

Chapter 1

Overview of the Agricultural Outlook 2017-2026

This chapter provides an overview of the latest set of quantitative medium-term projections for global and national agricultural markets. The projections cover production, consumption, stocks, trade and prices for 25 agricultural products for the period 2017 to 2026. The chapter starts with a description of the state of agricultural markets in 2016. In the next sections, consumption and production trends are examined, with a focus on regional developments. The chapter also reviews trade patterns showing the relative concentration of exports and dispersion of imports across countries for different commodities. The chapter concludes with global agricultural price projections and a discussion of uncertainty which might affect price projections. Growing demand for agricultural commodities is projected to be matched by efficiency gains in production which will keep real agricultural prices relatively flat.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law. The position of the United Nations on the question of Jerusalem is contained in General Assembly Resolution 181(II) of 29 November 1947, and subsequent resolutions of the General Assembly and the Security Council concerning this question.

The setting: Record production levels and abundant stocks led to continued price decreases in 2016

For most cereals, meat types, dairy products and fish, the 2016 production level was either the highest on record, or a close second. These exceptional production levels, along with stagnant demand and high levels of existing stocks, led to further declines in prices for most commodities (Figure 1.1). Oilseeds, biodiesel, cotton and fish saw a modest price recovery compared to 2015, and the sugar price continued its upward path.

Conditions in agricultural markets are heavily influenced by macro-economic variables such as global GDP growth (which supports demand for agricultural commodities) and the price of crude oil (which determines the price of several inputs into agriculture, and influences the demand for cereals, sugar crops, and vegetable oils through the market for biofuels). In 2016, global GDP growth remained low at 2.9%, the slowest growth rate since 2009. Crude oil prices, which had been low since mid-2014, increased at the end of 2016 following an agreement of both OPEC and non-OPEC producers to reduce output in 2017. However, throughout most of the year, oil prices were low by historical standards. In combination with sluggish GDP growth, this contributed to the price decreases observed in agricultural markets in 2016.

Summary of macroeconomic conditions and policy assumptions

This *Agricultural Outlook* presents a baseline scenario that is considered plausible given a range of assumptions on the macro-economic, policy and demographic environment. Box 1.4, at the end of the Overview chapter, describes in detail the main macroeconomic and policy assumptions that are adopted in the baseline projections. Compared to 2016, GDP growth is expected to pick up slightly in developed economies over the next ten years, but to slow in emerging markets and developing countries. Developing countries will continue to drive global population growth; however global population growth is projected to slow to 1% per year over the next decade. Inflation is projected to remain low in OECD countries and the People's Republic of China (hereafter "China"). In Brazil and the Russian Federation, inflation will come down from recent high levels, aided by currency stabilisation. Nominal oil prices are expected to increase at an average rate of 4.8% per year over the outlook period, from USD 43.8 per barrel in 2016 to USD 89.5 per barrel by 2026.

The baseline projections in the *Agricultural Outlook* assume current policy settings continue into the future. In particular, the decision of the United Kingdom to leave the European Union, officially communicated by the British government on 29 March 2017, is not included in the projections as the terms of departure have not yet been determined. In the current *Outlook*, projections for the United Kingdom are therefore retained within the European Union aggregate.

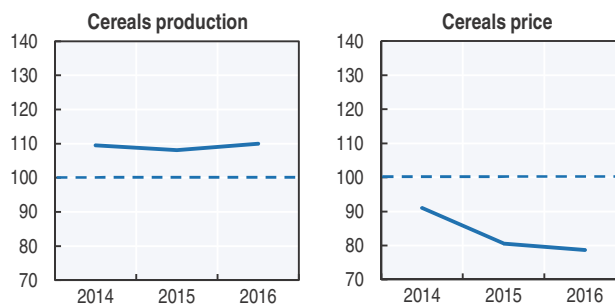
Figure 1.1. **Current market conditions for key commodities**

Current market conditions

Production Index
Average 2006-2016 = 100Price Index
Average 2006-2016 = 100

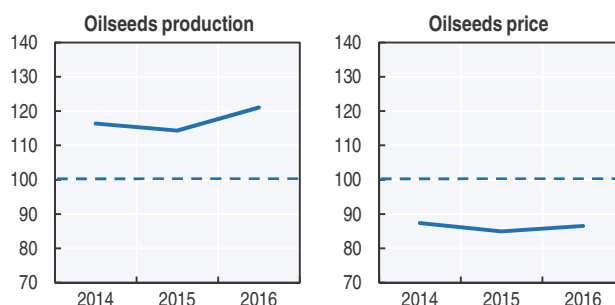
Cereals

World production reached a historical high in 2016, especially for wheat and maize following bumper crops in key exporters. The resulting surplus, along with maize destocking policies in China, led to continued declines in prices.



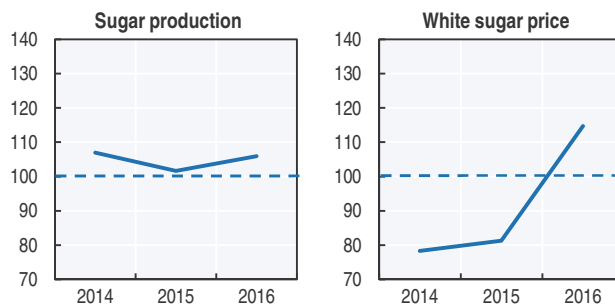
Oilseeds

Soybean production increased strongly in 2016 due to record crops in the United States and Brazil. World aggregate production of other oilseeds (rapeseed, sunflower seed and groundnuts) increased for the first time in three years. Following the 2015 decline, vegetable oil production recovered in 2016. Although oilseed prices increased in 2016, they remain below the average prices of the past decade.



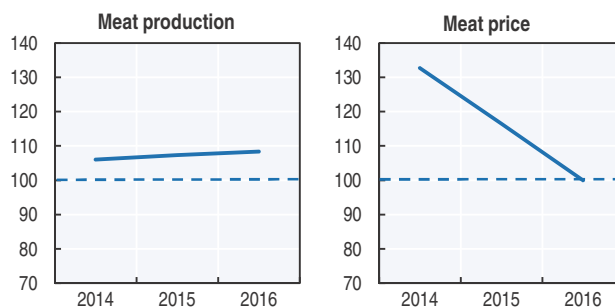
Sugar

Production in the 2016/17 season is expected to be insufficient to cover demand. Production setbacks occurred in key exporters Brazil and Thailand, and in India, the second largest producer. Sugar prices remain relatively high. Prices for high fructose corn syrup, the main alternative to sugar, also increased in 2016.



Meat

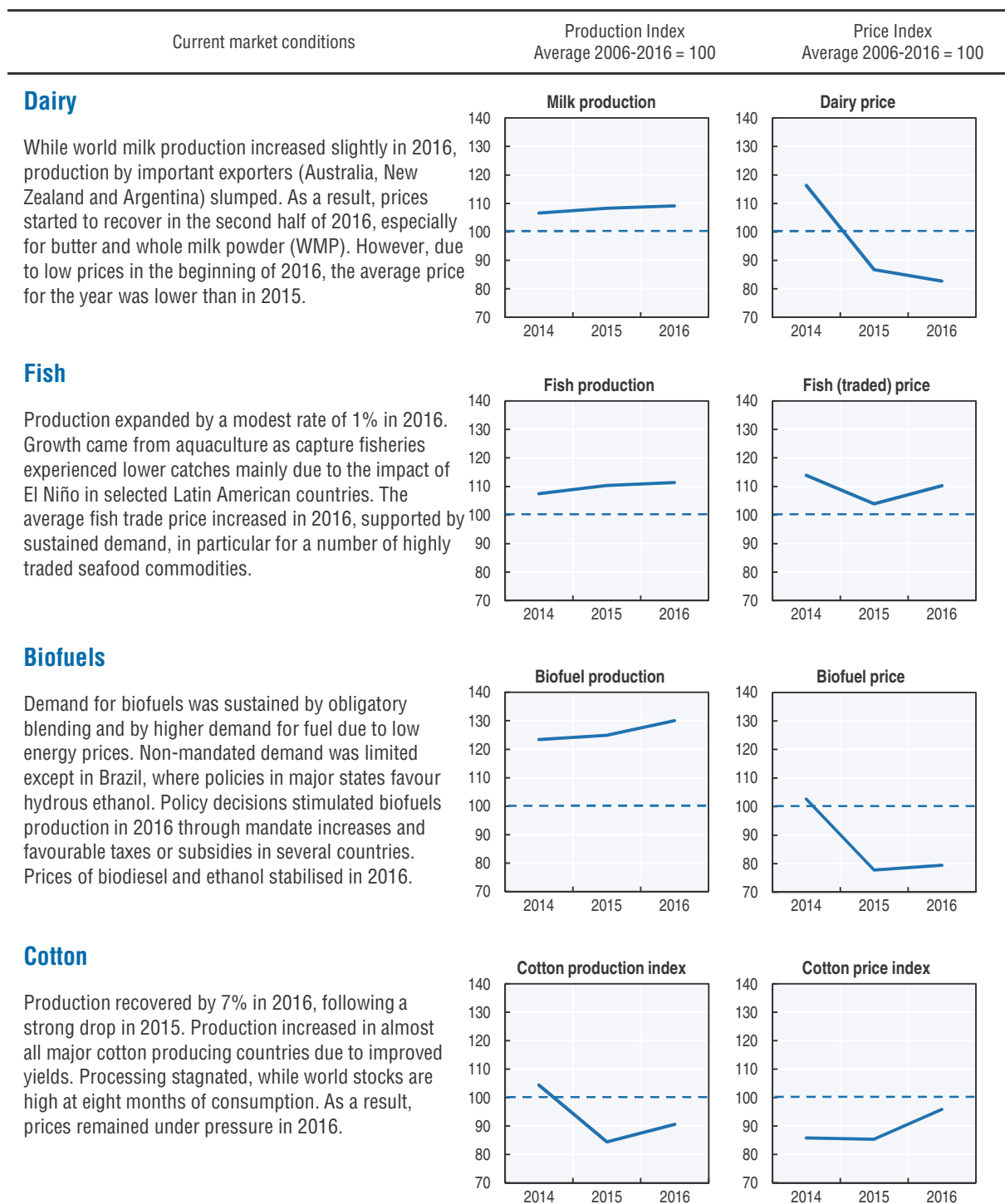
Overall production increased by only 1% in 2016, the second lowest rate in the last decade. Production of poultry and bovine meat expanded while pigmeat and sheep meat production declined. Despite a recovery near the end of the year, prices in 2016 were on average below the 2015 level. Relatively low feed costs and growing livestock inventories contribute to decreasing prices.



Note: All graphs expressed as an index where the 2006-16 average is set to 100. Production refers to global production volumes. Prices are nominal. More information on market conditions and evolutions by commodity can be found in the Commodity Snapshots in Chapter 3, the commodity snapshot tables in the Annex, and the online commodity chapters.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 2 <http://dx.doi.org/10.1787/888933520914>

Figure 1.1. **Current market conditions for key commodities** (Cont.)

Note: All graphs expressed as an index where the 2006-16 average is set to 100. Production refers to global production volumes. Prices are nominal. More information on market conditions and evolutions by commodity can be found in the Commodity Snapshots in Chapter 3, the commodity snapshot tables in the Annex, and the online commodity chapters.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 2 <http://dx.doi.org/10.1787/888933520914>

Consumption

Global demand growth will slow compared to the previous decade

The last decade has seen unprecedented growth in the demand for agricultural products. Between 2004-06 and 2014-16, the total consumption of cereals (wheat, maize, rice, and other coarse grains) increased from 2.0 bln t to 2.5 bln t, adding almost 500 Mt of additional demand. To put this in perspective, total domestic utilisation of cereals (including for non-food uses) in the United States was around 350 Mt in 2016. Similarly, the total consumption of poultry increased from 81 Mt in 2004-06 to 113 Mt in 2014-16, an increase of 32 Mt. The 2014-16 domestic utilization of poultry in the United States was 17 Mt. Demand for fish for human consumption also increased remarkably, growing from 111 Mt in 2004-06 to 149 Mt in 2014-16, an increase of 38 Mt; fish consumption in the United States in 2014-16 was 7 Mt. Over the last ten years, agricultural markets thus experienced a demand increase of historical proportions.

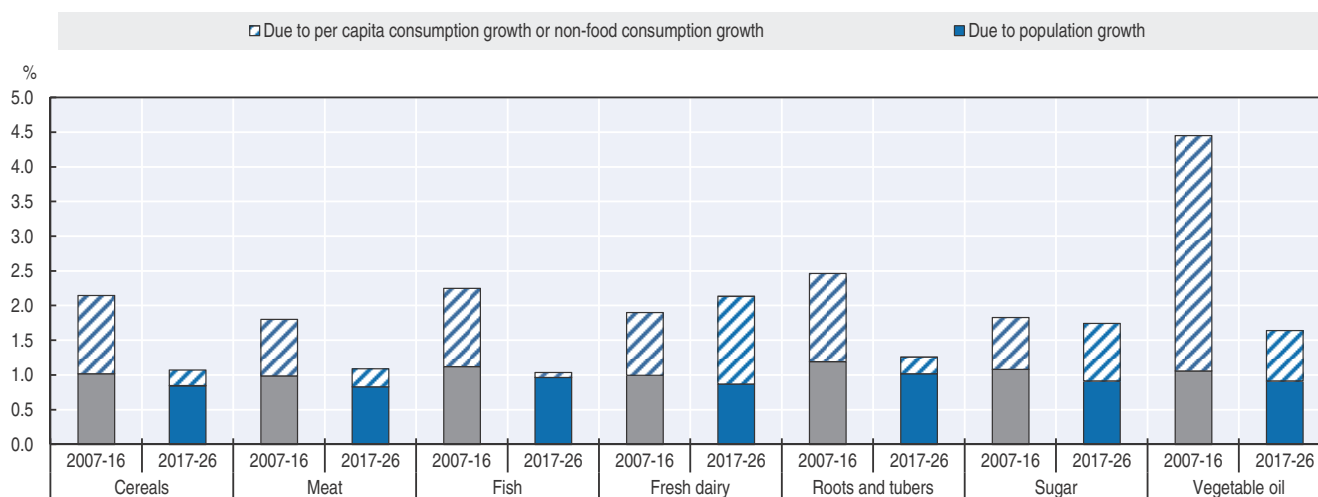
This increase was driven by two main factors: the rise of China and the growth in biofuel production. In China, income growth pushed up food demand. In particular, higher demand for meat and intensification of livestock production boosted demand for animal feed. In the developed world, food demand stagnated, but biofuel support policies strengthened the global demand for maize, sugarcane and vegetable oils.

While these factors will continue to influence global demand for agricultural products, their relevance will diminish relatively over the coming decade. Demand growth in China is slowing down, as income growth moderates and the propensity for households to spend additional income on food declines. The evolution of biofuels markets is heavily driven by policies and crude oil prices, and hence harder to forecast based on demographic and economic trends. Current policies and expected moderate crude oil prices appear likely to lead to a lower growth in biofuel production from agricultural crops compared to the last decade.

As a result, this Outlook projects that across most commodities, the growth in total demand (including non-food uses) will slow considerably compared to the previous decade (Figure 1.2). For most commodity groups, including cereals, meat, fish and vegetable oil, growth rates will be cut by around half. This slowdown will be particularly pronounced for the demand for vegetable oil, which was the fastest-growing commodity over the past decade, driven in part by biofuel policies. For sugar, however, the growth rate will decrease only moderately as the increase in per capita consumption is expected to contribute as much as the increase in population over the next decade.

A major exception to this trend is fresh dairy products. Projected growth rates for fresh dairy for the coming decade are higher than those experienced over the past ten years, driven by increasing per capita demand in developing countries, most notably India. For other dairy products such as cheese, butter, skimmed milk powder and whole milk powder (not shown in Figure 1.2), consumption growth slows compared to the previous decade, but remains at levels above those of cereals, meat or fish. Dairy, together with vegetable oil and sugar, will have the highest growth rates.

In contrast with the previous decade, the overall growth in agricultural demand over the outlook period will be mainly driven by population growth. The solid areas in Figure 1.2 indicate the share of the growth rate attributable to population growth, while the shaded areas indicate the contribution of growth in per capita consumption (including non-food consumption). For instance, the growth of cereal consumption for all uses will be around

Figure 1.2. **Annual growth in consumption for key commodity groups, 2007-16 and 2017-26**

Note: The population growth component is calculated assuming per capita demand remains constant at the level of the year preceding the decade. Growth rates refer to total demand (for food, feed and other uses).

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 2 <http://dx.doi.org/10.1787/888933520933>

1.1% per year over the next decade. If per capita consumption (including non-food) had remained at current levels, population growth by itself would induce a growth of 0.9% per year over the baseline period. The remaining share of 0.2% p.a. can be attributed to factors such as income growth and consumption preferences that impact both food and non-food consumption of cereals. Across commodity groups consumption growth over the previous decade was due to a roughly even split between population growth and increase in per capita consumption (including non-food). Over the next decade, however, per capita consumption growth will only play an important determining role for sugar, dairy, and vegetable oils. Higher per capita growth explains the higher overall growth rates for these commodities. The growth in fresh dairy consumption is exceptional, with the result that fresh dairy shows the highest consumption growth rate among the key commodities of the Outlook. However, trade of fresh dairy products will remain limited and, as a result, growth in consumption will have a limited impact on world dairy markets.

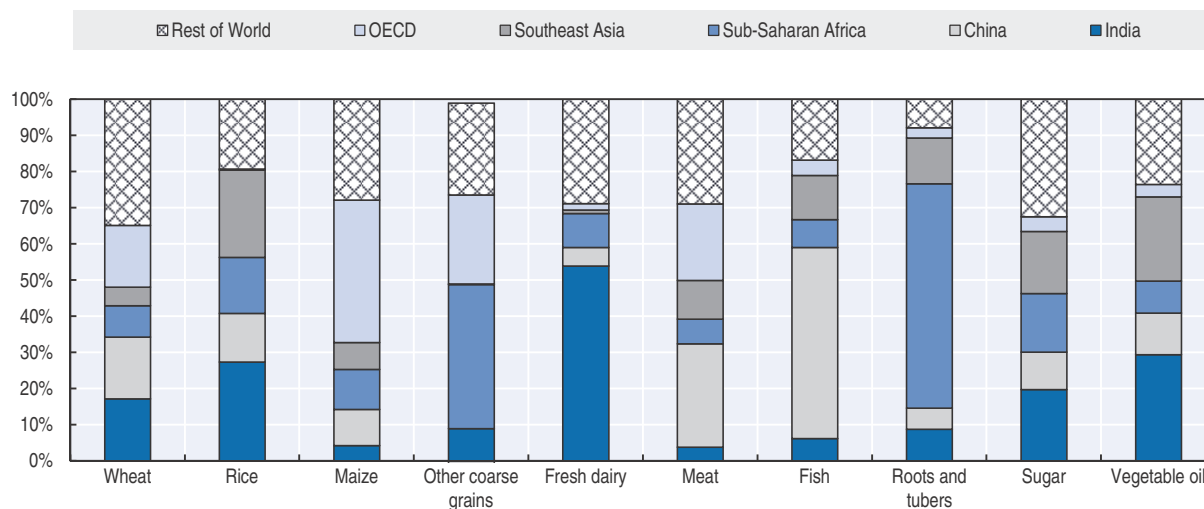
Projections indicate relatively low growth in total meat consumption, as per capita consumption is expected to level off in many middle-income countries with a high preference for meat, especially China. In the Least Developed Countries, meat demand will continue to be constrained by limited income growth in poor rural and urban households.

China, India and Sub-Saharan Africa drive global growth

The world's population will increase from 7.3 to 8.2 billion over the course of the outlook period. Almost all of this population growth will occur in developing countries. In Sub-Saharan Africa, the population will increase from 974 million to 1.3 billion, an increase of 289 million; the population of India will grow from 1.3 billion to 1.5 billion, an increase of almost 150 million. Together, Sub-Saharan Africa and India will account for 56% of total population growth over the next decade, while India overtakes China as the world's most populous country.

Given their strong population growth, India and Sub-Saharan Africa will also drive a large share of global demand. In addition, China will continue to contribute to demand for several key commodities (Figure 1.3). For cereals, total consumption (including for non-food uses) is expected to increase by 338 Mt over the outlook period. Of this, 38% will come from China, India and Sub-Saharan Africa. This share is lower for wheat and maize (where developed countries play a larger role), but higher for rice (where India alone accounts for 27% of the increase in consumption) and other coarse grains (where Sub-Saharan Africa accounts for 41% of the global consumption increase).

Figure 1.3. **Regional shares in commodity consumption growth, 2016-26**



Note: Demand growth compares 2026 to baseline (2014-16) average. Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 2 <http://dx.doi.org/10.1787/888933520952>

China accounts for large shares of the additional consumption of meat (29%) and especially fish (53%), two commodities where the demand growth from India and Sub-Saharan Africa is lower. For instance, India accounts for only 4% of the additional meat consumption. India is a bigger driver of additional demand for fresh dairy products (54%) and vegetable oil (29%), while Sub-Saharan Africa accounts for 62% of the increase in roots and tubers.

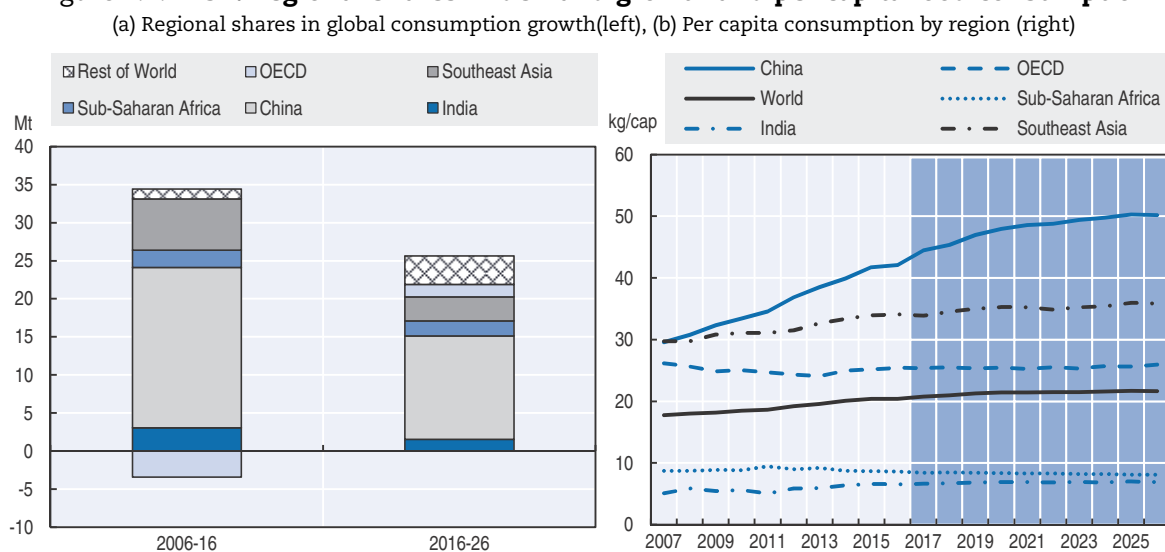
Figure 1.3 also indicates the role played by Southeast Asia (Indonesia, Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia) in demand growth in the coming decade. These countries will contribute to an important degree to the additional demand for rice (24%) and vegetable oil (23%), as well as sugar (17%), fish (12%) and roots and tubers (13%). By contrast, their role is lower for other commodities, fresh dairy in particular. These issues are discussed further in Chapter 2.

Lower consumption growth in China is reducing global consumption growth

As the preceding discussion makes clear, China will continue to play an important role in consumption growth for many commodities. However, compared with the previous decade, consumption growth will be considerably lower in China in the coming decade, a trend which leads to lower growth at the global level.

In the last decade, China was responsible for 21 Mt of additional fish consumption out of a global growth in consumption of 31 Mt (Figure 1.4). This growth was driven by an increase in per capita food consumption of fish from 30 kg/capita in 2007 to 42 kg/capita in 2016, a level two-thirds higher than the OECD average of 25 kg/capita. Over the next decade, Chinese per capita food consumption of fish is projected to increase further to 50 kg/capita. However, this represents a smaller increase than what was witnessed in the previous decade. At a global level, the effect is a strong reduction in the annual growth of consumption. As global per capita food consumption remains stable over the next decade, total growth in consumption of fish is practically equal to global population growth, as shown in Figure 1.2.

Figure 1.4. Fish: Regional shares in demand growth and per capita food consumption



Note: Consumption growth compares 2004-06 average to 2014-16 average, and 2014-16 average to 2026. Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia.

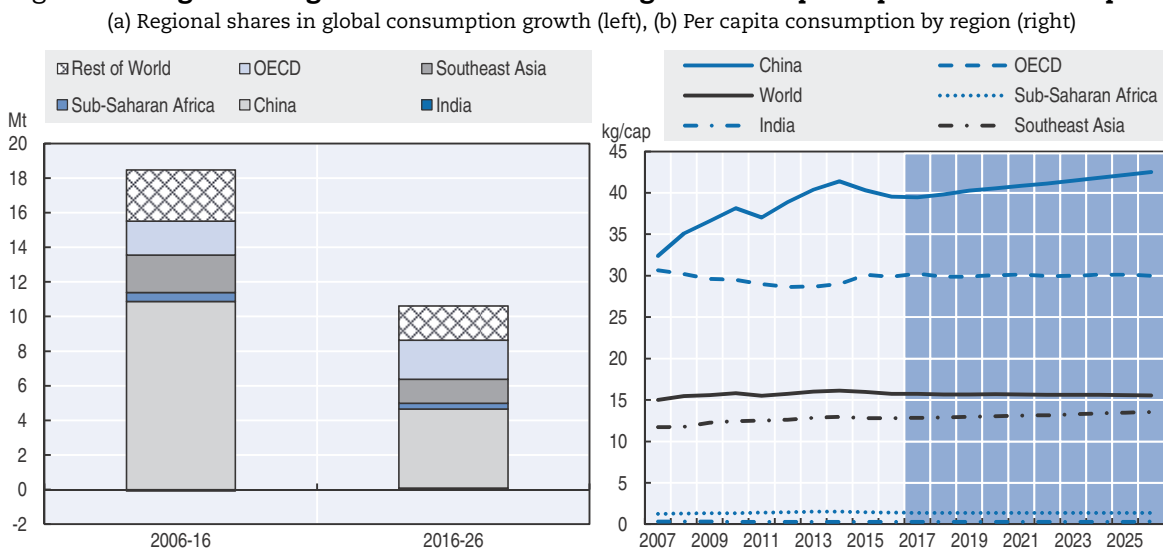
Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
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Likewise, annual consumption of pigmeat increased by 18 Mt in the last decade, of which 11 Mt (or 59%) was consumption growth in China (Figure 1.5). For the coming decade, the projected consumption growth for pigmeat is considerably lower at 11 Mt. This lower global consumption growth is almost exclusively explained by developments in China. After strong growth over the past decade, per capita consumption in China has reached 40 kg/capita in 2016, one-third above the OECD average. Over the outlook period, consumption growth is projected to be around one-third of the level observed in the last decade, resulting in a strong reduction in the growth of pigmeat consumption.

Most pigmeat consumed in China is produced domestically, but evolutions in the demand for meat have indirect effects on other markets through the derived demand for feed. In this way, evolutions in China also contribute to a lower growth in global demand for maize and soybeans over the next decade, as discussed below.

Global growth patterns shift as growth in demand in China decreases

Chinese growth in demand has been characterised by a strong increase in consumption of animal-based protein (fish, pigmeat) and associated feed demand.

Figure 1.5. **Pigmeat: Regional shares in demand growth and per capita food consumption**

Note: Demand growth compares 2004-06 average to 2014-16 average, and 2014-16 average to 2026. Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia. Per capita consumption expressed in retail weight.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

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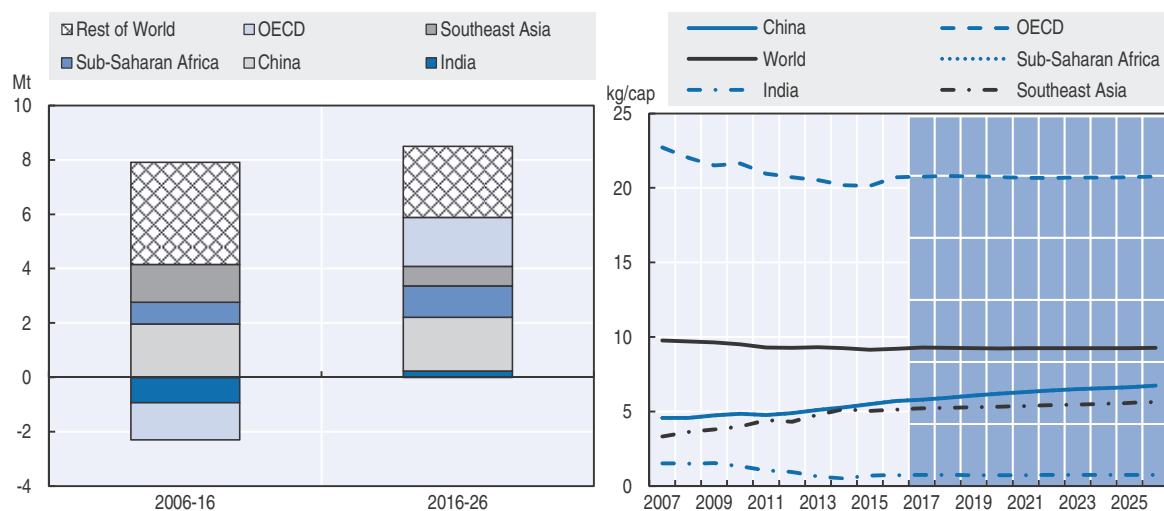
Consumption preferences in areas where strong population and income growth is expected in the projection period will differ from those of China, suggesting that future consumption growth will unfold in different directions.

Growth of pigmeat consumption will be limited as high demand for pork over the last decade was largely driven by Chinese consumption preferences, which are unlike those elsewhere in the world where strong population and income growth are expected.

For fish, as Figure 1.4 indicates, it seems unlikely that consumption increases in other countries can replicate the large growth seen in the past decade. This growth was driven by a strong increase in per capita consumption (of 12 kg/capita) in the world's most populous country, China. By contrast, per capita consumption of fish in India is currently below 10 kg/capita, a level which is expected to remain stable over the outlook period. Given similar food preferences, Southeast Asian countries could potentially increase their per capita fish consumption to the levels observed in China over the long run. However, although the total population of this region is large, it is only about half that of China's. Finally, Sub-Saharan Africa currently has a low per capita consumption of fish and this is projected to decrease further over the outlook period due to limited supply capacity. Hence, over the medium term it seems unlikely that other countries will drive global demand for fish to the same degree as China has done in recent years.

In markets where China's role is traditionally less pronounced, there is also no clear trend for other regions to drive growth in the future. For instance, the growth in demand for beef and veal meat was 6 Mt over the last decade and is projected to grow to 9 Mt in the next decade (Figure 1.6). Average per capita consumption in developing countries will remain at only about one-third of that of developed countries by 2026, but the bulk of beef and veal demand growth will continue to be driven by population growth in developing countries. Demand for bovine meat in the United States, which had decreased in recent years, is expected to recover. However, given already-high consumption levels, developed

Figure 1.6. **Beef and veal: Regional shares in demand growth and per capita food consumption**
 (a) Regional shares in global consumption growth (left), (b) Per capita consumption by region (right)



Note: Demand growth compares 2004-06 average to 2014-16 average, and 2014-16 average to 2026. Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia. Per capita consumption expressed in retail weight.

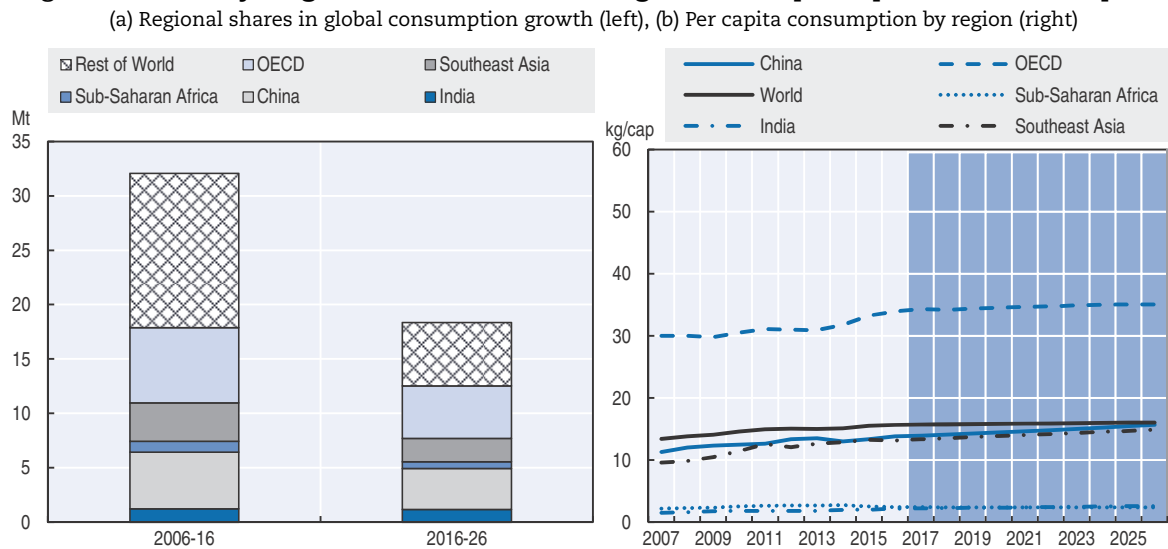
Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

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countries are not expected to increase per capita meat consumption levels much further. Nor are developing regions showing signs of increasing their per capita beef and veal consumption levels by much. In Sub-Saharan Africa, per capita beef and veal consumption is projected to remain low over the projection period, but total consumption expands strongly due to the rapidly increasing population. At a global level, per capita consumption is expected to remain stable, and beef and veal demand is therefore expected to grow at a similar rate to population growth.

The strong growth in poultry consumption last decade by 32 Mt was driven to a large extent by OECD countries (7 Mt) together with Brazil (3 Mt) and the Russian Federation (2 Mt). As demand growth in these countries will be more modest in the future, total consumption growth for poultry is expected to be 18 Mt in the next decade, only half of the increase over the past ten years. Based on its continued per capita consumption increase, China will remain a strong engine of growth in the global poultry market over the *Outlook* period. Per capita consumption in India is expected to grow by 30%, but originating from a low base, hence its overall share in global demand growth will remain low. In Sub-Saharan Africa, per capita consumption will remain stagnant, and overall consumption growth will be in proportion to population growth (Figure 1.7).

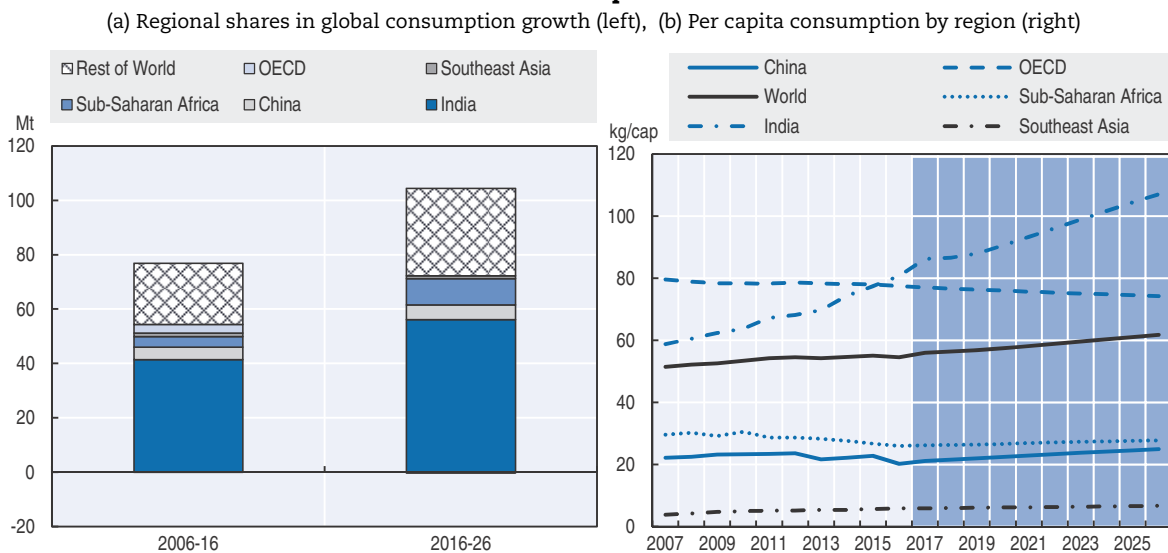
The demand for sheep (not shown here) is expected to increase by 3.2 Mt over the next decade, an acceleration compared with the previous decade, when demand grew only 2 Mt. The acceleration in demand is mostly due to China, where per capita consumption is projected to increase from 3.5 to 4.2 kg per capita, and Sub-Saharan Africa, where per capita consumption remains flat at around 2.2 kg per capita but where strong population growth drives higher demand. These per capita consumption levels are above the global average, which remains flat at around 2 kg per capita. At a global level, however, consumption and production of sheep meat is modest in comparison with other meat types.

Figure 1.7. Poultry: Regional shares in demand growth and per capita food consumption

Note: Demand growth compares 2004-06 average to 2014-16 average, and 2014-16 average to 2026. Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia. Per capita consumption expressed in retail weight.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
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The growth in consumption of dairy products will be led by an increase in the consumption of fresh dairy products. As shown in Figure 1.8, total consumption of fresh dairy products is expected to be 104 Mt higher at the end of the outlook period; more than half of this increase is due to continued demand growth in India. Per capita consumption of fresh dairy products in India has shown a strong increase in the past decade, as shown in the second panel of Figure 1.8. This trend is expected to continue and contrasts with

Figure 1.8. Fresh dairy products: Regional shares in demand growth and per capita food consumption

Note: Demand growth compares 2004-06 average to 2014-16 average, and 2014-16 average to 2026. Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
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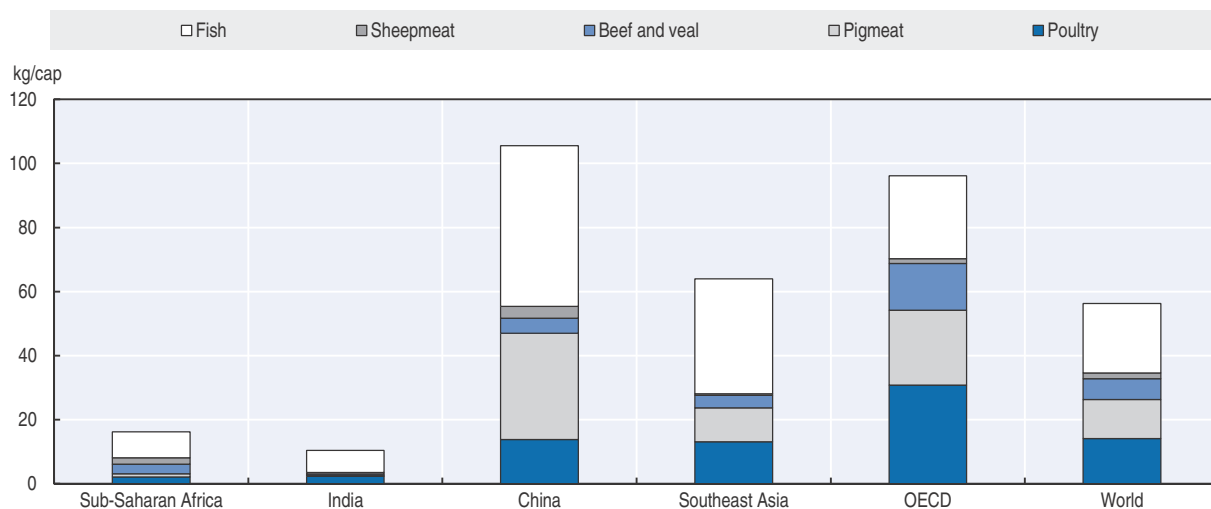
decreasing consumption in the developed world. Per capita consumption of fresh dairy products will remain much lower in China and in Sub-Saharan Africa. Overall, only a small share of fresh dairy products is traded; hence, the strong growth in consumption will have a limited impact on international dairy prices.

In contrast with fresh dairy products, the growth in global consumption of processed dairy products is expected to slow down in the next decade to 1.7% p.a., despite renewed interest in consumption of butter and dairy fat in developed countries. Supported by a shift in consumer preference towards healthy and less processed food, and more positive health assessments of dairy fat in recent years, per capita consumption is projected to grow across all processed dairy products in developed countries. In developing countries, the level and composition of dairy consumption will remain uneven across regions, but fresh dairy products will still account for a bulk of consumption in most regions. The growth in demand for butter and WMP is expected to be driven by both income and population growth, while for the other dairy products, increase in consumption will be proportional to population growth. Due to consumer preferences and persistent limitations in the development of supply infrastructure, per capita consumption of processed dairy products will remain much lower over the outlook period in Sub-Saharan Africa, Oceania (excluding Australia and New Zealand) and Asia, while other regions such as Latin America and Caribbean, North Africa and the Near East will close the gap with some of the developed countries.

Convergence in per capita food consumption patterns remains limited

As the preceding discussion suggests, there is no global convergence in per capita consumption patterns over the outlook period. At the end of the outlook period, large discrepancies will continue to exist in terms of per capita consumption of different commodities, as well as overall calorie and protein availability. These differences are especially stark for meat and fish (Figure 1.9), where large variations in per capita consumption will persist.

Figure 1.9. **Per capita food consumption of meat and fish in 2026**



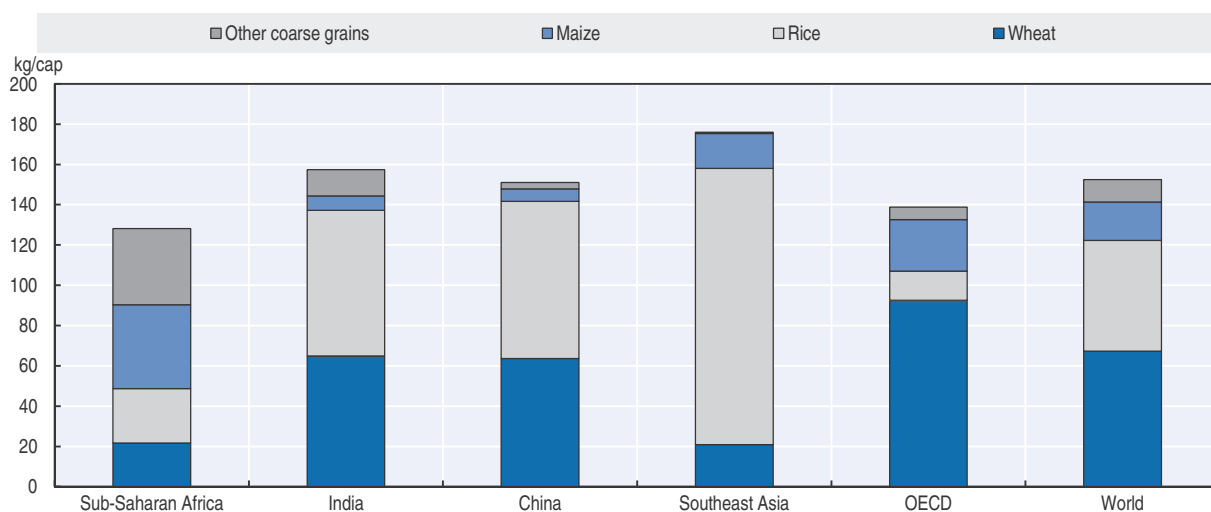
Note: Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia. Per capita consumption expressed in retail weight for meat; in live weight equivalent for fish.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

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Compared to meat consumption, total food consumption of cereals will vary less between different regions in 2026, as cereals continue to form an important part of the diet across the world (Figure 1.10). In Sub-Saharan Africa, cereal food consumption is spread more or less equally across wheat, rice, maize and other coarse grains, whereas wheat and rice dominate in China and India. Southeast Asia has particularly high per capita cereals consumption driven by rice, while for OECD countries, wheat will continue to dominate. In the Near East, per capita rice consumption is foreseen to increase by about 6%, mainly driven by immigration from Asian countries. At a global level, wheat and rice are roughly equally important in 2026.

Figure 1.10. **Per capita food use of cereals in 2026**



Note: Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

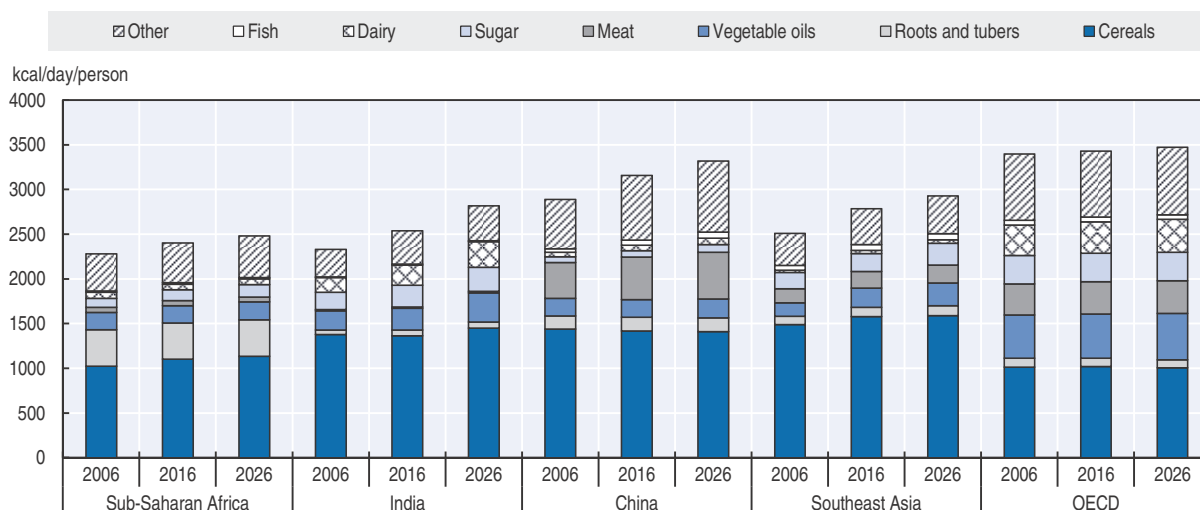
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Figure 1.11 shows the estimated calorie availability per capita in 2006, 2016 and 2026. The past decade saw increases in calorie availability in the developing world, especially in India, China and Southeast Asia. In OECD countries, average calorie intake decreased. These trends are projected to continue, bringing calorie availability levels in India and Southeast Asia closer to those in OECD countries. Calorie availability levels in China are currently estimated to be similar to the levels seen in OECD countries, but China would overtake the OECD countries over the outlook period.

In 2016, Sub-Saharan Africa and India show similar levels of per capita calorie availability. However, while calorie availability is expected to increase in India in the coming decade, Sub-Saharan Africa shows only limited growth. Compared to other regions, roots and tubers play a large role in Sub-Saharan Africa, accounting for 16% of total calorie availability in 2016, a share which remains constant in the coming decade.

Cereals are the most important source of calories across the world. However, Figure 1.11 also makes clear that as incomes grow, the relative importance of cereals typically decreases. In India, the contribution of cereals to calorie availability decreased from 60% in 2006 to 55% in 2016, and is projected to decrease further to 53% in 2026. This relative decline is in large part driven by the increasing calorie availability from vegetable oil, dairy and sugar. Similar trends can be seen in China (where vegetable oil and meat are

Figure 1.11. **Per capita calorie availability by food category**

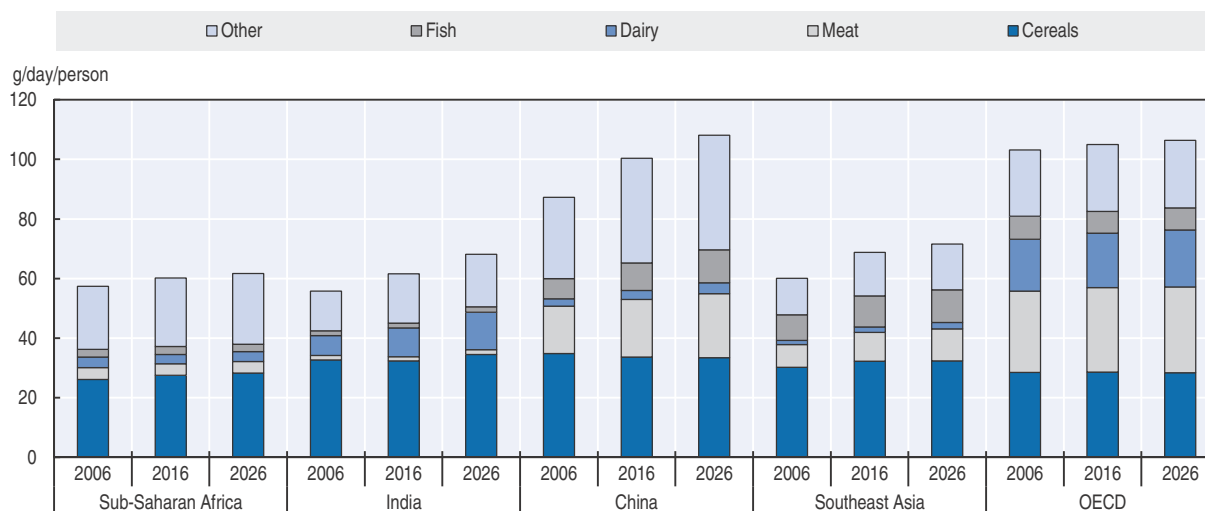


Note: Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia.
 Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
 1 <http://dx.doi.org/10.1787/888933521104>

increasingly important sources of calories) and Southeast Asia (where per capita calories from sugar are projected to increase by around 20% over the outlook period). One exception is Sub-Saharan Africa, where the role of cereals in total calorie availability has increased from 45% in 2006 to 47% in 2016. This share is expected to remain stable in the future.

Figure 1.12 shows the estimated per capita protein availability in 2006, 2016 and 2026. Compared to calorie availability, protein availability appears considerably more heterogeneous, with especially low levels in Sub-Saharan Africa, India, and Southeast Asia compared to China and OECD countries. A key driver of this difference is the low level of per capita animal protein consumption. In India, additional protein is coming from the fast

Figure 1.12. **Per capita protein availability by food category**



Note: Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia.
 Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
 1 <http://dx.doi.org/10.1787/888933521123>

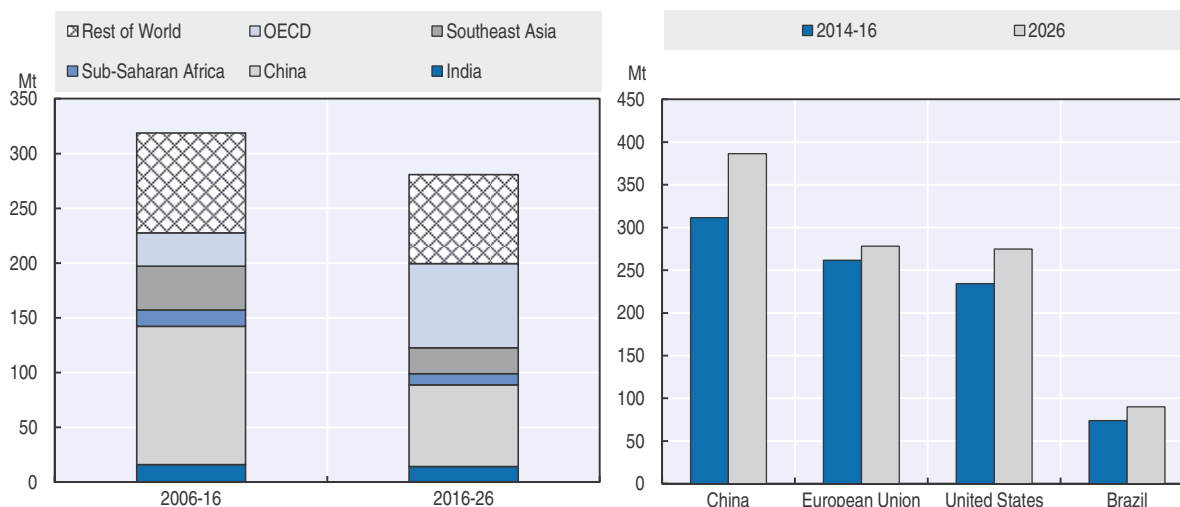
expanding fresh dairy product consumption, while in Southeast Asia, high fish consumption levels form an important contribution. Limited income growth in poor rural and urban households and the slow development of a retail infrastructure for animal protein, like meat, fish and dairy, are seen as the main constraints to protein consumption growth in Sub-Saharan Africa.

Emerging economies in Asia (China, India, Southeast Asia) have thus seen strong growth in per capita availability of calories and proteins. By contrast, Sub-Saharan Africa has seen little improvement in the past decade and projections show little growth in the coming decade. Overall, then, large differences in consumption patterns and in calorie and protein availability will persist over the outlook period.

Global demand for feed to grow at a slower pace

The global use of feed reached 1.5 bln t in 2014-16. Over the course of the projection period, feed use is projected to increase further to 1.8 bln t by 2026, a growth of 18% (1.7% per year). Maize and protein meal, which together account for about 58% of total feed consumption in 2014-16, will continue to increase their share in total animal feed. However, growth will slow down compared to the last decade (Figure 1.13). Between 2004-06 and 2014-16, feed use increased by around 300 Mt. Over the next decade, the additional consumption is projected to be about 270 Mt compared to the base period (2014-16), driven by lower demand growth in China as well as in Southeast Asia. In China, feed rations have reached a plateau after a steady intensification process; growth in global livestock production is not expected to be as strong as in the last ten years.

Figure 1.13. **Feed: Regional shares in demand growth and total use**



Note: Demand growth compares 2004-06 average to 2014-16 average, and 2014-16 average to 2026. Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 <http://dx.doi.org/10.1787/888933521142>

The projected expansion in the Chinese livestock sector will result in a 21% increase in feed use by 2026 compared to 2016, which constitutes a significant reduction from the 70% feed consumption increase during last decade. The slowdown is caused by the transition from a period of fast commercialization and subsequent intensification of feed rations in

the Chinese livestock sector, to more efficiency oriented production. Globally, China will still account for 28% of the demand increase in the coming decade. While demand for feed continues to increase in other regions (the European Union, the United States and Brazil in particular), the net effect is a marked slowdown of demand growth.

China, the European Union and the United States continue to be the leading consumers of feed, and their ranking does not change over the outlook period (Figure 1.13). Together, these three countries accounted for 53% of total feed consumption in 2014-16, a share which remains relatively stable.

Cereals are a key source for feed, especially maize (695 Mt in 2026, +21% over the outlook period), other coarse grains (182 Mt, +10%) and wheat (162 Mt, +17%). Protein meals, the second most important feed commodity, are expected to grow from 309 Mt in 2014-16 to 384 Mt in 2026, an increase of 24%. Protein meals are dominated by soybean meal, which accounts for more than two-thirds of global protein meal production.

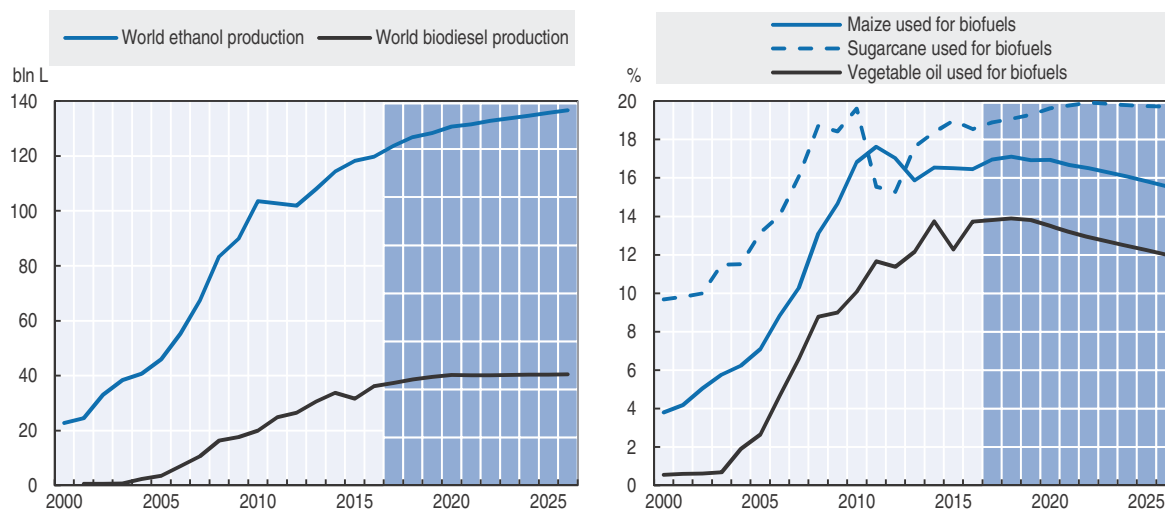
Biofuels market slows down, reducing the demand growth for maize

In addition to food and feed, agricultural commodities are used as feedstock for biofuel production. The production of ethanol is mostly based on maize and sugarcane, and ethanol production accounts for a large share of the total demand for maize (17% in 2014-16) and sugarcane (19%); likewise, biodiesel is mostly based on vegetable oils and accounts for a considerable share of demand (13%).

As policies started to stimulate biofuel production in the second half of the 2000s, world ethanol and biodiesel production increased strongly. As a result, a rapidly growing share of global sugarcane and maize production was used in ethanol production, while biodiesel started to claim a growing share of vegetable oil production (Figure 1.14). Between 2000 and 2010, the share of global sugarcane production going to biofuel production grew from 10% to almost 20%. For maize, the share of utilization going to biofuels grew from 4% to 18% in 2011. For vegetable oil, the biofuel share in use grew from less than 1% in 2000 to between 12% and 14% in recent years.

Figure 1.14. Growth in biofuel production, 2000-26

(a) World ethanol and biodiesel production (left), (b) Biofuels as % of demand (right)



Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 <http://dx.doi.org/10.1787/888933521161>

The policy-induced expansion of biofuels was thus a major driver of increased demand for maize, sugarcane and vegetable oil over the past decade. However, growth in biofuels production is slowing down. Between 2000 and 2010, production of ethanol grew at a pace of 17% per year, more than quadrupling production in the span of a decade. After a temporary fall in 2012, growth has resumed at a slower pace of 4% per year in recent years. A similar slowdown is observed for biodiesel.

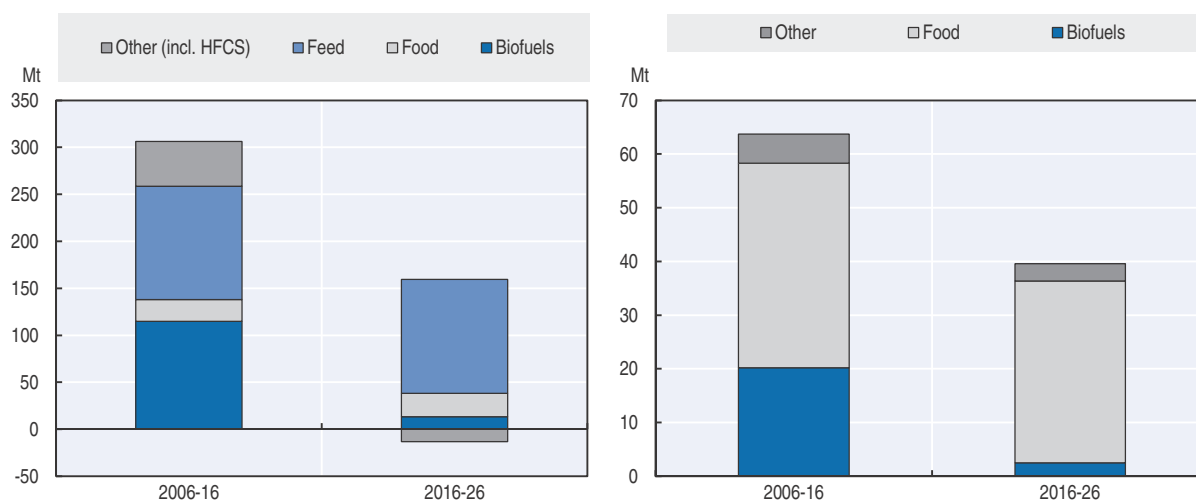
The initial growth in biofuels was heavily policy-driven, motivated by a concern for reducing greenhouse gas emissions, achieving energy security, as well as other considerations. Since the beginning, policies in key countries (United States, European Union, Brazil) have supported both the use and the production of biofuels. The evolution of biofuels markets is therefore highly sensitive to potential changes in policy, and is driven less by economic and demographic factors, which makes projections more difficult. The baseline projections are based on the best available information regarding future policies in the key regions, but projections are clearly sensitive to changes in the policy environment.

With these caveats in mind, a slowdown in growth is expected over the course of the outlook period. Annual growth in ethanol production is expected to be around 1% per year. In absolute terms, while ethanol production grew by 70 bln L between 2004-06 and 2014-16, growth is expected to be only 19 bln L in the next ten years. Similarly, biodiesel production grew 30 bln L between 2004-06 and 2014-16 but will grow by only 7 bln L over the course of the outlook period.

The slowdown of ethanol growth is driven in large part by a stagnating mandated ethanol use in the United States, whereas the demand for transportation fuels in Brazil is expected to be sustained. As a result, while demand for sugarcane (the major source of bio-ethanol in Brazil) remains relatively robust, the slowdown will be more pronounced in the growth of maize consumption, the main bio-ethanol feedstock in the United States. The stagnating ethanol demand in the United States is expected to be compensated partially by developing countries, specifically Thailand and India, where molasses is the main feedstock for ethanol production. Consumption in those two countries will continue to expand relatively fast, due to policies favouring the use of ethanol. In Thailand, demand for roots and tubers (cassava) will also continue to grow, benefitting from domestic policies in support of the ethanol industry.

Figure 1.15 shows the growth in demand for maize and vegetable oil in the last decade and over the projection period, by use. Reflecting the overall trend towards slowdown, biofuel use practically disappears as a source of demand growth over the outlook period for both commodities. For maize, the slowdown in the growth of biofuel use, together with a lower demand for feed, will account for most of the slowdown in the overall demand growth for maize. Compared to an additional consumption of 306 Mt in the last decade, use of maize is expected to grow by only 146 Mt over the next ten years, mostly driven by lower demand for biofuel use. For vegetable oil, the last decade saw an additional consumption of 64 Mt, but consumption in the next decade will only increase by 40 Mt. Most of this slowdown is explained by biofuels.

Although on a global scale biofuel use shrinks in its importance as a driver of demand growth, this net effect masks shifts among countries that reduce demand for feedstock for biofuels and others that increase their use over the outlook period. By 2026, the total use of vegetable oil for biofuels is expected to be around 26 Mt, with developed and developing countries (mostly Latin American and Asian countries) each accounting for half of the demand.

Figure 1.15. **Growth in demand for maize (left) and vegetable oil (right), by use**

Note: Demand growth compares 2004-06 average to 2014-16 average, and 2014-16 average to 2026. Southeast Asia includes Indonesia, the Philippines, Malaysia, Thailand, Viet Nam, Lao PDR, Myanmar and Cambodia.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

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In the last decade, biofuels accounted for 174 Mt of additional consumption of sugarcane. This is expected to slow down to an additional demand of 89 Mt over the next decade. Demand growth for other uses (most notably sugar production) was 355 Mt in the last decade and is expected to be 265 Mt in the coming decade. As a result, total demand for sugarcane will increase by 354 Mt in the next decade compared to a growth of 529 Mt in the last decade.

Production

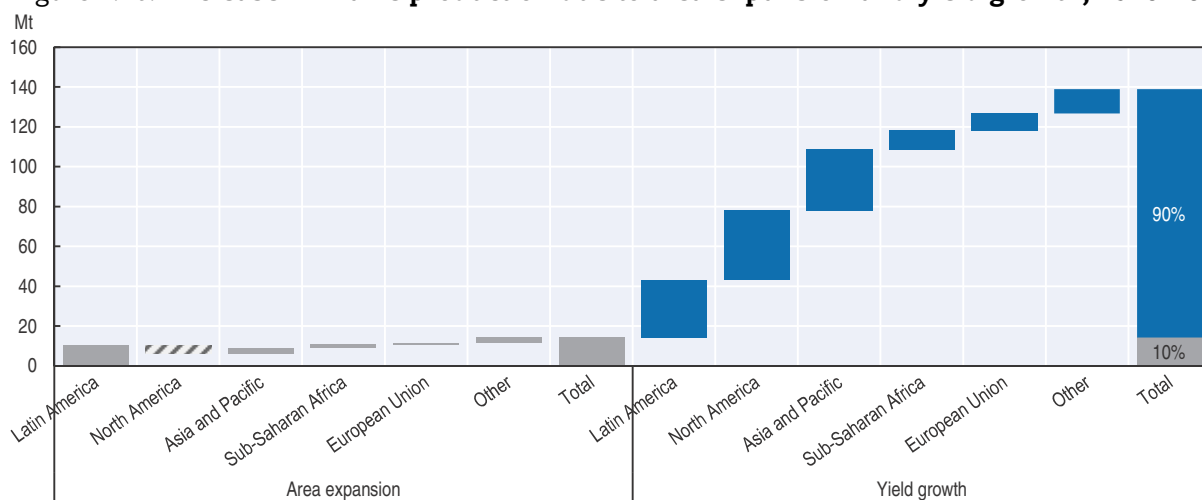
Yield growth will continue to drive global crop production

Over the outlook period, global cereal production is set to grow by around 1% p.a., leading to a total increase by 2026 of 11% for wheat, 14% for maize, 10% for other coarse grains, and 13% for rice. The bulk of the additional production over the outlook period is projected to be generated through crop yield improvements.

Figure 1.16 decomposes the total increase in maize production by region into the increase due to area expansion (keeping yields constant at their regional average in the baseline period) and to higher average yields. In the case of maize, area expansion accounts for only 10% of the total increase in production, driven mainly by growth in the area under cultivation in Latin America, which increases by 6.6% from 33.5 Mha in the base period to 35.7 Mha in 2026. By contrast, the area under cultivation in North America is projected to decrease, while changes are relatively minor in the other regions.

Latin America will contribute 28% of the total increase in maize production, or 39 Mt. Of this, around one-quarter is due to the increase in area. Asia and Pacific will account for 24% or 33 Mt. In contrast with Latin America, the growth in Asia and Pacific will be driven almost exclusively by yield gains. Despite a projected decrease in the area under cultivation, North America will contribute 31 Mt or 22% of the total increase. Together, these three regions will account for 74% of the total increase, with the remainder split between the European Union, Sub-Saharan Africa and other regions. In Sub-Saharan

Figure 1.16. Increase in maize production due to area expansion and yield growth, 2016-26



Note: Shaded areas indicate negative values. Growth compares 2026 to the baseline (2014-16) average.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 <http://dx.doi.org/10.1787/888933521199>

Africa, maize production is set to increase by 11 Mt. This increase is driven largely by higher yields in South Africa, Nigeria and Ethiopia, where production increases by 3.6, 1.8 and 1.8 Mt respectively over the projection period.

Global production of wheat is projected to increase by 11% over the outlook period, while the wheat area increases by only 1.8%. The increase in wheat production is therefore expected to occur through higher yields, most notably in Asia and Pacific, which will account for 46% of additional wheat production. Within the region and globally, India (15 Mt) will account for the biggest increase in production, and Pakistan (6 Mt) and China (5.5 Mt) are also expected to have significant gains. The European Union accounts for 13% of the production increase; large increases in production are also expected in the Russian Federation (9% of additional production) and Ukraine (6%).

Rice production is expected to grow by 66 Mt and will be almost exclusively driven by yield growth, which accounts for 93% of additional production. The global area dedicated to rice is expected to increase by only 1% from the base period, while global yields will increase by 12%. Major production gains are projected for India, Indonesia, Myanmar, Thailand, and Viet Nam. Yields in these countries are expected to increase by over 15%.

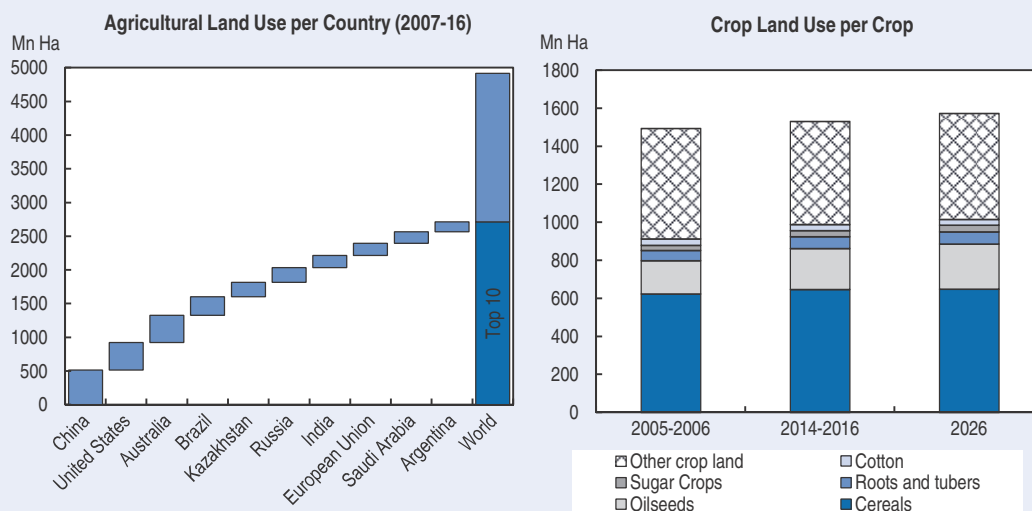
As yield growth will account for most of the production increase for cereals, the growth in total cereal production will have a relatively limited impact on land use. In contrast to cereals, area expansion will play an important role in the growth of oilseeds production, accounting for almost 50% of the global increase in soybean production in the coming decade. Area expansion will also remain important for growth of palm oil production. However, constraints and concerns over sustainability are expected to significantly limit growth of the cultivation area for palm oil as compared to the last decade. A global perspective on agricultural land use is provided in Box 1.1.

Yield growth is expected to satisfy most of the increasing demand for cereals over the outlook period. However, yields may show year-on-year variations depending on weather and climate conditions, such as the *El Niño* phenomenon. Figure 1.19 shows the yields of maize in the United States (the main producer) and for the world as a whole from 2000 to

Box 1.1. Agricultural land use

Between 1960 and 1993, global agricultural land use increased from 4.5 Bln ha to 4.9 Bln ha (FAOSTAT). Over the past ten years, however, global agricultural land use decreased by 62 Mha, a trend which is expected to continue. As shown in the first panel of Figure 1.17, more than half of agricultural land (which includes arable land and pastures) is located in ten countries, with the largest areas in China, the United States and Australia. This Outlook projects global agricultural land use to continue its decrease, albeit at a lower rate of 24 Mha over the coming decade. The share of the top-10 countries is also expected to decrease moderately.

Figure 1.17. Trends of global land use of agriculture



Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 <http://dx.doi.org/10.1787/888933521218>

Seventy per cent of global agricultural land is used in the form of pasture. Over the past decade, global pasture area declined at an average rate of 3 Mha per year; for the next ten years the annual reduction is estimated to be 1.7 Mha. At the same time, crop land is on an increasing trend due to the conversion between pasture and crop land. This Outlook assumes a continuation of the trend, with crop land projected to expand by 42 Mha, a similar increase as over the past decade. Sixty per cent of world crop land is located in ten countries, which are largely the same as the ones dominating total agricultural area, with Nigeria, Canada and Indonesia replacing Saudi Arabia, India and Kazakhstan.

As shown in the second panel of Figure 1.17, cereals are grown on about 42% of global crop land, while around 14% of cropland is devoted to oil crops. Both shares have been increasing over the past decade, but only the share of oil crops is projected to increase further over the projection period, especially due to favourable soybean production opportunities in South America. About 4% of global crop land is covered with roots and tubers, while sugar crops and cotton account for 2% each. The remainder (about 36%) is allocated to pulses, fruits and vegetables, other permanent crops, as well as set aside and fallow.

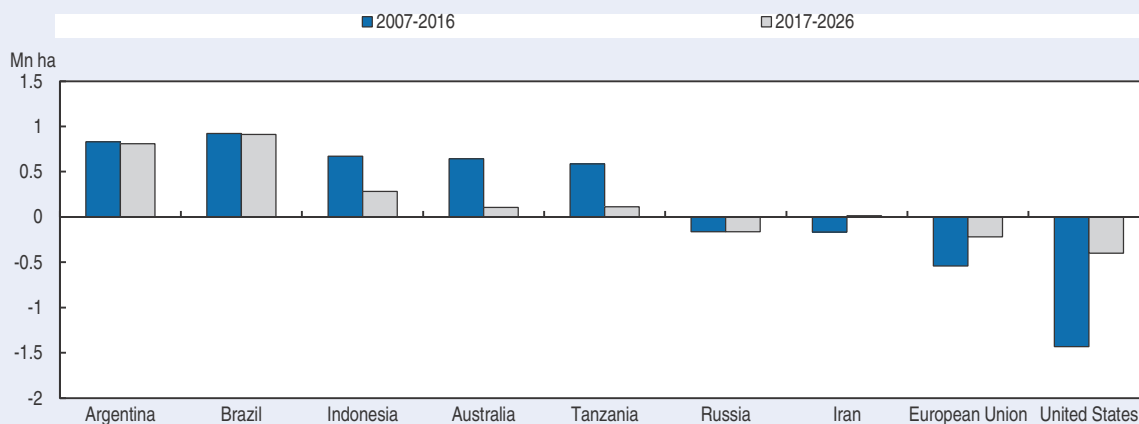
While the global picture appears quite stable, national developments are more dynamic. Agricultural land use, especially crop land use, is increasing in some countries that have potential for land expansion while decreasing in other countries due to factors that include urbanization, afforestation or desertification.

Figure 1.18 shows the average annual crop land change of selected countries where crop land use increased or decreased the most in absolute terms over the past decade, as well as the estimated annual change over the projection period. Argentina and Brazil experienced the strongest expansion in crop areas over the past ten years, adding respectively 10 Mha and 8 Mha to global crop land. For the next ten years,

Box 1.1. Agricultural land use (cont.)

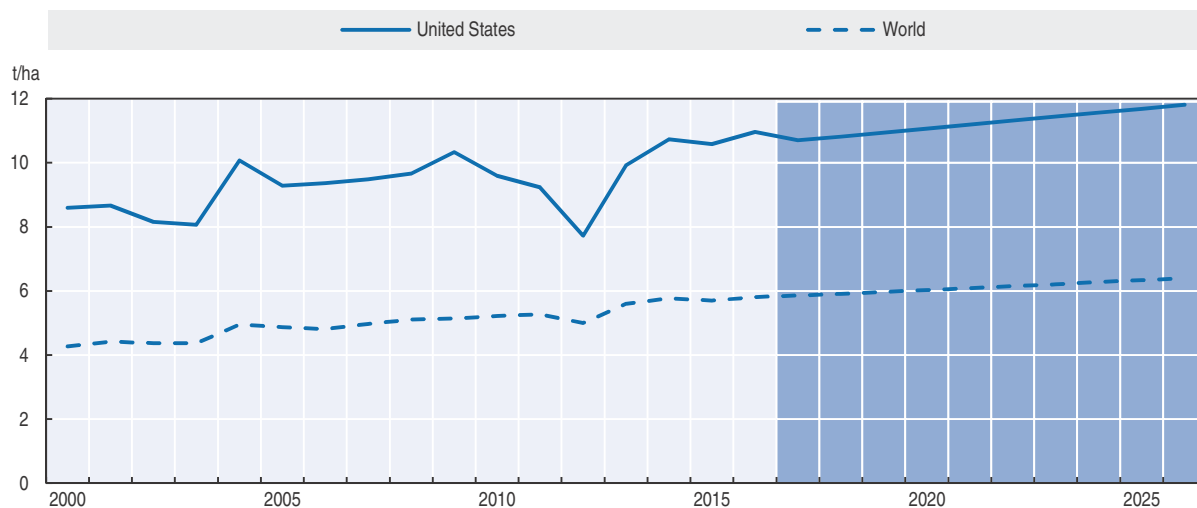
crop land expansion is expected to be in a similar range for these two countries. For the other three countries in which crop land expanded over the past decade, a slowdown is expected, partly because of lower price expectations as compared to the past decade. A major reduction of crop land has occurred and is projected for the United States and for the European Union as a consequence of urbanization and afforestation as well as re-conversion of crop land into permanent grassland. In the United States, the Conservation Reserve Program (CRP) has also contributed to the reduction of crop land over the past years. Due to modifications of this programme in the 2014 Farm Bill, the projected annual crop land reduction over the next ten years is lower than during the previous decade.

Figure 1.18. Average annual crop land change for selected countries



Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 2 <http://dx.doi.org/10.1787/888933521237>

Figure 1.19. Maize yields in the United States and globally



Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 2 <http://dx.doi.org/10.1787/888933521256>

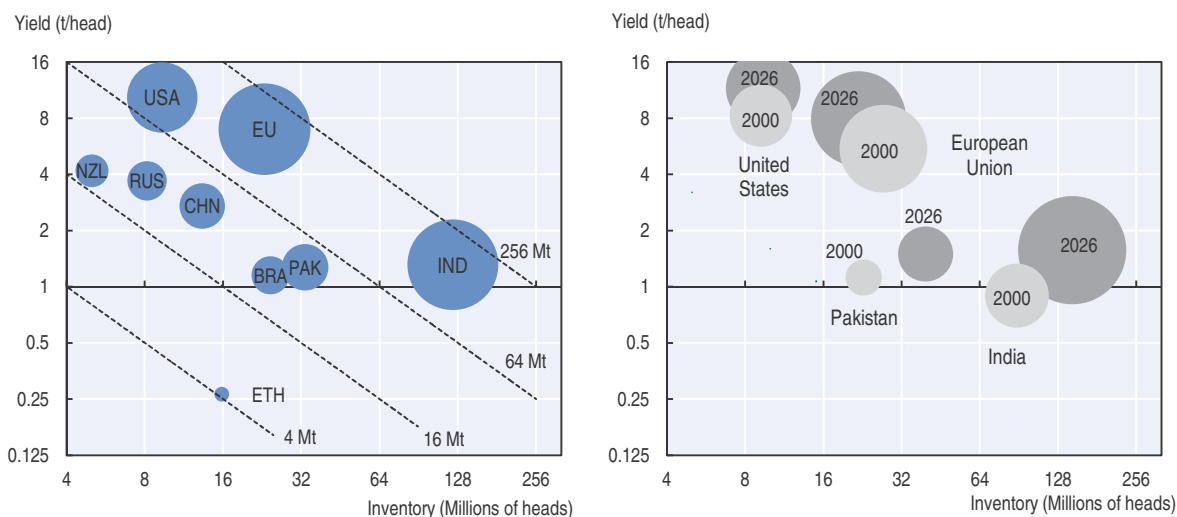
the end of the outlook period. While the *Outlook* assumes a steady increase in yield, year-on-year variations can be considerable. In 2012, maize yields in the United States fell by 16% compared to 2011, reducing the US share in world production from 35% to 31%. Average global yields are less volatile, as yields in main producing regions are typically not strongly correlated. However, the 2012 drop in US yields still contributed to a 5% drop in global yields. By 2013, US yields had fully returned to their long-run trend, but temporary changes in yields in large producers may have a considerable impact at a global level.

Dairy: Large structural differences persist between major producing countries

For many commodities, including cereals, dairy and meat, “intensive” (high-input, high-yield) and “extensive” (low-input, low-yield) producers will continue to co-exist. Figure 1.20 illustrates this co-existence for milk production, comparing the yield (in tonnes per head) and the size of the milking animal inventory (in million heads, including cows, buffalos, sheep, goats and camels) for several producers.

Figure 1.20. Milk production in selected countries

(a) Yield and herd size in 2016 (left), (b) Evolution over time for major producers (right)



Note: Yield is milk production in tonnes per head including non-cow milk. Inventory includes non-cow herds. Both axes are shown on a logarithmic scale to allow the comparison of producers who vary considerably in scale. The size of the bubbles indicates total milk production (including non-cow milk). The downward-sloping lines connect all combinations of yields and inventories which result in the same level of production (in Mt). ‘European Union’ refers to EU-28 in all years.

Source: OECD/FAO (2017), “OECD-FAO Agricultural Outlook”, OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 <http://dx.doi.org/10.1787/888933521275>

As the first panel of Figure 1.20 shows, extensive and intensive producers can be equally capable of reaching a given production level. India and the European Union both produced around 160 Mt in 2016; however, India achieved this level with an average yield of 1.3 t and 122 million heads, whereas the European Union had an inventory of only 23 million heads but average yields of 7 t per head. Likewise, production in China is more intensive than in Pakistan, yet both produce at similar levels (41 Mt in China versus 42 Mt in Pakistan in 2016). Ethiopia’s dairy inventory (16 million heads) is considerably larger than the US inventory (9 million heads), yet production in Ethiopia stood at 4 Mt in 2016, only a fraction of the US production of 96 Mt. In Ethiopia, non-cow milk production plays a

large role as 25% of dairy herds consist of camels, goats and sheep, which account for roughly 10% of milk production. However, even the cow inventory by itself (at around 11 million heads) exceeds that of the United States. In 2014, cow milk production in Ethiopia stood at 3.3 Mt, or 0.29 t per cow, far below US yields of around 10 t per cow.

In contrast to cereals, where up to 90% of production growth is accounted for by yield increases, a greater share of growth in milk production will be driven by increases in dairy herds. Globally, milking animal inventories will grow by 11% over the outlook period, or an increase of 79 million heads compared with the base period (2014-16). At 2016 yield levels, this would generate 48 Mt of additional production, out of a projected total increase of 178 Mt. Hence, around 27% of the projected increase is accounted for by increasing herd size.

Different regions have different dynamics over time, as shown in the second panel of Figure 1.20, which compares four large producers (the European Union, India, Pakistan, and the United States) in 2000 and in 2026, at the end of the outlook period. In all regions, yields increase over time. However, many developing countries start from a low base, so the absolute increases in productivity will remain small. In the United States, dairy herds remain roughly stable, while there is a decline in the European Union. In contrast, India and Pakistan witness both a strong increase in milking animal inventories as well as in yields, leading to strong growth in overall production. Over the first quarter of the 21st century, milk production in India will have nearly tripled. Over the course of the outlook period alone, milk production in India will grow 49%; in 2026, India will be the world's largest milk producer, with an output one-third above that of the second largest producer, the European Union. At the same time, this remarkable growth is achieved with yields below 2 tonnes per head, far below EU or US levels. Milk production in the European Union is projected to grow at 0.8% p.a. in the coming decade, which is slower than the 1.2% p.a. in the last decade, despite the end of the milk quota in 2015.

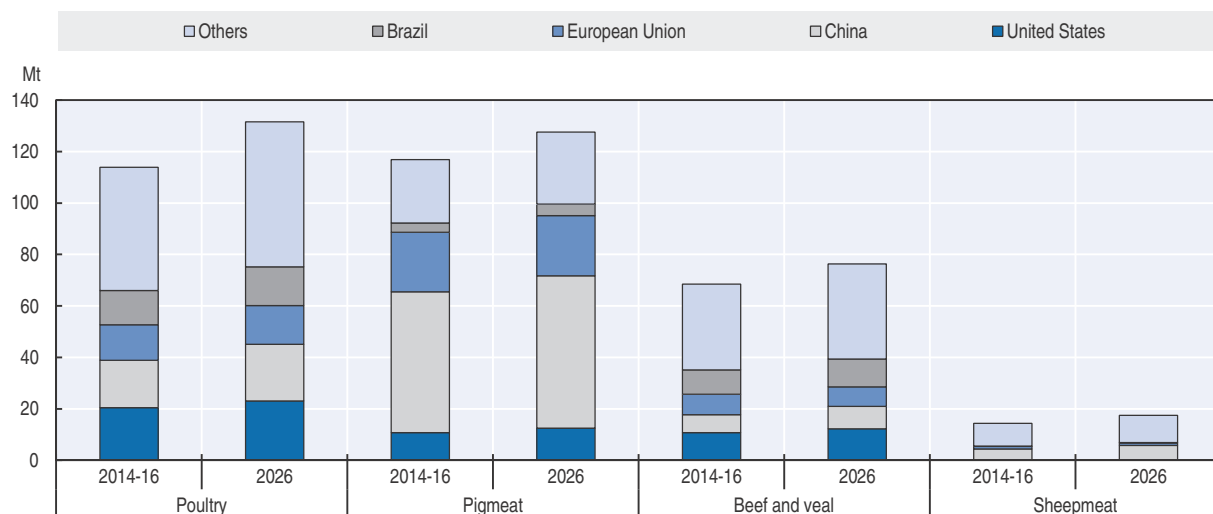
Over the course of the outlook period, the production of processed dairy products is expected to grow between 1.4% p.a. for cheese and 2.3% p.a. for skim milk powder (SMP). While the bulk of production of SMP and cheese will occur in developed countries, India will remain the top producer of butter. Given its large and expanding domestic market, however, India will not become an important player on the export market.

Continued growth in meat and fish production

Global meat production will expand by almost 40 Mt over the outlook period (Figure 1.21). Growth will continue to be driven mainly by poultry production, which increases from 117 Mt to 132 Mt (a 13% increase), and pigmeat, which grows from 116 Mt to 128 Mt (+ 10%). Beef, veal and sheep meat production are also projected to increase. Sheep meat, in particular, will register a strong growth (+21%), although it will start at a low base of 14.7 Mt in 2017 and reach 17.5 Mt in 2026.

Across the four main types of meat included in the *Outlook*, production will continue to be dominated by the “big four” meat-producing countries China, the European Union, the United States and Brazil. This dominance is especially strong for pigmeat, where these four countries account for 78% of global production in 2026. China in particular will continue to account for 47% of global pigmeat production over the course of the outlook period.

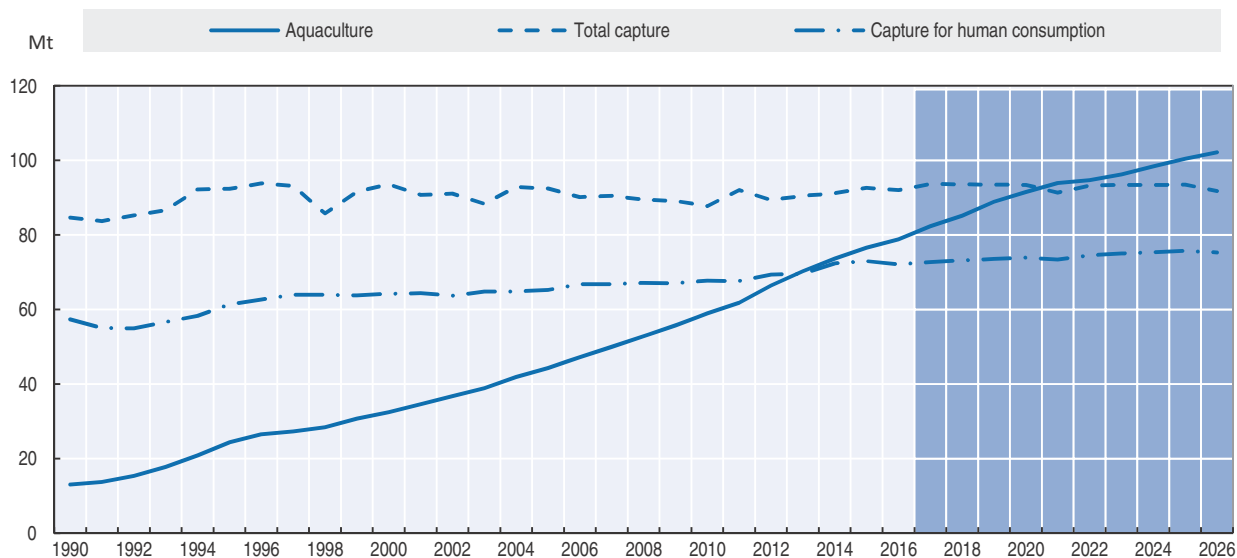
Figure 1.21. **Meat production, by type and country**



Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
 1 <http://dx.doi.org/10.1787/888933521294>

Fish production will continue to increase to almost 200 Mt by 2026. As shown in Figure 1.22, this growth is driven exclusively by the expansion of aquaculture production. Production through capture has been flat for the last decades, with the main exceptions being the years in which *El Niño* led to a decline in fish capture in some Latin American countries. This trend is expected to continue over the outlook period. Supported by low feed prices, aquaculture production will continue to grow and most of this increase will take place in China, which accounts for 17 Mt out of the 26 Mt total increase by 2026.

Figure 1.22. **Fish production**



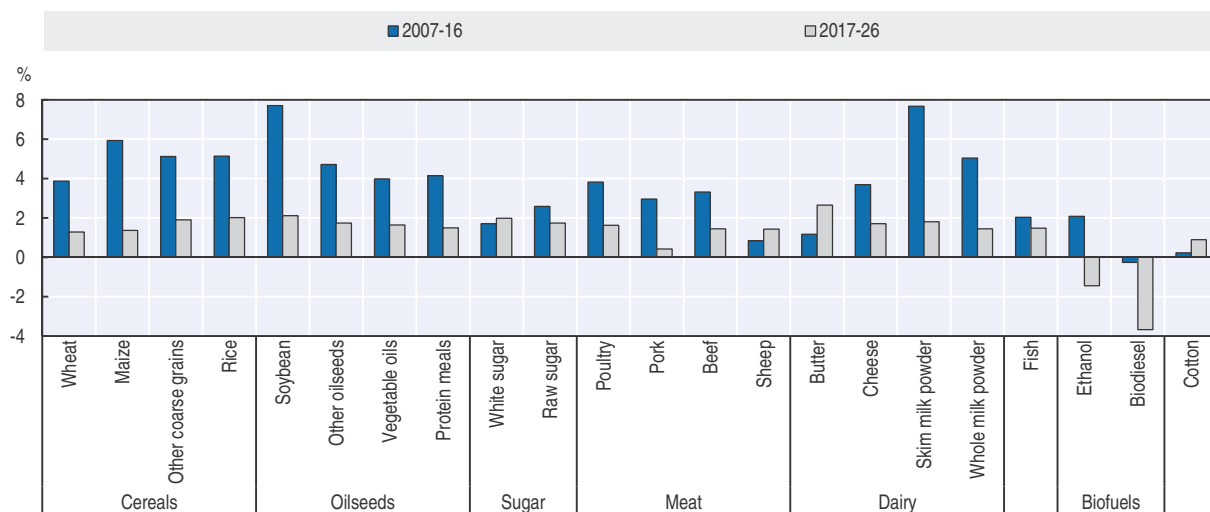
Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
 1 <http://dx.doi.org/10.1787/888933521313>

Trade

Agricultural trade growth is slowing, more closely mirroring output growth

Agricultural trade will continue to increase, but at a slower rate than in the past. Along with global supply and demand, trade is expected to expand less over the next ten years than in the previous decade (Figure 1.23). The slower growth is most apparent for cereals and oilseeds, which together account for about 45% of the value of agricultural trade, and for pigmeat and milk powders. Trade growth in biofuels is expected to be negative in the coming decade. Modest increases in trade volume growth are expected for white sugar, sheep meat, butter, and cotton.

Figure 1.23. **Growth in trade volumes by commodity**

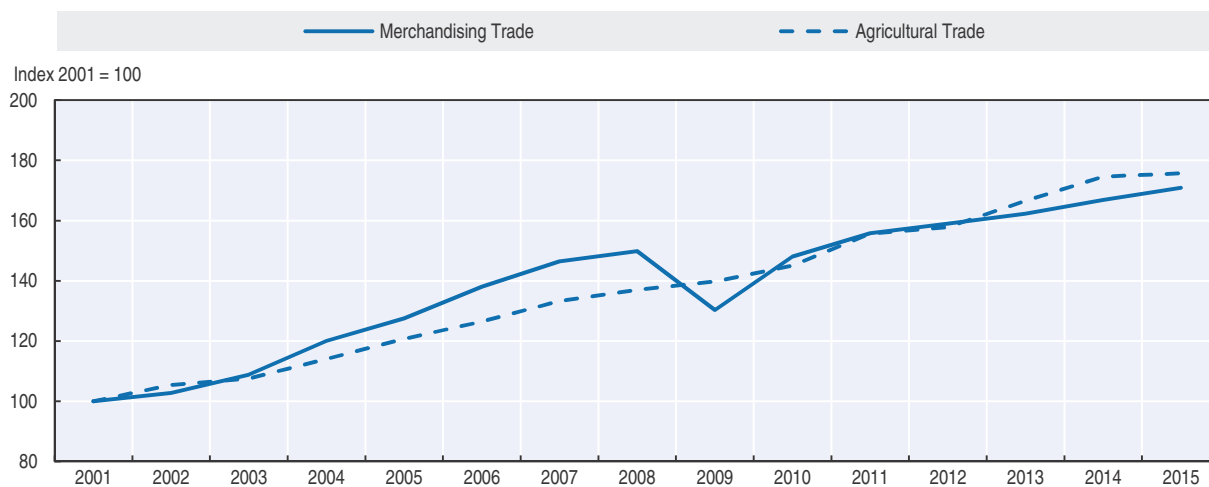


Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 <http://dx.doi.org/10.1787/888933521332>

The slowdown in agricultural trade is not an isolated phenomenon. The growth of global merchandise trade (which includes agricultural and non-agricultural goods) has been slowing down due to lower GDP growth. However, trade has also stopped growing as a share of global GDP.¹ This trend towards a lower share of trade to GDP appears to have started already before the Great Recession of 2008-09, leading some observers to question whether the trade slowdown represents "a new normal" (Hoekman, 2015).

Potential reasons cited for the slowdown in merchandise trade include: reduced demand growth; slower growth in global supply chain formation; a slowing of trade reforms; and a maturing trade sector in China (Lewis and Monarch, 2016). These factors, especially the latter two, also apply to agriculture. The effects and pace of policy reforms following the Uruguay Round have diminished, and some countries are strengthening policies to increase self-sufficiency. China's entry into the WTO in late 2001 was accompanied by a large upswing in its agricultural imports reflecting the impact of a new set of policies. However, import growth, particularly of soybeans, has slowed as demand for soymeal and oil has moderated.

Given the slowdown in agricultural trade projected in this Outlook, it is useful to compare the evolution of agricultural trade with the global slowdown observed in total merchandise trade. Figure 1.24 charts the evolution of trade in volume terms between 2001

Figure 1.24. **Evolution of trade volume for merchandise trade and agricultural trade**

Note: Merchandise trade index calculated based on chained volume index for global merchandise trade (World Trade Organization); agricultural trade index calculated using chained volume index method on exports in Aglink-Cosimo database.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 <http://dx.doi.org/10.1787/888933521351>

and 2015 for overall merchandise trade (using data from ITC's Trade Map) and a proxy for agricultural trade (using the Aglink-Cosimo database underlying this *Outlook*).² Both series are expressed in volume terms to neutralize the effect of price changes, such as the 2007 food price increases.

During the period 2001-15, both agricultural trade and merchandise trade grew at around 4% p.a. However, the figure clearly illustrates that growth rates slowed down in both agricultural and merchandise trade towards the end of this period. Merchandise trade grew at 6.6% in 2001-07, but this rate fell to 2.3% over the 2011-15 period. Similarly, agricultural trade growth averaged 4.9% in the 2001-07 period, but fell to 3.1% in 2011-15.

While merchandise trade witnessed a strong contraction and rebound in the wake of the Great Recession, agricultural trade volume growth was considerably more robust. A possible explanation is that the trade in agri-food products is determined by deeper 'fundamentals' such as population growth and lower demand elasticities compared to most other commodities, and is thus less sensitive to income shocks.

Moreover, the growth rate of global agricultural production is generally below the real growth rate of global GDP. As a result, the lower growth rate of agricultural trade volumes remains consistent with a constant share of production traded, as discussed below. In contrast, the lower growth rate of overall merchandise trade implies a decline in trade as a share of GDP.

While the growth rate of agricultural trade is slowing down over time, removing existing trade-related and distortionary domestic production policies could stimulate trade. This is documented in Box 1.2.

Despite the slowdown in trade, the share of production that is traded will not change significantly for the commodities covered in the *Outlook*. Figure 1.26 compares the share of production that was exported during the baseline (2014-16) with the projections for 2026. Milk powders remain the most traded agricultural commodities and fresh dairy products (not depicted in the figure) will continue to be among the least traded. The trade share for

vegetable oils and soybeans is also expected to remain high, with over 40% of production sold on international markets. The share of total exports of fish and fishery products (including fishmeal) will remain at about 30% of production. Despite the large volumes involved, trade in cereals is generally relatively small compared to overall production volumes. 23% of wheat production will be traded in 2026, compared to around 13% for maize and only 9% for rice.

Box 1.2. Impacts of policies on agro-food trade

Recent work by the OECD (2016) explores the impact of domestic support policies and trade policies (tariffs, quotas and export subsidies) of major agricultural producing regions on global agricultural production and trade, along with the effects of possible scenarios regarding the evolution of these policies in the future. The assessments were made through an application of the OECD's computable general equilibrium model, METRO, in conjunction with Aglink-Cosimo. This assessment of the impacts of policy settings as present around 2011-14 shows that agricultural support and barriers to agricultural trade still create significant distortions to world markets.

Overall, trade in all agro-food commodities would be higher in the absence of current support measures. Policies particularly limit trade in intermediate agricultural products (thus potentially hampering the development of global value chains in the agro-food sector) and industries for which demand and trade is projected to grow strongly into the future such as dairy and meat, suggesting that the costs of the status quo are likely to increase over time.

Domestic support policies may encourage national production but do not promote global production and could in fact be reducing it. For particular regions, the results also suggest that calls for increased isolation or constraints on integration in regional or global markets are likely to be counterproductive. The analysis suggests that policies that promote productivity and flexibility in production systems, enable market engagement by producers (particularly small producers), and provide safety nets for vulnerable households provide better alternatives for promoting food security than trade protection through tariffs and quotas.

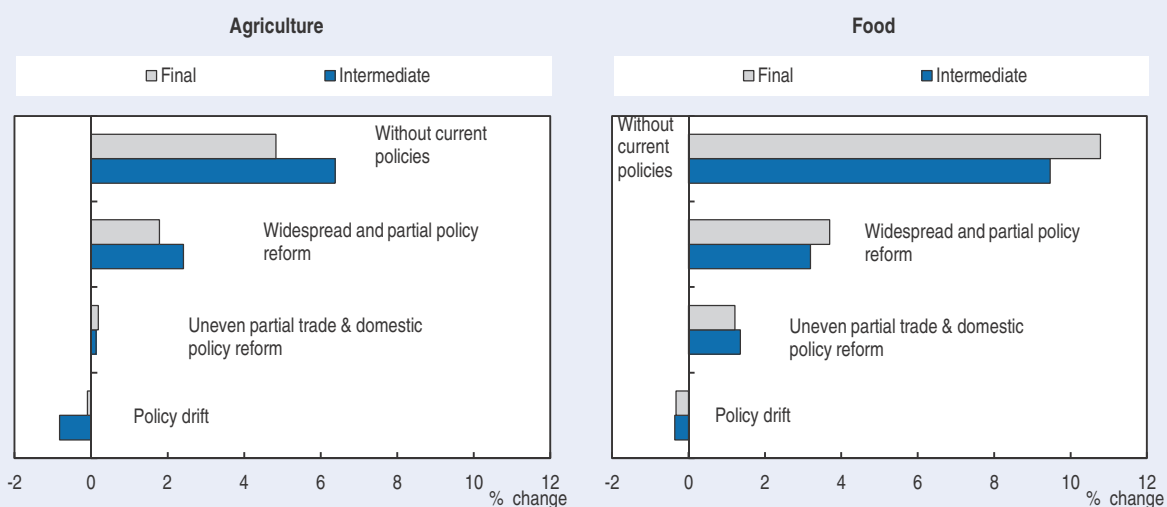
Four scenarios were explored regarding the possible evolutions of policies: *Without current policies*, which represents the removal of all tariffs, quotas and export subsidies, and distortionary domestic support to agriculture; *Widespread partial policy reform*, which represents the partial removal of tariffs, quotas and export subsidies, and distortionary domestic support across all countries worldwide; *Uneven partial trade and domestic policy reform*, which sees partial removal of tariffs, quotas and export subsidies, and distortionary domestic support in developed countries with very limited changes in others; and *Policy drift*, which sees some large emerging agricultural producers increase tariffs and producer support while other countries maintain their current policies. The results of these simulations on agro-food trade are shown in Figure 1.25.

Given the negative effects of domestic support policies and associated trade policies, the largest positive impacts on trade are found for the scenario in which all current domestic support and associated trade policies are removed. However, more modest levels of reform would also generate some growth in agro-food trade, albeit to a more limited extent.

Simulations of possible policy drifts, based on current trends, show that there is also value in preventing further drifts towards more protective policies that will complement the benefits that can be achieved from further reform. Reaching a binding agreement which ensures recent positive developments in trade policies and levels of support are not compromised, therefore, is of value. The agreement reached at the November 2015 WTO Ministerial takes some steps in this direction but more are needed.

Box 1.2. Impacts of policies on agro-food trade (cont.)

Figure 1.25. Impact on agro-food trade of policies, reforms and drifts

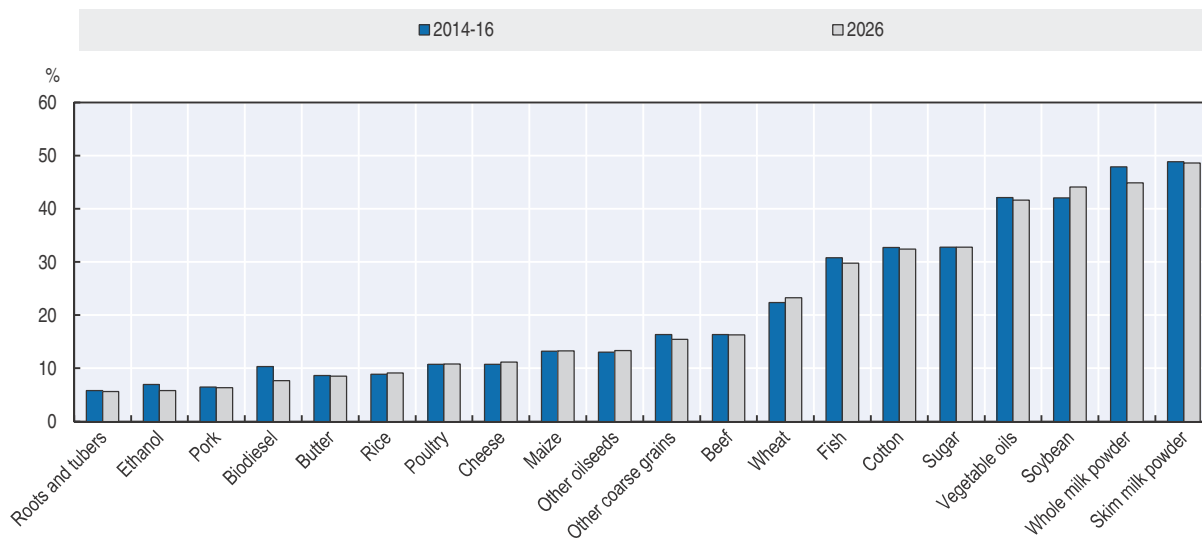


Note: Four scenarios were explored in this study: *Without current policies*, which represents the removal of all tariffs, quotas and export subsidies and domestic support to agriculture; *Widespread partial policy reform*, which represents the partial removal of tariffs, quotas and export subsidies and domestic support across all countries worldwide; *Uneven partial trade and domestic policy reform*, which sees partial removal of tariffs, quotas and export subsidies and domestic support in developed countries with very limited changes in others; and *Policy drift*, which sees some large emerging agricultural producers increase tariffs and domestic support while other countries maintain their current policies.

Source: OECD (2016).

1 2 <http://dx.doi.org/10.1787/888933521370>

Figure 1.26. Share of production traded



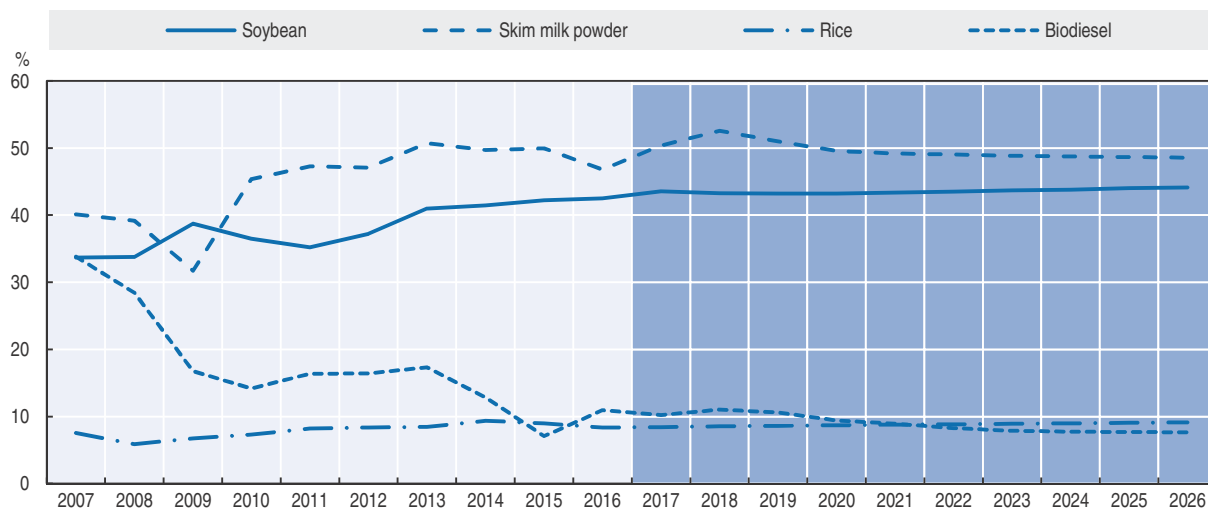
Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 2 <http://dx.doi.org/10.1787/888933521389>

While the shares of production traded do not change much for most commodities, there are some commodities where the importance of trade has undergone larger changes over the past decade. Figure 1.27 shows the evolution over time of the share of production

traded for soybeans, skim milk powder, rice and biodiesel. Soybeans and skim milk powder have seen strong growth in the share in production traded between 2007 and 2016, with the share for soybeans in particular increasing by 15 percentage points over the last decade. Over the outlook period, the share of trade in production for soybeans will continue to increase albeit at a much lower rate. In contrast, the role of trade has decreased strongly for biodiesel, with the trade share dropping from 34% in 2007 to 10% in 2016, with a further drop to 8% expected by 2026.

Figure 1.27. **Share of production traded for selected commodities**



Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 2 <http://dx.doi.org/10.1787/888933521408>

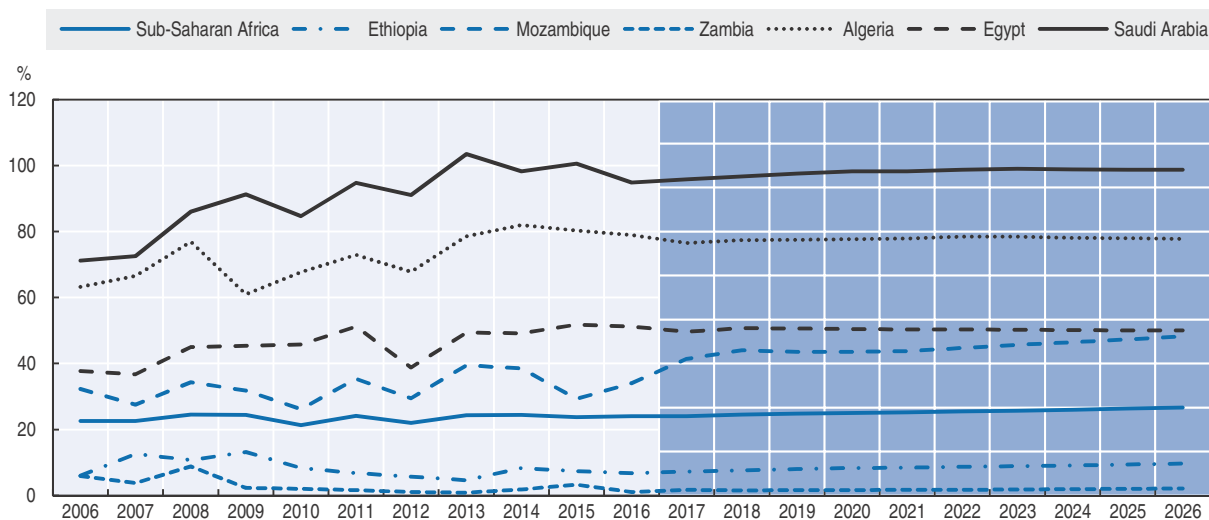
Import dependence remains high in Middle East and North Africa

The Middle East and North Africa are heavily dependent on agricultural imports, a situation which is expected to continue. Figure 1.28 shows imports as a share of domestic demand for cereals (including feed use) for Algeria, Egypt and Saudi Arabia, as well as for Sub-Saharan Africa as a whole and three countries (Ethiopia, Mozambique and Zambia) in particular. Cereal imports in Algeria, Egypt and Saudi Arabia account for half or more of domestic demand in 2016. Saudi Arabia is almost wholly reliant on imports for its cereal consumption.

In Sub-Saharan Africa, 24% of the domestically consumed cereal was imported in 2014-16. This share is expected to increase over the Outlook period to 27%. However, this average hides important heterogeneity among Sub-Saharan African countries. Mozambique, for instance, has imported between 30% and 40% of its domestic consumption in recent years. This share is expected to increase over the outlook period, approaching that in Egypt. By contrast, import dependence for cereals is much lower in Ethiopia and Zambia. Both countries are important cereal producers in their respective regions, especially for maize, which they typically export to neighbouring countries. Ethiopia is also an important regional supplier of other coarse grains and wheat in East Africa.

However, the stability in terms of import dependence does not hold for all commodities. Over the outlook period, Sub-Saharan Africa will increase its dependency on imports to meet its food fish consumption from 40% to 44%, although this is still below the ratios of 45%-48% experienced between 2006 and 2011.

Figure 1.28. Imports as share of domestic cereals demand in selected Middle Eastern and African countries

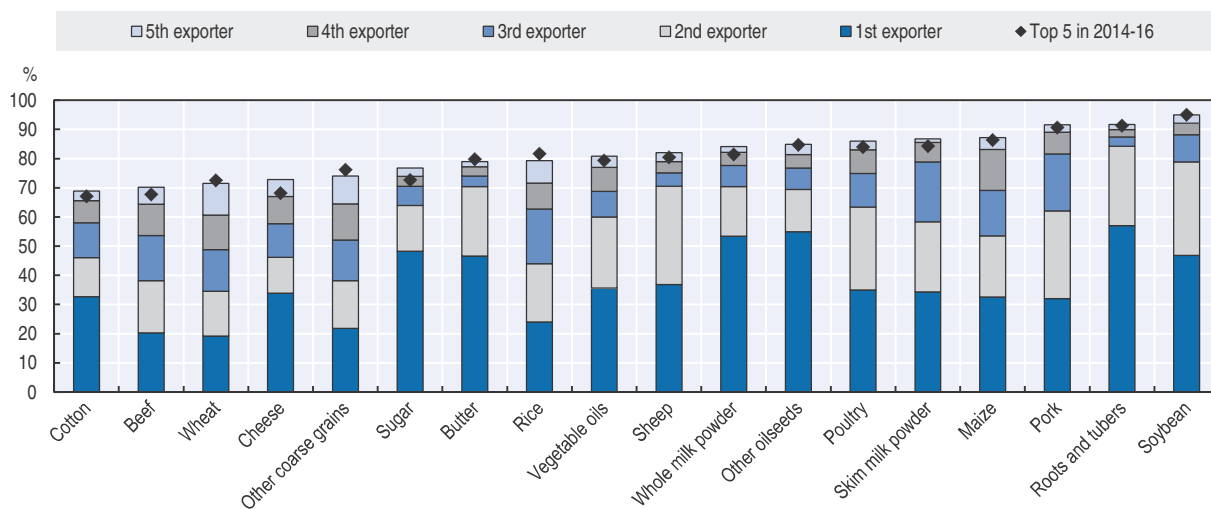


Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
 1 2 <http://dx.doi.org/10.1787/888933521427>

Agricultural exports to remain concentrated among a few key suppliers

Agricultural exports are traditionally concentrated among a small number of key exporting countries with a comparative advantage in production, often driven by geographical and climatic conditions. Figure 1.29 illustrates for selected commodities the export shares of each of the top five exporters in 2026, as well as the combined export share of the top five exporters during the base period (2014-16). Among the commodities covered in the Outlook, the five largest exporting countries typically account for 70% or more of global export volumes. Over the course of the projection period, this concentration will persist, although some commodity-specific changes occur.

Figure 1.29. Export shares of the top 5 exporters in 2026, by commodity



Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
 1 2 <http://dx.doi.org/10.1787/888933521446>

Exports of soybeans are dominated by Brazil and the United States, which together account for nearly 80% of global exports. The top five exporters account for almost 95% of total exports, the highest five-country concentration ratio of the commodities covered in the Outlook. The lowest five-country concentration ratio in 2026 is found for fish, at 50% (up from 46% in 2014-16). China is the main fish exporter with 23% of the total. Over the course of the outlook period, Viet Nam will overtake Norway as the second leading exporter of fish for human consumption. The second-lowest concentration ratio is found for cotton (at slightly below 70%), although the largest exporter, the United States, by itself accounts for one-third of global exports. Although beef and wheat have similar concentration ratios to cotton, the composition of the exports of the top 5 is more diversified. The key exporter in 2026 (Brazil for beef, the European Union for wheat) accounts for 20% of global exports, the lowest values among the commodities covered here.

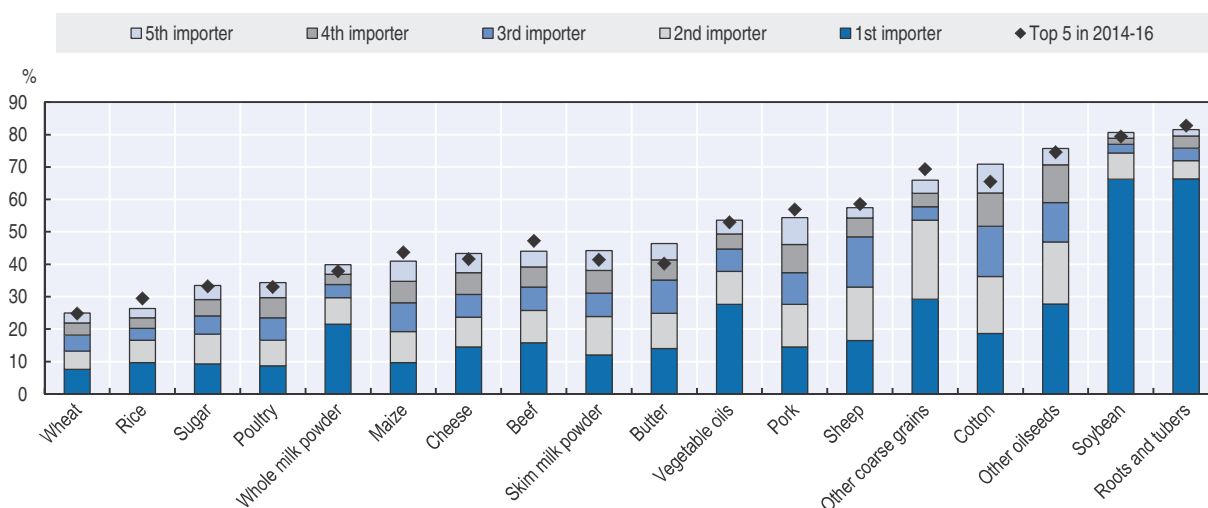
A small number of key exporters thus dominate most commodities. This creates a risk of potentially significant market impacts if exports are interrupted, either as a result of adverse production shocks (such as exceptionally poor harvests for cereal crops) or policy changes in the major exporting countries.

For a number of commodities, the five-country export concentration ratio will increase over the projection period. The dominance of dairy exports by suppliers in developed countries will continue as exports by the top 5 exporting countries increases for cheese (from 68% to 73%), whole milk powder (from 81% to 84%) and skim milk powder (from 84% to 87%), especially driven by export growth from the European Union. The market for meat, too, will see its concentration grow as suppliers in the Americas benefit from higher productivity and favourable local supplies of feed grain, as well as exchange rate depreciation in Brazil and Argentina. The five-country concentration ratio for poultry increases from 84% to 86% driven by growth from Brazil, the United States and the European Union. For beef, the five-country concentration ratio increases from 68% to 70%, driven by growth in Brazil and Australia. India maintains its position as third-largest beef exporter, accounting for 16% of global exports.

Imports will continue to be more widely dispersed than exports. Trade for a 'typical' agricultural commodity thus flows from a small number of key exporters to a broad group of importing countries (Figure 1.30). For some commodities, however, a relatively high share of import demand comes from just a few countries. This is particularly the case for roots and tubers and soybeans. For both commodities, China accounts for two-thirds of global imports. Global trade in roots and tubers is therefore mostly between Thailand and Viet Nam (who together account for more than 84% of exports) and China. Likewise, global trade in soybeans is mostly between Brazil and the United States (jointly responsible for 78% of exports) and China. In addition, China is also a major importer of several other commodities such as other oilseeds (mainly rapeseed), other coarse grains, cotton, and dairy products.

Risks and uncertainties around international trade

International trade in agricultural commodities is sensitive to several factors such as production conditions (such as variations in crop yields) and policy decisions in exporting countries, and macroeconomic conditions and consumer preferences in importing countries, most notably in China. China's policies and domestic demand potentially have the biggest impact for cereals, oilseeds and dairy products, as even small variations in domestic production and consumption can have a significant impact on the world market.

Figure 1.30. **Import shares of top 5 importers in 2026, by commodity**

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 <http://dx.doi.org/10.1787/888933521465>

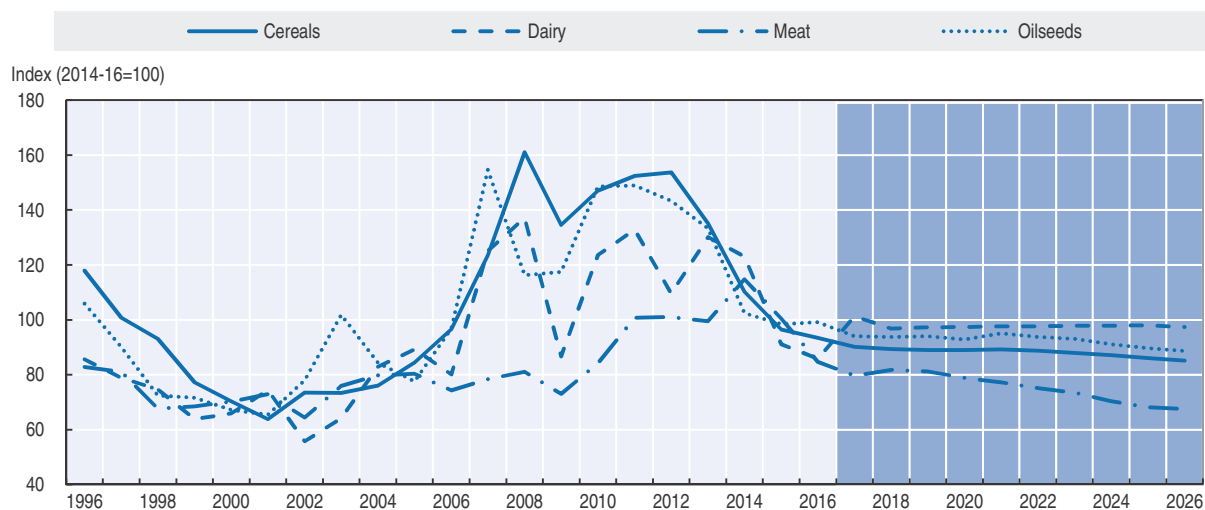
Stocks of some commodities, such as maize and cotton in China, and skim milk powder in the European Union, are at relatively high levels. The decision of when and how to release these stocks can impact international prices and trade flows. The phasing-out of export taxes in Argentina will open up new opportunities for the country's soybeans, sunflower seeds and their by-products, as well as maize.

Environmental concerns may impact international trade in agricultural commodities in the coming decade if consumer awareness leads to shifts towards goods perceived as more sustainable, for instance through an increased preference for "local food". Likewise, trade may also be affected by more rigorous regulations related to environment, food safety, environmental traceability and animal welfare regulations. Another important factor that could impact the projections relates to disease risks in livestock production and aquaculture, where protective measures can have a prolonged impact on supply, demand and trade.

Prices

The *Outlook* uses prices at main markets (e.g. US gulf ports, Bangkok) of each commodity as international reference prices. Historical observations are used to describe previous developments while projected values reflect future market trends. Near-term price projections are still influenced by the effects of recent market events (e.g. droughts, policy changes), whereas in the outer years of the projection period, they are driven by fundamental supply and demand conditions only.

Prices of different commodity groups such as cereals, dairy and oilseeds are highly correlated. In the coming decade, prices for these key commodity groups are projected to remain at or somewhat below current levels in real terms (Figure 1.31). Based on the projected supply and demand conditions, prices are expected to remain below the peaks reached during the 2006-16 period but above the levels seen in the early 2000s. Meat prices have historically followed a somewhat different path, avoiding the peak of 2007 but showing strong growth post-2009, leading to a price peak in 2014. Over the coming decade, meat prices are expected to fall in real terms to levels similar to those in the early 2000s.

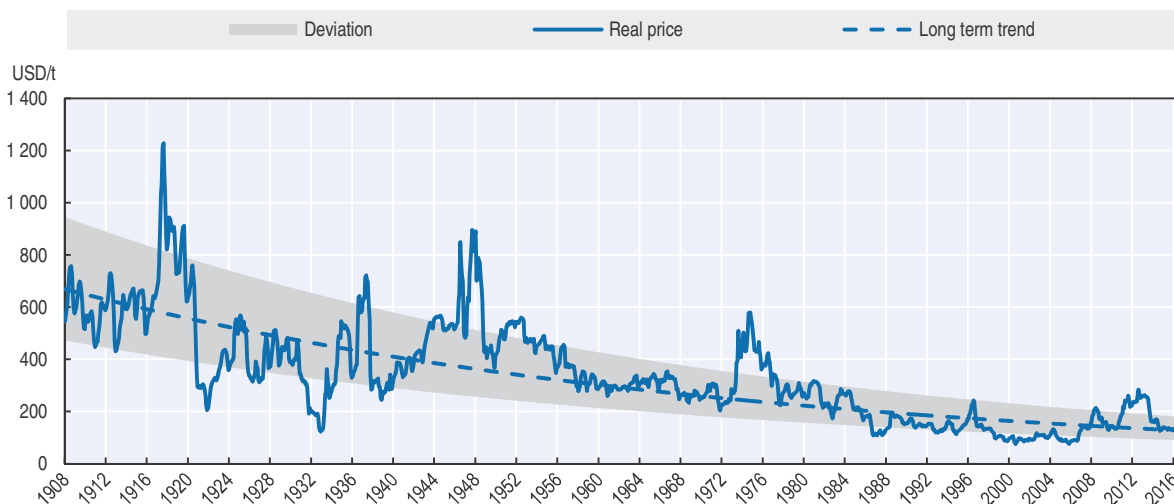
Figure 1.31. **Medium-term evolution of commodity prices in real terms**

Note: Price indices for commodity groups calculated using a constant weighting of commodities within each aggregate, using the average 2014-16 production value as weights.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 2 <http://dx.doi.org/10.1787/888933521484>

While prices for cereals thus appear to reach levels above those seen in the early 2000s, the question of whether real prices are on an increasing or a decreasing trend depends on the assessment period. Figure 1.32 shows monthly real prices for maize over more than a century (1908-2016). Over the long run, prices have clearly been on a declining trend, with an average price decrease of 1.5% per year in real terms. Similar trends exist for other commodities.

However, Figure 1.32 also illustrates that prices of agricultural commodities are subject to considerable volatility and may show large deviations from their long-term trends for an extended period of time. Between 1972 and 1977, for instance, the real price of maize

Figure 1.32. **Long-term price of maize in real terms**

Note: Deviation refers to one standard deviation above and below the trend line.

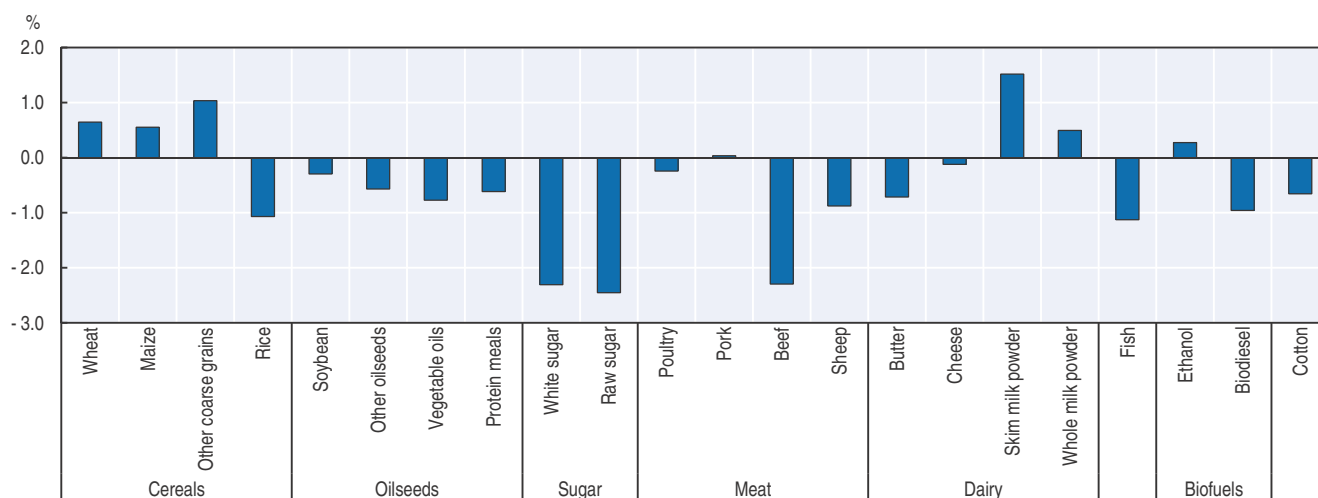
Source: Monthly "Corn price received" from USDA Quickstats, deflated using monthly CPI data from www.bls.gov/data.

1 2 <http://dx.doi.org/10.1787/888933521503>

remained above trend for 56 consecutive months, under the influence of higher oil prices. The deviation from the trend was large: in 1974, the real price of maize reached levels almost two and a half times the value predicted by the long-run trend. Yet despite this deviation, which far exceeds the 2007 price peak in both magnitude and duration, the maize price eventually returned to its long-term trend. A key insight from this long-term view is therefore that commodity prices in any given year may show considerable variation around their projected levels.

Figure 1.33 shows the projected annual price change (in real terms) of selected commodities over the course of the outlook period, with more detailed evolutions provided in Figure 1.34. For most commodities, projected price changes are modest, with a flat to declining trend, although there are some increases among cereals and dairy products.

Figure 1.33. **Average annual real price change for agricultural commodities, 2017-26**



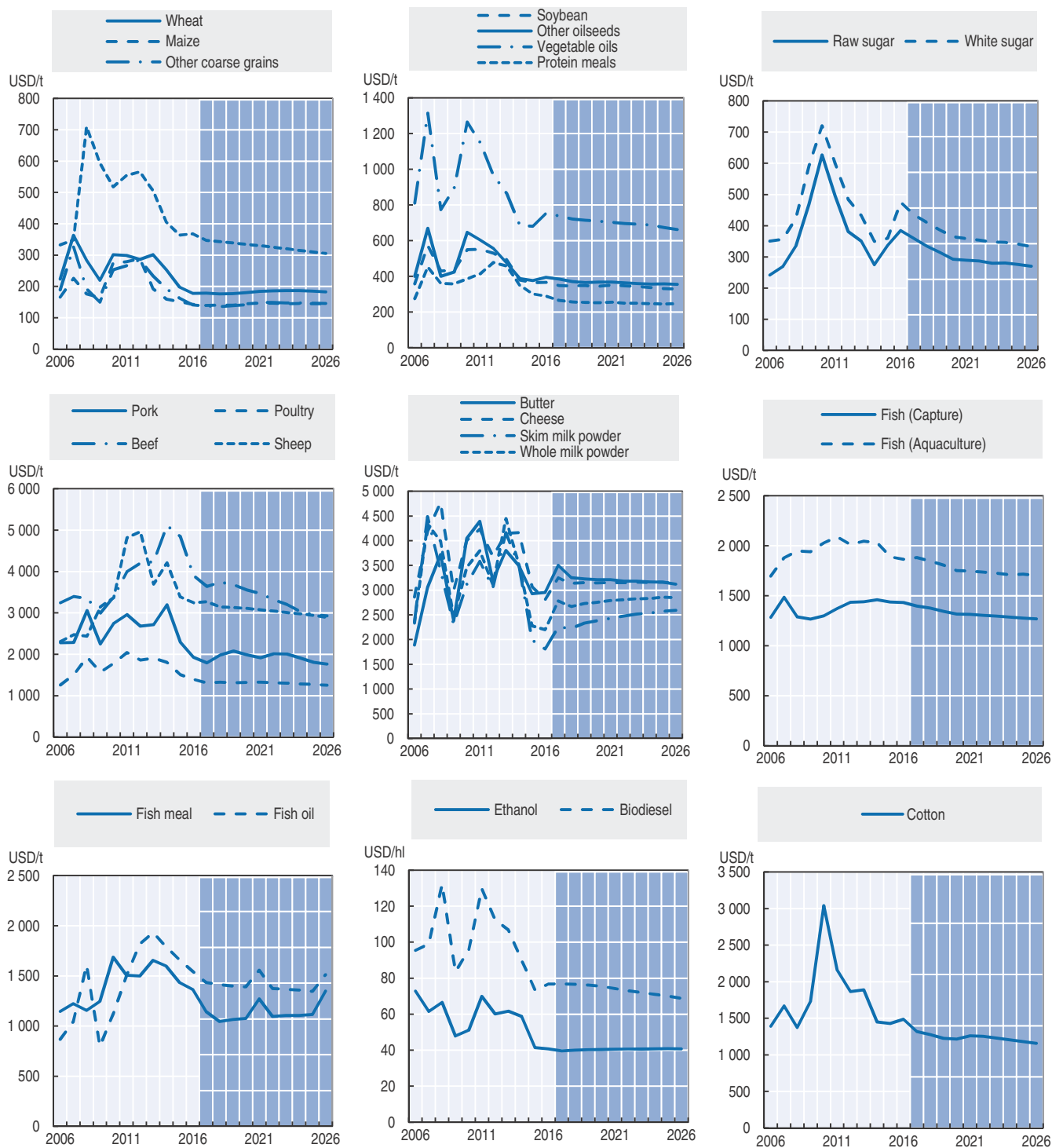
Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.
1 2 <http://dx.doi.org/10.1787/888933521522>

Among **cereals**, limited real price increases of less than 1% per year are expected for wheat and maize. For other coarse grains, a slightly higher price increase is expected, sustained by growing import demand from China and Saudi Arabia. For rice, a price decrease of 1% per year is expected.

Prices for **soybeans and other oilseeds** are expected to remain essentially at their current levels. Compared to the last decade, demand for **vegetable oil** is slowing down considerably, as many emerging economies (including China, Brazil and South Africa) are reaching a saturation point; as a result, a small decrease (of 1% per year) in real prices is projected. For **protein meals**, a modest decrease in real prices (less than 1% per year) is also expected due to the lower import demand and firm soybean meal production in the Americas.

Larger price changes are expected for **sugar**, with both white sugar and raw sugar prices projected to decrease by around 2% per year in real terms. This decrease is mostly explained by the high starting point. Following a peak in 2010, sugar prices declined until 2014, but increased strongly in the following two years as consumption outstripped production. However, over the outlook period the balance is expected to be restored, leading to a gradual decrease in sugar prices.

Figure 1.34. Evolution of individual commodity prices in real terms



Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

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<http://dx.doi.org/10.1787/888933521541>

Meat prices are expected to fall in real terms driven by production expansion through larger herds and heavier slaughter weights in key producing countries. Demand growth is limited given the slowdown in demand from China, and the absence of other developing countries as alternative sources of demand growth.

Prices for **dairy** products show a mixed picture, with a modest price decrease expected for butter, a small increase for skim milk powder and whole milk powder, and essentially flat prices for cheese.

Fish prices are expected to fall by 1% per year in real terms, given relatively high prices at the beginning of the outlook period. The decline projected in the outlook period brings the real price in 2026 below the prices observed in the 1996-2016 period. Aquaculture fish prices have been declining in real terms since 2011, a trend which is expected to continue throughout the outlook period.

For **biofuels**, ethanol prices are expected to remain at current levels in real terms while a modest price decrease is foreseen for biodiesel. The evolution of biofuels markets is heavily dependent on the evolution of crude oil prices and policy decisions, but also on the prices of feedstocks, e.g. vegetable oils for biodiesel and maize and sugar crops for bioethanol. The modest evolutions in prices for these feedstocks contribute to the relatively flat price evolutions for biofuels.

Cotton prices are set to decline by less than 1% per year. After reaching a historical peak in 2010-11, real prices fell by half. Large inventories (representing about 75% of annual consumption) will further depress prices in the early years of the outlook period. In later years, a slowdown in consumption is expected due to competition from man-made fibres.

Overall, prices are thus expected to remain at lower levels compared to the price peaks experienced in the past decade. As the higher prices of 2007-08 spurred investment in agriculture, an important question is therefore whether lower prices will lead to reduced investment. This question is explored in Box 1.3.

Box 1.3. **Will lower food prices reduce foreign agricultural investment in developing countries?**

The surge in commodity prices in 2007-08 has led to a wave of large-scale foreign investments in the agricultural sector of developing countries through several mechanisms. While developing country agriculture has traditionally been viewed as a high-risk low-profit sector, higher prices made the returns on investment more attractive for agribusiness companies. With higher prices, also agricultural land became more attractive financial investors, not least as the traditional asset classes such as equities, bonds and real estate lost their appeal amidst the financial crisis of 2007-08. Investment in farmland was supported by the expectation of further growth in global food demand, offering uncorrelated returns to bond and equity markets and providing a hedge against inflation (HighQuest Partners, United States 2010; FAO 2012).

Faced with soaring global food prices, countries dependent on food imports became increasingly concerned that international markets would no longer be an affordable and reliable source of supplies. Their fears were compounded when some food-exporting countries adopted export restrictions and outright bans to prevent a food price surge on their own market. These concerns spurred net-food-importing countries to invest in agricultural production in countries with “under-utilized” land with a view to exporting food to their home market. Finally, the rise in oil prices, which was a key driver of the food price spike, and policies promoting biofuels in major import markets led to a surge of investment in the production of feedstock crops for biofuels.

Box 1.3. Will lower food prices reduce foreign agricultural investment in developing countries? (cont.)

Almost a decade after the 2007-08 price spike, the overall market situation is decidedly different. Stocks are replenished, non-food demand has slowed, and agricultural production has risen, partly as a result of the investment surge. High outputs and slower demand growth have pushed prices lower; even in nominal terms, they are much below their peak levels of 2008. The medium-term outlook suggests that prices will remain subdued.

As investors respond to price signals, the question arises whether lower prices will result in lower investment in agriculture. Recent developments in global flows of foreign direct investment (FDI) in agriculture would seem to support this expectation. After reaching a peak of some US\$35 billion in 2009, FDI in food, beverage and tobacco decreased to around USD 20 billion per year in 2013-14 (FAO 2016). However, it would be premature to conclude that foreign investment in agriculture will stop. While global agricultural FDI flows are lower than in the aftermath of the global food price crises of 2007-08 and 2011-12, they are still higher than their average levels in the early 2000s. Partly, this reflects the fact that real food prices are still higher than in the early 2000s. Partly, other factors (such as food security policies) are at play, as output prices are not the only driver of agricultural investment. It seems that countries heavily dependent on food imports continue to invest in agricultural production abroad. Short-term or medium-term market conditions have only a limited impact on policies and strategies aimed at long-term national food security.

In addition to the size of investment flows, their quality is of crucial importance both for their impacts on markets and overall development. There is growing evidence that, with adequate initial support, inclusive models that involve local farmers as business partners without transferring land rights generate more profits and developmental benefits than other models (FAO 2014). Efforts by developing country governments to promote inclusive business models that benefit local farmers will increase both the quality and quantity of foreign investment. To support these efforts, FAO has launched a global programme to enhance responsible investments in agriculture and food systems. OECD and FAO are preparing a pilot project to test the practical application of the OECD-FAO Guidance on Responsible Agricultural Supply Chains with a group of companies. These activities and other related initiatives aim to promote agricultural investment and increase its returns. Higher returns are expected to make developing country agriculture more attractive to foreign investors.

In conclusion, while lower food prices have put downward pressure on agricultural FDI flows into developing countries, countervailing factors such as food security concerns and higher returns on investment are likely to play an increasingly important role. Despite the outlook for subdued prices, it would therefore be premature to conclude that agricultural FDI flows will decline over the medium-term.

Sources: FAO (2016); FAO, IFAD and WFP (2015); FAO (2014); FAO (2012); HighQuest Partners, United States (2010).

Risks and uncertainties

The projections in the *Outlook* are based on the Aglink-Cosimo model, supplemented with, and sometimes adjusted by, expert judgment. For most commodities, this year's *Outlook* predicts relatively stable market conditions in the coming decade. However, it is important to keep in mind limitations of the methodology behind the *Outlook*.

First, the *Outlook* is based on a specific set of assumptions on, for example, oil prices, GDP, exchange rates, population growth and the evolution of yields, among others. Several of these assumptions are explained in Box 1.4. These assumptions, while based on the best available estimates, remain intrinsically uncertain. As mentioned previously, given the historical variation in some of these variables a margin of error exists around the predictions made. Moreover, such uncertainty tends to cumulate over time. Hence, over the ten-year horizon of the *Outlook*, temporary deviations from a trend may swamp the actual trend, even if the outlook projections are fundamentally sound.

The sensitivity of the projections in this year's *Outlook* is assessed using a *partial stochastic analysis*, available online at www.agri-outlook.org. This analysis takes historical variations in a subset of market drivers, including yields, GDP growth, the oil price and exchange rates, and assumes that the historical variability of those factors continues into the future. The projections of the *Outlook* are recalculated on the basis of multiple "draws" from a distribution of these risk factors. Each simulation leads to an alternative future "path" for prices, production and consumption.

This partial stochastic analysis shows that uncertainties tend to accumulate, so the range of confidence in the baseline projections is lower at the end of the ten year projection period. They also point to a high probability of a major price swing within the next ten years. Moreover, while there may be a broadly equal chance of prices being higher or lower than under the baseline, the potential for prices to spike upwards exceeds the degree to which they can collapse.

By construction, however, several uncertainties are not incorporated in the projections nor in the partial stochastic analysis. These include the risk of outbreaks of transboundary pests and diseases, of increased variability in yields caused by climate change, and uncertainty around policies. Policy uncertainty is especially relevant for aspects of the *Outlook* that are highly sensitive to policy decisions, such as agricultural trade and the future evolution of biofuels.

Box 1.4. Macroeconomic and policy assumptions

The main assumptions underlying the baseline projection

The OECD-FAO *Agricultural Outlook* provides a base scenario considered plausible given a range of conditioning assumptions. These assumptions present a specific macro-economic, policy and demographic environment which underpins the projections for the evolution of demand and supply of agricultural and fish products.

The macro-economic assumptions used in the *Outlook* are based on the OECD *Economic Outlook* (November 2016) and the IMF's *World Economic Outlook* (October 2016). A detailed overview of the macroeconomic and policy assumptions can be found in the online Statistical Appendix; an overview of key assumptions is presented below.

Sluggish economic growth

Global GDP growth remained low in 2016 at 2.9%, the slowest growth rate since 2009. After a prolonged slowdown, there are signs that growth has stabilised in the emerging economies, helped by modest recoveries from recessions in Brazil and the Russian Federation. However, hopes that advanced economies would gain momentum have been disappointing. Economic conditions have weakened in these economies, and growth continues to be subdued with only a very modest recovery expected. An equally modest increase of 3.2% in global growth rates is expected in 2017, despite low-interest rates; the growth rate for 2018 is expected to be 3.6%.

In the United States, GDP growth in 2016 was 1.5% compared to 2.6% in 2015, but an assumed fiscal easing is expected to provide additional stimulus to domestic demand over the next two years. GDP growth is projected to lower to 2.3% in 2017 and pick up to 3.0% in 2018, while medium-term growth, projected at 1.8% per annum (p.a.), is dampened by an aging population and the recent trend of low total factor productivity growth.

Growth will remain modest in the Euro area as domestic demand is weighed down by weak investment, high unemployment and political uncertainties. For EU15 members as a group, an annual average growth rate of 1.6% is expected during the projection period.

Box 1.4. Macroeconomic and policy assumptions (cont.)

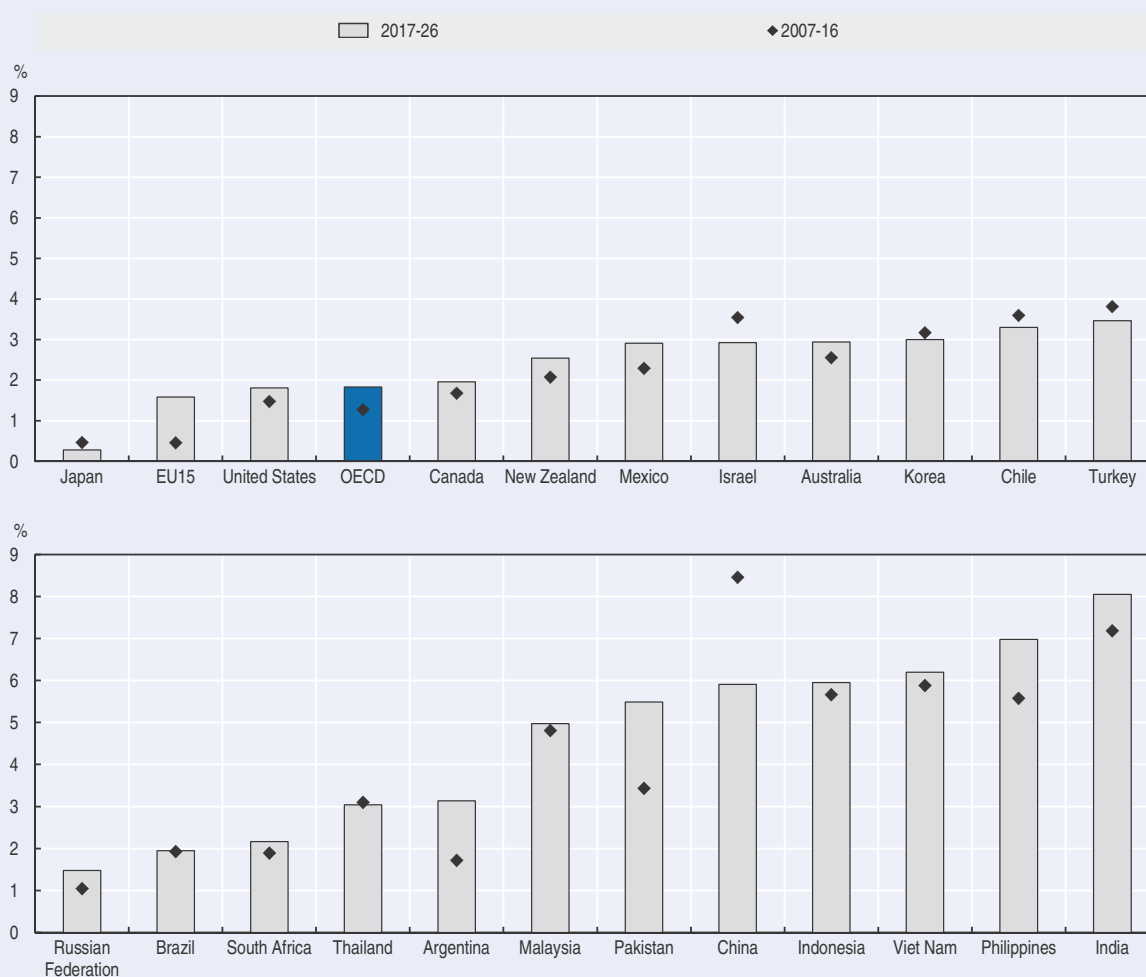
GDP growth in Japan is expected to remain modest, below 1% per annum over 2017-18. The country's medium-term prospects remain weak, with an annual growth rate per annum of 0.3% during the projection period, due primarily to a shrinking population.

Among OECD countries, Turkey is expected to experience the highest growth rate over the next ten years, with an average annual rate of 3.5%, followed by Chile at 3.3%, Korea at 3% and Australia, Israel and Mexico at just under 3%. After two years of low GDP growth, Canada is expected to recover moderately in 2017-18 and maintain an annual growth rate of 2% during the projection period.

The outlook for the large Emerging Market Economies (EMEs) is uneven and generally weaker than in the past. Growth is projected to continue to slow down in China, with an average annual growth of 5.9% over the next ten years, compared to 8.5% during the last decade, while growth in India continues to be resilient at 8% p.a. on average.

A slow recovery is projected for Brazil and the Russian Federation over the next two years, averaging about 1.9% p.a. and 1.5% p.a. respectively over the projection period. Argentina should recover quickly in 2017 from its 2016 recession with growth projected to rise to 3.1% p.a. on average.

Figure 1.35. GDP growth rates in OECD and selected developing countries



Note: Only selected developing countries shown in second panel. Assumptions for all countries are available in the online Statistical Appendix.

Source: OECD/FAO (2017), "OECD-FAO Agricultural Outlook", OECD Agriculture statistics (database), <http://dx.doi.org/10.1787/agr-data-en>.

1 <http://dx.doi.org/10.1787/888933521560>

Box 1.4. Macroeconomic and policy assumptions (cont.)

Over the next decade, growth prospects in developing economies are expected to remain diverse, but generally strong, across countries and regions. Myanmar, the Lao People's Democratic Republic and the Philippines are expected to lead growth in Asia, averaging 7.6% p.a., 7.1% p.a. and 6.95% p.a. respectively. Indonesia and Malaysia are expected to achieve a marginally higher growth rate than in the previous decade at 6.1% p.a. and 5.1% p.a., while growth in Thailand will remain at a similar rate as in last decade at 3.1% p.a. The picture for Sub-Saharan Africa is expected to remain uneven. In larger commodity exporting countries, such as Nigeria and Angola, growth should decelerate to 3.3% p.a., reflecting the adjustment of their economies to lower revenues from oil and other resource commodities. In contrast, several non-resource exporters, including Ethiopia, Cote d'Ivoire, Kenya and Senegal, are expected to continue expanding at a pace of more than 7% p.a., benefiting from favourable energy prices, an improved business environment, and strong infrastructure investment. Growth in North Africa and the Middle East is expected to pick up slightly to 3.8% p.a. as the slump in oil prices and ongoing conflicts continue to weigh on economic growth prospects. Growth in Saudi Arabia is expected to be weaker than in the last decade, with an average of 2.3% p.a. over the next ten years compared to 4.3% p.a. in the last decade. Benefiting from faster-than-expected increases in oil production following the removal of sanctions, growth in the Islamic Republic of Iran should pick up, averaging 4.4% p.a. Growth in Egypt is expected to average 6% p.a. The expected annual growth rate of 3.4% for Latin America over the projection period is similar to the last decade, although the Venezuelan crisis continues to weigh on the region's overall growth.

A slowdown in population growth

World population growth is expected to slow to 1% p.a. over the next decade, compared to 1.2% in the last decade. Developing countries continue to fuel this growth, particularly in Africa which is expected to have the fastest growth rate at 2.4% p.a. The Asia and Pacific region will account for more than half the world's population, and India, with an additional 149 million people by 2026, should overtake China as the most populous country.

Among OECD countries, the population of Japan is expected to decrease by nearly 4 million over the next ten years and that of the Russian Federation by 2.7 million. The population of the European Union is expected to remain stable, growing at a rate of 0.07% p.a. Australia has the highest projected population growth among OECD countries at 1.17% p.a., followed by Mexico at 1.06% p.a.

Inflation

Inflation remained weak in OECD countries in 2016, at around 1% on average; it was close to zero in the European Union, and negative in Japan after two years of slightly positive rates. Inflation in advanced economies is expected to increase over the next few years as oil prices increase modestly and output gaps gradually shrink, reaching central bank targets by around 2020.

Inflation is projected to increase from 1.1% in 2016 to 2.5% by 2019 in the United States, maintaining an average annual growth of 2.4% during the projection period. For the EU15 members as a group, the annual average inflation rate is projected at 1.8% for the next ten years. Inflation is expected to increase only slowly in Japan at 1.5% p.a. Amongst the major EMEs, consumer price inflation is projected to remain low in China and ease slowly in Brazil and the Russian Federation, facilitated by currency stabilisation.

Exchange rates

Nominal exchange rates for the period 2017-26 are mostly driven by the inflation differential in relation to the United States (with minor or no changes in real terms). Large exchange rate depreciations occurred for several advanced and emerging and developing economies in 2015. The Euro appreciated slightly in nominal terms against the US dollar in 2016, but is expected to depreciate in 2017 before appreciating again over the next ten years. Currencies are expected to appreciate in nominal terms relative to the US dollar over the next ten years in Japan, Canada, the Euro area, New Zealand, China, Islamic Republic of Iran, Malaysia, Philippines, and the Ukraine. Conversely, a strong depreciation in the currencies of Argentina, Brazil, India, South Africa, Turkey, Indonesia and Thailand is projected over the next decade. This will also be the case, but to a lesser extent, for the Russian ruble.

Box 1.4. Macroeconomic and policy assumptions (cont.)

Energy prices

World oil price assumptions to 2015 were obtained from the short-term update of the OECD *Economic Outlook* N°100 (November 2016). For 2016, the annual average monthly spot price was used, and oil prices during the projection period follow the path of the World Bank average crude oil price projected by the World Bank Commodities Price forecasts, released in October 2016.

Crude oil prices picked up at the end of 2016 after a steep drop which began in mid-2014. This increase followed an agreement by both OPEC and non-OPEC producers to reduce output by nearly 1.8 million barrels per day in the first half of 2017. The oil market will continue to rebalance itself in 2017, leading to a 32% increase of the nominal oil price, which will continue to rise moderately thereafter. Nominal oil prices are expected to increase over the outlook period at an average annual rate of 4.8%, from USD 43.8 per barrel in 2016 to USD 89.5 per barrel by 2026.

Policy considerations

Policies play an important role in agricultural, biofuel and fisheries markets, with reforms often changing the structure of markets. This *Outlook* assumes that policies will remain as they are throughout the projection period. The decision by the United Kingdom to exit the European Union is not included in the projections, as the terms of that departure have not been determined. In the current *Outlook*, projections for the United Kingdom are retained within the European Union aggregate. The Nairobi package of the World Trade Organization (WTO), especially concerning export competition, has been taken into account. In the case of bilateral trade agreements, only ratified or implemented agreements are incorporated. Thus, the North American Free Trade Agreement (NAFTA) remains unchanged throughout the *Outlook* projection while the partly implemented but not ratified Comprehensive Economic and Trade Agreement (CETA) is incorporated. The Trans Pacific Partnership (TPP) is not included as it has not been ratified. The ban by the Russian Federation on imports originating from specific countries was announced as a temporary measure and this *Outlook* assumes that the ban will be revoked at the end of 2017. The specific assumptions on biofuel policies are elaborated in the Biofuel chapter.

Notes

1. The weakness in world trade is documented and explained in recent work by the OECD. See Haugh et al., 2016.
2. As this trade measure is based on the commodities available in Aglink-Cosimo, it leaves out several important products such as fruit and vegetables or processed agri-food products. Moreover, the definition of agricultural trade here does not coincide with the definition in the Agreement on Agriculture. Nevertheless, the trade measure can serve as a useful proxy for agricultural trade more broadly, as Aglink-Cosimo covers the most important agricultural commodities.

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