate and secure funding support.
  - The pandemic has highlighted weaknesses in the food system, particularly in relation to the number of people vulnerable to food insecurity, that the third sector had already made clear.
- **Food System Finance:**
  - Compared to other areas of the economy, overall the food sector has been less impacted financially (with the exception of hospitality businesses) due to continued demand and ability of the production, logistics and transport, processing and retail sectors to operate.
  - A high percentage of self-employed within the agriculture, forestry and fishing sector (AFFS) meant c. £80 million claim value in the UK under the Self Employment Income Support Scheme. The number of people furloughed in the AFFS was similar to the whole UK economy.

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