OECD-FAO Agricultural Outlook 2015-2024

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2015-2024

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Foreword

The Agricultural Outlook 2015-2024, *is a collaborative effort of the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization (FAO) of the United Nations. It brings together the commodity, policy and country expertise of both organisations and input from collaborating member countries to provide an annual assessment of prospects for the coming decade of national, regional and global agricultural commodity markets. The special feature on Brazil has been prepared in collaboration with analysts associated with the Ministério da Agricultura, Pecuária e Abastecimento (MAPA) and Empresa Brasileira de Pesquisa Agropecuária (Embrapa). However, OECD and FAO are responsible for the information and projections contained in this document, and the views expressed in the special feature do not necessarily reflect those of Brazilian institutions.*

The baseline projection is not a forecast about the future, but rather a plausible scenario based on specific assumptions regarding the macroeconomic conditions, the agriculture and trade policy settings, weather conditions, longer term productivity trends, and international market developments. The projections of production, consumption, stocks, trade and prices for the different agricultural products described and analysed in this report cover the years 2015 to 2024. The evolution of markets over the outlook period is typically described using annual growth rates or percentage changes for the final year 2024 relative to a three-year base period of 2012-14.

The individual commodity projections are subject to critical examination by experts from national institutions in collaborating countries and international commodity organisations prior to their finalisation and publication in this report. The risks and uncertainties around the baseline projections are examined through a number of possible alternative scenarios and stochastic analysis, which illustrate how market outcomes may differ from the deterministic baseline projections.

The complete Agricultural Outlook, *including more detailed commodity chapters, the full statistical annex and fully documented Outlook database, including historical data and projections, can be accessed through the OECD-FAO joint Internet site:* www.agri-outlook.org. *The published* Agricultural Outlook 2015 *report provides: an overview of global agriculture and its prospects; an in-depth analysis of the outlook for Brazilian agriculture and a consideration of some of the challenges facing the sector; and snapshots for each commodity with associated statistical tables. The more detailed commodity chapters are contained in the OECD's iLibrary version of the report.*

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Acronyms and abbreviations

ACP	African, Caribbean and Pacific countries
ANP	National Agency of Petroleum, Natural Gas and Biofuels (Brazil)
ARC	Agricultural Risk Coverage (US Farm Bill Instrument)
ARC	Agriculture Risk Coverage
ARC-CO	Agricultural Risk Coverage based on a county revenue trigger (US Farm Bill Instrument)
ARC-IC	Agricultural Risk Coverage based on an individual farm-level revenue trigger (US Farm Bill Instrument)
ASF	African Swine Fever
Bln	Billion
Bln L	Billion litres
Bln t	Billion tonnes
BRICS	Emerging economies of Brazil, Russian Federation, India, China and South Africa
BRIICS	Emerging economies of Brazil, Russian Federation, India, Indonesia, China and South Africa
BSE	Bovine spongiform encephalopathy
c.w.e.	Carcass weight equivalent
CAP	Common Agricultural Policy (European Union)
CET	Common External Tariff
CFP	Common Fisheries Policy (European Union)
CIS	Commonwealth of Independent States
CPI	Consumer Price Index
cts/lb	Cents per pound
CV	Coefficient of variation
DPDP	Dairy Product Donation Program (United States)
E10	Blends of biofuel in transport fuel that represent 10% of the fuel volume
E15	Blends of biofuel in transport fuel that represent 15% of the fuel volume
E85	Blends of biofuel in transport fuel that represent 85% of the fuel volume
E100	Blends of biofuel in transport fuel that represent 100% of the fuel volume
EBA	Everything-But-Arms Initiative (European Union)
EISA Act	Energy Independence and Security Act of 2007 (United States)
El Niño	Climatic condition associated with the temperature of major sea currents
EPA	US Environmental Protection Agency
est	Estimate
EU	European Union
EU15	Fifteen member states that joined the European Union before 2004
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign direct investment
FTA	Free Trade Agreement

G20	Group of 20 important developed and developing economies (see Glossary)
GDP	Gross domestic product
GDPD	Gross domestic product deflator
GHG	Greenhouse gases
GM	Genetically modified
GSSE	General Services Support Estimate
ha	Hectares
HFCS	High fructose corn syrup
hl	Hectolitre
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
ITC	International Trade Centre
IUU	Illegal, unreported and unregulated (fishing)
kg	Kilogrammes
kt	Thousand tonnes
La Niña	Climatic condition associated with the temperature of major sea currents
lb	Pound
LDCs	Least Developed Countries
lw	Live weight
MERCOSUR	Mercado Común del Sur/Common Market of South America
MFA	Multi-fibre Arrangement
MFN	Most favoured nation
Mha	Million hectares
MPP	Margin Protection Program
Mt	Million tonnes
NAFTA	North American Free Trade Agreement
OECD	Organisation for Economic Co-operation and Development
p.a.	Per annum
PCE	Private consumption expenditure
PEDv	Porcine Epidemic Diarrhoea virus
PISA	Programme for International Student Assessment
PLC	Price Loss Coverage (US Farm Bill instrument)
PPI	Producer Price Index
PSE	Producer Support Estimate
r.s.e.	Raw sugar equivalent
r.t.c.	Ready to cook
RED	Renewable Energy Directive in the EU
RFS2	Renewable Fuels Standard in the US, which is part of the Energy Policy Act
RTA	Regional Trade Agreements
SDA	Same-day affirmation
SMP	Skim milk powder
SMP	Statutory Minimum Price
SPS	Single payment scheme (European Union)
STAX	Stacked Income Protection Plan (US Farm Bill Instrument)
t	Tonnes
t/ha	Tonnes/hectare

TFP	Total Factor Productivity
TRQ	Tariff rate quota
TSE	Total Support Estimate
UN	The United Nations
UNCTAD	United Nations Conference on Trade and Development
US	United States
USDA	United States Department of Agriculture
VAT	Value added tax
WFP	United Nations World Food Programme
WMP	Whole milk powder
WTO	World Trade Organization

Brazil specific acronyms and abbreviations

ABC	Brazilian Co-operation Agency
AGF	Aquisição do Governo Federal
BNDES	National Bank for Economic and Social Development
CIDE	Contribuição sobre Intervenção do Domínio Econônomico
COFINS	Social Contribution Tax
CONAB	Companhia Nacional de Abastecimento
Embrapa	Brazilian Agricultural Research Corporation
EPE	Empresa de Pesquisa Energética
FGV	Fundação Getulio Vargas
IBGE	The Brazilian Institute of Geography and Statistics
ICMS	Imposto sobre Circulação de Mercadorias e Serviços
ICO	International Coffee Organisation
MAPA	Ministry of Agriculture, Livestock and Food Supply
MDA	Ministry of Agrarian Development
PAA	Family Farming Food Acquisition Program
PGPAF	Family Farming Price Guarantee Program
PIS	Social Integration Tax
PRONAF	National Program for the Strengthening of Family

Currencies

ARS	Peso argentin
AUD	Australian dollars
BDT	Bangladeshi taka
BRL	Brazilian real
CAD	Canadian dollar
CLP	Chilean peso
CNY	Chinese yuan renminbi
DZD	Algerian dinar
EGP	Egyptian pound
EUR	Euro (Europe)
IDR	Indonesian rupiah
INR	Indian rupees
JPY	Japanese yen
KRW	Korean won

MXN	Mexican peso
MYR	Malaysian ringgit
NZD	New Zealand dollar
PKR	Pakistani rupee
RUB	Russian ruble
SAR	Saudi riyal
UAH	Ukrainian grivna
USD	US dollar
UYU	Uruguayan peso
ZAR	South African rand

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Executive summary

Prices for crops and livestock products showed diverse trends in 2014. Among crops, two years of strong harvests put further pressure on prices of cereals and oilseeds. Tighter supplies due to factors including herd rebuilding and disease outbreaks supported high meat prices, while the prices of dairy products dropped steeply from historic highs. Further adjustments to short-term factors are expected in 2015, before the medium-term drivers of supply and demand take hold.

In real terms, prices for all agricultural products are expected to decrease over the next ten years, as production growth, helped by on-trend productivity growth and lower input prices, outpaces slowing demand increases. While this is consistent with the tendency for long-term secular decline, prices are projected to remain at a higher level than in the years preceding the 2007-08 price spike. Demand will be subdued by per capita consumption of staple commodities approaching saturation in many emerging economies and by a generally sluggish recovery of the global economy.

The major changes in demand are in developing countries, where continued but slowing population growth, rising per capita incomes and urbanisation all increase the demand for food. Rising incomes prompt consumers to diversify their diets by increasing their consumption of animal protein relative to starches. For this reason, the prices of meat and dairy products are expected to be high relative to the prices of crops; while among crops the prices of coarse grains and oilseeds used for feed should rise relative to the prices of food staples. These structural tendencies are in some cases offset by specific factors, such as a flat demand for maize-based ethanol.

Lower oil prices are a source of downward pressure on prices, principally through their impact on energy and fertiliser costs. Moreover, under the projected lower oil prices, the production of first generation biofuels is generally not profitable without mandates or other incentives. Policies are not expected to lead to significantly higher biofuel production in either the United States or the European Union. On the other hand, a rise in the production of sugar-based ethanol in Brazil is expected to flow from the increase in the mandatory blending ratio in gasoline and the provision of tax incentives, while biodiesel production is being actively promoted in Indonesia.

In Asia, Europe and North America additional agricultural production will be driven almost exclusively by yield improvements, whereas in South America yield improvements and additional agricultural area are projected. Modest production growth is expected in Africa, although further investments could raise yields and production significantly.

Exports of agricultural commodities are projected to become concentrated in fewer countries, while imports become more dispersed over a large number of countries. The importance of relatively few countries in supplying global markets for some key

commodities increases market risks, including those associated with natural disasters or the adoption of disruptive trade measures. Overall, trade is expected to increase more slowly than in the previous decade, but maintaining a stable share relative to global production and consumption.

The current baseline reflects fundamental supply and demand conditions on world agricultural markets. However, the *Outlook* is subject to a variety of uncertainties, some of which are explored by stochastic analysis. If historical variations in yields, oil prices and economic growth are projected into the future, then there is a high probability of at least one severe shock to international markets within the next ten years.

Commodity highlights

- Cereals: High stocks and decreasing production costs are driving nominal cereal prices further down in the short term, while sustained demand and rising production costs should increase nominal prices again in the medium term.
- Oilseeds: Strong demand for protein meal will drive further expansion of oilseed production. This will result in a high contribution of the meal component to the overall oilseed return and further favour expansion of soybean production especially in Brazil.
- Sugar: Higher sugar demand in developing countries should help prices recover from low levels, leading to further investment in the sector. The market will depend on the profitability of sugar versus ethanol in Brazil, the leading producer, and will remain volatile as a result of the sugar production cycle in some key Asian sugar-producing countries.
- Meat: Output is expected to respond to an improvement in margins, with lower feed grain prices set to restore profitability to a sector that has been operating in an environment of particularly high and volatile feed costs for most of the past decade.
- Fisheries: Worldwide fisheries production is projected to expand by almost 20% by 2024. Aquaculture is expected to surpass total capture fisheries in 2023.
- Dairy: Exports of dairy products are projected to further concentrate in the four prime origins: New Zealand, the European Union, the United States and Australia, where opportunities for domestic demand growth are limited.
- Cotton: Prices will be suppressed in the short term by the drawdown of large stocks in the People's Republic of China (hereafter 'China'), but will recover and stay relatively stable for the remainder of the outlook period. By 2024, both real and nominal prices are expected to remain below the levels reached in 2012-14.
- Biofuels: Ethanol and biodiesel use is expected to grow at a slower pace over the next decade. The level of production is projected to be dependent on policies in major producing countries. At lower oil prices, trade of biofuels should remain small when expressed as a share of global production.

Brazil

This year's *Outlook* contains a special focus on Brazil. This country ranks among the world's ten largest economies and is the second largest global supplier of food and agricultural products. Brazil is poised to become the foremost supplier in meeting additional global demand, mostly originating from Asia.

Supply growth is projected to be driven by continued improvements in productivity, with higher crop yields, some conversion of pasture to cropland and more intensive livestock production. Structural reforms and a reorientation of support towards productivity enhancing investments, for example in infrastructure, could foster these opportunities, as could trade agreements that improve access to foreign markets.

Brazil has made outstanding progress in eliminating hunger and reducing poverty. Prospects for further reductions in poverty through agricultural development are widening, in some food crops as well as in higher value products such as coffee, horticulture and tropical fruits. The realisation of these opportunities calls for further targeting of rural development policies.

Brazil's agricultural growth can be achieved sustainably. While additional supply will continue to come more from productivity gains than area increases, the pressure on natural resources is expected to be alleviated by environmental and conservation initiatives, including support for sustainable cultivation practices, the conversion of natural and degraded cropland to pasture, and the integration of crop and livestock systems.

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PART I

Overview and special chapter

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PART I

Chapter 1

Overview of the *OECD-FAO Agricultural Outlook* 2015-2024

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 2015 to 2024. The chapter starts with a description of the state of agricultural markets in 2014 and explains the main macroeconomic and policy assumptions underlying the projections. In the next sections, consumption and production trends are examined, with a focus on calorie and protein consumption. 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, which include a stochastic analysis to illustrate how uncertainty about the macroeconomic environment and yield levels might affect price projections. Over the next ten years, real prices for all agricultural products are projected to decline from their 2014 levels but remain above their pre-2007 levels.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The useof 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: Divergence in crop and livestock markets in 2014

Following a period of exceptionally high crop prices, good harvests in key production regions replenished stock levels and sent prices downwards in marketing year 2013 (see glossary for a definition of marketing year). Production conditions remained favourable in 2014 and consequently, prices of cereals, oilseeds and sugar declined further. Despite the reduction in feed grain prices, meat prices reached record levels in 2014, as reduced herd numbers, combined with multiple disease outbreaks, restricted the immediate supply response. Prices of dairy products were high during the first part of 2014, but dropped in the second half of the year, while fish prices slightly declined in 2014 but remained higher than in 2013.

Record harvests for maize and wheat resulted in falling grain prices and ample stocks in 2014, with wheat prices attaining their lowest level since 2010. Global rice production was slightly lower in 2014 compared to 2013, but international rice prices remained under pressure. Global rice utilisation exceeded production for the first time in ten years, which led to a drawdown of global rice stocks.

Oilseeds production reached a new world record in marketing year 2014, with soybean production growing the most. With consumption failing to keep pace, oilseed prices fell. Vegetable oil prices also remained under pressure as both production and demand experienced slower growth rates. Rising demand made protein meal relatively expensive compared to feed grains.

International sugar prices continued their decline as production exceeded consumption for the fifth consecutive season. This decline was particularly pronounced due to the devaluation of the Brazilian real with respect to the US dollar. The current season is expected to be a turning point, with nearly no growth in global sugar production as increases in Europe were offset by large decreases in Brazil and Pakistan. The turn-around is not expected to be sufficient however and at the start of the outlook, some of the major sugar producers are expected to cut their production in response to the low prices.

Prices for most meat products, particularly beef, reached record levels in 2014. At the same time, the outbreak of Porcine Epidemic Diarrhoea virus (PEDv) in the United States and African swine fever in Belarus and the European Union, impacted pigmeat supply and prices. Sheep meat prices also increased in 2014 following several years of flock reduction in New Zealand, which was a result of the transformation of sheep farms into more profitable dairy operations. Given the substitutability among the various types of meat, the higher prices for beef, sheep meat and pigmeat also supported poultry prices.

The end of 2013 was characterised by high dairy product prices, due to a production shortfall in China in 2013 and year-on-year declines in milk production in first half of 2013 in the United States, the European Union, New Zealand and Australia. In the beginning of 2014, prices of dairy products started to decline amidst lower import demand in China, increasing production in major exporters and the import ban imposed by the Russian Federation on cheese from several major producing countries.

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Fish production, consumption and trade reached record levels in 2014. Prices for fish and fish products were strong during the first part of 2014 following high feed prices in 2012 and 2013. Later in the year, prices declined due to increased supply of certain fish species and lower demand in Japan and several European countries, but still remained higher than in 2013.

Global cotton production exceeded consumption again in 2014, while global stocks rose for the fifth consecutive year and international prices continued their decline. The accumulation of stocks was mainly driven by China's stockholding policies. In addition, the country has lowered its support to cotton farmers and reduced import quotas, two policy changes that affected the world cotton market in 2014.

Ethanol and biodiesel prices continued to decline in 2014 as a result of the decrease of the prices of biofuel feedstock and a strong decline in crude oil prices during the second half of the year. The policy environment was uncertain with no clear decisions on biofuel mandates and targets in either the United States or the European Union.

The projections in the *Outlook* consider the current market conditions for each commodity as well as macroeconomic and policy developments. The main macroeconomic and policy assumptions underlying the baseline projection are described in Box 1.1. One of the most noticeable macroeconomic assumptions concerns the decline in the crude oil price, which by February 2015 had declined by almost 50% from July 2014 levels. The price of the benchmark Brent crude oil is assumed to reach USD 88.1 per barrel by 2024. Other macroeconomic influences include moderate GDP growth in the OECD countries, slower GDP growth in the large emerging market economies, a slowdown in world population growth, low inflation in OECD countries and a strong US dollar. The projections also incorporate a detailed evaluation of the movements of the Producer Price Indices (PPI) and Consumer Price Indices (CPI) (see Box 1.2), which improves the representation of consumer prices in the model.

Box 1.1. **Macroeconomic and policy assumptions**

The main assumptions underlying the baseline projection

The *Outlook* is presented as one baseline scenario that is considered plausible given a range of conditioning assumptions. These assumptions portray a specific macroeconomic and demographic environment which shapes the evolution of demand and supply for agricultural and fish products. These general factors are described below.

A continuation of the moderate and uneven recovery is likely

Overall, the global economy continues to run in a low gear. At 3% over the past seven years, the pace of global growth is more than one percentage point below the 2000-07 period. Global trade growth also remains below trend. Recent divergent economic performance in the main OECD areas continues. The United States and United Kingdom have surpassed their pre-crisis GDP peaks, Japan has barely attained it, and the euro area as a whole is still below, though there are considerable differences among countries within the euro area. Labour market conditions are improving in the United States, United Kingdom and Japan but not in the euro area. In the OECD area alone, eleven million more people remain unemployed compared to 2007. A further slowdown could push the euro area closer to persistent stagnation with much weaker growth and inflation.

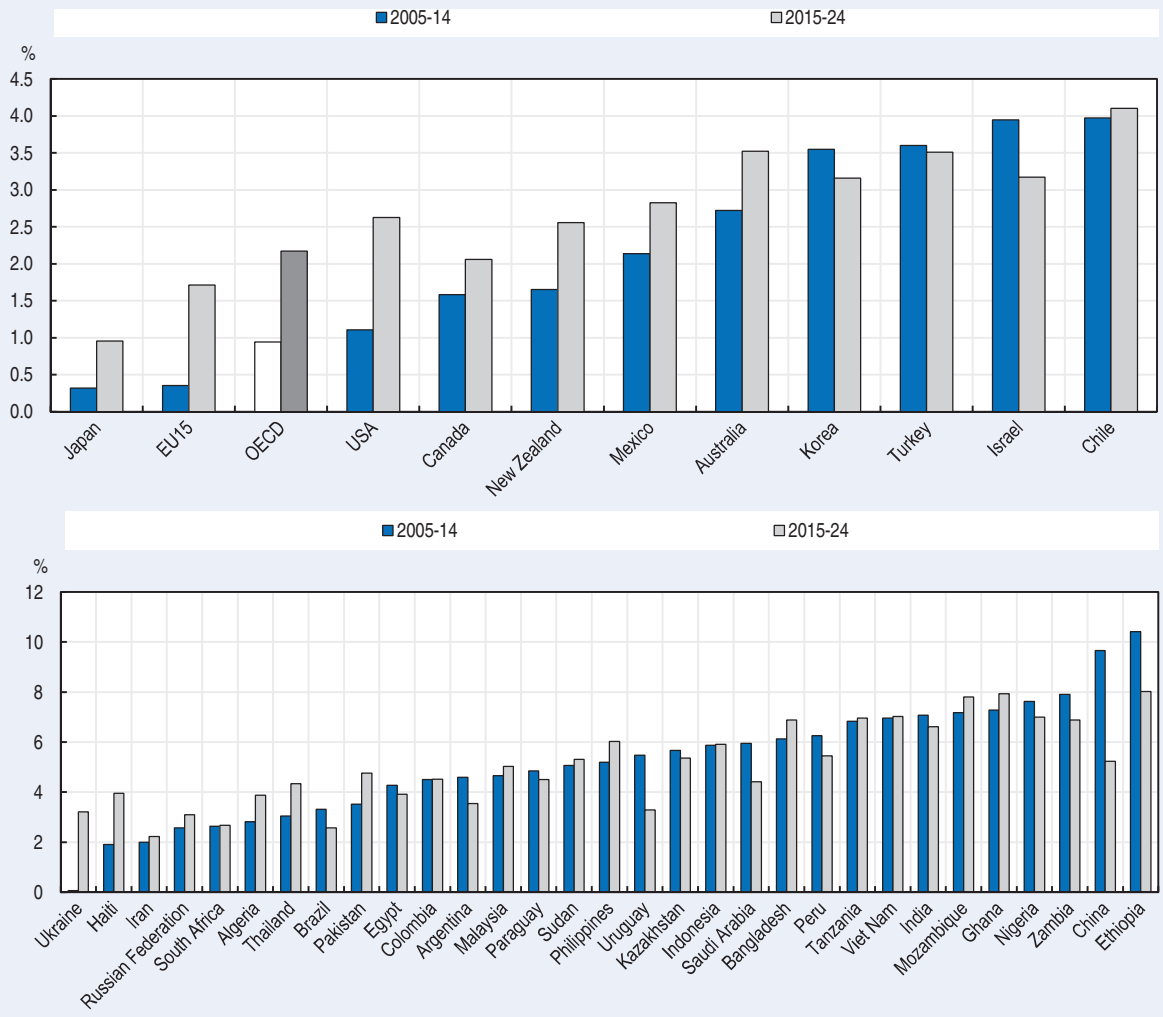
Box 1.1. **Macroeconomic and policy assumptions** *(cont.)*

Growth has also been diverging among the large emerging market economies. India and China remain the fastest-growing major economies. In the short-term, only modest growth is likely in Brazil and Russia, with the latter facing numerous obstacles, including low oil prices.

Although moderate improvement in global growth is expected over the next two years, it is expected to remain below the average rates attained in the decade prior to the crisis, with marked divergence across the major economies, large risks and vulnerabilities. Unemployment is also set to stay well above pre-crisis levels in many economies.

The macroeconomic assumptions used in the *Agricultural Outlook* are based on the *OECD Economic Outlook* (November 2014) and the International Monetary Fund's, *World Economic Outlook* (October 2014).

Figure 1.1. **Average GDP growth rates 2005-2014 and 2015-2024**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

StatLink *http://dx.doi.org/10.1787/888933228694*

Box 1.1. **Macroeconomic and policy assumptions** *(cont.)*

Real GDP growth in OECD countries increased gradually to reach 2.2% in 2014; it should be even stronger in 2015 at 2.5%. Over the medium term, growth is expected to maintain an average level of 2.2% p.a. EU15 members as a group are expected to recover gradually after the small recession in 2013 from 1.2% growth in 2014 to 1.4% in 2015 and 1.9% in 2016. It should then show a moderate average growth of 1.7% p.a. in the later years of the projection period.

Among the OECD countries, Chile, Australia and Turkey are expected to exhibit the strongest growth during the next decade at 4.1%, 3.5% and 3.5% p.a. respectively, followed by Korea at 3.2% p.a. The recovery is likely to remain moderate in the United States, Mexico and New Zealand during the next ten years, with growth rates of 2.6%, 2.8% and 2.6% p.a. respectively, while Canada should maintain an annual average growth of 2.1% p.a. Japan should show a small average growth of 1% p.a. over the next ten years.

India is now expected to overtake China and exhibit the strongest growth during the next decade, with an average annual growth rate of 6.6%. China's growth prospects have been revised downward to 5.2% p.a. Brazil and South Africa average growth should also be weaker than previously expected at 2.6% and 2.7% p.a. respectively. The Russian Federation is expected to recover quite rapidly over the next ten years at an average growth of 3.1% p.a. from a slightly positive growth in 2014. Argentina as well should recover quickly over the coming decade, bouncing back from the small recession of 2014 to an average growth rate of 3.5% p.a.

Developing countries in Asia and Africa are expected to grow strongly, but in most cases not as strongly as over the previous ten years. In Asia, the Philippines and Malaysia are expected to achieve higher growth rates than the previous decade, averaging 6.0% and 5.0% p.a. respectively. However, in general, the slower growth of the European Union, Japan and China is anticipated to put downward pressure on the growth of the region. In Africa, Sub-Saharan countries should show strong growth led by Ethiopia and Mozambique with growth rates during the projection period of 8.0% and at 7.8% p.a. respectively. Countries in North Africa are also expected to grow fast, but slower than those in the Sub-Sahara area. Compared with these two regions, growth in Latin America is expected to be weaker, partly due to lower commodity prices. The average annual growth rate of Columbia is 4.5% p.a. over the next ten years.

Population growth to slow

World population growth is expected to slow to 1% p.a. in the next decade, a total of more than 8 billion people to feed in 2024. Slower growth is expected in all regions and most countries, including India, whose population is nevertheless going to increase by 139 million people. An additional 768 million people will be living on the planet in 2024, nearly half of them in the Asia and Pacific region, although the growth rate in this region is below the growth rate experienced during the last decade.

Among OECD countries, population levels are expected to decrease during the coming ten years in Europe and in Japan. In Japan's case, the population will decrease by more than 3 million inhabitants by 2024. The European Union continues to grow at a rate of 0.13% p.a. Australia, Turkey and Mexico have the highest projected population growth rates among the OECD member countries.

The Russian Federation is another country where the population will be shrinking, with a drop of 4.8 million expected in the coming decade. The world population growth is still driven by developing countries. Among the developing countries, those in Africa are expected to show the fastest population growth at 2.42% p.a., which is lower than in the last decade.

Inflation growth differ among countries

Inflation in OECD countries is measured by the Private Consumer Expenditure (PCE) deflator. Low inflation is set to continue in the OECD, due to persistent slack and the recent sharp falls in oil and food prices, especially in the euro area, the United States and Japan. Inflation is likely to remain below target in many OECD economies at 2.2% p.a. over the next ten years.

Box 1.1. **Macroeconomic and policy assumptions** *(cont.)*

In the euro area, inflation has drifted down and is now close to zero. In the short term, the euro area is at risk of deflation if growth stagnates or if inflation falls further.

In Japan, after a long period of deflation, inflation became positive in 2014 but it remained well below the Bank of Japan's target of 2%. During the next decade however, inflation is expected to reach 2.1% p.a.

Despite an extended period of moderate growth, underlying inflationary pressures remain substantial in many large emerging market economies. Looking forward, inflationary pressures are projected to ease slowly. Sizeable exchange rate depreciations have pushed up prices in some countries, including Russia.

US dollar expected to remain strong

The nominal exchange rate for the period 2015-24 is mostly driven by the inflation differentials in relation to the United States (small change in real terms). The assumptions on exchange rates during the next decade are characterised by a stronger US dollar compared to other currencies in line with the recovery of the US economy. Nominal exchange rates adjust in line with inflation rates.

Currency depreciation is projected to be very strong in the next decade for some countries like Brazil, India, South Africa and Turkey. On the contrary, the Russian ruble should appreciate by 2024.

Drop in energy prices

The world oil price until 2013 is taken from the short term update of the *OECD Economic Outlook* n° 96 (November 2014). For 2014, the annual average daily spot price is used, while the average daily spot price for December 2014 is used as the oil price for 2015. Brent crude oil prices from 2016 are projected to grow at the same rate as projected by the *World Energy Outlook* (IEA, November 2014).

Oil prices declined sharply in the second half of 2014, reflecting a combination of weaker global demand and improved supply. In nominal terms, the price is expected to increase over the outlook period at an average annual growth rate of 3.7%, from USD 63.8 per barrel in 2015 to USD 88.1 per barrel by 2024.

Policy considerations

Policies play an important role in agricultural and fisheries markets, with policy reforms often changing the structure of markets. Policy reforms such as decoupled payments and continued progress towards the elimination of direct price supports imply that policies will have a less direct effect on production decisions in many countries. However, import protection, domestic support and price intervention policies still loom large in many developing countries and with growing impacts that reflect these countries' increasing importance in international markets and trade.

The projections for the United States take the Agricultural Act of 2014 (Farm Bill) into account. The new payment scheme of the Farm Bill has been incorporated into the model, although final participation rates of farmers in the different programmes were not yet available before finalising the projections. The assumptions were, however, aligned with those of the Congressional Budget Office in their March 2015 Baseline. In addition, the Environmental Protection Agency (EPA) has not yet issued final rulemakings for the 2014 and 2015 biofuel mandates. This *Outlook* assumes biofuel mandate levels in the United States to be determined by the evolution of gasoline use, the ethanol blend wall and the limited development of the cellulosic ethanol industry.

The reform of the Common Agricultural Policy (CAP) in the European Union is now fully reflected in the projections, including the implementation choices in the EU member states made in August 2014.

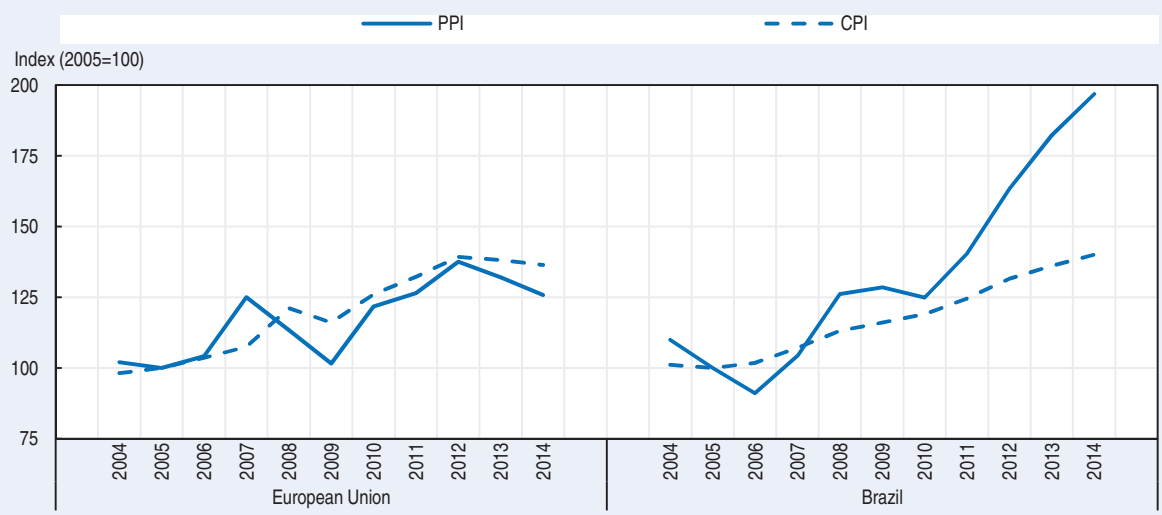
Box 1.2. **Lessons learned from recent evolution of PPI and CPI measures**

The *OECD-FAO Agricultural Outlook* projects the evolution, for major agricultural commodities, of supply, demand, trade as well as prices at the producer and final consumer levels over the medium term. To complement this database and allow new types of information aggregation, measures of Producer Price Indices (PPI) and Consumer Price Indices (CPI) have been computed for all countries on the historical database.[1] Those indices are only based on food products covered by the *OECD-FAO Agricultural Outlook*: Dairy, Sweeteners, Meats and Fisheries, Cereals and Fats. The harmonised food price index basket according the United Nations COICOP[2] definition includes a wider range of goods.[3]

CPI measures are already available in the *OECD-FAO Agricultural Database* for the different food product groups covered. These were combined into higher-level aggregates. The country level consumer food price index corresponds to the sum of the product level CPI weighted by the share of the value of use for this product compared to the total value of food use on an annual basis. Similarly it was possible to derive for every country in the database a Producer Price Index that corresponds to the same food product grouping but at the agricultural stage. The PPI measures the annual per cent change in the prices paid to farmers for their production. The aggregate PPI weight is the share of the value of production for a given commodity on total value of production.

This section describes the recent historical evolution of PPI and CPI measures computed in the context of the *OECD-FAO Agricultural Outlook*. Figure 1.2 depicts the development of those indices for the European Union and Brazil between 2004 and 2014. There are some important differences across countries. For the European Union, The PPI spike in 2007 was reflected with a delay in the CPI measure. However the decrease in agricultural commodity prices that followed the spike led to a more modest reduction in the CPI. Recently, the CPI measure has always been above the PPI in the European Union, with both indices moving in the same direction and decreasing slightly at the end of the period.

Figure 1.2. **Evolution of Producer Price Index (PPI) and Consumer Price Index (CPI) in the European Union and in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

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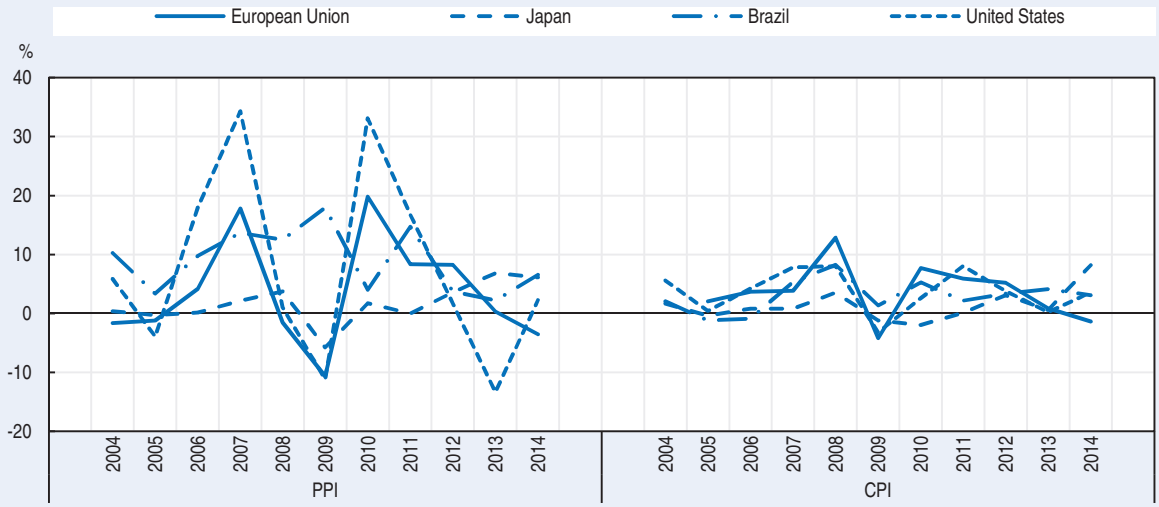
Box 1.2. **Lessons learned from recent evolution of PPI and CPI measures**

For Brazil, the historical evolution of both indices is very different, in particular between 2010 and 2014. The PPI has been increasing strongly due to strong international prices for high value products such as beef and to a lesser extent oilseeds[4] combined with the real depreciation. On the consumer side, the price increase has been relatively less important as reflected in the evolution of the CPI in Figure 1.2. The main reason behind this is increased competition at the retail stage and lower shares of meat and cereals in the consumer basket.

Figure 1.3. **Variations in Producer Price Index (PPI) and Consumer Price Index (CPI) for selected countries**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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PPI and CPI measures provide an aggregate vision of price movements across the various stages of production in the food supply chain. Figure 1.3 shows the recent historical evolution of variations in PPI and CPI for a selection of countries. This figure highlights disparities in the movement of producer and consumer prices. Over the 2004-14 period, CPI were typically far less volatile than PPI. The main explanations behind this lower volatility are that agricultural products only represent a small share of the value of food products, and that the structure of the food supply chain is characterised by concentrated retailers at the end of the chain that are using their monopsonistic power as buyers and competing on prices[5] at the consumer stage. Figure 1.3 also illustrates the issue of asymmetric price transmission along the food supply chain with downward price changes at the producer level only partially transmitted to final consumers.

1. Measures of CPI and PPI have been computed historically. Similar calculations will be undertaken in future Outlooks on the projection period. The deep exploration of the relationships between both indices historically enables some improvements in the representation of consumer prices in the AGLINK/COSIMO modelling framework.
2. COICOP refers to Classification of Individual Consumption According to Purpose as defined by the United Nations Statistics division: *http://unstats.un.org/unsd/cr/registry/regcs.asp?Cl=5&Lg=1&Co=01.1*.
3. The harmonised basket includes: bread and cereal; meat; fish and seafood; milk, cheese and eggs; oils and fats; fruits; vegetables; sugar, jam, chocolate and confectionery, salt; other food products.
4. Beef and oilseed shares of the Brazilian PPI were on average 28% and 20% respectively over the 2004-14 period.
5. Menu costs prevent retailers from constantly adjusting their prices.

Consumption: Consumption growth remains strongest in developing regions

The demand for agricultural products has expanded rapidly through the past decade, driven predominantly by increases in developing countries. Steady population growth, rising per capita incomes and continuous urbanisation not only increased the total demand for food products, but also allowed consumers in developing regions, particularly within large Asian economies, to diversify their diets by increasing protein intake relative to traditional starches. In developed economies, saturated per capita consumption levels combined with limited population growth resulted in stagnant food consumption. However, the introduction of policies aimed at improving energy security and environmental sustainability incentivised the production of biofuels, expanding the demand for the feedstock used in its production.

These same factors will continue to influence the prospects for demand growth over the *Outlook*, but the generally sluggish and uneven recovery of the global economy will cause the demand for agricultural commodities to increase at a slower rate than over the past decade. Differentiated rates of income and population growth will result in significant regional differences in consumption growth. Rapidly expanding Asian economies continue to account for the greatest share of additional food consumption, while expanding population numbers combined with rising income levels drive total consumption levels higher in Africa. In contrast, limited growth in food consumption within developed regions, combined with a largely stagnant biofuel sector results in reduced growth rates in the developed world.

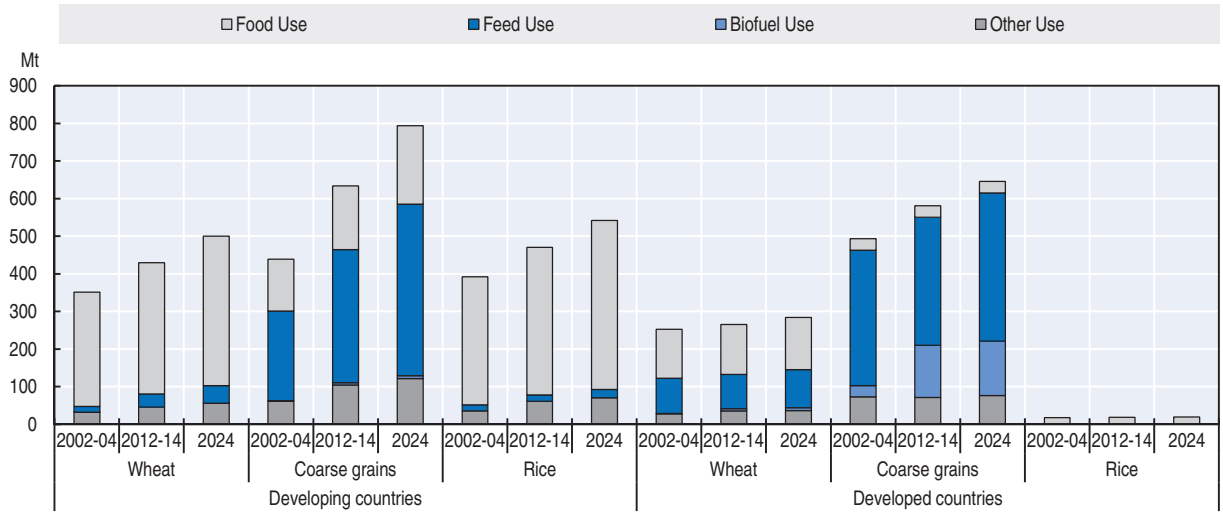
With biofuel demand stagnating, feed use will drive cereal demand

Particularly within the developed world, the emergence of biofuel and other industrial uses was an important driver of rising demand for cereals throughout the past decade. The use of coarse grains (predominantly maize) for biofuels almost tripled from 2004 to 2014, with almost 40% of additional coarse grains consumed over the past decade processed for biofuels. Over the outlook period however, significantly lower crude oil prices result in biofuel demand being closely tied to policies mandating their use. The share of US biofuel mandates that can be met by maize based ethanol remains limited by the E10 blend wall,[1] which, with decreasing domestic gasoline use over the medium-term, reduces growth prospects. As a result, there is limited scope for further expansion in the demand for biofuel, particularly in the United States and the European Union.

Cereals remain the most consumed agricultural product and global consumption will expand by almost 390 Mt by 2024, with coarse grains constituting more than half of the increase. Compared to the past decade, when feed use accounted for 36% of the growth in coarse grain consumption, over the outlook period, feed demand will constitute almost 70% of coarse grain disappearance. The dominance of feed in driving consumption growth is even more pronounced within developed regions; where the consumption of other cereals such as wheat and rice, which are used predominantly for human consumption, remains relatively stable (Figure 1.4). This growing importance of feed demand is also reflected in oilseeds processing for feed, which is projected to expand by 20% over the outlook period.

Within developing regions, almost 60% of total cereal use was consumed as food between 2012 and 2014, in contrast with the developed world, where food use accounted for only 10% of total cereal disappearance. The developing world will consume 49 Mt of additional wheat and 57 Mt of additional rice as food over the outlook period; marginally less than the past decade. However, rising demand for animal feed remains the core driver of cereal consumption growth. Additional global coarse grain consumption amounts to

Figure 1.4. **Main uses of cereals in developed and developing countries**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*
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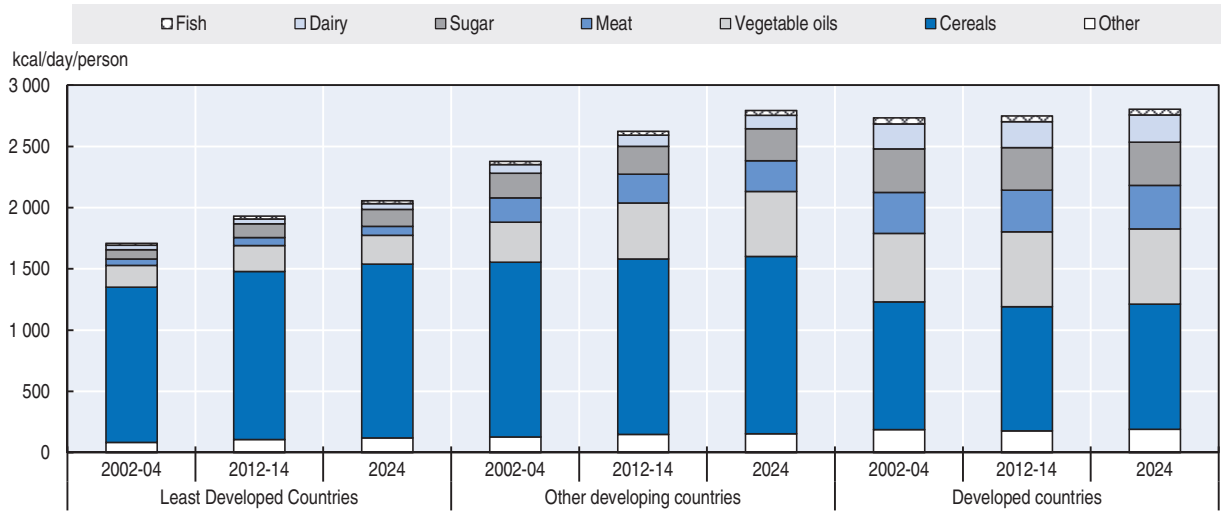
225 Mt over the ten year period, of which feed demand constitutes 70%, while more than 68 Mt of additional oilseeds will be processed to feed, reflecting average annual growth rates of 1.6% p.a. and 1.47% p.a. respectively.

Caloric intake in developing regions continues to rise and diversify

Across most cultures, cereals are still the main staple component of the daily diet and the single most important source of dietary energy. Rising incomes, changing preferences and increasing urbanisation have led to dietary diversification, hence cereals currently account for only 37% of total caloric intake obtained from commodities included in the *Outlook* in developed countries, while they still supplied 71% in least developed countries and 54% in the other developing countries (Figure 1.5). At a global level, total caloric intake is expected to rise; however the rate of increase differs across regions and income levels. Increasing by 6% over the 10 year projection period, total caloric intake in least developed countries surpasses 2 000 kcal per person per day by 2024, which remains well below developed country levels. Developing economies, excluding the least developed, exhibit the greatest increase in total caloric intake per capita, rising to almost 2 800 kcal per person per day by 2024, only marginally below the caloric intake projected for developed regions, where further expansion of total caloric intake remains limited.

In addition to rising absolute levels, the constituents of total caloric intake from modelled commodities continues to diversify, reflecting the changing dietary preferences associated with rising income levels, urbanisation and shifts in consumption habits. Calories obtained from cereals increase only marginally over the next ten years, but increasing consumption of convenient, ready-made food results in higher demand for sugar and vegetable oil, which account for the bulk of increased caloric intake in developing regions. Global sugar consumption per capita expands by around 1.03% p.a., while vegetable oil consumption per capita will grow by an annual average of 0.84%, however for both products, more than 95% of consumption growth will be concentrated in the developing world. Vegetable oil in particular represents an affordable source of fat and by 2024 daily calories obtained from vegetable oil in emerging economies will surpass

Figure 1.5. **Caloric intake per capita in least developed, other developing and developed countries**



Note: The category "other" includes eggs, roots and tubers. Vegetables, fruits, pulses and other food items are not included in this figure.
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.
StatLink *http://dx.doi.org/10.1787/888933228737*

530 kcal per person, compared to 615 kcal per person in developed regions. Despite expansion over the outlook period, daily calories obtained from vegetable oil within least developed regions remain less than 40% of developed country levels by 2024, however, after cereals, vegetable oil still constitutes the greatest source of dietary energy in least developed regions.

Vegetables, fruits and pulses are also crucial elements of diets; they provide vitamins and minerals and are necessary for dietary balance. They are not represented in the figures since they are not part of the commodities considered in the *Outlook*. Within least developed regions roots and tubers provide an important starch alternative and a low cost source of energy which accounts for almost 5% of total caloric intake. Box 1.3 provides more detail in this regard.

Box 1.3. **Emerging roles of roots and tubers**

Roots and tubers are plants that yield starch, either derived from their roots (e.g. cassava, sweet potato and yams) or stems (e.g. potatoes and taro). They are destined mainly for human food (as such or in processed form) and, like most other staple crops, they can be used for animal feed or for manufacturing starch, alcohol, ethanol and fermented beverages. Unless they are processed, they become highly perishable once harvested, which limits opportunities for trade and storage.

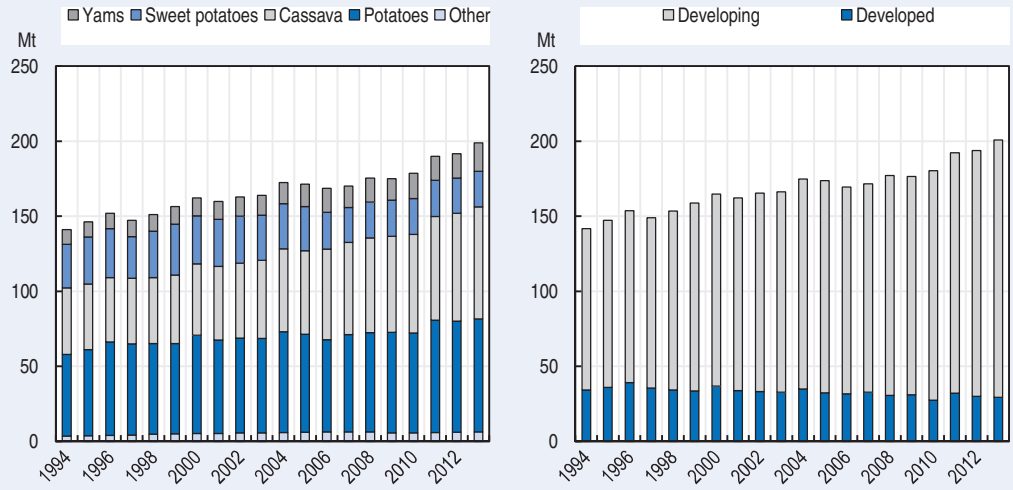
Within the roots and tubers family, potato dominates in worldwide production, with cassava a far-off second. Regarding global dietary importance, potato ranks fourth after maize, wheat and rice. The crop provides more calories, grows more quickly using less land and can be cultivated in a broader range of climates than any other staple food crop. Potato has also been strongly linked to economic development, at least historically. By providing a cheap source of energy and being easy to cultivate, it is thought to have liberated workers from the land thus fuelling the industrial revolution in England and elsewhere in northern Europe in the 19th century.

Box 1.3. **Emerging roles of roots and tubers** *(cont.)*

Potato's outright dominance, however, is being eroded by cassava. Indeed, trends in output growth of individual root crops reveal that cassava is currently rising at well over 3% p.a., outstripping population growth by almost three-fold. Cultivated mainly in the tropical belt and in some of the world's poorest regions, cassava production doubled in a little over two decades. Such is cassava's dynamism that it presently constitutes the fastest rising staple crop in production at the global level. Trends in the cultivation of root crops underscore a growing geographical divide between the contrasting roles of the commodity in agricultural economies.

Figure 1.6. **Production of roots and tubers, 1994-2013**

Breakdown by type (left) and breakdown by region (right)



Source: FAOSTAT (2015). FAO, *http://faostat.fao.org/*.

StatLink http://dx.doi.org/10.1787/888933228745

Once considered a subsistence crop, cassava is now seen as a commodity; key for value-addition, rural development and poverty alleviation, food security, energy security and for bringing about important macroeconomic benefits. These factors are driving the rapid commercialisation and large scale investments for upscaling the processing of cassava, and hence have contributed significantly to the global expansion of the crop.

Producing cassava requires few inputs and affords farmers great flexibility in terms of timing the harvest, as the crop can be left in the ground well after reaching maturation. Cassava's tolerance to erratic weather conditions, including drought, makes it all important in climate change adaptation strategies. Compared with other staples, cassava competes favourably in terms of price and the diversity with which it can be utilised. In the form of High Quality Cassava Flour (HQCF), cassava is increasingly being targeted by governments in Africa as a strategic crop to reduce cereal imports, which in the recent past have been prone to significant price-volatility. Mandatory blending with wheat flour helps to reduce the volume of wheat imports, therefore lowering import bills and conserving precious foreign exchange. In a similar vein, the drive towards energy security in Asia, twinned with mandatory blending requirements with gasoline, is also aiding the cassava industry through the establishment of ethanol distilleries that use cassava as a feedstock. With regard to trade, processed cassava manages to compete successfully on the global arena, such as with maize-based starch and cereals for animal feeding applications.

Box 1.3. **Emerging roles of roots and tubers** *(cont.)*

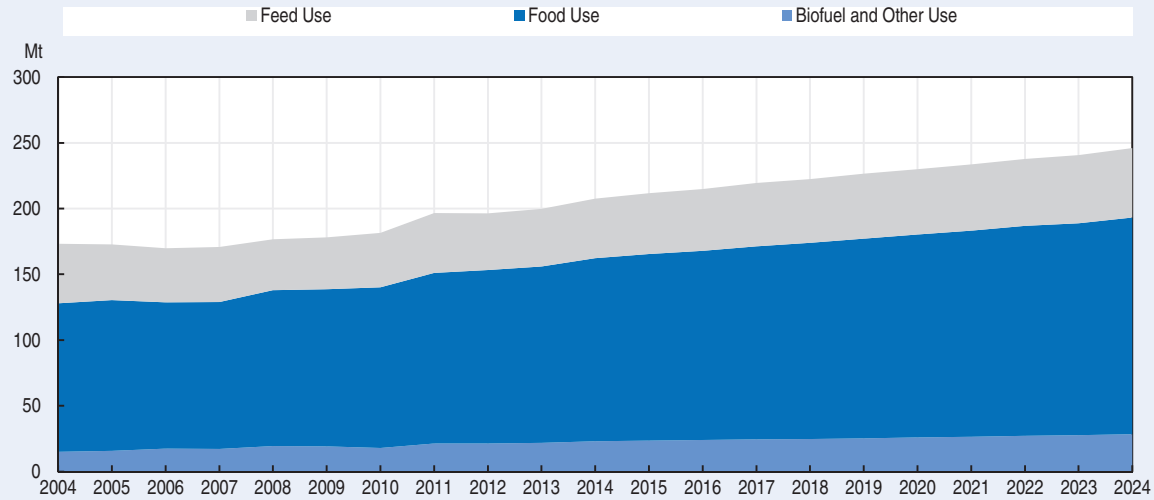
By contrast, potato is mostly confined to food use and features heavily in diets of developed regions, particularly Europe and North America. As overall food intake of potato in these regions is very high and might have reached saturation, the scope for consumption increases to outpace population growth remains limited in that part of the world, bar substitution with other staples. In fact, potato, which forms the bulk of the root and tuber sectors in developed countries, has been in long-standing decline for several decades with production growth falling well below that of population. But, thanks to rising food use in developing regions, potato production at the world level has sustained some growth momentum.

As for other root crops, global sweet potato cultivation has declined in recent years, mostly on account of a precipitous acreage decline (which shows no sign of abating), in China – the world's foremost producer. As with potato, sweet potato and the less prominent root and tuber crops food demand by and large caps growth potential given the limited commercial viability for diversified usage. Consequently, consumer preferences along with prices play important roles in shaping consumption.

In consideration of the evolving trends among root crops and between regions as well as their drivers, world production and utilisation is projected to expand by almost 19% over the next decade, where growth in developing regions could reach 2% p.a versus negative growth in developed regions. By 2024, an additional 1.3 kg p.a. of root crops will enter global diets, driven mostly by consumers in Africa where intake of roots and tubers could surpass 55 kg p.a. As for biofuel and other usage, a 23% expansion in demand is foreseen by these sectors over the next ten years.

Figure 1.7. **World utilisations of roots and tubers**

Dry weight, 1994-2024



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

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Despite robust global growth in protein intake absolute per capita consumption levels remain uneven

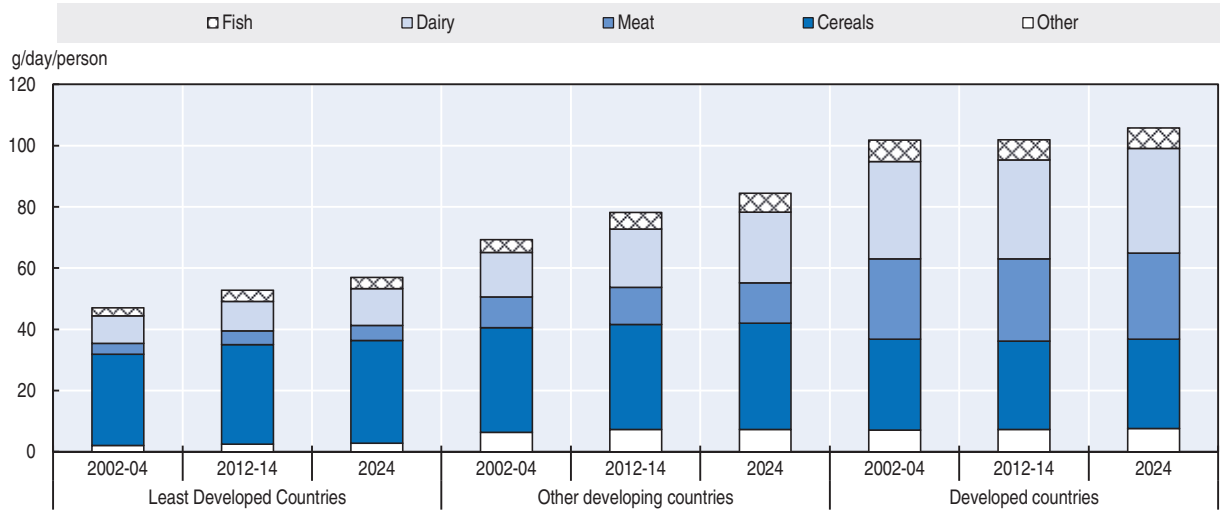
In contrast to total caloric intake, which remains largely stagnant in the developed world, protein intake on a per capita basis continues to increase across countries at all income levels (Figure 1.8). Regional variation in preferences and income levels result in differences in absolute levels of protein intake, as well as the sources from which protein is obtained. Within least developed regions, 60% of total protein intake will be obtained from cereals by 2024, two per cent points down from the base period, whilst the share of

meat in total protein intake ranges from 9% in least developed countries to almost 26% in developed countries and shows an increasing trend.

Global meat consumption will grow by an annual average of 1.4%, resulting in additional consumption of 51 Mt by 2024, which constitutes more than 16% of additional protein intake. Whilst meat consumption will grow faster in developing countries, absolute consumption levels on a per capita basis will remain less than half of developed country levels by 2024. Widely considered to be an affordable and healthy meat with low fat content and few religious impediments, poultry dominates meat consumption with an average annual growth of 2%. Poultry will be half of the additional meat consumed in 2024. In contrast, pigmeat consumption has reached saturated levels in many of the traditionally fast growing regions and expands by less than 1% per annum, resulting in it being surpassed by poultry as the world's preferred meat. Consumption of relatively more expensive bovine and sheep meat will increase by 1.3% and 1.9% per annum, respectively, over the outlook, driven by growing demand from Asia and the Middle East. Fish consumption also represents an important and affordable source of protein, especially in developing countries. Global fish consumption in 2024 is projected to be 19% above the base period, which results in a contribution to total protein intake of around 6.5% in both developed and developing regions by 2024.

Consumption of dairy products has expanded rapidly over the past decade and constitutes an important source of dietary protein. At a global level, the demand for dairy products will expand by 23% over the ten year projection period, approaching 48 Mt by 2024. Growth remains strongest in the developing world and in light of the preference for fresh dairy products within these regions, almost 70% of additional dairy production will be consumed fresh. Within the group of processed dairy products, cheese consumption is expected to continue to account for the greatest share while demand expands at an annual average rate of 1.6%. Butter consumption will grow the fastest, expanding by an annual average of 1.9%.

Figure 1.8. **Protein intake per capita in least developed, other developing and developed countries**



Note: The category "other" includes sugar, vegetable oil, eggs, roots and tubers. Sugar and vegetable oil represent negligible shares of total protein consumption. Vegetables, fruits, pulses and other food items are not included in this figure.
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.
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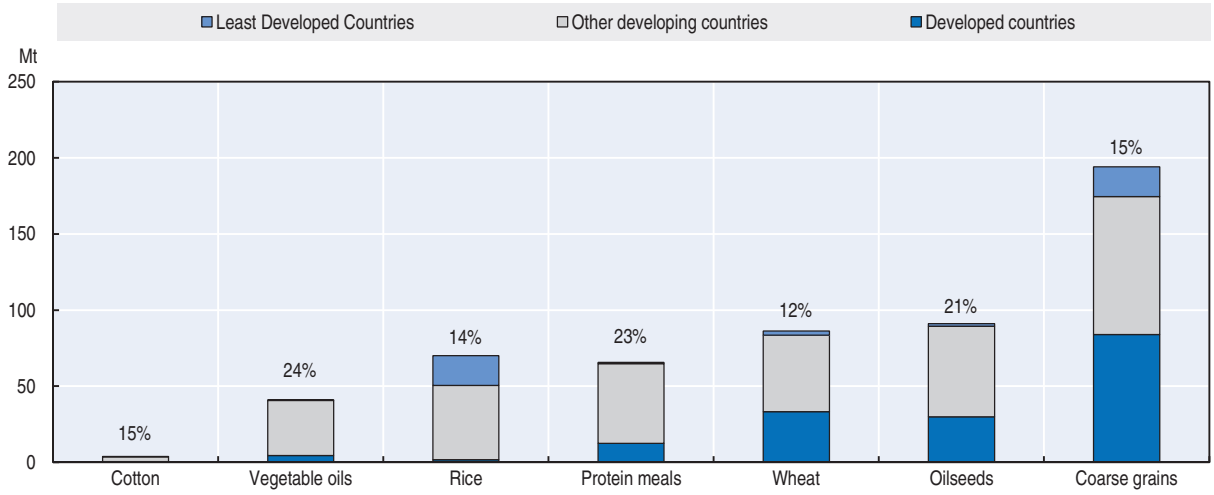
Production: Production growth concentrated in regions where resources are less constraining

Growth in demand for agricultural products remains robust over the outlook period inducing a substantial increase in production. This growth is considerably lower than during the past decade, when high prices provided incentives for large scale investments in agricultural land simply as an asset (Box 1.4). Furthermore, continuously evolving dietary preferences will influence relative price levels, which in turn will drive production decisions. As the demand for meat and dairy products grows, production of coarse grains and protein meal, which constitute the largest share of typical feed rations, also increases. In contrast, the production of cereals consumed predominantly as food expands at a slower rate.

At a global level, more than 320 Mt of additional cereals will be produced by 2024, of which 180 Mt will be coarse grains, representing more than one-half of additional production (Figure 1.9). Only 10% of the additional coarse grains will be produced in least developed countries, with other developing countries accounting for 48% and developed countries for 42% of the additional production. Oilseed production will also expand by more than 20% over the same period, resulting in firm increases in the production of oilseed products; protein meal output is projected to increase by 23%, reaching 355 Mt by 2024, while vegetable oil production will rise by 24% over the same period. Growth in vegetable oil production slows considerably in countries that traditionally produce high oil yielding crops such as sunflower and rapeseed, due in part to limited growth in biodiesel production, for which vegetable oil represents the main feedstock. In contrast, strong demand for protein meal results in oilseed area expansion being concentrated in areas that traditionally produce soybeans for its high protein meal content.

Figure 1.9. **Projected growth of crop production in least developed, other developing and developed countries**

Increase in volume and percentage, 2024 relative to 2012-14



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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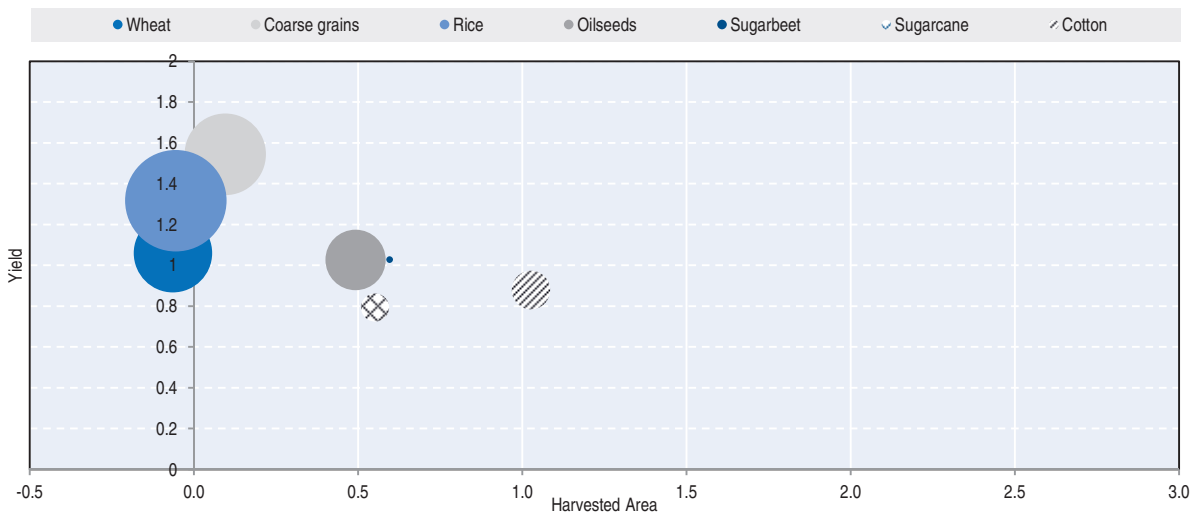
Despite robust demand at global level, possibilities to expand production are constrained by factors such as limitations in the expansion of agricultural land, environmental concerns and changes in the policy environment. As such, the dynamics behind production growth are distinctly different across various regions. For the commodities covered in this *Outlook*, global agricultural production grew at an average rate of 2.2% p.a. in the last decade, led by strong growth in Eastern European countries, including the Russian Federation (3.3%), Africa (2.9%), and Asia and Pacific (2.9%). Agriculture in Western Europe grew by only 0.7% p.a. while in North America it grew by 1.5%. Growth in global agriculture is projected to slow to around 1.5% p.a. in the next decade, due to slower growth in all regions, with the most notable slowdown in Eastern Europe and the Russian Federation to only 1.3% p.a., and Asia and Pacific to 1.7%. However, Africa and Latin America and the Caribbean lead global growth at 2.4% and 1.8%, respectively.

Within Asia and Pacific, land and natural resource constraints are particularly binding and hence continued productivity improvement will be a key driver of increased production. Within these regions, the area under coarse grains will remain relatively stable, with production growth attributed to increased yields. Given the limitations in total crop area, expansion of oilseed area will be at the expense of cereals such as rice and wheat, which are consumed predominantly as food (Figure 1.10).

Figure 1.10. **Arable crop areas and yield changes in Asia and Pacific region**

Average annual percentage change 2024 relative to 2012-14



Note: Axis refer to average annual percentage changes in yield and area harvested over the projection period (2015-24), while the size of the bubbles are indicative of the share in total arable crop area in the base period (2012-14).

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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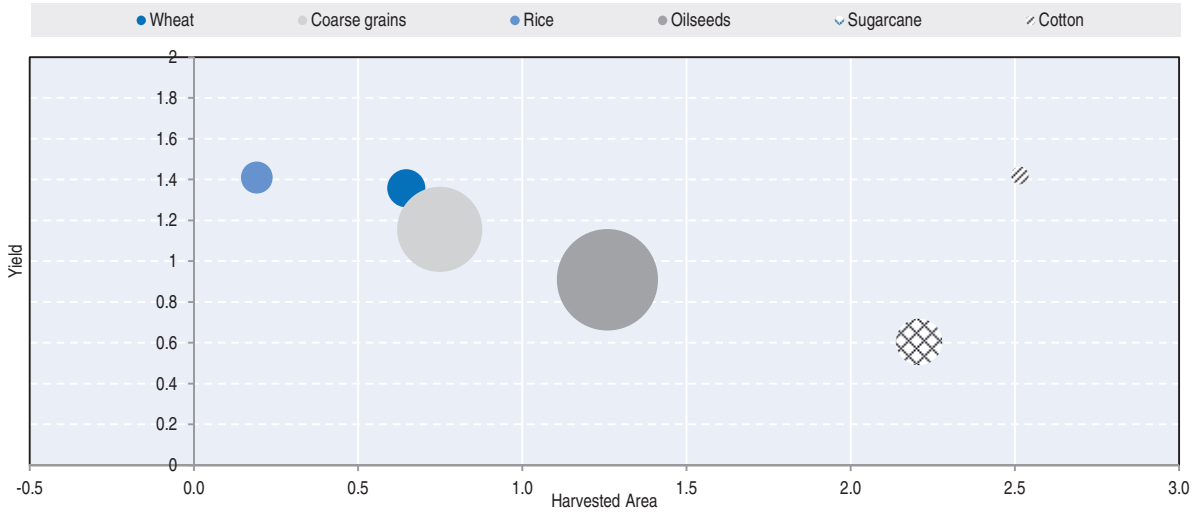
In contrast, land and natural resource constraints are less binding in Latin America and Caribbean, allowing for stronger production growth that reflects both area expansion and improved yield levels (Figure 1.11). Oilseeds and coarse grains already dominate land use within this region, and in response to strong protein meal demand, oilseed area expands by an annual average of 1.2% over the outlook period. Whilst a greater share of the additional area will be planted with oilseeds, this expansion does not come at the expense of other major crops, as area planted to coarse grains also expands by 0.7% per annum, while wheat area expands by 0.6% per annum. Africa, particularly Sub-Saharan Africa, is another region where

Figure 1.11. **Arable crop areas and yield changes in Latin America and Caribbean**

Average annual percentage change 2024 retalive to 2012-14



Note: Axis refer to average annual percentage changes in yield and area harvested over the projection period (2015-24), while the size of the bubbles are indicative of the share in total arable crop area in the base period (2012-14).

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

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land remains abundantly available and total crop area in the region will expand by more than 10% over the next ten years. Given the importance of maize as a staple in the region, the greatest share of additional area is attributed to coarse grains. Despite continued improvements, productivity gaps remain and crop yields in Africa remain well below global averages. Further investments into agricultural production capacity could potentially increase output from the region.

Box 1.4. **Responsible investments in agriculture**

Agricultural investment, including both domestic and foreign direct investment, can have transformative and positive impacts at local, national and regional levels. Increasing agricultural investment is, in fact, one of the most important and effective medium to long term strategies for increasing agricultural production, promoting economic growth, reducing poverty and strengthening food security.

Agricultural investment is a fundamental requirement in regions of the world where hunger and poverty are most widespread. Investment in agriculture is high in the political agenda this decade, following food and energy price spikes in 2007-08. Supported by views of global media, investors saw in agriculture an opportunity to invest, either in business enterprises, for example through the production of biofuel crops, or simply to speculate on land prices. While some investments were likely to generate benefits, there was a fear that others were doing more harm than good, carrying with them significant risks for local communities, governments, investors and the environment. International concern grew over the fate of the land being acquired, and of the people living on those lands. In response to these concerns, the international community and governments from the G20 called for initiatives promoting responsible agricultural investment that mitigate risks and maximise opportunities, in particular as they pertain to food security.

Box 1.4. **Responsible investments in agriculture** *(cont.)*

Various attempts were made to develop normative frameworks that would not just tackle these concerns, but also promote and trigger much needed, and better, agricultural investment. Examples include the *Principles for Responsible Investment in Agriculture and Food Systems*, developed by the Committee on World Food Security in 2014 the *Principles for Responsible Agricultural Investment that Respects Rights, Livelihoods and Resources* jointly developed by FAO, UNCTAD, IFAD and the World Bank in 2009, and the FAO-OECD Guidance for Responsible Agricultural Supply Chains, currently under development, which provides a synthesis of existing standards. These voluntary instruments, which are complementary to each other, are meant to provide frameworks for stakeholders to develop national policies, strategies, regulatory frameworks, corporate social responsibility programmes, individual agreements and contracts.

The analysis presented in this *OECD-FAO Agricultural Outlook* suggests that the agricultural commodity price levels that triggered large scale investment this decade will fall considerably over the next decade. The profitability of biofuel production is under pressure from low non-renewable fuel prices and as food prices move back to their long term secular downward trend. The new *Outlook* scenario is unlikely to sustain the current enthusiasm for investment in agriculture, but this is not a reason for abandoning these normative instruments. Quite the opposite; the adoption of normative instruments will help make investments profitable for both investors and host communities and is therefore expected to have a positive impact on agricultural production in the medium term.

Despite representing only a small share of total crop area at a global level, cotton is dynamic, with area expanding by 6% over the ten year projection period. Production growth is however becoming more concentrated in lower yielding areas and hence, at a global level, yield improvements will be limited to an average of 1.1% p.a. Nevertheless, the combination of area expansion and yield increases results in robust production growth across most regions, with China being the only significant producer where production is not projected to increase.

Policies continue to influence biofuel production decisions

The evolution of the biofuel sector over the past decade has been influenced strongly by the introduction of various policies including support measures and mandated blending levels. Over periods of high fossil fuel prices, the use of ethanol as an octane additive expanded rapidly. However, in light of the significantly lower oil price assumption over the outlook period, biofuel production will be tied closely to the policies mandating its use. In the United States and the European Union, these policies are not expected to require significantly higher biofuel production over the next ten years and limited production growth in the United States will arise mostly from ligno-cellulosic biomass based ethanol.

In contrast, Brazilian ethanol blending mandates have recently been increased to 27% and differential taxes have been put in place that favour the domestic hydrous ethanol industry. The *Outlook* also assumes that domestic gasoline prices will be kept above international ones in the early years of the projection period and that logistical issues will limit ethanol import possibilities in the short run. Consequently, the cost efficient domestic ethanol industry in Brazil is set to produce over the next ten years two-thirds of the additional global ethanol supply, with sugarcane as the main feedstock. Global

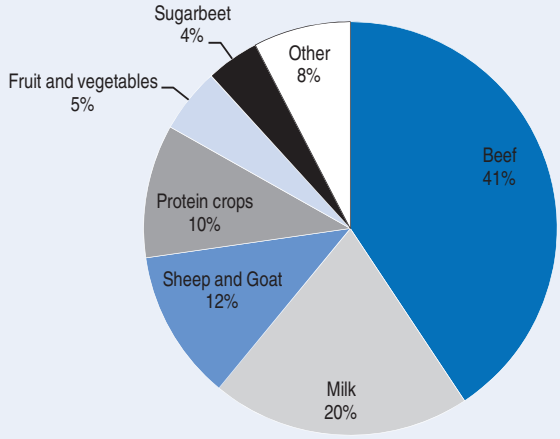
sugarcane production will increase by 21% over the outlook period and the share of global sugarcane production processed for ethanol is set to expand from 20% in the base period (2012-14) to 25% by 2024. Almost 60% of additional sugarcane production will originate from Brazil, the main sugarcane producer. While the base remains small, sugar output from Africa will also expand substantially in the next ten years, due to production increases in Sub-Saharan Africa, as well as Egypt. Sugarcane will account for 86% of total sugar production over the next decade; however marginal increases in sugar beet production in both the Russian Federation and the European Union following quota abolitions post 2017 are expected.

Box 1.5. **Implementation of agricultural policy changes in the European Union and the United States**

The United States' Agricultural Act of 2014 (also known as the 2014 Farm Bill) and the European Union's Common Agricultural Policy (CAP) reform of 2013 both contained considerable implementation flexibilities. In the United States, the new law required choices to be made by farmers; while in the European Union decisions needed to be made at the national and sub-national level. In last year's *Outlook Report* the CAP reform was partly included as the implementation decision was due in August 2014. The new Farm Bill was not included as the final decisions became available at a late stage of the process. Nevertheless, a description of the main elements of both policy changes is available in the *OECD-FAO Outlook* of 2014. Both policy changes are fully incorporated in the current *Outlook*, with some specific assumptions regarding their implementation.

Regarding the 2013 CAP reform, a number of choices have been provided by the member states. A flat rate of 30% of the total direct payment of EUR 42 billion is provided for greening measures and on average 55% is provided as decoupled basic payment, ranging from 12% in Malta to 68% in Ireland. A general provision of the 2013 CAP reform allowed for some coupling of direct payments to production. Except for Germany, all member states opted to make use of this flexibility, with coupled payments expected to account for EUR 4.2 billion annually, an average of 10% of Pillar 1 payments. Three countries; Belgium, Finland and Portugal, have been given special dispensation as their proposed share of Pillar 1 payments exceeded the limit of 13% plus 2% for protein crops. Malta granting less than EUR 3 million of coupled support is not bound by the percentage limit.

Figure 1.12. **Share of agricultural commodities in total coupled aid in the European Union**



Source: European Commission, *http://ec.europa.eu/agriculture/direct-support/direct-payments/index_en.htm.*

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Box 1.5. **Implementation of agricultural policy changes in the European Union and the United States** *(cont.)*

Many agricultural products benefit from coupled payments, but six sectors account for more than 90% of total coupled aid in the European Union (Figure 1.12). Those sectors are beef (with a share of 41%) in 24 member states, milk (20%) in 19 member states, sheep and goats (12%) in 22 member states, protein crops (10%) in 16 member states, fruits and vegetables (5%) in 19 member states, and sugar beet (4%) in 10 member states. Most of the coupled payments are a continuation of coupled support already existing under the previous CAP or, as in the case of milk and sugar beet, a compensation for ending the production quota in 2015 and 2017, respectively.

The share of coupled support has increased and marks a change in the long-term development of less coupled support in the European Union. According to the rules, coupled support is focused (only to be granted to sectors or regions where specific types of farming or specific agricultural sectors undergo difficulties), limited (granted within defined quantitative limits, based on fixed areas and yields or fixed number of animals) and aims to create an incentive to maintain current levels of production in such sectors or regions concerned. Additionally, member states may choose to lower the payment rate to recipients receiving payments exceeding EUR 150 000 and there is increased flexibility to move funds between Pillar 1 and Pillar 2 (rural development programmes). These two options have less impact on agricultural commodity markets. The new coupled support envelopes have been incorporated in the preparation of this *Outlook*.

The 2014 US Farm Bill ended the direct payments that farmers received regardless of their harvest quality or crop prices. Two new commodity programmes are created, Price Loss Coverage (PLC) and Agriculture Risk Coverage (ARC). These new support programmes are available for most crops, except for cotton, and farmers must make a one-time choice between the two programmes by 7 April 2015 for the 2014 to 2018 crop years. In addition, producers had also the opportunity to update the base area using the acreage of each covered commodity in proportion to the 4-year average of acres that were planted or considered planted to all covered commodity crops from 2009-2012. For cotton, which is ineligible for ARC and PLC, a new protection plan called the Stacked Income Protection plan (STAX) has been established.

PLC provides a price floor, and payments are tied to base area and a legislated reference price. ARC is a revenue-based assistance programme with two options for farmers, either based on a county- (ARC-CO) or on an individual farm-level (ARC-IC) revenue trigger. In either case ARC-CO or ARC-IC, support will be paid if revenues fall below 86% of the benchmark linked to the Olympic average of the previous five years. Under ARC-CO and PLC, the covered commodity is not required to be planted to receive the payment. Payments are made on 85% of the applicable crop's base area. ARC-IC requires planting or planting intentions for the covered commodity and payments are made on 65% of eligible area. ARC-CO and ARC-IC payments are capped at 10% of the benchmark revenue.

Participation rates of either programme are not yet recorded at the time of preparing this report. In the projections it is assumed that all farms are participating in ARC-IC, ARC-CO or PLC (Table 1.1). More soybean and maize producers are assumed to participate in ARC programmes, whereas more wheat producers of wheat are assumed to participate in PLC programme.

Table 1.1. **Assumed participation rates in US Farm Bill programmes for major commodities**

	ARC-CO		ARC-IC		PLC	
	2014-18	2019-24	2014-18	2019-24	2014-18	2019-24
Soybeans	44.1%	30.0%	14.7%	10.0%	41.2%	60.0%
Maize	45.0%	27.2%	15.0%	9.1%	40.0%	63.7%
Wheat	30.2%	20.9%	10.1%	6.9%	59.7%	72.2%

Note: ARC-CO (Agriculture Risk Coverage – county option), ARC-IC (Agriculture Risk Coverage – individual option), PLC (Price Loss Coverage).

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Box 1.5. **Implementation of agricultural policy changes in the European Union and the United States** *(cont.)*

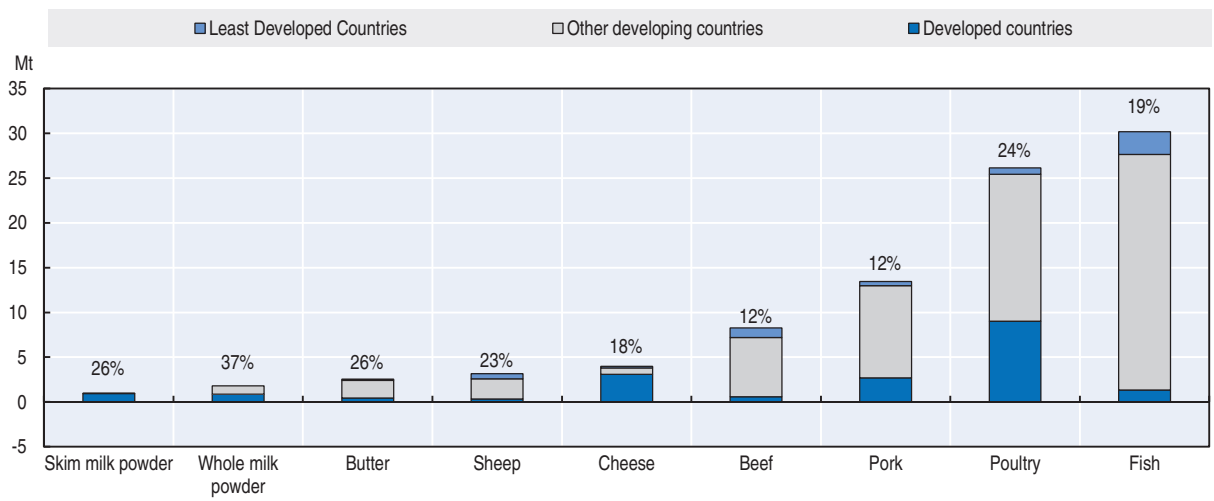
Dairy support in the United States has been reorganised by the new Farm Bill. The Margin Protection Program (MPP) is a voluntary risk management programme for dairy producers, which offers protection to dairy producers when the average calculated dairy production margin between the national all milk price and national average feed cost falls below a certain dollar amount selected by the producer for a consecutive two-month period, consisting of the months of January/February, March/April, May/ June, July/ August, September/October and November/December. Under the Dairy Product Donation Program (DPDP), dairy products are purchased for distribution to low-income Americans when the milk margin falls below a legislated trigger.

Improved profitability underpins growth in the livestock sector

For several years, meat production has been hampered by high and particularly volatile feed costs, which depressed producer margins. Years of herd liquidation in key bovine production regions, combined with several disease outbreaks restricted supply in 2014. As a result, meat prices reached record levels, despite a sharp decline in feed costs, marking a return to profitability in the livestock sector. Favourable meat to feed price ratios over the outlook period will support production growth particularly in industries such as poultry and pork which rely on intensive use of feed grains in the production process. A short production cycle allows the poultry sector in particular to respond quickly to improved profitability and underpinned by robust demand, production is projected to expand by 24% over the outlook period. Consequently by 2024, 26 Mt of additional poultry will be produced globally, capturing more than half of additional meat production. Pigmeat production will expand by 12% over the same period implying additional supply of 13 Mt (Figure 1.13).

Figure 1.13. **Projected growth in livestock production in least developed, other developing and developed countries**

Increase in volume and percentage, 2024 relative to 2012-14



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

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Least developed countries, which are less reliant on feed grains in producing poultry and pigmeat, will account for a very limited share of additional output. Instead growth is dominated by other developing countries, where reduced feed prices result in greater intensification and hence rising use of feed in the production system. In 2024, these developing countries, excluding the least developed countries, will account for 58% and 77% of the additional poultry and pigmeat production, respectively. Within many developed regions, environmental regulations combined with more stringent animal welfare regulations limit the potential for further expansion and hence production growth is slower.

Bovine production exhibits greater flexibility in feeding regimes and extensive production in least developed countries accounts for 13% of the additional 8 Mt of bovine meat produced by 2024. The developing countries, excluding the least developed countries, continue to dominate and represent 79% of additional bovine production: together, Brazil, China and India account for 42% of the additional production supply. At a global level, sheep production will expand at a faster rate relative to the past decade and slightly less than 40% of the additional 3 Mt of sheep meat produced by 2024 will originate from China. Sheep production is largely pasture based and particularly in New Zealand, one of the largest sheep meat exporters, production continues to be influenced by competition for pasture from the dairy sector.

Rising milk production throughout the past decade was a result of dairy herd expansion, as average yields declined by an annual average of 0.2%, due to a fast increasing dairy herd in low yield regions. Over the outlook period, milk production is projected to increase by an annual average of 1.8%, with the bulk of the additional milk produced in developing countries, notably India, which overtakes the European Union to become the largest milk producer in the world. Lower costs will increase feed use in the production system, resulting in higher milk production per dairy cow. Consequently, within developing countries, growth in milk production will result from both herd expansion and productivity gains. In contrast, dairy herds are projected to decline in most developed countries, reflecting productivity gains, as well as constraints in water and land availability.

Production of the four main dairy products will follow the trend of milk production over the outlook period. Butter and whole milk powder (WMP) production will expand faster, at 2.2% p.a. and 2.7% p.a. respectively, as the bulk of these products are produced in developing countries. Cheese and skim milk powder (SMP) production is however concentrated in developed countries and, in line with slower growth in milk production in these countries, production will grow by an annual average of 1.5% p.a. and 1.8% p.a., respectively.

Fishery production will expand by more than 30 Mt over the outlook period, 96% of which will be produced in developing countries. Aquaculture remains one of the fastest growing food sectors and while growth slows from the past decade, it accounts for the majority of additional fish production and is set to surpass captured fisheries by 2023. Nevertheless, capture remains dominant for certain species and, particularly in developing countries, captured fish provide an affordable source of protein.

Trade: Trade to expand for all commodities, except biofuels

With the exception of biofuels, trade volumes of most agricultural commodities are projected to expand over the outlook period. Limited advanced ethanol mandate provisions[2] in the United States create the expectation that bilateral ethanol trade between Brazil and the United States will not take place over the medium term. Cotton, sugar and poultry are projected to experience the strongest growth in trade over the outlook period at around 3% p.a. in volume terms. The relative strong growth in cotton trade is fuelled by China's return to the world markets in the second part of the projection period and continued import demand for cotton by textile-producing countries.

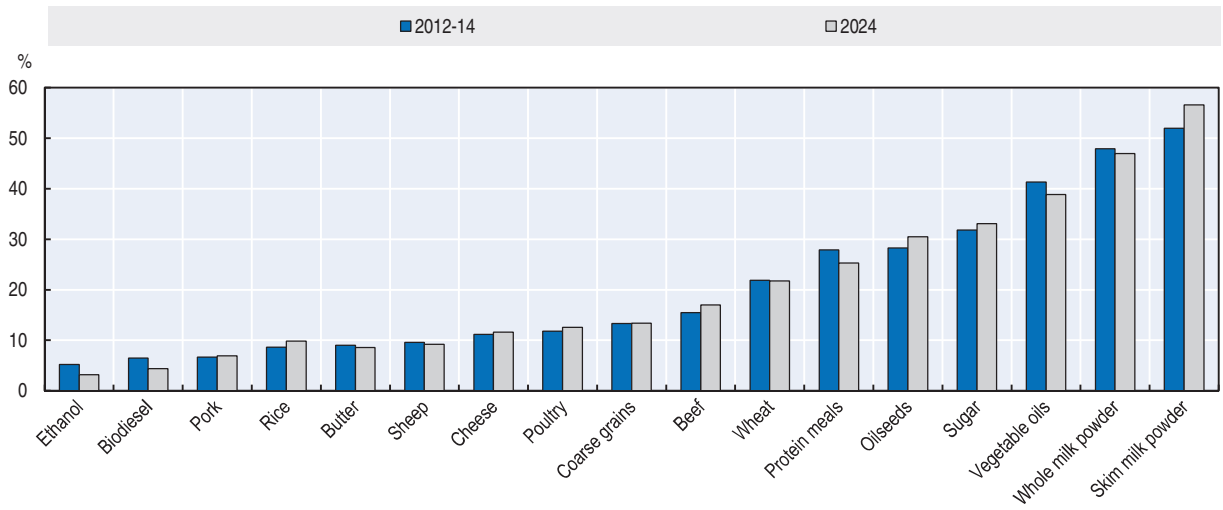
The projected deceleration of oilseed crush in China will cause a slowdown in the growth of oilseed trade. Despite a decline over the outlook period, meat prices remain high relative to historic norms, which will stimulate production in net importing developing countries, slowing trade growth compared to the last decade. Fish trade is also affected by increasing prices, high transportation costs and slower expansion of aquaculture production.

Lightly processed food and feed products are the most traded commodities

The share of cereal production that is traded will remain stable over the projection period (Figure 1.14). Wheat will remain the most traded cereal by 2024, with 22% of its output expected to be exported, while these shares approach 13% and 10% for coarse grains and rice, respectively. The share of protein meal production that reaches international markets is expected to decrease over the projection period, from 28% in 2012-14 to 25% in 2024. This is a direct result of the expansion of livestock production in the main protein meal producing countries, where a greater share of protein meal will be used domestically, at the expense of exports. Vegetable oil is one of the highest traded commodities, with around 40% of its production entering international markets, especially palm oil from Indonesia and Malaysia.

Figure 1.14. **Share of traded production in 2024 compared to 2012-14**

Share of net exports in total production



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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Ethanol trade as a share of production is expected to decrease over the outlook period as import demandfrom major consuming countries is expected to remain limited. Meat exports will expand at a similar rate to production, resulting in relatively constant shares of trade in total production. Exports from the European Union, the second largest exporter of meat, will grow marginally as environmental constraints and stringent animal welfare regulations limit the expansion of domestic supply.

The tradability of the different dairy products varies significantly. Whereas WMP and SMP are the highest traded commodities, trade in butter and cheese is below average and very little trade occurs in fresh dairy products (liquid milk, cream, yogurt, etc.). Although demand for fresh dairy products is much greater than for WMP and SMP, their trade is limited due to transportability constraints (trade is not depicted in the figure as it is below 1% of world production).

Most trade flowing from few exporters to large number of importers

Exports of agricultural commodities tend to be concentrated in a few countries, while imports are mostly dispersed over a larger number of countries. The limited number of exporters for most commodities reflects a comparative advantage in these countries due to natural endowments, domestic policies and climatic conditions. However, the dependency on a few countries for the provision of a certain commodity increases the risk that if supply from one country is disrupted due to a natural disaster or trade protective measures, it could have significant repercussions on international markets.

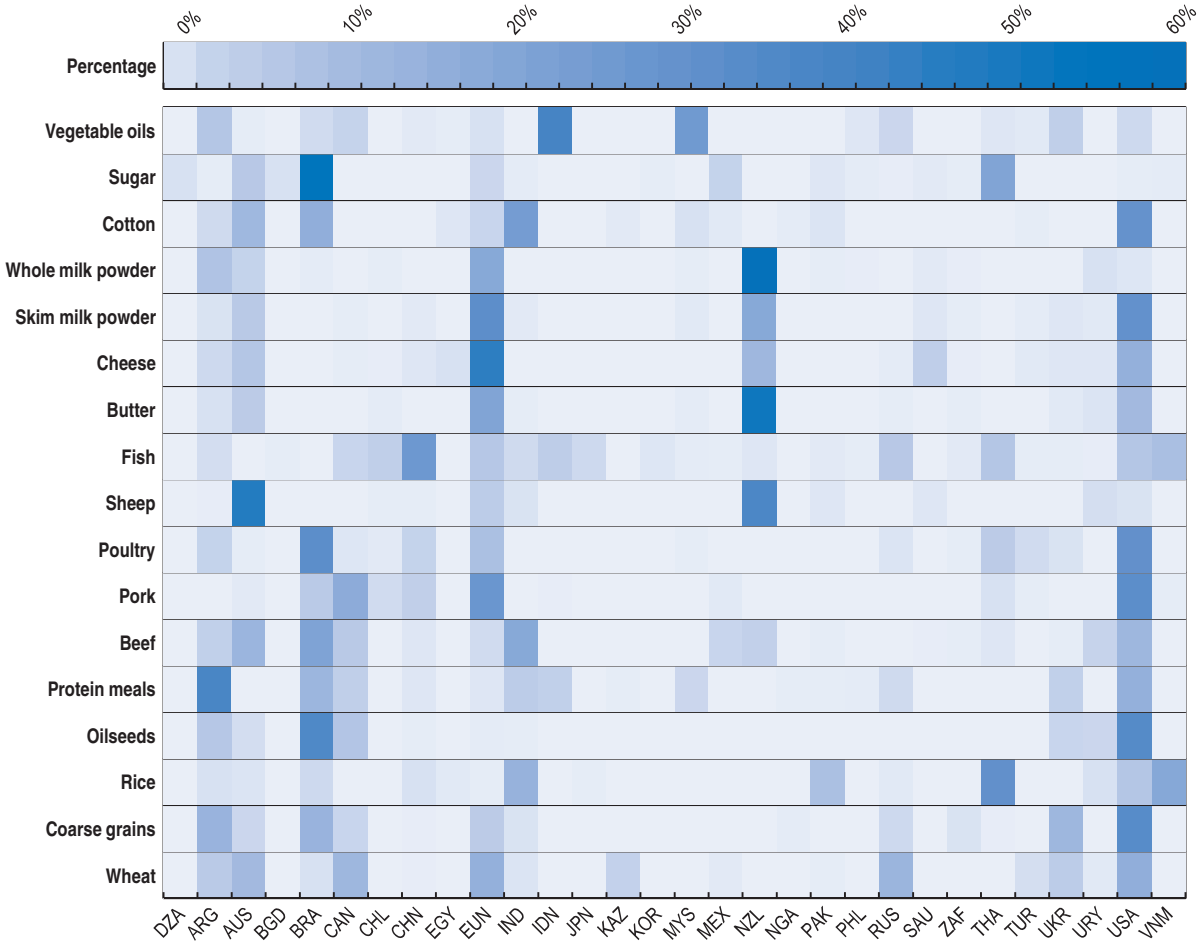
Figure 1.15 and Figure 1.16 display the concentration of exports and imports, respectively, by country and by commodity. These two figures are so-called "heatmaps", where a darker shade indicates a higher share in global exports (Figure 1.15) or global imports (Figure 1.16) for a specific commodity. Comparing these two figures illustrates the concentration of exporters and dispersion of importers, as Figure 1.15 is composed of fewer areas that are shaded compared to Figure 1.16, and at the same time the areas in Figure 1.15 are generally darker than in Figure 1.16.

By 2024, the United States, the European Union and Brazil are expected to remain among the top exporters. The United States is projected to be the largest exporter of coarse grains, pork and cotton, with export shares in global trade reaching 33%, 32% and 24%, respectively. In addition, the United States is among the five top exporters of wheat, rice, oilseeds, protein meal, beef, poultry, fish, butter, cheese and SMP. Its exports of coarse grains are expected to rise in terms of volume as domestic demand for biofuel production is projected to slowdown.

Exports of dairy products will also remain highly concentrated. By 2024, the United States and the European Union will each account for about a third of SMP exports, while the European Union will remain the primary cheese exporter with a share of 40%. New Zealand will be the world's primary origin of butter and WMP, with export shares reaching 48% and 56%, respectively. Some developing countries are expected to enter the trade arena, such as Argentina and Saudi Arabia which will export WMP and cheese, respectively.

More than half of the world's sugar exports will originate in Brazil by 2024. This market share is lower than in the base year as Thailand and Australia are expected to start exporting more sugar. Brazil will also become the leading world exporter of beef and poultry by 2024, with export shares of 20% and 31%, respectively. Brazil and the United States will account for more than two third of global exports of oilseeds and Argentina will

Figure 1.15. **Concentration of exports by commodity, 2024**



Note: A darker shades indicates a higher share in global exports for a specific commodity. Only the countries which have a relatively significant share of exports for at least one of the commodities are represented. Countries: (CAN) Canada, (USA) United States, (EUN) European Union, (AUS) Australia, (NZL) New Zealand, (JPN) Japan, (ZAF) South Africa, (KAZ) Kazakhstan, (RUS) Russian Federation, (UKR) Ukraine, (DZA) Algeria, (BRA) Brazil, (CHL) Chile, (MEX) Mexico, (URY) Uruguay, (BGD) Bangladesh, (CHN) China, (IND) India, (IDN) Indonesia, (KOR) Korea, (MYS) Malaysia, (PAK) Pakistan, (PHL) Philippines, (THA) Thailand, (VNM) Viet Nam, (SAU) Saudi Arabia and (TUR) Turkey.

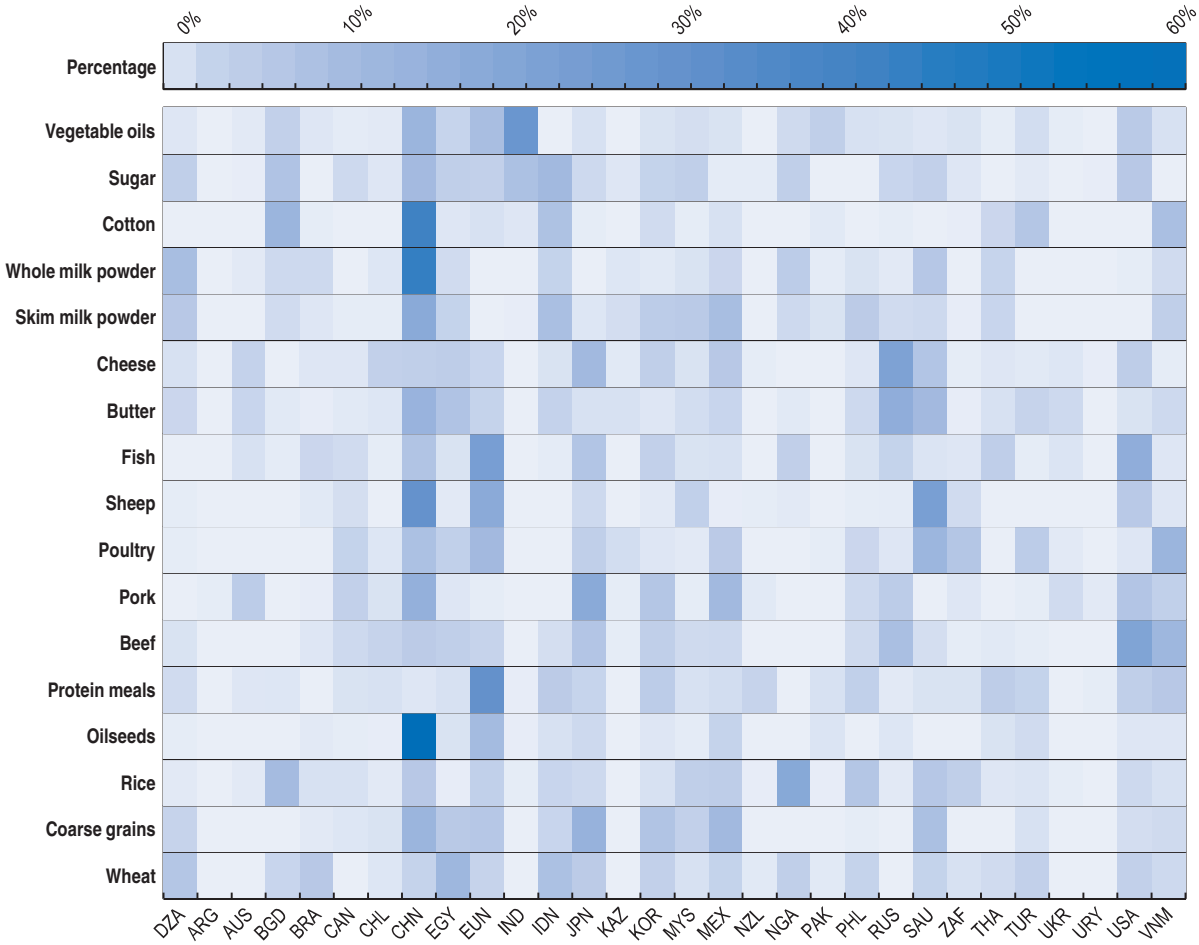
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

StatLink *http://dx.doi.org/10.1787/888933228835*

stay the largest exporter of protein meal with a share of 36%. Whereas protein meal and oilseeds exports are concentrated in the Americas, vegetable oil exports continue to be dominated by Asia.

Asia remains the main source of vegetable oil, rice and fish exports. Vegetable oil exports are concentrated in Indonesia and Malaysia, rice exports in Thailand and Viet Nam, while China and Viet Nam are leading fish exports. Thailand is foreseen to remain the main rice exporter by 2024. Whereas vegetable oil trade is global, rice exports circulate mainly within the region. Except for India, rice exports from all of the traditional exporters, namely Pakistan, Thailand, Viet Nam and the United States, are expected to increase. India is expected to retain its position as the second largest exporter of cotton and beef by 2024.

Figure 1.16. **Concentration of imports by commodity, 2024**



Note: A darker shades indicates a higher share in global imports for a specific commodity. Only the countries which have a relatively significant share of imports for at least one of the commodities are represented. Countries: (CAN) Canada, (USA) United States, (EUN) European Union, (AUS) Australia, (NZL) New Zealand, (JPN) Japan, (ZAF) South Africa, (KAZ) Kazakhstan, (RUS) Russian Federation, (UKR) Ukraine, (DZA) Algeria, (BRA) Brazil, (CHL) Chile, (MEX) Mexico, (URY) Uruguay, (BGD) Bangladesh, (CHN) China, (IND) India, (IDN) Indonesia, (KOR) Korea, (MYS) Malaysia, (PAK) Pakistan, (PHL) Philippines, (THA) Thailand, (VNM) Viet Nam, (SAU) Saudi Arabia and (TUR) Turkey.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

StatLink *http://dx.doi.org/10.1787/888933228841*

The Russian Federation, Ukraine and Kazakhstan are expected to reinforce their role as wheat exporters, as production growth continues to outpace consumption growth in these countries.

Imports are more dispersed over a larger group of countries. However, Figure 1.15 clearly illustrates that China will be the main importer of many commodities. It is projected to be the largest importer of oilseeds, SMP, WMP, cotton and sheep with import shares reaching 61%, 15%, 25%, 40% and 20%, respectively. Given China's focus on becoming self-sufficient in food grains, this *Outlook* assumes that feed grain imports will increase further as a result, with China becoming the second largest importer of coarse grains with barley and sorghum imports being larger than maize.

The import ban imposed by the Russian Federation on cheese and butter, among other goods, is expected to only temporarily disrupt trade flows (Box 1.6). Consequently the

Russian Federation is projected to remain the main destination of cheese and butter over the medium term.

Trade patterns between the developed and developing world are expected to persist over the next ten years. Wheat, coarse grains, meat and dairy products will generally be exported by developed countries and imported by developing countries. Fish and protein meal trade on the other hand will follow the opposite direction, with the European Union being the largest importer for both commodities. Trade within developing regions in particular will be strong for rice and oilseeds.

Both trade and domestic policies (temporary trade restrictions, bilateral trade agreements, stockholding programmes, etc.) are expected to significantly influence trade patterns. The implementation of several bilateral trade agreements for commodities such as meat, fish and dairy, have the potential to diversify trade flows in the next ten years. Trade of dairy products and meat on the other hand could also potentially be restricted through temporary trade barriers that arise from sanitary and food safety concerns regarding disease outbreaks. Many domestic policies have spill-over effects into international markets. Stockholding programmes in exporting countries, for example, influence the availability of commodities for international trade. The release of large inventories of rice that were accumulated in Thailand will soften international prices, which in turn may discourage less competitive rice-exporters from entering international markets.

Box 1.6. **Global impact of the Russian Federation's restrictions on imports of agricultural and food products**

On 7th August 2014 the Government of the Russian Federation announced a restriction on imports of a wide range of food products in response to sanctions previously imposed by some countries on the Russian Federation over the security situation in Ukraine. The prohibition, which is expected to stay in place for one year, covers imports of beef, pork, poultry, processed meats, fish and other seafood, milk and milk products, vegetables, fruits and nuts from the European Union, United States, Canada, Australia and Norway. The affected products account for two thirds of all food expenditure by Russian households. Thirty six per cent of these products (by value) came from the affected countries. For some products, the share of imports from the affected countries was quite high: 71% for pork and 53% for fish and seafood.

The main outcome of the ban has been a realignment of trade flows, with a greater share of Russian imports originating in the countries not affected by restrictions, in particular in South America. More EU and US exports are now going to Asian markets that were previously supplied by South American exporters. Within the Russian Federation, the measure is affecting domestic prices, consumption and overall welfare, exacerbated by the exchange rate fluctuations. With the ruble losing almost half of its value in relation to the US dollar between July 2014 and February 2015, imports have rapidly become more expensive, eroding the purchasing power of consumers. As a result, consumer prices of pork and chicken registered an initial jump, increasing by 27% during 2014. A large increase was also registered for apples (21%), well above the general CPI of 11%.

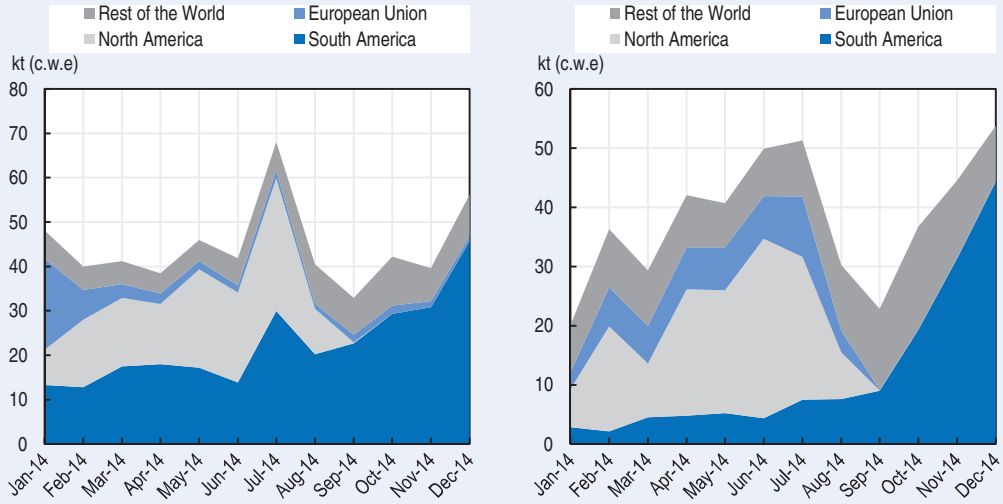
Pig meat is one of the products most affected by the ban. The Russian Federation is expected to continue increasing its own production in line with the long-term trend, with government support policies favouring large-scale farms. So far there has not been any major increase in beef imports by the Russian Federation as these were already coming primarily from South America before the ban.

Box 1.6. **Global impact of the Russian Federation's restrictions on imports of agricultural and food products** *(cont.)*

Overall, no notable increase in domestic meat production has been observed following the import restrictions. The main effects of the ban have been, first, a major shift in the import sources, and, second, an overall decline in aggregate agricultural imports. In the second half of 2014 the value ofagricultural and food imports in the Russian Federation declined by 6.4% relative to the same period in 2013, with a sharp decline towards the end of 2014 as a result of the steep fall in the ruble. Among the affected products, the strongest fall in imports during 2014 has been pig meat (41% in volume terms). The share of Brazilian pig meat within trade flows to the Russian Federation increased from an average of 21% during 2013 to 72% in the last quarter of 2014. Brazil has now replaced the EU as the main exporter of pork to the Russian Federation. In poultry, Brazil's share increased from 9.8% in 2013 to 25.4%. Dairy imports from the EU dwindled, while Argentina, Uruguay and, in particular, Belarus increased their shipments substantially. Belarus' share in the total value of imports of dairy products by the Russian Federation went from approximately 40% in the beginning of 2014 to 72% after the sanctions.

Figure 1.17. **Monthly pork and poultry imports in Russian Federation, 2014**

Pork (left panel) and Poultry (right panel)



Note: c.w.e.: Carcass weight equivalent
Source: Global Trade Information Services, Inc. (GTI).

StatLink http://dx.doi.org/10.1787/888933228857

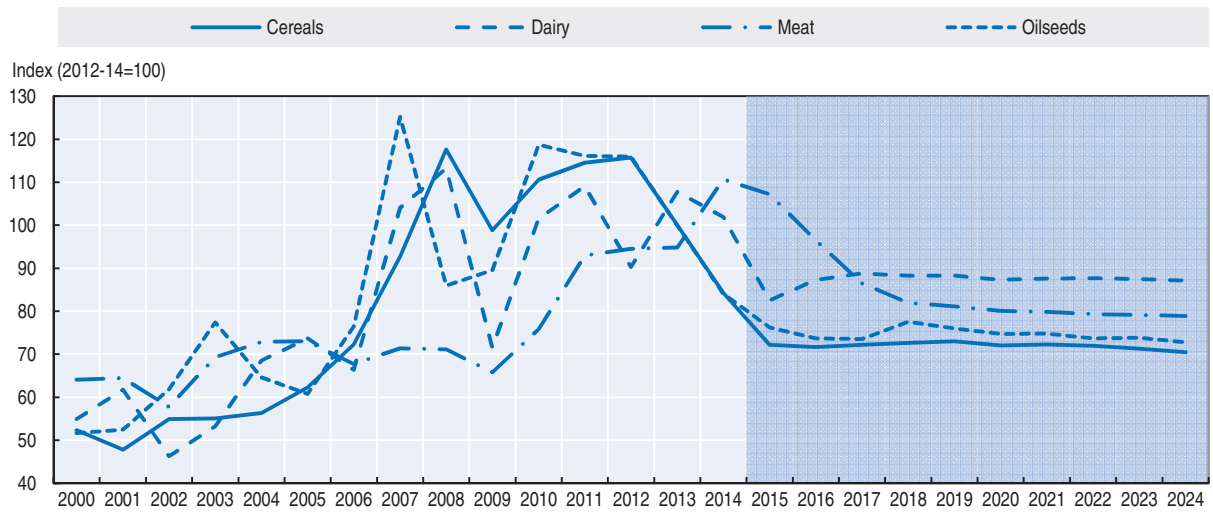
The bans add to market access restrictions, including sanitary and phytosanitary measures, that the Russian Federation was already imposing on some imports, for example, pork from the EU, dairy and meat products from Ukraine, and fruits from Moldova. However, when the import ban was introduced in August 2014, Russian authorities swiftly granted phytosanitary and veterinary certificates to a number of trading partners, in particular South American countries, thus helping to reorient imports.

The import prohibition should expire in August, but regardless of whether or not it will be renewed, some structural changes may be associated with the measure. South America, already the main exporter of beef to the Russian Federation, is now gaining market shares in other products, consolidating their overall commercial ties. Nearby countries, such as Azerbaijan, Belarus, China, Israel, Serbia and Turkey are also gaining ground as suppliers to the Russian Federation in a variety of products. New exporters, such as Serbia in the case of pork, are competitive enough to remain in the Russian market even after the ban is lifted, having its position firmly established during the period of low competition from the major producing countries. This realignment in supplies may have longer-term implications for trade, production and consumption in the Russian Federation, as well as for the global market.

Prices: Real prices follow the long term declining trend

Over the next ten years, real prices are projected to decline from their 2014 levels but remain above their pre-2007 levels. When considering only the last 15 years, projected prices appear to be on a higher trend (Figure 1.18). The period of low prices in the early 2000s was followed by a period of high and volatile prices starting in 2007. Prices started to moderate in 2013, but are not expected to drop to the levels witnessed in the early 2000s.

Figure 1.18. **Medium term evolution of commodity prices in real terms**



Note: Index calculated by a constant weighting of commodities within each aggregate. The weight is calculated by the average 2012-14 production value.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

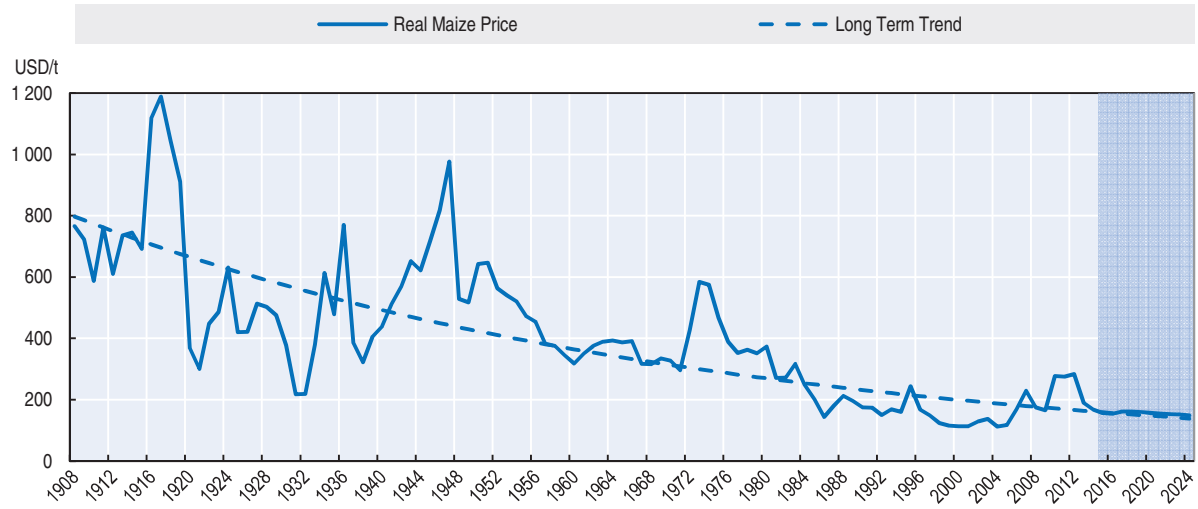
StatLink *http://dx.doi.org/10.1787/888933228861*

However, the question of whether real prices are on a higher or lower trend depends on the period over which prices are examined. When analysing the evolution of real prices over the last century, the projected prices continue a trend of long-term decline. This is illustrated in Figure 1.19, which displays the evolution of maize prices from 1908 until 2024. Prices during the early 2000s were below the trend, while current and projected prices are more on trend. Other commodities follow similar downward sloping price paths over the long-term. Even though real prices are projected to decline, this does not preclude the likelihood that prices will experience bouts of volatility, including upward price spikes, in the next ten years. Some of the factors that can lead to higher variability in the prices are analysed in the next section.

Lower crude oil prices to have limited impacts on commodity prices

Crude oil prices affect the prices of agricultural products and biofuels through different channels. In the case of agricultural products, lower crude oil prices lead to reduced energy and fertiliser costs. This effect is muted as energy input costs are only part of the total cost of production. For example, it is estimated that in the United States energy and fertiliser costs account for 10% and 20.8% respectively of expenditures to produce coarse grains. These shares are considerably lower in developing countries where production systems are less intensive and less mechanised and where there is low price transmission between energy and crop prices. The demand response to changing prices is

Figure 1.19. **Long-term price of maize in real terms, 1908-2024**



Note: The US yellow #2 Gulf maize price is used as a benchmark for the coarse grain world market price. This price is recorded back to 1960 in World Bank datasets as monthly data. Monthly prices were converted to annual averages using the maize marketing year September-August. For the years 1908-59 the series is extended using the relative changes in "corn price received" from the USDA quickstats. Nominal prices are deflated using the consumer price as reported by the Federal Bank (*www.minneapolisfed.org/community_education/teacher/calc/hist1800.cfm*).

StatLink http://dx.doi.org/10.1787/888933228870

less pronounced than the supply response as consumers' demand for agricultural products is rather inelastic.

The situation is different for biofuels. The demand for biofuels remains strongly driven by policies and hence minimum levels of demand are maintained irrespective of relative biofuels and crude oil prices. In fact, as policies regulate biofuel demand, the link between biofuels and crude oil prices is relatively limited. However the development of biofuels behind mandate levels depends on the comparative price ratio between biofuels and crude oil. When the price of crude oil falls, biofuels become less competitive which leads to lower market-driven demand and lower investments in the sector which can be compensated at least partially by increasing policy-related biofuel demand due to stronger transportation fuels use.

The current outlook on the energy sector, which is expected to be characterised by ample supplies and strong price competition among major producers, motivated a downward revision of the oil price projections compared to last year's *Outlook*, which are now projected to reach USD 88.1 in nominal terms by 2024. These lower oil prices are expected to mute agricultural price increases in the short term. Indeed, the previous two marketing years were characterised by above average yields, which drove prices down to their current levels. Returning to more normal yields will decrease world supply of all major crops in the upcoming marketing seasons and as a result prices should rise. Furthermore, incentives to increase production are dissipating after a period of decreasing prices, which in turn also puts upward pressure on prices. The factors pushing for higher prices are partially offset by lower energy prices following the decline in crude oil prices. The effect of lower oil prices on agricultural commodity prices will, however, be limited in the medium term. While oil does influence the cost of production, as well as feedstock demand through biofuel, it remains only one factor in an extensive list of factors that affect commodity prices. Other factors, such as weather conditions, policies, economic growth,

population growth and exchange rates should also be considered and the interaction of these different factors outweighs the impact of lower oil prices. Box 1.7 examines the impact of a shock in crude oil prices on commodity prices, while Box 1.8 analyses how a growth of more than 2% in GDP in each of the G20 economies affects commodity markets.

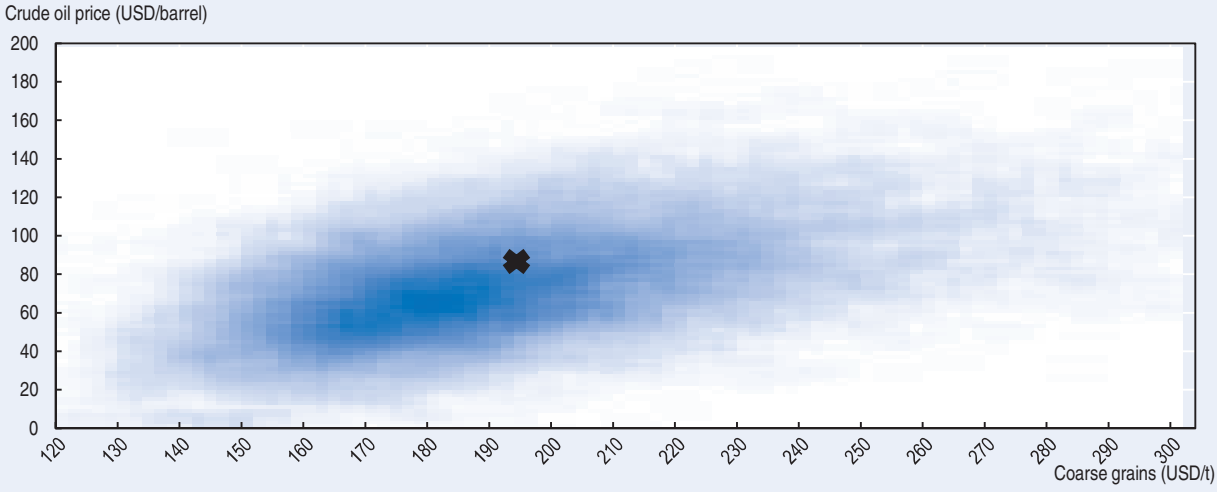
Box 1.7. **The implications of crude oil price variations for agricultural markets**

During the first half of 2014 oil prices remained stable at around USD 110 per barrel. However, from July onwards prices declined, at first gradually but more dramatically in Q4 2014, with the price ending the year just above USD 50 per barrel. The *2015 Agricultural Outlook Database* has an average price just below USD 100 per barrel for 2014, and an average price just above USD 60 per barrel in 2015. This represents a significantly lower assumption for oil price in the outlook period in comparison to previous years.

As a result, price projections for agricultural products in the *2015 Agricultural Outlook* have been softened to reflect the changing price assumption for oil. However, these projections give the medium-term expected trend and not the volatility that could occur over the ten year outlook period.

The following simulations illustrate how the link between oil prices and agricultural prices can be weakened by other sources of uncertainty, including yields and other macroeconomic variables. Figure 1.20 provides a heat map for 1 000 simulations of the oil price against the coarse grain price in 2024, where a darker colour indicates a greater probability of this combination of oil and coarse grain price occurring. The heat map indicates that there is a link between an increased oil price and an increased coarse grain price. Estimates suggest that a 10% rise in oil price is associated with a 3% rise in coarse grain price. However, whilst an increased oil price raises the probability of a higher coarse grain price; it does not necessarily imply a higher price. At any point in time there are a number of other sources of volatility which could absorb the impact of a rising oil price or further amplify it.

Figure 1.20. **Relationship between coarse grain price and crude oil price in 2024**



Note: The darker colour represents a greater probability of this combination of oil and coarse grain price occurring. The cross represents the central assumption in 2024.
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

StatLink http://dx.doi.org/10.1787/888933228887

Whilst the coarse grain price has been analysed here for illustrative purposes, the same links occur for most other agricultural products, with the exception of biofuels, where there are additional effects deriving from policies that are implemented and the nature of the product as a substitute for oil.

Box 1.8. **Estimated market effects of the G20 growth initiative**

In the Brisbane Action Plan of November 2014, the Leaders of the G20 economies pledged to implement macroeconomic and structural policies that would raise GDP growth in each of the G20 economies by more than 2% above projected rates by 2018. Positive spill-overs from the G20 growth are expected to also boost GDP growth of non-G20 countries by 0.5% by 2018. The following scenario assumes that agriculture contributes to additional G20 growth in the form of productivity improvements that reduce the cost of production of each product by 2% below the baseline in equal instalments by 2018 and remain below the baseline for the remainder of the projection period.

The increase in real incomes boosts demand for most agricultural products, while the reduction in costs boosts supply. The broad result is greater quantities of agricultural goods produced, consumed and traded, but relatively small impacts on prices, where the two effects offset each other.

The largest increases in consumption occur for products with a relatively high income elasticity of demand, namely meats, fish and dairy products, with an induced demand for additional feed grains. There are relatively modest impacts on the consumption of basic food staples, such as wheat and rice.

For the G20 as a group, higher incomes and lower costs reinforce each other and production and consumption are above the baseline levels. Production and consumption of butter, beef and veal, whole milk powder and fish are affected the most in the scenario with consumption and output about 1% above the baseline starting in 2019.

Higher incomes increase import demand by the G20 for most commodities with wheat and rice the exceptions. Imports of whole milk powder are more than 2% above the baseline from 2017. Changes in import demand of non-G20 and least developing countries are more variable, although import demand for most products is marginally above the baseline. On the export side the picture is more diverse, with exports from major G20 exporting countries expanding as those of LDCs decline.

Figure 1.21. **World price effects of higher G20 incomes**

Percentage increase in world price relative to the baseline

Note: The scenario assumes a GDP growth of 2% above projected rates by 2018 in the G20, with agriculture contributing in the form of productivity improvements that reduce the cost of production of each product by 2% below the baseline in equal instalments by 2018. Positive spill-overs from the G20 boost GDP growth of non-G20 countries by 0.5% by 2018.
Source: OECD and FAO Secretariats.

StatLink http://dx.doi.org/10.1787/888933228890

Box 1.8. **Estimated market effects of the G20 growth initiative** *(cont.)*

The effects on markets vary over time. In the Aglink-Cosimo model, supply exhibits a delayed response to cost reductions, so prices first rise before the effects of production responses take hold. Once incomes and production costs have stabilised after 2018, changes to demand and supply resulting from differences in relative prices, lead to moderately declining and then stabilising prices (Figure 1.21). In most cases prices are higher in 2024, although the effects are small. The biggest effects are for those products where the consumption increases are greatest, namely meat, fish and some dairy.

In this scenario, non-G20 countries only benefit from the spill-over effect on incomes and not from the reduction in agricultural costs. This raises demands in these countries, and induces a domestic supply response. Any upward pressure on prices in these countries could be offset by agricultural productivity improvements. Focusing more policy effort on improving agricultural productivity growth is a key recommendation of the inter-agency report lead by FAO and OECD for the Australian Presidency of the G20 on Opportunities for Economic Growth and Job Creation in Relation to Food Security and Nutrition (FAO and OECD, 2014).

Nominal prices to increase marginally for crops and dairy, meat prices to follow the same trend with a lag of two years

International crop prices have been declining since 2013, in response to two successive record harvests in grains and oilseeds. The resulting situation of ample supplies and replenished stocks, gives rise to expectations of nominal prices declining further in the short term, before returning to a marginally upward trend for the rest of the projection period. Meat prices reached record highs in 2014 and are projected to decline over the next ten years in response to lower feed costs and slowing global demand growth.

The projections are based on specific assumptions about a set of factors that influence the supply, demand, trade and prices of commodities. These factors include policy settings, crop yields, and macroeconomic assumptions such as income growth, exchange rates and oil prices. To examine the sensitivity of commodity prices to these factors, the price projections specifically incorporate the impact of varying yields and macroeconomic conditions. Box 1.9 explains in detail how these partial stochastics were performed and how to interpret the results.

Box 1.9. **Stochastics explained**

Why perform a partial stochastic analysis on price projections?

The objective of the stochastic analysis is to assess how uncertainty on key assumptions about the macroeconomic environment and yield levels might affect price projections. The stochastic analysis is only partial as it does not capture all sources of variability. For example, uncertainty related to policy changes or animal diseases are not considered.

What are the assumptions behind the stochastic analysis?

Stochastic analysis gives an estimation of possible future variations based on historical variations. It does not provide a confidence interval for the future or probability of a particular price occurring. It considers that:

- The central assumption is correct
- Historic variations and correlations will continue into the future
- The considered factors are the only causes of volatility

Box 1.9. **Stochastics explained** *(cont.)*

Which variables are considered for the stochastic analysis?

The following 40 country-specific macroeconomic variables and 79 country- and commodity-specific yields are treated as uncertain in the partial stochastic runs:

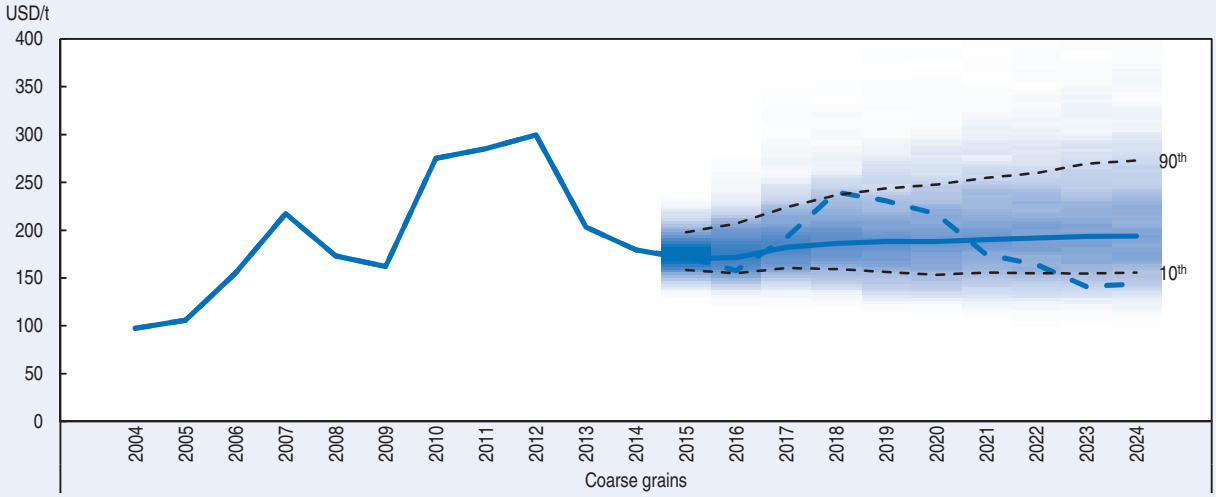
Global macroeconomic drivers: real Gross Domestic Product (GDP), the Consumer Price Index (CPI), the GDP Deflator and national currency-USD exchanges rates in Australia, Brazil, Canada, China, the European Union, India, Japan, New Zealand, the Russian Federation and the United States; and the world crude oil price.

Agricultural yields: uncertainty affecting the yields of 17 crops and milk in 20 major producing countries is also analysed, giving a total of 79 product-country-specific uncertain yields. The chosen 79 uncertain yields are deemed to be the most influential to commodity markets.

What is shown in the graph?

The ***smooth blue line*** in the Figure 1.22 shows the historical evolution and projected price trend (baseline) for coarse grains. The dotted lines and shaded areas illustrate how the projected price can vary when taking into account uncertainties regarding yield and macroeconomic drivers, i.e. when partial stochastic analysis is applied. The ***dotted blue line*** represents one arbitrarily chosen price path out of the 1 000 simulations that arise from the stochastic analysis. It clearly illustrates how prices vary from year to year. The ***shaded areas*** indicate how the various stochastic factors affect the probability that the price will attain a particular level in one specific year. The projected value for a specific year will lie somewhere in the shaded area. The darker the shading in a specific area, the higher the probability that the price will be located in that area, however a price path will not generally follow a consistently higher or lower path. As such, the shaded area should be regarded as the area in which prices could realistically oscillate. The lower and upper ***black dotted lines*** indicate the 10th and 90th percentiles, respectively.

Figure 1.22. **Coarse grain price in nominal terms including variation derived from stochastic analysis**



Note: The smooth blue line represents the historical price evolution and baseline. The dotted blue line represents one arbitrarily chosen price path out of the 1 000 simulations. Darker shading represents a greater probability that the price will reach a particular level in one specific year. The lower and upper dotted black lines represent the 10th and 90th percentiles, respectively.
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

StatLink *http://dx.doi.org/10.1787/888933228906*

Box 1.9. **Stochastics explained** *(cont.)*

How should the results be interpreted?

In the short term, the degree of uncertainty is much lower than in the medium term. This is mainly a result of the macroeconomic uncertainty, which is modelled such that it accumulates over time, while yield variation is assumed to remain relatively constant over time. In the graph, this is illustrated by the fact that the shaded areas are much more concentrated in early years and more spread out in later years.

The probability that prices will be situated in a very light shaded area is low in any particular year. However, the probability that prices appear in a very light shaded area at least once over the entire projection period is considerably higher. This is also illustrated by the 10th and 90th percentiles, where the probability that prices fall outside this range is 20% any given year, but is much higher when considering the entire ten year period. The occurrence of a jump in prices is hence not excluded by the stochastics; an extreme macroeconomic event or an exceptionally low or high yield can lead to a price hike above the 90th percentile or a price drop below the 10th percentile.

Note: More information on the stochastic analysis can be found in the Methodology which can be accessed online on *www.agri-outlook.org/*.

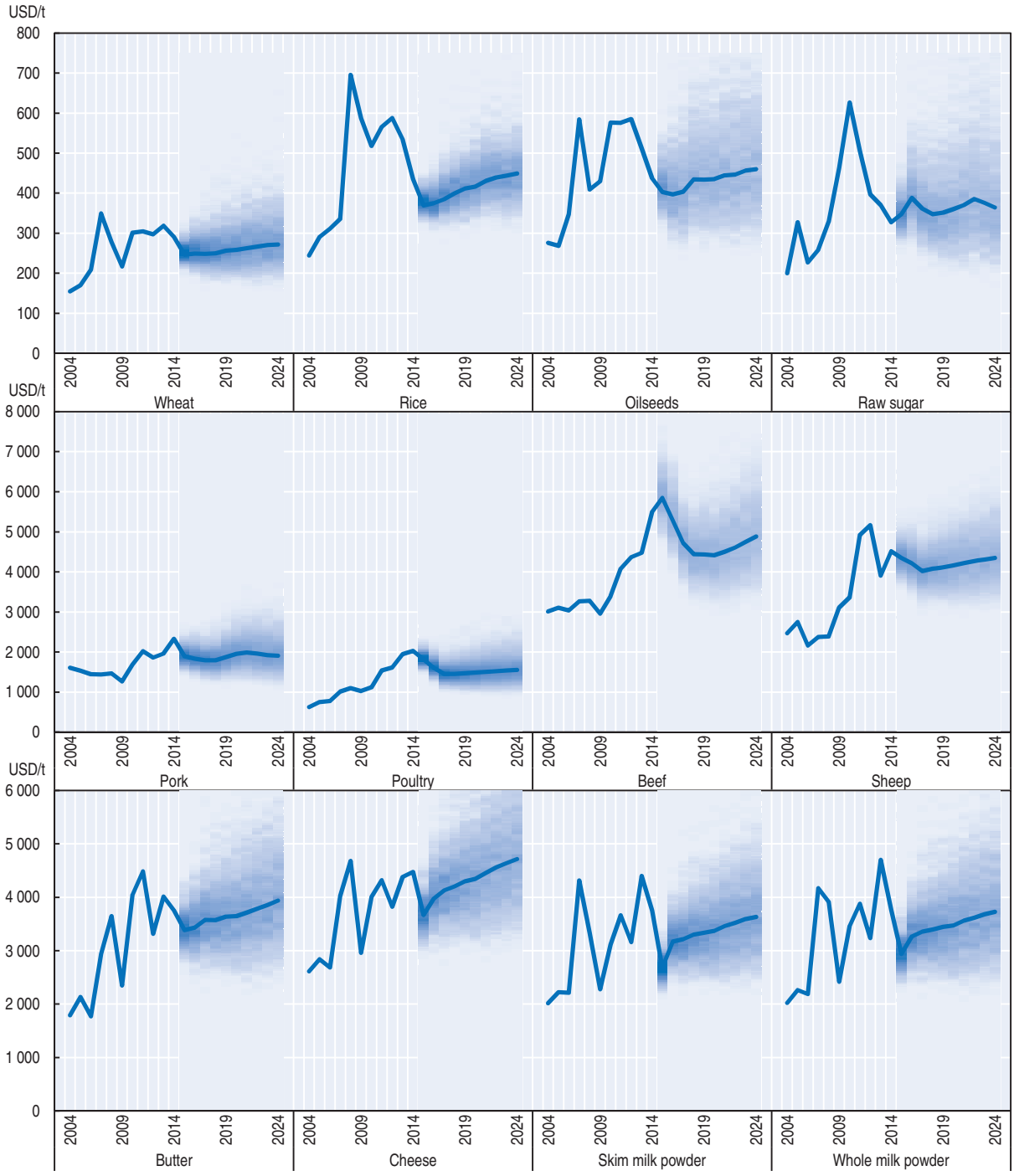
Figure 1.23 and Figure 1.24 show for selected commodities the nominal price evolution together with the variation around the baseline, as derived from the stochastic analysis. The variation incorporates both macroeconomic and yield uncertainty. As simulated, yield uncertainty remains constant over time while macroeconomic uncertainty accumulates and hence becomes more apparent at the end of the projection period.

Cereal prices are expected to decline in the short term as a result of the historically high production in 2013 and 2014, high stock levels, slower economic growth, and lower oil prices. In the medium term, prices are expected to slightly trend upwards in line with the increasing cost of production. Rice price levels will recover later compared to the other grains, due to the accumulated stocks in Thailand which are expected to put downward pressure on prices for several years. The world reference price of rice has been changed back to the Thai price after two years of using the price in Viet Nam. After the suspension of paddy pledging programme in 2014, the price of rice in Thailand converged to the prices in Viet Nam and other producing countries, and Thailand has become the largest rice exporter again surpassing India.

Oilseed prices are projected to follow the price path of cereals, hence decreasing in the short-term but increasing over the medium-term. In real terms, oilseed and oilseed product prices are expected to decline over the projection period. A slowdown in demand for vegetable oil due to saturation in per capita demand in emerging countries and a reduced growth in biodiesel production will cause vegetable oil prices to decline faster than protein meal prices in real terms.

Nominal prices for sugar are expected to recover from the current low prices, which are a reflection of four years of global surplus combined with devaluation of the Brazilian real with respect to the US dollar. Sugar producers are adjusting their output, which will lead the world sugar market into a deficit phase and hence move prices slightly upwards. During the projection period, sugar prices will remain volatile and exhibit an oscillating pattern as a result of the production cycle in some key Asian sugar-producing countries. The impact of the abolition of sugar quotas in the European Union in 2017 is expected to lead to a decline in sugar prices within the European Union in 2017, although this decline

Figure 1.23. **Agricultural price trends in nominal terms including variation derived from stochastic analysis**

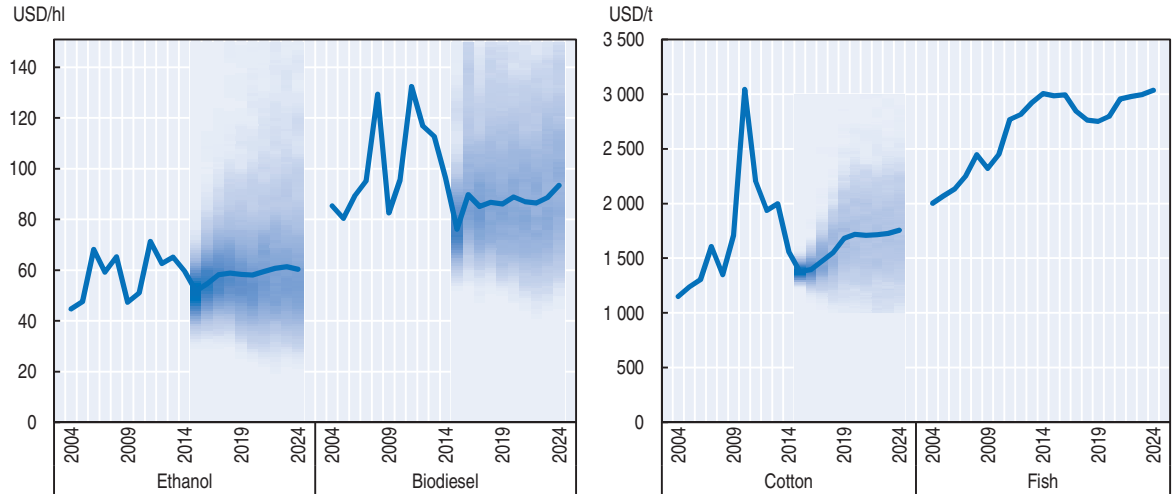


Note: The nominal prices for coarse grains are represented in Figure 1.22.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

StatLink *http://dx.doi.org/10.1787/888933228914*

Figure 1.24. **Price trends in nominal terms for biofuels, cotton and fish, including variation derived from stochastic analysis**



Note: No stochastic analysis is performed for fish

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

StatLink *http://dx.doi.org/10.1787/888933228925*

has already started in 2014 as efficient producers have already begun to produce more to gain market shares (combined with a record crop), but the impact on world prices remains uncertain. In real terms, sugar prices are expected to return to their levels before the 2009 price peak.

Meat prices attained record levels in 2014. With the exception of sheep prices, nominal meat prices are expected to fall to lower levels by 2024 as a result of increased productivity and lower feed costs. Nominal prices for beef will remain high in the short term, as herds are being rebuilt in several meat producing countries. Over the medium term, prices will ease due to rising production levels. The decline in pigmeat and poultry prices is projected to start at the beginning of the projection period, as a result of lower feed grain prices. An increase in supply in pigmeat in the United States and Brazil combined with a reduction of imports by the Russian Federation will put additional downward pressure on pigmeat prices over the projection period. Sheep meat prices on the other hand will remain high fuelled by strong import demand in China. Even though beef, pigmeat and poultry prices are expected to decline in nominal terms over the projection period, the output price-to-feed price ratio will remain favourable for meat producers.

Prices of milk and dairy products dropped during the second half of 2014 due to a strong reduction in import demand in China, increasing production in the major exporters and the import ban in the Russian Federation. Over the next ten years, nominal prices are expected to recover from their current low levels driven by growing import demand. Cheese prices will exhibit the strongest growth rate among all dairy products and are expected to attain price levels similar to the highs of the previous years by 2024. Prices in real terms are projected to decline slowly but will stay considerably above pre-2007 levels.

Among all commodities considered in the *Outlook*, ethanol is most influenced by oil price variations. The drop in crude oil prices in 2014 is expected to put downward pressure on ethanol prices in the short term. Brazilian ethanol is assumed to be uncompetitive in the first half of the projection period due to a domestic pricing policy that keeps gasoline

prices in Brazil above international oil prices. Biodiesel prices are projected to be mostly policy-driven and will hence be related to the price evolution of vegetable oil.

Cotton prices are projected to fall during the early years of the projection period as China is expected to reduce its substantial cotton stocks. Prices will recover and stay relatively stable for the remainder of the outlook period. By 2024, real and nominal prices are expected to remain below the levels reached in 2012-14.

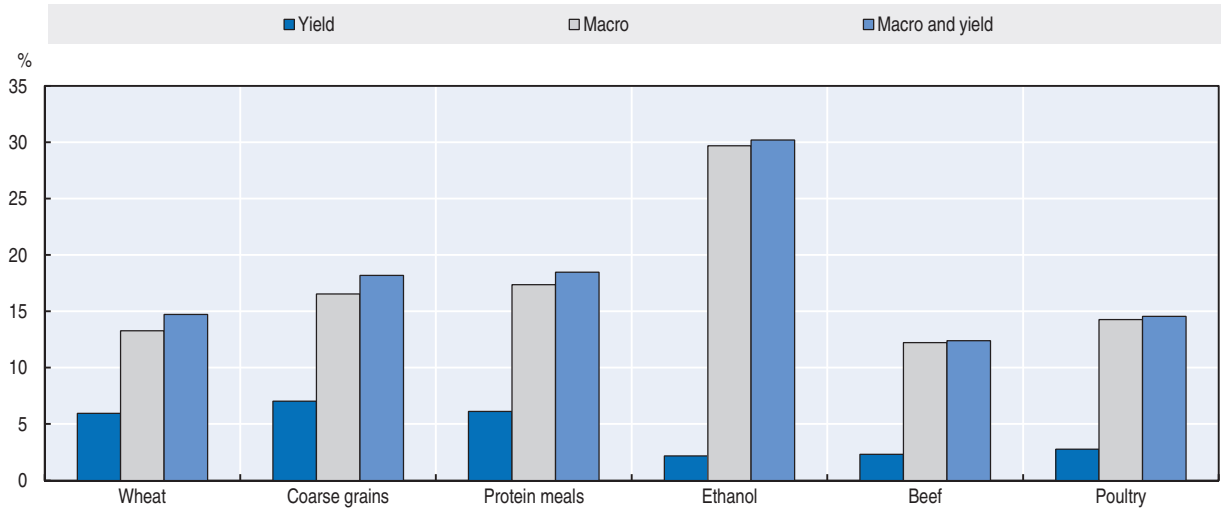
The fish sector is expected to enter a decade of higher nominal prices on account of high costs of production. Capture fish prices will increase at a faster rate than aquaculture prices, as the production of capture fisheries will be curtailed by quotas. Nevertheless, the price levels of fish caught in the wild will remain below farmed fish, given the increasing share of lower value fish in total catches. In real terms, capture and aquaculture prices are assumed to decline due to productivity gains and lower feed prices. Fishmeal and fish oil prices are expected to retreat from the very high levels they reached in recent years.

Macroeconomic uncertainty and yield uncertainty have varying impacts on price variability

Figure 1.23 and Figure 1.24 show that some commodity prices are more sensitive to yield and macroeconomic uncertainty than others. For certain commodities, the combination of yield and macroeconomic uncertainty drives this variability in prices, while for other commodities the macroeconomic uncertainty exerts a stronger impact than yield uncertainty. Figure 1.25 shows for selected commodities how the uncertainty coming from macroeconomic conditions and crop yields separately and jointly affects prices. The indicator used to represent the impact of uncertainty on projected prices is the average annual coefficient of variation (ACV) during the projection period. Minor revisions in the methodology[3] resulted in a relatively lower effect for yield uncertainty and relatively larger impact of macroeconomic uncertainty on price variability compared to the previous *Outlook*.

Figure 1.25. **Uncertainty of prices in 2024 by scenario**

Average annual coefficient of variation 2015-24



Note: Yield and Macro correspond to subsets of the complete stochastic analysis. For a detailed explanation, please refer to the Methodology, which can be accessed on *www.agri-outlook.org/*.
Source: OECD and FAO Secretariats.

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Arable crops clearly experience a larger influence from yield uncertainty than other commodities because yield uncertainty directly affects the production of arable crops. These effects get transmitted to other products as coarse grains are used for feed and biofuel feedstock. Since poultry production relies much more on the intensive use of feed grains and protein meals than beef, it experiences a higher impact from yield uncertainty.

Macroeconomic uncertainty plays a bigger role than yield uncertainty as it includes a combination of factors, which influence prices through a variety of channels. The price of crude oil and the GDP deflator, for example, influence input prices, while GDP growth and CPI determine consumption levels.

Protein meal prices move together with coarse grain prices as both commodities are used for feed. As a result, prices of protein meals display a similar sensitivity to macroeconomic uncertainty as coarse grains.

Ethanol prices demonstrate only a small impact of yield uncertainty compared to macroeconomic uncertainty. Most of this uncertainty is driven by Brazil, as it is the only country where ethanol consumption is at the same time market-driven and determined by policies through the compulsory blending of ethanol in regular gasoline. In Brazil, market-based ethanol demand is directly related to the ratio between domestic prices of gasoline and of ethanol. The macroeconomic environment in Brazil is affecting the level of domestic gasoline use and thus the amount of ethanol that has to be blended into gasoline.

Notes

1. The blend wall term refers to short run technical constraints that act as an impediment to increased ethanol use. E10 refers to gasohol with 10% volume of ethanol blended into petrol. E10 is still the most commonly available gasohol in the United States.
2. Sugarcane based ethanol qualifies as an advanced biofuels in the United States.
3. For a detailed explanation, please refer to the Methodology, which can be accessed on *www.agri-outlook.org/*.

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PART I

Chapter 2

Brazilian agriculture: Prospects and challenges

This chapter reviews the prospects and challenges facing Brazil's agriculture, biofuel and fish sectors over the next decade. It reviews sector performance, outlines the current market context, provides detailed quantitative medium term projections for the ten-year period 2015-24, and assesses key risks and uncertainties. Brazil's main challenges lie in sustaining productivity and production growth, while ensuring that such growth is reconciled with the country's poverty and inequality reduction objectives and the need for environmental sustainability. The chapter describes the main domestic and trade policies seeking to address these multiple objectives and suggests some strategic priorities, in the areas of productivity-enhancing investments, as well as targeted measures to ensure broad based sustainable development. Brazil is projected to maintain its role as a leading supplier to international food and agriculture markets over the next decade while also meeting the needs of an expanding and increasingly wealthy population. The key risks to this optimistic outlook pertain to Brazil's macroeconomic performance, the pace of structural reforms, and external factors including China's import demand.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The useof 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.

Introduction

Brazil is among the world's ten largest economies, with a GDP of over USD 2 trillion in 2013. It has the fifth highest population (now over 200 million) and the fifth largest surface area. Real GDP per capita has grown at an average of nearly 5% per year since 1995, enabling per capita incomes to reach USD 11 200 in 2013 and consolidating Brazil's position as an "upper middle income" country (World Development Indicators, 2014). In recent years, the country has made outstanding progress in poverty reduction, with the proportion of the population living on less than USD 1.25 per day falling from 7.2% to 3.8% between 2005 and 2012, and the proportion living on less than USD 2 per day falling from 15.5% to 6.8% over the same period. Nevertheless, over one-half of households live with per capita income at or below the minimum wage, and, despite some progress over the past decade, income distribution remains one of the world's most uneven. In 2012 the highest earning 10% of households accounted for 42% of total income, and the lowest earning 10% responded for just 1% (World Development Indicators, 2014).

The agricultural sector plays an important role in underpinning Brazil's economic performance, even though agriculture's share of GDP is no more than one would expect given the country's level of development, at 5.4% in 2010-13. Brazilian agriculture has seen strong growth for over three decades. Total agricultural output has more than doubled in volume compared to its level in 1990 and livestock production has almost trebled, primarily on the basis of productivity improvements. The sector makes an important contribution to the country's trade balance. Exports by agriculture and agro-food industries totalled over USD 86 billion in 2013, accounting for 36% of total exports. These exports more than offset deficits in other sectors and have been rising in importance, strengthening the sector's role as an earner of foreign currency. Brazil's agricultural exports make it a major player on international markets. Brazil is the world's second largest agricultural exporter and the biggest supplier of sugar, orange juice and coffee. In 2013 it surpassed the United States as the largest supplier of soybeans and it is a major exporter of tobacco and poultry. It is also a major producer of maize, rice and beef – the majority of which are absorbed by the large domestic market.

The agricultural sector absorbed about 13% of Brazil's employment in 2012, or almost three times its share in GDP. The implied low labour productivity compared to the rest of the economy reflects in part the dualistic nature of farming in Brazil, where capital-intensive and large-scale production co-exists with traditional farms, including many small and resource-poor farms producing for self-consumption or local markets. Nevertheless, the labour productivity gap in agriculture is declining, with rapid improvements in labour productivity driven mainly by more capital-intensive production. Some of that growth occurred among small-scale farms producing high value products. The country is relatively urbanised, with 15% of the population living in rural areas in 2013 (World Bank, 2015). The majority of the poor live in urban areas and spend a significant share of their income on food. The rural poor are less numerous, but the incidence of

poverty is more than double that in urban areas, at nearly 30%. Agriculture is also a buyer and supplier for a significant part of the rest of the economy – the agricultural input sectors, agro-processing and retailing altogether contribute an additional 17% to GDP and around 18% to employment (OECD, 2014).

One of the most outstanding developments of the Brazilian economy over the past decade has been the pronounced reduction in poverty and hunger. A new approach to tackling these problems was implemented in 2003 with the launching of the Zero Hunger Program. The model adopted in Brazil represented a breakthrough, by making the war on poverty and hunger a central policy priority and by recognising that the multi-sectoral dimensions of the problems required concerted actions across government departments, with widened involvement of civil society. This approach has attracted widespread interest internationally, and efforts to implement the Brazilian approach are being pursued in numerous countries of Latin America and also in certain countries of Africa and Asia. In Brazil, as in many other countries, access to food, rather than availability of supplies, was identified as the most significant factor contributing to hunger and food insecurity. Broad-based social protection and development measures aimed at strengthening the inclusion of vulnerable populations in economic growth and improving their access to food were complemented by targeted measures to raise productivity and production among "family" farms.[1] This inclusive approach continues to represent an over-riding national priority as reflected in the Brazil without Extreme Poverty Plan of 2011. While the measures implemented since the early 2000s have been effective in eradicating hunger as measured by the FAO's undernourishment indicator (FAO, 2014), the Government considers that still much remains to be done to tackle poverty, including among rural populations that depend on agriculture for their livelihoods.

The rise in agricultural productivity over the past three decades has had an important impact on access to food supplies in the domestic market. Since the mid-1970s, the prices of basic foods have decreased continuously, raising real incomes and lowering inflationary pressures (Tollini, 2007). Agriculture is also expected to make an increasing contribution to enhanced environmental sustainability through the adoption of policies and implementation of targeted programmes, such as those promoting environmentally sound agricultural practices, incentives to low carbon agricultural initiatives and support to biofuel production.

Finally, agriculture in Brazil is an important contributor to the country's energy supply. Renewable energy from agriculture, comprises of sugarcane biomass (42%), hydraulic energy (28%), firewood (20%) and other sources (10%). These account for almost half of the total energy supply (MME/EPE, 2013b).

For the past twenty years, Brazil's agricultural sector has grown rapidly on the basis of increased productivity, as well as expansion and consolidation of the agricultural frontier in the Centre-West and Northern regions. Although the internal market absorbs the largest part of Brazilian agricultural output, this growth has been mainly driven by the expansion of the production of export-oriented products, especially soybeans, sugar and poultry. The share of these products exported increased sharply in the 1990s, but has generally stabilised. In 2013, China replaced the European Union as the single most important market for Brazil's agriculture-based exports, reinforcing the recent trend towards new commercial partners, such as countries in East Asia and the Pacific, the Middle East, and Latin America.

Agriculture was significant in enabling Brazil to withstand the financial crisis, with high prices for agricultural commodities providing incentives to increase production and contributing to an average of 3.5% real GDP growth per year between 2005 and 2013. However, since 2011, the economy has grown at just over 2% per year, compared with over 8% in China and more than 5% in India. Growth remains hampered by structural weaknesses in the economy, which include weak infrastructure, an onerous indirect tax system, burdensome administrative procedures, low engagement in international trade and low levels of education and skills. As this chapter argues, improvements in these areas have the potential to raise medium-term prospects significantly both for sustained agricultural growth, but also for economic development more widely.

Trends and prospects for Brazilian agriculture

The growth and performance of Brazilian agriculture

Trends in production and productivity

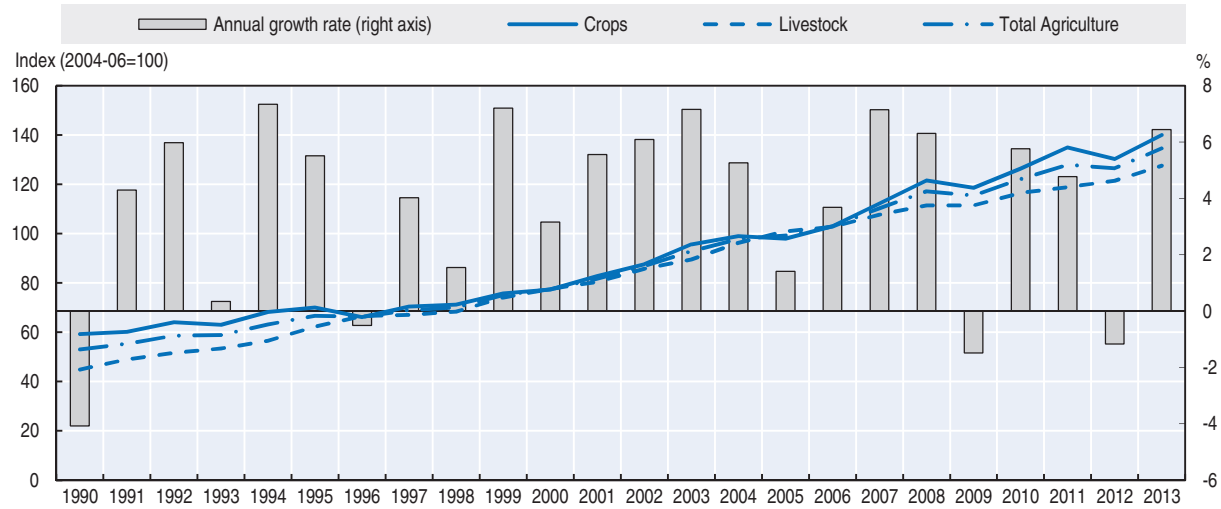
Brazil's varied climate leads to diversified agriculture of both temperate and tropical products. The South and Centre-West regions of the country have higher rainfall, better soils and more developed infrastructure. Farms in these regions use purchased inputs more intensively and are equipped with higher technologies. Central Brazil contains substantial areas of degraded grassland with potential for crop production. Most of Brazil's grains, oilseeds and other export crops are produced in the South and Centre-West regions, although soybean production is increasing in the MaToPiBa region, containing the states of Maranhão, Tocantins, Piauí and Bahia. The North-East and the Amazon basin area lack well-distributed rainfall and good soils, while infrastructure and capital markets remain less developed than in the South and Centre-West regions. Livestock production is an important economic activity in the Centre-West and Amazon regions where production and exports of tropical horticultural products have also increased.

Brazilian agriculture has seen strong growth for over two decades, although not without troughs in certain years as a result of poor harvests. Total agricultural output has more than doubled in volume compared to its level in 1990 and livestock production has almost trebled (Figure 2.1).

Deep economic reforms in the 1990s spurred agricultural growth. The abandonment of the import substitution strategy led to broad trade, exchange rate and domestic market liberalisation. Although the first half of the 1990s proved to be extremely turbulent and destabilising for the agriculture sector, by the end of that decade macroeconomic stabilisation had been achieved. Agricultural policies were liberalised as part of the overall reform: previous production and supply control systems were dismantled and price interventions scaled down and re-instrumented. Trade policy liberalisation removed ICM export taxes, licensing and quantitative restrictions on agro-food. It also abolished state control of wheat, sugar and ethanol trade. Brazil entered key trade agreements, including the Uruguay Round Agreement and the Mercosur Customs Union.

These reforms progressively enabled agricultural resources to be re-allocated to activities where the country has a comparative advantage and to tap the potential of world markets. The farm structure underwent considerable change with the exit of less efficient producers and the development of large farms which have exploited economies of scale and technical progress, particularly in the Centre West. According to the most recent Agricultural Census, from 2006, units of less than 20 hectares constituted two-thirds of the total farm

Figure 2.1. **Brazil's agricultural output, 1990-2013**



Source: FAOSTAT (2015), On-line database accessed on February 23, 2015. FAO, *http://faostat.fao.org/*.

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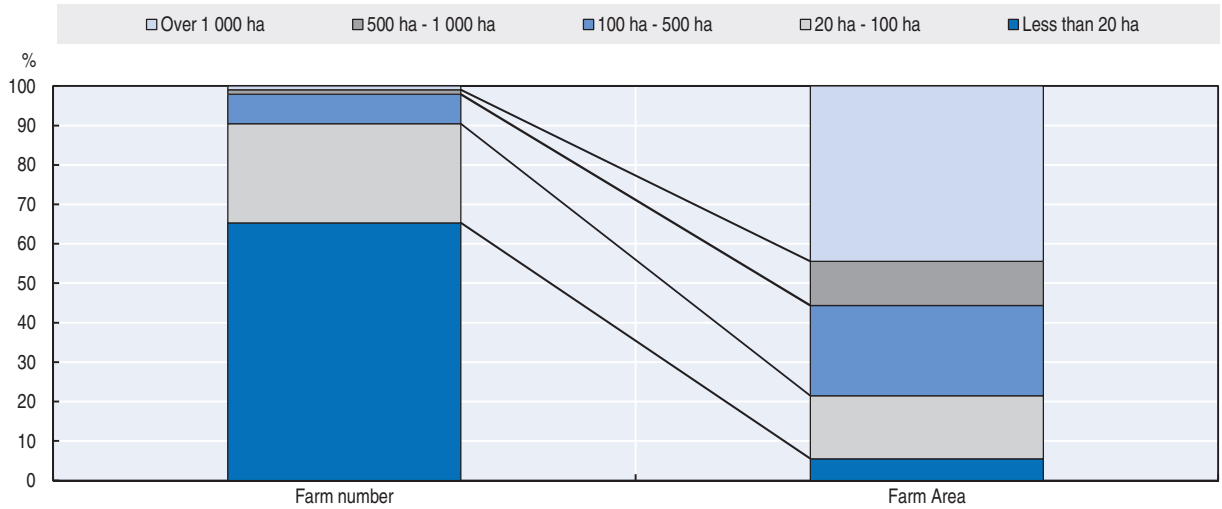
number in Brazil, but occupied less than 5% of farmland. On other hand, holdings of over 1 000 hectares accounted for only 1% of the total farm number and accounted for 44% of farmland (Figure 2.2). To some extent these data reflected the existence of unproductive *latifundia*, although improved macroeconomic stability and the development of financial markets have reduced the incentives for speculative landholding. The data also exclude the more recent effects of agrarian reforms. In the period between 2003 and 2009, nearly 600 000 families were settled in about 48 million hectares. These reforms, which accelerated in the late 1990s, provided free of charge settlement for disadvantaged people on lands and facilitation to purchase land to start up agricultural activity. Established and newly settled small-scale producers received substantial credit concessions and benefitted from a range of other rural development and social programmes targeted to the rural poor.

Figure 2.2. **Brazil's farm structure, 2006**



Source: IBGE (2006).

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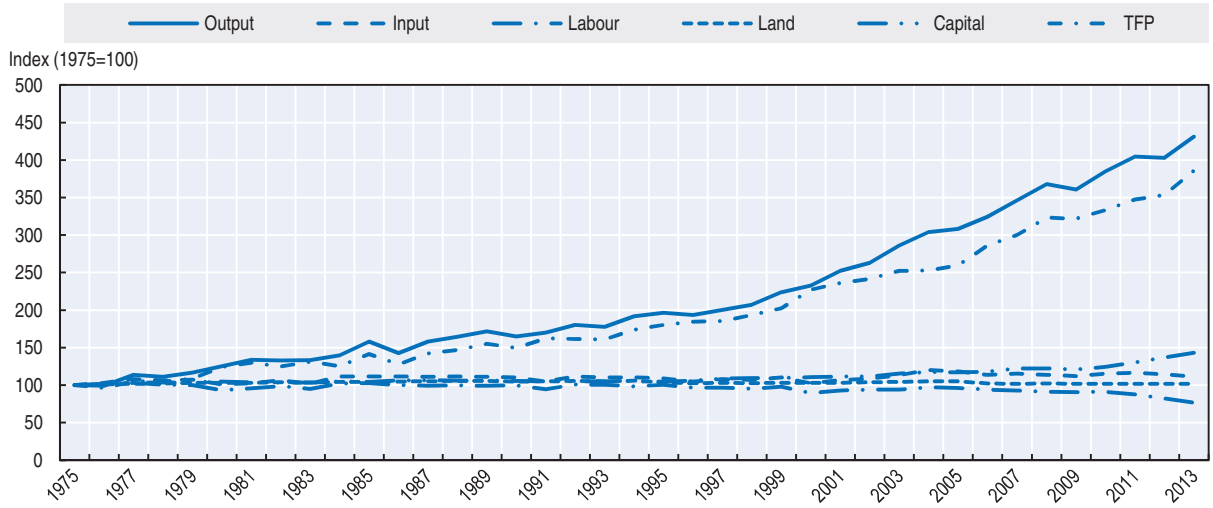
Brazil's agricultural growth has been underpinned by rapidly increasing efficiency in utilisation of production factors, particularly land and labour (Figure 2.3). Indeed, agriculture was the dominant driver of labour productivity within the overall economy, contributing 85% to the aggregate labour productivity growth in the four sectors (agriculture, manufacturing, mining and services) between 2002 and 2007, and almost one-half between 2007 and 2012 (OECD, 2013b). Productivity improvements were in part an effect of capital replacing labour, with agriculture's share of employment falling from 18% in 2002 to less than 13% in 2012. Policy stimulus has propelled the rapid mechanisation and replacement of obsolete machinery in agriculture between the mid-1970s and mid-1990s; for example, the total tractor fleet more than trebled during this period and the value of the machinery and equipment stock more than doubled in constant prices (FAOSTAT, 2013).

Brazil has emerged as one of the top global performers in agricultural Total Factor Productivity (TFP) growth. Of the 172 countries covered in a study by USDA,[2] it ranked 12th by the rate of TFP growth between 2001 and 2010. Brazil demonstrated the strongest TFP improvements in agriculture among the BRIICS and the OECD countries. According to data from Gasques et al. (2014), TFP growth in Brazilian agriculture increased 3.5% per year between 1975 and 2013 with a higher rate of over 4% from the start of the new century (Figure 2.3). This contrasts with the trends in the rest of the economy, where growth was achieved mostly due to increased employment of productive factors, with the rate of TFP growth slowing (OECD, 2013b).

Figure 2.3. **Trends in agricultural output and Total Factor Productivity in Brazil, 1975-2013**



Source: Gasques et al. (2014).

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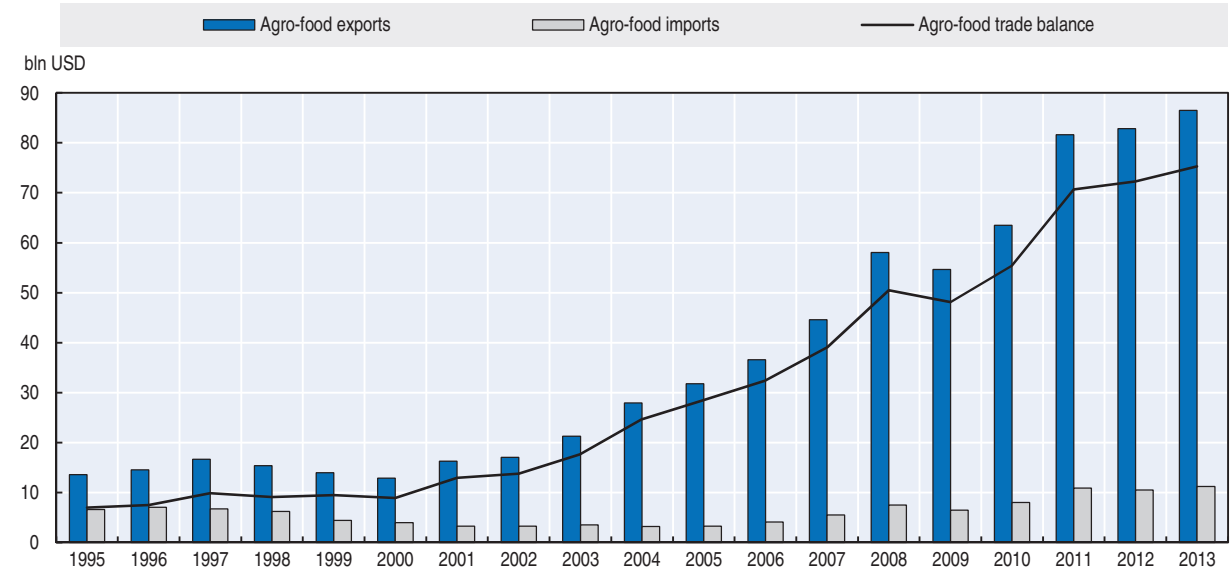
Among the factors underpinning the growth of productivity are the longstanding investments in agricultural research that have enabled Brazil to achieve the most advanced technology for tropical agriculture. That research made better crop and livestock technologies available to producers and the agro-industry, notably tropical technologies making possible the incorporation of Brazilian *cerrados* (savannah areas) into productive use. Most important were the technologies of nitrogen fixation, particularly in soybean varieties, no-tillage systems and the emergence of new grain varieties and livestock breeds adapted to the tropics. Productivity improvements over the past fifteen years were

facilitated by economic reforms, which enabled the re-allocation of resources and the structural changes in agriculture and its associated industries. By establishing a more competitive environment, the economic reforms also strengthened producer incentives to increase productivity and therefore to uptake innovations.

Trends in agricultural and agri-food trade

Brazil is a large exporter of agricultural products with a trade surplus of USD 78.6 billion in 2013.[3] With economic liberalisation and rapid growth of demand from emerging economies, particularly China, agro-food exports have grown rapidly (Figure 2.4). The export growth was influenced also in some years, by large depreciation of the domestic currency. Brazil's largest trading partners are the European Union, China, the United States, Japan, the Russian Federation and Saudi Arabia. Despite exporting large volumes of agricultural products, most of the production is consumed domestically.

Figure 2.4. **Brazil's agro-food trade, 1995-2013**



Source: UN Comtrade Database (2013).

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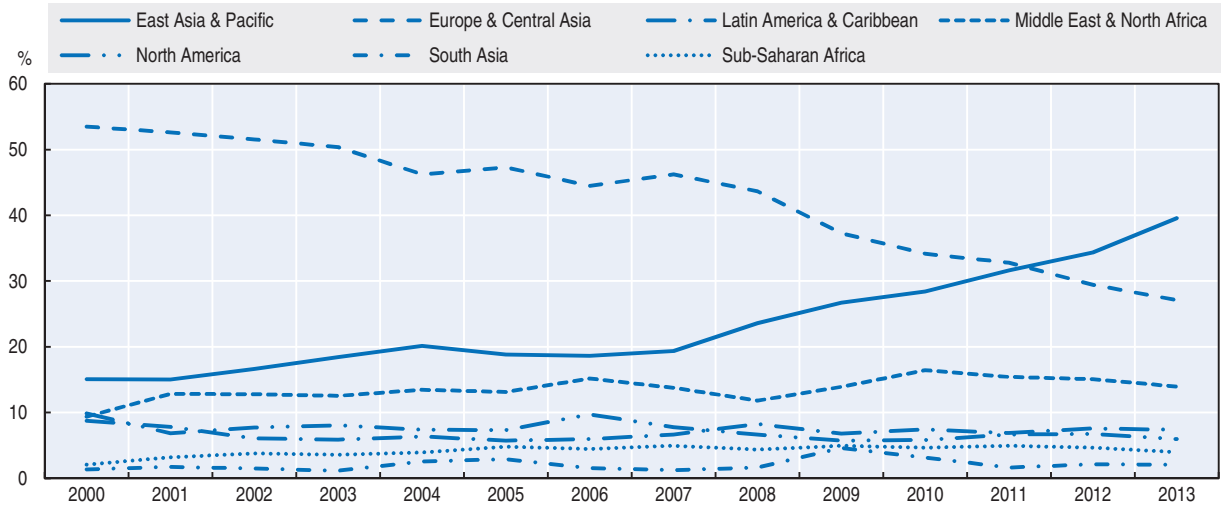
Brazil's exposure to international trade is less than the other BRIICS or other comparable size economies, partly due to the size of the domestic market. Trade (imports plus exports) as a share of GDP in 2013 in Brazil accounted for about 28% of GDP compared with an average of over 50% in the other BRIICS economies, 60% among the group of upper middle income countries to which Brazil belongs, 47% for Brazil's developing Latin American neighbours and a world average of 60%. Among major economies, only the United States, an economy that is almost eight times bigger has comparably small share. Brazil has become the second largest exporter of agricultural and agro-food products in the world behind the United States rising from fourth place in 2000. In 2013, Brazil agricultural exports (as defined at the WTO) totalled USD 89.5 billion (about 9% of world total), compared with USD 14.3 billion in 2000 (4.5% of world total). The share of agricultural exports in total export earnings increased from 25% to 36% over the same period.

The destination of Brazilian agricultural exports has evolved considerably over the past fifteen years. In 2000, countries located in Europe and Central Asia were the dominant partners taking more than 53% of Brazil's agricultural exports. East Asia and the Pacific was a distant second destination, accounting for about 15% of Brazil's agricultural exports. By 2013, countries in East Asia and Pacific bought almost 40% of Brazil's agricultural goods, while countries in Europe and Central Asia took 27% (Figure 2.5).

Figure 2.5. **Destination of Brazilian agricultural exports, 2000-2013**



Source: UN Comtrade Database (2013).

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The rising importance of the East Asia and Pacific region derives from China's demand for Brazilian agricultural products. In 2000, China was the 11th most important import market demanding less than USD 0.5 billion or 3% of the total. By 2013, China was the largest demander of Brazilian agricultural produce, buying almost USD 20.5 billion, or 23% of the total. The second biggest market for Brazilian agricultural goods in 2013 was the European Union, importing almost USD 18.3 billion (almost 20% of total), followed by the United States importing roughly USD 4.6 billion.

Although Brazil exports to more than 180 countries, a relatively small number of countries take up most of the produce. In 2000, the top ten markets (includes individual EU members) bought 57% of Brazil's total agricultural exports and the top 20 accounted for 75%; by 2012 these shares were 56% and 72% respectively.

The type of agricultural products that Brazil exports has also changed since the start of the century. Segregating the agricultural products into four broad categories based on their degree of processing, in 2000 the largest export category was processed products such as juices, fresh or frozen meat valued at USD 5 billion or 35% of exports followed closely by exports of bulk products such as soybeans and coffee valued at USD 4.8 billion or 33% of the total. Horticultural products such as fresh fruits and vegetables were a relatively minor part of exports valued at USD 567 million (4% of total). By 2013, Brazil's exports had become more specialised, with exports of bulk products totalling USD 39.5 billion or 44% of total agricultural exports, and exports of processed products, although also expanding to USD 26.7 billion accounting for 30% of the total. Exports of horticultural products accounted less than 2% of total exports, despite almost trebling since 2000 to USD 1.4 billion.

Brazil is relatively heavily dependent upon a few products to generate most of its export earnings from the sector. In 2013, soybean exports totalled USD 23 billion, representing 26% of agricultural export earnings. The top ten products generated almost 82% of export earnings from agricultural goods – compared to 79% in 2000 (MAPA, Intercambio Comercial do Agronegócio: principais mercados de destino, 2013). The composition of the top products and relative rankings changed somewhat between the two years however with maize and ethyl alcohol surpassing soybean oil and prepared meats. The rise in ethyl alcohol exports, which was driven by US biofuel policy, is not projected to be sustained in the current *Outlook*.

In addition, Brazil is relatively unintegrated with global value chains, with a modest 10% of intermediate inputs originating overseas, while a relatively small share of Brazilian exports are used by other economies to generate their own exports. One explanation is Brazil's relatively high protection of its manufacturing sector.

While Brazil has increased its export share of the international agricultural and food market, its imports of food and its products have also risen. An increase from USD 4.1 billion in 2000 to USD 11.1 billion in 2013 covered domestic shortfalls in certain commodities, and provided consumers with additional choices. Imports of wheat account for about 20% of the imported value, while other major imports include dairy products, olive oil and various food preparations.

Development of the Brazilian ethanol industry

The blending of sugarcane based ethanol with gasoline in Brazil dates back to 1931. Cheap crude oil prices after the Second World War meant that the blending of ethanol into regular gasoline was not commercially viable. However, in November 1975 in response to the first crude oil crisis, the Brazilian government created the National Alcohol Program, "Proálcool". This programme enacted the obligatory blending of anhydrous ethanol with gasoline (hereafter referred as gasohol) for fuels used by ordinary cars, which enabled the sugarcane based ethanol industry to increase its producing capacities. Proálcool successfully reduced the impact of the oil crisis on the Brazilian trade balance and increased the country's energy self-sufficiency. Nevertheless, when the second oil crisis occurred in 1979, Brazil was still importing the majority of its oil which renewed the government's focus on Proálcool and led to increased subsidies for both producers and consumers and credit for investment into the sector. The first car running on hydrous ethanol was launched in 1979.

A succession of factors in the second half of the 1980s, including the downward oil price shock, increased international sugar prices, the debt crisis and deregulation of the Brazilian economy, reduced the profitability of the ethanol sector until the early 2000s when it became the target of massive investments. Growing concerns about global warming, greenhouse gas emission and energy security led a certain number of developed and developing countries to implement ambitious biofuel targets or mandates as well as other support measures to the biofuel sector. Under the Renewable Fuel Standard (RFS2), set in 2007 in the United States, Brazilian sugarcane based ethanol qualified as an advanced fuel, which increased demand for Brazilian ethanol on the international market.

In addition, the introduction of flex-fuel vehicles in March 2003 contributed to the rebound of the ethanol industry. This new technology was widely accepted by automobile manufacturers and consumers (MME/EPE, 2013a): In 2004, flex-fuel vehicles represented 22% of light vehicles sales in Brazil. In 2014, their share reached more than 88%. Domestic Brazilian

ethanol demand jumped from about four billion litres in 2003 to 16.5 billion in 2009, with an annual growth rate exceeding 15% (MME/EPE, 2014) boosted by the increase in fuel use and by the competitive price of hydrous ethanol with respect to gasohol. During the same period, total ethanol production increased from 14.5 to 26.1 billion litres, in order to meet not only domestic demand, but also international contracts and other uses. This boost in production was made possible by extensive debt financing from the sugar and ethanol industries.

The global economic crisis at the end of the last decade interrupted the upward trend of the Brazilian ethanol industry, reducing the construction of new plants and capital investment in the existing units. As a consequence, the expansion of sugarcane production fell. This was felt strongly from 2010, as the sector was highly indebted and investments were cut, which resulted in higher production costs. This, along with several climatic problems that resulted in low sugarcane yields, contributed to the rise in the international sugar price amplified the negative impacts on the ethanol industry.

From 2006, Brazil's fossil fuel pricing policy, adopted in order to contain inflation and applied by Petrobras,[4] kept the Brazilian gasoline price insulated from the crude oil price fluctuations in the international market. This affected ethanol prices and profits of the ethanol industry. Uncertainty concerning the future of biofuel policies in the United States and to a lesser extent in the European Union added to the ethanol crisis. Given the strong decrease of international crude oil prices in 2014, Brazilian petrol retail prices are at present slightly above international prices. This coupled with differentiated taxation between ethanol and gasohol as well as the increased blending requirement for anhydrous ethanol that entered in place in 2015 should help the Brazilian ethanol industry in the short term.

Sustainability performance of agriculture

Although driven mainly by strongly increasing productivity, agricultural growth was also associated with an expansion of agricultural land, which increased by 34 million hectares between 1990 and 2012. On a global scale, this was one of the largest expansions during that time period. In the first half of the 1990s, this occurred mostly due to the outstretching of pastureland – a process driven by the introduction of new land management technologies and policy stimulus, but which virtually stopped by the end of that decade. Since then, agricultural land has increased mainly due to expansion of arable areas, which in over only four crop years, 2000/01 to 2003/04, soared by 9 million hectares, with soybean plantings increasing by 50%. The expansion of soybean area, particularly in the Centre West, has in turn boosted plantings of crops that are rotated with soybeans, notably second crop maize and cotton.

Recent decades have also seen a shrinking of native forest land, the share of which in total land fell from 68% to 61% between 1990 and 2011. There is continued debate on how and to what degree agriculture contributed directly or indirectly to this process.[5] A significant share of deforestation was due to illegal logging activities, with cleared land subsequently used for pasture. This led to concerns regarding the expansion of agriculture in the Amazon region in particular, which together with surrounding *cerrado* savannah contains the largest portion of the world's terrestrial biodiversity. The accumulated area of deforestation in the legal Amazon[6] increased from 43 million hectares in 1990 to 75 million hectares in 2010 (IBGE, 2013). Since the mid-2000s, Amazon deforestation rates have been consistently decelerating, reflecting progressive tightening of land use monitoring. This trend was temporarily reversed with a rise in deforestation in 2013 of 5 891 km^2, but the latest estimates for 2014 indicate a reduction of 18% to 4 848 km^2 (National Institute for

Spatial Research). Some analyses tend to link recent deforestation rates with infrastructure projects carried out in the Amazon region, rather than with the expansion of agriculture (FGV, 2013). The environmental impact of agricultural expansion in the Amazon region and *cerrado* has received much public attention, both nationally and internationally.

The available data suggest that fertiliser and agricultural chemical use in Brazil has intensified. However, according to the 2006 Agricultural Census, almost 70% of farms reported they did not use any fertiliser during the census year, and the same share reported no use of agricultural chemicals. This implies that the impacts of fertiliser and chemical use are strongly differentiated by the type of agricultural system and by region (Helfand et al., 2013). Given the abundance of rainfall and water resources, the importance of irrigation in Brazil is small, with only around 2% of agricultural land equipped with irrigation. This share, nevertheless, has tended to increase since 1990, with agriculture currently making almost 60% of annual freshwater withdrawals. Brazil ranks fifth worldwide in terms of overall greenhouse gas (GHG) emissions, although total emissions have fallen sharply as a result of reduced deforestation. Agriculture is a significant source of GHG emissions, as a result of both land-use change and considerable growth in livestock inventories, which rose by almost 40% between 1990 and 2010 in cattle equivalents, among the most important increases globally (USDA, 2013). The expansion of inventory doubled livestock density, from 3 heads per hectare of agricultural land in 1990 to 6 heads in 2011. These levels are comparable with those in New Zealand where a pastoral system prevails, but are low compared to world regions with more intensive livestock production (e.g. the European Union with an average total cattle number per hectare of 9.6 heads).

Average figures for Brazil disguise substantial differentiation in the nature and scale of environmental pressures across Brazil resulting from different farming systems. For example, commercial farming in the southern states of Rio Grande do Sul, São Paulo and Paraná is input intensive, with high fertiliser use. Farming systems in these areas are associated with concerns on the impact of agricultural water use on resource levels, and pesticide use on water quality. In the Centre West farming systems are more extensive. Farmers in these regions increasingly use direct planting which also reduces the risks of erosion; however, a loss of natural forest cover and biodiversity is a significant concern in these parts of the country (OECD, 2005). The use of no tillage or minimum tillage practices (direct planting) mitigates some of the pressures on the soil and requires less fuel. At the same time it facilitates the use of double or even triple cropping. Direct planting is also associated with the use of GMOs, which leads to less use of pesticides.

Brazil's agricultural outlook

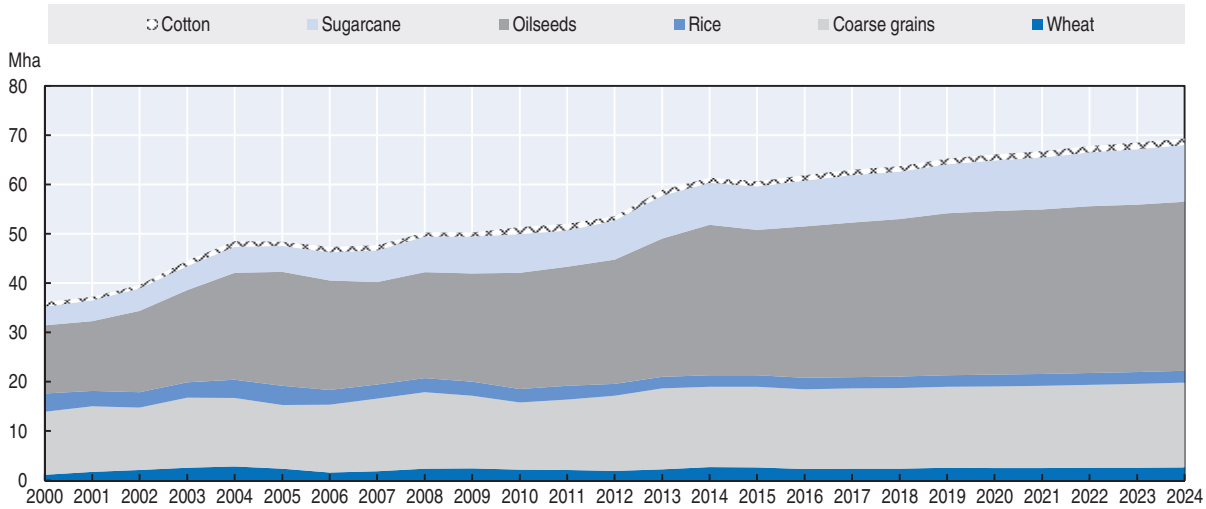
The outlook for Brazilian agriculture remains positive, despite the prospect of slower growth in both domestic and international demand, and declining real prices for most agricultural commodities. On the supply side, producers are expected to benefit from continued productivity growth, complemented by a depreciating Brazilian real (BRL). The current projections assume that there are no significant changes to agricultural policy settings over the next ten years, and that "normal" weather with no severe events prevails from one year to the next. Projections for macroeconomic changes in Brazil and the rest of the world are based on the *OECD Economic Outlook* (November 2014) and the International Monetary Fund's, *World Economic Outlook* (October 2014), while international oil prices are projected to grow at the same rate as projected by the IEA's *World Economic Outlook* (see Chapter 1). Changes in any of these assumptions can significantly alter the projections.

Brazil exhibited relatively strong growth in real income averaging 3.5% per annum from 2000 to 2007. With the onset of the global financial crisis, growth diminished somewhat from 2008 to 2013 averaging 3.1% per annum. Until 2016, growth is not expected to exceed 2% per year. From 2017 to the end of the projection period, real GDP growth is expected to average 2.6% per annum. The exchange rate of the Brazilian real (BRL) relative to the USD is expected to depreciate throughout the outlook period making Brazil's export sectors more competitive in world markets but also increasing the cost of imports. This is not expected to put undue pressure on consumer prices, with inflation remaining low.

Crops

During the next ten years, Brazil's crop sector is expected to continue growing on the basis of yield growth and increase in agricultural area. Producer prices are expected to rise briskly during the next ten years, but when adjusted for inflation, crop prices are relatively flat. Land use for the major crops in 2024, (oilseeds, coarse grains, rice, wheat, sugarcane and cotton), is expected to reach 69.4 million hectares (Mha), 20% greater than the average area used during the three years 2012-14, representing a growth rate of some 1.5% per annum (Figure 2.6).[7] In relative terms, this area expansion is primarily driven by the 37% (relative to the base period)[8] expected increase in land allocated to sugarcane production, followed by the 35% and 23% increase in area allocated to cotcoarse grains, domestic feed demand for an expanding livestock sector accounts for most of the additionalexpected to tas expton and oilseed production respectively. In absolute terms however, oilseeds, predominantly soybeans, will continue to dominate land use in Brazil over the next ten years taking up almost half of the additional crop area in 2024.

Figure 2.6. **Trend in land used for crop production in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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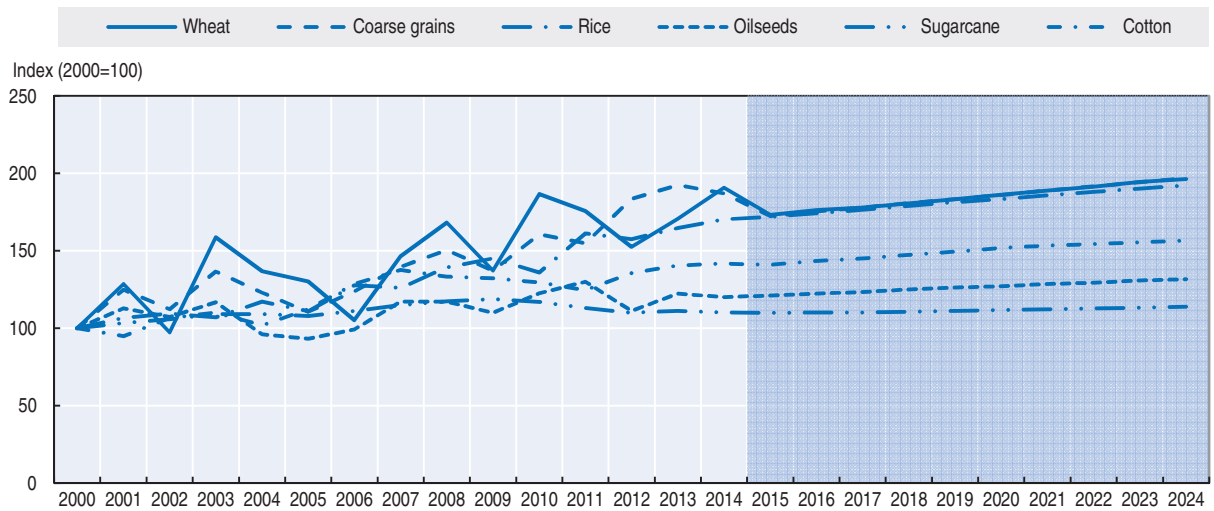
A growing domestic market is expected to take up most of the additional coarse grains and sugarcane production. In the case of coarse grains, domestic feed demand for an expanding livestock sector accounts for most of the additional production whereas in the case of sugarcane it is the expanding ethanol market. Consequently, for these crops, the share of production going to international markets is relatively flat during the next ten

years. This is not the case for cotton or oilseeds, where the projections indicate that the world markets draw a larger share of production.

Productivity is also expected to improve over the coming ten years but at different rates across crops (Figure 2.7). Lack of investment in the sugarcane sector in the recent past, coupled with adverse weather conditions led to below average yields. Investment in the highly mechanised sugarcane plantations is expected to increase during the outlook period, leading to marginal yield improvements which nonetheless, do not reach previous peaks. Similarly, oilseed yields are not expected to improve substantially in the course of the next ten years. In contrast, productivity gains in cereals – coarse grains, wheat and rice – increase substantially, while cotton yields increase more moderately (Figure 2.7).

Figure 2.7. **Growth in yields for cereals, sugarcane and cotton in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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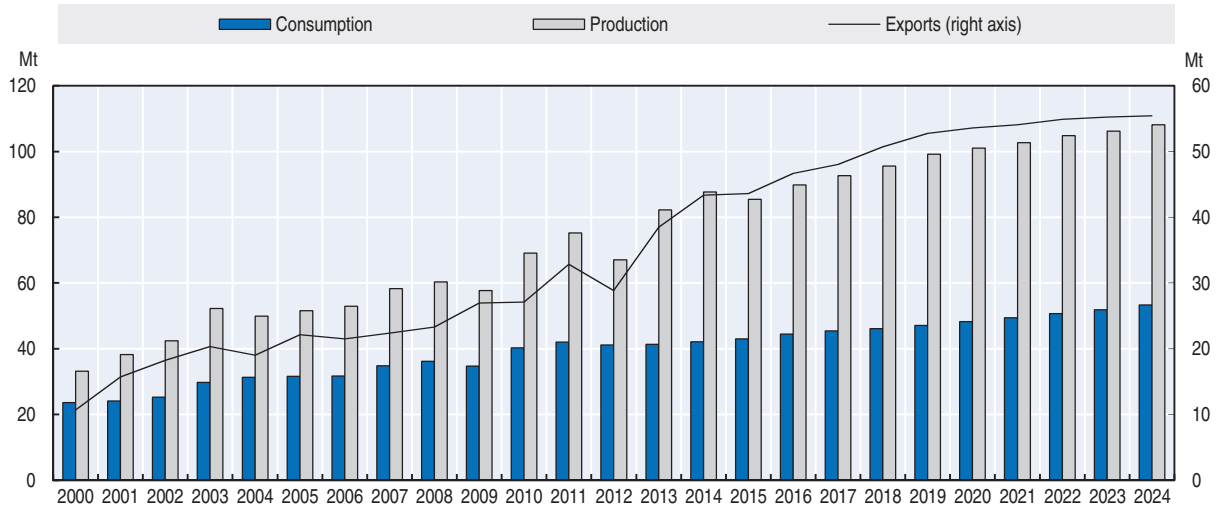
Oilseeds

Soybeans are expected to continue to be Brazil's most important agricultural product. Currently, Brazil is the second largest producer behind the United States but during the outlook period, the difference is expected to narrow as soybean production in Brazil will continue to expand. Among the large oilseed producing and exporting countries, Brazil has the greatest potential to expand production. It is as productive as the United States (average yields are about the same) but has a large available land base to produce soybeans, whereas the United States is more competitive in producing maize, which limits its potential to shift large swaths of area into soybeans to meet future oilseed demand.

Producer prices are expected to remain relatively strong during the projection period rising by 6.9% per annum. This gives support to oilseed production, which is expected to increase by 2.5% per annum during the projection period, to 108 million tonnes (Mt) (Figure 2.8).[9] Most of the expected production increase comes from a 23% increase in area harvested to 34.3 million hectares (Mha) in 2024, as average yield is expected to increase modestly to 3.15 t/ha in 2024. The additional land to produce soybeans is expected to come mostly from the MaToPiBa region, which includes Maranhão, Tocantins, Piauí and Bahia States, and is not expected to compete with other cropland or reduce land allocated to other crops.

Figure 2.8. **Production, consumption and exports of oilseeds in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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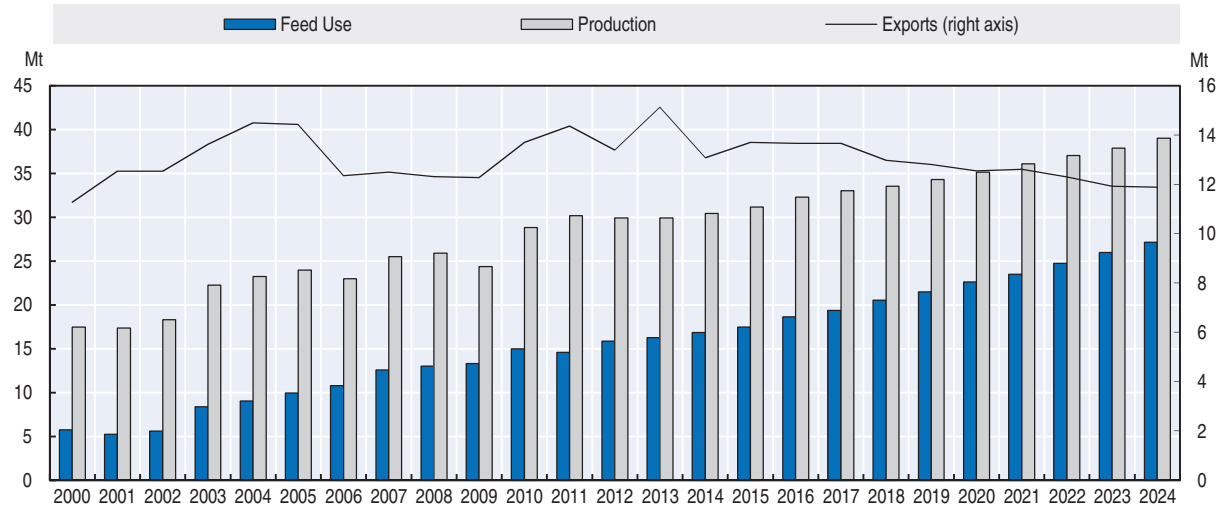
Consumption of oilseeds is also expected to increase over the projection period but at a slower rate than production (2.3% per annum) to 53.3 Mt. The growing domestic surplus (the gap between production and domestic consumption) will be exported.

Soybeans are expected to continue being the most lucrative export product with more than half of Brazilian production destined for world markets. Valued at domestic producer prices, these exports generate BRL 87.5 billion (USD 22.8 billion) in 2024. China has been the world's largest import market for soybeans and Brazil's largest customer. Brazil also became China's largest supplier in 2013 surpassing the United States. This *Outlook* is conditional on China's strong demand for imported soybeans continuing, and most of this additional demand coming mostly from Brazil, the country with the most potential to expand production in the coming years. Should this demand falter, or should China's food security concerns push for increased diversification in import sources, Brazil may have to quickly adjust production given the size of alternative import markets. As illustrated in Box 2.1, should China's demand weaken not only will Brazil's oilseeds exports to China fall, oilseeds export to other countries will also decline. Without alternative international markets, Brazil's oilseed production and exports fall below the baseline.

Brazil not only produces a large quantity of soybeans, it also has a considerable crushing sector producing soybean meal and soybean oil. Although most of Brazil's soybean production is for export markets, domestic demand for crush is expected to continue increasing. Demand for crush is expected to grow by around 2.3% per annum during the period so that by the end of the projection period, demand for crush is expected to reach almost 47.1 Mt, some 27% above the base period (Figure 2.9). Higher crush results in higher protein meal production which grows to 39 Mt in 2024. Most of the additional production stays at home to feed the pork and poultry sectors with feed use increasing by 4.9% per annum to more than 27 Mt, some 66% higher than the base. However, crushing capacity is not expected to expand sufficiently quickly to keep pace with rising domestic demand for soybean meal from the poultry and pork sectors. Additional domestic demand is expected to reduce exportable surplus resulting in declining exports of soybean meal.

Protein meal exports decline to about 11.9 Mt from almost 14 Mt in the base period. Nonetheless, Brazil will continue to edge the United States as the second largest exporter of soybean meal.

Figure 2.9. **Protein meal production, feed use and exports in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

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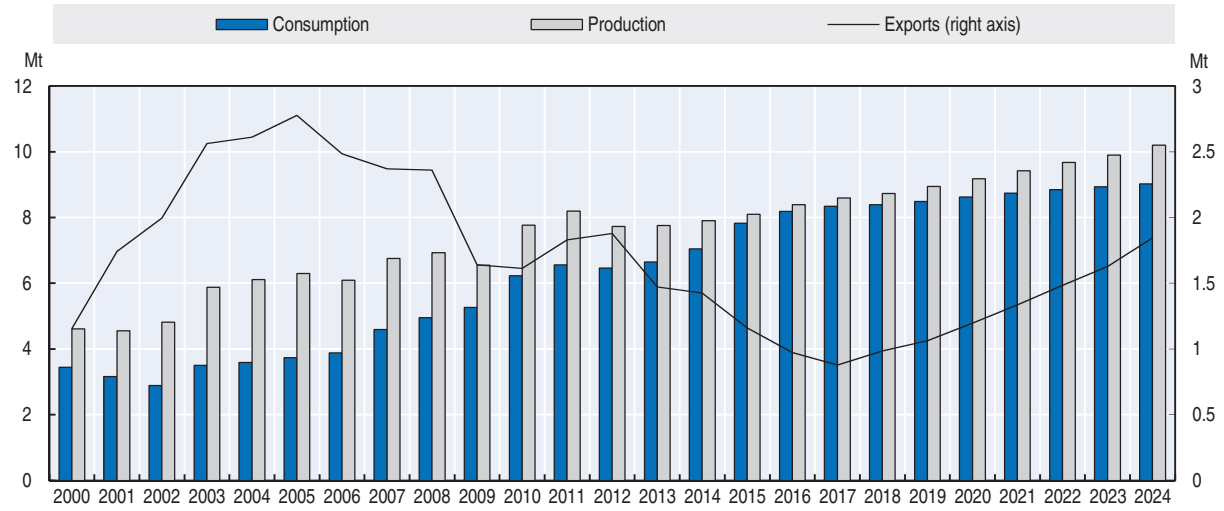
The additional crush demand for soybean meal will result in increasing supply of soybean oil. Production of vegetable oil grows at an average annual rate of 2.5% rising to 10.2 Mt by 2024 some 31% above the base period. However, domestic demand for vegetable oil for human consumption will grow at a slower rate. Demand of vegetable oil for human consumption grows at only 2.2% per annum to about 5.2 Mt (Figure 2.10). Per capita consumption of vegetable oil is expected to increase by around 1.5% per year to reach 24.2 kg per person.

Figure 2.10. **Production, consumption and exports of vegetable oils in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

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An additional source of domestic demand for vegetable oil is for the production of biodiesel. Total consumption of vegetable oil grows at 1.4% per annum to 9 Mt some 34% higher than the base period. During the first half of the projection period, biodiesel demand is expected to increase strongly due to the domestic blending mandate. Slower food demand and biodiesel production in the second half of the outlook period will lead to increasing exportable surplus. Vegetable oil exports are expected at 1.8 Mt in 2024 almost unchanged from 1.6 Mt in the base period.

Box 2.1. **Impact of China's economic growth on Brazil's agricultural exports**

As a major agricultural exporter, Brazil's agricultural commodity markets are affected by developments in major importing countries, especially China. Brazil's agricultural exports to China have surged since 2000, especially in the last five years and the main exports are oilseeds, vegetable oil, cotton, sugar and poultry. In 2014, about 71% of total oilseeds exports (31 Mt), or 35% of Brazil's total production, were exported to China, which also accounted for about 40% of China's total oilseeds imports. The export shares of vegetable oil and cotton to China in Brazil's total export were also high in 2014, at 28% and 24% respectively. The export shares of sugar and poultry to China in Brazil's total export were smaller at 9.5% and 6.4% respectively.

After more than three decades of rapid growth, China's economy is entering a "new normal" with a lower growth path. The Chinese government lowered its target growth rate to around 7% for 2015 seeking more sustainable development. For the *Outlook*, economic growth is expected to continue moderating, falling to 4.2% in 2024. As a consequence, Brazil's agricultural exports to China will slow down in the outlook period. While oilseeds exports from Brazil to China will increase to 47 Mt in 2024, during the outlook period, the exports will grow by only 3.9% p.a, compared with 18.9% p.a. in the previous decade. Also exports of sugar, cotton and poultry are projected to expand more slowly than before. Brazil's exports of vegetable oil to China reached a high of 0.95 Mt in 2012, but decreased sharply to 0.36 Mt in 2014. Considering China imports more oilseeds for domestic crushing, which will substitute for the import of vegetable oil, vegetable oil imports are expected to continue the downward trend to 0.2 Mt in 2024.

However, China faces many uncertainties in the future as its economy transitions, and its economic performance and consequent import demand will affect Brazil. To assess the quantitative impacts, two different scenarios altering China's economic growth rate were implemented: an optimistic one in which economic growth each year is 25% higher than in the baseline, and a pessimistic one in which annual growth is 25% lower than in the baseline.

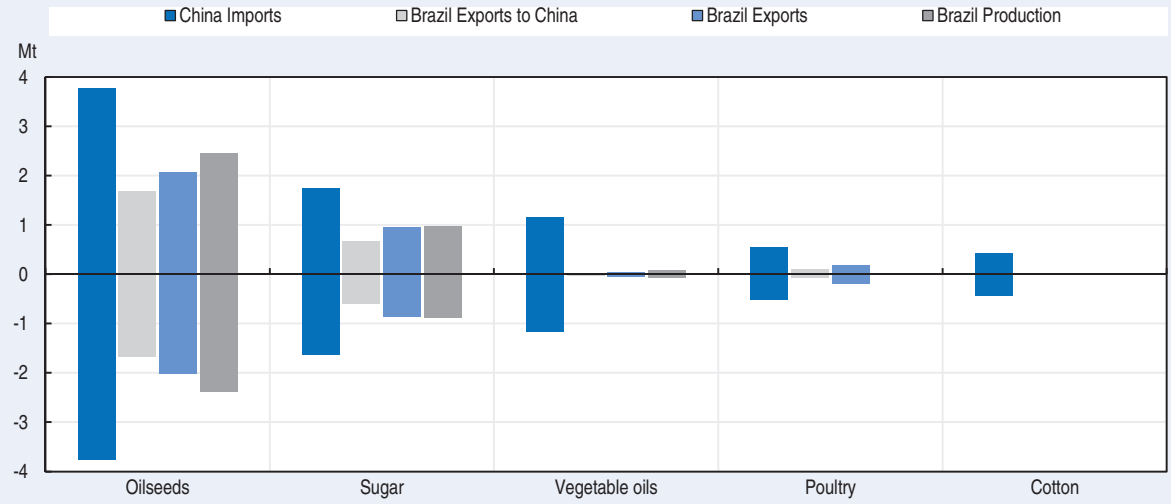
As expected, Brazil's agricultural exports are affected by China's economic performance. The impacts occur not only directly through bilateral trade, but also indirectly through changing world prices, which are to varying degrees transmitted to domestic markets of all countries, including Brazil. Figure 2.11 shows the extent to which China will import more (less) agricultural products from all suppliers, including from Brazil if the economy grows faster (slower) than in the baseline. Under the higher growth scenario, the increase in Chinese imports will raise world prices, which will lead producers to increase their production and consumers to reduce their consumption. The results show that the overall impacts on Brazil's production and total exports are positive, and oilseeds and sugar account for a sizeable share of the overall increase. In general, Brazilian production will increase relative to other suppliers, as the supply of land is more elastic and there is greater scope to increase the intensity of production. However, the impacts are almost opposite and symmetrical if China's economic growth is lower than in the baseline.

Box 2.1. **Impact of China's economic growth on Brazil's agricultural exports** *(cont.)*

The impacts on Brazil's oilseeds market are the largest, followed by vegetable oil and sugar; the impacts on cotton and poultry seem modest. For example, in high growth scenario, China's total oilseeds import demand increases by 2.9 Mt, or 2.9% compared to the baseline in 2024, and about half of the increased import demand (1.5 Mt) is met by Brazil. The producer price of oilseeds in Brazil increases by 2.6% due to the expanded market, which stimulates a total production increase of 2.4 Mt. The results show that Brazil's oilseed exports to other countries will increase slightly due to the country's comparative advantage in producing this product. Brazil's total oilseeds export increases by 1.9 Mt from the baseline in 2024. The annual average growth rates of Brazil's total oilseeds exports and production during the next decade are 2.9% and 2.4% higher, respectively. However, if Chinese economic growth is worse than in the baseline, not only will Brazil's oilseeds exports to China be 1.4 Mt lower in 2024, the country's oilseeds export to the other countries will decline by a further 0.4 Mt, which leads to decreases in both total exports and production of 3.2% p.a. and 2.1% p.a. from the baseline, respectively. The results also show the same trends for other commodities, with a strong pass-through from Chinese imports to Brazilian exports in the cases of sugar and poultry, but much weaker transmission for vegetable oil and cotton.

Figure 2.11. **Impact of higher or lower economic growth in China's on Brazil's agricultural sector**

Absolute changes compared to the baseline in 2024



Source: OECD and FAO Secretariats.

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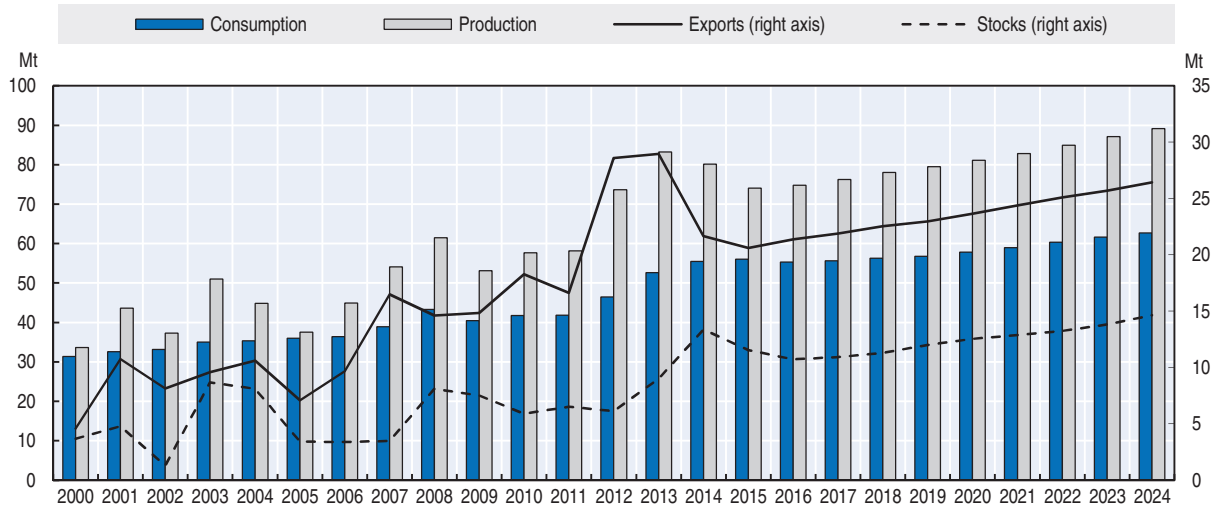
Coarse grains

Maize is by far the dominant coarse grain grown and consumed in Brazil. Coarse grain demand is dominated by feed use. Feed use is expected to increase following a small decline in 2016, growing at 1.5% per year during the projection period to about 49.9 Mt by 2024, 23% above base period volume, more than keeping pace with the assumed increase in the production of non-ruminant meat (Figure 2.12). Total use increases at an average rate of 1.4% per year to reach 62.7 Mt in 2024, 22% above the base period level.

The producer price is expected to increase at a rate of 5.5% per annum, thus bolstering coarse grain production which is expected to total more than 89 Mt by the end of the outlook period. This will be underpinned by a moderate expansion in area harvested and

Figure 2.12. **Coarse grains production, consumption, exports and stocks in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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by yield improvements, which continue at recent trends and reach a new high of 5.2 t/ha in 2024. Production is expected to rise faster than domestic consumption, resulting in rising net exports that are back up to the base period level of 26.4 Mt by 2024. Brazil has build-up stocks that have reached relatively high levels compared to use. Expectations are for stock-to-use ratios to fall modestly during the early projection years, with a gradually rebuilding in the second half of the decade, such that the stocks-to-use ratio reaches 23% in 2024.

Wheat

Demand for wheat in Brazil is dominated by food use which represents 95% of total consumption. Demand for human consumption is expected to continue to increase but below the trend in the last decade. Food demand for wheat is expected to total 11 Mt in 2024, 4% higher than the base. With rising population the result is a slight decrease in per capita consumption. Feed and other uses for wheat are expected to remain relatively flat so that total consumption in 2024 is about 11.5 Mt.

The producer price is expected to increase during the outlook period rising about 6.4% per annum incentivising production. Area harvested is expected to decline somewhat at the beginning of the outlook and then increase slowly during the remainder of the projection period, totalling 2.6 Mha in 2024. Production is expected to increase primarily through increasing yield. Average yield is expected to grow about 1% per annum to almost 3 t/ha in 2024. Production increases from about 6 Mt in the base to 7.8 Mt in 2024. Rising domestic supply is sufficient to keep pace with demand and imports remaining relatively flat. With the import price increasing an average of 6.4% per year, imports of 6.6 Mt in 2024 are slightly below the base period value of 6.7 Mt. Wheat stocks in 2012 fell to very low levels which were replenished in the subsequent two years. There may have been overshooting and in 2014 stocks are estimated at 1.8 Mt yielding a relatively high stocks-to-use ratio of 16%. During the course of the outlook stocks are expected to grow with demand so that a relatively more stable stock to use ratio of 11% is expected.

Rice

Rice, along with wheat and pulses, is an important part of the Brazilian diet. During the course of the next ten years, rice production is expected to increase at an average annual rate of 1.6% to 9.5 Mt, mostly as a result of improvements in average yield as harvested area is not expected to change materially. Harvested area remains relatively flat at around 2.4 Mha while yield is expected to increase by almost 1.3% per annum to almost 4 t/ha. Consumption on the other hand is expected to be relatively flat growing only to 8.7 Mt by 2024. Consequently, Brazil's exportable surplus grows somewhat during the outlook confirming Brazil's switch from a rice importer to a rice exporter. Even with a rising population however, consumption keeps pace and per capita consumption remains at about 40 kg during the period.

Sugar

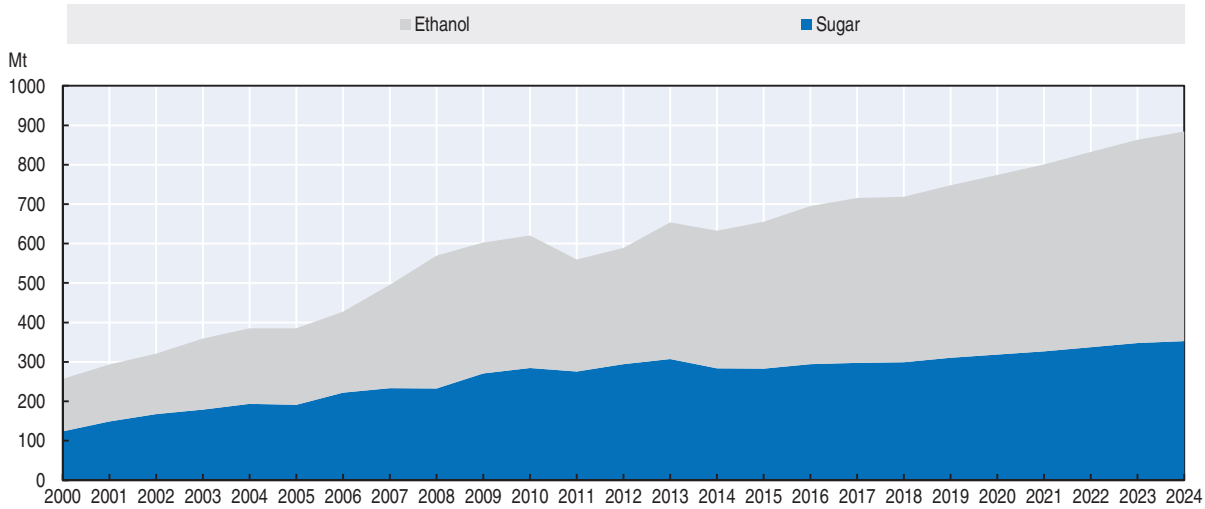
Brazil continues and will continue to be the world's largest sugar producer and exporter. In recent years, however, lack of investment in the sugarcane sector, coupled with adverse climatic conditions, has resulted in below average yields. Brazil's cost advantage in sugarcane production has also been eroded as increased mechanisation in other countries has slightly reduced Brazil's competitiveness in world markets. These factors, along with recent low sugar prices, have caused several mills to go bankrupt or be mothballed. Some of these negative factors are expected to reverse during the outlook period. The expected Brazilian real depreciation relative to the US dollar and lower oil price should help spur investment in the highly mechanised sugarcane plantations.

In contrast to the producer price for refined sugar, which declined after 2010 until just before the beginning of the outlook, the producer price for sugarcane increased during this time as a result of continuing demand for sugarcane for ethanol. For the outlook period, the producer prices for both refined and cane sugar are expected to rise, at a more modest 2.6% per annum for cane sugar and relatively more robust 4.8% per annum for white sugar. Consequently, sugarcane production is expected to grow at an annual rate of 3.3% to 884 Mt (42% higher than the base period level) driven mostly by increases in area harvested (Figure 2.13). Harvested area increases at an annual rate of 2.9% and is expected to rise to 11.5 million hectares by 2024. Average yield on the other hand has fallen from its 2010 high and is expected to increase moderately over the course of the outlook and not reach the previous high as sugar margins, which are highly dependent on the level of the Brazilian real, will not be high enough for big companies to invest heavily in the sector.

With a rising producer price, sugar production, after a very slow growth period, is expected to reach 48.4 Mt from 38.9 Mt during the base period. This is primarily driven by measures to encourage ethanol production which will divert more sugarcane to ethanol rather than sugar production. Sugarcane used for ethanol production grows to about 532 Mt by 2024 61% above the level in the base period. As a result the share of sugarcane going into sugar production drops from 47% in the base period to 40% at the end.

Sugar consumption is expected to rise to 15.8 Mt (average annual growth rate of 1.4%) during the course of the outlook to 17% above the base period level. Even with more and more of the sugarcane destined for the ethanol market, sugar production expands faster than consumption resulting in larger exportable surplus. Total exports rise from 25.7 Mt in the base period to 31.9 Mt at the end, growing 4.1% per year. Brazil's exporters seem to focus on exporting raw rather than refined sugar. Most of Brazil's sugar exports are in raw form, and although Brazil is exporting increasing quantities of refined sugar over the

Figure 2.13. **Allocation of sugarcane between ethanol and sugar production in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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coming ten years, they do not return to the levels in the base period. Whereas exports of raw sugar grow to almost 27 Mt, averaging a growth rate of 4.7% per annum, exports of refined sugar grow much slower averaging 1.8% per annum to 5.2 Mt, some 15% below the base period level. Brazil's overall share of the world sugar market, although below the highs of the recent past gradually increase over the outlook period to almost 44% in 2024.

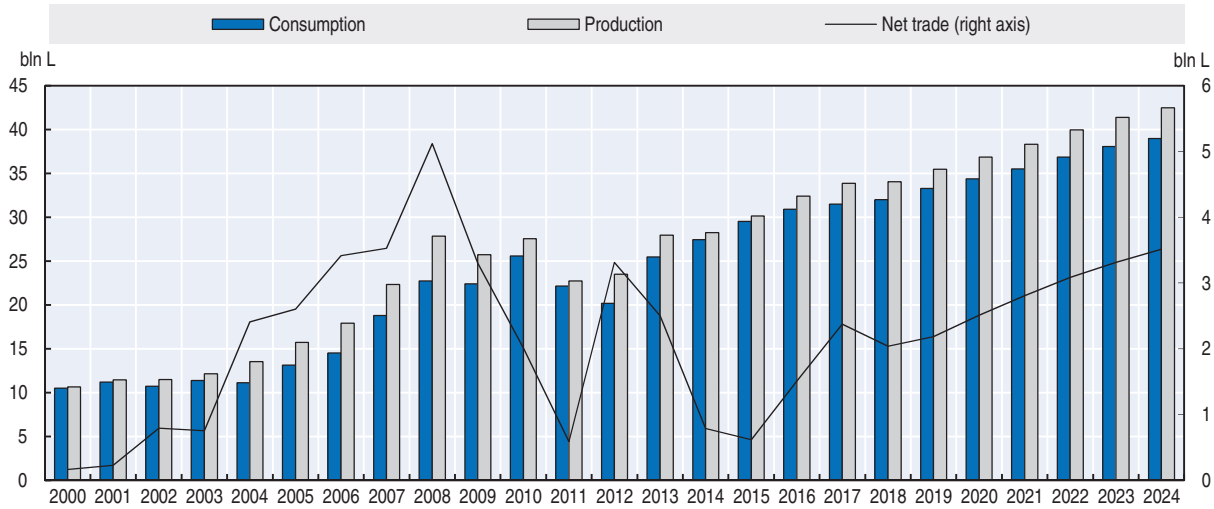
Biofuels

This *Outlook* assumes that over the first part of the projection period domestic gasoline prices in Brazil will be kept slightly above international prices and that they will reconnect with world crude oil prices in the later part of the projection period. Recent policy changes that include the hike in gasoline taxes while maintaining low taxes on ethanol as well as the new 27% blending requirement in gasohol (up from 25%) are expected to provide some relief in the short term to the domestic Brazilian ethanol industry by keeping the ethanol to gasoline price ratio favourable for ethanol use at least in some states. This should imply that in the first years of the projection period the Brazilian ethanol market should remain relatively isolated from the world market with producer prices above international ones. Sugarcane based ethanol production is thus expected to increase by about 60% to almost 42.5 billion litres (bln L) during the outlook period, most of which will be consumed domestically (Figure 2.14).

Total demand for ethanol is expected to rise to almost 39 bln L by the end of the projection period, pushed by the blending requirement and by the competition between hydrous ethanol and gasohol at the pump. Fuel ethanol use in 2024 is expected to comprise of 17 bln L of anhydrous ethanol and 21 bln L of hydrous ethanol for fuel use.

Net exports are projected to remain limited at the beginning of the projections period as the Brazilian ethanol industry will mostly fill sustained domestic demand, before rebounding to a little more than 3.5 bln L by 2024. The export recovery should take place in the second half of the projection period when Brazilian ethanol and gasoline prices are

Figure 2.14. **Ethanol use, production and net trade in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.
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expected to move in line with international ones. Export expansion should occur at a relatively moderate rate as opportunities are expected to be limited because of uncertainties around the US bioenergy policy and the 10% blend wall limit.

Biodiesel use will also increase because of the higher blending requirement that was introduced in late 2014 (7%). Domestic use and supply is expected to rise from 3.4 bln L in 2014 to 5.1 bln L by 2024. Export opportunities will be limited.

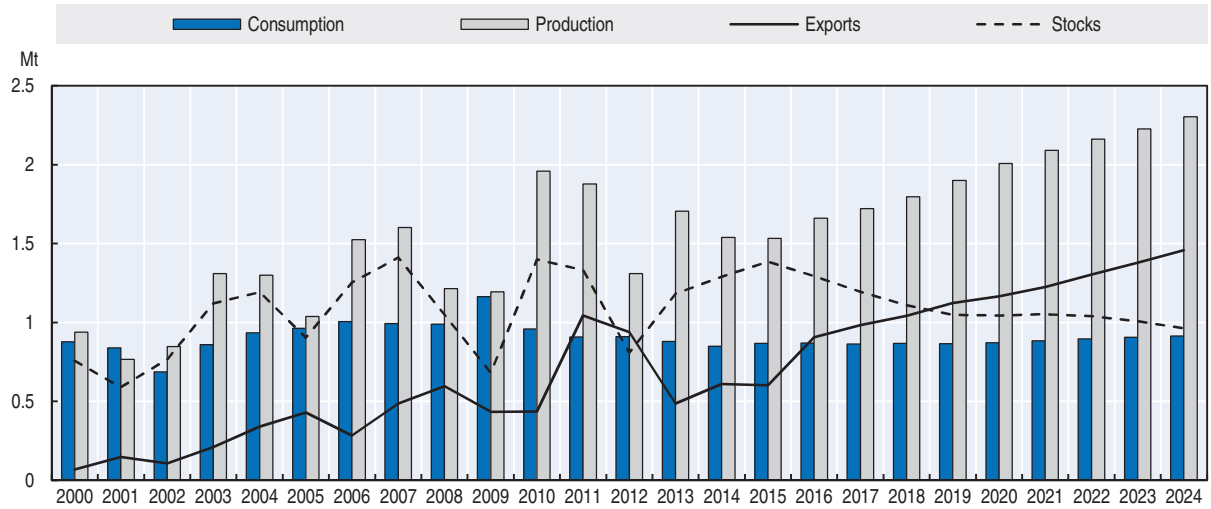
Cotton

Cotton is another important commodity for Brazil. Advances in soil technology and the development of new crop varieties have enabled cotton yields to rise rapidly since the late 1990s to more than double world average. This has enabled Brazil to become the world's fifth largest cotton producer. Government policies may also have contributed to Brazil's expanding cotton production with a minimum producer price policy to support farmer's income when prices are low.

During the course of the projection period, Brazil's continued technological progress and abundant land base and other natural endowments are expected to enable cotton production to grow at a faster rate than production by other major cotton producing countries such as China, the United States and Pakistan. During the next ten years, production is expected to grow at an annual average rate of 4.6% to attain 2.3 Mt in 2024, 52% more than the base period (Figure 2.15). This is driven mostly by an expansion in land use with harvested area growing 3.3% per annum to 1.36 Mha which is some 35% above base period level. Yield growth is expected to temper down during the next ten years with a growth rate expected to average around 1.2% per annum. Brazil's cotton production is expected to grow even faster than the world's largest cotton producer, India, which has a greater potential for higher yield growth as it starts from a low base. During the course of the next ten years, Brazil is expected to draw-down cotton stocks.

With domestic demand relatively flat and an expected robust growth in world price, the world market is important for Brazil's cotton sector. During the projection period, the

Figure 2.15. **Cotton production, consumption, stocks and exports in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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share of cotton exported grows from less than half of production to 63% by the end of the period making Brazil among the world leaders capturing about 14% of the world market.

The projections outlined above are conditional on the recovery in cotton mill consumption in world markets and the reduction in China's cotton stocks. Changing competition for resources to produce other commodities is also expected to influence the outlook for cotton markets.

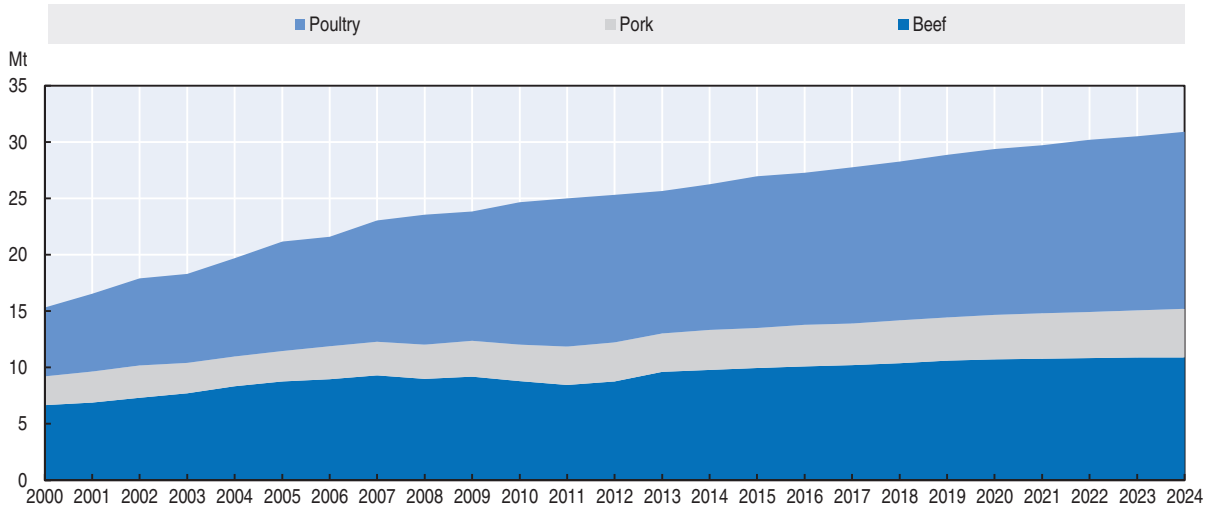
Brazil is also able to utilise its position as a large cotton producer to move up the value chain into processing cotton. Brazil is the fifth largest cotton processing country with a 3% share of the world's market. This is used mostly to satisfy domestic demand which is expected to increase slowly over the medium term but is not expected to surpass the levels recorded in late 2000s, when global per capita consumption of cotton reached historical highs.

Meat

Brazil is among the world's largest producers and exporters of poultry, beef and veal, and pigmeat. Brazilian meat production is expected to continue its fast growth in the coming decade. The depreciation of the Brazilian real relative to the US dollar, lower projected feed costs, improved animal genetics along with better health and nutrition, combined with an increasing domestic and international demand should sustain the projected expansion of Brazilian meat production. Production of poultry meat will be responsible for more than half of the projected increase in meat production fuelled by both domestic and international demand. The remaining expansion of the meat sector will be shared between beef and pigmeat (Figure 2.16).

Producer prices are expected to increase strongly during the next ten years especially for pork (5.9%) and beef and veal (4.4%) per annum, whereas poultry prices grow at a more modest rate of 3.9% per annum. When adjusted for inflation however, prices mostly rise at a modest rate.

Figure 2.16. **Beef, pigmeat and poultry production in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*

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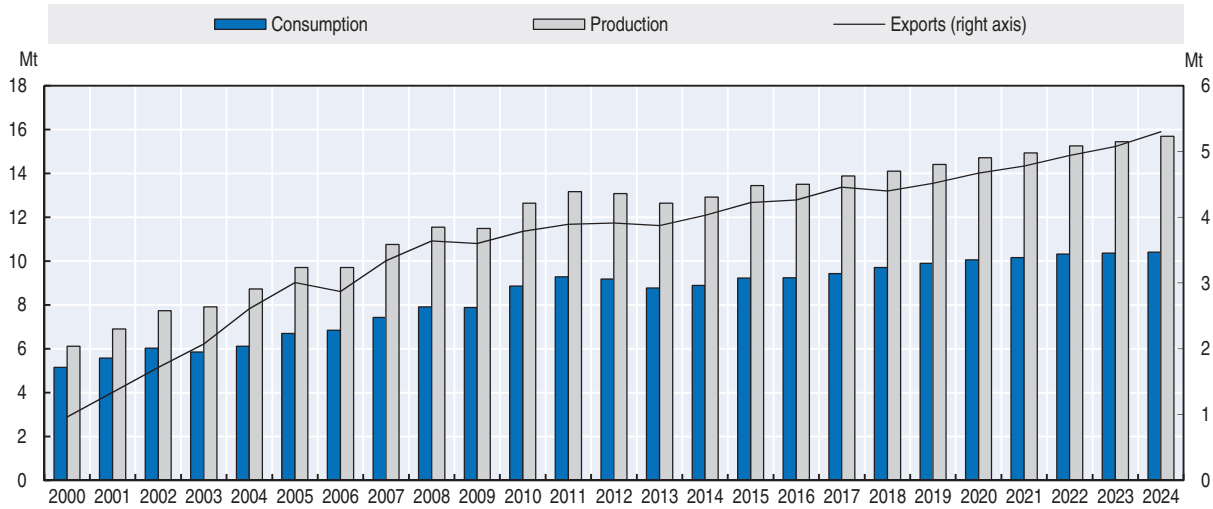
With the expectation that the price for poultry meat will rise at a slower rate than the price for beef and pigmeat, domestic consumption grows faster than population with per capita consumption rising to 42.3 kg per person per year (kg/p) from 39.3 kg/p in the base period. In general, per capita consumption of the three primary meat types is poised to increase reflecting Brazil's continuous economic development. Per capita consumption reaches 83 kg/p in 2024, adding 5.8 kg/p to each person's diet relative to the base period driven primarily by additional consumption of poultry meat.

Even with rising domestic consumption, Brazil's competitiveness in the beef and veal, and poultry international markets is projected to increase and with a depreciating currency bolstering price competitiveness. An increasing share of production is projected to go to consumers overseas enabling Brazil to capture international market share in beaf and veal, and poultry.

Poultry

Reflecting the increasing diversification of the developing world diet towards animal protein, demand for poultry meat is expected to continue increasing including in Brazil where poultry maintains its position as the dominant meat in consumers' diet. Production rises by 22% relative to the base period rising to 15.7 Mt (ready-to-cook weight r.t.c.) (Figure 2.17). Domestic consumption is also poised to increase, but at a slower rate raising the exportable surplus. Brazilian poultry sector is geared to supply to the expected increased world demand leading to sustained export supply. Exports continue to expand throughout the projection period reaching 5.3 Mt in 2024 increasing Brazil's share of the poultry world market to a little above 31%.

Figure 2.17. **Production, consumption and exports of poultry meat in Brazil**



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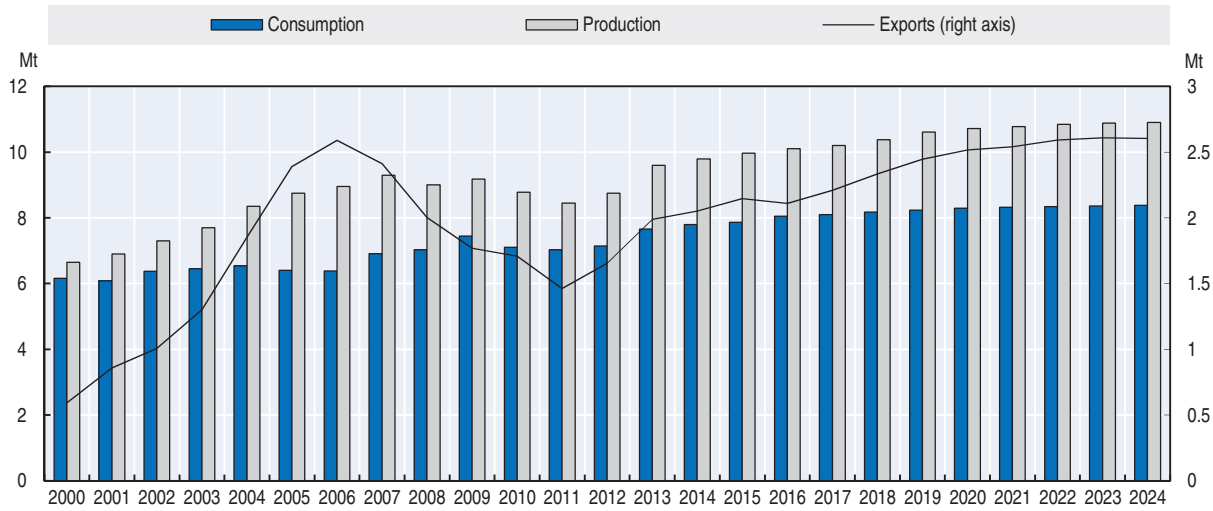
Beef and veal

Brazilian beef production is expected to increase, driven by improved animal genetics, better management of forage plants enabling greater stocking density, greater availability of cattle for slaughter, stable domestic cattle prices, and improved feed efficiency resulting in increasing carcass weight due to higher use of feed during the dry season. Production is expected to increase at an average rate of 1.1% to almost 11 Mt (carcass weight equivalent) in 2024, some 16% above the base period (Figure 2.18). Rising consumer price in an environment of relatively low income growth dampens domestic consumption which rises to 8.4 Mt in 2024, some 11% above the base period.

Figure 2.18. **Production, consumption and exports of beef and veal in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*

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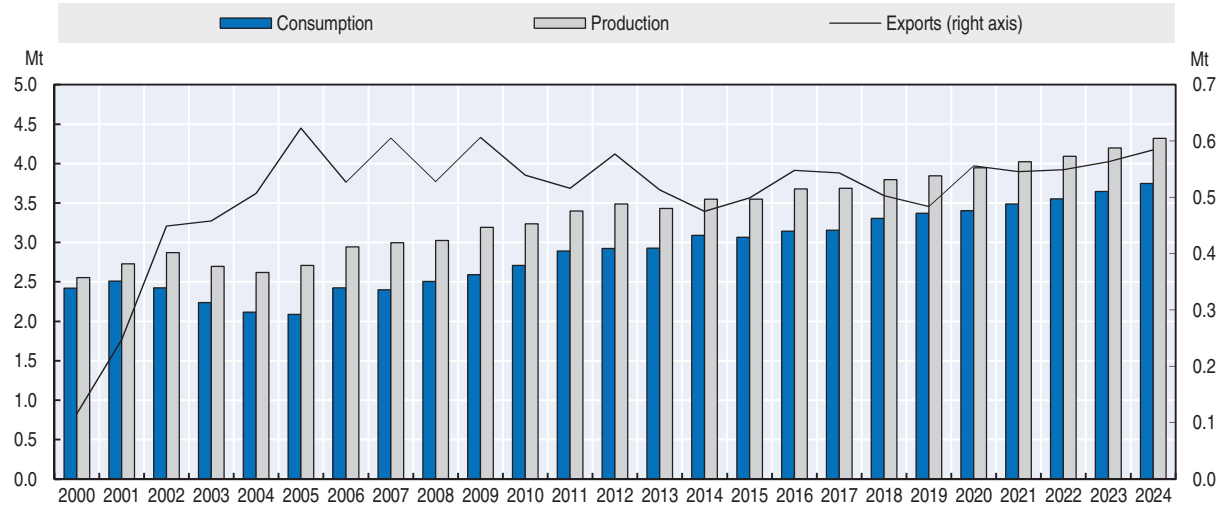
The expansion of the Brazilian cattle herd, coupled with strong international demand and the depreciation of the Brazilian real, is likely to maintain Brazilian beef highly competitive in the world market. Beef and veal exports are expected to grow by an average annual rate of 2.7% rising to 2.6 Mt some 37% above the base period. The additional exports increase Brazil's share in the world market to 20% in 2024 compared to the 18% share in the base period.

Pigmeat

Sparked by relatively low feed cost and rising prices, pigmeat production is expected to grow to 4.3 Mt (carcass weight equivalent) in 2024, 24% higher than the base period (Figure 2.19). The growing Brazilian pigmeat production mainly supplies the increasing domestic demand which increases to 3.7 Mt in 2024, 26% higher than the base period even with domestic consumer prices rising 5% per annum. Pigmeat continues as the least favoured meat for Brazilian consumers, but even with rising population, per capita consumption grows by 2 kg/p to 13.5 kg/p in 2024.

The take-up by domestic consumers absorbs most of the additional supply, nonetheless, pigmeat exports rebound during the projection period from their recent lows. Brazilian meat exports will benefit from a stronger international demand, the ongoing depreciation of the Brazilian currency and the lower projected feed costs (with the expected abundant soybean and corn crops) improving Brazil's competitiveness in the numerous destinations it currently supplies. In the short term, Brazil is expected to increase its pigmeat exports to the Russian Federation, due to the one-year import ban Russia imposed on the United States, Australia, Norway, Canada and the European Union to counter their economic sanctions. Part of Brazil increased share of pigmeat exports to the Russian market is expected to remain for the medium term.

Figure 2.19. **Production, consumption and exports of pigmeat in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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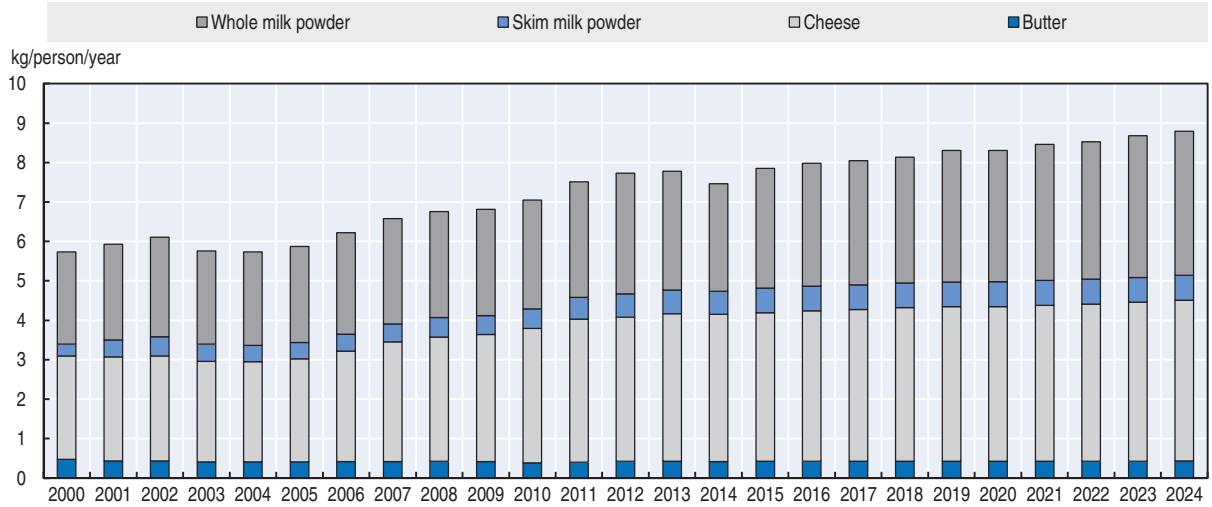
Dairy

Brazil is basically self-sufficient in dairy and dairy products and no major structural changes are anticipated during the projection period. The cow herd is expected to increase slowly and milk production is expected to continue trending with domestic demand increasing slowly and keeping pace with population and income growth. Milk yields are also expected to increase slowly during the projection period and remain at low levels reflecting the pasture-based production system.

With domestic prices expected to rise from 6% to 8% during the projection period, domestic demand for dairy products (butter, cheese, skim milk and whole milk powder) is expected to increase slowly with population and income. Production will basically track demand minimising the role of international markets for this sector. Among the four products, Brazilian's appear to prefer cheese consuming 4 kg/p, a moderate increase during the projection period (Figure 2.20). But, demand for whole milk powder expands faster during the projection period, with per capita consumption rising to 3.7 kg/p. Per capita consumption of butter and skim milk powder is expected to remain relatively flat at 0.4 kg per person and 0.6 kg/p respectively. With domestic production more or less tracking domestic consumption, imports of butter and skim milk powder remain stable at low levels while imports of cheese and whole milk powder decline slightly. Dairy is mostly consumed in fresh or lightly processed form and during the next ten years, will account for a stable share of 53% of Brazilian milk production. At 84 kg/p in 2024 Brazil's per capita consumption of fresh dairy products is projected to be comparable to values in North America.

Figure 2.20. **Per capita consumption of dairy products in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

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Pulses

Pulses, in particular beans, are part of the basic diet in Brazil, and therefore this crop along with rice is very important for food security and nutrition. Over the past decade, production of beans has ranged between 2.8 Mt and a record 3.6 Mt achieved in 2011. The crop is vulnerable to adverse weather, resulting in large annual fluctuations in output. In recent years production has been curtailed by drought in the northeast and by pests and

disease in the centre-south. The domestic market absorbs about 3.5 Mt of beans annually. Imports are needed to bridge the gap. In recent years they have fluctuated between 120 kt and as much as 400 kt. In the period to 2023/24, production is expected to remain stable at about 3.2 Mt, although short-term crop shortfalls may occur. The upward trend in yields would be maintained thanks to the further application of existing technologies and the ongoing improvements to infrastructure, such as irrigation, particularly in larger scale production units. Over the next decade, domestic consumption is expected to increase to about 3.6 Mt, suggesting that imports will persist at current levels

Coffee

Brazil is the world's largest coffee producer and exporter, accounting for about one third of global production and exports. Production has been growing steadily over the years, driven by gains in yields. The area harvested actually declined since the early 2000s due to climate shocks (e.g frost and drought) as well as damage caused by pests and diseases. Total coffee production and consumption in Brazil has increased over the last decade by 3.7% and 2.7% respectively. Although output in 2014/15 is expected to decline due to the severe drought that hit the main producing areas, domestic consumption is foreseen to remain stable at the levels of the previous year.

Total coffee exports for 2014/15 also contracted, as a result of the production setback. About 90% of Brazilian coffee exports are in the form of green beans, with shipments of instant coffee accounting for most of the remainder. Brazil's Integrated Processed Coffee Export Program (PSI) aims to position Brazilian coffee further up the value chain by boosting the share of processed coffee products.

Brazilian exports are mainly shipped to the United States market followed by Germany, Japan and Italy. As a result of steady growth in domestic consumption, Brazil is now the world's second largest market after the United States. Demand for quality coffee has expanded driven by shifts in consumer preferences as well as development in the retail market, in particular increased presence of international coffee shops.

In the next decade, coffee production is expected to reach 61 million 60 kg bags in 2023/24, up 25% from 2013/14. This growth reflects continued increases in yields sustained by further investment and better crop management. Moreover, there is considerable scope for production expansion among smallholders.

Coffee exports are foreseen to rise by 25% to 40 million 60 kg bags thereby consolidating Brazil as the main producer and exporter world-wide. Although the projected growth is slower than in the past decade, several factors could have an impact on export levels. In particular, rapid growth in domestic consumption could curtail export supplies. The expanding domestic market has dampened exports somewhat with projected export levels as a share of production falling to 65% compared to 68% currently. Another factor is that the increasing emphasis on export of processed coffee products could encounter less favourable prospects due to existing tariff escalation in several markets. However, the fact that Brazil offers a wide range of coffees (instant, roasted beans, roasted ground, special, organic, etc.) gives it a competitive edge over many other producing and exporting countries.

Oranges and orange juice

Brazil is the world's largest exporter of processed citrus, in particular frozen concentrated orange juice (FCOJ). Production of oranges is destined mostly to processing for export. The domestic market for processed fruit is relatively small, with domestic consumption being mostly in fresh form. Production of oranges in Brazil has remained stable during the past decade following rapid growth in previous periods. More recently, farmers in some regions have abandoned their orchards due to continuing losses in the fresh fruit market.

Production of oranges is expected to increase in the coming decade, although at a slower pace. By 2023/24 total output could reach 17.5 Mt, about 7% above the 2013/14 level. Continued increases in productivity would more than offset further reductions in areas that would drop by about 13% during the decade. The domestic market is expected to continue to absorb only relatively small volumes of fresh fruit. The share of production destined to processing increases in the period to 2023/24, and exports of orange juice rise to 2.6 Mt.

Fruits

Brazil is one of the world's largest producers of fruit. Its output is largely absorbed by the domestic market. Among the major fruits produced are bananas, apples, grapes, melons and tropical fruits, particularly mango, avocado, pineapple and papaya. The exact areas of cultivation and volumes of production are difficult to ascertain because a large share of output takes place on small farms for self-consumption or sale at local markets. Over the past decade, increasing emphasis has been given to the production of organics and targeted technical assistance and support measures are being extended to family farm units engaged in this type of cultivation.

For all major fruit varieties, both expansion of areas and improvements in yields have contributed to higher output levels. In terms of total volumes, the most important fruit is *pineapple*. Over the past decade, production ranged between 2.2 Mt and 2.7 Mt, with the average output of recent years amounting to about 2.5 Mt. Production may expand to 2.9 Mt over the next decade, largely in line with rising domestic demand. The domestic market absorbs the near totality of production, and exports have dwindled to virtually nil. *Apples* also represent a very large volume crop, with production ranging around 1.25Mt. Production of apples has experienced a strong upward trend over the past decade, reflecting mainly rapidly increasing yields. Export volumes have fluctuated from year-to-year, but on average amounted to less than 10% of production. The domestic market has been growing rapidly and absorbs the bulk of output. By 2023/24, apple production is projected to reach more than 1.6 Mt as a result of greater planted areas and further increases in yields.

Continued strong growth to 2023/24 is also projected for *grape* production. The crop is largely irrigated and makes use of advanced cultivation and harvesting technologies. Since 2005 production has increased steadily to more than 1.4 Mt. Over the next decade, with expanded areas and higher yields the crop could reach 1.65 Mt. Production is mostly destined to the domestic market.

Over the past decade, *melon and cantaloupe* production has also expanded because of both greater plantings and higher yields. Among fruits varieties, melons are more dependent on world markets with around a third of production exported. However, this share has fallen over the past decade owing to rising domestic demand.

Bananas are the most widely cultivated fruit, grown throughout the country. Production is expected to continue to increase as a result of productivity gains. While exports have been low over the past decade owing to the importance of the domestic market, an increase in sales to foreign markets could occur as a result of industry reorganisation and the opening of new marketing channels.

In addition to pineapple, a vast range of *tropical fruits* are produced in Brazil. Mangos, avocados and papaya are the most important in volume terms. These fruit varieties are mainly absorbed by the domestic market, and they contribute significantly to nutritional needs of rural and urban populations. Production of these fruits appears to have remained fairly stable over the past decade. Little change is expected in avocado production in the period to 2023/24, while papaya and mango will keep their upward trend in the next decade reaching respectively 1.8 Mt and 1.4 Mt. About 10% of mango production is exported, while only very small amounts of the other fruits find their way to foreign markets.

Table 2.1. **Summary of production levels of other products in Brazil**

	Unit	2005/06	2010/11	2011/12	2012/13	2013/14	2014/15	2023/24
Beans	Mt	3.5	3.7	2.9	2.8	3.4	3.2	3.2
Coffee	Million bags[1]	32.9	48.1	43.5	50.8	49.2	45.3	61.0
Oranges (fresh)	Mt	17.9	18.5	19.8	18.0	17.5	16.5	17.5
Avocado	Mt	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Pineapple	Mt	2.3	2.2	2.4	2.5	2.5	2.5	2.9
Papaya	Mt	1.6	1.9	1.9	1.5	1.6	1.6	1.8
Mango	Mt	1.0	1.2	1.2	1.2	1.2	1.2	1.4
Banana	Mt	7.0	7.3	6.9	6.9	7.1	7.2	7.8

Note: Calendar year first years shown.
1. One bag of coffee equals to 60 kg.
Source: FAO/CONAB/ICO and Ministry of Agriculture, Livestock and Food Supply.

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Fisheries and aquaculture

The fisheries and aquaculture sector plays an important role in Brazil's food security, providing an important source of proteins and a livelihood for millions of households. It is estimated that about 4 million people[10] are directly or indirectly involved in this sector.

In Brazil fisheries and aquaculture can be undertaken along 8 400 km of the marine coastline and in its abundant freshwater resources, one of the largest hydrographic basins in the world. During the last few years, major increases in total fishery production have been driven by aquaculture. Production from aquaculture has been significant, with an average growth rate of about 9% per year in the last decade.[11]

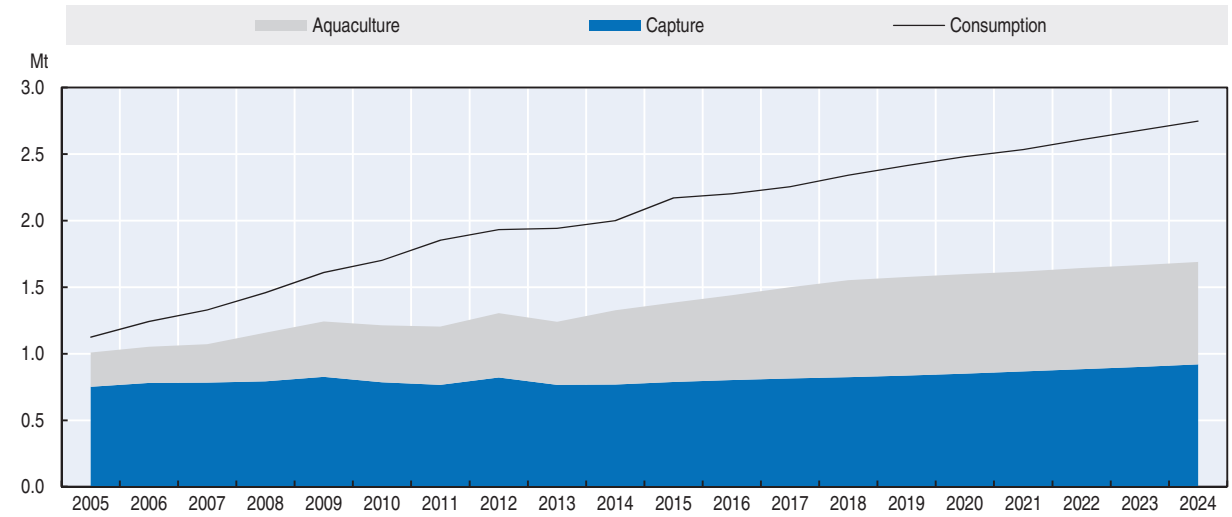
At present, Brazil is the second major aquaculture producer in the American continent after Chile. Major increases are occurring in freshwater species, which dominate production, with mariculture[12] representing about 15% of the total. Prospects for aquaculture are good with production expected to grow to 52% above the average level for 2012-14 by 2024, driven by increasing domestic demand and by national policies which support the sustainable growth of the sector. Main challenges for further expansion are linked to environmental issues and potential impacts of aquaculture on biodiversity and ecosystem services. Efforts to enhance the collaboration between the Ministry of Fisheries and Aquaculture and the Ministry of Environment to address the sustainability of the sector are underway.

Notwithstanding output of catches that has slightly increased during the past decade, several coastal and inland fishery resources are fully exploited or overexploited, as a result of excessive fishing. Most fisheries are carried out by obsolete fleets very often directed at fish stocks that are already heavily exploited, resulting in low efficiency. Excessive fishing effort has caused productivity to fall, and conflicts over access to resources. These occur between artisanal and industrial fishers and among fishing communities.

The artisanal fisheries dominate capture production, with more than 60% of total landings. This share is higher in inland fisheries. Prospects are for slightly growing catches, mainly due to further increases in inland waters obtained through improved management of resources. During the past decade, about 30% of capture fisheries originated from inland waterways.

During the past decade, domestic consumption of fish and fishery products has increased steadily thanks to growing fishery production and imports. Apparent per capita fish consumption grew from 6.0 kg/p in 2005 to 9.9 kg/p in 2014. This growth is also a result of massive campaigns within the country to promote fish consumption. Significant regional variations exist, with higher consumption in the Amazonia state. Apparent per capita fish consumption is expected to further expand over the next decade, reaching 12.7 kg/p in 2024, a growth of 30% from the average level 2012-14 (Figure 2.21).

Figure 2.21. **Fishery production and consumption in Brazil**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*
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For several years, Brazil has been a net importer of fish and fishery products and the largest importer of fish in Latin America and Caribbean. The sharp increase in demand with the strengthening of the Brazilian real against the US dollar led to an impressive increase in imports of fish for human consumption (from USD 297 million in 2005 to USD 1.5 billion in 2014) and a decrease in exports (from USD 405 million to USD 207 million in the same period). Even with the projected depreciation of the Brazilian real against the US dollar, prospects are for imports to increase by 46% (in volume terms) during next decade.

The fishery and aquaculture sector is in a restructuring phase. Major efforts have concentrated on institutional strengthening aimed to obtain a more effective planning and

management of fisheries. Current government policies towards the sector are based, among other things, on the following criteria: sustainability, social inclusion, adequate structuring of production chains, strengthening the domestic market, territorial approaches for management and development programmes, increased competitiveness, and consolidation of state policies.

Government policies are also looking to improve post-harvest activities, with the aim of reducing losses due to improper handling and storage of fish. These wastes occur in particular in artisanal fisheries, but also in industrial fisheries. The Ministry of Fisheries and Aquaculture estimates that adoption of measures to reduce these losses could increase income from fishing by 40%. Furthermore, the legal framework is also seeking to stimulate private sector involvement in all aspects of fish production, processing and marketing. It encourages the establishment and operation of fish processing industries and of industries that provide basic inputs for the fisheries sector.

The effects of government policies on Brazilian agricultural markets

The government of Brazil pursues three broad kinds of policies towards the agricultural sector: an economic one of supporting continued growth of the sector, and the associated generation of income; a social one related to the livelihoods of poorer households and their costs of food purchases; and an environmental one related to the conservation of natural resources and biodiversity. This section looks at specific policies in these three areas, with a view to identifying some strategic priorities for the coming decade.

Macroeconomic and structural policies

Since the elimination of import substitution policies in the late 1980s, an important determinant of the performance of Brazil's agriculture has been the broader context in which the sector operates. Determining factors include the macroeconomic context, governance and the quality of public institutions, the regulatory environment, finance and tax policy, investment policy, labour market policies, the development of hard and soft infrastructure, and education and human capital.

In terms of the overall macroeconomic context, Brazil has achieved much improved stability since the mid-1990s, but real interest rates remain high (reflecting the so-called "Brazil cost"), with financing at market interest rates accounting for more than 30% of crop costs for those crop farmers obliged to borrow at commercial rates. By international standards, Brazil provides relatively high rates of protection, with an average applied tariff of around 10%. This raises the cost of imports including inputs used for agriculture. As a result, Brazil has a low participation in global value chains, while the import content for all Brazilian exports is estimated to reach only 10%, and 7% for exports of primary agricultural commodities and food products. In addition to protection at the border, Brazil uses local content provisions in publicly-financed projects; this condition is also imposed by the National Bank for Economic and Social Development (BNDES) on loans for capital goods, including by the agro-food and agro-processing sectors. Imported capital goods are not financed under the National Rural Credit System, except if there is no similar product made domestically, while those products are subject to a minimum of 60% local content provision.

On the other hand, Brazil has a relatively open FDI regime, and in mid-2012 was the world's sixth largest recipient of FDI. However, FDI is restricted in several sectors, including acquisition of rural land by foreign legal or physical persons reflecting concerns regarding

potential "land grabbing" following the global food price hikes of 2007 and 2008. The agro-processing sector faces much fewer restrictions. Foreign investment, for example, has contributed to the development of fertiliser production in Brazil; FDI has also been very important in the sugar and ethanol sectors, driving their technological development.

Financial markets in Brazil are largely bank based. Free market borrowing costs are high, for a variety of reasons including a high Central Bank refinancing rate, compulsory bank reserves that are high by international standards, and a high level of taxation of the banking sector. This increases the cost of capital and creates a bias toward short-term high-risk investment instead of long-term investment. Some farmers and agribusinesses benefit from the existence of directed credit BNDES at rates higher than the ones under the National Rural Credit System, mainly the long-term interest rate fixed by the government (TJLP) plus administrative fees.

Over the last two decades, Brazil's tax and contribution systems increased public revenues from 24% to 34% of GDP, a share which is comparable to that of many developed economies but is high relative to most Latin American and other BRIICS economies (e.g. 17% in China, 18% in India, 12% in Indonesia and 27% in South Africa). Brazil's taxes are also difficult to comply with, in particular the indirect taxes, including the state VAT (*Imposto sobre Circulação de Mercadorias e Serviços*, ICMS), for which each of Brazil's states has its own tax code, tax base and tax rates.

Agriculture and agro-processing sectors are exempt from the ICMS tax on raw material and semi-processed products destined for export, which effectively applies to the bulk of Brazilian agricultural exports. This preference, since its introduction in mid-1990s, has been one of the factors contributing to the expansion of agricultural exports. ICMS preferences are also granted on sales of agricultural inputs. Thus, various reductions in the ICMS taxable base apply to inter-state trade in agricultural inputs. Federal legislation also empowers states to adopt similar preferences for transactions within states. Other preferences concern social security contributions. Exports, including agro-food exports, are free from PIS/COFINS taxes; PIS/COFINS rates are also set at zero on imported agricultural inputs, and the payment of these taxes is suspended on some domestically produced primary agricultural products supplied for processing. Agricultural producers also have the right to write off losses incurred in the previous year from taxable income, and companies engaged in agricultural activity may depreciate the integrity of the value of acquired capital goods in the same fiscal year (OECD, 2005; World Bank and PwC, 2013a).

Numerous studies cite weaknesses in transport and other physical infrastructures as a critical structural impediment to the Brazil's economic and social development. Road and railway density in Brazil is less than half of the average for the rest of BRIICS, and far below that of the key OECD economies (although such a comparison is limited given the differences in the countries' geographic conditions and development levels). During the 2013 soybean harvest, lorries queued for 25 kilometres to get to the port in Santos. The weakness of Brazilian infrastructure is recognised by the government, which since the mid-1990s has undertaken important institutional and regulatory reforms in the infrastructure sectors, and from the mid-2000s introduced various federal and state programmes. Governments at the federal and state levels have also introduced various tax and credit incentives to increase private investment in infrastructure.

The overall national policy on infrastructure development has important implications for the agro-food system. Several projects implemented by the Ministry of Transport and the Secretariat of Sea Ports are not specific to agriculture but have high potential to

improve the capacity and the time involved in the handling and transport of agricultural commodities. Other activities include the development of electronic systems to facilitate the control of shipments in ports and other border points, and financial support for private and public storage. The agro-system should gain significantly from these policies and investments, which will increase capacity and reduce the time involved in the handling and transport of agricultural commodities, and significantly improve cost competitiveness.

The nation's education improvement became a national policy in the 1980s, although Brazil continues to lag in education both in terms of education attainment levels and student performance. Brazil's performance was close to the average for Latin American countries in the OECD's PISA tests for 2012 but 2.5 years of schooling below the average for OECD countries. Agricultural education has seen a strong rise in university enrolments and in the disciplines offered driven by the agricultural boom in Brazil, but the performance of rural schoolchildren still lags that of their urban counterparts. In 2014, the 2014-24 national education plan (*Plano Nacional de Educação, PNE*) was approved, stipulating than no less than 7% of GDP will be allocated to education in 2019 and no less than 10% in 2024. It also prioritises reducing inequality and promotes education access.

Agricultural support policies

The main agricultural policy instruments are price support, concessional credit and insurance support, although specifically targeted policies are also in place to raise incomes and food security in vulnerable family farms. The specifics of these programmes are described in Box 2.2. They are complemented by regulations on land use, the specification of which agricultural zones are suitable for given crops (and therefore more likely to receive official credit), as well as regulations on biofuel use and organic production. Brazil also directs substantial public funds into land reform to empower the poor to generate better incomes. These funds provide disadvantaged groups with access to agricultural land, financial resources, and the knowledge and skills necessary to undertake farming and other economic activities.

The OECD's annual measurement of support to agriculture attaches a monetary value to the different forms in which support can be provided to the agricultural sector. Support is classified according to its tendency to distort production of trade, but it also gives an indication of how policies priorities vary across the sector. One element is support to farmers, which can be provided by supporting prices above world market levels or by making direct budgetary payments. This support is captured by the Producer Support Estimate (PSE). A second element is budgetary support to agriculture in the form of "general services", for example for research and development, advisory systems, and food inspection. These are captured by the General Services Support Estimate (GSSE). Moreover, in some countries governments also transfer taxpayers' money to (often poorer) consumers through food subsidies. Together, the producer support, general services support and taxpayer transfers to poorer consumers represent the OECD's Total Support Estimate (TSE).

Brazil provides a much lower rate of support to farmers than the OECD average, or than most of the emerging economies covered by the OECD's annual Monitoring and Evaluation (Figure 2.22). In 2012-14, the share of farmers' gross receipts coming from support (%PSE) averaged 4% in Brazil. This compares with rates of and 3% in Chile and 12% in Mexico, two Latin America OECD countries. It is considerably lower than the average of 19% in the European Union and 19% in China, its two major markets. It is also lower than the 8% average in the United States, its main competitor for several products. The OECD average is 18%. Although Brazil's PSE is relatively low, most support is provided through distorting instruments,

Box 2.2. **Agricultural price, credit and insurance programmes in Brazil**

Market price support aims to reduce price volatility, protect farmers' incomes, improve the availability of food supplies and offset the additional costs of producers in regions that are distant from the main markets and ports. There are also specific programmes that target small-scale agriculture, with some purchases being distributed via food programmes.

Minimum guaranteed prices are reviewed annually, covering thirty-three crops. They are announced regionally through the PGPM (*Política de Garantia de Preços Mínimos*) by the Secretary of Agricultural Policy (SPA) operated by the National Food Supply Agency (*Companhia Nacional de Abastecimento*, CONAB). This mechanism covers a great variety of crops from rice, wheat, maize, cotton, soybeans, to regional crops like cassava, beans, açaí, guaraná, sisal, and a few livestock products like cow and goat milk, and honey. Other price support mechanisms for commercial agriculture are the direct government purchases (*Aquisição do Governo Federal*, AGF) and the provision financing of storage by the FEPM (*Financiamento para Estocagem de Produtos Agropecuários integrantes da Política de Garantia de Preços Mínimos)* former *Empréstimo do Governo Federal*-EGF. The Ministry of Agrarian Development (MDA) supports the development of family farming, and makes use of the minimum prices policy. Instruments that support prices and target small-scale agriculture are government purchases similar to AGF (*Programa de Aquisição de Alimentos*, PAA) and the minimum prices programme for family farms, (*Programa de Garantia de Preços para a Agricultura Familiar*, PGPAF). Under PAA, CONAB makes direct acquisitions from family farms at market prices, with the product either going into stock or distributed as part of a food programme. The PGPAF ensures that small-scale farmers receive a guaranteed price based on the average regional production cost of family farms.

In 2014, under the minimum prices policy, for the commercial sector BRL 5.6 billion (USD 2.5 billion) were spent on price support, government purchases of agricultural products and maintenance of public stocks. For family agriculture the PAA programme (government purchases) allocated BRL 1.2 million (USD 516 million) in 2014. In 2013, deficiency payments through the *Premio Equalizador Pago ao Produtor* (PEPRO) programme were given to mostly maize farmers (USD 211 million). For 2014, PEPRO was available for wheat (USD 35 million), cotton (USD 105 million) and maize (USD 110 million).

Agricultural credit is the main producer support instrument for the sector and it is provided to both commercial and small-scale family farms. The National Rural Credit System (*Sistema Nacional do Credito Rural,* SNCR) directs credit to farmers at preferential interest rates. For commercial agriculture the SNCR system provides credit for marketing, working capital and investment. Some investment credit allocations under SNCR are funded by BNDES and managed by MAPA like *Programa ABC, Moderagro, Moderinfra, Moderfrota, PSI rural, Prodecoop, Pronamp, Procap-Agro, Inovagro and PCA*. Credit for family farms falls under the auspices of PRONAF-Credit of MDA and provides only working capital and investment loans. Support is also provided to producers through debt rescheduling. Major debt rescheduling occurred during the late 1990s and early 2000s for both commercial and family producers. Debt rescheduling contributed 10% of the PSE in Brazil in 2012-14.

Sources of funding for concessional credit come from "compulsory" resources (*Exigibilidade dos Recursos Obrigatórios)* where banks are obliged to either hold 34% of their sight deposits as obligatory reserves at the Central Bank at zero interest rate or to allocate the same proportion in loans to agricultural activities at below market interest rates. It is also mandatory that banks allocate 72% of their savings deposits to rural credit at market interest rates, although for part of these the interest rate may be preferential if the government covers the difference. In addition, "constitutional" funds are available for the North, Northeast and Midwest regions.

Concessional credit provided to farmers continued to increase in 2014, growing by 13% compared to 2013. Credit allocated to agriculture reached BRL 177 billion (USD 76 billion) in 2014, of which 13% (BRL 24 billion or USD 10 billion) was allocated to family agriculture. The remaining 87% was allocated to commercial agriculture. In recent years, rural credit investment programmes have been strengthened with the aim of expanding grain storage capacity, promoting technological innovation in rural properties and extending the use of agricultural machineries.

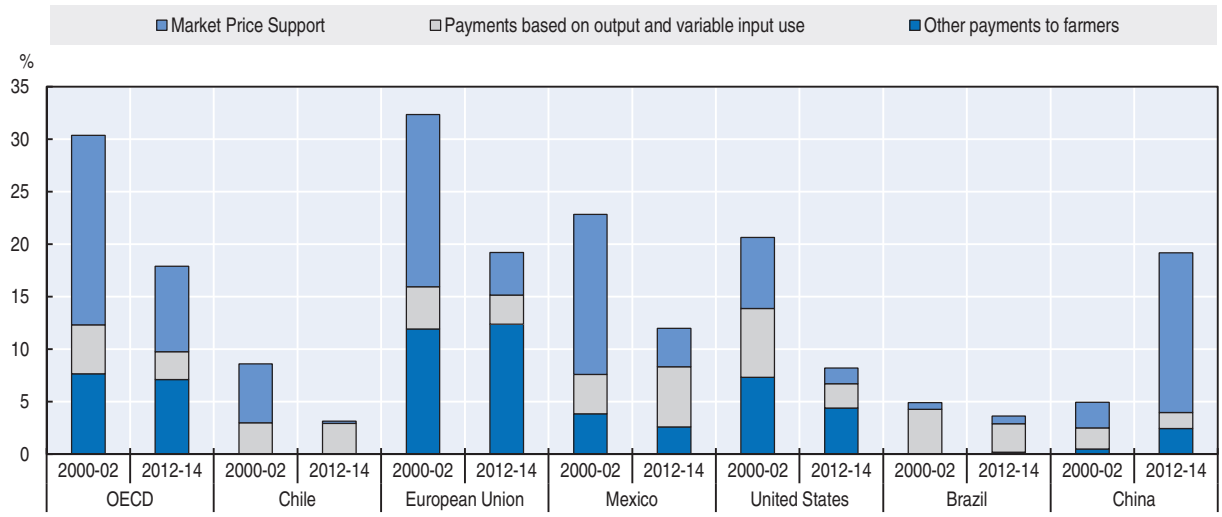
Box 2.2. **Agricultural price, credit and insurance programmes in Brazil** *(cont.)*

Agricultural insurance is another important area for the government. There are four main programmes: the rural insurance premium programme (*Programa de Subvenção ao Prêmio do Seguro Rural*, PSR), the general agriculture insurance programme (*Programa de Garantia da Atividade Agropecuária*, PROAGRO) these two targeting commercial farmers and administered by MAPA. PROAGRO-Mais or family agriculture insurance (*Seguro da Agricultura Familiar*, SEAF) and crop guarantee programme (*Programa Garantía-Safra*, GS) that deal with family small-scale agriculture. These four programmes support farmers either by paying part of the insurance premium costs or by compensating farmers for production losses due to natural disasters. Agricultural insurance, which has been increasing rapidly, accounted for 17% of the support to farmers during 2012-14.

In 2014, the rural insurance (*seguro rural*) programme provided BRL 700 million (USD 300 million) in insurance subsidies to commercial producers and covered 10 million hectares of major crops; resources allocated to the other insurance programme called PROAGRO were much higher at BRL 1.5 billion (USD 645 million). These two programmes serve large-scale agriculture only. Insurance support for family farms is under the programme PROAGRO-MAIS-SEAF. This programme spent in 2014 more than BRL 3.2 billion (USD 1.3 billion) to support small-scale agriculture. Subsidy rates go from 40% to 100% of the premium.

Figure 2.22. **The level and composition of producer support in Brazil and selected countries**

Producer support estimate as a percentage of gross farm receipts



Source: OECD (2015), "Producer and Consumer Support Estimates", *OECD Agriculture Statistics* (database), doi: *http://dx.doi.org/10.1787/agr-pcse-data-en* (forthcoming).

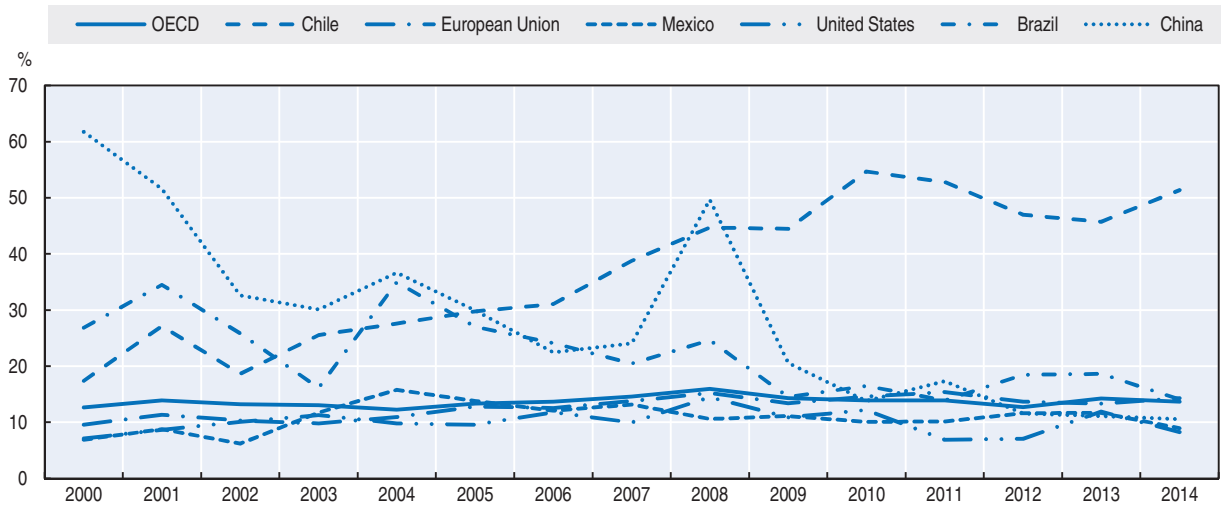
StatLink http://dx.doi.org/10.1787/888933229155

including extensive support to stabilise prices (minimum guaranteed prices) and intervention in the credit system to provide credit to farmers at preferential rates.

As well as supporting farm prices and providing direct payments to farmers, governments provide budgetary support to agriculture more generally. In Brazil, the share of the GSSE in total transfers generated by agricultural policy (as measured by the TSE) was similar to the OECD average in 2012-14, at 17%, and higher than in most markets or competitor countries. However, it is much lower than the 50% share in Chile over the same

period (Figure 2.23). A relatively small part of total support is therefore directed to sector-wide investments that would ensure long-term productivity gains, such as knowledge systems, infrastructure and supporting institutions. Overall, support to the agricultural sector imposes a relatively low burden on the Brazilian economy. In 2012-14 the ratio of the TSE to GDP was 0.4% in Brazil. Altogether, these data suggest that there is a scope for policy to become better targeted to productivity and sustainability outcomes, and for increased spending on the provision of important public goods.

Figure 2.23. **Share of general services (GSSE) in total support (TSE)**



Source: OECD (2015), "Producer and Consumer Support Estimates", *OECD Agriculture Statistics* (database), doi: *http://dx.doi.org/10.1787/agr-pcse-data-en* (forthcoming).

StatLink http://dx.doi.org/10.1787/888933229163

Brazil's Agricultural Innovation System

Science and technology played an important role in the remarkable development of the Brazilian agricultural sector. Investment in R&D has resulted in high growth in Brazilian scientific knowledge, particularly within tropical agriculture. Embrapa has provided comprehensive recommendations ranging from how to correct acid soils and low fertility, the development of varieties that are adapted to the low latitudes and higher temperatures of tropical environments, and to pest and disease control and production systems. Universities also produce high level research in areas complementing Embrapa's activities, such as in nutrition, health and the environment.

Foreign co-operation, which focused traditionally on tropical areas in Latin America, is developing with a wider range of countries in the OECD area, Africa and South-East Asia. The collaboration of Embrapa with other developed countries benefited from a pioneer mechanism, the LABEX (Virtual Laboratories Program), active in the United States, Europe and Asia. This mechanism facilitates participation in global or regional agricultural research networks. Embrapa is also actively collaborating on technology transfer and adaptive research with developing economies, with an emphasis on tropical areas in Latin America, the Caribbean and Africa. With this strategy, the Brazilian government is stimulating public R&D organisations and the private sector to expand their international actions. Brazil's role in promoting South-South co-operation is described in Box 2.3.

Box 2.3. **Brazil's role in promoting South-South co-operation**

Brazil is a strong promoter of South-South co-operation. Over the past decade, there has been a substantial increase in the Brazilian resources allocated to technical co-operation. As a result, the country has gradually switched from a position of recipient to a position of provider of development assistance. The technical co-operation provided by Brazil is characterised as being demand-driven, non-conditional and observant of equality among development partners.

Agriculture tops the list of priority fields of Brazilian technical co-operation. Embrapa, considered a source of cutting-edge expertise on tropical agriculture, research, technology and training, has seen a surge in demand for Brazilian technical co-operation support. Between 2003 and 2012, agriculture accounted for nearly 20 per cent of total initiatives, followed by projects in the sectors of health (15%), education (11%), public security (11%) and environment (6%). Other areas accounting for individual shares of less than 5% included social development, energy, science and technology, communications, and many more.

The Ministry of External Relations (MRE) has shaped the focus and geographical location of technical co-operation initiatives which are coordinated by its Brazilian Co-operation Agency (ABC). Africa continues to be the top destination, accounting for about 55 per cent of total allocations, with the bulk of these for Portuguese-speaking countries. During 2013-15 technical co-operation projects, at design or implementation stage, amounted to USD 36 million and benefitted 42 countries of Africa, with agriculture accounting for 19% of the regional total.

More recently technical co-operation has become increasingly diversified in terms of country coverage, co-operation modalities and thematic focus. During 2013-15, projects also benefitted 31 countries of Latin America and the Caribbean and 21 of Asia, Oceania and the Near East.

The broadening of Brazil's technical co-operation in agriculture is illustrated by its participation in the Africa-Brazil-Latin America and Caribbean Agricultural Innovation Market Place that aims to link experts and institutions to develop co-operative research projects for development. Its primary focus is on smallholder farmers, increasing food production and contributing to reducing hunger and poverty (*www.mktplace.org*).

With accumulating expertise and increasing size of operations, Brazilian co-operation is gradually moving from small-scale ad hoc projects to larger projects with longer time horizons, addressing also sustainability and capacity building needs. Cotton Four was the first structural project of this kind, launched in 2009, with Embrapa as the implementing agency, in partnership with Benin, Burkina Faso, Chad and Mali. Its aim was to promote sustainable development of the region's cotton value chain through the transfer of Brazilian tropical farming technology, in particular improvement of the genetic base of cotton plants, integrated pest management and introduction of the no-till farming system. ABC's budget for the first phase of the project was USD 5.2 million. A second phase of this horizontal partnership, Cotton 4 + 1, between Brazil and the four countries of West Africa plus Togo began in 2014. Other longer term projects involving Embrapa technical support include the development of rice farming in Senegal and several inter-related initiatives to strengthen the agricultural sector of Mozambique.

The rise in Brazil's technical co-operation has been accompanied by increased trilateral co-operation arrangements with other donor countries and UN agencies. In Mozambique, Embrapa is engaged in three large projects i) Platform with the United States aimed at training for technological innovation and development of agriculture; ii) Food Security with the United States to strengthen family and/or subsistence horticulture; and iii) ProSavannah with Japan to adapt Brazil's successful experience in the Cerrado for agricultural development of the Mozambican Savannahs in the Nacala Corridor. Both public and private contributions are supporting parts of this very large and long term project.

Box 2.3. **Brazil's role in promoting South-South co-operation** *(cont.)*

Aside from technology and training, another area of technical co-operation draws on the transfer of Brazil's experience in the field of policies for agricultural and rural development. Beginning in 2010 with the Brazil-Africa Dialogue, the idea of providing support to partner countries to adapt Brazil's policies to promote agricultural development has attracted interest. Thus, the Brazilian Programme to Strengthen Family Farming provided inspiration for the More Food International Programme which offers exchange in public policies expertise and credit facilities to improve productivity through the purchase of farm machinery and equipment. Participating countries include Ghana, Kenya, Mozambique, Senegal and Zimbabwe.

A food acquisition programme, similar to that implemented in Brazil, called Purchase from Africans for Africa (PAA Africa) aims to address food security through public procurement from small farmers and donations to vulnerable families, school feeding programmes, and building of stocks. The Brazilian government has committed USD 2.4 million to support the project in Ethiopia, Malawi, Mozambique, Niger and Senegal. FAO and WFP are assisting in the implementation of this trilateral co-operation programme. With the support of FAO, the Brazilian experience in developing innovative policies and programmes like the "Fome Zero" is being shared with a great number of countries in Latin America and the Caribbean, and, progressively, in Africa.

The role of the private sector in the Brazilian Agricultural Innovation System (AIS) has grown significantly over the last two decades due to the boom in agribusiness, especially in the Cerrado region of central Brazil. Its role is primarily oriented to the supply of inputs and technical assistance to farmers, but agricultural research is growing (seeds, equipment, machines, feed, agrochemicals, etc.).

It is important to foster and support private investment in agricultural R&D by adapting regulatory and policy impediments for investment in innovation and simplifying programmes that finance private innovation. The capacity of businesses to participate in local innovation projects could be strengthened, for example by supporting networking and actions to raise awareness and facilitate exchanges of staff and trainees with public research organisations. Different agencies such as BNDES (Brazilian Development Bank) and FINEP (Funding Agency for Projects and Programs) have specific programmes to boost private-public partnerships. A new programme launched in March 2015 invites external agents to open R&D laboratories in Brazil (*www.innovateinbrasil.com.br/*).

The Ministry of Agriculture, Livestock and Food Supply (MAPA) is responsible for the coordination of agricultural research at the federal level through Embrapa. The Ministry of Agrarian Development (MDA) leads rural technical assistance and extension services which focus on family agriculture. At the national level, the priorities for R&D are established by the national government through the different ministries involved in innovation, led by the Ministry of Science, Technology and Innovation (MCTI) which also has a strong role in providing resources for agricultural research, especially at the university R&D level. Agricultural research is thus integrated into the national innovation system, as reflected in the National Strategy for the Development of Science, Technology and Innovation 2012-15, and follows clear mechanisms at both the federal and state levels. Stakeholders are represented in councils and boards that discuss sectoral demands and priorities. Embrapa applies regular performance and impact evaluations, internally or with outside experts, and the results are made available to the public. Estimates of the social benefits of research have been published yearly for over ten years.

In order to overcome the constraints to poorer farmers not linked to a supply chain or credit market, the Politica Nacional de Assistencia Tecnica e Extensao Rural (PNATER) called for targeted technical assistance services for family farms. During 2003-09 some BRL 1.5 billion were allocated to assist 2.5 million farm families. The National Agency for Technical Assistance and Rural Extension (ANATER) was created in 2013 by the Federal government to expand the resources and scope of public extension services to poorer farmers and to address sustainability issues. While ANATER is being structured, the Brazilian Government is supporting family farming with the National Program for the Strengthening of Family Farming (PRONAF), the Plano Safra 2014-15 and the National Policy for Organic Farming and Agroecology launched in 2013 with the support of the MDA.

Policies to improve the environmental sustainability of agriculture

Agricultural policy has increasingly focused on sustainable agricultural development. Agricultural zoning represents an important instrument linking agricultural support to environmental sustainability of farming activity. Respect of zoning rules is used as a condition of producers' eligibility for concessional credit and subsidised insurance programmes. Brazil has voluntarily committed to reduce its greenhouse gas emissions by between 36.1% and 38.9% in the period to 2020. To this end, the government launched in 2010 a key credit programme named Plano ABC, Low Carbon Agriculture, which promotes the recovery of pasture areas that have suffered soil degradation and puts into place a system of integrated production of crop, livestock and forestry. Since its inception until early 2015, some 32 000 contracts have been approved with the release of credit amounting to about USD 10 billion.

A range of specific programmes promote sustainable agricultural practices. Such programmes are designed for both the commercial and family farm segments. Several credit programmes for the family farm segment have an environmental focus. These include credit for plantings on unproductive and degraded soils, credit for forest planting including palm oil for biofuel, and credit to modernise production systems and preserve natural resources. PRONAF's Agroecology programme provides investment credit for the introduction of environmentally sustainable agricultural systems and organic production. However, possibly the most far-reaching longer run impacts may derive from environmental rules applicable to the use of agricultural land, including the requirement that farms set aside areas as preservation land. The implementation of the new forest code of 2012 calls for the registration of farm units with the Rural Environmental Register (Cadastro Ambiental Rural – CAR). After May 2017, rural properties not included in the CAR will not have access to agricultural credit. However, farmers may commit to complying with environmental requirements according to the relative Environmental Compliance Plan (PRA), including forest restoration, soil conservation and the above-mentioned maintenance of a share of the property under natural cover. In addition to having 20 years to comply with the PRA, they will receive financial support (particularly small farmers) to assist rehabilitation. Implementing this Plan, which aims to better regulate land use, preserving river bank areas, reducing deforestation in the Amazon and strengthening reforestation efforts, is a major challenge for the government and the sector.

Biofuel policies

In addition to promoting sustainable agricultural practices, the government is implementing a range of agro-energy policies, Brazil's main sources of agricultural renewable energy are sugarcane (ethanol and biogases), planted forests (firewood and charcoal) and biodiesel. The Brazilian government has provided strong support for biofuel via measures, which include: lending to construct ethanol plants and storages; tax incentives on flex-fuel cars which can run on any combination of ethanol and gasoline; and mandatory blending ratios for both gasoline and diesel. The mandatory blending of ethanol with gasoline in fuel mixtures continues to take place, as well as the mandatory blending of biodiesel with fossil diesel. The current blending ratios are 27% and 7% respectively. Most of the biodiesel comes from soybean oil, although the use of palm oil is increasing. Other programmes like animal and plant health continue to be important in the agricultural policy framework. More than BRL 240 million (USD 123 million) have been spent annually in this area over the last five years.

Given the current context, measures to provide relief in the short term to the Brazilian sugar and ethanol industry are more or less restricted to a differentiated taxation between hydrous ethanol and gasohol and an expansion in the mandatory anhydrous ethanol blend in gasoline.

Differentiated taxation has existed for a long time. ICMS, whose rate is set independently by each state of the federation, is the main tax levied on hydrous ethanol and gasohol sales. The lowest tax rate for hydrous ethanol (12%) is charged in São Paulo State, the largest producer and consumer state, whereas the average country tax rate is 16%. For gasoline, the average country tax rate is about 25%.

Relief measures were introduced at the beginning of 2015: the anhydrous ethanol blend in gasoline increased to 27%, the CIDE tax was reintroduced for gasoline and PIS/COFINS tax levels were increased for gasoline only. However, the scope of these measures remains relatively limited, providing relief only for the most efficient and least indebted groups in this sector.

The National Programme for Biodiesel Production and Use (PNPB) was launched by the Brazilian Government in 2005. It brings together both large-scale agribusinesses and smallholder farmers (MDA, 2011). The programme introduced a mandatory content of 2% (B2) biofuel added to fossil diesel in 2008 and set a 5% (B5) goal for 2013, though in reality this was reached in 2010. Brazil became the world's third largest producer and consumer of biodiesel in 2014, and towards the end of the year a new mandatory content of 7% (B7) was established (Presidência da República, 2014). The consumption in that year reached 3.4 billion litres (bln L) (ANP, 2014).

An important initiative implemented under the PNPB was the Social Fuel Seal scheme that is awarded to biodiesel producers that make from 10-30% (a share that varies by region) of their feedstock purchases from smallholders. Incentives to purchase from smallholders include tax reductions, favourable credit terms and, importantly, the possibility to participate in the 80% volume share stage of biodiesel auctions.[13] In addition to the Social Fuel Seal Scheme, the Ministry of Agrarian Development (MDA) established a biodiesel production centre project that aimed to increase small-scale farmer participation. By 2014, 85 000 farms were participating in the PNPB and 42 companies, accounting for 99% of national biodiesel production, had the Social Fuel Seal (MDA, 2014).

The programme has had positive impacts on job creation in rural areas and has also enabled the introduction of up-to-date technology and training to small farmers, leading to increased productivity on degraded land (FAO, 2013).

Domestic social policies impacting on agriculture

Since the early 2000s, improved macroeconomic conditions along with targeted social safety-net policies have been reflected in significant reductions in national poverty. Between 2001 and 2012 overall poverty declined from 24.3% to 8.4% of the population,[14] while extreme poverty fell from 14% to 3.5%.[15] Over this period, the income of the poorest 20% of the population grew by three times as much as that of the wealthiest 20%,[16] with a resultant narrowing the inequality gap which nevertheless remains large.

In parallel with poverty reduction, Brazil has made rapid progress in reducing hunger. In fact, it has already achieved both the Millennium Development Goals (MDG) target of halving by the end of 2015 the proportion of its people who suffer from hunger as well as the more stringent 1996 World Food Summit (WFS) target of reducing the absolute number of hungry people.[17] Since the early 2000s, the undernourishment rate in Brazil has fallen by half from 10.7% to below 5%. According to recent analysis by the Ministry of Social Development and Fight against Hunger the undernourishment rate fell to less than 2% in 2013.

Although policies already existed in the late 1990s to redress regional economic and social inequality, the greatest acceleration in poverty reduction occurred when ending hunger was put in the centre of Brazil's political agenda by former President Luis Ignacio Lula da Silva. The launching of the *Zero Hunger* programme in 2003 introduced a new approach that gave utmost priority to food security as well as social and economic inclusion for vulnerable population groups, through coordinated macroeconomic, social and agricultural policies.

The *Zero Hunger* programme became the core of the Food and Nutrition Security Policy adopted by the government in 2006; and this inclusive food security model was gradually incorporated into national laws aimed at promoting the progressive realisation of the human right to adequate food, as enshrined in Brazil's Constitution in 2010. The Brazil without Extreme Poverty strategy adopted in 2011 builds on the success of Zero Hunger and targets the extremely poor. The current National Food and Nutrition Security Plan incorporates more than 40 programmes and actions with total expenditures amounting to some USD 35 billion in 2013.

The main thrusts of the Food and Nutrition Security Policy involve economic policies and social protection measures, in particular the *Bolsa Família* cash transfer mechanism (described in Box 2.4), combined with innovative measures to strengthen family farming. These two major components aimed at promoting, in an integrated manner, income generation, job creation, growth of agricultural production and improved access to food. Policy actions to enhance food security and nutrition were subsequently extended to cover other areas having implications for the agricultural sector, including sustainable agricultural practices and education in nutrition and food habits.

Box 2.4. **Bolsa Família**

Bolsa Familia, launched in 2003, represents the largest programme of this sort worldwide. Since 2011 *Bolsa Familia* has been a part of the Brazil without Extreme Poverty Plan that targets the extreme poor. This programme currently provides direct income transfers to more than 13.8 million low-income families. These transfers have had an immediate impact in increasing access to food which in turn has stimulated production and local farm income growth.

Over the longer run, the transfers represent an investment in human capital and productivity as a result of the conditions that must be met to qualify for the allowances. Aside from health monitoring and immunisation of children, the requirement of school attendance has contributed to improving opportunities for social and economic inclusion of future generations. Analysis of evidence from the 2010 census indicates that *Bolsa Familia* was associated with a pronounced increase in continued studying, or at least studying and working, as contrasted to working only, in both urban and rural areas. The probability of working only declined most in rural areas, especially for boys.

Investment in this programme tripled in ten years, reaching nearly USD 11 billion in 2013, and currently accounting for about one-third of Federal expenditure on food security and nutrition programmes (CAISAN, 2014).

Family farming

The strengthening of family farming under the Zero Hunger programme was the other key element in the programme for improving income, employment and access to food among vulnerable populations. In 2013, expenditures to support family farmers totalled USD 5.6 billion.[18] The numbers of such family farms are impressive, representing more than 80% of production units. Overall, more than 12 million persons, or about 75% of total rural employment, work in family establishments.[19] Additionally, family farming accounted for 38% of the gross value of agricultural production in 2006 (FAO/INCRA 2006). At the inception of the Zero Hunger programme more than 25% of Brazil's poor population was living in rural areas where the poverty rates exceeded 45%. Between 2003 and 2009, more than 5 million people in rural areas were removed from poverty and the incidence of poverty dropped from 45% to 28%. In these regions, family farming remains the dominant economic activity.

The National Program for the Strengthening of Family Farming (PRONAF) aimed at redressing market failures that had led to depressed prices and condemned smallholders to shrinking production, falling incomes and precarious access to food. Among the main measures in favour of family farming, PRONAF provides low interest credit, the bulk of which has been destined to agriculture. Over the past decade, family farm categories were gradually increased to include units with higher gross annual income, thereby broadening access to targeted rural credit. Between 2003 and 2014, PRONAF credit resources increased from BRL 2.4 billion to about BRL 25 billion. Of the total credit provided in 2014, nearly 60% was for investment.

PRONAF operations are supported by the Family Farming Price Guarantee Program (PGPAF), an insurance programme that provides discounts on credit contracts to offset drops in farm revenue owing to reductions in market prices or climate-induced crop losses. In addition, a harvest insurance fund specifically targets farmers in Brazil's semi-arid region when drought causes severe crop losses for family farmers.

The Family Farming Food Acquisition Program (PAA) implemented in 2003 was initially intended to provide incentives to family farms to increase food production both for self-consumption and for sale at guaranteed prices to public sector procurement agencies. Procurement is made from family farm enterprises registered with PRONAF in order to sustain prices, enhance marketing opportunities and through donations improve food availability of vulnerable populations. Since the middle of the last decade, by far the largest share of procurement has been for simultaneous donation. In 2014, 85% of procurement funds were used in this manner (CONAB-PAA, 2014). A significant share of PAA procured supplies (34% in 2014) is used for the school meal programme. In 2009 the National School Meal Program (PNAE) required public schools to allocate at least 30% of food expenditures to direct purchases from family farmers. Under the PNAE an estimated 47 million free-of-charge meals are served in schools every day.[20]

Between 2003 and 2014 about BRL 3.3 billion was spent under the PAA, and the total number of suppliers was more than 51 000. Since 2011 under the Brazil without Extreme Poverty Plan, PAA procurement is specifically targeted to the 16 million persons living in extreme poverty with monthly income below BRL 70. In 2014, nearly 24 000 PAA suppliers, or 47%, fell within this category.

The prioritisation of family farming was also reflected by measures to transfer suitably adapted technologies by Embrapaand state research organisations as well as the implementation of projects to promote development in a number of sectors such as animal husbandry, fruits and vegetables and staple food crops. The National Program for Biodiesel Production and Use (PNPB), which contains special provisions for family farmers, was launched by the Brazilian Government in 2005.

Agricultural trade policies

Brazil undertook radical trade reforms in the late 1980s and early 1990s. Tariff reductions, and the liberalisation of domestic markets, coupled with important technological and structural shifts in the agro-food sector, created a new incentive structure in Brazilian agriculture. Currently, agricultural and food commodities imported to Brazil are subject to *ad valorem* tariffs, and no specific tariffs or special safeguards are imposed. Only a very small percentage (0.2%) of agricultural tariff lines has a tariff quota.

Brazil, along with Argentina, Uruguay, Paraguay and Venezuela is a member of MERCOSUR. Bolivia started a process of accession in December 2012 which has not yet concluded. The Mercosur Common External Tariff (CET) constitutes the core of Brazil's import tariff structure. The CET incorporates 1 030 agricultural tariff lines with tariff rates ranging from 0% to 20%. However, each Mercosur member country has a list of exceptions to the CET.

Using the WTO definition of agriculture, the simple average most-favoured nation (MFN) tariff in 2014 was 10.2%. About 8% of agricultural MFN applied tariff rates were duty free in 2013 and most (57%) were between 5-10%. About 1.6% of tariff lines exceed 25% (WTO, ITC and UNCTAD, World Tariff Profiles 2014). Groups of products facing above average tariffs include: dairy products (18.3%), sugar and confectionary (16.5%), beverages, spirits and tobacco (17.0%), and coffee and tea (13.3%), while imports of cotton (6.9%), oilseeds, fats and oils and their products (7.9%), and animals and animal products (8.2%), are subject to tariffs lower than the average.

Brazil's simple average WTO bound tariff rate for 2004 (final year of the implementation period for developing countries) was 35.3%. Brazil's average bound tariff rate for agricultural goods is more than three times the average applied MFN rate. The minimum and maximum bound tariff rates coincide with the minimum and maximum applied MFN rates. However, while over 250 tariff lines were bound at the maximum of 55%, only two are actually fixed at this level. This "tariff overhang" is largely due to the existence of the Mercosur CET which sets the effective border protection at levels much below the country's bindings.

MERCOSUR has signed different agreements with almost all countries in Latin America. In 2009, MERCOSUR signed a Free Trade Agreement (FTA) with Israel, with Egypt in 2010 and with Palestine in 2011. Preferential agreements between MERCOSUR and India and with the South African Customs Union (SACU) were signed in 2009. No trade agreements have been signed since then. The trade agreements with Israel and India are in force, but the agreements with Egypt, Palestine and SACU still need to be ratified by the National Congress.

The majority of agricultural imports from MERCOSUR enter the member countries duty free, while the average tariff on agricultural imports from non-MERCOSUR countries is close to 12%. Brazilian exporters face relatively low duties when exporting to most of their major partners. Exports of all goods to the European Union in 2012 faced a trade-weighted average MFN rate of 6.2% while exports to the United States and China faced tariffs averaging respectively 3.4% and 7%. However, Brazilian goods entering the Russian Federation faced duties averaging 21.4% while to enter Japan they had to overcome an 83% average tariff.

There has been a rapid growth in Brazil's agricultural exports, although those exports remain centred around bulk and lightly processed commodities and there is relatively little integration with global value chains. One reason for this is high tariffs on manufacture relative to other countries, which raises the cost of imported inputs. Although Brazil has liberalised its trade over time, the average applied tariff rate on manufactured products fell from 16% in 1996 to 10% in 2012. That rate is higher than the applied rate by the other BRIICS and about three times higher than the world average.

Box 2.5. **Sanitary and phyto-sanitary regulations in Brazil**

Importation of products subject to SPS controls requires a non-automatic license. The Ministry of Agriculture, Livestock and Food Supply (MAPA), through its Secretariat of Agricultural Protections (SDA), is responsible for the protection of animal and plant health. The SDA is vested with authority to control the SPS aspects of production and international trade of all livestock, fruits, vegetables, grains, plants, veterinary drugs, pesticides and the components; it also registers and inspects products and activities that use genetically modified organisms, on behalf of the National Technical Commission on Biotechology (CTNBio), which issues the relevant authorisation. The Ministry of Fisheries and Aquaculture (MPA) is responsible for aquatic, animal health; its General Coordination Office for Aquatic Animal Health (CGSAP) carries out sanitary controls to protect the natural and reproduction environments in Brazil, including on imports of fish and aquatic animals and their reproductive materials. The Brazilian Health Surveillance Agency (ANVISA), an autonomous entity linked to the Ministry of Health under a management contract, is in charge of controlling the production and marketing of products and services subject to sanitary surveillance for the protection of human health. ANVISA is responsible for, *among other things*, approving the importation of food products and performing sanitary inspections at the points of entry into Brazil.

Imports of agricultural products are subject to Brazil's sanitary and phyto-sanitary (SPS) standards. Brazil's system is based on risk analysis that generally takes into account an import's origin and product characteristics (see Box 2.5). Brazil accepts phytosanitary and zoosanitary certificates issued by official sanitary services in countries that follow the guidelines of the Codex Alimentarius Commission, the World Organisation for Animal Health, the International Plant Protection Convention and other international scientific organisations. A total of 3 275 product lines at the HS-8 digit level are subject to SDA controls with 2 675 of these lines requiring SDA authorisation prior to shipment or arrival at Brazil's borders.

Strategic challenges

The prospects for Brazilian agriculture over the next ten years are favourable, notwithstanding the prospects of slower growth in both domestic and international demand, and real prices declining from recent peaks for most agricultural commodities. Both domestic and international markets are expected to grow, with a shift in the composition of demand towards products in which Brazil is a competitive producer; in particular meat and associated feed requirements (maize and oilseeds), sugar, and higher value products such as tropical fruits. That growth will provide further opportunities for Brazil's commercial agriculture, but will add new opportunities for family farms in products where economies of scale are less evident, notably coffee, tropical fruits and horticulture. As a result of this growth, agriculture will continue to play an important role in terms of employment, income generation and export earnings. Increased incomes for family farms and abundant supplies of a diverse range of foods will also contribute to further improvements in food security and nutrition.

The dynamism of Brazilian agriculture was founded on the availability of new technologies adapted to tropical agriculture, the adoption of modern management methods, including financial instruments, and changes in policies. The key to future growth is sustaining improvements in agricultural productivity, which will come from a combination of improvements in crop yields, some conversion of pasture (including degraded and abandoned pasture lands) to cropland, and more intensive livestock production. Brazil's agricultural research and innovation system has been hugely successful, bringing new technologies to farming in tropical areas, and making available innovative new production and management practices. That success can be leveraged through greater private sector engagement. The full potential of the private sector to contribute to agricultural innovation can be realised by strengthening the enabling regulatory framework, improving infrastructure, promoting qualified human capital and developing investment partnerships for research and development between the public and private sectors. At the same time, continued commitment by the government to agricultural research and development, including in new areas such as biotechnology and responses to climate change, are needed to address problems confronting the agricultural sector generally.

The participation of farmers in Brazil's economic growth can be enhanced by further investment in education, training and extension services which provide wider dissemination of existing technologies. However for many traditional farmers, the key to their development will be balanced rural development that creates jobs outside as well as within agriculture. Broad based support, including education and public health support, can help consolidate Brazil's successes in reducing poverty and eliminating hunger, ensuring incomes rise to sustainable levels well beyond the poverty threshold.

Among the factors influencing the competitive position of Brazil's agricultural sector, improvement in logistics and transport infrastructure is a key priority. This would reduce the costs of Brazil's export oriented producers, while benefiting farmers of all types through improved access to domestic markets. The strengthening of animal and plant health and inspection systems is another area that can also underpin the longer term development of domestic and international markets for the Brazilian agricultural sector.

In general, Brazil allocates a relatively low share of its agricultural support to sector-wide investments, such as infrastructure, extension services, and institutional support and knowledge systems. While short term benefits accrue to farmers from price support and credit programmes, in the longer run sector-wide investments can have a higher pay-off to farmers. Although Brazil provides comparatively low support to farmers, there may be opportunities to gradually transfer additional resources to public investment in the light of the expected improvements in agricultural productivity and the associated profitability of the sector. Moreover, the expansion of credit facilities from private sector sources could release further public resources for longer term investment

The lack of a Doha Round WTO agreement has impeded market access for Brazilian producers to many parts of the world. Without a comprehensive WTO agreement, Brazil would gain from a deepening of trade reforms within Mercosur and the broader pursuit of trade agreements with existing and potential partners. Over the past decade a large share of Brazil's exports has gone to China. As China's growth slows, other Asian markets will be progressively more important. At the same time, cross-sectoral liberalisation would eliminate biases in incentives across sectors and reduce the costs of imported inputs. This would help promote value addition in agriculture and greater insertion into global value chains – both of which remain underdeveloped by international standards. Those gains could be reinforced by reforms to the country's complex and costly tax system, and by the removal of administrative obstacles that producers face in establishing and conducting businesses.

One of the overriding challenges for Brazilian agriculture in the long run is the strengthening of productivity growth and the maintenance of international cost competitiveness while making further progress in reducing poverty and inequality. Under the Zero Hunger programme and subsequent National Food Security and Nutrition Program, significant reductions in hunger and poverty rates have taken place in the country over the past decade. Since 2011 the focus given under the Brazil without Extreme Poverty Plan to assisting particularly needy families, most of whom are located in rural areas, can contribute to lessening the economic and social exclusion of these vulnerable groups. Aside from conditional cash transfer payments, longer term benefits can accrue from targeted rural technical assistance.

The improvements in agricultural production can be achieved sustainably. Most of the anticipated increases in production will come from productivity gains, and the stress on natural resources - especially land, but in some regions water too – can be alleviated. There is also scope for further development of more sustainable production practices, including the conversion of existing and degraded cropland to pasture and the integration of crop and livestock systems. Brazil has a large amount of land that can be exploited for agricultural production without further encroaching on the Amazon rainforest. This will imply tighter regulations on illegal activity, and technical and financing support to the Forest Code. It could be further strengthened by assigning property rights on land that has

already been cleared. Clearer property rights would also improve the sustainability of land use in other regions.

The benefits of sustainable growth in Brazil's agriculture are vast. Simultaneously it improves food availability for both domestic and international consumers, while generating income opportunities for a diverse constituency of farmers. Those gains are fully compatible with the government's emphasis on reducing poverty and income inequality, and simultaneously improving the environmental sustainability of the agricultural sector.

Notes

1. Brazil has an official definition of a "family farm" that is adopted in this chapter (Law 11.326/2006 of 24 July 2006, Administrative order Ministry of Agrarian Development No. 111 of 20 November 2003 and Resolution No. 3.467 of 2 July 2007). A family farm must be managed by the owner, use principally family labour, and have a size of less than 4 fiscal modules. A fiscal module is a tax-related measure based on the potential income generation from the land, ranging between 5 and 110 hectares, depending on the geographical area. Using this definition, 84% of Brazil's farms are family farms, averaging 18.4 hectares. By contrast non-family farms average 309 hectares.
2. USDA use data published by FAOSTAT to calculate TFP growth as the difference between output growth and input growth (*www.ers.usda.gov/data-products/international-agricultural-productivity.aspx*). The aggregate index of output volume is based on Agricultural Gross Production in constant 2004-06 USD, smoothed over time using a Hodrick-Prescott filter. The aggregate index of input use is calculated as the average of land, livestock, machinery, fertiliser and feed use indexes, weighted by the shares of these inputs in agricultural production available in the literature.
3. This value is based on the WTO definition of agricultural products which does not include fish and fish products.
4. Petrobras is a semi-public Brazilian multinational energy corporation. Petrobras's activities include the exploration and production of oil and natural gas, oil refining, transportation and distribution of natural gas and oil products, electricity generation and petrochemical production.
5. The different perspectives are summarised, for example, in Box 1.1, "The impact of agriculture on the Brazilian Amazon" in OECD (2005), and in FGV (2013), pp. 26-29.
6. "Legal Amazon" encompasses nine Brazilian states and covers five million square kilometres – more than 50% of Brazil's total area.
7. Because of double or even triple cropping along with area substitution among the various crops, the figures may overstate the extent that new land is brought into production.
8. Unless indicated otherwise, all references to relative change in the value in 2024 are with respect to the average value during the three years 2012 to 2014. The term base period is also used to refer to the average value for 2012 to 2014.
9. The Brazilian Ministry of Agriculture, Livestock and Food Supply (MAPA) projects soybean production for 2024 at 118.0 million tons. Methodological differences help to explain the different results for this crop as well as for wheat and rice, as MAPA uses forecasting models based on time series while the FAO-OECD projections are based on a structural model.
10. *www.mpa.gov.br/files/Docs/Planos_e_Politicas/Plano%20Safra%28Cartilha%29.pdf*.
11. Aquaculture data have been recently revised by the Ministry of Fisheries and Aquaculture (MPA).
12. Mariculture: Cultivation, management and harvesting of marine organisms in their natural habitat or in specially constructed rearing units, e.g. ponds, cages, pens, enclosures or tanks.
13. Auctions are run by the Brazilian National Agency of Petroleum, Natural Gas and Biofuels. Eighty percent of the total biodiesel volume supplied in fulfilment of the mandatory blend is reserved for Social Fuel Seal holders, while the remaining 20% is open to competition for producers with or without the Social Fuel Seal.
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PART I

Chapter 3

Commodity snapshots

This chapter describes the market situation and highlights of the latest set of quantitative medium-term projections for world and national agricultural markets, for the ten-year period 2015-24. Each one of the commodity highlights is complemented by a more detailed discussion in the full online version. It provides information on prices, production, use, trade and main uncertainties for cereals, oilseeds, sugar, meat, dairy products, fish, biofuels and cotton. The quantitative projections are developed with the aid of the partial equilibrium model Aglink-Cosimo of world agriculture. The chapter also includes a description of the macroeconomic and policy assumptions underlying the projections, and each of the commodity highlights is followed by statistical tables.

CEREALS

Market situation

The grains market situation in the marketing year 2014 (see glossary for a definition of marketing year) was characterised by ample supply. Two consecutive record maize harvests in the United States, above average maize, barley and yields in the European Union and the Russian Federation drove global coarse grain stocks up to record levels and market prices to their lowest levels in the past five years. The wheat market situation was similar since harvests were good in most of the major wheat producing countries with significant production gains in Argentina, the Commonwealth of Independent States (CIS) and the European Union. However, wheat production in 2015 is expected below the 2014 record output, reflecting an expected decline in winter wheat production in Europe with yields anticipated to return to average levels from the previous year's highs. Global rice production in 2014 reached almost 495 Mt in milled rice equivalent, slightly lower than 2013 and well below levels that would have been attained had growth continued at its ten year trend of 2% p.a. This outcome is largely due to climatic setbacks in Asia resulting in production declines in India, Indonesia, Nepal, Sri Lanka and Thailand. For the first time in a decade, global rice utilisation surpassed production, resulting in a drawdown of global rice stocks to 177 Mt.

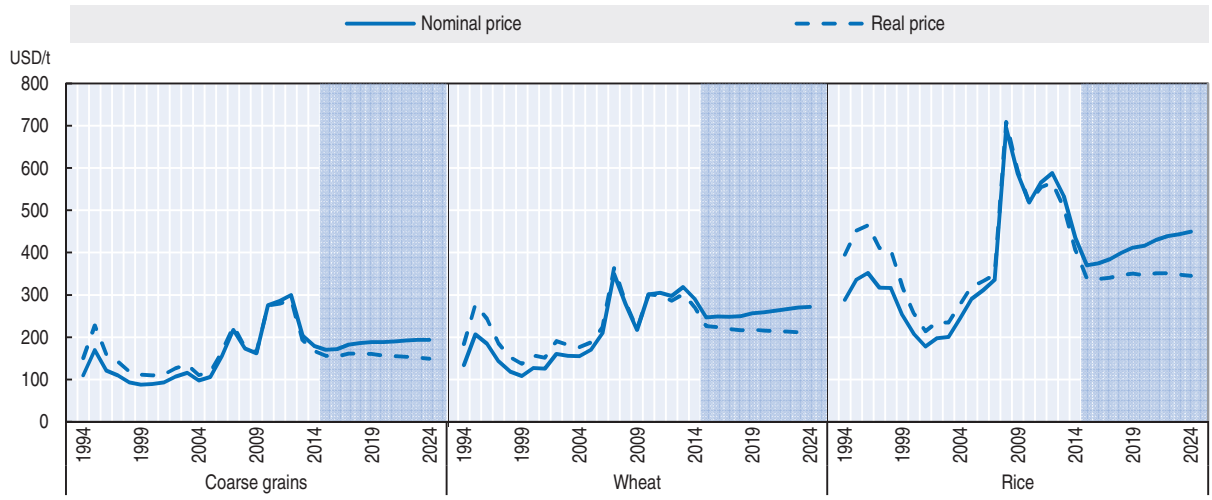
Projection highlights

Cereal prices start from low levels in 2014 compared to those recorded since 2007. In the short term, slower economic growth, historically high production over the past two years that led to stocks build-up, as well as low oil prices may cause prices to decrease further. However in the medium term, the price development in nominal terms is expected to be cost driven, increasing slightly behind inflation and thus moderately declining in real terms. For rice, the turning point to an increasing nominal price path is expected a season later than for other grains, given huge rice stocks accumulated in Thailand. Average nominal prices of the three cereals over the outlook period are projected to be from 6% to 15% lower than in the previous decade (Figure 3.1).

Production of cereals is expected to increase over the next decade. In 2024 production will be 14% greater than the base period (2012-14) mainly driven by yield improvements while area expansion is expected to be limited. Relative to the base period, production in 2024 is projected to increase by similar magnitudes for wheat (12%), coarse grains (15%) and rice (14%). An additional 86 Mt of global wheat supply is projected with a large share being produced in India (15 Mt), the Russian Federation (13 Mt), China (8 Mt) as well as the European Union and Argentina (7 Mt each). Coarse grain production is set to increase by 194 Mt (United States 51 Mt, China 37 Mt, European Union 12 Mt, the Russian Federation 6 Mt and Ukraine 6 Mt). The global increase of 70 Mt in rice production is expected to be dominated by Asian countries (61 Mt) mainly India (17 Mt), Indonesia (8 Mt), Bangladesh, Thailand (6 Mt), Viet Nam and China (5 Mt).

Global cereal consumption is expected to grow by 388 Mt reaching 2 786 Mt by 2024. Wheat consumption increases by 13% compared to the base period and continues to be dominated by food use at a constant share of about 69% of total use. Feed use of wheat is

Figure 3.1. **World cereal prices**



Note: Coarse grains: US GULF Maize, No. 2 Yellow (fob), US Gulf, wheat: US wheat No. 2 Hard Red Winter (fob), rice: Thailand, 100% B, 2nd grade.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

StatLink *http://dx.doi.org/10.1787/888933229173*

projected to increase predominately in China, the Russian Federation and the European Union. Coarse grain consumption continues to be dominated by feed use accounting for more than two thirds of the increase in global consumption (additional 156 Mt of feed use). Most of the additional feed is going to be consumed in developing countries (1 030 Mt) to feed an expanding livestock sector. Food use of rice is expected to drive total consumption up to 562 Mt by 2024. The growth is expected to be higher in developing countries (1.2% p.a.) than in developed countries (0.4% p.a.) with Asian countries accounting for almost 80% of global consumption increase.

Global cereal trade is expected to grow slightly faster than production (1.6% p.a. vs. 1.3% p.a.) which implies growing shares of trade in global production. For wheat this share is expected to reach 21% by 2024, compared with 13% and 9% for coarse grains and rice respectively. Continuing historical trends, developed countries are expected to supply wheat and coarse grains to developing countries, while rice is mostly traded between developing countries. The global players on international rice markets are expected to remain the same.

Given normal stocks and after returning to average yields by 2015, the downward risk on cereal prices over the outlook period is higher than the upward potential. A possible further slowdown of fast growing economies, such as China, and growing competition among exporters could also increase this risk. On the other hand, supply shortages caused by severe droughts may result in surging international prices.

The expanded cereals chapter is available at
http://dx.doi.org/10.1787/agr_outlook-2015-7-en

OILSEEDS AND OILSEED PRODUCTS

Market situation

Global oilseeds production in the 2014 marketing year (see glossary for a definition of marketing year) reached record levels for the second year in a row. Thus, oilseed prices have fallen considerably and remain under pressure. At the same time soybean production increased faster than production of rapeseed, sunflower and groundnuts (the other included oilseeds), increasing the sector's concentration.

Vegetable oil production did not increase commensurate with oilseeds production due to a slower expansion of palm oil and the increasing share of soybeans, which have considerably lower oil content than other main oilseeds. On the other hand, demand growth has slowed in recent times due to stagnating biodiesel production from vegetable oils in developed countries. This has resulted in low vegetable oil prices. Current low prices are expected to result in increasing food demand in the near future.

Continuously growing demand for protein meal has been the main driver behind the expansion of oilseed production in recent years. This has increased the share of protein meal in the value of oilseeds and favoured soybeans over other oilseeds. Compared with coarse grains and other feed ingredients, protein meal prices have stayed relatively high; but a correction might be expected during 2015.

Projection highlights

In nominal terms all oilseeds and oilseed product prices are projected to increase less than the assumed inflation rate over the outlook period. Resulting real prices will decline slightly, based on the assumption of further efficiency gains in the sector which enables it to satisfy the growing global demand at real prices below the current level. The price relationships within the sector will shift slightly. Due to saturation in per capita food demand in many emerging economies and reduced growth in biodiesel production from vegetable oils, real vegetable oil prices will decline faster than real protein meal prices.

During the outlook period, global oilseeds production is expected to continue its expansion, yet at a growth rate of 1.6% p.a. it will fall short of the 3.5% p.a. experienced during the last decade. Production of rapeseed in Canada and the European Union is expected to grow much slower than in the previous decade as high oil-containing oilseeds like rapeseed are more affected by the slower growth in vegetable oil prices.

International oilseeds trade accounts for a consistently high share of global production of around 31% during the next decade. The main flow continues from the Americas (United States and Brazil) to Asia (mainly China). Globally, crushing of oilseeds into meal (cake) and oil dominates the use of oilseeds; direct food use is significant only in a few Asian countries. By 2024 more than 87% of the world oilseed production will be crushed.

Vegetable oil includes the oil from crushing oilseeds (around 53%), palm (36%), palm kernel, coconut and cottonseed. World vegetable oil production will remain concentrated among a few countries in the coming decade. Despite a slowdown in area expansion, significant growth still occurs in the main palm oil producing regions of Indonesia and

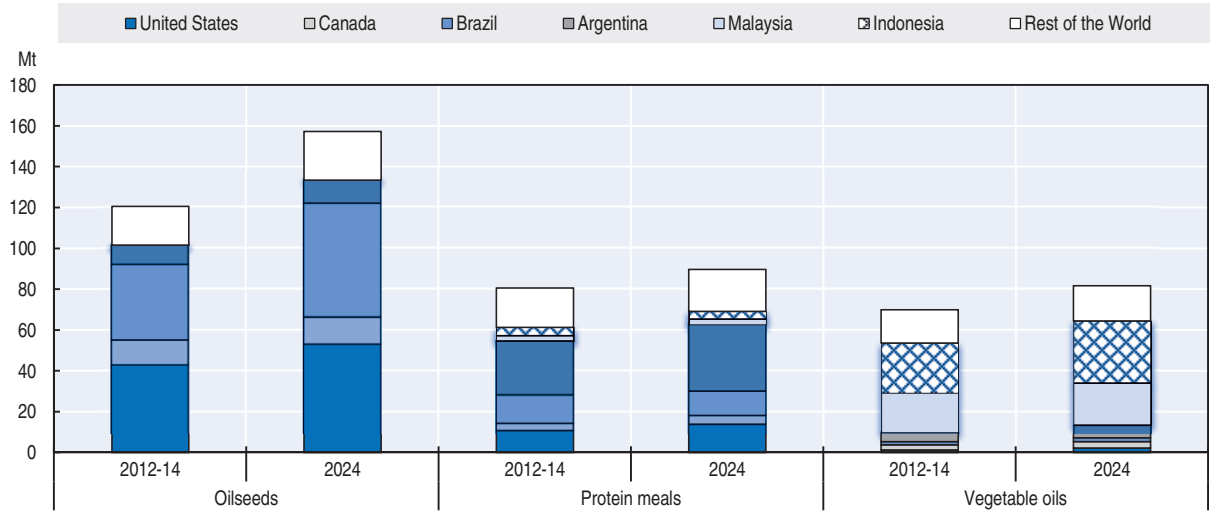
Malaysia. The other source of growth is soybean oil produced in the crush of the increasing soybean production. Demand growth for vegetable oil is expected to slow down in the coming decade due to a) reduced growth in per capita food use in developing countries at 1.1% p.a. compared to 2.7% in the previous decade, and b) stagnant biodiesel production from vegetable oils due to the gradual fulfilment of quotas and expected reductions in biodiesel production targets.

Protein meal production and consumption is dominated by soybean meal. Compared to the past decade, consumption growth of protein meal slows down significantly, reflecting both slower growth in global livestock production and a degree of saturation in the inclusion of protein meal in feed rations. Commercial farms have increasingly optimised the use of protein meal in feed ration in important developing countries, especially China dampening demand. Chinese consumption of protein meal is projected to grow by 2.0% p.a. compared to 7.8% p.a. in the previous decade, still exceeding the growth rate of animal production however.

Growth in world trade in oilseeds is expected to slow down considerably in the next decade, compared to the previous decade. This development is directly linked to the projected deceleration of oilseed crush in China. Because livestock production increases rapidly in the main protein meal producing countries, domestic use of protein meal increases and trade will only expand slightly in the coming decade, resulting in a declining share of trade in world production.

Whereas, oilseed and protein meal exports are dominated by the Americas, vegetable oil exports continue to be dominated by Indonesia and Malaysia (Figure 3.2). Vegetable oil is one of the agricultural commodities with the highest share of trade compared to production at 39%. It is expected that this share remains stable throughout the projection.

Figure 3.2. **Exports of oilseeds and oilseed products by origin**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*
StatLink *http://dx.doi.org/10.1787/888933229182*

In addition to the issues and uncertainties common to most commodities (e.g. macroeconomic environment, crude oil prices and weather conditions), each sector has its specific supply and demand sensitivities. The low stock level at the end of the

outlook period is a source of uncertainty for the stability of prices, for example, if the sector is affected by adverse weather events. Biofuel policies in the United States, European Union and Indonesia are a source of major uncertainties in the vegetable oil sector, because they have an impact on a large share of the demand in these countries.

The expanded oilseed chapter is available at
http://dx.doi.org/10.1787/agr_outlook-2015-8-en

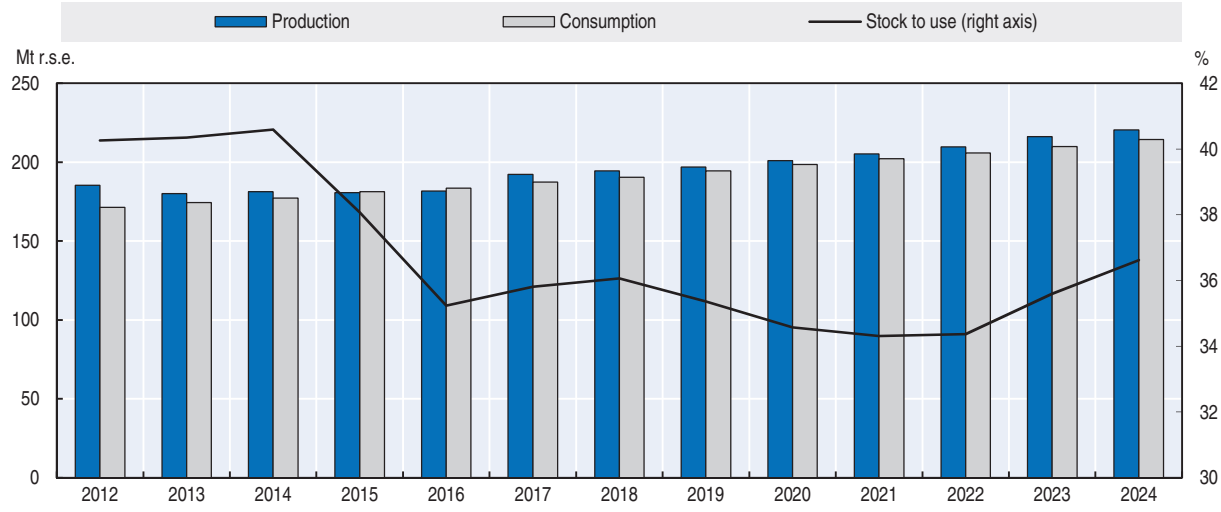
SUGAR

Market situation

After significant increases in sugar production over the past four seasons, leading to large production surpluses, international sugar prices fell to levels that have not been seen since 2010. With global sugar production expected to exceed global sugar consumption one more time, sugar quotations are anticipated to remain under downward pressure for the remainder of the marketing year (see glossary for a definition of marketing year).

However, the current season is expected to be the last in the surplus phase of the world sugar production cycle.[1] With falling world prices and largely replenished stocks in a number of countries -the global stocks-to-use ratio is high for a third consecutive year at the start of the *Outlook*, investment in the sector is expected to wane, ushering the start of the deficit phase of the world sugar production cycle.

Figure 3.3. **Production, consumption and stock-to-use ratio of sugar**



Note: r.s.e.: Raw sugar equivalent
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), http://dx.doi.org/10.1787/agr-outl-data-en
Projection highlights.

StatLink http://dx.doi.org/10.1787/888933229199

Projection highlights

World sugar prices are expected to continue to be volatile and to oscillate over the course of the *Outlook* around a moderately upward trend but to decline in real terms. The international raw sugar price (Intercontinental Exchange No. 11 contract nearby futures) is projected to reach USD 364/t (USD 16.5 cts/lb) in 2024, in nominal terms. Similarly, the indicator world white sugar price (Euronet, Liffe futures Contract No. 407, London) is projected to reach USD 434/t (USD 19.7 cts/lb) in nominal terms in 2024 and the white sugar premium will narrow over the coming decade. Brazil's cost of production of sugar expressed in US dollars and the allocation of Brazilian sugarcane crop between sugar and ethanol production will be key elements in the determination of the world sugar price levels over the outlook period.

Based on normal weather conditions and the set of macroeconomic expectations assumed, global sugar production is projected to increase by 2.2% p.a. in the coming decade to reach nearly 220 Mt by 2024, an increase of around 38 Mt over the base period (2012-14).[2] Most of the additional production will originate in countries producing sugarcane rather than sugar beet, and is more attributed to area expansion notably in Brazil, even though yield improvements are foreseen for sugar crops and sugar processing. A higher share of the world's sugarcane production will be devoted to producing ethanol, rising from about 20% during the base period to 26% in 2024.

Sustained by a steady growth in sugar demand, global consumption of sugar is projected to grow at around 2% p.a., slightly higher than in the previous decade, to reach 214 Mt in 2024. World sugar demand growth will occur mainly in some developing countries in Africa and Asia. In contrast, sugar consumption is projected to show little, or no growth, in many of the developed countries consistent with their status as mature or saturated sugar markets. As a result, the global stock-to-use ratio is expected to decrease and average at 36% on the outlook period, compared to 40% during the base period.

Over the coming decade, exports are expected to remain highly concentrated, with Brazil keeping its position as the world's leading exporter (around 40%) and Thailand boosting its market share. Imports, on the other hand, will remain more diversified. Depending on its level of sugar production, India will continue to face large imports or exports. The share of sugar that is traded relative to global sugar production should increase slightly to reach 33% in 2024 with growing domestic production helping to support growing consumption in developing countries.

On the medium term, alternative sweeteners, in particular high fructose corn syrup, are set to compete further with sugar in the sweetener market. However, sugar's share of the global sweeteners market will continue to account for about 80% of the total.

The projections in this *Outlook* are based on the assumption that sugar prices will be sufficiently attractive in the short term to encourage new investments in producing countries, both at the farm and processing level. Any shocks, such as changes in sugar policies originating from the major producing countries, economic situation, oil price (especially for highly mechanised producers and processors), exchange rates or weather conditions could impact the results of this *Outlook*, with consequences for producers and consumers.

The expanded sugar chapter is available at
http://dx.doi.org/10.1787/agr_outlook-2015-9-en

MEAT

Market situation

Meat prices reached record levels in 2014, driven mainly by an increasing beef price. At the same time, the Porcine Epidemic Diarrhoea virus (PEDv) in the United States and African swine fever in Europe, lowered pigmeat supply in 2014 pushing pigmeat prices upwards. Sheepmeat prices also increased in 2014 following several years of flock reduction in New Zealand, induced by the conversion of sheep farms to more profitable dairy operations and accentuated by drought conditions whilst substitutability among the various meats ensured firm demand and strong poultry prices.

After several years of cow herd liquidation in major producing regions, the United States bovine sector in particular started a cattle herd rebuilding phase in 2014 that sent beef prices higher. Although herd rebuilding is expected to support beef prices in the short term, the effects of PEDv are abating and hence the price of pork and poultry should follow lower feed grain prices. Sheep meat prices remain high along with other meats, supported by higher import demand, particularly from China for mutton and the EU for lamb, combined with flock rebuilding in Australia

Projection highlights

The *Outlook* for the meat market remains largely positive, with feed grain prices set to remain low for the projection period restoring profitability in a sector that had been operating in an environment of particularly high and volatile feed costs over most of the past decade.

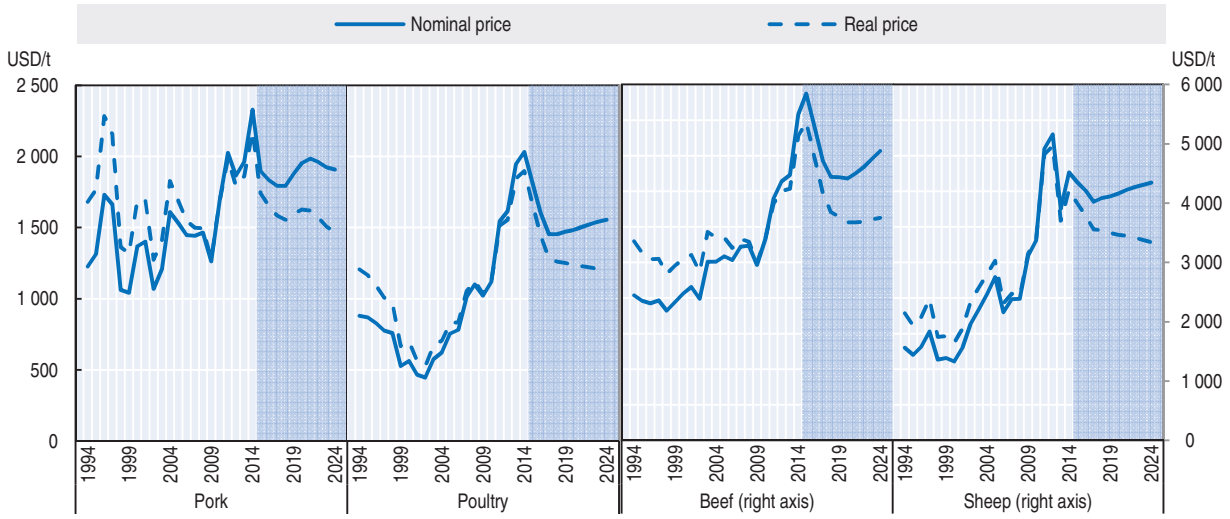
Production is projected to expand, as a result of increased profitability, particularly in the pigmeat and poultry sectors, as well as in regions such as the Americas where feed grains are used intensively to produce meat. However, this year's *Outlook* is projecting weaker economic growth for both developed and developing countries, somewhat limiting consumption growth.

Nominal meat prices are expected to remain high throughout the outlook period, although below 2014 levels with the exception of beef which is expected to remain high for another two years, as herds are rebuilt in several parts of the world. By 2024, prices for beef and pigmeat are projected to increase to around USD 4 900/t carcass weight equivalent (c.w.e.) and USD 1 900/t c.w.e. respectively, while world sheep meat and poultry prices are expected to rise to around USD 4 350/t c.w.e. and USD 1 550/t c.w.e. respectively. In real terms meat prices are expected to trend down from their latest high levels, although they will remain higher than in the previous decade (Figure 3.4).

Global meat production rose by almost 20% over the last decade, led by growth in poultry and pigmeat. Over the next decade, global meat production will expand at a slower rate, and in 2024 will be 17% higher than the base period (2012-14). Developing countries are projected to account for the vast majority of the total increase through a more intensive use of protein meal in feed rations in the region. Poultry meat will capture more than half of the additional meat produced globally by 2024, compared to the base period. In general production will also benefit from both improved meat-to-feed price margins as well as better feed conversion ratios in the next decade.

Global annual meat consumption per capita is expected to reach 35.5 kg retail weight equivalent (r.w.e.) by 2024, an increase of 1.6 kg r.w.e. compared to the base period. This

Figure 3.4. **World meat prices**



Note: US Choice steers, 1 100-1 300 lb dressed weight, Nebraska. New Zealand lamb schedule price dressed weight, all grade average. US Barrows and gilts, No. 1-3, 230-250 lb dressed weight, Iowa/South Minnesota. Brazil average chicken producer price ready to cook.
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.
StatLink *http://dx.doi.org/10.1787/888933229200*

additional consumption will consist mainly of poultry. Globally, per capita consumption of pig and bovine meat is expected to remain stable at levels comparable to the base period. In absolute terms, consumption per capita of meat in developed countries is expected to remain more than double that in the developing countries (68 kg r.w.e. compared to 28 kg r.w.e. in 2024), However, consumption growth in developed countries over the projection period is expected to remain slow relative to developing regions. Rapid population growth and urbanisation within many developing regions remains a core driver of total consumption growth.

Growth in meat trade is projected to decelerate compared to the past decade. Globally almost 11% of meat output will be traded. The most significant growth in import demand originates from Asia, which captures the greatest share of additional imports for all meat types. Africa is another fast growing meat importing region albeit from a lower base. Although developed countries are still expected to account for slightly more than half of global meat exports by 2024, their share is steadily decreasing relative to the base period. Brazil's share of global exports is expected to remain stable at around 21%, contributing to a quarter of the expected increase in global meat exports of the projection period. Trade policies remain one of the main factors driving the outlook and dynamics in the world meat markets. The implementation of various bilateral trade agreements over the outlook period could diversify meat trade considerably. The outbreak of PEDv in the United States has illustrated the extent to which disease outbreaks can affect both domestic and international markets. A reduction of almost 1.5% in US supplies through 2014 contributed to higher pigmeat prices. Globally, impacts of trade agreements or animal diseases vary significantly, however, depending on whether the region is an importer or exporter, as well as the magnitude of market share.

The expanded meat chapter is available at
http://dx.doi.org/10.1787/agr_outlook-2015-10-en

DAIRY

Market situation

Chinese milk production declined by 5.7% in 2013 leading to strong import demand for dairy products and to higher world prices. Additionally, during the first half of 2013, major players on the world dairy market – the United States, the European Union, New Zealand and Australia – produced less milk than a year ago. The main reasons were high feed cost and adverse weather conditions in Oceania and parts of Europe. Prices for skim milk powder (SMP) and whole milk powder (WMP) reached a new peak in April 2013, above the 2007-08 commodity boom level.

Production in the major dairy exporting countries started to increase in mid-2013, as feed prices declined and milk margins improved. Nevertheless, due to continued strong demand on the world market, dairy prices remained high into early 2014.

Prices of dairy products started declining in the beginning of 2014. This price decline accelerated in August with China's declining demand for WMP and the Russian Federation's import ban, for among other products, cheeses from the European Union, the United States, Australia and other origins. Since late 2014, the EU production is less dynamic especially because of binding milk quotas until March 2015, while the seasonal decline in Oceania is stronger than a year ago. On the other hand, the devaluation of the Euro makes EU exports more competitive and results in increasing EU exports of dairy products, and US milk production remains considerably above the year ago level.

Projection highlights

International prices of several dairy products declined in 2014 following new highs attained in 2013. Nominal prices over the medium term are expected to firm. Real prices are projected to decline slightly in the next decade, albeit remaining considerably above the pre-2007 levels.

World milk production is projected to increase by 175 Mt (23%) by 2024 when compared to the base years (2012-14), the majority of which (75%) is anticipated to come from developing countries, especially from Asia. The growth rate for milk production over the projection period is expected to average 1.8% p.a. which is below the 1.9% p.a. witnessed in the last decade. Dairy cow numbers are expected to decline in developed countries, whereas herd expansion in developing countries is projected to slow down. In terms of yield per dairy cow, faster increases are expected than in the previous decade, mainly in developing countries.

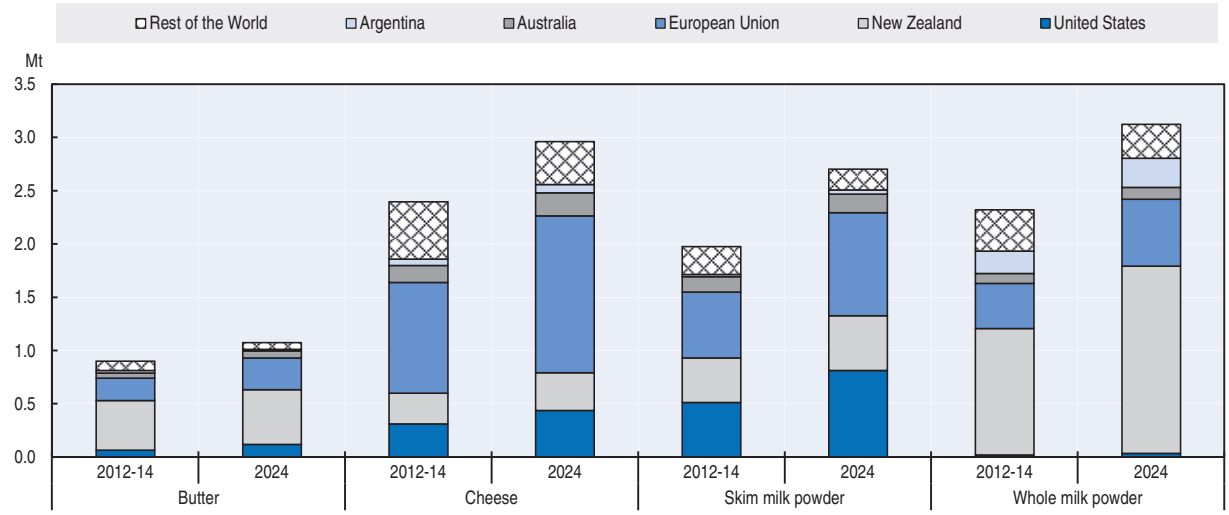
Production growth of the main dairy products (butter, cheese, SMP and WMP) is increasing at the world level at similar pace as milk production. Resulting in a slightly faster increase in the production of fresh dairy products especially in developing countries by 3.0% p.a. where the majority of consumption is in the form of milk or other fresh dairy products.

Per capita consumption of dairy products in developing countries is expected to increase by 1.4% to 2.0% p.a. The expansion in demand reflects continuing albeit more modest income growth and further globalisation of diets. By contrast, per capita consumption in the developed world, reflecting the already relatively high per capita

consumption of these products, is projected to increase between 0.2% and 1.0% p.a., with the lower figure for butter, which competes with vegetable oil, and the higher figure for cheese. Nevertheless, butter recovers from declining consumption in developed countries observed in the last decade.

A general expansion of trade in dairy products is expected over the coming decade. Strong growth is expected for whey, WMP and SMP, at more than 2% p.a. Lower growth is expected for cheese and butter, at 2.0% p.a. and 1.5% p.a., respectively. The bulk of this growth will be satisfied by expanded exports from the United States, the European Union, New Zealand, Australia and Argentina (Figure 3.5). In the recent past, the international dairy market has been supplied by a few countries. This concentration is expected to increase over the next decade. New Zealand is the lead exporter for butter and WMP, whereas the European Union is the main exporter of cheese and SMP.

Figure 3.5. **Exports of dairy products by origin**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

StatLink *http://dx.doi.org/10.1787/888933229218*

Development of the dairy market remains uncertain, potentially altering market outcomes as described. Major impacts can come from disease outbreaks, trade restrictions, weather developments and policy changes. World demand will remain strong, especially from China. Nevertheless, the development of Chinese self-sufficiency ratios in milk and dairy products is a main determinant of the future price development on world dairy markets. The *Outlook* assumes a slight increase in China's import dependency. The largest supplier of dairy exports, New Zealand, is weather dependent due to the predominantly pasture-based production, and environmental constraints could curb the projected production growth.

The expanded dairy chapter is available at
http://dx.doi.org/10.1787/agr_outlook-2015-11-en

FISH

Market situation

The market prospects for fish continue to be positive. The year 2014 was characterised by historical peaks in production, trade and consumption, only slightly affected by events such as the Russian Federation's import ban and reduced catches in South America.

Apparent per capita fish consumption is estimated to have reached about 20 kg in 2014, with aquaculture overtaking capture fisheries as the main source of fish for human consumption for the first time.

Developing countries, in particular in Asia, will continue to drive major changes and expansion in global fishery production, trade and consumption, being the main producers, exporters and growing consumers. However, in 2014, trade increased faster in developed countries than in developing countries. This is counter to the long-term trend, which has seen developing countries, particularly in South America and South and East Asia, steadily increase their proportion of world trade in fishery products. The major factors behind this reversal were booming growth in the United States market and a record-breaking year for key producer and exporter Norway.

Fish prices grew sharply during the first part of 2014 and weakened during the rest of the year due to softening consumer demand in many European markets and Japan, and improving supply situation of certain fishery species. However, fish prices remained above 2013 levels for most species and products, in particular for farmed species. The FAO Fish Price Index (base 2002-04 = 100) indicates that prices are at record heights reaching a peak in March 2014 (at 164, with aquaculture species at 168).

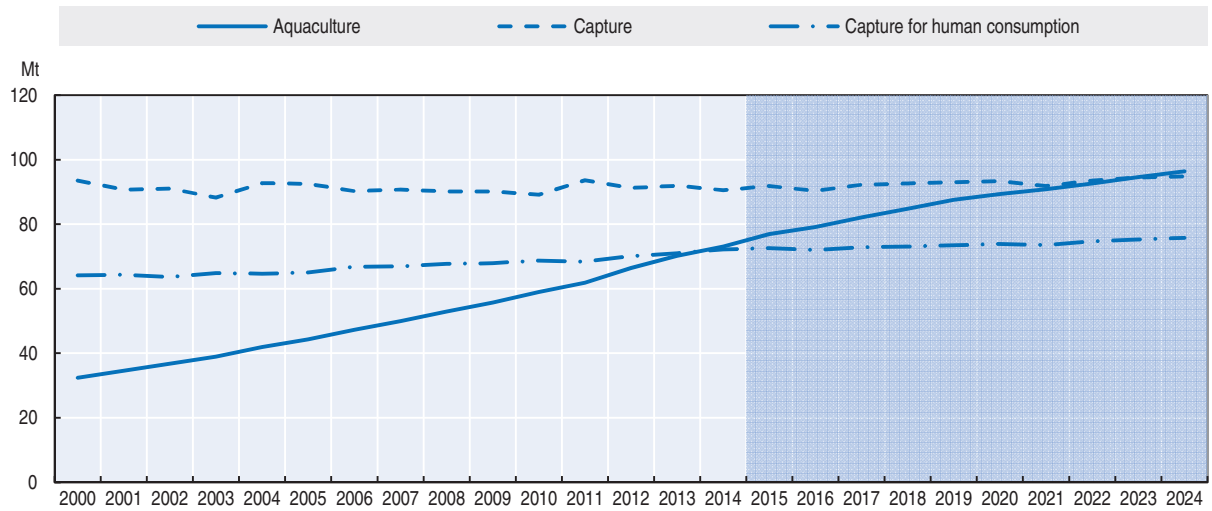
Projection highlights

The main drivers affecting world fish prices for capture, aquaculture and traded products will be income and population growth, limited increase in capture fisheries production, high meat prices in the short term, and feed prices. All these factors will contribute to high fish prices in the near future followed by a decline in the remaining years of this decade and an increase in the 2020s. In real terms, prices are expected to decline from the record high of 2014. The aquaculture to coarse grains price ratio is expected to be cyclical over 2015-24 and to eventually stabilise slightly lower than the historical average (1990-2014). The price ratio between aquaculture and fishmeal will remain relatively stable. Since the feed demand for fishmeal from aquaculture and livestock sectors is growing faster than supply, an increase in the fishmeal to oilseed meal price ratio is expected. The popularity of the Omega-3 fatty acids in human diets and the growth in aquaculture production have both contributed to a rise in the fish oil to oilseed price ratio since 2012, which is expected to be maintained over the medium term. However, since fish oil and oilseed oil prices are starting from very high levels, a decline is expected in nominal terms for the rest of this decade.

Fisheries production worldwide is projected to expand by 19% between the 2012-14 base period and 2024, to reach 191 Mt. The main driver of this increase will be aquaculture, which is expected to reach 96 Mt by 2024, 38% higher than the base period (average 2012-14) level. Aquaculture will remain one of the fastest growing food sectors, notwithstanding a

slowdown of its average annual growth rate going from 5.6% in the previous decade to 2.5% in the projection period. In 2023, aquaculture will surpass total capture fisheries (Figure 3.6). This development heralds a new era, indicating that aquaculture will increasingly be the main driver of changes in the fisheries and aquaculture sector. Nonetheless, the capture sector will remain dominant for a number of species and vital for domestic and international food security. World production of fishmeal is expected to eventually return to the 5 Mt level by the end of the outlook period and world fish oil production should hover around 1 Mt. In both cases, the share of production of fishmeal and fish oil obtained from whole fish is expected to fall compared to the previous decade.

Figure 3.6. **Aquaculture and capture fisheries**



Note: "Capture for human consumption refers" to the Capture production excluding ornamental fish, fish destined to the production of fishmeal, fish oil and other non-food uses. All aquaculture production is assumed to be destined to human consumption.
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", OECD Agriculture Statistics (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.
StatLink *http://dx.doi.org/10.1787/888933229221*

World per capita apparent fish food consumption is projected to reach 21.5 kg in live weight (lw) equivalent in 2024, up from 19.7 kg in the base period. The average annual growth rate will be lower in the second half of the outlook period, due to more competitive meat prices. Per capita fish consumption is expected to increase in all continents, with Asia showing the fastest growth. In contrast with previous *Outlook Reports*, for the first time, a slight increase is projected for Africa. Lower feed and crude oil prices reduced production and transportation costs enhancing African aquaculture production and imports. Per capita fish consumption will remain higher in more developed economies, even if it is expected to grow more rapidly in developing countries.

Fuelled by sustained demand, innovations and improvements in processing, preservation, packaging, transport and logistics, total fish, and fishery products (fish for human consumption, fishmeal on a lw basis) will continue to be highly traded, representing about 31% of production (36% including intra-EU trade) in 2024. However, global fish trade for human food is projected to grow slower than in the past decade due to increasing domestic consumption by main producers. Developing countries are expected to account for 64% of global fish exports for human consumption by 2024, down from 66% in the base period. Developed regions will continue to remain the main importers.

The key uncertainty for the fish projections remains the productivity gains in aquaculture, which might be affected by several factors, including availability and accessibility to land, water, financial resources, improvement in technology, feeds, etc. In addition, animal disease outbreaks have shown to the potential to affect aquaculture production and subsequently domestic and international markets depending on the size and the species involved. Natural productivity of fish stocks and ecosystem and the occurrence of *El Niño* are the key uncertainties impacting capture fisheries and also the fishmeal and fish oil outlook. Trade policies, and in particular bilateral trade agreements, remain an important factor influencing the dynamics of the world fish markets.

The expanded fish chapter is available at
http://dx.doi.org/10.1787/agr_outlook-2015-12-en

BIOFUELS

Market situation

Cereals, oilseeds and vegetable oil prices in 2014 continued their decrease in nominal terms. This, coupled with the strong decline in crude oil prices in the second half of the year, led to lower world ethanol[3] and biodiesel[4] prices in a context of ample supply for both products.

The policy environment around biofuels remained uncertain, with the absence of a final rulemaking by the United States Environmental Protection Agency (EPA) for policies in 2014 and 2015, and by the fact that the European Union's 2030 Framework for Climate and Energy Policies adopted in October 2014 that did not define clear targets for biofuels beyond 2020. The evolution of the crude oil price and various domestic policy signals provided incentives to the Brazilian ethanol industry.

Projection highlights

This *Outlook* assumes that ethanol use in the United States will be limited by the 10% ethanol blend wall[5] and that cellulosic ethanol will not be available on a large scale until the last years of the projection period. For the European Union, the fulfilment percentage of the Renewable Energy Directive (RED)[6] target coming from biofuels expressed in energy share is assumed to reach 7% by 2019.[7] In Brazil, the *Outlook* assumes that Brazilian retail prices of petrol over the first part of the next decade will be kept slightly above international prices.[8] Elsewhere in the world, biofuel sectors in general continue to be driven by a mix of price trends and effective policy support. Proposed production and consumption targets vary considerably across countries leading to a wide range of growth prospects for individual countries.

Decreases in crude oil and biofuel feedstock prices should lead to a strong decline in ethanol and biodiesel prices at the beginning of the projection period. Subsequently, both ethanol and biodiesel prices are expected to recover in nominal terms close to their 2014 levels (Figure 3.7).

Global ethanol and biodiesel production are both expected to expand to reach, respectively, almost 134.5 and 39 billion litres (Bln L) by 2024. Food-crop based feedstocks are expected to continue to dominate ethanol and biodiesel production over the coming decade as indicated by the lack of investment in research and development (R&D) for advanced biofuels, the size of the required investments and the lack of policies' visibility for operators. Most of the additional ethanol production is expected to take place in Brazil. Incentives based on national biofuel policies will continue to influence biodiesel production patterns. Indonesia will surpass the United States and Brazil in the latter years of the outlook period to become the second largest biodiesel producer behind the EU.

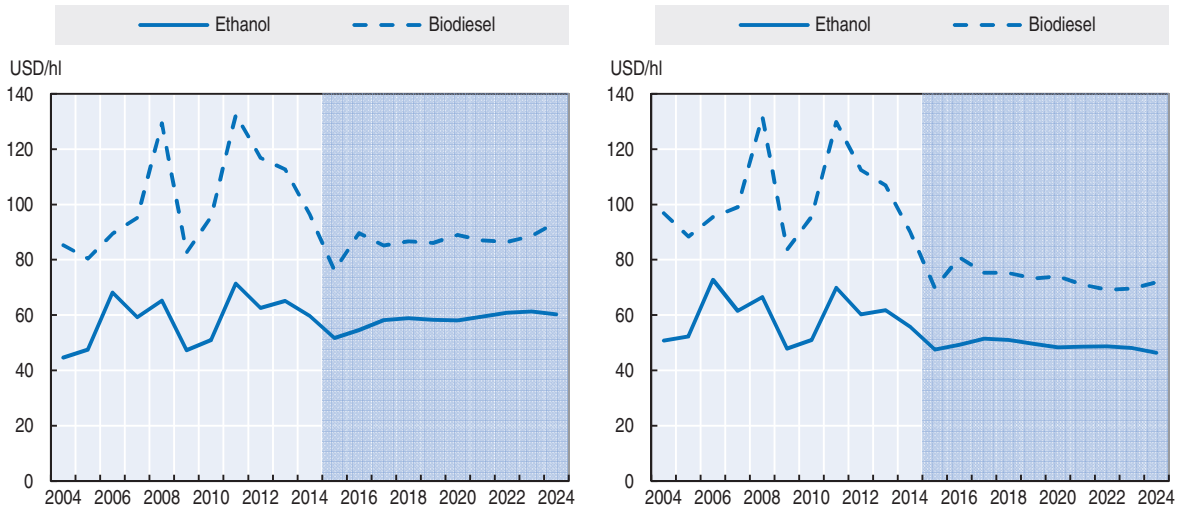
Ethanol use in the United States will be limited by the ethanol blend wall and by declining gasoline use in the latter years of the projection period. In Brazil, ethanol use expansion is linked to the high mandatory anhydrous ethanol blending requirement and to a differential taxation system that allows hydrous ethanol to compete with gasohol at least in some states. In the European Union, biodiesel use is projected to increase to its highest level in 2019 when the RED target is assumed to be met.

Ethanol and biodiesel trade in the next ten years is not expected to expand. The bilateral ethanol trade that occurred between Brazil and the United States is not expected to take place as the need for sugarcane based ethanol to fill the US advanced mandate should remain limited. Argentina and Indonesia continue to dominate biodiesel exports, the United States and EU are the only significant importers.

The future evolution of the political will to support biofuel blending in transportation fuel represents the key uncertainty to the sector. This decision process will be shaped mainly by macroeconomic developments in key countries, relative prices of feedstocks and fossil fuels, prevailing views on environmental benefits of biofuels and the global food security situation.

Figure 3.7. **Evolution of biofuel world prices**

Expressed in nominal terms (left panel) and in real terms (right panel)



Note: Ethanol: wholesale price, US, Omaha; Biodiesel: Producer price, Germany, net of biodiesel tariff and energy tax.
Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en.*

StatLink *http://dx.doi.org/10.1787/888933229237*

The expanded biofuels chapter is available at
http://dx.doi.org/10.1787/agr_outlook-2015-13-en

COTTON

Market situation

The world cotton market in 2014 was affected by policy changes in China, which reduced the amount of support offered to farmers. This policy change lowered the gap between domestic and international cotton prices introduced in 2011. Falling domestic prices increased mill consumption after several seasons of decline, and a reduction in import quotas sharply reduced China's demand for cotton from the rest of the world.

Global cotton production has decreased and consumption increased over the last few years, but the international market has yet to equilibrate. Global production at 25.8 Mt in 2014 exceeds consumption and global cotton stock rose for the fifth consecutive year as the stocks-to-use ratio climbed to 86%. The United States and Pakistan increased production in 2014, but falling international prices in the beginning of 2014 resulted in lower production in southern hemisphere countries such as Brazil and Australia. Global mill consumption continued to rebound in 2014. Except for Brazil, major cotton mill users, namely China, India, Pakistan, Turkey, Bangladesh, the United States and Indonesia increased consumption.

Global cotton imports declined for the second consecutive season to 7.6 Mt, with China, Indonesia and Turkey reducing imports. Policy changes in China and lower import demand elsewhere caused cotton exports to decline. India's exports also declined sharply, but as harvested area expanded, India moved past China as the world's largest cotton producer in 2014.

Projection highlights

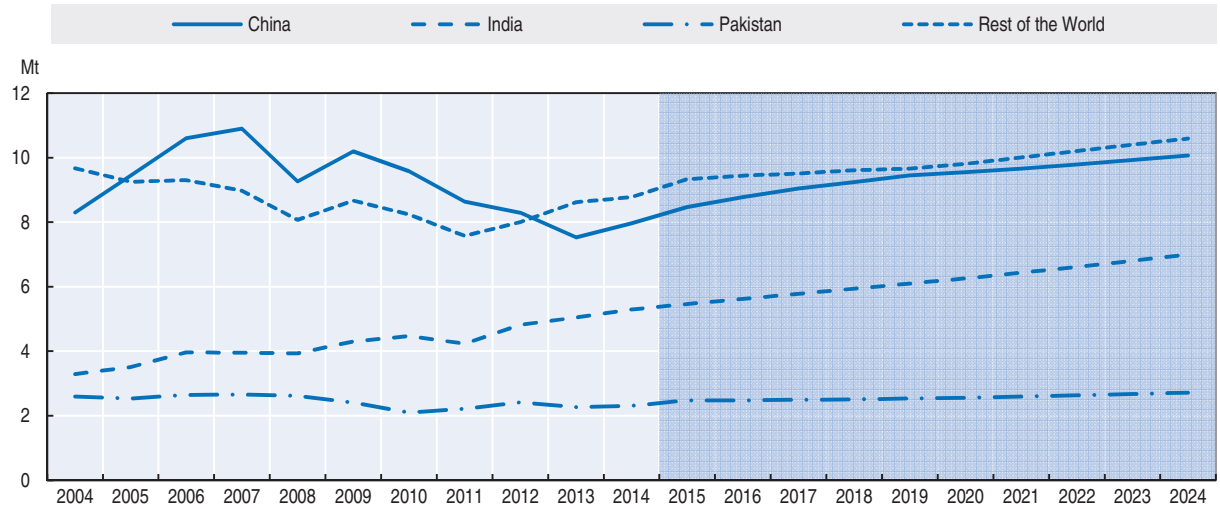
Relatively stable cotton prices are expected during 2015-24 as the volatility surrounding the 2010 spike in cotton prices subsides. The shift from building stocks to reducing them in China is one of the major factors behind a drop foreseen in world cotton prices during the early years of the outlook period. By 2024, world cotton prices are expected to be lower than in 2012-14 in both real and nominal terms. The world price in 2024 in real terms is expected to be 23% lower than in the base period (2012-14), and 9% lower than its 2000-09 average.

World production is expected to grow more slowly than consumption during the first years of the outlook period, reflecting the anticipated lower prices with the large global stocks that accumulated between 2010 and 2015 influencing the market. The stock-to-use ratio becomes 46% in 2024. World cotton area grows throughout the projection period, but does not surpass the peaks seen in 2004 and 2011. Yields rise around the world, but global average yield grows slowly as production switches from relatively high yielding countries, like China, to relatively low-yielding ones in South Asia and Sub-Saharan Africa.

World cotton use is expected to grow at 1.8% p.a., a rate slightly above the long term average of 1.7% during the last 20 years. In 2006 and 2007, world consumption reached a peak of 26.5 Mt, and following significant declines during 2008-11 – and with a relatively slow recovery – this peak is not likely to be surpassed again until 2017. World per capita consumption of cotton increases, but the level in 2024 is nonetheless expected to remain below historical peaks. China is expected to remain the largest consumer of cotton fibre, but its consumption growth is expected to become lower than India's and other growing consumers

such as Bangladesh and Viet Nam. Consequently, China's share of world consumption is expected to stagnate (Figure 3.8). While reforms of China's cotton support policy will help sustain its share of world textile mill use of cotton, wage gains and demographic shifts are significant factors limiting that share. India's consumption is expected to rise by 39% over the medium term, to make it the leading beneficiary of growing world consumption.

Figure 3.8. **Cotton consumption by major country**



Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database), *http://dx.doi.org/10.1787/agr-outl-data-en*.

StatLink *http://dx.doi.org/10.1787/888933229240*

World trade rises at a rate above its long-term average in the *Outlook*, with exports in 2024 19% above those in the base period. The United States retains its position as the world's largest exporter accounting for 24% of world trade. India retains its position as the world's second largest source of cotton while increasing its global share from 18% in the base period to 20% by 2024. Brazil and least developed countries (LDCs) in Sub-Saharan Africa are also expected to increase their export shares. China retains its position as the world's largest import market for cotton throughout the outlook period. Reflecting the rebound of its consumption, China's share of world trade is foreseen to increase to 39% in 2024. Bangladesh's share rises more than any other importer, up from 10% to 13%. Imports are also expected to increase in Viet Nam and Indonesia increasing their share of the international cotton market.

Important sources of uncertainty in the current *Outlook* are the level of consumer demand and its relationship to industrial demand for cotton fibre, the largest among natural fibres of vegetable or animal origin. Due to significant value-added in the production of consumer products, and substantial opportunities to substitute synthetic fibres for cotton, the relationship between consumer spending on clothing and the volume of cotton consumed can vary significantly. China's cotton policies and prospects for productivity gains around the world are another source of uncertainty.

The expanded cotton chapter is available at
http://dx.doi.org/10.1787/agr_outlook-2015-14-en

Notes

1. In some key Asian producing countries such as India, contrary movements between administered sugarcane and market determined sugar prices generate payment arrears by mills to sugarcane growers, leading to periods of surplus followed by periods of deficit.
2. See the glossary for the definition of the sugar crop year. The assumptions underlying the baseline projections can be found in the Box on macroeconomic assumptions.
3. Wholesale price, United States, Omaha.
4. Producer price, Germany, net of biodiesel tariff and of energy tax.
5. The term blend wall refers to short run technical constraints that act as an impediment to increased ethanol use. It is assumed in this *Outlook* that US cars will not be able to consume gasohol with more than 10% of ethanol mixed with petrol.
6. *http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF*.
7. The remainder of the RED target will at least be partly filled by electric cars and other sources.
8. A description of the Brazilian ethanol industry and its link with the level of gasoline prices is provided in Chapter 2.

Annex: Commodity snapshot tables

Table 3.A1.1. **World cereal projections**

Marketing year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
WHEAT												
World												
Production	Mt	700.4	723.8	723.8	731.6	740.3	745.9	756.4	763.2	771.6	779.2	786.7
Area	Mha	221.6	224.6	222.8	223.5	224.2	223.9	224.7	225.0	225.4	225.8	226.1
Yield	t/ha	3.16	3.22	3.25	3.27	3.30	3.33	3.37	3.39	3.42	3.45	3.48
Consumption	Mt	694.4	711.1	720.9	727.1	737.4	744.1	752.7	760.2	768.4	776.9	784.3
Feed use	Mt	125.7	129.3	132.5	133.6	137.1	138.0	140.4	141.9	144.0	147.0	148.9
Food use	Mt	480.9	489.2	495.1	500.1	505.8	510.7	515.5	519.7	525.1	530.6	535.7
Biofuel use	Mt	6.6	6.9	7.3	8.1	8.3	8.6	8.2	8.1	7.9	7.6	7.5
Other use	Mt	81.2	85.7	85.9	85.3	86.2	86.8	88.6	90.5	91.5	91.8	92.2
Exports	Mt	147.7	150.9	150.3	153.3	156.0	157.6	159.6	160.9	162.2	163.2	164.6
Closing stocks	Mt	180.6	211.4	214.2	218.7	221.7	223.4	227.1	230.2	233.3	235.6	238.0
Price[1]	USD/t	302.0	246.6	249.0	248.2	249.5	256.7	258.5	262.2	266.3	270.2	271.8
Developed countries												
Production	Mt	362.4	368.5	367.2	370.2	375.7	376.9	382.7	385.0	388.9	392.4	395.6
Consumption	Mt	265.2	267.9	270.8	269.9	273.1	274.2	276.7	278.3	280.5	282.5	283.9
Net trade	Mt	99.2	97.9	96.4	97.9	100.0	101.6	103.9	105.2	106.9	108.6	110.6
Closing stocks	Mt	67.2	77.3	77.3	79.8	82.3	83.5	85.6	87.1	88.6	89.8	90.9
Developing countries												
Production	Mt	338.0	355.3	356.6	361.4	364.6	369.0	373.7	378.2	382.7	386.8	391.1
Consumption	Mt	429.3	443.2	450.1	457.2	464.2	470.0	476.0	481.9	487.9	494.4	500.4
Net trade	Mt	-97.1	-97.9	-96.4	-97.9	-100.0	-101.6	-103.9	-105.2	-106.9	-108.6	-110.6
Closing stocks	Mt	113.4	134.0	136.9	139.0	139.4	140.0	141.6	143.1	144.7	145.8	147.1
OECD[2]												
Production	Mt	285.7	288.0	284.8	285.5	288.9	289.0	293.6	294.7	297.4	299.9	302.2
Consumption	Mt	219.2	220.9	222.6	220.7	222.5	222.7	224.4	225.2	226.8	228.3	229.1
Net trade	Mt	65.4	65.4	62.3	62.9	64.1	65.1	67.3	68.3	69.5	70.6	72.4
Closing stocks	Mt	49.0	56.1	56.0	57.9	60.2	61.3	63.2	64.4	65.6	66.6	67.4
COARSE GRAINS												
World												
Production	Mt	1 255.3	1 276.2	1 297.2	1 323.9	1 345.3	1 365.6	1 381.5	1 396.4	1 414.7	1 431.0	1 449.4
Area	Mha	336.8	341.7	344.4	346.6	348.9	350.4	351.1	351.6	352.3	353.0	353.7
Yield	t/ha	3.73	3.73	3.77	3.82	3.86	3.90	3.94	3.97	4.02	4.05	4.10
Consumption	Mt	1 215.0	1 280.0	1 296.5	1 312.2	1 334.6	1 353.6	1 371.1	1 391.0	1 408.0	1 424.7	1 440.1
Feed use	Mt	694.7	736.3	747.9	760.5	775.3	788.1	800.3	813.9	826.0	839.1	850.7
Food use	Mt	200.2	205.5	209.5	212.9	216.4	220.3	224.0	227.7	231.7	235.7	239.5
Biofuel use	Mt	143.9	150.9	150.7	150.6	153.8	155.0	153.8	154.1	153.8	153.0	152.1
Other use	Mt	130.9	140.6	141.1	139.3	139.5	139.7	141.5	143.0	143.6	143.4	143.8
Exports	Mt	159.4	155.4	158.7	161.9	164.7	167.6	171.0	174.2	178.0	181.3	185.0
Closing stocks	Mt	220.4	251.1	245.9	251.7	256.5	262.5	267.1	266.6	267.5	267.9	271.2
Price[3]	USD/t	227.4	169.9	171.5	182.1	186.0	188.2	188.0	190.0	191.9	193.4	193.7
Developed countries												
Production	Mt	645.8	664.8	675.0	687.4	697.2	703.9	708.2	711.5	717.4	723.0	729.8
Consumption	Mt	580.9	605.9	608.7	612.4	620.8	626.9	629.7	635.6	639.3	642.9	646.0
Net trade	Mt	54.8	67.1	69.7	70.5	71.6	72.7	74.9	76.2	78.0	79.7	82.1
Closing stocks	Mt	81.3	97.0	93.6	98.0	102.8	107.1	110.7	110.3	110.4	110.7	112.4
Developing countries												
Production	Mt	609.5	611.4	622.2	636.5	648.0	661.8	673.4	685.0	697.3	708.0	719.6
Consumption	Mt	634.1	674.2	687.8	699.7	713.8	726.8	741.4	755.4	768.7	781.7	794.1
Net trade	Mt	-39.5	-59.4	-61.4	-61.9	-63.1	-64.0	-65.9	-66.8	-68.3	-69.7	-71.7
Closing stocks	Mt	139.0	154.1	152.3	153.7	153.7	155.4	156.5	156.3	157.1	157.2	158.8
OECD[2]												
Production	Mt	585.3	600.4	608.5	618.7	626.6	632.1	635.4	637.8	642.9	647.5	653.3
Consumption	Mt	571.8	595.7	598.6	601.4	609.1	615.0	618.2	624.1	627.8	631.6	635.1
Net trade	Mt	3.5	12.4	13.3	13.0	12.6	12.8	13.9	14.2	14.9	15.7	16.6
Closing stocks	Mt	76.6	90.7	87.3	91.7	96.5	100.8	104.2	103.8	103.9	104.0	105.7

StatLink http://dx.doi.org/10.1787/888933229752

Table 3.A1.1. **World cereal projections (cont.)**

Marketing year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
RICE												
World												
Production	Mt	494.0	506.3	509.2	516.3	523.3	530.3	538.2	545.8	552.2	558.0	564.1
Area	Mha	162.3	161.4	160.3	160.3	160.0	160.1	160.3	160.3	160.3	160.5	160.9
Yield	t/ha	3.04	3.14	3.18	3.22	3.27	3.31	3.36	3.41	3.45	3.48	3.51
Consumption	Mt	488.8	505.6	511.3	518.7	524.3	529.6	536.2	543.4	549.6	555.5	561.9
Feed use	Mt	17.6	18.7	19.4	19.8	20.4	20.7	21.1	21.6	22.0	22.6	23.1
Food use	Mt	409.5	420.3	424.7	431.4	436.3	441.1	446.7	452.7	457.9	462.6	467.5
Exports	Mt	40.1	42.8	42.5	43.5	44.4	45.5	46.7	48.4	49.7	51.0	52.2
Closing stocks	Mt	178.2	177.7	175.6	173.2	172.1	172.8	174.8	177.2	179.8	182.3	184.5
Price[4]	USD/t	518.9	369.8	374.9	384.8	399.4	411.9	416.0	430.3	438.8	443.5	449.4
Developed countries												
Production	Mt	17.9	18.7	18.5	18.7	18.9	19.0	19.1	19.2	19.4	19.5	19.6
Consumption	Mt	18.7	19.1	19.0	19.2	19.3	19.4	19.5	19.5	19.6	19.7	19.8
Net trade	Mt	-0.8	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2
Closing stocks	Mt	4.7	4.5	4.4	4.4	4.5	4.5	4.5	4.5	4.6	4.6	4.6
Developing countries												
Production	Mt	476.2	487.6	490.7	497.6	504.4	511.4	519.1	526.6	532.8	538.5	544.5
Consumption	Mt	470.1	486.5	492.3	499.5	505.0	510.3	516.7	523.8	530.0	535.8	542.1
Net trade	Mt	1.1	0.5	0.5	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.2
Closing stocks	Mt	173.6	173.3	171.1	168.7	167.7	168.4	170.3	172.7	175.2	177.7	180.0
OECD[2]												
Production	Mt	21.4	22.2	22.0	22.3	22.3	22.4	22.5	22.6	22.8	22.9	23.0
Consumption	Mt	22.4	23.0	23.0	23.2	23.3	23.4	23.6	23.7	23.8	23.9	24.0
Net trade	Mt	-1.1	-0.9	-0.9	-0.9	-0.9	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Closing stocks	Mt	6.5	6.4	6.3	6.3	6.3	6.2	6.3	6.2	6.2	6.2	6.2

Note: Marketing year: See Glossary of Terms for definitions.
Average 2012-14est: Data for 2014 are estimated.

1. No. 2 hard red winter wheat, ordinary protein, United States f.o.b. Gulf Ports (June/May), less EEP payments where applicable.
2. Excludes Iceland but includes all EU28 member countries.
3. No. 2 yellow corn, United States f.o.b. Gulf Ports (September/August).
4. Milled 100%, grade b, nominal price quote, f.o.b. Bangkok (January/December).

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

StatLink *http://dx.doi.org/10.1787/888933229752*

Table 3.A1.2. **World oilseed projections**

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
OILSEED (marketing year)												
World												
Production	Mt	425.2	451.4	455.6	463.4	468.7	479.6	486.8	494.3	501.8	508.3	516.4
Area	Mha	196.0	201.8	201.8	203.1	203.4	205.8	207.0	208.3	209.4	210.2	211.4
Yield	t/ha	2.17	2.24	2.26	2.28	2.30	2.33	2.35	2.37	2.40	2.42	2.44
Consumption	Mt	428.4	450.7	459.4	466.4	470.8	478.9	486.3	494.1	501.3	508.3	515.7
Crush	Mt	368.3	389.7	397.7	404.8	408.9	416.4	422.9	430.2	437.0	443.5	450.6
Exports	Mt	120.7	138.3	142.0	144.1	145.8	147.6	150.2	152.0	154.2	155.8	157.4
Closing stocks	Mt	41.0	50.7	46.9	43.9	41.9	42.6	43.1	43.3	43.8	43.8	44.4
Price[1]	USD/t	511.2	403.0	396.9	403.9	434.3	433.9	435.2	444.7	446.7	456.7	459.6
Developed countries												
Production	Mt	186.8	201.4	198.7	200.0	201.3	204.8	207.2	210.0	212.2	214.3	216.7
Consumption	Mt	149.0	155.7	156.9	158.2	158.1	160.0	161.4	163.3	164.8	166.1	167.5
Crush	Mt	134.7	140.7	142.0	143.3	143.3	145.2	146.5	148.3	149.7	151.0	152.3
Closing stocks	Mt	15.6	22.7	20.3	17.2	15.5	15.8	16.0	16.2	16.4	16.4	16.7
Developing countries												
Production	Mt	238.4	250.0	256.9	263.4	267.4	274.8	279.6	284.3	289.6	294.0	299.7
Consumption	Mt	279.5	295.0	302.5	308.2	312.7	318.9	324.9	330.8	336.5	342.1	348.2
Crush	Mt	233.6	248.9	255.7	261.5	265.7	271.2	276.4	281.9	287.3	292.5	298.3
Closing stocks	Mt	25.5	28.0	26.7	26.7	26.3	26.8	27.1	27.1	27.4	27.4	27.8
OECD[2]												
Production	Mt	156.9	169.1	165.6	166.6	167.5	170.2	172.3	174.7	176.4	178.2	180.1
Consumption	Mt	131.3	136.6	137.4	138.6	138.5	140.0	141.2	142.9	144.2	145.3	146.4
Crush	Mt	118.2	123.1	124.0	125.2	125.2	126.8	127.9	129.4	130.7	131.8	132.9
Closing stocks	Mt	14.1	21.4	18.9	15.8	14.2	14.4	14.6	14.8	15.0	15.0	15.2
PROTEIN MEALS (marketing year)												
World												
Production	Mt	289.2	305.9	312.1	317.7	321.2	327.0	332.3	338.2	343.8	349.1	354.8
Consumption	Mt	287.1	306.0	312.3	317.6	321.3	326.8	332.1	338.2	343.5	349.0	354.5
Closing stocks	Mt	17.0	17.3	17.1	17.1	17.0	17.3	17.5	17.6	17.9	18.0	18.3
Price[3]	USD/t	453.1	354.1	356.4	354.4	375.0	378.4	379.8	396.2	398.0	408.7	411.1
Developed countries												
Production	Mt	93.7	98.0	98.9	99.7	99.6	100.8	101.8	103.2	104.2	105.3	106.2
Consumption	Mt	109.5	114.7	115.2	115.9	114.7	115.1	115.2	116.3	116.7	117.2	117.9
Closing stocks	Mt	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.0
Developing countries												
Production	Mt	195.4	207.9	213.3	218.0	221.5	226.2	230.5	235.1	239.5	243.9	248.6
Consumption	Mt	177.6	191.2	197.0	201.7	206.6	211.7	216.9	221.9	226.8	231.8	236.6
Closing stocks	Mt	15.2	15.4	15.2	15.2	15.1	15.4	15.6	15.6	15.9	16.0	16.3
OECD[2]												
Production	Mt	87.2	90.4	91.3	92.0	91.9	92.9	93.8	95.0	96.0	96.9	97.8
Consumption	Mt	114.5	119.6	120.2	120.8	119.8	120.2	120.4	121.5	122.0	122.6	123.3
Closing stocks	Mt	2.0	2.1	2.1	2.1	2.0	2.1	2.1	2.1	2.1	2.1	2.1
VEGETABLE OILS (marketing year)												
World												
Production	Mt	169.4	179.1	183.1	186.9	190.0	193.8	197.3	200.9	204.2	207.3	210.5
Of which palm oil	Mt	58.4	62.7	64.7	66.5	68.3	69.9	71.5	73.0	74.3	75.6	76.8
Consumption	Mt	167.5	178.8	183.1	186.7	190.0	193.5	197.2	200.7	204.0	207.2	210.4
Food	Mt	136.7	143.6	146.7	149.5	151.9	154.5	157.3	160.4	163.2	165.9	168.6
Biofuel	Mt	20.4	23.3	24.3	24.9	25.7	26.4	27.0	27.2	27.6	27.8	28.2
Exports	Mt	69.9	70.3	71.7	73.2	74.4	75.6	76.9	78.3	79.4	80.7	81.8
Closing stocks	Mt	23.1	23.8	23.9	24.1	24.0	24.4	24.5	24.8	24.9	25.1	25.2
Price[4]	USD/t	902.6	698.1	726.9	725.9	754.0	773.3	784.5	796.0	809.3	822.9	839.4
Developed countries												
Production	Mt	43.0	44.3	44.5	44.9	44.9	45.5	45.9	46.3	46.8	47.1	47.4
Consumption	Mt	48.8	49.9	50.0	50.2	50.5	50.6	50.8	50.7	50.6	50.5	50.4
Closing stocks	Mt	3.3	3.5	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.5	3.5
Developing countries												
Production	Mt	126.4	134.8	138.6	142.0	145.0	148.4	151.5	154.5	157.4	160.2	163.1
Consumption	Mt	118.7	128.9	133.1	136.5	139.5	142.9	146.3	149.9	153.4	156.7	160.0
Closing stocks	Mt	19.8	20.4	20.3	20.4	20.5	20.8	21.0	21.2	21.4	21.6	21.7
OECD[2]												
Production	Mt	36.0	36.9	37.1	37.5	37.5	37.9	38.2	38.7	39.0	39.3	39.5
Consumption	Mt	48.0	49.1	49.2	49.4	49.6	49.7	49.9	49.8	49.6	49.6	49.5
Closing stocks	Mt	2.8	3.1	3.2	3.3	3.2	3.2	3.1	3.1	3.1	3.2	3.2

Note: Average 2012-14est: Data for 2014 are estimated.
1. Weighted average oilseed price, European port.
2. Excludes Iceland but includes all EU28 member countries.
3. Weighted average protein meal, European port.
4. Weighted average price of oilseed oils and palm oil, European port.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

StatLink http://dx.doi.org/10.1787/888933229765

Table 3.A1.3. **World sugar projections**

Marketing year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
WORLD												
SUGARBEET												
Production	Mt	257.7	255.9	258.6	263.2	266.9	269.6	271.0	271.8	273.3	274.9	275.6
Area	Mha	4.6	4.6	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Yield	t/ha	56.35	55.91	56.19	56.63	57.03	57.42	57.79	58.00	58.23	58.50	58.77
Biofuel use	Mt	14.5	15.5	15.7	12.6	12.5	12.5	12.4	12.4	11.3	11.3	11.1
SUGARCANE												
Production	Mt	1 766.0	1 807.8	1 843.7	1 954.9	1 962.5	1 983.9	2 017.3	2 060.2	2 102.6	2 174.7	2 213.0
Area	Mha	25.1	25.7	26.0	27.3	27.4	27.5	27.7	28.0	28.4	29.2	29.6
Yield	t/ha	70.37	70.47	70.81	71.53	71.71	72.10	72.84	73.46	74.03	74.43	74.83
Biofuel use	Mt	352.0	398.1	427.0	445.3	447.2	465.6	484.3	503.8	526.0	547.8	564.9
SUGAR												
Production	Mt rse	182.2	180.6	181.7	192.3	194.5	197.0	200.9	205.2	209.8	216.2	220.5
Consumption	Mt rse	174.3	181.2	183.6	187.5	190.5	194.5	198.6	202.1	205.9	209.9	214.3
Closing stocks	Mt rse	70.4	69.0	64.7	67.1	68.7	68.8	68.7	69.3	70.8	74.7	78.5
Price, raw sugar[1]	USD/t	364.8	347.4	388.5	361.7	347.5	351.3	359.8	370.3	385.5	375.3	363.9
Price, white sugar[2]	USD/t	452.4	415.3	467.3	455.4	440.8	436.2	429.7	440.2	451.6	447.5	434.0
Price, HFCS[3]	USD/t	596.4	475.4	469.8	456.1	477.1	483.9	477.7	481.6	488.8	485.2	479.6
DEVELOPED COUNTRIES												
SUGARBEET												
Production	Mt	202.9	197.9	198.5	200.7	202.9	204.4	204.7	204.4	204.5	204.5	203.9
SUGARCANE												
Production	Mt	76.6	79.1	79.9	80.3	81.2	82.0	83.1	83.6	83.8	83.9	84.2
SUGAR												
Production	Mt rse	42.1	41.7	42.1	43.2	43.9	44.4	44.7	44.8	45.1	45.2	45.3
Consumption	Mt rse	49.7	50.0	50.0	50.6	50.1	50.4	50.8	50.9	51.2	51.5	51.9
Closing stocks	Mt rse	15.4	14.6	13.3	12.5	12.5	12.5	12.7	12.9	13.0	13.4	13.8
HFCS												
Production	Mt	9.7	9.8	9.9	10.5	10.7	10.8	11.1	11.4	11.6	11.8	12.0
Consumption	Mt	8.1	8.2	8.2	8.9	9.0	9.1	9.2	9.5	9.7	9.9	10.0
DEVELOPING COUNTRIES												
SUGARBEET												
Production	Mt	54.7	58.0	60.2	62.5	64.0	65.3	66.3	67.4	68.8	70.3	71.6
SUGARCANE												
Production	Mt	1 689.4	1 728.7	1 763.8	1 874.6	1 881.3	1 901.9	1 934.2	1 976.6	2 018.7	2 090.8	2 128.8
SUGAR												
Production	Mt rse	140.1	138.9	139.6	149.1	150.6	152.6	156.2	160.4	164.6	171.0	175.2
Consumption	Mt rse	124.6	131.2	133.5	136.9	140.3	144.0	147.8	151.2	154.7	158.4	162.4
Closing stocks	Mt rse	55.0	54.4	51.4	54.7	56.2	56.3	55.9	56.4	57.8	61.3	64.6
HFCS												
Production	Mt	3.1	3.1	3.2	3.2	3.2	3.3	3.3	3.4	3.4	3.5	3.5
Consumption	Mt	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8
OECD[4]												
SUGARBEET												
Production	Mt	167.2	165.5	166.2	168.3	171.0	172.7	173.6	173.4	173.6	173.8	173.8
SUGARCANE												
Production	Mt	116.7	118.9	120.7	123.3	124.8	125.1	124.9	125.0	125.6	126.4	127.7
SUGAR												
Production	Mt rse	41.2	40.1	40.6	41.8	42.5	43.0	43.2	43.3	43.6	43.8	43.9
Consumption	Mt rse	45.7	46.1	46.1	46.6	46.1	46.3	46.6	46.7	46.9	47.1	47.4
Closing stocks	Mt rse	13.0	12.5	11.4	10.4	10.3	10.1	10.3	10.5	10.7	11.0	11.3
HFCS												
Production	Mt	10.9	11.0	11.1	11.8	11.9	12.1	12.4	12.7	12.9	13.2	13.4
Consumption	Mt	10.2	10.4	10.5	11.3	11.4	11.6	11.8	12.2	12.4	12.6	12.9

Note: Marketing year: See Glossary of Terms for definitions.
Average 2012-14est: Data for 2014 are estimated.
rse: raw sugar equivalent.
HFCS: High fructose corn syrup.

1. Raw sugar world price, ICE contract No. 11 nearby, October/September.
2. Refined sugar price, White Sugar Futures Contract No. 407, Euronext market, Liffe, London, Europe, October/September.
3. United States wholesale list price HFCS-55 , October/September.
4. Excludes Iceland but includes all EU28 member countries.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

StatLink http://dx.doi.org/10.1787/888933229770

Table 3.A1.4. **World meat projections**

Calendar year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
WORLD												
BEEF AND VEAL												
Production	kt cwe	67 139	68 091	68 205	68 778	69 820	71 084	72 006	72 944	73 921	74 657	75 391
Consumption	kt cwe	66 704	67 567	67 651	68 248	69 304	70 554	71 472	72 412	73 389	74 125	74 863
PIGMEAT												
Production	kt cwe	115 315	118 444	120 219	121 799	123 158	124 119	125 069	126 042	126 846	127 836	128 762
Consumption	kt cwe	114 641	118 230	119 733	121 327	122 680	123 642	124 604	125 574	126 365	127 344	128 265
POULTRY MEAT												
Production	kt rtc	107 638	111 954	114 386	117 474	119 941	122 164	124 630	126 935	129 294	131 552	133 785
Consumption	kt rtc	107 081	111 108	113 543	116 649	119 114	121 340	123 805	126 107	128 468	130 727	132 956
SHEEP MEAT												
Production	kt cwe	13 962	14 457	14 726	14 995	15 294	15 638	15 924	16 232	16 525	16 833	17 124
Consumption	kt cwe	13 846	14 416	14 685	14 963	15 243	15 586	15 873	16 181	16 476	16 780	17 071
TOTAL MEAT												
Per capita consumption[1]	kg rwt	33.9	34.1	34.2	34.5	34.7	34.9	35.0	35.1	35.3	35.4	35.5
DEVELOPED COUNTRIES												
BEEF AND VEAL												
Production	kt cwe	29 094	28 250	27 719	27 562	27 869	28 283	28 694	29 050	29 361	29 530	29 675
Consumption	kt cwe	28 815	27 978	27 450	27 314	27 656	28 164	28 521	28 804	29 060	29 171	29 284
PIGMEAT												
Production	kt cwe	41 806	42 485	43 042	42 903	43 214	43 387	43 480	43 630	43 863	44 159	44 486
Consumption	kt cwe	39 092	39 742	40 141	40 009	40 188	40 249	40 307	40 308	40 334	40 430	40 538
POULTRY MEAT												
Production	kt rtc	44 499	46 341	47 467	48 451	49 338	49 985	50 778	51 556	52 214	52 889	53 515
Consumption	kt rtc	41 996	43 605	44 487	45 295	45 819	46 200	46 807	47 338	47 790	48 267	48 762
SHEEP MEAT												
Production	kt cwe	3 287	3 333	3 353	3 374	3 415	3 454	3 492	3 527	3 562	3 593	3 623
Consumption	kt cwe	2 650	2 669	2 665	2 670	2 662	2 674	2 692	2 710	2 728	2 741	2 756
TOTAL MEAT												
Per capita consumption[1]	kg rwt	64.5	65.0	65.3	65.4	65.8	66.1	66.5	66.8	67.1	67.3	67.6
DEVELOPING COUNTRIES												
BEEF AND VEAL												
Production	kt cwe	38 045	39 841	40 486	41 216	41 951	42 801	43 312	43 893	44 560	45 127	45 715
Consumption	kt cwe	37 889	39 589	40 201	40 934	41 648	42 390	42 951	43 608	44 329	44 954	45 579
PIGMEAT												
Production	kt cwe	73 509	75 959	77 176	78 896	79 945	80 732	81 589	82 411	82 983	83 677	84 277
Consumption	kt cwe	75 549	78 488	79 592	81 317	82 492	83 394	84 297	85 265	86 031	86 914	87 727
POULTRY MEAT												
Production	kt rtc	63 140	65 613	66 919	69 023	70 604	72 179	73 852	75 379	77 080	78 663	80 271
Consumption	kt rtc	65 085	67 504	69 056	71 354	73 295	75 140	76 998	78 768	80 678	82 460	84 194
SHEEP MEAT												
Production	kt cwe	10 676	11 125	11 373	11 622	11 879	12 184	12 432	12 705	12 963	13 239	13 501
Consumption	kt cwe	11 195	11 747	12 019	12 293	12 582	12 912	13 181	13 472	13 748	14 039	14 315
TOTAL MEAT												
Per capita consumption[1]	kg rwt	26.5	26.8	27.0	27.3	27.5	27.7	27.9	28.0	28.2	28.3	28.5
OECD[2]												
BEEF AND VEAL												
Production	kt cwe	27 162	26 338	25 761	25 634	25 937	26 320	26 690	27 017	27 349	27 538	27 720
Consumption	kt cwe	26 366	25 849	25 301	25 206	25 502	25 871	26 216	26 495	26 778	26 907	27 053
PIGMEAT												
Production	kt cwe	39 858	40 347	40 793	40 609	40 819	40 964	41 064	41 243	41 471	41 744	42 087
Consumption	kt cwe	36 744	37 791	38 219	38 047	38 178	38 234	38 319	38 385	38 415	38 481	38 587
POULTRY MEAT												
Production	kt rtc	43 182	44 698	45 851	46 864	47 738	48 389	49 203	49 983	50 661	51 340	51 987
Consumption	kt rtc	40 361	41 848	42 787	43 714	44 299	44 700	45 316	45 858	46 317	46 807	47 315
SHEEP MEAT												
Production	kt cwe	2 639	2 690	2 710	2 726	2 763	2 798	2 832	2 861	2 891	2 919	2 947
Consumption	kt cwe	2 006	2 027	2 020	2 016	2 001	2 008	2 020	2 032	2 046	2 053	2 067
TOTAL MEAT												
Per capita consumption[1]	kg rwt	64.7	65.4	65.6	65.7	66.0	66.2	66.5	66.8	67.0	67.1	67.3

Note: Calendar Year: Year ending 30 September for New Zealand.
Average 2012-14est: Data for 2014 are estimated.

1. Per capita consumption expressed in retail weight. Carcass weight to retail weight conversion factors of 0.7 for beef and veal, 0.78 for pigmeat and 0.88 for both sheep meat and poultry meat.
2. Excludes Iceland but includes all EU28 member countries.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

StatLink http://dx.doi.org/10.1787/888933229782

Table 3.A1.5. **World dairy projections: Butter and cheese**

Calendar year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
BUTTER												
World												
Production	kt pw	9 972	10 357	10 537	10 760	11 021	11 266	11 520	11 759	12 013	12 272	12 522
Consumption	kt pw	9 890	10 279	10 528	10 746	11 002	11 233	11 487	11 727	11 983	12 241	12 491
Stock changes	kt pw	1	16	5	2	1	0	0	-1	-2	-2	-2
Price[1]	USD/t	3 695	3 387	3 433	3 578	3 571	3 635	3 648	3 711	3 784	3 852	3 937
Developed countries												
Production	kt pw	4 442	4 581	4 577	4 617	4 665	4 702	4 749	4 780	4 814	4 847	4 879
Consumption	kt pw	3 916	3 993	4 036	4 052	4 075	4 081	4 107	4 121	4 138	4 155	4 173
Developing countries												
Production	kt pw	5 530	5 777	5 960	6 143	6 356	6 564	6 771	6 979	7 200	7 425	7 643
Consumption	kt pw	5 974	6 286	6 493	6 694	6 927	7 152	7 380	7 607	7 845	8 086	8 318
OECD[2]												
Production	kt pw	4 131	4 263	4 273	4 323	4 377	4 421	4 477	4 516	4 560	4 602	4 643
Consumption	kt pw	3 535	3 643	3 676	3 702	3 731	3 745	3 781	3 804	3 831	3 858	3 887
Stock changes	kt pw	1	16	5	2	1	0	0	-1	-2	-2	-2
CHEESE												
World												
Production	kt pw	21 501	22 284	22 483	22 874	23 273	23 651	24 037	24 367	24 717	25 078	25 466
Consumption	kt pw	21 251	21 997	22 277	22 626	23 005	23 387	23 775	24 107	24 460	24 824	25 211
Stock changes	kt pw	23	32	-49	-7	13	9	8	5	2	0	1
Price[3]	USD/t	4 226	3 667	3 974	4 130	4 201	4 299	4 346	4 457	4 558	4 640	4 714
Developed countries												
Production	kt pw	17 311	17 865	18 057	18 397	18 705	19 003	19 319	19 575	19 834	20 098	20 387
Consumption	kt pw	16 576	17 042	17 206	17 434	17 669	17 919	18 166	18 357	18 560	18 768	18 996
Developing countries												
Production	kt pw	4 190	4 419	4 425	4 478	4 568	4 648	4 718	4 792	4 882	4 980	5 079
Consumption	kt pw	4 674	4 956	5 071	5 193	5 336	5 469	5 608	5 751	5 900	6 056	6 216
OECD[2]												
Production	kt pw	16 714	17 338	17 478	17 770	18 054	18 336	18 628	18 862	19 102	19 351	19 629
Consumption	kt pw	15 879	16 374	16 506	16 729	16 958	17 200	17 443	17 626	17 823	18 025	18 247
Stock changes	kt pw	23	32	-49	-7	13	9	8	5	2	0	1

Note: Calendar year: Year ending 30 June for Australia and 31 May for New Zealand in OECD aggregate.
Average 2012-14est: Data for 2014 are estimated.

1. F.o.b. export price, butter, 82% butterfat, Oceania.
2. Excludes Iceland but includes all EU28 member countries.
3. F.o.b. export price, cheddar cheese, 39% moisture, Oceania.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

StatLink http://dx.doi.org/10.1787/888933229796

Table 3.A1.6. **World dairy projections: Powders and casein**

Calendar year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
SKIM MILK POWDER												
World												
Production	kt pw	3 804	4 081	4 121	4 196	4 286	4 369	4 447	4 528	4 606	4 687	4 776
Consumption	kt pw	3 826	4 057	4 125	4 197	4 287	4 369	4 447	4 526	4 604	4 686	4 775
Stock changes	kt pw	2	1	-2	-2	-2	0	1	2	1	1	0
Price[1]	USD/t	3 771	2 678	3 172	3 213	3 301	3 337	3 371	3 463	3 524	3 592	3 630
Developed countries												
Production	kt pw	3 356	3 623	3 662	3 726	3 821	3 907	3 982	4 059	4 138	4 210	4 284
Consumption	kt pw	1 825	1 871	1 888	1 888	1 909	1 918	1 922	1 931	1 936	1 946	1 959
Developing countries												
Production	kt pw	448	458	458	470	465	462	465	469	468	477	492
Consumption	kt pw	2 001	2 186	2 236	2 309	2 378	2 451	2 524	2 595	2 668	2 741	2 817
OECD[2]												
Production	kt pw	3 191	3 457	3 496	3 559	3 652	3 737	3 809	3 885	3 962	4 035	4 115
Consumption	kt pw	1 982	2 052	2 071	2 071	2 092	2 100	2 106	2 116	2 122	2 133	2 148
Stock changes	kt pw	2	1	-2	-2	-2	0	1	2	1	1	0
WHOLE MILK POWDER												
World												
Production	kt pw	4 843	5 224	5 382	5 534	5 691	5 871	6 017	6 176	6 333	6 499	6 657
Consumption	kt pw	4 854	5 224	5 382	5 534	5 691	5 871	6 017	6 176	6 333	6 499	6 657
Stock changes	kt pw	1	0	0	0	0	0	0	0	0	0	0
Price[3]	USD/t	3 900	2 941	3 263	3 357	3 395	3 444	3 473	3 560	3 616	3 682	3 728
Developed countries												
Production	kt pw	2 237	2 519	2 562	2 630	2 703	2 781	2 845	2 917	2 985	3 051	3 117
Consumption	kt pw	563	620	597	602	608	612	618	623	630	635	641
Developing countries												
Production	kt pw	2 606	2 705	2 820	2 904	2 988	3 091	3 172	3 258	3 348	3 448	3 540
Consumption	kt pw	4 291	4 604	4 784	4 932	5 083	5 260	5 398	5 552	5 703	5 864	6 016
OECD[2]												
Production	kt pw	2 472	2 752	2 801	2 873	2 950	3 030	3 097	3 173	3 246	3 316	3 387
Consumption	kt pw	837	903	888	901	914	926	941	954	968	982	997
Stock changes	kt pw	1	0	0	0	0	0	0	0	0	0	0
WHEY POWDER												
Wholesale price, United States[4]	USD/t	1 296	1 221	1 278	1 244	1 296	1 290	1 287	1 316	1 313	1 324	1 318
CASEIN												
Price[5]	USD/t	8 924	8 683	9 215	9 121	9 306	9 207	9 213	9 338	9 332	9 434	9 338

Note: Calendar year: Year ending 30 June for Australia and 31 May for New Zealand in OECD aggregate.
Average 2012-14est: Data for 2014 are estimated.

1. F.o.b. export price, non-fat dry milk, 1.25% butterfat,Oceania.
2. Excludes Iceland but includes all EU28 member countries.
3. F.o.b. export price, WMP 26% butterfat, Oceania.
4. Dry whey, West Region, United States.
5. Export price, New Zealand.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

StatLink http://dx.doi.org/10.1787/888933229804

Table 3.A1.7. **World fish and seafood projections**

Calendar year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
FISH												
World												
Production	kt	161 180	168 792	169 486	174 471	177 582	180 775	182 833	182 831	186 256	189 130	191 348
of which aquaculture	kt	69 942	76 945	79 113	82 124	84 843	87 544	89 352	90 869	92 648	94 618	96 395
Consumption	kt	160 982	168 779	169 473	174 458	177 569	180 762	182 820	182 818	186 243	189 117	191 335
of which for food	kt	140 807	149 520	151 142	155 028	158 031	161 124	163 298	164 577	167 327	169 905	172 199
of which for reduction	kt	14 998	14 774	13 911	15 075	15 248	15 413	15 362	14 147	14 886	15 247	15 236
Price												
Aquaculture[1]	USD/t	2 132.1	2 183.9	2 187.2	2 075.6	2 015.4	2 007.4	2 041.0	2 158.4	2 174.5	2 188.3	2 215.3
Capture[2]	USD/t	1 525.2	1 528.7	1 564.4	1 535.5	1 521.2	1 537.2	1 566.2	1 621.5	1 644.4	1 666.9	1 693.5
Product traded[3]	USD/t	2 913.9	2 983.5	2 992.1	2 843.3	2 760.9	2 749.9	2 795.9	2 956.7	2 978.7	2 997.6	3 034.6
Developed countries												
Production	kt	28 472	28 780	28 884	29 095	29 202	29 367	29 492	29 552	29 641	29 729	29 821
of which aquaculture	kt	4 310	4 439	4 574	4 762	4 968	5 175	5 333	5 440	5 560	5 659	5 762
Consumption	kt	36 665	36 921	36 372	36 770	36 855	37 010	37 093	37 073	37 247	37 519	37 696
of which for food	kt	31 634	32 231	31 692	32 140	32 276	32 494	32 636	32 635	32 894	33 203	33 417
of which for reduction	kt	4 221	4 073	4 062	4 013	3 960	3 898	3 839	3 820	3 735	3 698	3 660
Developing countries												
Production	kt	132 707	140 012	140 601	145 376	148 380	151 408	153 341	153 279	156 615	159 401	161 527
of which aquaculture	kt	65 632	72 505	74 540	77 362	79 875	82 369	84 019	85 429	87 088	88 958	90 632
Consumption	kt	124 317	131 858	133 101	137 688	140 715	143 753	145 728	145 745	148 996	151 599	153 639
of which for food	kt	109 173	117 290	119 450	122 888	125 755	128 630	130 662	131 942	134 433	136 702	138 782
of which for reduction	kt	10 777	10 701	9 849	11 062	11 288	11 515	11 524	10 326	11 151	11 550	11 576
OECD												
Production	kt	30 829	31 302	31 144	31 571	31 771	32 061	32 277	32 183	32 526	32 642	32 766
of which aquaculture	kt	5 962	6 184	6 385	6 644	6 906	7 196	7 434	7 615	7 766	7 918	8 061
Consumption	kt	38 509	39 057	38 492	38 993	39 167	39 432	39 613	39 571	39 950	40 321	40 596
of which for food	kt	31 656	32 568	32 185	32 702	32 909	33 210	33 446	33 529	33 905	34 329	34 655
of which for reduction	kt	6 097	5 961	5 779	5 763	5 729	5 695	5 639	5 514	5 516	5 464	5 413
FISHMEAL												
World												
Production	kt	4 666.3	4 701.3	4 518.7	4 840.2	4 913.2	4 986.3	5 009.3	4 728.6	4 950.5	5 072.2	5 100.4
from whole fish	kt	3 446.2	3 433.0	3 239.1	3 535.8	3 592.0	3 646.3	3 647.7	3 359.1	3 556.9	3 661.9	3 673.0
Consumption	kt	4 872.8	4 782.4	4 573.8	4 600.9	4 863.0	4 936.0	5 067.8	4 971.4	4 693.7	5 045.9	5 074.1
Variation in stocks	kt	-206.5	-81.1	-55.1	239.3	50.2	50.3	-58.6	-242.8	256.8	26.4	26.3
Price[4]	USD/t	1 674.3	1 574.5	1 547.9	1 296.7	1 323.1	1 370.7	1 387.1	1 565.4	1 459.2	1 487.5	1 520.3
Developed countries												
Production	kt	1 316.5	1 377.3	1 394.5	1 397.0	1 395.9	1 398.2	1 398.7	1 405.2	1 399.0	1 402.7	1 406.5
from whole fish	kt	977.3	978.0	979.3	971.5	962.5	951.0	940.1	939.3	921.9	916.2	910.3
Consumption	kt	1 689.2	1 502.1	1 411.8	1 422.3	1 474.6	1 453.7	1 457.7	1 385.6	1 288.0	1 377.8	1 381.1
Variation in stocks	kt	11.7	-42.4	-6.1	24.3	0.2	0.3	-28.6	19.2	14.8	1.4	1.3
Developing countries												
Production	kt	3 349.8	3 324.0	3 124.2	3 443.2	3 517.3	3 588.1	3 610.6	3 323.5	3 551.5	3 669.5	3 693.9
from whole fish	kt	2 469.0	2 455.0	2 259.9	2 564.3	2 629.4	2 695.3	2 707.5	2 419.8	2 635.1	2 745.7	2 762.7
Consumption	kt	3 183.6	3 280.3	3 162.0	3 178.6	3 388.5	3 482.3	3 610.1	3 585.8	3 405.7	3 668.0	3 693.0
Variation in stocks	kt	-218.2	-38.7	-49.0	215.0	50.0	50.0	-30.0	-262.0	242.0	25.0	25.0
OECD												
Production	kt	1 684.8	1 760.4	1 737.0	1 745.8	1 748.7	1 757.2	1 758.0	1 739.8	1 754.0	1 754.4	1 755.1
from whole fish	kt	1 327.1	1 351.9	1 312.6	1 311.0	1 306.1	1 300.8	1 290.2	1 264.7	1 267.7	1 258.6	1 249.8
Consumption	kt	1 913.6	1 735.2	1 628.8	1 662.7	1 728.8	1 720.4	1 736.7	1 650.6	1 542.2	1 660.9	1 672.6
Variation in stocks	kt	-30.1	-53.1	-18.1	34.3	0.2	0.3	-28.6	8.2	25.8	1.4	1.3

StatLink http://dx.doi.org/10.1787/888933229811

Table 3.A1.7. **World fish and seafood projections (cont)**

Calendar year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
FISH OIL												
World												
Production	kt	951.7	1 021.3	974.2	1 036.3	1 048.3	1 063.2	1 065.3	1 006.7	1 049.0	1 071.1	1 074.3
from whole fish	kt	575.3	600.4	552.3	610.5	618.4	625.9	622.5	559.7	597.2	614.4	612.7
Consumption	kt	996.3	1 039.9	1 029.9	942.0	1 049.2	1 064.0	1 066.0	1 102.5	954.2	1 071.6	1 074.8
Variation in stocks	kt	-44.6	-18.7	-55.6	94.3	-0.9	-0.8	-0.7	-95.8	94.8	-0.5	-0.5
Price[5]	USD/t	1 951.3	1 731.1	1 661.1	1 571.5	1 575.9	1 608.8	1 639.0	1 823.1	1 700.1	1 727.0	1 754.5
Developed countries												
Production	kt	418.7	460.0	459.0	458.9	461.0	465.8	468.4	471.6	472.1	474.9	477.8
from whole fish	kt	173.8	181.1	179.3	175.6	173.7	171.4	168.8	168.1	164.1	162.3	160.5
Consumption	kt	596.4	661.9	654.5	565.6	630.6	631.1	624.6	660.2	535.1	604.5	599.5
Variation in stocks	kt	11.1	-9.7	-23.6	22.3	-0.9	-0.8	-0.7	-23.8	22.8	-0.5	-0.5
Developing countries												
Production	kt	533.0	561.3	515.3	577.4	587.4	597.5	596.9	535.1	576.9	596.1	596.5
from whole fish	kt	401.5	419.3	373.0	434.9	444.7	454.5	453.6	391.6	433.2	452.1	452.2
Consumption	kt	399.9	378.0	375.3	376.4	418.6	432.9	441.3	442.4	419.1	467.1	475.2
Variation in stocks	kt	-55.7	-9.0	-32.0	72.0	0.0	0.0	0.0	-72.0	72.0	0.0	0.0
OECD												
Production	kt	554.7	614.9	606.1	608.6	610.4	615.3	617.4	614.9	619.5	621.4	623.4
from whole fish	kt	268.7	286.4	276.5	275.3	273.0	270.6	267.2	260.5	260.4	257.5	254.7
Consumption	kt	747.4	806.1	792.4	702.0	783.4	786.6	781.0	810.3	674.8	760.1	753.8
Variation in stocks	kt	10.7	-23.5	-30.6	29.3	-0.9	-0.8	-0.7	-30.8	29.8	-0.5	-0.5

Note: The term "fish" indicates fish, crustaceans, molluscs and other aquatic animals, but excludes aquatic mammals, crocodiles, caimans, alligators and aquatic plants.

Average 2012-14est: Data for 2014 are estimated.

1. World unit value of aquaculture fisheries production (live weight basis).
2. FAO estimated value of world ex vessel value of capture fisheries production excluding for reduction.
3. World unit value of trade (sum of exports and imports).
4. Fishmeal, 64-65% protein, Hamburg, Germany.
5. Fish oil, any origin, N.W. Europe.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

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Table 3.A1.8. **Biofuel projections: Ethanol**

	PRODUCTION (mln L)		Growth (%)[1]	DOMESTIC USE (mln L)		Growth (%)[1]	FUEL USE (mln L)		Growth (%)[1]	SHARE IN GASOLINE TYPE FUEL USE (%)				NET TRADE (mln L)[2]	
										Energy share		Volume share			
	Average 2012-14est	2024	2015-24	Average 2012-14est	2024	2015-24	Average 2012-14est	2024	2015-24	Average 2012-14est	2024	Average 2012-14est	2024	Average 2012-14est	2024
NORTH AMERICA															
Canada	1 853	2 039	0.08	2 880	3 034	0.52	2 880	3 034	0.52	4.7	5.1	6.8	7.4	-1 027	-996
United States	53 961	56 691	0.04	52 499	55 063	0.05	51 452	53 447	-0.07	6.7	7.2	9.7	10.4	1 416	1 621
of which second generation	0	1 273	..	..	..	..	..	..	..	..	..	..	..	..	..
EUROPE															
European Union	6 896	9 491	2.19	7 783	11 074	3.51	5 419	8 568	4.78	3.1	5.4	4.5	7.8	-887	-1 583
of which second generation	67	430	..	..	..	..	..	..	..	..	..	..	..	..	..
OCEANIA DEVELOPED															
Australia	340	348	0.05	327	347	0.05	327	347	0.05	1.0	1.0	1.4	1.5	13	0
OTHER DEVELOPED															
Japan	356	361	0.00	1 338	1 774	1.50	887	1 298	2.11	0.0	0.0	0.0	0.0	-982	-1 413
South Africa	265	466	6.53	87	263	11.22	46	222	15.53	..	..	..	..	179	203
SUB-SAHARAN AFRICA															
Mozambique	92	128	0.67	126	160	2.27	70	103	3.69	..	..	..	..	-34	-33
Tanzania	145	195	0.39	199	254	2.35	110	163	3.82	..	..	..	..	-53	-59
LATIN AMERICA AND CARRIBBEAN															
Argentina	664	1 750	6.21	598	1 130	3.65	495	1 023	4.13	4.1	7.9	5.9	11.3	65	620
Brazil	26 566	42 482	3.71	24 367	38 968	3.13	22 600	36 890	3.26	37.7	45.0	47.5	55.0	2 199	3 514
Colombia	417	536	3.01	531	695	2.96	460	621	3.33	..	..	..	..	-114	-159
Mexico	84	227	9.19	285	533	3.06	0	0	..	0.0	0.0	0.0	0.0	-200	-306
Peru	361	377	0.38	331	368	1.63	234	283	2.14	..	..	..	..	29	9
ASIA AND PACIFIC															
China	8 064	8 898	1.54	8 185	9 334	2.10	5 294	6 153	2.16	3.0	1.9	4.4	2.7	-121	-436
India	2 081	2 317	0.14	1 943	2 426	1.37	1 138	1 595	2.10	..	..	..	..	138	-109
Indonesia	197	207	0.66	156	209	1.31	108	157	1.75	..	..	..	..	41	-2
Malaysia	0	0	-0.01	0	0	1.26	0	0	2.30	..	..	..	..	0	0
Philippines	191	294	0.64	519	736	2.43	462	663	2.71	..	..	..	..	-328	-442
Thailand	1 242	2 323	5.09	1 092	2 100	4.71	984	1 980	5.08	..	..	..	..	150	223
Turkey	104	118	0.24	160	170	1.08	105	117	1.57	..	..	..	..	-55	-52
Viet Nam	448	582	2.74	357	475	2.47	254	380	3.15	..	..	..	..	91	108
TOTAL	**108 197**	**134 436**	**1.57**	**107 771**	**134 118**	**1.58**	**93 777**	**117 522**	**1.57**	**7.0**	**7.8**	**10.1**	**11.3**	**5 667**	**4 300**

.. Not available

Note: Average 2012-14est: Data for 2014 are estimated.

1. Least-squares growth rate (see glossary).
2. For total net trade, sum of all positive net trade positions.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

StatLink *http://dx.doi.org/10.1787/888933229825*

Table 3.A1.9. **Biofuel projections: Biodiesel**

	PRODUCTION (mln L)		Growth (%)[1]	DOMESTIC USE (mln L)		Growth (%)[1]	SHARE IN DIESEL TYPE FUEL USE (%)				NET TRADE (mln L)[2]	
							Energy share		Volume share			
	Average 2012-14est	2024	2015-24	Average 2012-14est	2024	2015-24	Average 2012-14est	2024	Average 2012-14est	2024	Average 2012-14est	2024
NORTH AMERICA												
Canada	392	486	0.33	538	794	1.56	1.9	2.1	2.1	2.3	-145	-308
United States	5 149	4 723	0.41	5 719	6 633	2.19	2.3	2.4	2.5	2.6	-570	-1 910
EUROPE												
European Union	11 599	13 120	0.27	13 014	13 452	-0.34	5.3	5.9	5.7	6.4	-1 415	-332
of which second generation	52	185	..	..	..	..	..	..	..	..	..	..
OCEANIA DEVELOPED												
Australia	63	280	11.96	72	276	11.04	0.3	1.1	0.3	1.2	-9	4
OTHER DEVELOPED												
South Africa	77	268	17.55	77	268	17.55	..	..	..	..	0	0
SUB-SAHARAN AFRICA												
Mozambique	74	78	-0.07	29	42	3.70	..	..	..	..	45	37
Tanzania	63	101	4.70	6	38	14.97	..	..	..	..	56	63
LATIN AMERICA AND CARIBBEAN												
Argentina	2 565	2 923	1.17	1 043	1 429	0.62	6.7	9.5	7.3	10.3	1 522	1 494
Brazil	3 118	5 094	1.23	3 119	5 070	1.19	4.9	6.5	5.3	7.0	-1	24
Colombia	666	968	3.34	665	968	3.37	..	..	..	..	1	0
Peru	98	108	0.03	275	272	1.57	..	..	..	..	-177	-165
ASIA AND PACIFIC												
India	300	792	12.89	433	900	8.65	..	..	..	..	-133	-108
Indonesia	2 044	6 789	7.62	1 007	5 638	9.92	..	..	..	..	1 037	1 151
Malaysia	240	619	5.42	105	294	11.28	..	..	..	..	135	325
Philippines	187	281	2.04	187	281	2.04	..	..	..	..	0	0
Thailand	944	1 001	1.01	944	1 001	1.01	..	..	..	..	0	0
Turkey	13	14	0.88	13	14	0.92	..	..	..	..	0	0
Viet Nam	28	145	10.02	28	145	10.14	..	..	..	..	0	0
TOTAL	**27 913**	**38 569**	**2.13**	**27 568**	**38 297**	**2.14**	**3.2**	**3.6**	**3.5**	**4.0**	**1 795**	**1 700**

.. Not available

Note: Average 2012-14est: Data for 2014 are estimated.

1. Least-squares growth rate (see glossary).
2. For total net trade, sum of all positive net trade positions.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

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Table 3.A1.10. **World cotton projections**

Marketing year

		Average 2012-14est	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
WORLD												
Production	Mt	26.0	25.1	25.1	25.4	26.0	26.6	27.3	28.0	28.6	29.3	29.9
Area	Mha	33.2	32.7	32.6	32.7	33.0	33.3	33.8	34.2	34.6	35.0	35.3
Yield	t/ha	0.71	0.77	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84	0.85
Consumption	Mt	23.8	25.7	26.3	26.8	27.3	27.7	28.2	28.7	29.2	29.8	30.4
Exports	Mt	8.8	8.0	8.4	8.6	8.8	9.1	9.4	9.7	10.0	10.3	10.5
Closing stocks	Mt	19.2	20.6	19.6	18.4	17.3	16.3	15.6	15.1	14.7	14.4	14.0
Price[1]	USD/t	1 830.6	1 377.3	1 396.5	1 472.6	1 551.9	1 678.2	1 718.3	1 709.1	1 713.3	1 725.6	1 754.9
DEVELOPED COUNTRIES												
Production	Mt	6.1	5.7	5.6	5.6	5.7	5.8	6.0	6.2	6.3	6.4	6.5
Consumption	Mt	1.7	1.8	1.9	1.9	1.9	1.9	1.9	1.9	2.0	2.0	2.0
Exports	Mt	4.8	4.1	4.2	4.2	4.2	4.3	4.4	4.5	4.6	4.7	4.8
Imports	Mt	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Closing stocks	Mt	1.7	1.9	1.8	1.7	1.7	1.6	1.7	1.7	1.8	1.8	1.8
DEVELOPING COUNTRIES												
Production	Mt	20.0	19.5	19.6	19.9	20.3	20.8	21.3	21.9	22.3	22.8	23.3
Consumption	Mt	22.1	23.9	24.5	25.0	25.4	25.9	26.3	26.8	27.3	27.8	28.3
Exports	Mt	4.0	3.9	4.3	4.4	4.6	4.8	5.0	5.2	5.4	5.6	5.8
Imports	Mt	8.4	7.7	8.1	8.3	8.5	8.8	9.1	9.4	9.7	10.0	10.3
Closing stocks	Mt	17.5	18.7	17.8	16.7	15.6	14.7	14.0	13.4	12.9	12.5	12.2
OECD[2]												
Production	Mt	5.4	5.1	5.1	5.1	5.3	5.3	5.5	5.6	5.7	5.9	6.0
Consumption	Mt	3.2	3.4	3.4	3.4	3.4	3.3	3.3	3.4	3.4	3.4	3.4
Exports	Mt	3.8	3.3	3.5	3.5	3.5	3.6	3.6	3.7	3.8	4.0	4.1
Imports	Mt	1.6	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5
Closing stocks	Mt	1.8	2.2	2.1	1.9	1.9	1.9	1.9	2.0	2.0	2.1	2.1

Note: Marketing year: See Glossary of Terms for definitions.
Average 2012-14est: Data for 2014 are estimated.

1. Cotlook A index, Middling 1 3/32", c.f.r. far Eastern ports (August/July).
2. Excludes Iceland but includes all EU28 member countries.

Source: OECD/FAO (2015), "OECD-FAO Agricultural Outlook", *OECD Agriculture Statistics* (database). doi: http://dx.doi.org/10.1787/agr-outl-data-en

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The twenty-first OECD edition of the *Agricultural Outlook*, and the eleventh prepared jointly with the Food and Agriculture Organization of the United Nations (FAO), provides projections to 2024 for major agricultural commodities, biofuels and fish. Notable in the 2015 report is a special feature on Brazil.

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