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United Kingdom Agricultural Production and Trade Policy Post-Brexit

Jeremy Jelliffe, Adam Gerval, Megan Husby, Philip Jarrell, and Brian Williams

Abstract

The United Kingdom (UK) is an important regional agricultural producer with historical prominence in the global agri-food trade. Agriculture covers more than two-thirds of UK land, and top agricultural goods produced include animal products (beef, pork, lamb, poultry, and dairy) and grain (wheat, barley, and oats). Agri-food represents the largest manufacturing sector in the UK, which is known for specialty products. Over recent decades, the UK's membership in the European Union (EU) mostly defined the country's agri-food production and trade policies. After leaving the EU through Brexit, the UK is responsible for constructing agricultural policy and negotiating trade agreements. This report explores trends in UK agricultural production and trade and considers the historical UK-EU coupling and potential shifts in agri-food trade patterns post-Brexit.

Keywords: Brexit, United Kingdom, European Union, Europe, trade, regional food and agriculture productivity

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A report summary from the Economic Research Service

United Kingdom Agricultural Production and Trade Policy Post-Brexit

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What Is the Issue?

Brexit, the United Kingdom's (UK) departure from the European Union (EU), fundamentally changed the relationship between the UK and EU, leading to divergences in agricultural and trade policies. Almost five decades of membership in the EU helped shape UK agricultural production and trade policy. Post-Brexit, the UK's devolved approach to agricultural policy, after nearly a half-century of participation in the EU Common Agricultural Policy (CAP), means that each national administration (England, Northern Ireland, Scotland, and Wales) is responsible for its own agricultural policy framework and any ramifications for changes in agricultural production. Divergences between the four nations existed under the CAP; however, the absence of the EU's overarching framework has meaningful implications for the UK's post-Brexit agricultural policies. Trade agreements (TAs), on the other hand, are negotiated at the UK level by His Majesty's Government (HMG). Recent and ongoing trade negotiations indicate that the UK has begun to set terms directly with trade partners, though initially, the majority of TAs are EU agreements rolled over by the UK and various trading partners. Market issues that alter trade patterns, such as the border between the Republic of Ireland and Northern Ireland and the associated Northern Ireland Protocol, have affected trade between the UK and EU. In addition, Brexit has led to opportunities to expand UK trade relationships with non-EU partners.

What Did the Study Find?

The UK left the EU in 2020, which led to changes in the UK's agricultural production and trade policy. National agricultural policies are set by each of the devolved administrations of England, Northern Ireland, Scotland, and Wales, while trade policy is determined by HMG. Highlights from this report include:

- At the national level, differences in agricultural policy development (Northern Ireland, Scotland, and Wales) and/or implementation (England) range from continuation to the phasing out of EU-style programs and payments.
- Attention to the relationship between the agri-food sector and the environment is a shared feature of each national plan.

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- Agricultural research and development (R&D) investment and productivity growth is another shared policy aim. Historical investment trends led to a slowdown in associated productivity trends during the last decade. Relative to other European countries, UK agricultural productivity growth moved from the top quarter to the bottom quarter over this period.
- The UK negotiated TAs before and after Brexit, with the primary trend being the rollover of EU TAs (36 agreements representing 63 countries). Multiple new TAs were finalized with key partners (such as Australia and New Zealand), and additional trade talks continue with other possible partners, including the UK's application to the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP).
- The EU-UK Trade and Cooperation Agreement (TCA) incorporates some previous aspects of the customs union¹ and is reviewed every 5 years. Phase-in of the TCA by the EU was completed in January 2022, while the transition grace period for the UK was extended through 2023.
- The TCA eliminates tariffs on EU and UK produced goods, allowing for mostly free trade with few exceptions. These include rules of origin that require tariffs on some processed goods entering the EU from the UK (and vice-versa), as well as additional regulatory hurdles and nontariff trade barriers that present challenges to EU–UK agri-food trade, such as Scottish seed potatoes that cannot be exported to the EU or Northern Ireland because of the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) rules related to pest and disease issues.
- Accounting for agricultural and related products (e.g., forest products), the United States is the second largest UK trade partner and has maintained a trade surplus with the UK every year since 2000. Over the period from 2010–20, UK demand for U.S. forest products used in construction and power generation (e.g., primarily wood pellets, assembled casks, and hardwood lumber) increased on average by 17.7 percent annually.
- Overall, the UK is a net importer of agricultural goods, mainly from the EU, while China is the UK's third largest agri-food trade partner and experienced the greatest growth over the 5-year period of 2016–21, with frozen fish, prepared foods, and frozen vegetables as the top agri-food UK imports. However, China remains well below the EU and United States for exports to the UK.

How Was the Study Conducted?

This report draws on the following sources: (1) UK demographic, agricultural production, and trade data; (2) the USDA, Economic Research Service International Agricultural Productivity (IAP) data product; (3) UK trade agreements; and (4) agricultural policy documentation from the devolved administrations (England, Northern Ireland, Scotland, and Wales). Demographic and production data are available from the UK government and Eurostat. The Trade Data Monitor was used to generate relevant trade data. IAP provides indexes of aggregate agricultural inputs, outputs, and productivity. Descriptions of UK trade agreements and agricultural policy documentation from the devolved administrations are based on publicly available documentation.

¹ Under the European Union Customs Union (EUCU), there are no tariffs or other trade restrictions between members. In addition, the European Commission negotiates international trade deals on behalf of EUCU members.

United Kingdom Agricultural Production and Trade Policy Post-Brexit

Introduction

Agriculture and the broader agri-food sector are essential to the United Kingdom's (UK) economy. The UK is an important regional agricultural producer in the northern Atlantic Ocean with historical preeminence in global agri-food trade. Departure from the European Union (EU), known as Brexit, has significant implications for UK agricultural production and trade. Agriculture is central to the UK's relationship with the EU and has been a focus from UK's entry into the EU² to their active role in the EU Common Agricultural Policy (CAP) and during Brexit negotiations. Furthermore, the costs and returns from EU membership are closely tied to the CAP, which comprised about 40 percent of the EU budget in 2016 at the time of the UK's Brexit vote. Post-Brexit, the UK has taken control of its agricultural production and trade policy for the first time in nearly 50 years, though the country remains bound by existing international agreements. These developments raise questions about the future of the UK's agricultural sector. First, how will the replacement of the CAP address the multifunctionality of sectoral aims (e.g., farm viability and the environment)? Second, how will agri-food markets (producers and consumers) be affected by UK trade agreements?

Addressing these questions begins with establishing the UK context, basic demographics, membership, and departure from the EU, and an overview of trends in agricultural production and trade. A review of the relevant strands of the literature on Brexit and agriculture offers further context and analysis. This includes results from initial post-Brexit studies that document early effects on the agri-food sector, particularly for trade. However, there remains significant uncertainty as principal post-Brexit policy details have yet to emerge, and given the slow-moving nature of the sector, it could be years before the effects of Brexit on UK agriculture are revealed. Thus, stated and potential developments—from short- to long-term—are reviewed in the context of the evolution of Brexit over two extended periods: (1) the short-term aspect beginning with the lead up to the UK's departure from the EU in 2020 following the Brexit referendum in 2016, the concurrent Coronavirus (COVID-19) pandemic, and attributing early observed trends to Brexit; and (2) the middle-to-long-term view that considers the enactment of UK agricultural policy and trade agreements, and prospective shifts that come from the reworking of the UK and EU relationship through Brexit. Going forward, the outlook broadens to reflect this uncertainty for the future while contending with the basic realities of leaving the EU CAP and single market³ and of evolving trade relationships with non-EU partners—especially for the United States and China, the next largest UK trade partners, as well as countries like Australia and New Zealand that have negotiated post-Brexit trade agreements.

² The UK joined the European Economic Community (EEC) that later became the EU.

³ The European Single Market enables the free movement of people, goods, capital, and services between EU member states, as well as Iceland, Lichtenstein, Norway, and Switzerland, with certain exceptions. The European Union Customs Union specifically addresses the free movement of goods between member states as a part of the European Single Market.

The United Kingdom, European Union, and Brexit

The UK is the third largest economy in Europe, following Germany and France. From 2007 to 2021, UK Gross Domestic Product (GDP) averaged \$3.01 trillion and grew at an average rate of 0.27 percent per year⁴ (USDA, ERS, 2022). In terms of geography, the UK comprises England, Northern Ireland, Scotland, and Wales (figure 1). While the British Isles encompass over 6,000 islands, the island of Great Britain (England, Scotland, and Wales) comprises over 90 percent of the UK's land area and includes each of the nations except

Figure 1

Map of the United Kingdom (UK) with delineation of nations and capital cities



Source: USDA, Economic Research Service.

⁴ Real GDP, 2015 base year; the 3-year average from 2015–17 is 1.55 percent, excluding 2020 and 2021 because of COVID-19.

for Northern Ireland, which is located on the island of Ireland. The UK is known for its temperate climate, characterized by warm summers and cool winters, moderated by warm Gulf Stream water and air currents originating in the Caribbean. Despite the relatively high latitude, the Gulf Stream provides good growing conditions for grain production in the form of barley and wheat, as well as pasture lands used in animal production, with just over 70 percent of UK land used for agriculture. Also, the country's extensive coastline (12th longest in the world) and associated fisheries provide an important foodstuff to the region.

Overall, 67.7 million people live in the UK, with the majority (84 percent) living in England and in urban areas (89 percent). The average individual income is between \$35,000 and \$42,000 annually (table 1). Data indicate that the UK population has a declining workforce with a growing proportion in retirement (ages 65 and over). By 2030, the share of the working age population is projected to shrink by 2 percent, while the share of the population that is 65 and older will increase by more than 16 percent (OECD Stat, 2021). The population has also shifted from rural to urban centers, a movement that has averaged close to 1 percent annually from 2015 to 2020.

Concerns over the availability of agricultural labor have been created by urbanization and a shrinking workforce, as well as a reliance on EU workers in the UK, especially in parts of the food and agriculture sectors (e.g., horticulture, butchers, haulage sector, and dairy) (House of Commons, 2022). While agriculture is a small contributor to the UK economy (less than 1 percent), broader agri-food production is the largest UK manufacturing sector

(Petetin and Dobbs, 2022); UK food industry output was valued at \$173 billion in 2021 (Vasquez-Nicholson, 2021). As of 2022, the combined effects of Brexit and COVID-19 resulted in a shortage of about 500,000 workers in the agri-food sector, which employs an estimated 4.1 million people (UK House of Commons, 2022). A subset of this shortage is seasonal agricultural labor to harvest crops, which has occurred at a greater rate than the broader sector, with an estimated 25 percent of labor needs met for the 2022 season and associated losses for fruit and vegetable growers estimated at more than \$70 million (Vasquez-Nicholson, 2021; National Farmers' Union, 2022). Also, about 80,000 EU seasonal farm workers enter the UK every year, and 67 percent of UK seasonal workers have previously come from Ukraine (Hill, 2022; Vasquez-Nicholson, 2021).

In addition to the UK's reliance on EU labor and services, the country is a large importer of agricultural and related products, as domestic production accounts for 60 percent of the food consumed in the UK (Vasquez-Nicholson, 2021). Strong trade linkages with the EU, from proximity, trade agreements, and prior membership (Customs Union and Single Market), offer access to export markets for UK products and the bulk of UK agricultural imports that are not produced domestically (e.g., fresh fruit and vegetables).

Table 1
United Kingdom demographics, 2020

Population (total)	67,195,769
Youth	15,678,174
Workforce	38,965,142
Elderly	12,552,453
Urban	83 percent
Rural	17 percent
<i>GDP (growth rate by year)</i>	
2017	1.74 percent
2018	1.25 percent
2019	1.43 percent
2020	- 9.85 percent
2021	7.44 percent
Individual income (median)	\$40,367
England	\$40,820
Northern Ireland	\$35,011
Scotland	\$41,353
Wales	\$37,010
Food cost (weekly mean)	\$51.62
At home	\$33.95
Away from home	\$17.68

Note: GDP = Gross Domestic Product

Source: USDA, Economic Research Service using data from UK Department for Environmental Food and Rural Affairs (Defra); UK Office for National Statistics (ONS); and Organisation for Economic Co-operation and Development (OECD).

EU membership, the Common Agricultural Policy, and European Single Market

The UK is one of the earlier members of the EU, joining the initial six members of the European Economic Community (EEC), along with Ireland and Denmark, during the first expansion in 1973. The EEC was established by the Treaty of Paris in 1957 and has expanded seven times since its formation, with the bloc becoming the EU in 1993 under the Maastricht Treaty and expanding to a maximum of 28 countries in 2013 with the addition of Croatia. Following the Brexit referendum in 2016, the UK formally seceded from the EU in 2020, the first and only country to do so. Post-Brexit, the EU comprises 27 member states with an additional 10 nations seeking membership (6 of these nations have achieved candidate status). Expansion over the last half century saw the EU become a major agricultural producer and trader.

A principal goal of Brexit was for the UK to regain sovereignty to control its laws and regulations rather than deferring a portion of that power to the EU (Murphy, 2021). At the same time, the conception of UK sovereignty under EU membership evolved from accession in 1973 through the UK devolution settlement into constituent nations in 1999, which was embedded in EU membership (Keating, 2022). The capacity for governance by the constituent nations functioning under the EU differs from a post-Brexit UK, where additional capabilities are necessitated for the devolved administrations. For example, the UK relies on EU institutions in the form of agri-food (CAP) and trade (Single Market) policies, whereby post-Brexit policies are enacted by the constituent nations' devolved administrations in the former case and by His Majesty's Government (HMG) in the latter. Thus, Brexit required the UK to develop capabilities to both effectively advocate for the needs of the constituent nations in the UK government (e.g., trade policy), as well as at the level of the constituent nations to develop and implement separate agri-food policies (Murphy, 2021; Keating, 2022).

Common Agricultural Policy

Establishment of the CAP in 1962 was a principal effort during the first 5 years of the EEC. The first version of the CAP mainly addressed food security in member countries following World War II and associated food shortages. The CAP and agricultural trade are important factors in UK-EU relations, from prior to joining, accession negotiations, as a member (including Brexit and EU-UK Trade and Cooperation Agreement (TCA)), and post-Brexit. Through the first decade of its implementation, the CAP comprised about 90 percent of the EEC budget. When the UK joined in 1973, the CAP share of the EEC budget exceeded 75 percent and remained greater than 50 percent until 2004 (EC, 2021a). In comparison with the broader EU economy, CAP expenditure is a small proportion of EU GDP, less than 0.5 percent since 2000. The CAP share of GDP declined steadily to 0.34 percent in 2021, at close to \$60 billion or a third of EU budget expenditures (EC, 2021b). Despite being less than a percent of the EU economy, the CAP share of the budget has made it central to EU negotiations.

Since its inception, the CAP has been reformed several times. The most recent version is “CAP 2023–27,” which takes effect January 1, 2023. Through various iterations, the primary components (i.e., pillars) of the CAP have been in place for more than two decades following the Agenda 2000 reforms (European Parliament, 2022). The two-pillar framework of the CAP allocates support payments to farmers directly (Pillar I) or in receipt of public goods, such as environmentally beneficial practices (Pillar II). Pillar I can be characterized as legacy CAP that provides direct support to farmers. Current support mechanisms under Pillar I differ from early CAP, which provided coupled payments and export subsidies to EU producers, as well as greater funding relative to current levels for agricultural research and development (R&D) to increase productivity. These early CAP mechanisms resulted in highly intensive production and environmental degradation (Petetin and Dobbs, 2022). To mitigate these effects, the CAP mostly decoupled payments from production and introduced greening programs to improve the environmental footprint of EU agriculture. As part of the 1992 MacSharry reforms, this coincided with EU accession to the World Trade Organization (WTO) and the removal of export subsidies.

Pillar II codified the greening of the CAP as a principal aim of EU agri-food policy while also providing funding for rural development programs (RDPs). Support for rural development, for example, and infrastructure investment (e.g., roads and broadband) could benefit farmers and the communities where they live. These investments

aid the operationalization of innovative farm technologies such as record keeping and connectivity of on-farm equipment. In this way, economic expansion (e.g., small business grants), social cohesion, and rural sustainability are components of RDPs under Pillar II (Petetin and Dobbs, 2022). A central part of Pillar II is the development of agri-environment schemes⁵ (AESs) that provide payments to farmers in receipt of public goods in the form of environmentally friendly practices. For example, setting aside land for habitat and buffer zones near environmentally sensitive areas (e.g., wetlands and waterways) or adopting less intensive production systems, such as no-till, which improve soil health, require fewer chemicals and fertilizers, increase organic matter (carbon sequestration), and reduce erosion.

Cross-compliance of Pillars I and II is another feature of the CAP that was established to achieve environmental aims. At least 30 percent of Pillar I support must be allocated in receipt of greening conditions under Pillar II. Furthermore, EU member states have autonomy under Pillar II to identify and define the RDPs and AESs that are best suited to their unique needs, subject to EU statutory management requirements (SMRs). Under CAP 2023–27, this autonomy has been further extended to Pillar I, whereby country-level CAP strategic plans are developed, revised, and approved in consultation with the EU governing body. However, from the early 1990s to the most recent CAP, environmental degradation has not been reversed, despite greening measures, cross-cutting, and the ability of EU members to set their own priorities under Pillar II (Petetin and Dobbs, 2022). To address urgent environmental concerns, the European Commission (EC) introduced the Farm to Fork and Biodiversity Strategies as part of the broader European Green Deal. Both strategies are separate from the CAP. However, provisions in the strategies have raised concerns over agricultural input reductions that could lead to decreased agricultural production, higher prices, and food insecurity, as well as barriers to agri-food trade with the EU in the form of mirror clauses (Beckman et al., 2020; 2022).

The UK advocated for CAP reform beginning with the process of joining the EEC up until Brexit (Gravey, 2022). UK-supported reforms included the reduction of CAP spending as a proportion of the EU budget and environmental provisions that began with environmentally sensitive areas (ESAs) under the EU Agricultural Act of 1986, to greening in the early 1990s, and Pillar II under Agenda 2000. Reflected in England’s post-Brexit agricultural policy slogan, “public money for public goods,” is another argument made by the UK for CAP reform; whereby “agriculture should be given support not because they farm, but because they provide public goods” (Gravey, 2022). The goal of the UK was to reduce the share of CAP funding to Pillar I by increasing support to Pillar II, which did not happen. However, autonomy over Pillar II and cross-compliance with Pillar I effectively shifts some resources to environmental aims. Under CAP, the UK extended CAP (Pillar II) autonomy to England, Northern Ireland, Scotland, and Wales (Petetin and Dobbs, 2022). Thus, post-Brexit UK agricultural policy set by the devolved administrations is a continuation of precedent established under the CAP.⁶ Over the 2–3 years immediately following Brexit, UK agricultural policy across all four nations prioritized stability in the farm sector by maintaining prior support under CAP and EU standards.⁷

The Single Market, Agri-Food Standards, and the Ireland Border

Another characteristic of the EU is the free movement of goods and services between member states facilitated by a Customs Union and Single Market. In the context of the agri-food sector, the 2002 EU General Food Law defines rules and requirements for the Single Market. It applies to the production and movement of agri-food products within the Single Market as well as EU trade policy and negotiations. Rules and standards applied to agri-food trade policy can take a variety of forms, from being broadly defined as technical barriers to trade (TBT) or nontariff measures (NTMs) to more specific cases of sanitary and phytosanitary (SPS)

⁵ The term “scheme” is often used in the UK to denote a policy, program, or plan. As is the case for AES, this CAP component is abbreviated through the remainder of the document, and/or the authors replace the term scheme with a suitable alternative where appropriate.

⁶ Post-Brexit UK agricultural policy is detailed in the short-term outlook section of this report.

⁷ Continuation of CAP-style programs is detailed in the short-term UK agri-food policy and trade section.

measures, such as maximum residue limits (MRLs) for agri-chemicals (e.g., pesticides). The Single Market also employs tariff-rate quotas (TRQs) as a measure to control some of the flow of imports into the EU. The adoption of such policies may be justified for a variety of reasons, such as to follow international agreements (e.g., the WTO),⁸ to minimize risk to agriculture from pests and diseases, or to follow established food safety requirements. In the case of TRQs, a primary goal is to meet international agreements by opening the market to outside goods while also retaining a level of protection for Single Market producers. The Single Market allows for the unrestricted movement of goods, but members are required to abide by EU standards.

Despite Brexit, the UK remains bound by Single Market rules in some cases through the EU-UK TCA.⁹ For instance, UK agri-food products exported to the Single Market must meet EU rules and requirements, such as production practices (e.g., animal welfare standards) and marketing (e.g., packaging and labeling). No longer a member of the Single Market, the UK faces new restrictions to trade with the EU. To limit restrictions, there is likely to be resistance in the UK to any move away from EU standards, especially regarding imports of hormone-treated beef and poultry that have undergone pathogen reduction treatment (PRT).¹⁰ This is especially relevant to alignment of SPS measures between the EU and UK as it relates to continued free trade across the Irish border.

The UK also remains a partial member of the Single Market because of the Northern Ireland Protocol (NIP) component of the TCA. To avoid a hard EU-UK land border on the island of Ireland,¹¹ the NIP established a special relationship between Northern Ireland and both the EU and UK. The NIP places conditions upon the movement of goods to and from Northern Ireland to maintain the integrity of Single Market rules and regulations, as well as some parameters on the development of Northern Ireland's agricultural policy (Petetin and Dobbs, 2022). In other words, Northern Ireland is subject to both UK and EU regulatory compliance (e.g., agricultural inspections at ports). In terms of EU compliance, the NIP introduced barriers to the internal movement of UK goods between Great Britain and Northern Ireland; for example, Scottish seed potatoes are banned by the EU, and by extension Northern Ireland, because of SPS measures.¹² Under the NIP, Northern Ireland continued to receive EU support (i.e., CAP) payments. The NIP should not hinder the development of agricultural policy by Northern Ireland based on the autonomy recognized by both the EU under CAP 2023–27 and the UK approach to devolved national policies (Petetin and Dobbs, 2022).

⁸ Application of these measures to UK trade is in the later section on short-term UK agri-food policy and trade.

⁹ The EU-UK TCA is described in the later section of this report on short-term UK agri-food policy and trade.

¹⁰ Hormone and chemical uses in food production that have been banned in the EU include pork and beef produced with growth hormone feed additives (e.g., ractopamine) and chicken dipped in a chlorinated solution to control for pathogens (i.e., pathogen reduction treatment (PRT)).

¹¹ Upholding the 1998 Belfast and Good Friday Agreements was an aim of Brexit negotiations for both the UK and EU; these agreements relied on the EU framework to facilitate an open border on the island of Ireland (Murphy, 2021).

¹² Internal SPS requirements are implemented in some cases of high risk to domestic production. An example in the United States, the movement of agricultural goods between Hawaii and other U.S. States that is monitored by USDA inspectors.

UK Agricultural Production and Trade

Production Profile

Output

Annual UK agricultural output value was over \$34 billion in 2020, with a 3-year average of \$35 billion during 2018–20 (figure 2). The most recent data available for the national level (2018) indicates that England produces the most agricultural output (\$26 billion), with a consistent share of around 75 percent of UK output from 1995 to 2018 (figure 3). While Northern Ireland experienced growth in the share of UK agricultural output over this same period, from 6.8 to 8.6 percent, Scotland’s and Wales’ proportions of overall UK output remained stable over the period at 12 percent and 6 percent, respectively.

Table 2
Distribution of United Kingdom (UK) crops by area, 2020

Crop type	Hectares, thousand
<i>Arable crops:</i>	4,314
Wheat	1,387
Barley	1,388
Oilseed rape	380
Peas for harvesting dry and field beans	233
Corn	228
Oats	210
Potatoes	142
Sugar beet (not for stock-feeding)	111
Rye, mixed corn, and triticale	53
Linseed	33
<i>Horticultural crops:</i>	166
Vegetables grown outdoors	118
Orchard fruit	23
Soft fruit and wine grapes	11
Outdoor plants and flowers	11
Greenhouse crops	3
<i>Total</i>	4,480

Source: USDA, Economic Research using data from UK Department of Environment, Food and Rural Affairs, 2020.

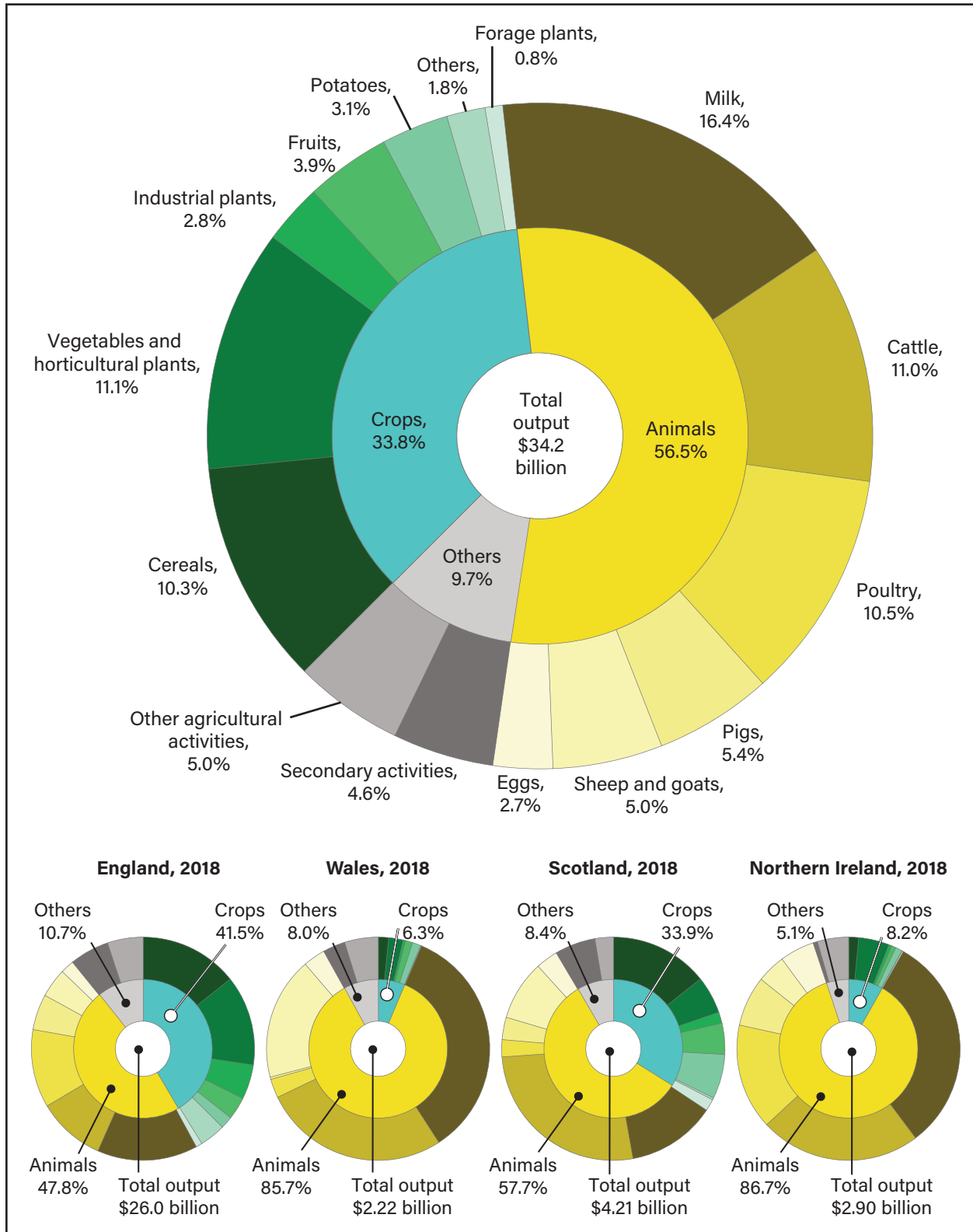
to animal products was highest in England and lowest in Northern Ireland. The proportion of overall UK output of crop versus animal production was mostly consistent from 1995 to 2018 when England and Scotland were responsible for over 95 percent of UK crop production (85 percent and 11 percent, respectively). Concurrently, animal production is predominant in Wales and Northern Ireland, meaning their proportion of overall UK animal production was much higher relative to their share of crop output (10 percent and 13 percent, respectively). However, from 1995 to 2018, Wales experienced the highest growth trend for crop output of the UK nations, while Scotland also experienced a slightly increasing trend over this period, as England’s and Northern Ireland’s crop production indexes were mostly flat. In terms of animal products, Northern Ireland experienced the highest positive growth trend over the same period, followed by less positive growth in Scotland and stable output (no growth) in England and Wales.

By area, agriculture comprises 71 percent of the total land in the UK, with 25 percent of UK area allocated as arable land for crop production. At the national level, the proportion of land in agriculture is highest in Wales (85 percent) and lowest in England (68 percent), with Scotland (70 percent) and Northern Ireland (75 percent) in between (Eurostat, 2022). However, for arable land, England’s proportion is the highest (37 percent), lowest in Scotland (10 percent), and Wales (12 percent) and Northern Ireland (14 percent) fall in-between. The contrast in agricultural land versus arable land reflects the higher land use for animal production (i.e., pasture) in Wales, Northern Ireland, and Scotland.

By category, crop production comprises slightly more than a third of agricultural land use, animal products account for just over half, and the remainder (about 10 percent) is allocated to other agricultural activities. Within crops, vegetables and horticultural plants are the largest category by value, while cereal production is the largest category by area and second largest by value, with wheat and barley at the top of the list, respectively (table 2). For animal products, milk is the largest by value, followed by cattle and then poultry. Both crop and animal output have grown substantially since the early 1960s, with most of the growth occurring during the first half of the period (1961–2019) and leveling off through the second half (figure 4).

At the national level, the proportion of UK crops relative

Figure 2
United Kingdom (UK) value agricultural output, percent of total by category, 2020, and national breakdown, 2018

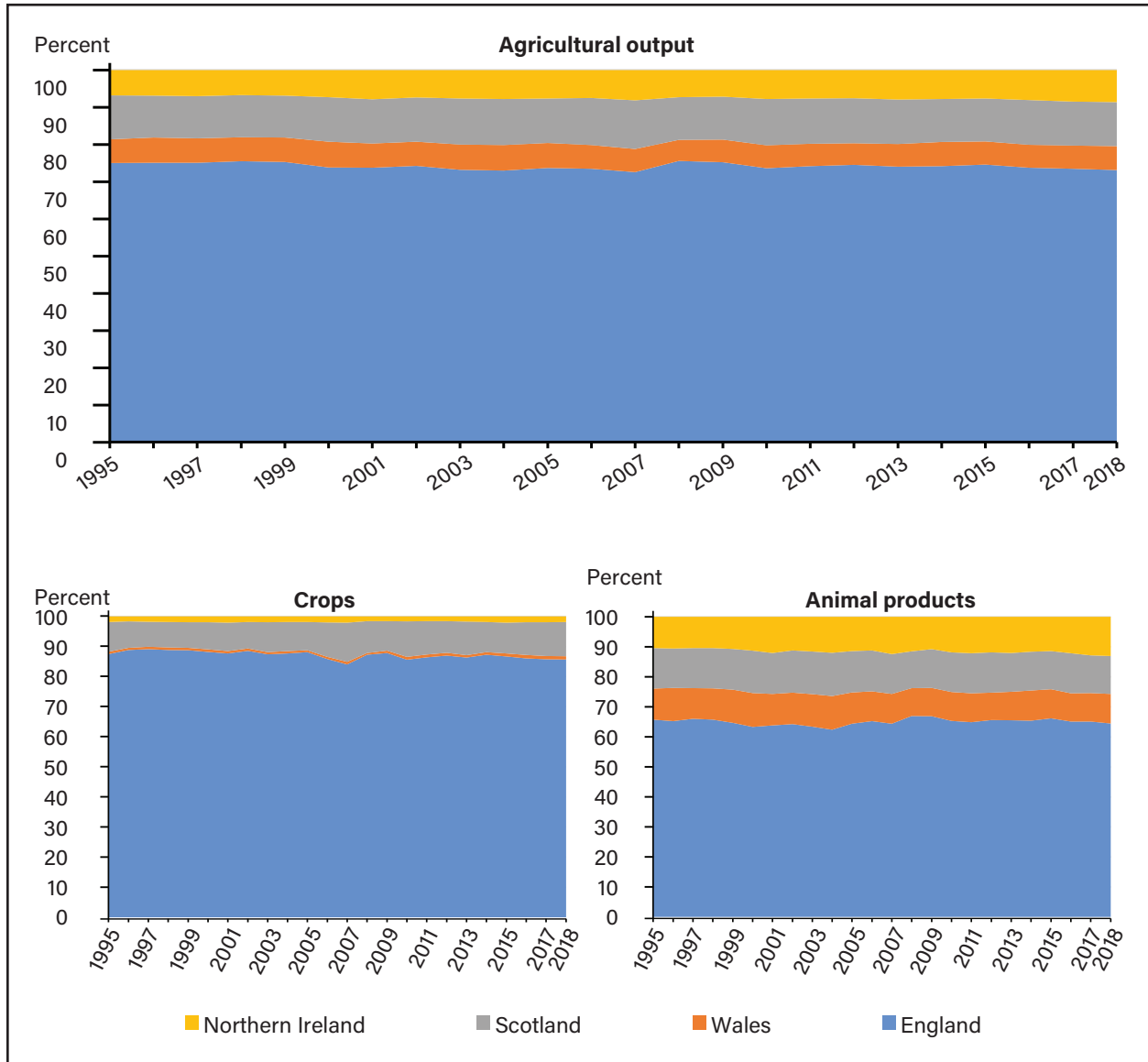


Note: 2020 data used for UK; 2018 represents the most recent annual national data available for the UK at the nomenclature of units for territorial statistics, level 2 (NUTS 2) value of agricultural output. Values are in real terms, adjusted for inflation.

Source: USDA, Economic Research Service calculations based on UK Department for Environment, Food and Rural Affairs, 2020, and Eurostat, NUTS 2, 2022.

Figure 3

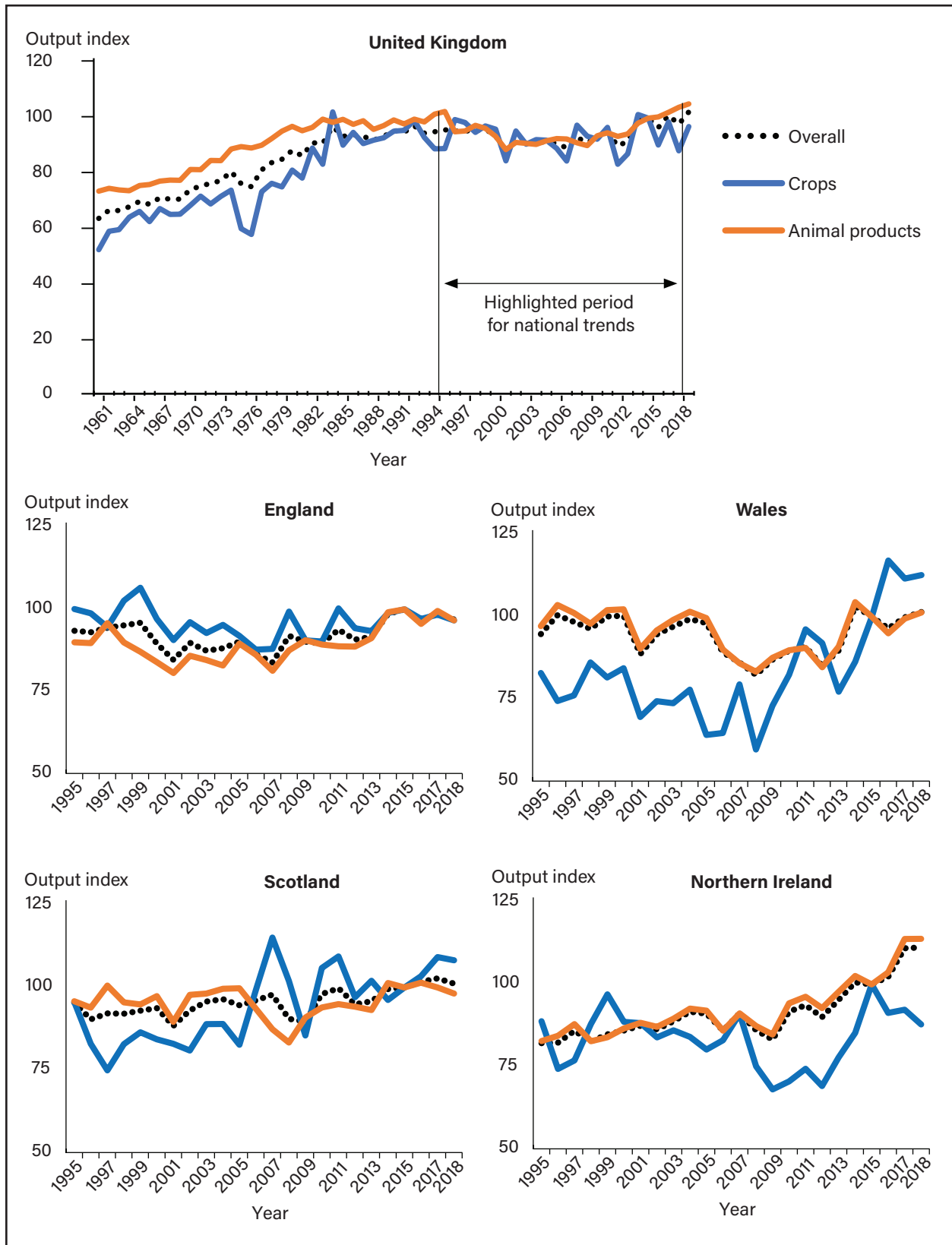
United Kingdom (UK) value of agricultural output, percent by nation (England, Wales, Scotland, and Northern Ireland), 1995-2018



Note: In the top graph, agricultural output is based on overall crops and animal products. 2018 represents the most recent annual data available for the UK at the nomenclature of units for territorial statistics, level 2 (NUTS 2) value of agricultural output.

Source: USDA, Economic Research Service calculations based on UK Department for Environment, Food and Rural Affairs, 2020, and Eurostat, 2022.

Figure 4
United Kingdom (UK) agricultural output index trend for crops and animal products, 1961-2019



Index = 100 in 2015.

Source: USDA, Economic Research Service (ERS) using data from USDA, ERS, International Agricultural Productivity Data Product, 2021, and Eurostat, 2022.

Crops

Crops accounted for \$11.6 billion of the UK's total agricultural output in 2020. The total cultivated area in the UK was approximately 4.48 million hectares (ha). Arable crops comprise 4.31 million hectares (Mha) of the cultivated area, and horticultural crops comprise 166,000 ha. Wheat, barley, and rapeseed comprise 73 percent of the UK's cultivated area (table 2). Overall, UK crop production nearly doubled since the early 1960s, with output growth happening during the first half of this period before leveling off in the early 1990s. At the national level, by crop category, England produces the most crops by variety, volume, and value in the UK, growing 85 percent of cereals, 94 percent of industrial plants, 75 percent of forages, 89 percent of vegetables and horticultural products, 59 percent of potatoes, 78 percent of fruit, and 98 percent of other crops. Scotland is the second largest crop producer in the UK, with a relatively larger share of production in cereals (14 percent), forage plants (23 percent), potatoes (34 percent), and fruits (18 percent).

Wheat is the largest crop produced in the UK by area. Wheat accounts for approximately 40 percent of the arable land and 39 percent of all land under cultivation in the UK. The average production of wheat over the last 5 years (2016–20) was 13.7 million tons, accounting for 1.8 percent of world production and positioning the UK to be a top 15 world producer.¹³ However, wheat production in the UK suffered a 40-percent decline in production in 2020 due to low yields and a reduction in planted area, dropping the country's contribution to the global supply by half a percentage point.

Barley is the second largest crop produced in the UK by area. Barley accounts for approximately 26 percent of the arable land and 25 percent of all land under cultivation in the UK. Average production of barley over the last 5 years (2016–20) was around 7.3 million tons, accounting for 5 percent of the world's 2020 production and positioning the UK to be a top 10 world producer.

Rapeseed is the third largest crop in the UK by area. Rapeseed accounts for approximately 12 percent of the arable land and 11 percent of all land under cultivation in the UK. The average production of rapeseed over the last 5 years was around 1.7 million tons, accounting for 1 percent of the world's production of rapeseed in 2020 and positioning the UK to be a top 10 world producer. The UK was a net exporter of rapeseed oil until the neonicotinoid¹⁴ ban in 2013, when production declined, and imports increased as the UK's capacity for seed oil extraction (pressing) for export remained.

The UK produces several other arable and horticultural crops for human consumption, animal feed, and ornamental uses. Ranked in descending order by area, these include peas, corn, oats, potatoes, vegetables grown outdoors, sugar beets, rye, linseed, orchard fruit, soft fruit, outdoor plants and flowers, and greenhouse crops. In terms of value, vegetables and horticultural plants comprise 11.1 percent of the total agricultural output, with cereals (10.3 percent), fruits (3.9 percent), potatoes (3.1 percent), and industrial plants (2.8 percent) following in order. Fruits, vegetables and horticultural plants, and potatoes are among the highest value per hectare crops grown in the UK.

Animal Products

In 2020, animal products accounted for nearly \$20 billion of the UK's total agricultural output. Milk, cattle, and poultry accounted for 67 percent of the total animal output value in 2020. Similar to crops, UK animal production also increased from the early 1960s. Overall, animal products output increased by about a third, with steady growth during the first half of this period up to the 1990s, followed by a period of declining output from 1996 to 2009, before rising again during the last decade to surpass the previous 1995 high in 2019. The period of decline beginning in the mid-1990s is explained by large-scale outbreaks of pathogenic diseases

¹³ USDA, Foreign Agricultural Service, International Production Assessment Division, Crop Explorer.

¹⁴ Neonicotinoids are a class of pesticide used in agricultural production.

across livestock operations in the UK. Namely, cattle production was curtailed by bovine spongiform encephalopathy (BSE, i.e., mad cow disease) and foot-and-mouth disease, which led to the culling of an estimated 10 million head of cattle to end the outbreak (Woods, 2011).

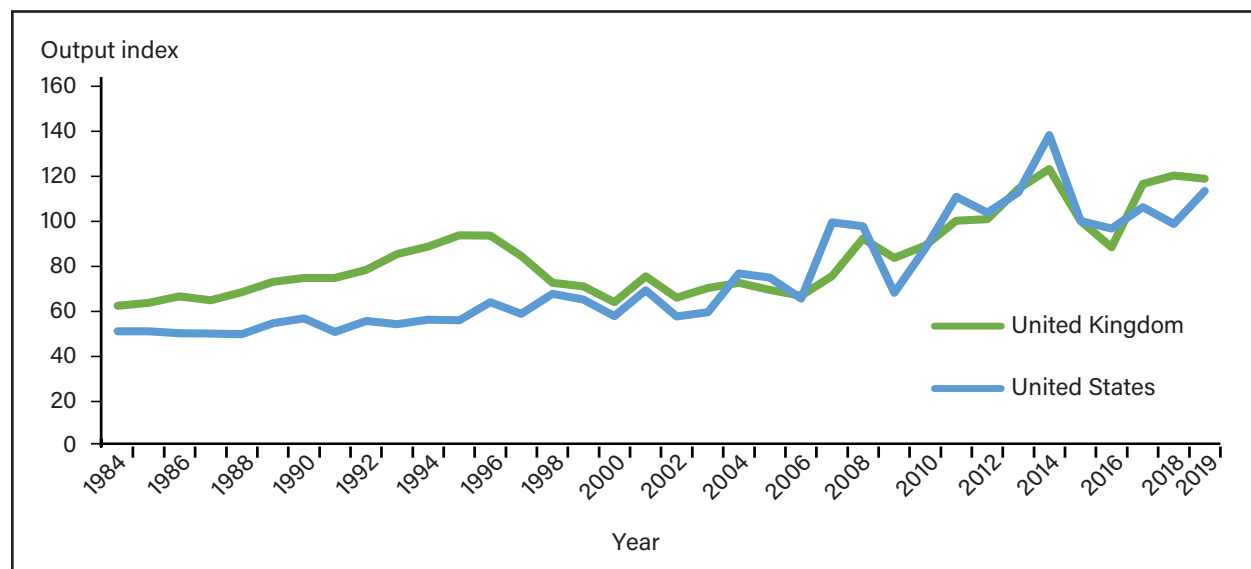
In terms of value, beef and veal production declined from 2016 to 2019. From 2018 to 2019, the value of beef and veal production decreased by 6.5 percent despite an increase in production volume as prices declined 7.5 percent year over year. At the national level, the value of cattle production was greatest in England (51 percent), followed by Scotland (23 percent), Northern Ireland (14 percent), and Wales (12 percent). However, considering output on the basis of land area (share of UK land), Northern Ireland and Wales maintained a larger share of animal production per hectare, approximately 2.5 and 1.5 times that of England, respectively.

Poultry production in the UK saw growth of 23 percent over the decade from 2011 to 2020, with 2.4 percent average annual growth over this period. Also, despite a 2.6-percent decline in production volume from 2018 to 2019, the production value increased 1 percent during the same period. Chickens comprised 86 percent of the poultry production value, while turkeys, ducks, and geese comprised the remaining 14 percent. England produced 83 percent of UK poultry, followed by Northern Ireland at 13 percent.

The hog sector also saw growth from 2018 to 2019, with a pork production increase of 5.2 percent in value and 3.5 percent in volume. England produced 79 percent of UK pork, followed by Northern Ireland at 12 percent.

Milk constituted 16.2 percent of UK agricultural production in terms of monetary value, making dairy products the largest domestic commodity. Milk production increased from 2018 to 2019 by 1.6 percent to a total of 15.2 billion liters. Despite increased production volume over this period, the total value of milk production decreased by 1.2 percent to \$5.7 billion, driven by lower milk prices. Although milk production increased in the UK, dairy herd numbers declined. Increased milk production can be attributed instead to higher per-cow yields—a similar trend to what has been seen in the United States over recent years. While the UK saw steady positive growth in dairy production, growth rates were lower than in the United States from the late 1990s onward (figure 5). In 2018, England produced 63 percent of UK dairy, followed by Northern Ireland (15 percent), Wales (13 percent), and Scotland (9 percent).

Figure 5
Milk production index trends for the United Kingdom (UK) and United States, 1984–2019



Index = 100 in 2015.

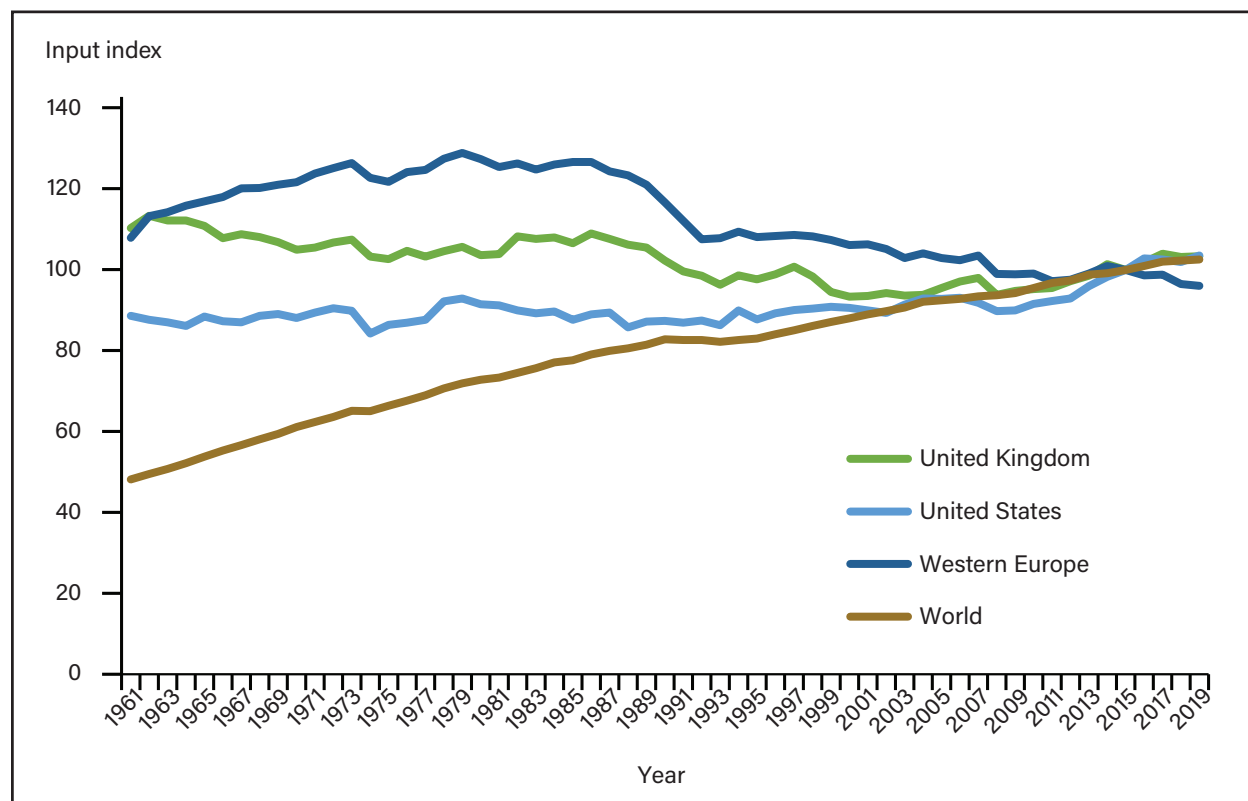
Source: USDA, Economic Research Service calculations using data from USDA, National Agricultural Statistics Service and the UK Department of Environment, Food and Rural Affairs.

The lamb and mutton production value for the UK increased by 8.2 percent from 2016 to 2019. Sheep production was over \$1.5 billion in 2019, which constitutes 15.3 percent of total UK meat production in terms of value. The production value decreased by 2.5 percent from 2018 to 2019 despite a 6.4-percent increase in production volume during the same period. Combining sheep with goats, England is the largest producer (55 percent), followed by Wales (20 percent), Scotland (18 percent), and Northern Ireland (6 percent).

Input Use and Total Factor Productivity

Taking a closer look at UK agriculture, productivity growth over the second half of the 20th century strengthened the sector. Trends over the last 60 years generated more overall production of crops and animal products on slightly less land while using substantially less labor and more capital (USDA, ERS, 2021). Overall, aggregate agricultural input¹⁵ use has declined slightly in the UK since the early 1960s (figure 6). An overall decrease in input use of nearly 10 percent was observed over this same period. Cross-country comparison shows that the UK's trend of declining input use is similar to trends in other Western European countries but contrasts with rising U.S. and global total input use.

Figure 6
Aggregate input index trends for the United Kingdom, United States, Western Europe, and the world, 1961–2019



Index = 100 in 2015.

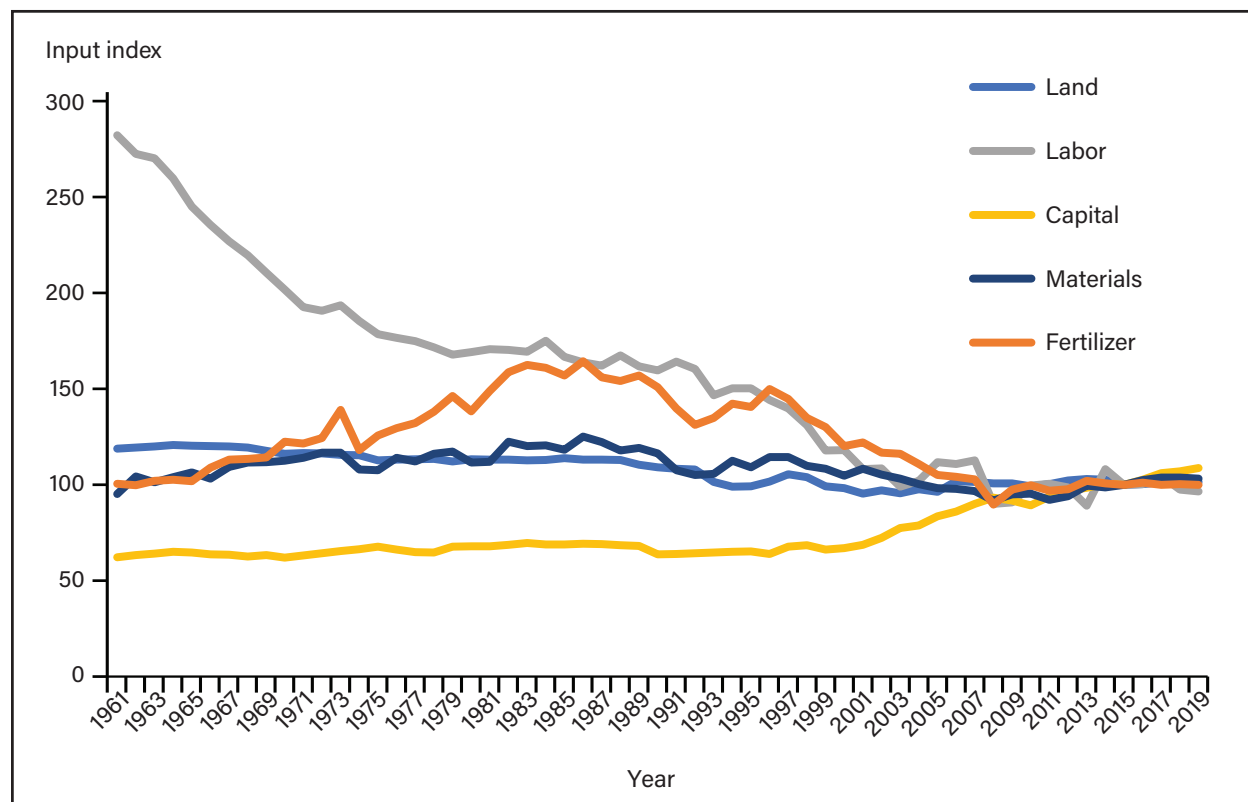
Note: Western Europe includes: Austria, Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, Switzerland, and United Kingdom.

Source: USDA, Economic Research Service, International Agricultural Productivity Data Product, 2021.

¹⁵ The USDA, ERS International Agricultural Productivity data product index of Agricultural Inputs (Land, Labor, Capital, and Materials), 2015=100.

Upon closer inspection of the UK, shifts in the composition of the input set occurred that are not reflected by the overall declining trend. These shifts include a reduction in the agricultural land base and the adoption of more intensive practices (e.g., fertilizer), along with a movement from labor- to capital-intensive production from 1961 to 2019 (figure 7). Notably, this labor-capital shift accelerated during the second half of this period, which is indicative of payoffs from investment in agricultural R&D being applied on the farm (Thirtle et al., 2008).

Figure 7
Input sub-index trends for the United Kingdom (UK), 1961–2019



Index = 100 in 2015.

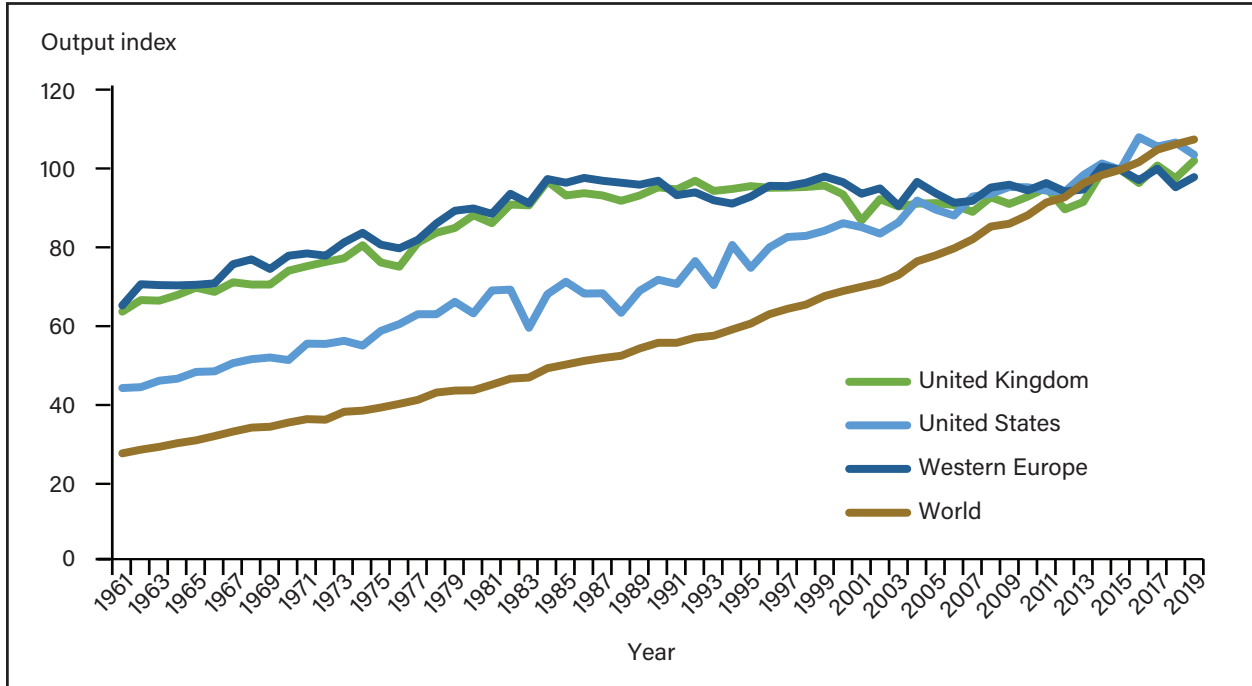
Source: USDA, Economic Research Service, International Agricultural Productivity Data Product, 2021.

Total Factor Productivity

The combined trends since the early 1960s of increased UK agricultural output (figure 8) with decreased input use coincides with increasing total factor productivity (TFP) from 1961 to 2019 (figure 9). These International Agricultural Productivity estimates are calculated by taking the difference between the rates of growth in outputs and inputs while applying relevant regional cost shares (USDA, ERS, 2021). While TFP can be estimated using various methodologies, this index and growth accounting approach is well established for the measurement of TFP (i.e., the Solow residual). By holding aggregate input steady while growing output, the UK experienced the highest rate of TFP growth compared with other regions of interest during the initial decade (1960–70) of this period before beginning to slow in the 1970s, with a continued slowdown in the 1980s and 1990s. Researchers such as Thirtle et al. (2004) attributed this slowdown mainly due to cuts in public agricultural R&D. More recent cuts to agricultural R&D are observed in the second decade of the 21st century (figure 10). Because R&D lags in agriculture are typically more than a decade, the downturn in spending during recent years remains relevant for years to come despite projected UK investment in agricultural R&D in the future (Thirtle et al., 2008; Pardey et al., 2016a, 2016b; UK Defra, 2022).

Figure 8

Aggregate output index trends for the United Kingdom, United States, Western Europe, and the world, 1961-2019

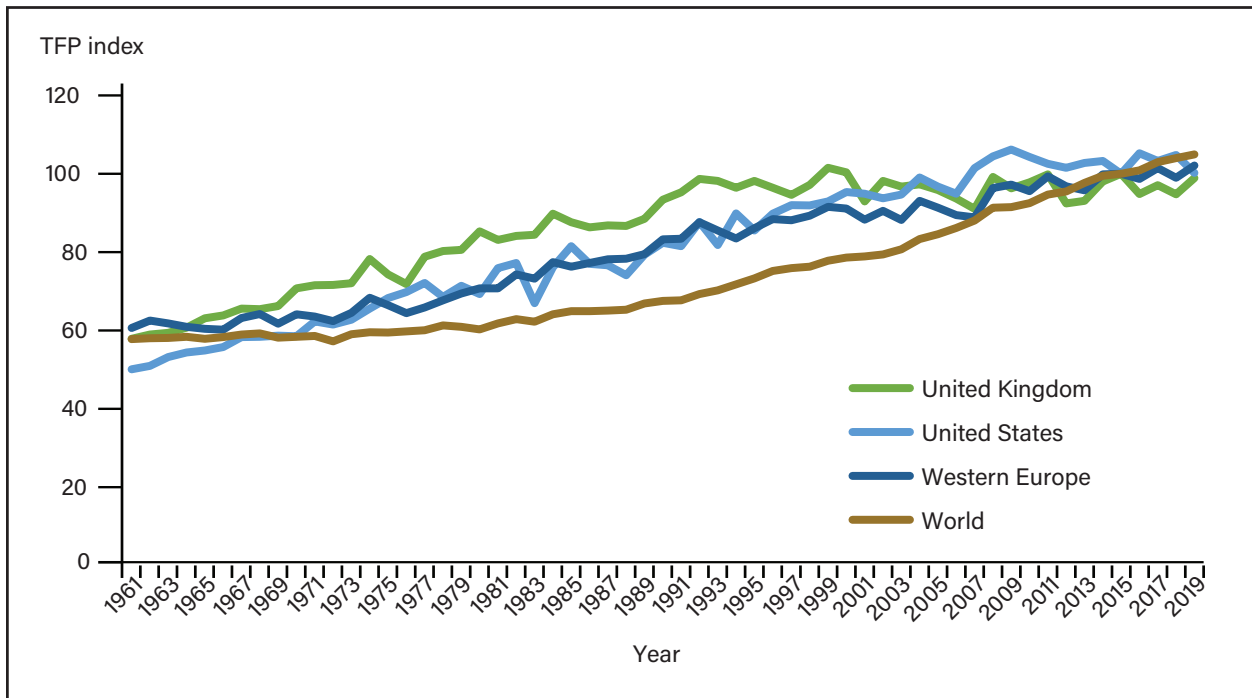


Index = 100 in 2015.

Source: USDA, Economic Research Service, International Agricultural Productivity Data Product, 2021.

Figure 9

Total factor productivity (TFP) index trends for the United Kingdom, United States, Western Europe, and the world, 1961-2019

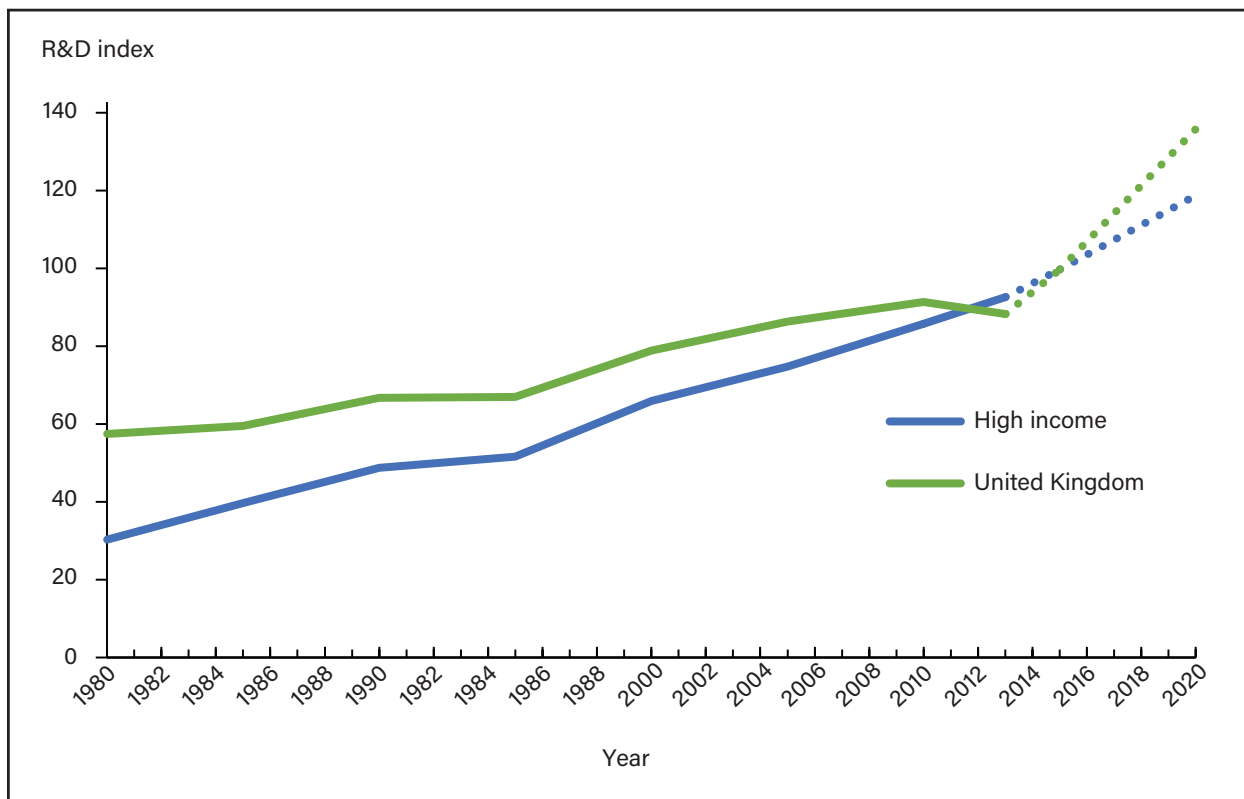


Index = 100 in 2015; TFP = total factor productivity.

Source: USDA, Economic Research Service, International Agricultural Productivity Data Product, 2021.

Figure 10

Food and agricultural research and development (R&D) index trends for the United Kingdom and high-income countries, 1980–2020



Index = 100 in 2015; solid line = actual, dotted line = projected.

Note: High income group comprises France, Germany, Japan, Republic of Korea, United Kingdom, and United States.

Source: USDA, Economic Research Service using data from Pardey et al., 2016a.

According to USDA international agricultural TFP estimates, UK productivity has remained stagnant over 30 years from 1990 to 2019 (USDA, 2021). In terms of ranking among European countries, UK mean agricultural TFP growth dropped from the top quartile (1990–2011) to the bottom (2012–19) quartile during this period, which was the result of strong positive growth in the rest of Europe over the last decade. This observation from the agricultural sector coincides with relatively low UK productivity in the broader economy, for which a major focus of post-Brexit policy has been to close the productivity gaps between the UK and other advanced economies (UK ONS, 2022). Continued productivity growth in the sector is also aligned with broad policy aims as a pathway to reduce the relative contribution of agriculture to global climate change and to protect the environment (UK DEFRA, 2022). Changes in the nature of the CAP may have contributed to the slowdown in TFP growth. In earlier years, the CAP focused on increasing productivity, but it has more recently diversified policy objectives of achieving food safety, animal welfare, and environmental stewardship (Antonopoulos et al., 2022). As a result, the measurement of agricultural productivity is evolving to incorporate a variety of production attributes, e.g., the Organisation for Economic Co-operation and Development’s (OECD) *Network on Agricultural Total Factor Productivity and the Environment, 2017–21* (Bureau and Anton, 2022). These measures address the multifunctionality of the agricultural sector, for example, by incorporating environmental capital stocks and flows in addition to conventional inputs and outputs (e.g., food and fiber) and could be used to address economic and environmental sustainability, such as extractive versus regenerative systems of production (Bell, 2022).

UK Agri-Food Trade

The UK is a large importer of food products, ranked fifth in the world for agricultural and related products (Trade Data Monitor, 2021). The country's reliance on imports of agricultural and related products reflects its lack of resources relative to its population size. Typically, UK exports comprise high-value consumer-oriented products, primarily distilled spirits, dairy products, and processed seafood products. The EU is the largest UK trade partner for both imports and exports. An overview of U.S. agri-food trade with Europe is also provided in this section.

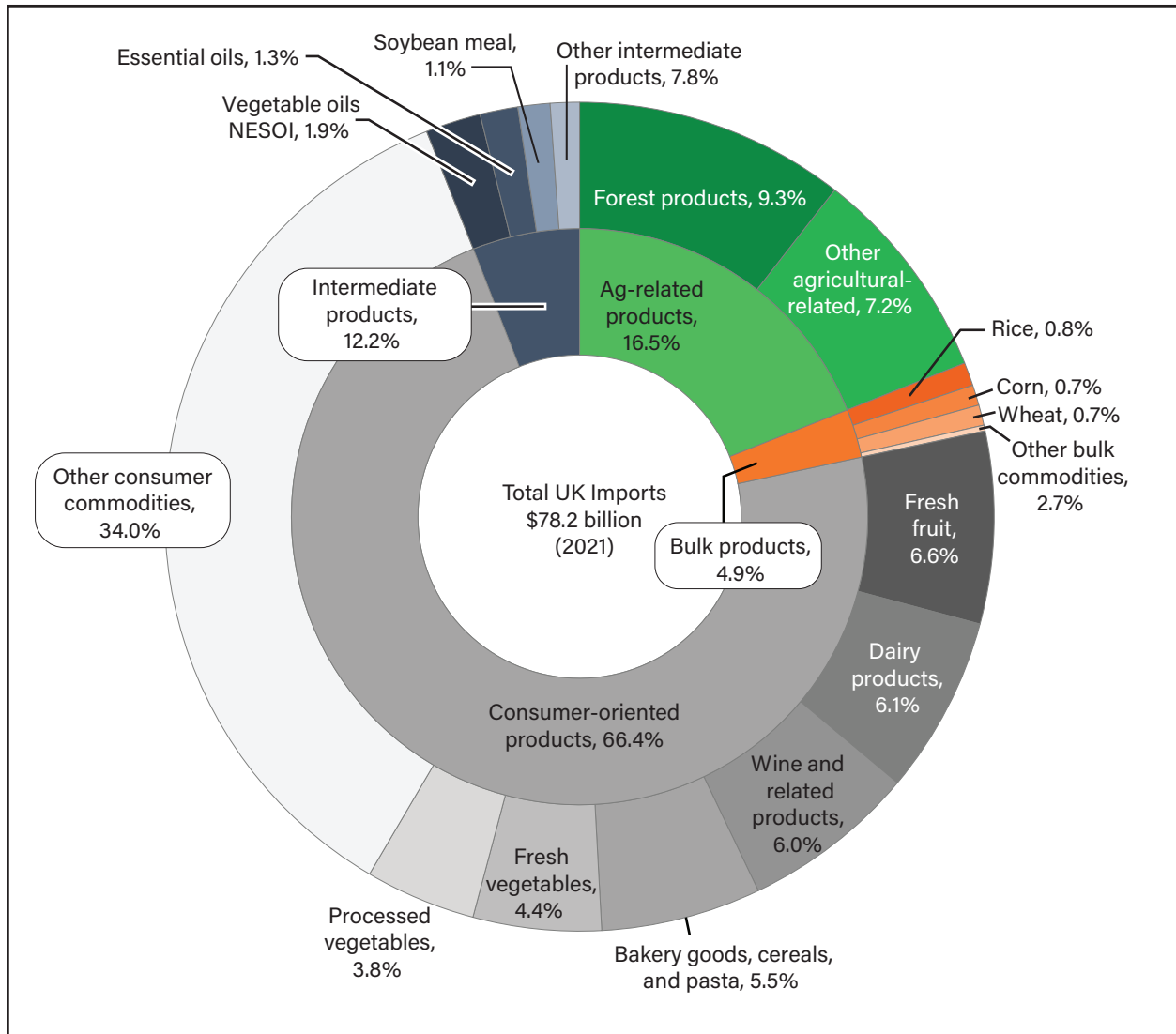
Imports

More than 70 percent of UK agricultural imports are from the EU. The largest commodity groups imported to the UK from around the world are forest products (\$9.66 billion in 2021) and fresh fruit (\$5.05 billion in 2021) (figure 11). By country, the United States is the largest supplier of forest products (\$1.33 billion in 2021), about a quarter of the aggregated total supplied by the Single Market to the UK (\$5.55 billion in 2021). Over the last decade, imports of forest products used primarily for power generation (e.g., wood pellets) have averaged double-digit growth annually. This is largely driven by global climate change concerns and greenhouse gas (GHG) reduction targets of UK (and EU) policy and broader international commitments (e.g., the Paris Climate Accords¹⁶). This has increased U.S. exports, which is a major supplier of forest products to the UK and the rest of Europe. Regarding exports of fresh fruit to the UK, the majority share comes from the EU (primarily Spain, the Netherlands, and Germany), South Africa, and South American countries such as Peru and Colombia. The UK, likewise, imports a considerable volume of dairy products, nearly entirely from the EU, with the Republic of Ireland shipping more than a quarter of this volume. U.S. dairy exports to the UK increased slightly over the last decade but remain small in comparison with the EU. From 2016 to 2021, the value of UK agri-food imports increased from the EU, United States, China, Brazil, Canada, South Africa, and India (figure 12).

¹⁶ The Paris Climate Accords of the 2015 United Nations Climate Change Conference are international agreements to limit global temperature increase to 1.5 degrees Celsius above pre-industrial levels.

Figure 11

Total United Kingdom (UK) agricultural imports, 2021 (percent by commodity of total)

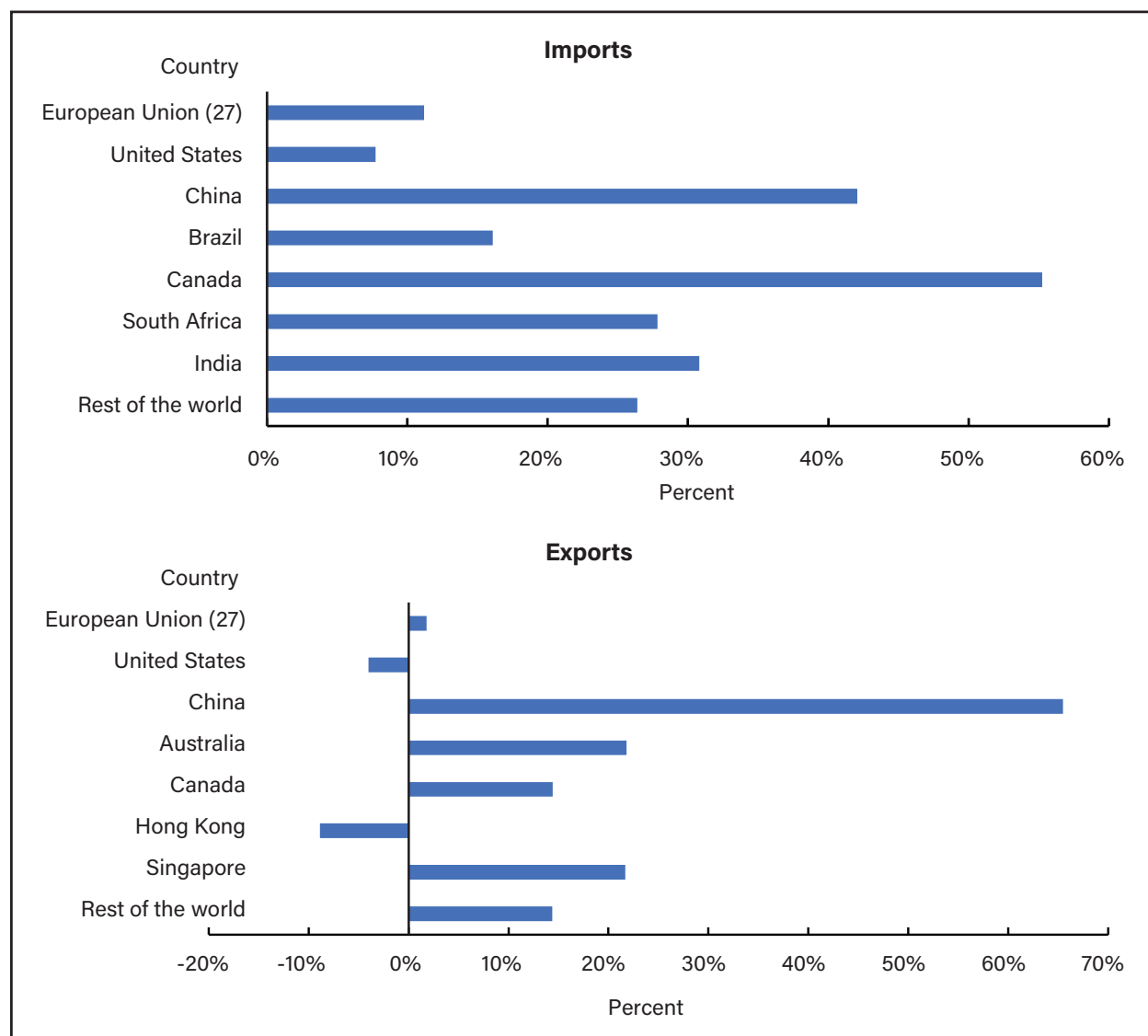


Note: NESOI = not elsewhere specified or included.

Source: USDA, Economic Research Service using data from Trade Data Monitor, 2022.

Figure 12

Percentage change in United Kingdom (UK) agricultural trade imports and exports, 5-year trends, 2016–21



Note: European Union (EU) data are a simple sum and do not account for EU internal trade. The “27” next to European Union denotes the number of countries in the EU.

Source: USDA, Economic Research Service calculations from Trade Data Monitor, 2022.

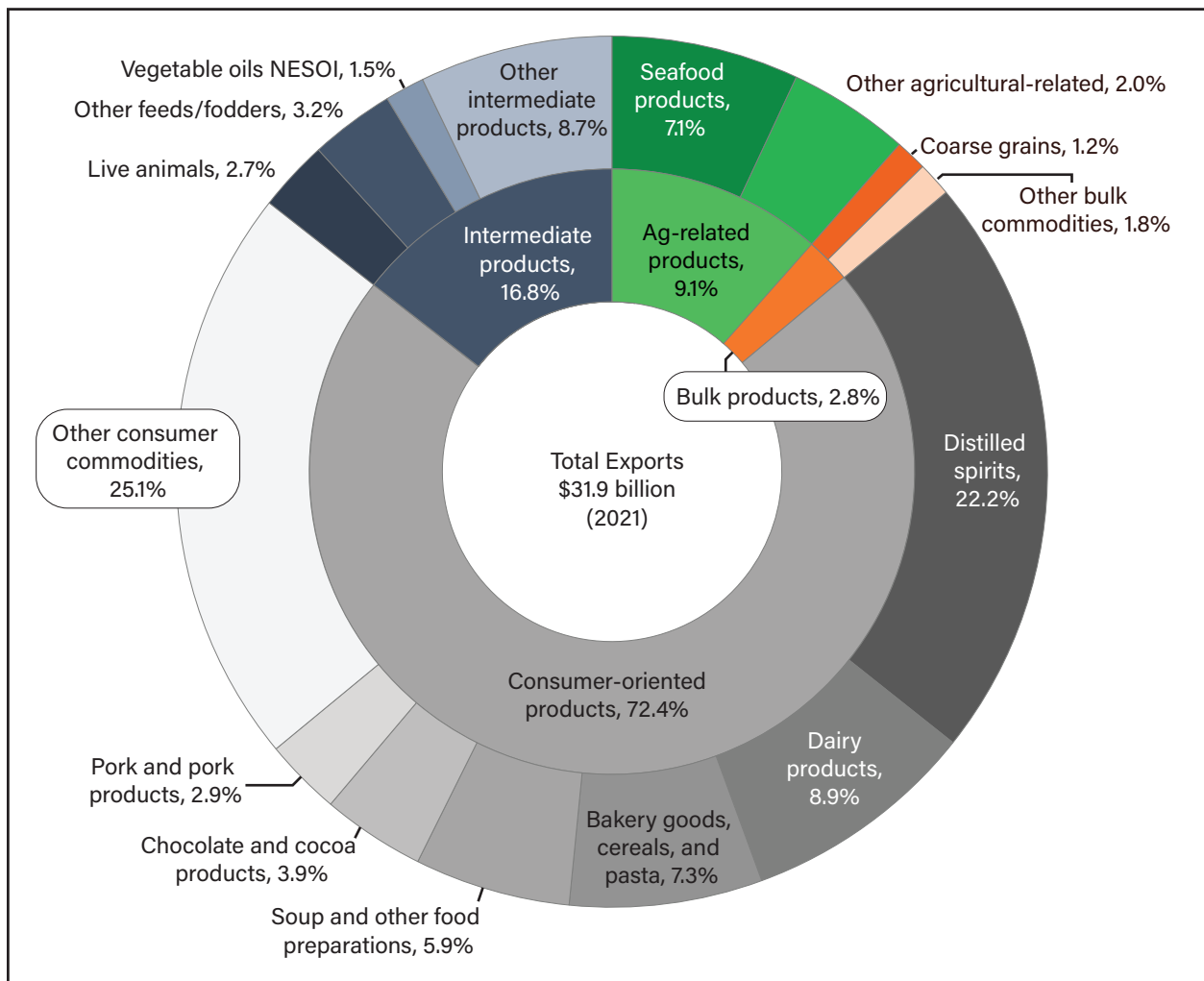
Exports

Agri-food exports are an important source of UK trade, consisting primarily of processed and consumer-oriented goods, with the general mix of goods mirroring UK exports to the United States (figure 13). Much of the UK’s agri-food exports have centered around these goods, which are produced from domestic and imported primary and/or intermediary materials. For instance, prior to Brexit, the UK imported wine that was processed (i.e., blended and/or bottled) before exporting to other markets—mainly to and from the EU.¹⁷ Notable trends in UK agri-food trade from 2016 to 2021 included increased exports to the EU, China (driven by African swine fever (ASF)-related demand for pork), Singapore, and Australia, while UK exports to the United States and Hong Kong decreased over this period.

¹⁷ Under EU-UK TCA Rules of Origin, minimally processed products are subject to tariffs.

Animal products, as a category, are an important source of primary agricultural exports for the UK. This is especially true for Northern Ireland, Scotland, and Wales, where these products comprise the majority share of agricultural output. Furthermore, because of prior integration with the EU and recognition of the Single Market’s standards, most UK exports in this category are to the EU. The EU was the largest destination for UK beef and veal exports, with 140,000 tons exported in 2019 compared with 27,000 tons to the rest of the world (ROW). In 2020, the United States resumed beef imports from the UK after more than 20 years since a ban was implemented in the mid-1990s following BSE outbreaks. Most UK poultry exports were sent to the EU, with 254,000 tons exported in 2019; exports to the ROW combined totaled 109,000 tons. Despite an 8.4-percent decrease in pork exports to the EU during 2018–19, UK exports to the EU retained a majority share with 158,000 metric tons, compared with 118,000 metric tons going to the ROW. Exports to the ROW increased 45 percent over this period, with additional trade opportunities created by China’s reduced production due to ASF outbreaks. The EU is the largest destination market for UK lamb and mutton, with 101,000 metric tons exported in 2019. Although over 94 percent of UK lamb and mutton exports go to the EU, exports to the ROW grew 33 percent to 6,000 tons from 2018 to 2019. In January 2022, the United States lifted restrictions on UK lamb, a move that is estimated to generate nearly \$50 million in trade during the next 5 years (UK Defra, 2021).

Figure 13
Total United Kingdom agricultural exports, 2021 (percent by commodity of total)



Note: NESOI = not elsewhere specified or included.

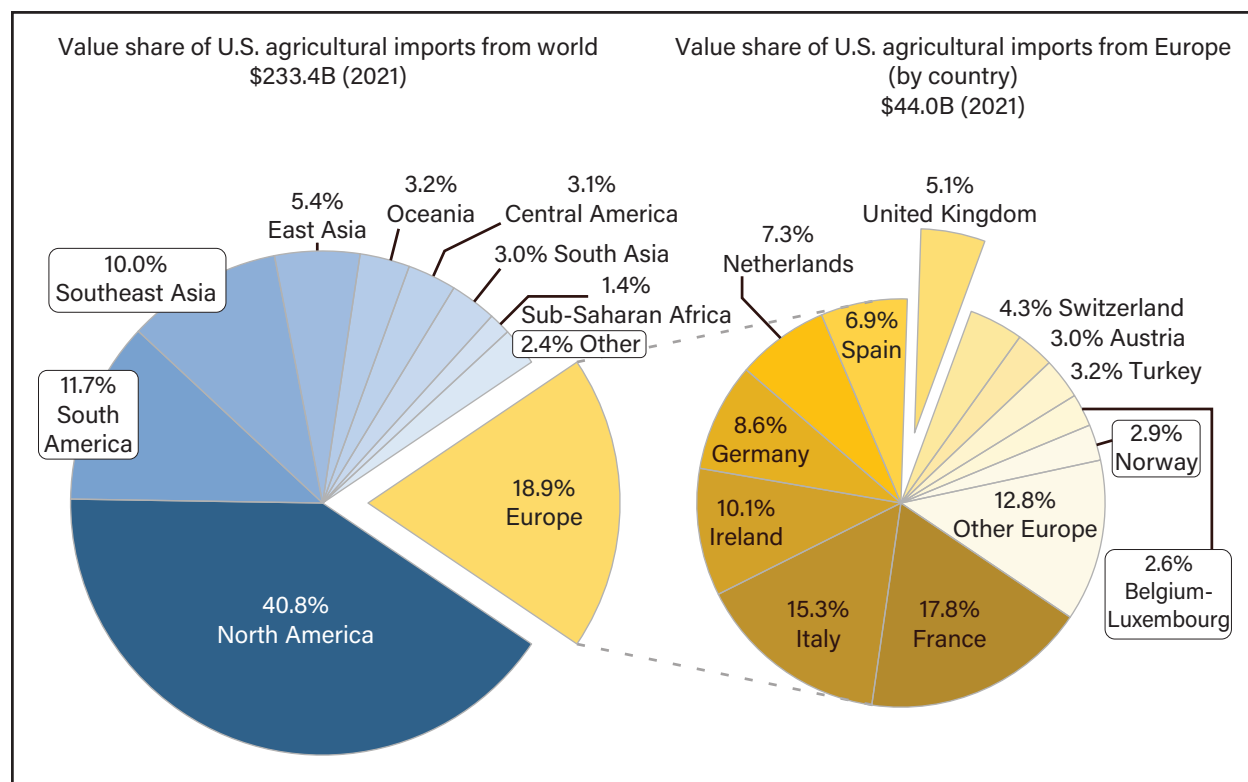
Source: USDA, Economic Research Service using data from Trade Data Monitor, 2022.

U.S. Agri-Food Trade With the EU and UK

Europe as a region is a major U.S. trading partner, serving as a significant source of both imports and exports. Since 1990, U.S. agricultural imports from the EU have increased more than fivefold, rising from \$5.7 billion to \$36.7 billion in 2021 (figure 14). However, U.S. agricultural exports to the EU increased at a much slower rate—from \$10 billion to \$11.8 billion over the same period (figure 15). The discrepancy in the export volume between the two trading partners is largely due to U.S. consumers' increased demand for European alcoholic beverages and continued EU impediments to U.S. imports such as TBT, SPS measures, high tariffs, and grain import licensing systems (Arita et al., 2017). EU tariff levels on agricultural products averaged 8 percent higher than the average U.S. agricultural tariff level of 4.5 percent (WTO, 2022). At the same time, many U.S. brands of food products have been commonly consumed in Europe but not imported because of the location of manufacturing in the EU by U.S. multinational corporations, such as the H.J. Heinz Company and the Kellogg Company, or because of franchising or brand licensing, such as the McDonald's Corporation and The Coca-Cola Company. Since 1990, imports of wine products, distilled spirits, and beer accounted for two-thirds of all U.S. agricultural import value from the European continent. In that time, France surpassed the UK in exports of distilled spirits and supplied more than half of all imports of alcoholic beverages in 2021, while countries like Italy and the Netherlands remained top suppliers of wine and beer products, respectively. The UK is a top supplier of alcoholic beverages, although its share, primarily fueled by exports of distilled spirits, shrunk from 20.9 percent in 1990 to 9.6 percent in 2021 as France increased its export supply to the United States.

Figure 14

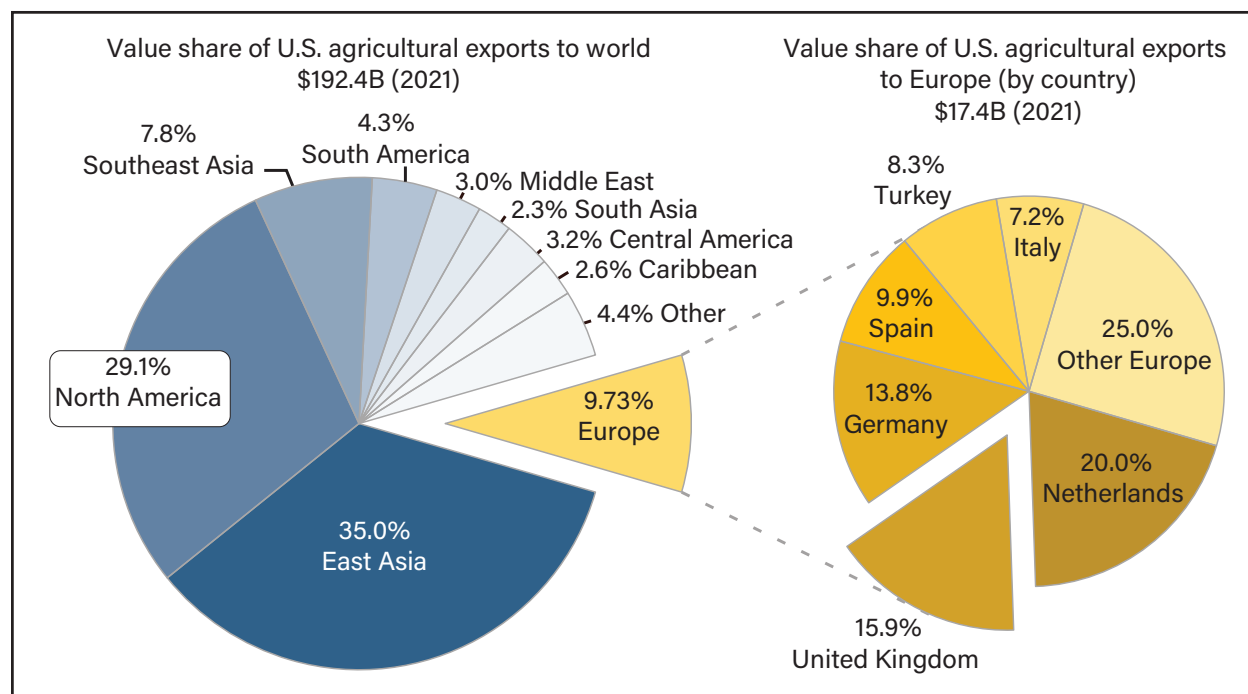
Value share of U.S. agricultural imports by region with Europe breakdown, 2021



Source: USDA, Economic Research Service using data from Trade Data Monitor, 2022.

Figure 15

Value share of U.S. agricultural exports by region with Europe breakdown, 2021



Source: USDA, Economic Research Service using data from Trade Data Monitor, 2022.

Lacking the advancement of bilateral trade negotiations between the United States and the UK, the share of U.S. alcoholic beverage exports to the UK could continue to drop following 2018 import restrictions under Section 301 of the Trade Act of 1974 and Section 232 of the Trade Expansion Act of 1962.¹⁸ Such disputes tend to adversely affect high-value consumer products such as alcoholic beverages (Ridley et al., 2022). For example, tariffs on alcoholic beverages and other food products were lifted following the resolution of a decades-long dispute between Boeing (United States) and Airbus (EU) in June 2021. As part of this dispute, EU duties on American whiskeys were established, and the United States imposed an equivalent 25 percent retaliatory tariffs on EU products. The United States suspended UK tariffs in early 2022;¹⁹ however, UK exports of whiskeys and gin to the United States remained below their pre-COVID-19 levels throughout 2021, down 57 percent from 2019. This example highlights the historical tendency of targeting agricultural products in retaliation of trade disputes between the EU and the United States. The disputes have often led to high-value exports of processed goods from the UK, EU, and United States being struck by tariffs (e.g., scotch, wine, and bourbon). As the UK is less involved with EU bilateral disputes as a result of Brexit, trade between the UK and its partners may no longer face this source of disruption.

The U.S. export basket to the European continent diversified in the last few decades, with exports of various nuts (e.g., almonds, pistachios, and walnuts), soybeans, and forest products as the top commodities exported to the region in 2021. The UK is an inverse of this trade dynamic, where the composition of the U.S. export basket to the UK has remained relatively consistent since 1990, though increasing in volume. The export value

¹⁸ For details on U.S. Section 232 and 301 trade actions in 2018, see Weaver (2019). The effects of the 2018 U.S. 232 and 301 retaliatory tariffs on U.S. agriculture are examined in detail by Morgan et al. (2022).

¹⁹ This action mirrored the 2021 EU-U.S. agreement to remove the Section 232 and 301 import restrictions, but following Brexit, the UK negotiated a resolution with the United States separately from the EU.

of U.S. agricultural and related products to the UK more than doubled from \$1.19 billion in 1990 to \$2.76 billion in 2021. This increase was driven by the export of forest products (table 3). Comprising nearly a third of all U.S. agricultural exports to the UK in 2021, U.S. exports of lumber and forest products—primarily wood pellets, assembled casks, and various hardwood lumbers (e.g., white oak, poplar, and walnut)—remain the primary driver of U.S. market share in the UK (figure 16). Many UK power stations have undergone a transition to burning biomass, mainly wood pellets, rather than coal as part of the UK’s GHG reduction targets. This led to the UK becoming the predominant importer of wood pellets in the world, accounting for 52 percent of global wood pellet imports in 2020. The United States provided 63 percent of the UK’s wood pellet imports in 2021. The United States is also the largest single-country supplier of ethanol (non-beverage) to the UK, with exports valued at \$102 million in 2021 (USDA GATS, 2022). Wine products, various nuts, and soybeans serve as the other primary U.S. commodities exported to the UK.

Table 3

U.S. agricultural exports to the United Kingdom (UK) grew in a number of major categories

Description	Annual growth in U.S. exports to the UK, 2010–20 (nominal, percent)	Export values in 2020
Forest products	17.74	\$925 million
Alcoholic beverages*	0.92	\$328 million
Tree nuts	10.84	\$197 million
Food preparations	18.64	\$155 million
Essential oils	1.14	\$89 million
Fresh vegetables	11.33	\$84 million

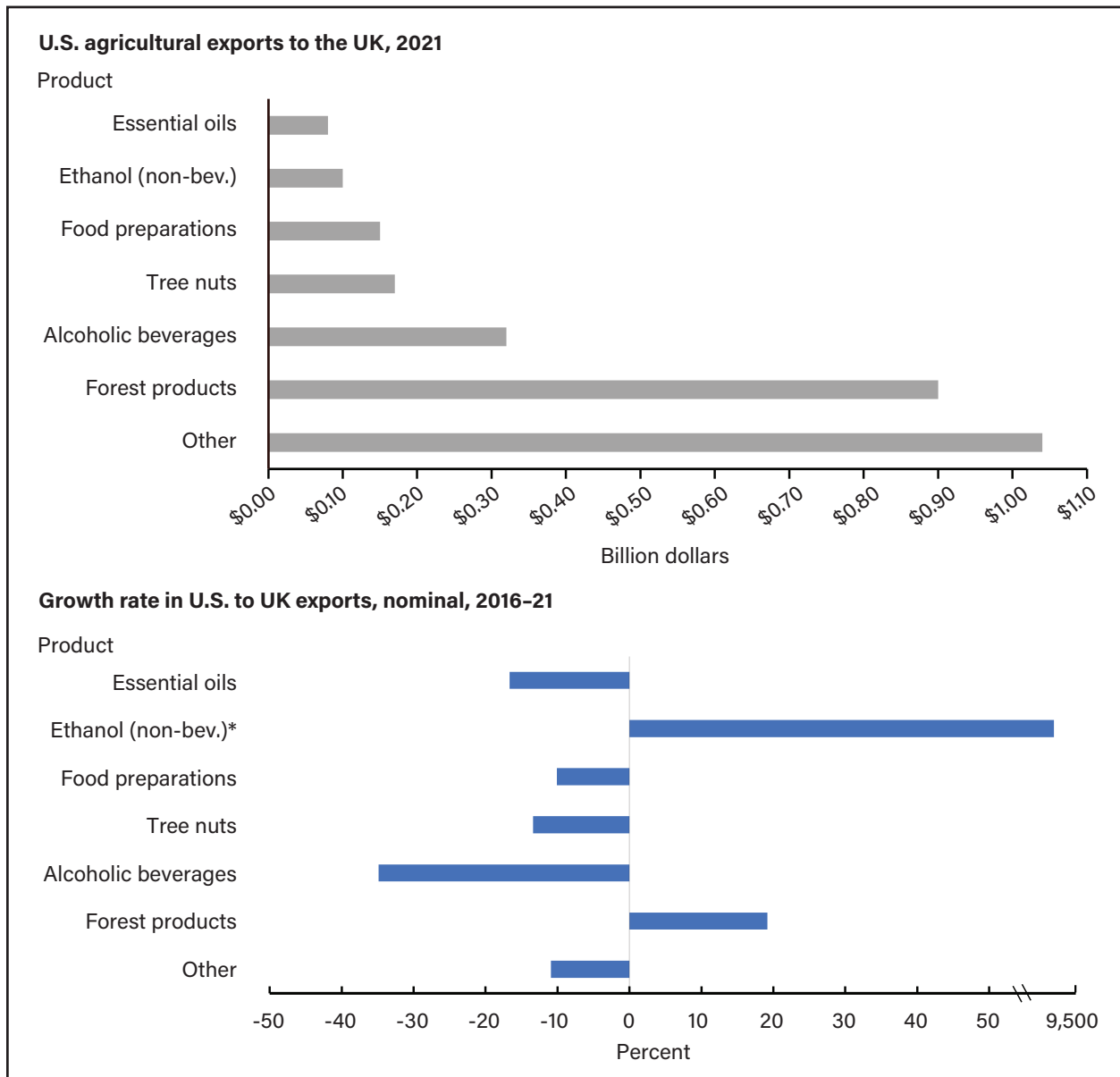
* = Aggregation of distilled spirits, wine products, and beer.

Note: Categories include only those goods included in the U.S. Department of Agriculture’s definition of agriculture.

Source: USDA, Economic Research Service calculations from Trade Data Monitor data.

Figure 16

U.S. agricultural exports to the United Kingdom (UK) by product, 2021, and 5-year trends, 2016–21



Note: non-bev. = non-beverage

*x-axis scale cut off to include ethanol (non-beverage) growth rate during this period of 9,507.7 percent.

Source: USDA, Economic Research Service calculations from Trade Data Monitor, 2022.

Brexit Studies and the Agri-Food Sector

Studies leading up to and following the 2016 Brexit referendum have ranged from broadly based to an analysis of specific sectors for the expected outcomes of the UK’s departure from the EU. The pre-Brexit studies considered alternative assumptions about how Brexit would change the relationship between the UK and EU, as well as other international trade partners. Limited studies included scenarios that have remained aligned with post-Brexit realities, though some patterns of study results are consistent with early post-Brexit estimates (Hill, 2022). An extensive 2018 report by HMG in the lead-up to Brexit considered the long-term economic

effects of the UK's departure from the EU (HMG, 2018). The report summarized multiple studies, including several scenarios for the UK's exit from the EU, as well as the negotiation of alternative labor migration and trade deals, and presents varying levels of UK GDP reduction associated with Brexit. Declines in UK GDP for the broad economy and sector-specific economic losses are consistent throughout the Brexit literature (Sampson, 2017; Born et al., 2019). Early post-Brexit analysis also found lower UK GDP relative to a non-Brexit scenario based on peer economic performance (Springford, 2022).

While the HMG (2018) report considered the UK-EU relationship, other studies also evaluated the uncertainty Brexit might introduce into UK trade outside of Europe. As the UK negotiates TAs, evidence of negative trade externalities can be found beyond Europe (Graziano et al., 2020). Researchers suggested that trade negotiations between the UK and non-EU countries might take a substantial amount of time, introducing uncertainty into trade policy. In estimating elasticity and cross elasticities of export value between the UK and non-European trade partners, Graziano et al. (2020) found that Brexit impacts a larger portion of UK trade than previously estimated and introduced additional uncertainty to other countries' trade.

In the context of the agri-food sector, Hill (2022) summarized the associated Brexit literature that has been most widely regarded, particularly the limited aspects of these analyses that have remained relevant following the EU-UK TCA. However, prior to the implementation of post-Brexit arrangements, the range of findings presented in the literature mainly consisted of smaller-to-larger UK economic losses. For instance, the 2008 HMG report claimed that UK-EU agri-food trade is subject to additional costs in all scenarios considered, with estimated increases ranging from 1 to 42 percent (HMG, 2008). Choi et al. (2021) used computable general equilibrium (CGE)²⁰ modeling to examine multiple Brexit scenarios, ranging from no deal being signed to a free trade agreement between the UK and EU, and found scenarios that introduced additional trade friction resulted in economic losses (i.e., lower GDP) for the UK. On the EU side, the authors found that consumers tended to benefit from lower food prices,²¹ which, when combined with a reduction in the CAP budget from the UK exit, left EU farmers worse off (Choi et al., 2021). This point reaffirmed findings by other researchers who considered UK agriculture post-Brexit and the associated shift away from CAP support (i.e., Pillar I) payments, which could result in reduced farm income and profitability (Downing and Coe, 2018; Helm, 2017; Nortje, 2020; Patton et al., 2020). A study by Cheptea et al. (2021) applied a structural gravity model²² to estimate effects on UK-EU agri-food trade under five Brexit scenarios and found a diversion of trade away from the UK and EU. Like Graziano et al. (2020), the trade diversion effects were estimated on aggregate and not allocated to specific countries or regions.

Other themes (and studies) from the literature on the agri-food sector and Brexit include farmer welfare (Ojo et al., 2021), prospective post-Brexit trade agreements (Davis et al., 2017), and general economic consequences of Brexit (Kierzenkowski et al., 2016; Bellora et al., 2017). A series of articles in *EuroChoices*²³ also considered the effects of Brexit on UK agriculture (Hubbard et al., 2018), trade agreements (Feng et al., 2017), and the social contributions of agriculture (Hill and Bradley, 2019). The overwhelming finding throughout the reviewed literature is that, over the short-to-medium term, Brexit is disruptive to the economy for multiple reasons (e.g., flows of trade and services) and will lead to economic welfare losses in at least the UK, with the potential for welfare losses to other EU members. While there are some instances where specific subsectors may benefit, the overall projected impacts from Brexit on food and agriculture are mostly negative in the short-to-medium term as negotiations are completed and trade patterns change (Hill, 2022).

²⁰ A CGE model is a technique consisting of a series of behavioral equations and accompanying economic data that are used to model impacts from shocks to an economy.

²¹ The EU price decrease is from increased single market supply from reduced food exports to the UK.

²² A gravity model predicts trade flows between countries based on the size and relative location of the two trade partners. Under a gravity model, the level of trade between two countries increases as the proximity of the two countries increases, and vice-versa, trade falls as proximity decreases.

²³ A publication of the European Association of Agricultural Economists (EAAE).

In addition to sectoral analysis, some studies looked at the varying effects of Brexit on the UK's devolved administrations. At the national level, the effects on the agri-food sector are considered in this report, though some past work included a broader sectoral breakdown (similar to HMG (2018) for the UK). An example is Ojo et al. (2021), who dissected UK Brexit effects on the four devolved administrations and found varying rates of sectoral vulnerability between nations, resulting from a reduction in support payments that could leave many UK farm operations at risk of financial distress and lead to the shuttering of some. For instance, they found that under a baseline scenario, farm viability was low for all the devolved administrations, with viability rates at 29 percent in England, 22 percent in Northern Ireland, 14 percent in Scotland, and 21 percent in Wales. Examples of nation-specific studies and findings include the following:

- Arnold (2020), who focused on the island of Ireland, discussed the prospective effects of Brexit on agriculture in Northern Ireland. The findings from this extensive report are broad, with 13 sections, 2 of which are focused on agriculture and the environment. The authors stress the importance of the Irish border, NIP, and alignment between Northern Ireland and the Republic of Ireland to maintain peace and prosperity for the two populations that carry an important rural heritage in farming.
- Parlevliet (2020) looked at agriculture in England post-Brexit, finding differences between farms on productive land that prioritize food production over environmental public goods, as well as vice-versa for operations on marginal land that favors the latter over food production—where both types of operations (characterized by land quality) are motivated by their expected returns under the post-Brexit Environmental Land Management (ELM) policy.
- Lampkin et al. (2021) set the stage for Scottish agriculture following Brexit. The context of the report aligns with UK priorities for the environment and sustainable farming systems. Results from the ScotFarm²⁴ model show that even under alternative environmental payment plans, Scottish farms can receive all or a significant portion of pre-Brexit CAP payments.
- Dwyer (2018) considered agriculture, land use, and rural areas in Wales after Brexit, finding that producers will receive decreased support than previously under the CAP and face stiffer competition and lower prices for important products (e.g., sheep and beef). However, there will be some opportunities for farm businesses to respond adaptively.

Because UK agricultural policy is set by the devolved administrations, studies at the level of these four examples are useful for understanding the national context of the agri-food sector.

Post-Brexit studies have begun to disentangle trends driven by the UK exit from the EU and implementation of the TCA, with the earliest studies released around mid-2021. Brexit also coincided with two major global events that have disrupted agricultural trade worldwide—the COVID-19 pandemic that began in 2020 and the war in Ukraine that broke out in 2022. Consequently, the impacts of Brexit itself are difficult to isolate, though it can be done in some cases. Evidence from these early analyses indicate economic losses to the UK economy across various sectors. One study looked at differences between the UK and other Group of Seven (G7) countries²⁵—as well as non-G7 advanced economies—with respect to the rate of recovery following the first wave of the COVID-19 pandemic; the authors found that UK economic recovery (i.e., GDP and labor supply rebound) has been slower compared with peer nations (HMG, 2022b; Springford, 2022). Analysts also found that post-Brexit global investment in the UK was reduced, as evidenced by data on foreign direct investment (Posen, 2022). In the case of agri-food, one early study showed a 1.5-percent annual increase in the

²⁴ ScotFarm is a farm-level dynamic linear programming model that optimizes farm profit subject to a number of limiting farm resources. It is described as being “developed to conduct impact assessments of policy reforms such as CAP reform and Brexit on Scottish farms” (Lampkin et al., 2021).

²⁵ G7 countries include Canada, France, Germany, Japan, Italy, the United Kingdom, and the United States.

cost of food associated with Brexit over the 2-year period from 2020 to 2021 (Bakker et al., 2022). Researchers also examined the effects of the EU-UK TCA and found it reduced the number of small- to medium-sized UK firms that export to the EU as well as UK exports to the smaller EU economies, while trade with non-EU partners increased at a rate greater than the decline in trade with the EU (Freeman et al., 2022). Another report on post-Brexit trade found that Northern Ireland benefited from integration with both the UK and EU under the NIP, outperforming the UK average economic recovery with better trade and investment conditions (MacQueen et al., 2022). Study findings have also indicated certain exports from the UK to the EU have declined since Brexit, notably dairy products (Polet, 2021; Knight, 2021a). Expanded agricultural trade (e.g., farm inputs, vegetables, roots, and tubers) between the UK and non-EU partners following the enactment of the EU-UK TCA is also evidenced by researchers (Bakker et al., 2022).

UK Agri-Food Policy, Trade, and Brexit

In the lead-up to Brexit following the 2016 referendum, the UK developed internal capabilities and policies to replace various functions performed by the EU. After the UK officially left the EU on January 31, 2020, a nearly 2-year transition period allowed the UK to participate in the Single Market and Customs Union while the two entities negotiated a TCA (TCA, 2020). This provided additional time to develop internal capabilities, complete EU-UK negotiations, and limit disruptive effects on the UK economy and trade. During this post-Brexit, pre-TCA period, the UK had to continue following EU policies and standards (e.g., CAP and SPS).

The agri-food sector featured in the shift from EU to UK governance in two main areas: (1) replacement of the CAP and (2) negotiation of trade agreements. For the CAP replacement, agricultural policy is developed and implemented by the devolved administrations of England, Northern Ireland, Scotland, and Wales. In trade agreement negotiations, the agreements are negotiated by HMG, mostly consisting of rolled-over EU trade agreements with other countries, as well as focused on setting the parameters of the post-Brexit EU-UK relationship under the TCA. Developments to agri-food policy and trade are considered here in the context of a short-term view of the immediate effects of Brexit and in regard to the development and transition to post-EU agri-food policies and trade agreements. Some final considerations are then discussed for the post-Brexit view over the medium-to-long term, taking into account apparent challenges and opportunities for the UK agri-food sector in the future.

UK Agri-Food Policy and Trade in the Short-Term

UK Agricultural Policy after the CAP

Barring pest and disease outbreaks or persistent adverse weather conditions, UK agricultural production should remain stable in the short term. Most elements of the CAP are expected to continue while new policies are formulated, resulting in little short-term policy impact on UK agricultural production. As described in the earlier section on the EU-UK relationship, the CAP is not “one-size-fits-all,” so agricultural policy already differed between the devolved administrations leading up to Brexit (Petetin, 2022). Post-Brexit UK agri-food policy can be framed as a continuation of national trends of CAP-type programs and support. For example, England, on one hand, prioritized environmental protection under Pillar II, while Scotland, Wales, and Northern Ireland, conversely, retained Pillar I support programs in the form of per-head payments for cattle and sheep producers (i.e., coupled payments), which allowed production to continue on marginal land that

would otherwise be economically infeasible.²⁶ Nationally developed agricultural policy frameworks reference former provisions of the CAP to contextualize policy positions, indicating whether a policy will be continued or changed, gradually or immediately.

Continuing the example by drawing distinctions between national priorities, England's application of CAP Pillar II prioritized environmental policy aims and is reflected in the country's post-Brexit "public money for public goods" motto of the ELM policy. Agricultural policies in the other three nations are still under development, with the continuation of CAP-type support in the near-term and retained elements from the CAP included in their proposed policies, such as Pillar I support payments to farmers. Diverging from the EU and CAP is not as simple as abandoning past support mechanisms in favor of new ones; in fact, the autonomy to tailor programs to national priorities directly fits with the modern CAP. As described previously regarding CAP, under the most recent version (CAP 2023–27), EU member states have greater autonomy to set their own policy agenda. This CAP relies upon country-specific strategic plans to determine how to allocate CAP resources based on national needs and overarching EU policy aims (e.g., environmental stewardship) (EU, 2021). In this way, UK agricultural policy enacted at the national level aligns with the new CAP and diversity in agricultural policy implementation across continental Europe. Thus, EU and UK policies are moving similarly toward a delivery rather than a regulatory approach.

Building upon the example of contrasting agricultural policy approaches in the UK, England's policy will likely be more similar to rich EU countries with a proportionately small agricultural sector. The other nations' policies will likely be more aligned with larger agricultural producers like the Republic of Ireland or France. The level of divergence between the UK's devolved administrations is constrained by the UK Internal Market Act 2020 and the published Common Framework all four UK nations agreed to, though Northern Ireland is also subject to additional parameters under the EU-UK TCA (i.e., NIP). The predominance of grain and animal production in UK agriculture, and support for the livelihood of farmers and long-term stewardship of the working land and environment, are essential factors during the development of constituent policy frameworks. For instance, growers will be compensated for environmental services associated with forgone agricultural production (under England's ELM and by the continuation of CAP Pillar II-type programs in the rest of the UK).

The CAP's reorientation away from intensive farming to environmental stewardship, animal welfare, and multifunctionality may be another explanation for relatively weak UK productivity growth. Reductions in the use of inputs resulting from these policies are likely to decrease output unless some yield-enhancing technologies can be advanced, but such technologies are likely to take years to develop and achieve widespread adoption (Thirtle et al., 2008). As a result, the UK may likely rely more heavily on imported agri-food products to compensate for this decline. Thus, investment in public agri-food R&D is another area that has been prioritized by HMG post-Brexit (GFS, 2022). Balancing the joint aims of productivity growth and environmental protection could be supported by tractable measures of environmentally adjusted TFP (Bell, 2022; Bureau and Anton, 2022). While the agri-food policies of the devolved administrations may align in some respects, such as prioritizing productivity and the environment, there is no evidence of a broader UK strategy for the sector. This can also be interpreted as a departure from the EU and, for example, the European Green Deal Farm to Fork and Biodiversity Strategies (European Commission, 2020), as well as being reflected in the approval process for member state strategic plans under CAP 2023–27 (EU, 2021).

All four of the UK's constituent nations have provided at least some detail about their post-Brexit agricultural frameworks, though specific policy measures are still in various stages of development and implementation across the UK. Each nation established a transition period with some form of CAP-style support payments remaining in place in the short term. Agricultural economists from UK agricultural ministries suggest that many farm businesses will be under financial pressure, particularly in the grazing livestock and cereal sectors,

²⁶ Also referred to as "headage schemes" in EU and UK documentation.

and a significant decrease in support payments could challenge the viability of many producers (Patton et al., 2020; Ojo et al., 2021). With more than 100 percent of net farm income coming from CAP-style support payments, in some cases, ending these payments outright would create a significant impact on UK agriculture, the rural economy, the environment, and upstream and downstream industries. Thus, the effectiveness of alternative payment programs is at the forefront of national agricultural policy discourse. Notwithstanding, pre-Brexit national trends under the CAP—along with details from the respective devolved administrations pre- and post-Brexit—supports internally divergent agricultural policies in the UK. The status of policy development is thus summarized at the national level.

Agricultural Policy in England, Northern Ireland, Scotland, and Wales

England

England is the only UK nation that has completed a post-Brexit agricultural policy framework, the ELM policy. The framework fully phases out CAP Pillar I-type direct payments by 2027, with a reduction in this type of payment over a 7-year timeframe. In place of CAP, England adopted the ELM and makes payments to farmers in receipt of productivity and environmental improvement (similar to CAP Pillar II) (UK Defra, 2020). ELM was developed through pilot programs and consultations. For example, the first pilot program included a sustainable farmer incentive payment where farmers can choose from eight categories of sustainable practices. The level of practices they undertake—from beginning to advanced—determines the level of payment the farmers receive. Money saved from Pillar I-type support payments may be used to fund investment in capital and management improvements, as well as to help farmers exit agriculture if desired. Under ELM, farmers can receive equivalent levels of CAP support by participating in various programs (Petetin and Dobbs, 2022). These programs fit with the ELM slogan of “public money for public goods” by prioritizing environmental protection.

Northern Ireland

As part of the Brexit process, the UK and the EU agreed to the NIP, which among other things, provides an EU-funded agricultural state aid carve out for Northern Ireland, which presently does not include a set end date for support payments. While support for other UK regions comes directly from the UK budget, payments for Northern Ireland come from the EU. Despite this extra budgetary support, Northern Ireland is developing new support programs through a consultative process to deliver on four key areas: (1) increasing productivity, (2) ensuring environmental sustainability, (3) improving resilience, and (4) maintaining a responsive supply chain (DAERA, 2022). To do this, Northern Ireland is proposing to develop a simple area-based income measure to provide a basic safety net but at a level that does not interfere with productivity or innovation. Farmers will be required to undertake certain standards of farming activity. Also, a per-head sustainability measure for brood cows and ewes was proposed, along with several other measures aimed at helping to transition away from Pillar I-type payments to payments linked to providing public goods through agriculture.

Scotland

Taking an approach of maintaining the policy mechanisms of the CAP, Scotland decided its key goal is to maintain stability for its farming sector and plans to keep Pillar I-style support payments in place until at least 2024 (Scottish Government, 2021). This includes retained per-head payments for cattle and sheep to support culturally important production that would not otherwise be profitable on marginal lands. As part of the process of developing post-Brexit agricultural policy, Scotland is also collecting stakeholder input around the

themes of sustainability, simplicity, and profitability. Scottish leaders have also asked the UK government to maintain the overall level of funding for agricultural programs past 2022, which could be a significant determinant in future policy direction if funding is lowered (Petetin and Dobbs, 2022).

Wales

Wales announced the Sustainable Farming Scheme (SFS) to replace CAP direct payments beginning in 2025, with a multi-year transition period to follow (Welsh Government, 2021). The SFS includes per-head coupled payments for cattle and sheep production that is in line with Scotland's plan. Like the other countries, this new program is in development and is expected to provide payments linked to environmental outcomes while retaining some support for longstanding culturally important production systems on marginal land. SFS focuses on sustainable land management, setting national minimum standards, and deemphasizing rural development compared with prior arrangements under the CAP (Petetin and Dobbs, 2022). The legislative framework to implement new programs is scheduled to be considered in 2022.

Agri-Food Trade for a Global Britain

Brexit will affect UK trade patterns for agri-food goods as the country remains a large importer. Given the importance of trade, the post-Brexit UK vision is for a “Global Britain” that negotiates deals with countries such as Canada, India, Israel, Mexico, the United States, and the nations that comprise the Gulf Cooperation Council—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Negotiations of trade agreements by HMG on behalf of the UK were active during the period leading up to and following Brexit. Rolled-over EU trade agreements set the terms between the UK and more than 60 countries, and new trade agreements (e.g., Australia and New Zealand) have been signed since Brexit.

Throughout the period of the UK's membership with the EU, the country reaped the benefits and bore the costs from EU trade negotiations, including agreements with countries and regions such as Canada, Central America, Mexico, and South Korea. Leading up to Brexit, UK negotiations were mostly successful at rolling over EU trade terms, at least as a short-term arrangement until future negotiations are completed (table 4). Notably, only a few trade relationships defaulted to WTO terms following Brexit. Thus far, the UK has negotiated a handful of trade agreements that differ from a continuation of EU terms. Japan-UK was the first of these agreements (October 2020), followed by add-on provisions in the agreement with Norway, Iceland, and Lichtenstein (June 2021). Most recently, digital trade agreements with Singapore (February 2022) and Ukraine (November 2022), and trade agreements with Australia (December 2021) and New Zealand (February 2022) have been negotiated, as well as commencement of 2022 UK trade negotiations with India (January 2022), Canada (March 2022), Mexico (May 2022), Gulf Cooperation Council (June 2022), and Israel (July 2022). The UK also applied to join the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) in February 2021 and negotiations started in September 2021 (Webb, 2022). Accession to the CPTPP would further expand export markets for UK spirits, as well as strengthen the country's ties to large agricultural suppliers such as Australia, Canada, and Mexico.²⁷

²⁷ Burfisher et al. (2014) considers agriculture in the Trans-Pacific Partnership (precursor to CPTPP).

Table 4

United Kingdom (UK) trade agreements (TAs) and countries represented

UK trade agreement status	Number of agreements	Countries represented
Rollover (EU)	44	67
Effective (mechanism)	36*	63
Full ratification	26	39
Bridging mechanism	2	2
Provisional application	9	26
Still in discussion	4	4
UK negotiations		
Completed (signed)	3	3
Current	4	13
In preparation	3	8
EU-UK TCA	1	27

Note: * = Sum of effective TAs is less than total because the TAs of Andean countries Ecuador and Peru are considered “full ratification” trade agreements, and Colombia’s trade agreement is noted as a “bridging mechanism.” EU = European Union; TCA = Trade and Cooperation Agreement.

Source: USDA, Economic Research Service using information from UK Department for International Trade, 2022.

The United States began trade negotiations with the UK in May 2020, though a timeline to complete a trade agreement is not yet clear. In some cases, the United States and UK have made agreements on trade for specific products. This includes trade in wine and mutual recognition of certain distilled spirits (USTR, 2022). A recent measure agreed to between the two countries is an approval of UK beef and lamb exports to the United States for the first time in more than 20 years. Differing assessments of risk over BSE and genetically modified organisms (GMOs) curbed UK-U.S. agricultural trade in past years. The BSE issue was resolved with the United States reauthorizing UK beef imports at the end of 2021. If UK regulators are less restrictive of new technologies such as genetic engineering than are EU regulators, U.S. crops produced with such technologies may be able to gain a share of the post-Brexit UK market. However, there is also potential for new barriers. If, for instance, producers face higher costs to comply with UK commitments to reach GHG emission targets, these producers may seek measures to protect them from competing imports produced in countries with less stringent regulations. In this case, other imports from the United States may align with UK objectives. For example, wood chips used to produce sustainable energy are already a top U.S. agricultural export to the UK. Also, the United States is the second largest supplier of bioethanol to the UK after the EU. The comparative advantage of U.S. over EU bioethanol production could also lead to increased U.S. trade in renewable fuels with the UK.

As its trade policy becomes independent of the EU’s, the UK may utilize negotiations with the United States and other partners to diversify its suppliers of agricultural imports. Furthermore, U.S. exports to the UK benefit from a shared language, perceived affordability, familiarity, and additional capacity from established import-export firms (Vasquez-Nicholson, 2021). While the U.S. market share in the UK agricultural market is small (4 percent), it could be expanded through new trade opportunities. This viewpoint is supported by early evidence of an increased non-EU share of UK imports of agri-food inputs and products such as vegetables, and roots and tubers (Bakker et al., 2022). Despite these shifts, about 70 percent of UK agri-food trade is with the EU, and a primary focus of trade negotiations was the post-Brexit EU-UK TCA.

EU-UK Trade and Cooperation Agreement

The EU-UK TCA was ratified on December 24, 2020, and entered into effect on January 1, 2021, with the EU-side grace period to phase in TCA regulations ending January 1, 2022. On the UK side, the TCA regula-

tions phase-in, originally set to conclude in June 2022, was extended 18 months to January 2024 to allow additional time for the UK transition. Under the EU-UK TCA, the UK is afforded mostly²⁸ tariff-free access to the EU market, but new challenges, such as paperwork requirements, rules of origin, and nontariff measures, could affect trade patterns. For instance, the UK is no longer used as a hub for onward trade in wine and nuts since these products would be subject to additional duties under the EU-UK TCA rules of origin. Also, the status of resident foreign workers and the movement of labor and services between the UK and EU resulted in challenges post-Brexit, especially in the agri-food sector with associated UK labor shortages.

Following the TCA, trade between the EU and UK declined (Bakker et al., 2022). There was controversy about whether steep declines in trade volume were due to Brexit or the impacts of COVID-19 (Freeman et al., 2022). However, part of the decline is likely associated with an adjustment period to the new UK-EU trade regime, as multiple challenges were experienced. For example, delays in shipments between the EU and UK arose because of new customs requirements (e.g., paperwork), leading to spoilage and certain EU businesses ceasing orders from the UK. The UK-side phase-in of the TCA to 2024 extended the adjustment period for UK border checks. Though once checkpoint infrastructure and personnel (e.g., veterinary inspectors) are established, UK inspections for animal products coming from the EU could cause similar delays and trade reductions. Growth in the UK's agri-food trade with non-EU partners post-Brexit suggests the TCA may have played a role in diversifying trade away from the EU. Recognition of trade barriers and shifting trade patterns could prompt the adoption of new arrangements when the TCA is renegotiated in 5 years (Holmes, 2022).

Additional Considerations for UK Agri-Food Trade

The negotiation of new trade agreements has been touted as an advantage of Brexit, with recent deals (e.g., Australia and New Zealand) highlighted by UK leadership as an early win (HMG, 2022a). On the other hand, a notable critique described these agreements as deals that give “back side payments to get back to (trade) level under the EU, which is better than the alternative (i.e., trade reduction)” (Posen, 2022). The EU-UK TCA also introduced TBTs with the UK's largest trade partner post-Brexit. Furthermore, the UK no longer benefits directly from EU trade negotiations as a member, though multilateral trade negotiations by the EU (e.g., WTO) could still benefit the UK in some cases of EU-UK regulatory alignment (Petetin and Dobbs, 2022). Another consideration is the UK's former role as an EU member (prior to Brexit), having aligned with countries like Sweden and the Baltics to support free trade and oppose protectionist measures introduced by other EU members. A post-Brexit example is an internal EU procurement policy introduced by France that could impact trade by adding a requirement that public expenditures preferentially select products from the Single Market over foreign ones.

Issues related to the agri-food trade include TBTs in the form of regulatory hurdles (e.g., border inspections and paperwork) and NTMs, such as SPS standards, as well as tariff-rate quotas (TRQs) that limit the amount of foreign products that can enter the market tariff-free or at a lower rate.²⁹ NTMs factor into trade agreements by preventing imports that do not meet domestic standards (e.g., food safety, SPS, and labeling).³⁰ This is relevant in multiple cases related to post-Brexit UK agri-food policy aims such as environmental protection and animal welfare that could affect trade (Petetin and Dobbs, 2022).

Animal products in the UK is an example that illustrates these issues. The UK may implement some of the most stringent animal welfare regulations, which could prompt new investments by farmers (Sietto, 2022). Many UK farmers are concerned that lower cost imports may not satisfy these UK animal welfare standards,

²⁸ Rules of origin in the EU-UK TCA impose tariffs on some processed goods comprised of materials from outside the UK or EU. The food industry is particularly affected by these requirements since many processed products do not qualify for tariff-free trade (Institute for Government, 2020; HMG, 2021).

²⁹ For further examination of TRQs and agricultural trade, see Beckman et al. (2021).

³⁰ For an examination of the effects of SPS standards and TBTs on U.S.-EU agricultural trade, see Arita et al. (2015).

leaving UK producers at a disadvantage unless the imports are restricted (Petetin and Dobbs, 2022). Animal product standards (e.g., non-hormone-treated beef and non-pathogen reduction-treated poultry) are among the longstanding issues that have prevented some U.S. farmers from trading with the EU and UK (Bolla, 2019). In addition to NTMs, high external tariffs are another factor that has generally kept non-EU products out of the UK—along with other European markets.

In cases where UK standards are met but a comparative advantage in agriculture remains an issue, TRQs may limit the market share of lower cost imports. For instance, EU TRQs for U.S. high-quality beef that meets EU standards were based on overall imports to the Single Market, but now the UK must renegotiate allocations for U.S. high-quality beef. Recently reapproved UK beef and lamb exports to the United States post-Brexit is another potential area of growth for trans-Atlantic trade. UK producers of beef, lamb, and milk may benefit from foreign market access under the finalized trade agreements, but these producers also may be wary of comparative advantage from countries like Australia and New Zealand. In response to these concerns, the UK-Australia trade agreement includes TRQs that are phased out over 15 years to fully expand agricultural trade between the two countries. More sensitive markets, such as UK lamb, will transition over the full term, while in some cases, this transition will be complete within 5 years. For example, wheat and barley TRQs are enforced for only 4 years before tariffs and quotas are eliminated.

Some UK products may benefit from new export markets in cases where market stability may justify expanded output. China has been the UK pork sector's largest export market since 2016, and exports doubled between 2018 and 2020 following Chinese herd reductions associated with ASF outbreaks. Exports dropped as China contained the ASF outbreak and production rebounded, but China remained the top UK pork export market in the first half of 2022. However, the UK hog industry also had to contend with uncertainty related to Brexit (e.g., labor shortages for butchers and haulers) and the ongoing COVID-19 pandemic that prevented market stability with slaughter volume projected to fall in 2022 (Knight, 2021b).

UK Agri-Food Sector in the Medium-to-Long Term

Several relevant factors to the UK agri-food sector are observed in the medium-to-long term. These include challenges from global climate change, the ongoing COVID-19 pandemic, and Russia's military invasion of Ukraine, which are likely to affect this sector and the broader economy for many years to come. Policy timelines and targets are also set over a longer timeframe. In some cases, these are broad multinational commitments such as the Paris Climate Accords' 2030 goals. UK agri-food policy and trade agreements will also reach important milestones in the medium-to-long term. For example, the phase-out of CAP-style support payments under England's ELM will conclude in 2027. Multiple UK trade agreements are likely to be finalized, and UK markets will continue to be opened to imports as TRQs are phased out, while UK producers may benefit from greater access to foreign markets. In addition, the first renegotiation of the EU-UK TCA in 2026 could recognize trade barriers and shifting trade patterns and prompt the adoption of new arrangements, which also applies to future reviews (i.e., at 10 and 15 years). Nevertheless, inferring developments over the medium-to-long term is complicated by unforeseeable circumstances and potential changes in policy direction on multiple fronts (i.e., production and trade) in the future.

Investment in R&D to address anticipated and unforeseen effects from global climate change is a UK priority post-Brexit. While public funding for R&D may become available in the short term, the benefits from these investments in the agri-food sector are likely to be accrued over the medium-to-long term. A tradeoff between the local environment and input use that is generally associated with lower yields may also be addressed by investments in R&D. In other words, technological advancement may mitigate some of these production declines through greater productivity, but in addition to R&D, this requires capacity building to

aid in proof-of-concept, scaling, delivery, promotion, and ultimately adoption by producers. In the past, UK public investment in R&D and the adoption of new technologies served as an important factor in driving the country's domestic productivity gains in the lead-up to joining the EU and as an early member (Thirtle et al., 2008). Again, while time horizons for the returns from R&D are long, meeting environmental goals in the meantime may entail a reduction in output. Unlike shifting patterns of existing trade volumes, the demand generated from shrinking domestic production presents novel opportunities to expand UK agri-food trade. This has been illustrated in the case of the EC's European Green Deal strategies to reduce the use of conventional agricultural inputs, where projections include greater reliance from the EU on imported goods as well as increased food prices in the Single Market (Beckman et al., 2020).

Trade in goods and technological advancement may help to supplement these needs initially and reduce the timescale from innovation to adoption by farmers. One example is the use of gene editing (or enhanced breeding) to remove undesirable genes from the germplasm and/or hasten the process of traditional breeding techniques for desirable traits (e.g., yield, seasonality, and drought and disease resistance).³¹ The UK has participated in genetically edited wheat trials, though no commercial varieties have been released, as well as calls from researchers to adopt recent developments in animal breeding (e.g., to reduce diseases and relative GHG emissions) (Harvey, 2021; McKie, 2021; Stokstad, 2021; Wilson, 2021). Furthermore, consideration of biotechnology and additives in animal feed (e.g., GMO corn and soy or red seaweed, given the relative size of the UK coastline) may offer a lower cost and more environmentally friendly alternative to producers that currently feed with wheat and barley (UK FSA, 2021; Roque et al., 2021; Sabin, 2021). Openness to biotechnologies is a longstanding debate in the EU and UK (Kupferschmidt, 2018). While there may be varying degrees of consumer acceptance of biotechnology within the UK, navigating these issues as an independent nation may lead to expedited approval and use (Stokstad, 2021; Wilson, 2021). This is an example of divergent policy between the EU and UK, where evolving stances and approval processes related to bioengineering have already led to trade issues (HMG, 2022a). Concurrently, the UK remains highly integrated with the EU for agricultural and food trade, which could be affected by shifts in biotechnology policy by either party.

Considering future alignment between the UK and EU, both the EC's European Green Deal and HMG's Government Food Strategy include aspirational targets for the agri-food sector by 2030. For instance, the European Green Deal aims to set aside 10 percent of agricultural land for biodiversity and habitat, with a corresponding goal in the Government Food Strategy to triple England's forested area by 2030 and restore 280,000 ha of peatland by 2050. While the Government Food Strategy does not call for specific cuts to conventional agricultural inputs (e.g., fertilizer and pesticides), it does focus on agricultural sustainability, reduction targets for sectoral GHG emissions, revised animal welfare standards, and investment in agri-food R&D. Both the European Green Deal and Government Food Strategy address food waste as an important means to improve the sustainability of European food systems. Aside from the devolved approach to agriculture, trade provisions in the Government Food Strategy may play a similar role to the European Green Deal in setting UK policy. Language in the Government Food Strategy reflects HMG's post-Brexit "Global Britain" with trade agreements negotiated to offer the best value for imported products and secure markets for UK products abroad, though EU influence on trade policy remains an essential consideration as the UK relies most heavily on exchanges with the Single Market. This is also reflected by public procurement guidance in the Government Food Strategy that includes environment, sustainability, and animal welfare considerations, which differs from the post-Brexit EU proposal to favor public procurement from Single Market producers over external sources. Other European Green Deal-related trade policies that could bear relevance to the UK include the carbon border adjustment mechanism (CBAM) and deforestation-free supply chains, which could benefit U.S. trade in

³¹ Varieties generated through genetic engineering are not achievable through gene deletion alone or traditional breeding techniques. For further discussion on the differences between gene editing and genetic engineering in the context of EU policy, see Kupferschmidt (2018).

forest products as a leader in sustainable forestry. Products certified as (net) deforestation-free from sustainably managed forests, as well as opportunities in this sector for carbon sequestration and the sale of GHG offsets may generate significant opportunities for U.S. foresters (U. S. Department of State, 2021).³²

Summary: Post-Brexit UK Agri-Food Policy and Trade

The outlook described here is based on the report's discussion of post-Brexit policy changes and the UK's limited agricultural production capacity. From the short-to-long view, a few common threads are apparent for UK agri-food policy and trade. First, the UK will likely remain a large importer of agri-food products and generate additional import demand to account for declining domestic supply as support to producers is reduced in favor of environmental protection aims. The predominant reliance on agri-food trade with the EU will likely be maintained, at least in the short run, while contending with challenges from the concurrent COVID-19 pandemic and the introduction of new regulatory hurdles and nontariff barriers now that the UK is no longer part of the Single Market. Early considerations of agricultural policy at the national level affirm this path as some of the devolved administrations gradually move away from an EU CAP-style policy framework while maintaining some consistency with EU CAP-style payments to producers over the immediate term. In time, the realization of different scenarios, such as shifts in Pillar I support payments to maintain overall levels of farmer income compared with scenarios where farmer income is reduced, could reveal long-term effects from Brexit on UK agri-food production. Similarly, trade policy has relied on rolled-over agreements negotiated under the EU, with trade agreements recently completed with Australia and New Zealand. The UK seeks to benefit from trade negotiations through diversified import supply and greater export demand for its high-value processed goods. Again, the effects of Brexit could come through shifts in UK agri-food trade and the realization of areas of global comparative advantage and consumer demand for high-value specialty products. Broadly speaking, engagement with the UK over the coming years presents new opportunities for partnerships and expansion of trade flows into the island nation. In the case of the United States, strong trends in wood products, as well as a shared language, perceived affordability, familiarity, and established import-export capacity, present an optimistic outlook from across the pond.

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³² In 2019, about 11 percent of U.S. GHG emissions were offset by the forest sector. For a detailed examination of the sector's potential for GHG mitigation, see Giebink et al. (2022).

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