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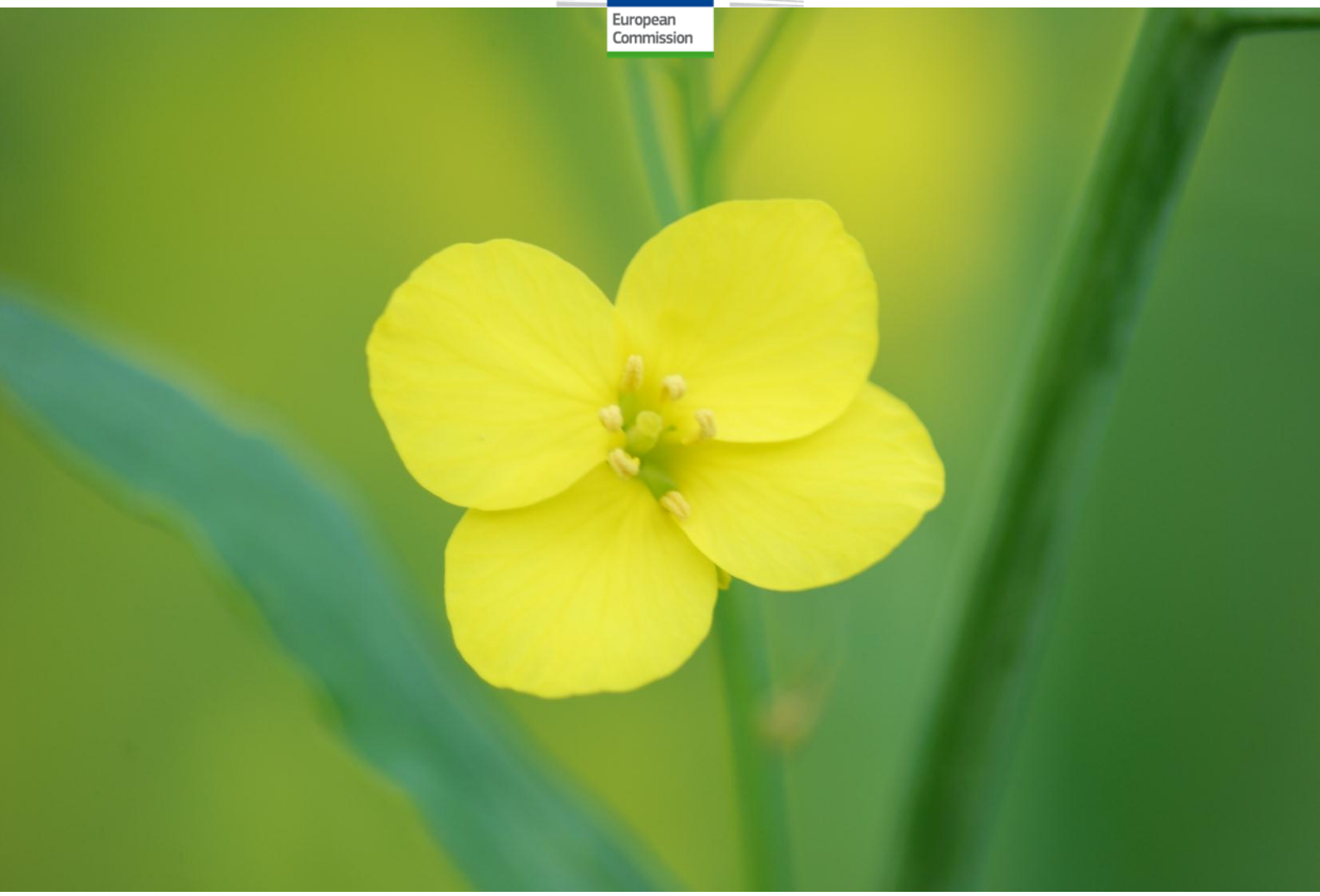

Prospects for Agricultural Markets and Income in the EU 2013-2023

December 2013

Agriculture and Rural Development

Note to the reader

After almost two years of negotiations between the Commission, the European Parliament and the Council, a political agreement on the reform of the Common Agricultural Policy (CAP) was reached on 26 June 2013. Notwithstanding, the implementation process is still ongoing as Member States are offered options upon which they will have until August 2014 to decide. In parallel, trade agreements are negotiated and being concluded that will affect EU agricultural markets. Both these processes and other policy developments require a good understanding of the current and expected state of the agricultural sector in order to credibly assess their impact on markets and farmers' income.

The outlook, covering the period between 2013 and 2023, provides projections for major agricultural markets and income in the EU based on specific assumptions regarding macroeconomic conditions, the agricultural and trade policy environment, weather conditions and international market developments deemed plausible at the time of the analysis. Thus, these projections should be seen as a tool for medium-term market and policy analyses, but not for forecasting or monitoring of short-term market developments.

The projections and analyses have been carried out on the basis of agro-economic models available at the European Commission. This report is based on the information available at the end of September 2013 and reflects current agricultural and trade policies, subject to pre-agreed future changes.

An uncertainty analysis accompanies the market projections in order to quantify the possible variation of the results due to upside and downside risks surrounding the outlook settings; in particular the macroeconomic environment and the variability of yield for the main crops. Specific uncertainty scenarios analyse, among others, the impact of changes in feed costs or changes in productivity trends in Africa.

As part of the validation process, an external review of the baseline and uncertainty scenarios was held at an Outlook Workshop in Brussels on the 23-24 October 2013. The workshop collected valuable input from high-level policy makers, modelling and market experts from the EU and third countries and international organisations such as the Organisation for Economic Co-operation and Development, the United Nation's Food and Agriculture Organisation and the World Bank.

This European Commission publication is a joint effort between the Directorate-General for Agriculture and Rural Development and in the Joint Research Centre's Institute for Prospective Technological Studies (JRC-IPTS). Authorship and responsibility for the contents of the publication rest with the Directorate-General for Agriculture and Rural Development.

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We are grateful to participants in the Outlook Workshop in October 2013 and many other colleagues for the feedback received during the preparation of this report. The cover picture shows a rapeseed flower.

Executive summary

This report presents the medium-term outlook of major EU agricultural commodity markets and agricultural income to 2023, based on a set of coherent macroeconomic and policy assumptions deemed most plausible at the time of the analysis. Under these assumptions agricultural commodity prices are expected to stay firm over the medium term, supported by factors such as the growth in global food demand, the development of the biofuel sector and a low productivity growth. Prospects for agricultural income grow at EU level during the outlook period, resulting from ongoing restructurating rather than from income increases at sector level.

Policy and macroeconomic assumptions

The medium-term outlook reflects current agricultural and trade policies, as altered by future changes that have been agreed upon. The agreement on the reform of the common agricultural policy (CAP) towards 2020 provides Member States with implementation options which need to be decided by August 2014. Therefore, the baseline will reflect the CAP reform only in part. The baseline uses historical data for the current 28 EU Member States (including Croatia, which joined in July 2013). Trade policy is assumed to respect the Uruguay Round Agreement on Agriculture. The free-trade agreements with Columbia, Peru and Central America are taken into account.

Macroeconomic assumptions include zero EU GDP growth in 2013, followed by a moderate growth in 2014 and between 1.8% and 2.0% for the remainder of the outlook period. The exchange rate is assumed to appreciate slightly, with an expected exchange rate of 1.36 USD/EUR in 2014 and 1.41 USD/EUR in 2023.

Arable crops

The medium-term outlook for arable crops is relatively positive thanks to solid world demand and firm prices. In the EU, feed and food demand are expected to increase only marginally, with the biofuel market remaining the most dynamic demand factor. On the supply side, growth depends on better yields, as arable area is expected to decline slightly (in line with the long-term trend). Overall, the projected growth in domestic consumption of cereals, oilseeds and sugar is largely dependent on the assumptions for bioenergy use. It is assumed that progress towards meeting the Renewable Energy Directive (RED) target of 10% of renewables in energy share will continue and as of 2020 biofuels will contribute to 8.5% of liquid transport fuels; the remainder will be met from other renewable energy sources, e.g. electric cars.

The medium-term prospects for the EU cereals markets are characterised by relatively tight market conditions, low stocks and prices which are expected to remain above their historical averages. These developments are driven by moderate supply growth reaching 316 million tonnes by 2023, mainly the result of low annual yield growth rates (0.6% on average) and an increase in the domestic use of cereals in the EU, most notably due to growing demand for ethanol in the framework of the RED. Some reallocation between crops in the context of a stable overall cereal area is expected, with maize and common wheat further increasing their share (up to 18% and 41% respectively) at the expense of other cereals. The

growing demand for rice will be satisfied by increasing imports, reducing the EU self-sufficiency slightly to 64%.

Similar drivers impact upon the medium-term prospects for the EU oilseed markets. Supply growth is driven by moderate yield growth and to a lesser extent by a slightly expanding oilseed area. The expected increase in domestic use of oilseeds in the EU would also be driven by additional demand for vegetable oil as biodiesel feedstock, while food consumption of vegetable oil stays constant at best.

The medium-term outlook for sugar beet and sugar is mixed. Driven by expectations on world prices, growing demand for ethanol and the abolition of the quota scheme in 2017, EU sugar beet production is projected to expand in the coming decade; additional volumes will be used mainly to produce sugar rather than ethanol. With no more quotas, out-of-quota and in-quota prices will progressively merge and the production of ethanol from sugar beet will be less competitive. In addition, isoglucose is expected to increasingly replace sugar in selected food consumption uses, following the expiry of isoglucose production quotas in 2017.

Meat

The EU meat sector is expected to be supported by strong demand on the world market, driven by improved economic conditions. In Europe, prospects of recovery in economic growth should leave consumers with more disposable income, allowing for a higher consumption of meat products. EU *per capita* meat consumption, which reached its lowest level for the past 11 years (64.7 kg retail weight) in 2013, is expected to recover from 2014 as more meat comes onto the market. In 2023, *per capita* consumption is expected to reach 66.1 kg, similar to the 2011 level. Over the projection period, it is expected that poultry meat will remain the most dynamic product (thanks to its cheaper price, convenience and healthy image) and pork will remain Europe's favourite meat, while the consumption of beef and sheep meat is projected to drop both in absolute and relative terms.

Mainly due to developments in the dairy herd (which represents around 2/3 of beef production), beef production is projected to decline by around 7% from the 2010-12 average to a low 7.6 million tonnes in 2023. Following two years of decline due to the implementation of new animal welfare rules, pig meat production is expected to increase as of 2014, to 23.4 million tonnes in 2023. This increase (+2.8% against the 2010-12 average) is moderate because of environmental constraints in some of the main producing countries (e.g. the Netherlands and some parts of France). Poultry meat will expand the fastest at a rate of 0.8% per year in 2012-23, with production expected to reach 13.6 million tonnes by 2023. The decline in sheep production will slow down in comparison to the past decade because prices are expected to stay firm.

Milk and dairy products

The medium-term prospects for milk and dairy commodities are favourable on both the world and domestic markets. World demand remains dynamic (especially in the emerging economies). Despite the end of the quota system after 2014/15, the EU milk production expansion is projected to remain limited mainly because environmental constraints will play an increasing role in certain Member States. Deliveries, which could reach 150 million tonnes in 2023, will also adapt to the pace of consumption growth in both the EU and on the world market. The projected

production increase will come from further yield improvements to 8 500 kg/cow in the EU-15 in 2023 and 6 050 kg/cow in the EU-N13.

It is expected that the cheese sector will be boosted by a dynamic world market and steady growth in domestic demand. Cheese production is therefore expected to absorb most of the additional milk delivered to dairies. 2023 production is projected to reach 10.7 million tonnes, with exports close to 1 million tonnes. By 2023, the production of fresh dairy products is expected to have increased by 3% compared to 2012 and reach 48.3 million tonnes. Butter production is expected to stabilise from 2015 onwards, at 2.3 million tonnes, as operators prefer to use dairy fat for cheese. Skimmed milk powder (SMP) production could reach 1.25 million tonnes by 2023 driven mainly by export demand – from 2016, half of the production will be exported. Increased milk availabilities should mean that whole milk powder (WMP) production declines more slowly than in the past decade, down to 604 000 tonnes by 2023.

After a small decrease between 2013 and 2016, the EU milk farm gate price (in real fat content) is expected to stay firm, driven by robust world prices for cheese and SMP.

Agricultural income

The medium-term trend for agricultural income is expected to be positive. Real agricultural income per labour unit is projected to increase by 1.8% per year from 2013 to 2023 as the result of a continuous decrease in the workforce employed in agriculture, which more than compensates the expected deterioration of total agricultural factor income in real terms.

In the EU-15, real agricultural income per working unit is expected to be 17.5% higher by 2023, whereas in the EU-N13 it could more than double. Given the difference in income development, the gap between the absolute levels of agricultural income per worker between the EU-15 and EU-N13 will narrow but will still remain substantial.

Uncertainty analysis and caveats

The outlook for EU agricultural markets and income presented in this publication is based on a specific set of assumptions regarding the future economic, market and policy environment. In addition, the baseline assumes normal weather conditions, steady yield trends and no disruptions (e.g. from animal disease outbreaks, food safety issues, etc.).

The projections are not intended as a forecast of future outcomes, but instead as a description of what may happen given a specific set of assumptions and circumstances deemed plausible at the time of the analysis. As such, they serve as a reference for policy simulations. The assumptions imply relatively smooth market developments; in reality, as we have seen (particularly in recent years), markets tend to be more volatile.

An uncertainty analysis accompanies the presented baseline to quantify some of the upside and downside risks and to provide background on variation of the results. This concerns in particular the macroeconomic environment and the variability of yield for the main crops, as well as selected scenarios relating among others to the impact of changes in feed costs or changes in productivity trends in Africa.

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Abbreviations

EU	European Union
EU-N13	EU Member States which joined in 2004 or later
EU-15	EU including the 15 Member States before 2004
EU-27	EU including 27 Member States (excluding Croatia)
EU-28	EU including the current 28 Member States
NUTS2	Nomenclature of Units for Territorial Statistics (level 2)
US	United States of America
JRC-IPTS	Joint Research Centre – Institute for Perspective Technological Studies
FAO	Food and Agriculture Organization of the United Nations
OECD	Organisation for Economic Co-operation and Development
CAP	Common Agricultural Policy
RED	Renewable Energy Directive
EUR	Euro
USD	US dollar
CPI	Consumer Price Index
GDP	Gross Domestic Product
SMP	Skimmed Milk Powder
WMP	Whole Milk Powder
1st-gen.	first-generation
2nd-gen.	second-generation
hl	hectolitres
kg	kilogrammes
t	tonnes
t.o.e.	tonnes oil equivalent
w.s.e.	white sugar equivalent
c.w.e.	carcass weight equivalent
r.w.e.	retail weight equivalent
CV	coefficients of variation
ACV	average coefficient of variation

1. Introduction – baseline setting

This report presents the medium-term outlook of major EU agricultural commodity markets and agricultural income to 2023, based on a set of coherent macroeconomic and policy assumptions deemed most plausible at the time of the analysis.

The first part of the report summarises the main features of the baseline projections for the cereal, oilseed, sugar, biofuels, meat and dairy markets and agricultural income in the EU for the period 2013-23. The baseline assumes normal weather conditions, steady demand and yield trends and no disruptions (e.g. from animal disease outbreaks, food safety issues, etc.). The assumptions imply relatively smooth market developments; in reality, as we have seen (particularly in recent years), markets tend to be more volatile. To address this, the second part of the publication (from Chapter 7) focuses on uncertainties surrounding the baseline setting, in particular as regards the macroeconomic environment and the variability of yield for the main crops, as well as specific scenarios relating among others to the impact of changes in feed costs or changes in productivity trends in Africa. The implication of these uncertainties on price developments is also illustrated in the first part of the report.

Assumptions as to the world market environment are based on the OECD-FAO's agricultural outlook of June 2013, taking into account recent global macroeconomic prospects. The statistics and market information are those available at the end of September 2013 and the macroeconomic assumptions are based on projections published in November 2013.

1.1. Policy assumptions

Medium-term projections reflect current agricultural and trade policies, as altered by future changes that have been agreed upon. The agreement on the reform of the common agricultural policy (CAP) towards 2020 provides Member States with implementation options which need to be decided by August 2014. The following aspects of the CAP reform are expected to have a particular impact on market and income developments:

1) **Expiry of milk quotas:** Milk quotas will be abolished by April 2015.

2) **Expiry of the sugar quota system:** Sugar and isoglucose quotas will be abolished after the 2016/17 marketing year.

3) **Intervention mechanisms:** Up to 3 million tonnes a year of common wheat, 50 000 tonnes of butter and 109 000 tonnes of skimmed milk powder can be bought in each year at fixed intervention prices. Beyond these limits, intervention would be possible by tender, as it is with durum wheat, barley, maize, paddy rice and beef and veal.

4) **Decoupled single farm payment:** Historical budget expenditure and future budget envelopes are used to calculate average per hectare decoupled payments for the EU-15 and the EU-N13[1]. Payments will fall gradually in the

[1] i.e. the 13 countries which joined the EU in 2004 or later.

EU-15 and increase in the EU-N13. These payments include the basic premium, greening, young farmer, small farms, first hectares etc.

5) **Coupled payments:** The assumed level of coupled payments is based on the level of their recent expenditure including commodity linked payments (i.e. under Article 68[2]) in the EU-15 and complementary national direct payments in the EU-N13. Pending final decisions by Member States, it is assumed here that the level will remain constant throughout the outlook period.

Depending on Member States' implementing decisions in 2014, further payments may be coupled and budget allocations shifted between the direct payment and the rural development envelopes.

The effects of 'greening', in particular the requirements on permanent grassland and ecological focus area, are also taken into account to the extent possible based on assumptions used in the Impact Assessment of CAP reform. Further work is underway, in particular regarding crop diversification provisions, to better estimate the aggregated impact on production.

The baseline will therefore reflect the CAP reform only in part because further implementation measures are yet to be decided. Furthermore, given the geographical aggregation of the model used, the redistribution of direct payments within Member States and regions is not included. Nonetheless, this baseline can still serve as a reference for implementation scenarios.

The baseline uses historical data for the current 28 EU Member States (including Croatia, which joined in July 2013). Possible future accessions are not taken into account. Due to continuing differences in policy transition and in the level of economic development, we continue to distinguish between the EU-15 and the EU-N13 when it comes to production and consumption.

As regards international trade, it is assumed that all commitments under the Uruguay Round Agreement on Agriculture, in particular on market access and subsidised exports, will be honoured in full. No assumptions are made as to the outcome of the Doha Development Round. The implications of the Bali Ministerial Declaration have not been explicitely taken into account. The free-trade agreements with Columbia, Peru and Central America are taken into account, but bilateral and regional trade deals still in the pipeline (e.g. the agreements with Canada and Ukraine, which have been concluded but not yet ratified) are not.

1.2. Macroeconomic environment

World GDP grew by 2.6% in 2012. Similar growth rates are expected for 2013 and 2014, after which growth is anticipated to recover from the economic crisis. However, over the projection period, GDP growth is assumed to decline slightly from 3.9% to 3.6%. These projections reflect slightly lower growth levels than previous ones and account for the slowing down of the economic growth in certain emerging countries.

[2] Article 68 of EC Regulation 73/2009 allows Member States to grant assistance to sectors with special problems.

Although EU GDP increased in 2010 and 2011, following the deep 2009 recession, it declined again in 2012 by 0.4%. Zero growth is expected in 2013, followed by rises of 1.4% in 2014 and between 1.8% and 2.0% for the remainder of the outlook period. Economic growth in the EU-N13 exceeds that in the EU-15, but from a base of considerably lower total GDP. The outlook assumes that the turmoil of the economic crisis which started in 2008 will dissipate after 2014, though with lower rate of growth than previously projected.

Table 1.1 Baseline assumptions on EU key macroeconomic variables

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Population growth		**0.3%**	**0.3%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.1%**	**0.1%**
	EU-15	0.4%	0.4%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%
	EU-N13	-0.1%	-0.2%	-0.2%	-0.1%	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.2%
Real GDP growth		**2.0%**	**1.6%**	**-0.4%**	**0.0%**	**1.4%**	**1.9%**	**1.9%**	**2.0%**	**1.9%**	**1.9%**	**1.9%**	**1.9%**	**1.8%**	**1.8%**
	EU-15	2.0%	1.5%	-0.5%	0.0%	1.3%	1.9%	1.7%	1.8%	1.7%	1.7%	1.7%	1.8%	1.7%	1.7%
	EU-N13	2.1%	3.0%	0.6%	0.6%	2.0%	2.5%	4.3%	5.2%	4.4%	4.3%	4.2%	4.1%	4.0%	3.8%
	World	4.3%	3.1%	2.6%	2.5%	3.3%	3.9%	3.9%	3.9%	3.8%	3.8%	3.7%	3.7%	3.7%	3.6%
Inflation (Consumer Price Index)		**2.0%**	**3.0%**	**2.6%**	**1.7%**	**1.6%**	**1.6%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**	**1.9%**	**1.9%**
	EU-15	1.9%	3.0%	2.5%	1.7%	1.6%	1.5%	1.9%	2.0%	1.9%	1.9%	1.9%	2.0%	1.9%	1.9%
	EU-N13	2.8%	3.8%	3.7%	1.7%	1.8%	2.3%	2.7%	2.7%	2.5%	2.5%	2.5%	2.5%	2.4%	2.4%
Exchange rate (USD/EUR)		**1.33**	**1.39**	**1.28**	**1.33**	**1.36**	**1.36**	**1.36**	**1.37**	**1.37**	**1.38**	**1.39**	**1.40**	**1.41**	**1.41**
Crude oil price (USD per barrel Brent)		**79**	**111**	**112**	**108**	**100**	**94**	**96**	**99**	**103**	**106**	**109**	**112**	**114**	**116**

Sources: DG AGRI estimates based on the European Commission macroeconomic forecasts and IHS Global Insight

In 2011, the EU population surpassed the 500 million mark but, in a trend expected to continue over the outlook period, growth has been slowing. Projections show a steady decrease in annual population growth from 0.2% to 0.1% in the medium term, with slightly higher growth in the EU-15 and a marginal drop in the EU-N13.

Further to the economic crisis, annual inflation in the EU was still high in 2012 at 2.6%, for the outlook period, assumptions range between 1.6% and 2.0%. In general, inflation is expected to be higher in the EU-N13 than in the EU-15.

The euro reached a value of USD 1.39 in 2011, but dropped to USD 1.28 in 2012. In 2013, it strengthened again to around USD 1.33 and this trend is expected to continue during the outlook period, with an expected exchange rate of 1.36 USD/EUR in 2014 and 1.41 USD/EUR in 2023.

The Brent oil price was stable at 112 USD/barrel in 2011 and 2012. It declined slightly to 108 USD/barrel in 2013 and is expected to drop further in the first few years of the outlook period to 94 USD/barrel in 2015, and thereafter to strengthen to 116 USD/barrel in 2023. These values are nominal, i.e. real oil prices will fall over the outlook period, one important factor being the availability of new mineral oil resources, predominantly in the US. Recent gas price developments (divergence from mineral oil prices and regional differences due to the availability of shale gas in North America) have not been included in the baseline. If they persist, however, they could have a strong bearing on fertiliser and energy prices (and hence competitiveness) in various countries and regions.

These macroeconomic assumptions have mixed implications for EU agricultural markets. Continuing world population growth drives increasing demand and supports higher prices for agricultural commodities, while the expected lower economic growth in the short term will limit income growth and thus reduce the potential for demand growth. EU oil prices are expected to fluctuate around current levels. Due to the high level of uncertainty, most of the analysis in the second part of the report focuses on the implications of alternative macroeconomic scenarios for the prospects for EU agriculture to 2023.

2. Arable crops

The global medium-term outlook for arable crops is relatively positive thanks to solid world demand and firm prices. In the EU, feed and food demand are expected to increase only marginally and the biofuel market is the most dynamic demand factor. On the supply side, growth depends on better yields, as arable area is expected to decline slightly (in line with the long-term trend).

This chapter covers a range of arable crops (common wheat, durum wheat, barley, maize, rye, oats, other cereals, rapeseed, sunflower seed, soybeans, rice and sugar beet) and some processed products (sugar, vegetable oils, protein meals, biodiesel and ethanol). It looks first at demand and land-use developments and then at the cereals, rice, the oilseeds, sugar and biofuels sectors.

2.1. Demand developments

Demand for arable crops is broken down into four broad categories of use:

- for direct human consumption;
- as feed for livestock production;
- as feedstock in the energy production; and
- for industrial and other uses which, although relatively less important, can in some cases (e.g. fibres, starch, isoglucose) account for large amounts of arable feedstock.

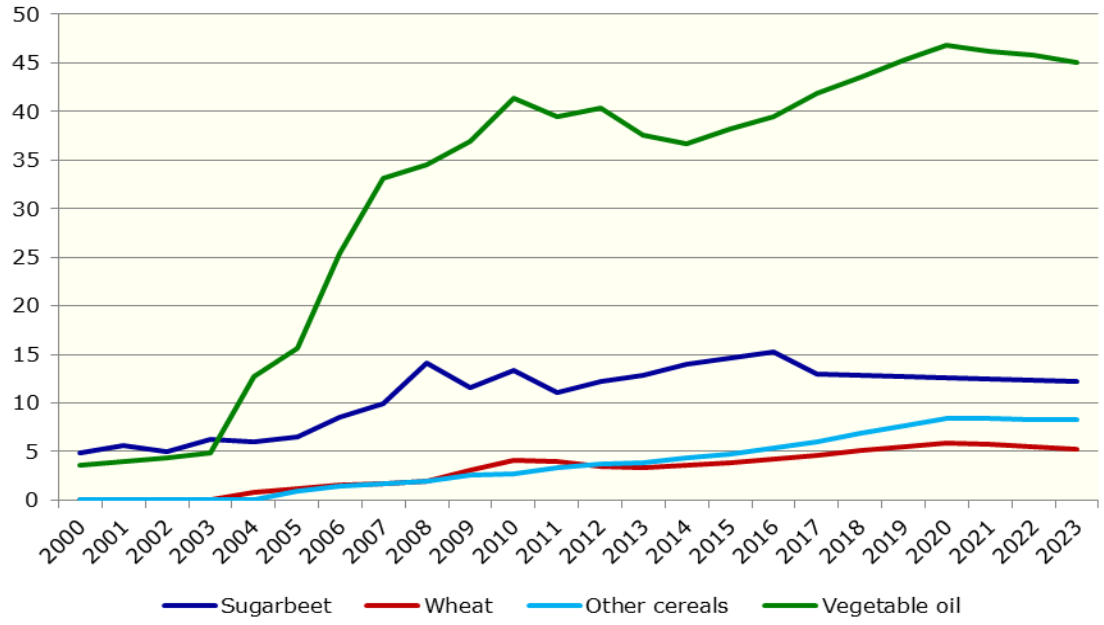
The recent increase in biofuel production and raising biogas production in some Member States imply treating the production of energy from arable feedstock as a separate category than it habitual inclusion under 'industrial use'. This chapter includes a section assessing the biofuels market in more detail.

Graph 2.1shows the increasing importance of biofuels in overall feedstock demand. Cereals are the only sector in which demand can be expected to increase significantly over the outlook period. So far, the demand for biogas is reflected only in the land-use balance, as mostly the complete biomass is used as a feedstock and not only the grains (which are covered in the balances below).

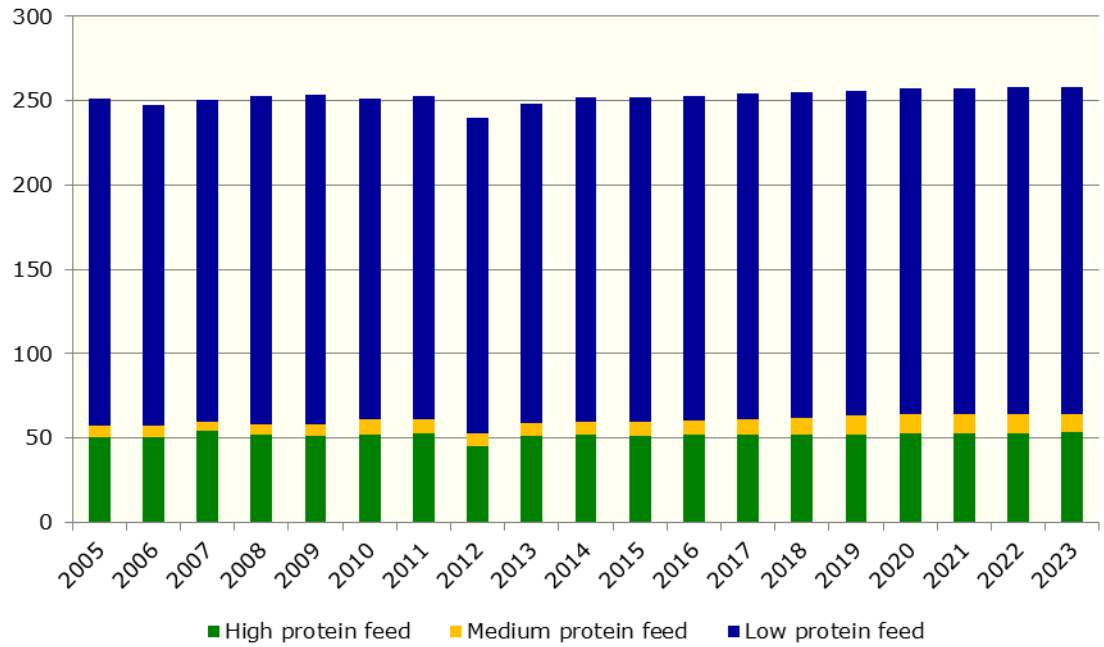
Compound feed demand in the EU livestock sector is price-sensitive, especially if broken down according to feed ingredients. Demand for high-protein feeds (mainly soybean meal and other oilmeals) saw a strong decline in the 2012/13 marketing year, due to high prices and limited availability (Graph 2.2).

Generally, the demand for high-protein and low-protein feeds (mainly cereals) has been steady in the past decade and is expected to remain so for the coming ten years. The production of medium-protein feed continues to increase, but from a low base, primarily due to the growing availability of dried distillers' grains with solubles (DDGS), a by-product of cereal-based ethanol production.

Graph 2.1 Share of biofuel use in overall feedstock demand (%)



Graph 2.2 EU compound feed use (million tonnes)

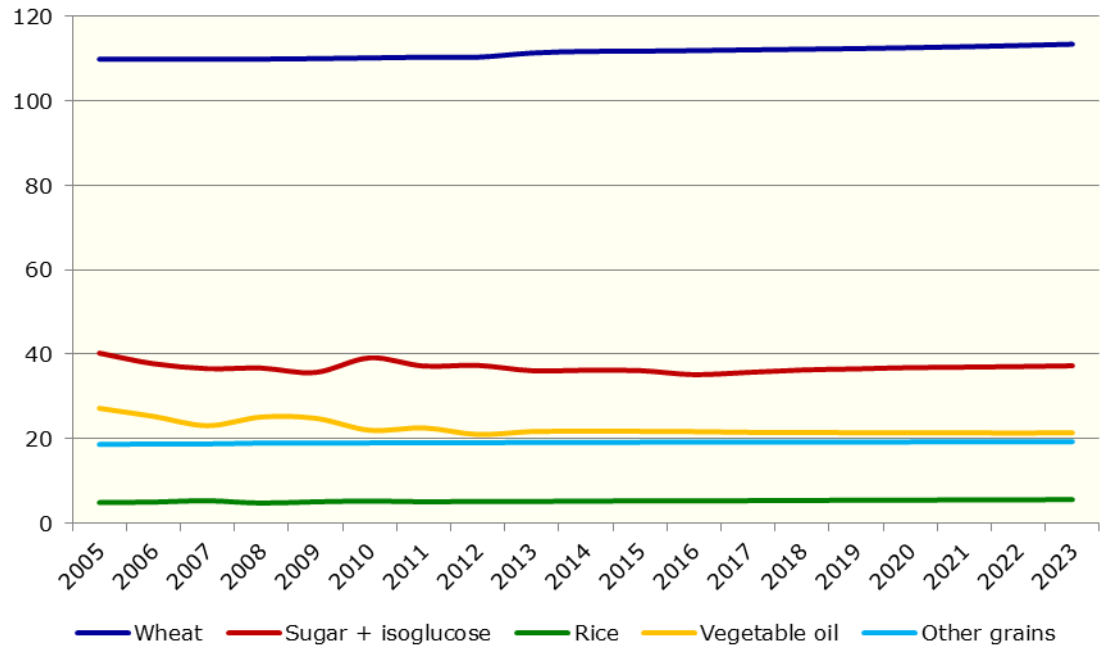


The feed conversion rate development is driven by two main (and opposed) factors: the growing use of compound feed in ruminant production at the expense of forage-based feed; and increasing feed efficiency in livestock production. We expect these factors to balance each other out in the coming decade, so that the volumne of compound feed per livestock output will not change substantially.

The 'direct food' demand for arable crops, including first-stage processing, is expected to remain steady over the outlook period. Slight increases are expected in

the case of common and durum wheat, other cereals, rice and sweeteners (sugar and isoglucose) (Graph 2.3). In the case of the latter, especially the end-of-quotas in 2017 is likely to affect consumption patterns. Of the arable-based products covered, only vegetable oils will see declining *per capita* consumption mainly because of lower overall fat consumption and high prices.

Graph 2.3 *Per capita* consumption in the EU (kg)



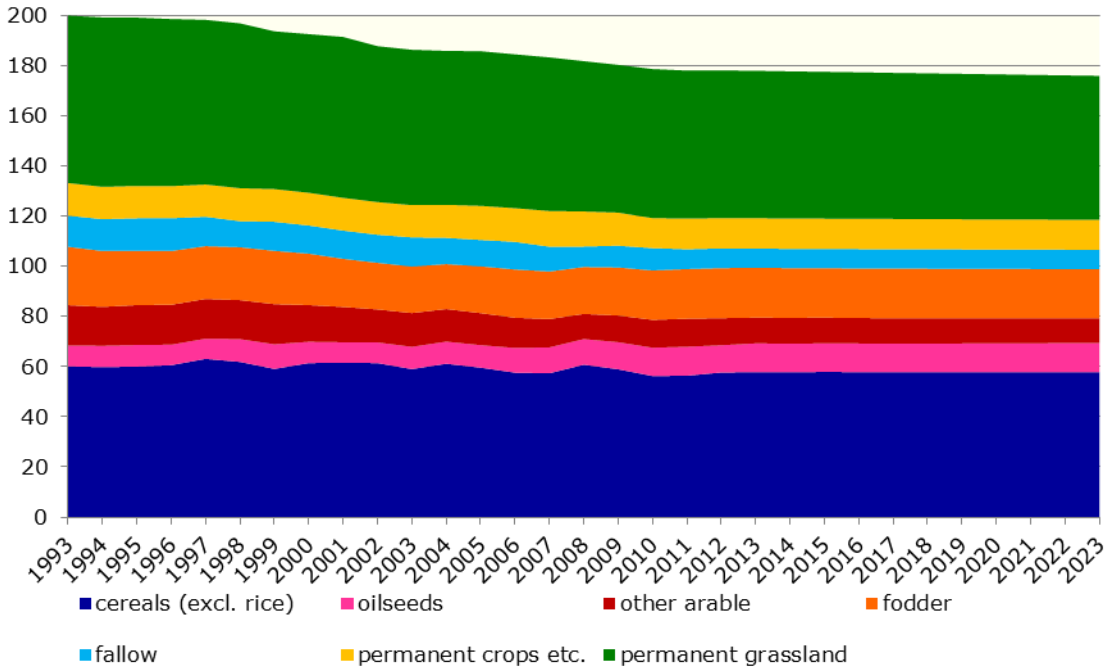
Apart from their use as energy feedstock, general demand for arable crops is growing slowly in the EU and this is expected to remain the case during the outlook period.

2.2. Land-use developments

Agricultural products covered in this chapter all require arable land for their production. Agricultural land in the EU has seen a slight reduction over time – in general, because of the increasing use of land for building purposes and the extension of forests and other habitats. About a third of agricultural land is permanent pasture and a small proportion is used for permanent crops, kitchen gardens and greenhouses, leaving around 60% for arable crops (Graph 2.4).

The implementation of the CAP reform in the coming years might change agricultural land-use patterns, due to the shift from historical to regional references for decoupled payments. Protection under the new 'greening' provisions should slow the erosion of the area covered by permanent pasture. Of the large categories in Graph 2.4, oilseeds are the only one for which land-use has increased significantly in the past 20 years, a development driven to some extent by the increased use of rapeseed oil to produce biodiesel.

Graph 2.4 Agricultural land-use developments in the EU (million ha)



On the other hand, the area of fallow land (including set-aside) has declined noticeably due to the end of compulsory set-aside in 2008 and the area for 'other arable crops' has decreased due to a concentration of arable production on the most profitable crops. The inclusion of 'ecological focus area' under CAP greening measures may result in an increase in fallow and set-aside land.

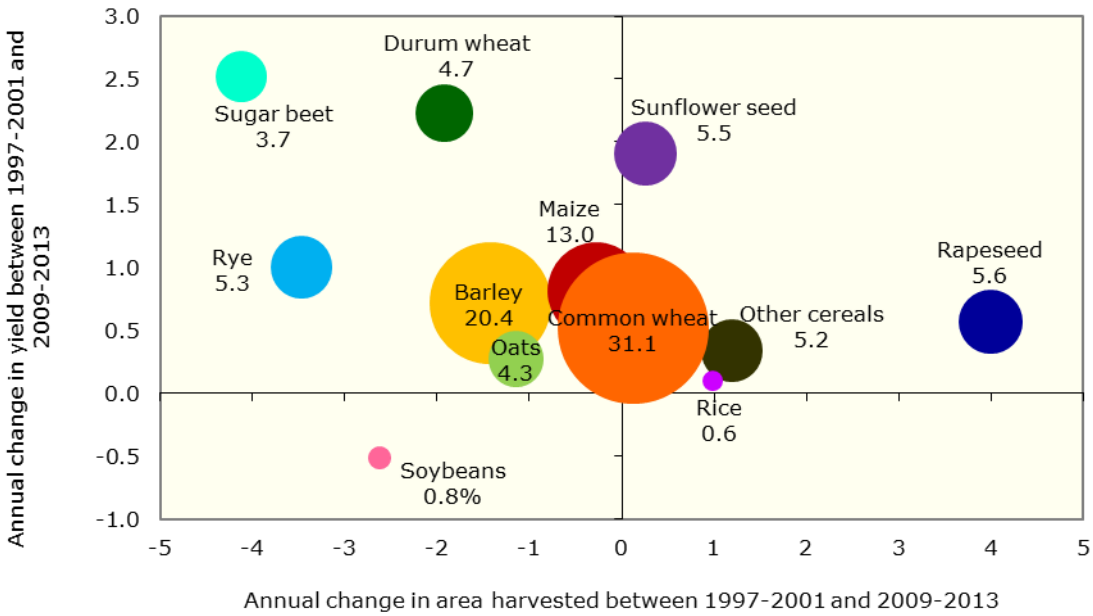
Land-use for most fodder crops (e.g. lucerne, temporary grassland) is declining, but that for green maize is on the up, so overall land use for this category should stay relatively stable over the longer term. The recent expansion of green maize is due partly to its use as a feedstock in the production of biogas, mainly in Germany, where it has spread to 1 million additional hectares in the past ten years (though growth has now come to a halt following a change in the support arrangements for biogas production).

Cereal land-use has dropped slightly in the past 20 years, but yields (and overall production) have increased. These trends are expected to continue in the the coming decade.

Graph 2.5 compares historical land-use and yield developments for individual crops on the basis of average annual changes between 1997-2001 and 2009-13 (the multi-year averages factor out annual fluctuations, especially as regards yields). Rapeseed saw the biggest area expansion (about 4% on average), driven by its use as a biofuel feedstock.

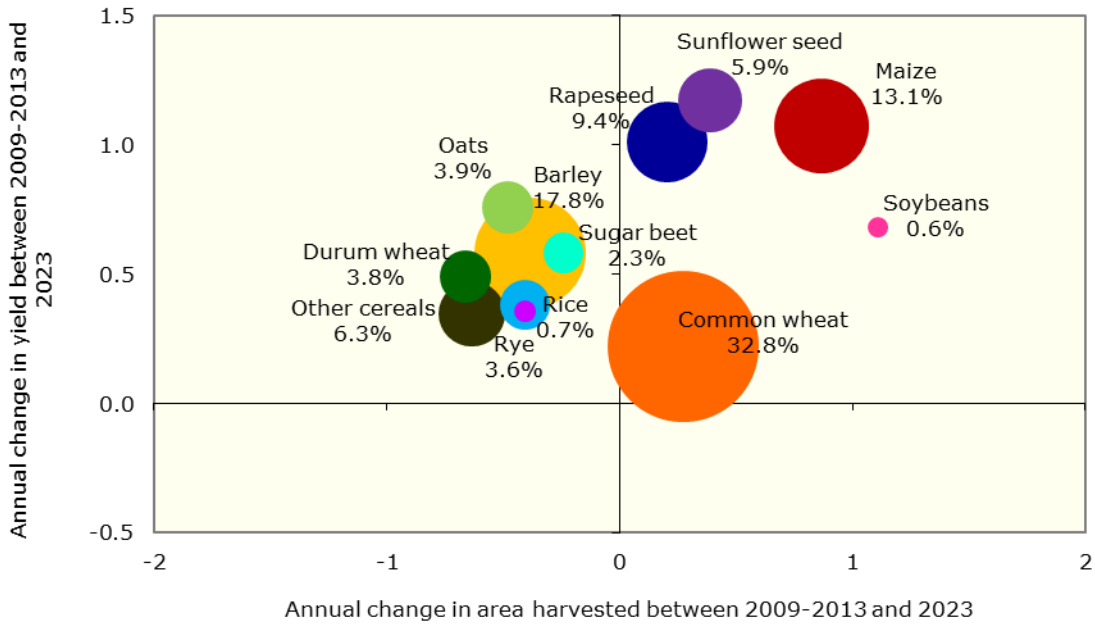
Other cereals and rice also expanded significantly, but at a slower rate. For other cereals, the most notable shift is from rye (with a sharp decrease in area) to triticale. Sugar beet area also fell significantly as a result of the 2006 sugar market reform (shrinking sugar quotas) and improved yields (less land required to produce the same quantities). Average yields for durum wheat and sunflower also improved. For soybeans, on the other hand, yields decreased slightly which combined with smaller areas reduced production significantly.

Graph 2.5 Annual changes in area and yields by crop between 1997-2001 and 2009-13 in the EU (%)



* size of bubble refers to share in area harvest on average in the years 1997-2001 (values are given in percent)

Graph 2.6 Annual changes in area and yields by crop between 2009-13 and 2023 in the EU (%)



* size of bubble refers to share in area harvest on average in the years 2009-2013 (values are given in percent)

Area and yield projections for the coming decade appear to converge much more than in the past (Graph 2.6). Soybean production looks set to recover from the contraction of the past decade, with an expansion in both land and yield. The area planted to other oilseeds (sunflower and rapeseed) and maize is expected to increase further, while a decrease is expected for other crops. For oilseeds, the

expansion is driven by strong demand for vegetable oils and biodiesel. Maize is in demand as ethanol feedstock, but also for animal feed and for processing into isoglucose. Common wheat yield growth is virtually stagnant, with no recent increases in the main producing countries e.g. France, Germany and the United Kingdom. Expectations are more optimistic for sunflower seed, maize and rapeseed, which have seen the most dynamic yield growth in recent years.

2.3. Cereals

Recent market developments

EU production from the 2012 the cereal harvest was 281.2 million tonnes, about 10 million tonnes less than in the previous year due to droughts in some regions. Exports of common wheat and barley were strong, so domestic grain was in shorter supply in the 2012/13 marketing year. A further increase in maize imports helped to cover demand for feed grains. Nevertheless, animal feed use decreased by 3.8 million tonnes to 163.2 million tonnes and domestic consumption was down slightly, at 276.0 million tonnes. Stocks sank as low as 27.6 million tonnes (about 10% of domestic use).

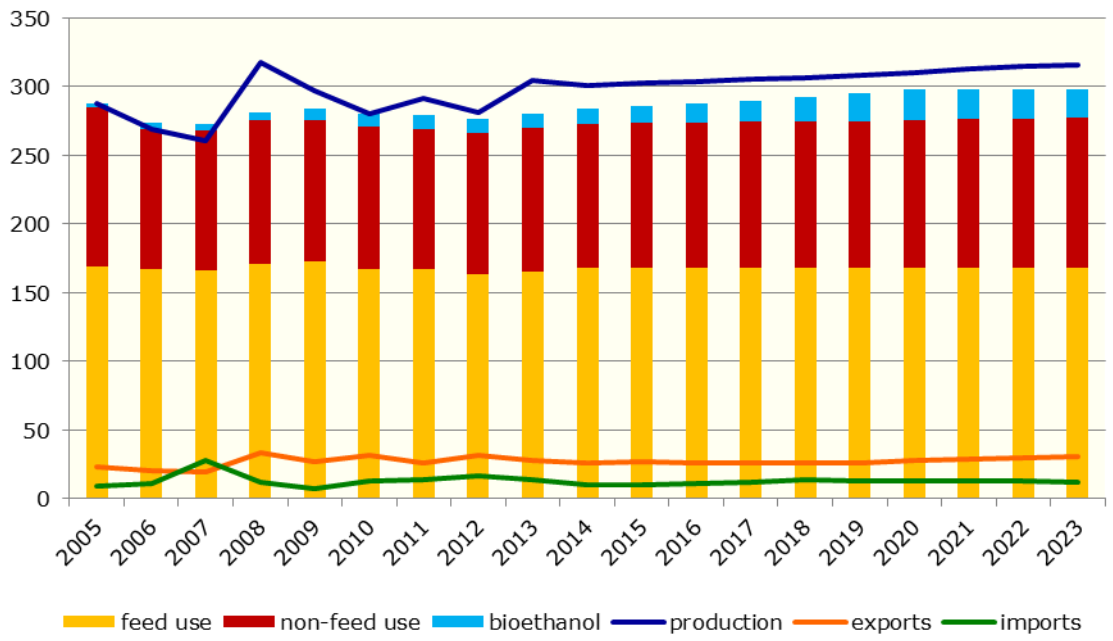
The EU cereals production is expected to recover in 2013 with a production of 304.3 million tonnes (about 8% more than in 2012) from a marginally increased sown area. Maize yields in Romania, Hungary and Bulgaria were hit by drought in 2012 but production are expected to improve to 64.5 million tonnes (up by about 8%) in 2013. Common wheat production is expected to increase at a similar rate, to 136 million tonnes. Barley production is expected to follow the trend of recent years, rising by 10% as compared with 2012, to 60.1 million tonnes. The overall increase in production should lead to slightly lower cereal imports (14.0 million tonnes). Demand for food and feed should recover as more domestic grain becomes available on the market. As exports from the Black Sea area to the world market recover, the EU will export less and replenish its stocks; ending stocks are expected to be around 38.7 million tonnes (14% of domestic use).

Market outlook

The medium-term prospects for the EU cereals markets are characterised by relatively tight market conditions, low stocks and prices which are above long-term averages (Graph 2.7). The EU remains a net exporter of cereals.

Consumption growth is driven mainly by the demand for cereals as ethanol feedstock. Feed use is stable throughout the baseline period. On the production side, a steady growth based on slightly increasing yields is expected. The effects of the yield variations are discussed in more detail in Chapter 8.

Graph 2.7 EU cereals market developments (million tonnes)



Market balance has been tight in recent years due to a general production shortfall in the EU combined with difficulties in sourcing imports on the world market in 2012 (Graph 2.7). Prices are expected to be generally higher throughout the baseline period, resulting in slower reduction of cereals acreage and possibly leading to yields stabilising or even accelerating growth to reverse recent trends.

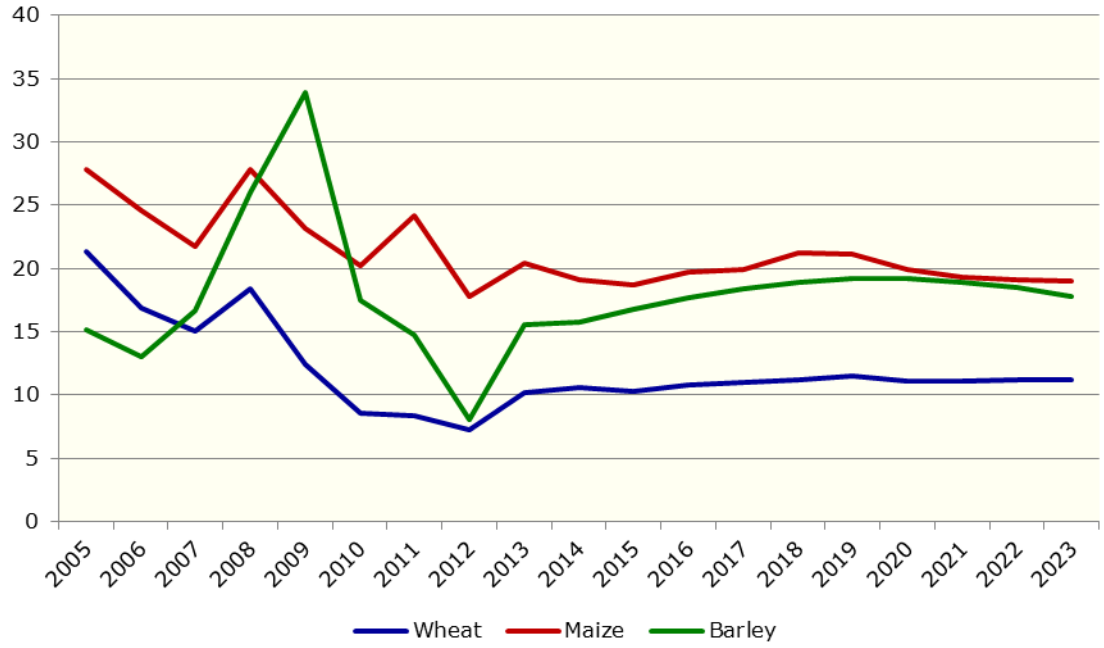
Common wheat and maize will expand at the expense of other cereals

The shift towards common wheat and maize is expected to continue in the coming decade, driven by biofuel demand and good export prospects. Other cereals will continue to lose market share. Export prospects are particularly good for common wheat, of which the EU has traditionally been a big net exporter. As domestic food and feed demand for wheat remain stable, the expected increase in domestic production will allow exports to expand slightly.

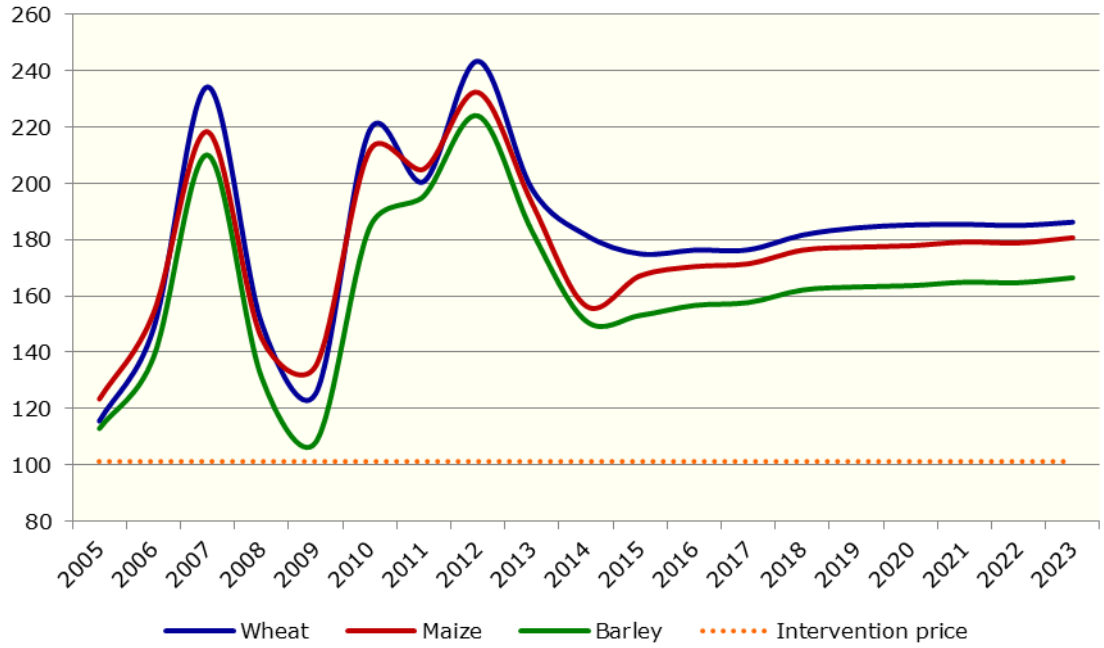
The outlook for maize is clearly dominated by the expected increase in its use as ethanol feedstock – the proportion used for bio-ethanol rises from about 5% to 14% by 2023 - at the expense of feed use, which drops from 78% to 67%. Food and industrial use increases after 2016, when the production quota for isoglucose is lifted, leading to increased production. Although maize production is increasing faster than all other cereal, it still falls short of overall demand and the EU is expected to remain a net importer throughout the baseline period.

Overall, EU cereals markets are expected to remain tight. The recovery from a very tight 2012/13 season has started, with increased production in 2013, but the stock-to-domestic use ratios for the major cereals will remain below the past decade's average in the EU (Graph 2.8), while that of maize will remain stable. The stock-to-domestic use ratio of maize is considerably higher than for wheat as the reference point is the end of June and the main EU harvest starts only in September.

Graph 2.8 EU stock-to-domestic use ratios for major cereals (%)



Graph 2.9 EU domestic prices for major cereals (EUR/tonne)



As indicated above, prices are expected to stabilise at a level above long-term averages (Graph 2.9). Prices for wheat and maize are similar, but the price gap with barley is expected to widen in line with the further concentration on maize and common wheat production. The low stock-to-use ratios imply that prices are likely to react strongly to any production shortfall in the EU or major supplying regions, e.g. South America or the Black Sea region. Box 2.1 highlights the inclusion of

uncertainty in price paths for common wheat, illustrating the possibility of large price variability.

Box 2.1 Price uncertainty in the medium-term outlook

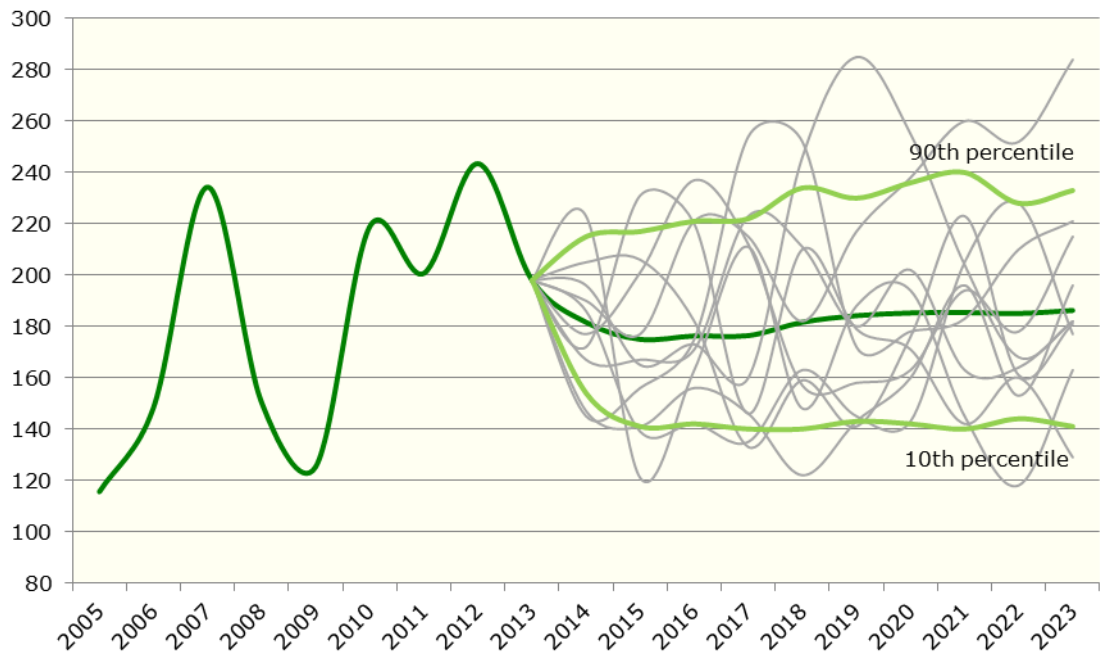
Uncertainties about future yields and macroeconomic indicators are incorporated in the baseline projections (Chapter 8), enabling us to illustrate potential price paths underlying the core baseline, as demonstrated for common wheat in

Graph 2.10.

The smooth baseline price line in dark green can be interpreted as an average of the potential price paths. The grey lines show ten arbitrary selected price paths out of almost 600 possible paths derived infrom the uncertainty analysis. These paths show strong variability between marketing years.

Two additional lines are included to present the 10th and 90th percentiles. Each year in 10% of the simulations (out of the 600) prices are below (higher) the 10th (90th) percentile, but this level of low (high) price is determined by some extreme macroeconomic assumptions or very unlikely high (low) yields. In the following chapters reference will be made to the baseline and the 10th and 90th percentiles.

Graph 2.10 Possible price paths for common wheat in the EU (EUR/tonne)



In summary, the cereals outlook points to high prices (though still below 2012/13 levels) and the EU is expected to be able to maintain its position as a net exporter. Maize production, in particular, will continue to grow due to the use of maize as a feedstock for the ethanol industry. Markets are expected to remain tight, with volatile prices and possible price spikes in the event of production disruptions.

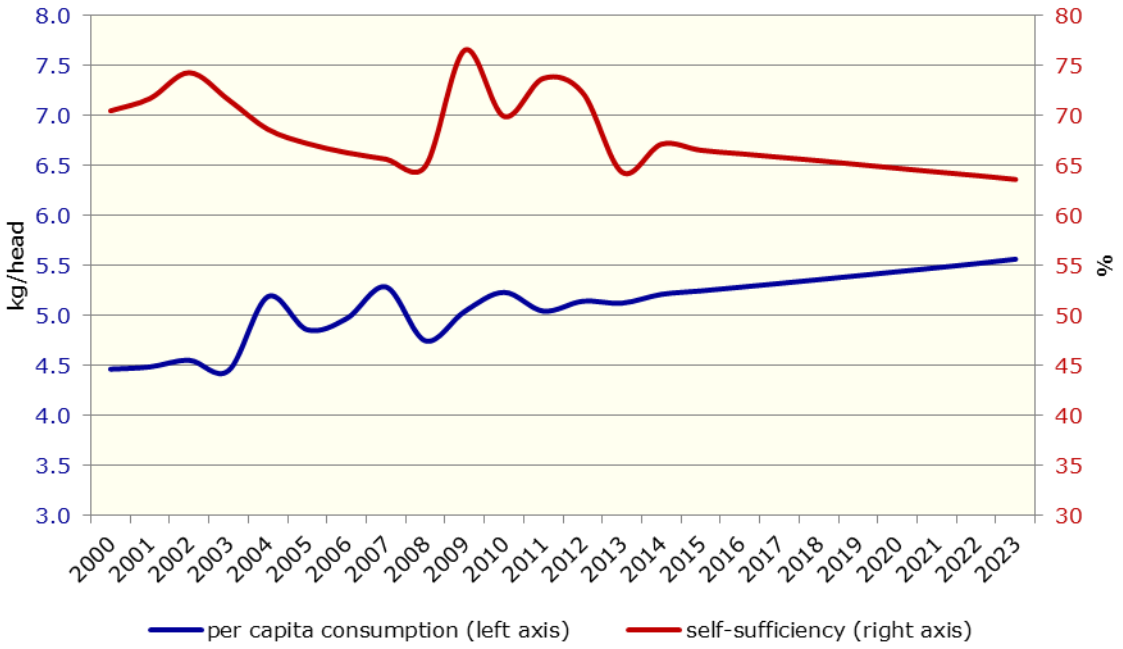
2.4. Rice

Rice is an important cereal worldwide, especially because of its importance in the Asian diet. Although it is not a major arable crop in the EU, rising consumption and its importance for the rest of the world mean that trends on the EU market are worth monitoring.

The EU's main rice-producing areas are in Italy (about 50% of total production) and Spain (about 30%). The characteristic use of paddy fields makes significant expansion unlikely in the coming decade, so the key variable is yield. Although yield growth in the past decade has been slow, a modest increase in the growth rate is expected on the back of relatively high prices and increased domestic demand. In general, the EU rice production is expected to remain stable over the next decade.

Graph 2.11 illustrates the link between increasing per capita rice consumption and decreasing self-sufficiency decade and over the coming ten years.

Graph 2.11 *Per capita* rice consumption and self-sufficiency



The EU will continue to produce less rice than it needs, and thus continue to import, especially since the market features a wide range of different varieties (Indica, Japonica, Basmati etc.) for specific uses.

2.5. Oilseed complex

Recent market developments

At 27.2 million tonnes, the 2012 oilseed harvest was lower than in previous years due to a considerable reduction in rapeseed area and low sunflower yields. Combined with a low soybean harvest in the US, availability was low for the 2012/13 season and this curbed the use of protein meals in EU compound feed and

the use of vegetable oils. The 2013 harvest rebounded due to upturns affecting the same two factors; rapeseed area and sunflower yield. Currently, the harvest is estimated at 29.7 million tonnes, which has already considerably relieved tension on the tight market.

Market outlook

Oilseeds are an important crop in the EU, where the sector is represented mainly by rapeseed and sunflower seed (soybeans, the most important oilseed worldwide, account for a very low proportion of EU production due to their yield disadvantage in Europe as compared to cereals; and groundnuts make up part of the oilseed aggregate used, but they are of very little importance in the EU).

About 92% of oilseeds are crushed into protein meal and vegetable oil. Protein meal is an important ingredient in the compound feed recipes used by the EU livestock industry.

Vegetable oils (also including cottonseed oil, palm oil, palm kernel oil and coconut oil) are used for human food consumption, industrial uses and (especially in the EU) to produce biodiesel. The remainder is used as direct feed or food, e.g. sunflower seed, groundnuts. The demand side is therefore assessed via the EU protein meal and vegetable oil markets.

EU oilseeds production has experienced a boom in the past decade, fuelled to a large extent by rising biodiesel production levels. The main beneficiary has been rapeseed, the source of the most suitable vegetable oil for biodiesel. It is expected that oilseed area will expand slightly in the coming decade, at a much slower pace. Despite the increased production, the EU will remain a strong net importer of oilseeds, protein meals and vegetable oils (mainly soybeans, soybean meal and palm oil).

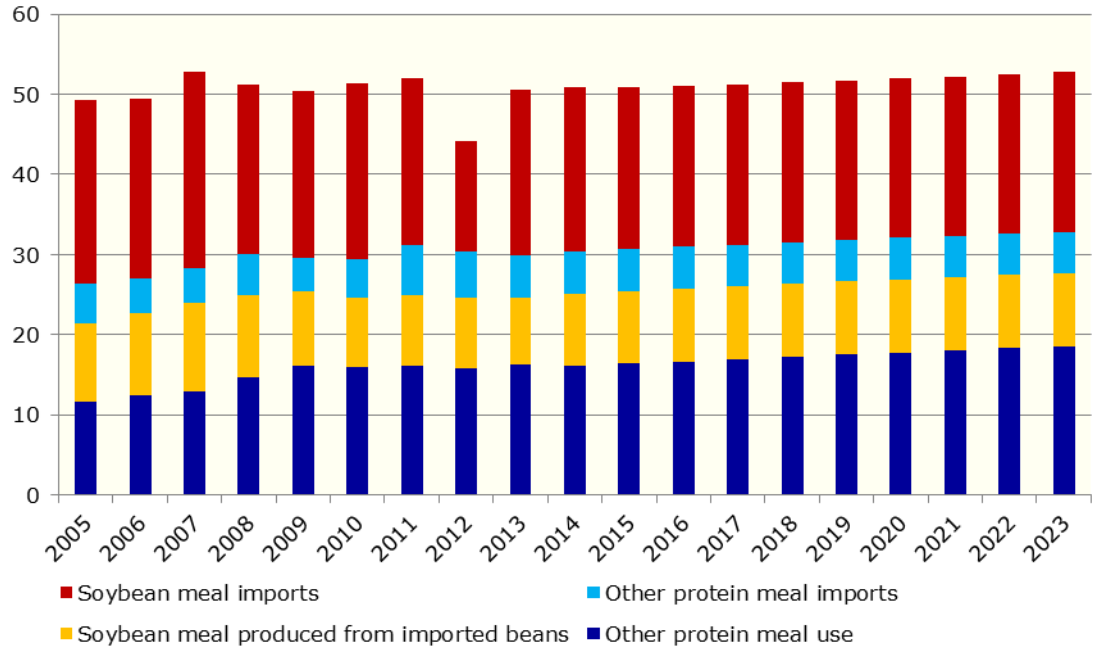
Oilseeds: further focus on rapeseed

Oilseed production in the EU increased considerably in the past decade and a further expansion is expected for the coming decade. Nevertheless, the EU will remain a considerable net importer of oilseeds, predominately of soybeans.

Rapeseed accounts for about two thirds of the EU's oilseed production and soybeans for about 73 % of its imports. These proportions have been stable in recent years and should remain so over the outlook period. Due to increasing production and steady demand for imports, the importance of rapeseed in the overall use of oilseeds increases to about 53 % by the end of the period, by which time the figure for soybeans will have fallen slightly below the current level, to 28 %.

Protein meal: high net imports to remain

Graph 2.12 Protein meal feed use in the EU (million tonnes)



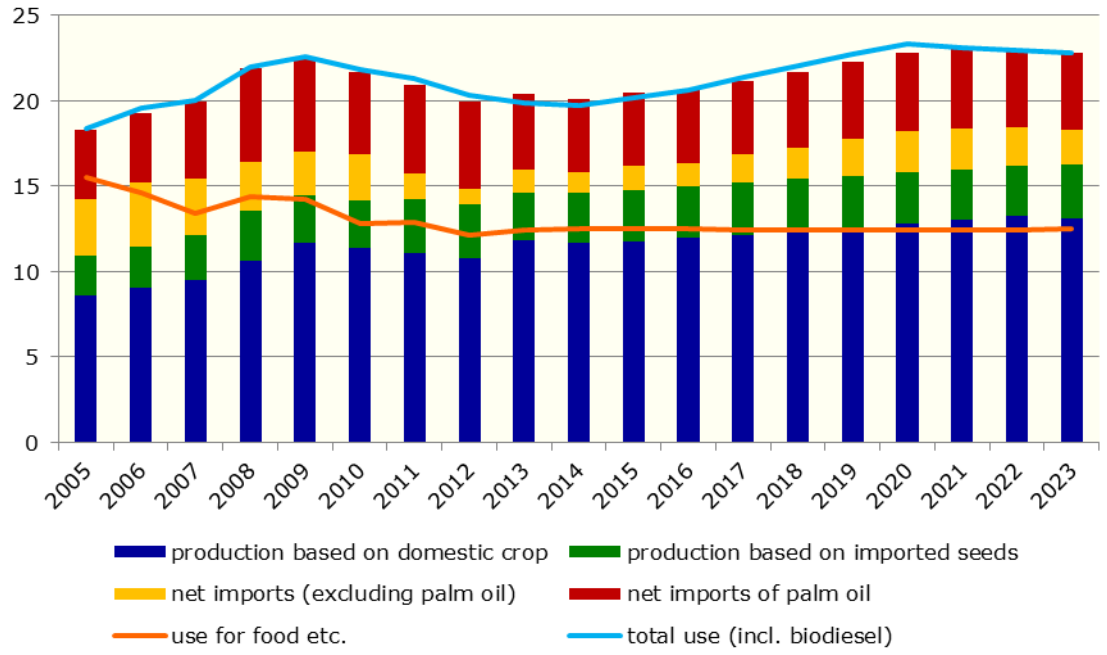
The EU is the world's second largest user of protein meal as an ingredient in animal feed, China having overtaken it only recently. As the protein meal favoured because of its protein content, soybean meal, is available from domestic crops only in very limited quantities, the EU is a major importer of soybean meal and soybeans for crushing.

In the 2012/13 marketing year imports of soybean meal declined substantially due low availabilities in the main producing countries (US, Brazil and Argentina). Subsequently feed use rationed. Prospects for the coming decade indicate that overall feed demand will increase only slightly, with demand for soybean meal remaining stable and rapeseed meal gaining market share (Graph 2.12).

Vegetable oil: balance of demand between biofuel and food use

Except for olive oil, which accounts for less than 10 % of the total production (1.8 million tonnes), the vegetable oils we have looked at are those produced in the biggest quantities in the EU. Demand has increased substantially in recent years, mainly because of the rising demand for feedstock for the production of biodiesel (Graph 2.13). On the other hand, per capita human consumption of these oils continues to decline, but this tendency is slowing down and food use is expected to be relatively steady over the next decade.

Graph 2.13 EU vegetable oil origin and use (million tonnes)



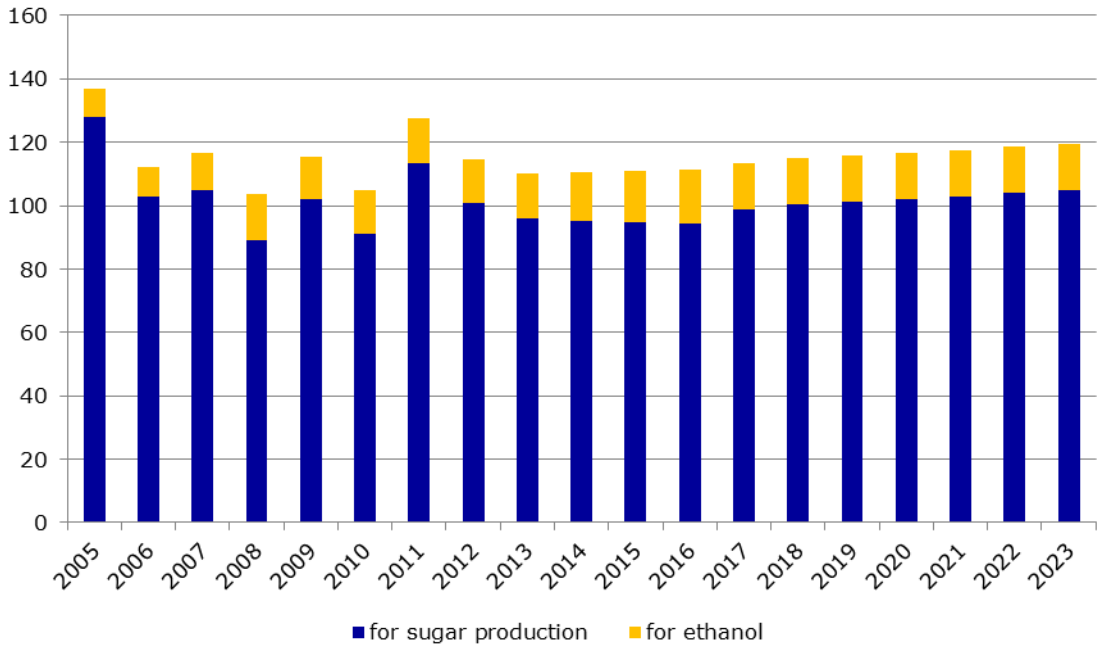
Domestic production is covering a greater proportion of overall needs and may actually cover food demand in the next ten years. Nevertheless, the EU remains highly dependent on imports, either in the form of oilseeds for crushing or finished vegetable oils (mainly palm oil).

2.6. Sugar beet and sugar

The 2012 sugar beet harvest was lower than previous year's, but still considerably above quota level. As the sugar quota is expressed in white sugar equivalent (13.3 million tonnes, excluding Croatia), it is only at processed level that production can be gauged accurately. The 3 million tonnes of out-of-quota can be exported (within limits agreed in the World Trade Organisation), processed for ethanol or put to other industrial uses. The remainder is carried forward and counted as the first quota production for the next year. In 2013, the harvest is expected to be lower than in 2012 (mainly due to reduced sowings, but also yields are lower).

Given expectations as regards world prices, growing demand for ethanol and the winding up of the quota scheme in 2017, EU sugar beet production is projected to expand in the coming decade (Graph 2.14). Additional volumes will be used mainly to produce sugar, as sugar beet is expected to become less competitive as feedstock for ethanol once the quota arrangements cease to apply. The importance of ethanol as an outlet for sugar beet increased considerably following the 2006 reform, but is likely to decline with the disappearance of the sugar quota in 2017 (Graph 2.15). Currently, there are separate markets for in-quota and out-of-quota sugar. Prices for the former are substantially above world market levels, whereas those for the latter are below. With no more quotas, prices will merge and the production of ethanol from sugar beet will be less competitive.

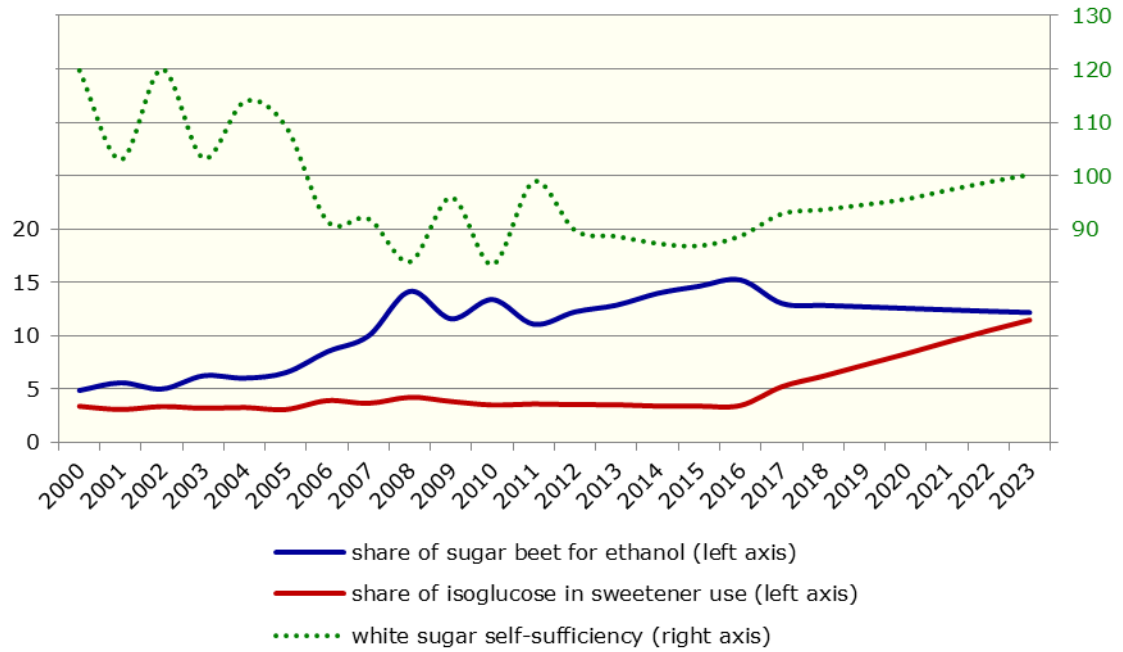
Graph 2.14 EU sugar beet production by use (million tonnes)



The market balance for sugar looks fairly steady over the projection period (see statistical annex). Since its reform of the sector in 2006, the EU has turned from being a net exporter of sugar into a net importer, with its self-sufficiency in white sugar declining from around 120% to between 90% and 100% (Graph 2.15).

In the future, the EU is expected to move closer to full self-sufficiency and being an occasional net exporter, especially after the quota system is lifted. The latter will lead to a reduction of the domestic sugar price in the EU and make imports less attractive. Therefore, it is expected that sugar imports will decline from current levels. However, being a net exporter does not mean that imports will completely disappear. Due to the relatively short production period of sugar in the autumn and its regional concentration in North Western Europe, there will be ample need for imports in certain periods and certain regions. The most competitive origins that have free access to the EU market will therefore continue exporting to the EU.

Graph 2.15 EU sugar market indicators (%)

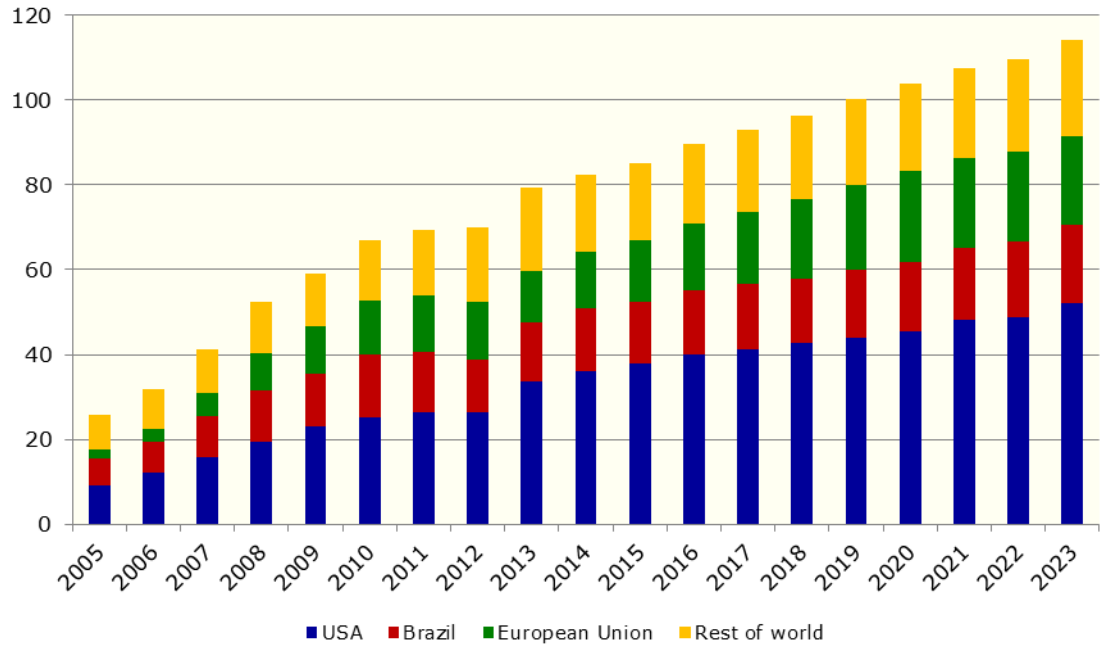


With the expiry of the quota scheme in 2017, isoglucose will start to compete on the domestic sweetener market, especially in regions with a high grain surplus. Although it is unclear how production will develop, isoglucose is expected to account for a rapidly increasing proportion of overall sweetener use (Graph 2.15) - though far less than the United States' 40 % or 25 % in Canada and Mexico. The development of isoglucose will curb the expansion potential for domestic sugar use in the EU.

2.7. Biofuels

The cereals, sugar and oilseeds markets are increasingly affected by biofuel developments. The world's main biofuel producers and consumers are the US, Brazil and the EU (Graph 2.16). The first two mainly produce ethanol, whereas the EU has a more mixed approach, with a higher proportion of biodiesel. Brazil was the first country to develop a significant biofuels market. In the past decade, the US has rapidly become the leading consumer and producer. In 2012 world consumption seemed to take a rest in its upward trend, partly as a result of the dramatic drop in US maize production, which led to the possibility to roll-over mandates between years, but also as the result of the US reaching already its required use of maize-based ethanol.

Graph 2.16 World biofuel consumption (million t.o.e)



High oil prices favour the production of biofuels, as in that situation the production based on crops is more competitive, turning ethanol production price competitive with fossil fuels. Nevertheless, the development of biofuel markets still depends heavily on policy stimuli.

The relevant policy context in the EU stems from two directives setting out sustainability criteria for biofuel production and procedures for verifying compliance:

- the Renewable Energy Directive (RED), which entered into force in 2009, set an overall binding target to source 20 % of EU energy needs from renewables such as biomass, hydro, wind and solar power by 2020. Member States have to cover at least 10 % of their transport energy use from renewable sources (including biofuels); and

- the Fuel Quality Directive, which develops these policies further.

The criteria are under review and a Commission proposal (COM(2012) 595) published on 17 October 2012[3] is currently in legislative procedure. We do not anticipate other changes having a significant impact on EU biofuel markets.

In order focus on agricultural markets, the biofuel baseline is very simplified and distinguishes only two biofuel types, ethanol and biodiesel. The land-use implications of biomass-based biofuel production processes ('second generation' biofuels) are not considered, as they are still in their infancy. Our specific assumptions for biofuels are:

[3] http://ec.europa.eu/prelex/detail_dossier_real.cfm?CL=en&DosID=202037

1. The consumption estimates for diesel and petrol-type fuels are taken from the recent baseline developed using the POLES model by the JRC-IPTS together with the Commission's Directorate-General for Energy;

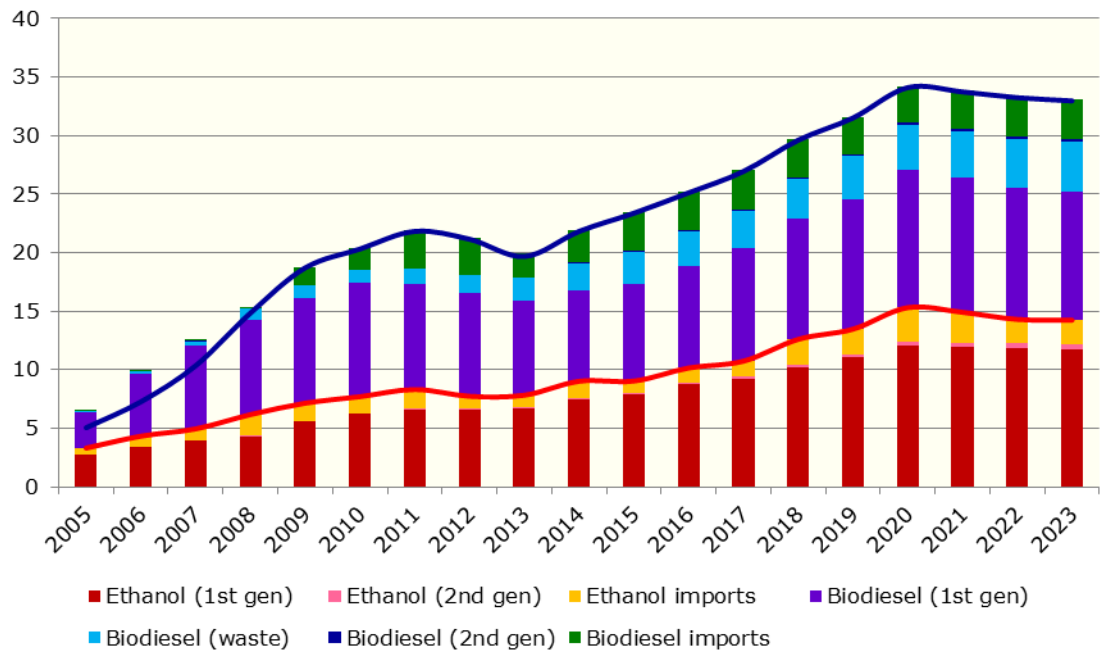
2. Consequently, it is assumed that by 2020 biofuels will account for about 8.5% of total EU transport energy consumption; and

3. Due to low investment and the time lag in the development of second-generation biofuels (excluding biodiesel based on waste oils), these processes will remain in their infancy throughout the baseline period and only reach 0.13% of all transport energy consumed.

It is assumed that the shortfall *vis-à-vis* the 10% target will be met from other renewable energy sources, e.g. electric cars. In addition, business information and the slow expansion of biofuel use in recent years suggest limited growth potential for ethanol and second-generation capacity.

On the demand side, with current standard blends we would be close to the current 'blend wall'. Diesel cars are currently certified for blends with up to 7% biodiesel by volume (Fatty Acid Methyl Ester (FAME) or Dimethyl Ether (DME); around 6.5% in energy terms) and for petrol cars the limit is 10% ethanol by volume (around 6.7% in energy terms). Both levels are exceeded in the current baseline - and would require either usage of higher blends (which is possible for current diesel engines by drop-in diesel substitutes, such as Hydrotreated Vegetable Oil (HVO)) or of adjusted engines for the use of higher blends of other biofuels. Based on the beforehand assumptions it is not expected that the energy share originated from biofuels will increase after 2020.

Graph 2.17 EU biofuel consumption by source (million t.o.e)



It is expected that most of the EU's biofuel demand will be covered by domestically produced biofuels from agricultural feedstock (first-generation biofuels) (Graph

2.17). Ethanol is expected to develop more dynamically, but biodiesel will still dominate in absolute terms.

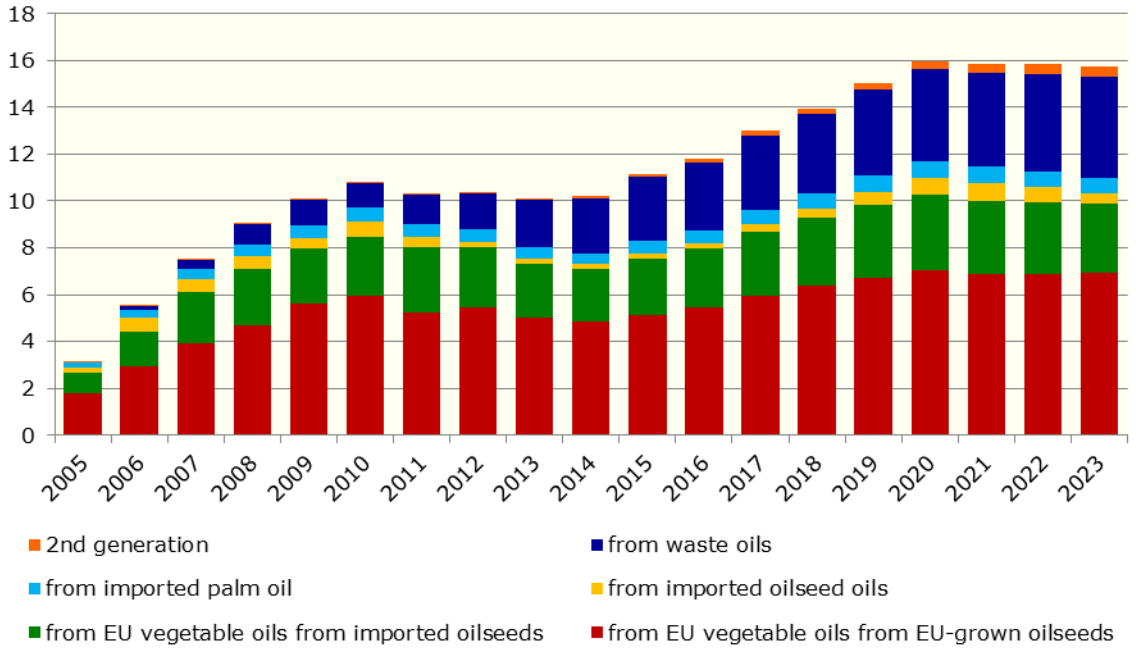
The only other important domestic source will be biodiesel based on waste oils (used cooking oils and tallow) which, like second-generation biofuels, benefit from double-counting towards the RED target for transport fuels.

In addition to domestic sources (based partly on imported feedstock), a considerable proportion of the EU's biofuel demand is covered by biofuels imported, as such or in blends.

Growing importance of waste oils as biodiesel feedstock

The main feedstock for the production of biodiesel is vegetable oil, in particular rapeseed oil (Graph 2.18). Although, in recent years the use of waste oils (used cooking oils and tallow) have increased their importance as feedstock, as biodiesel produced from waste oils benefits from double counting under the RED. Especially for used cooking oil growth is limited by the non-biofuel use of vegetable oil and the increasing collection costs if sourced from households. Biodiesel production accounts for over 40% of vegetable oil demand in the EU and any change in production considerably impacts price formation in this market.

Graph 2.18 EU biodiesel production by source (billion litres)

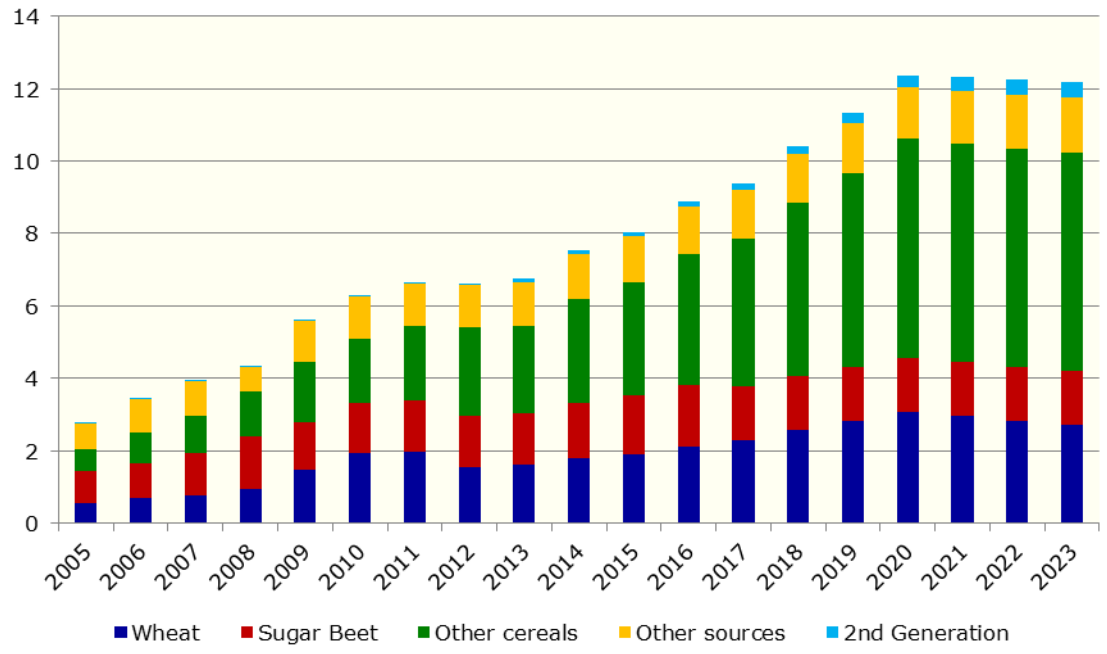


Strong increase in ethanol production based on maize as feedstock

For ethanol, multiple feedstocks are used; the main crop-based feedstocks are sugar beet and cereals (Graph 2.19). Ethanol can be produced from most intermediate products between harvested sugar beet and the final white sugar but, for the sake of simplicity, the feedstock is referred to as sugar beet in this medium-term projection. The proportion of sugar beet used to produce ethanol has passed 10% in the past decade, but no significant further increase is currently expected.

Most of the future growth will be in the use of other cereals, especially maize, as ethanol feedstock.

Graph 2.19 EU ethanol production by source (billion litres)



The production of ethanol from cereals (the main technique used in the US) has increased significantly in the past decade and is expected to continue to rise in the EU. Nevertheless, it is not expected that this will account for more than 10% of overall demand for cereals, so changes in ethanol production will have less impact on the respective feedstock markets.

Since biofuel markets are policy-dependent, current discussions on the review of EU biofuel policy could lead to substantial changes:

- limiting the proportion of first-generation biofuels would slow the increase in demand for agricultural feedstock (vegetable oils, sugar beet and cereals);
- revised sustainability criteria could require greater greenhouse gas savings from biofuels as compared to fossil fuels;
- updated default estimates of greenhouse gas emissions from biofuels may favour the use of different sources of feedstock; and
- on the basis of current data, the inclusion of indirect land-use change criteria would significantly affect vegetable-oil-based-biodiesel.

A recent report[4] assesses different policy options against last year's baseline.

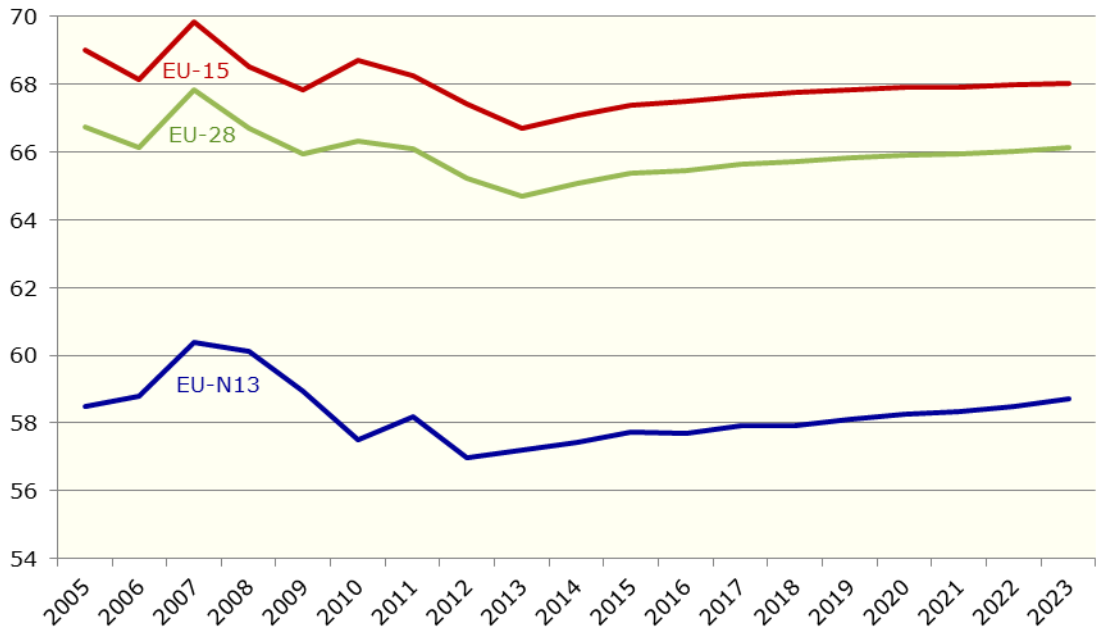
[4] *Impacts of the EU biofuel policy on agricultural markets and land use* Sophie Hélaine, Robert M'barek and Hubertus Gay (http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6559)

3. Meat products

The EU meat sector is expected to be supported by strong demand on the world market driven by favourable economic conditions. In Europe, prospects of improved economic growth should leave consumers with more disposable income allowing for a higher consumption of meat products.

In 2012, unfavourable weather in several parts of the world (drought in the US, Black Sea region and Eastern Europe) drove up grain, and consequently feed prices, which affected meat production and put pressure on margins despite meat prices reaching historical highs worldwide in 2012 and 2013. In the current outlook feed prices are expected to remain relatively high throughout the projection period, though significantly below 2012 levels. Projected meat prices are also to remain firm due to strong world demand and limited supply response.

Graph 3.1 Total meat consumption in retail weight (kg *per capita*)



EU meat demand: poultry meat to grow the fastest but at a slower pace than previously

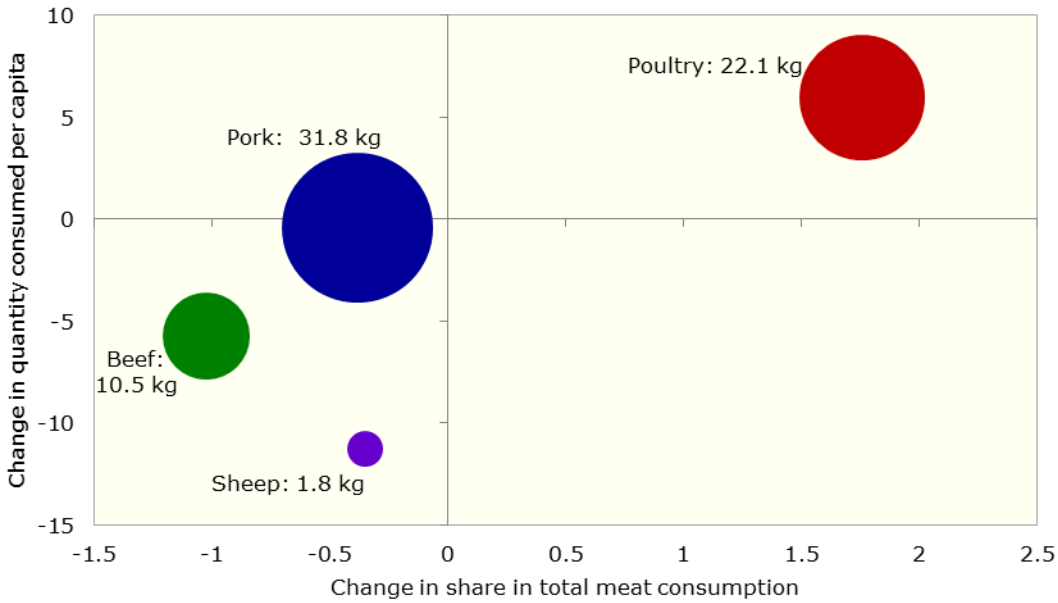
Lower availabilities, higher meat prices and the ongoing economic downturn with high unemployment rates especially in the southern European countries meant that overall meat consumption contracted in 2012 and 2013 (-1.5% from 2011), reaching its lowest level for the past 11 years (64.7 kg *per capita*)[5] in 2013, as consumers turned to cheaper meats and cuts.

[5] Consumption *per capita* is measured in retail weight. Coefficients to convert the carcass weight into retail weight are 0.7 for beef and veal, 0.78 for pig meat and 0.88 for poultry and sheep meat.

Consumption is expected to recover from 2014 as more meat comes in onto the market. By the end of the projection period, *per capita* consumption is expected to reach 66.1 kg, similar to the 2011 level (Graph 3.1). The recovery is moderate because more people are changing their food habits towards more fish and/or 'less meat' in their diets.

Individuals typically consume around 10 kg more meat in the EU-15 than in the EU-N13, but this gap is expected to narrow slightly in the next few years, due mainly to faster growing poultry meat consumption in the new Member States. Current EU-15 and EU-N13 *per capita* consumption levels of pork, poultry and sheep meat are quite similar, but individuals in the EU-15 tend to eat far more beef: about 12 kg as against 4 kg in the EU-N13.

Graph 3.2 EU meat consumption in 2023 as compared with 2010-12 average (%)



*The size of bubble represents the share of individual meats in total meat consumption in 2023

Over the projection period, poultry meat is expected to remain the most dynamic product (thanks to its price, convenience and health considerations) and partially compensate for falling beef and sheep meat consumption. Poultry consumption is expected to increase both as a proportion of total meat consumption and in absolute terms (Graph 3.2.). Pork will remain Europe's favourite meat, while the consumption of beef and sheep meat is projected to drop in both in absolute and relative terms.

3.1. Beef and veal

Recent developments

A steady decline in EU cattle numbers from 2009 affected both suckler and dairy cow herds. This was not fully offset by higher average slaughter weights and beef and veal production declined, most sharply in 2012 (almost -4%) and 2013 (-3%).

In those two years, exports to third countries decreased from 2011's record level because of the lack of supply and protectionist measures introduced in Turkey and Russia which have increased duties on import from the EU or, simply, banned EU beef on animal health grounds[6]. Restrictions on trade for sanitary reasons are used by these countries to limit imports from the EU and they might introduce such restrictions also over the projection period. However, this possibility is not taken into account in these projections. Other destinations for EU live cattle are Lebanon and Algeria.

In 2012, EU meat imports decreased further because of Argentina's policy of limiting exports in a context of limited beef production, while imports from Brazil and Uruguay remained quite stable. Consequently, imports were 4.4% lower (at 275 000 tonnes) in 2012 than in 2011 reaching their lowest level in the past decade and failing to make up for low domestic supply. In 2013, EU imports from third countries will grow by 10.6%, with rising shipments from Brazil and Uruguay, while volumes from Argentina (despite some expected recovery in production) will contract further.

The scarce supply caused consumer prices to rise and put additional pressure on consumption. Following a 1% decline in 2011, overall consumption dropped more significantly in 2012 (around 3% year-on-year) and the trend continued in 2013 (almost -2%); *per capita* consumption fell by around half a kilogram in two years (from 11.2 kg in 2011 to 10.7 kg in 2013).

Market outlook: production coming back after quota abolition

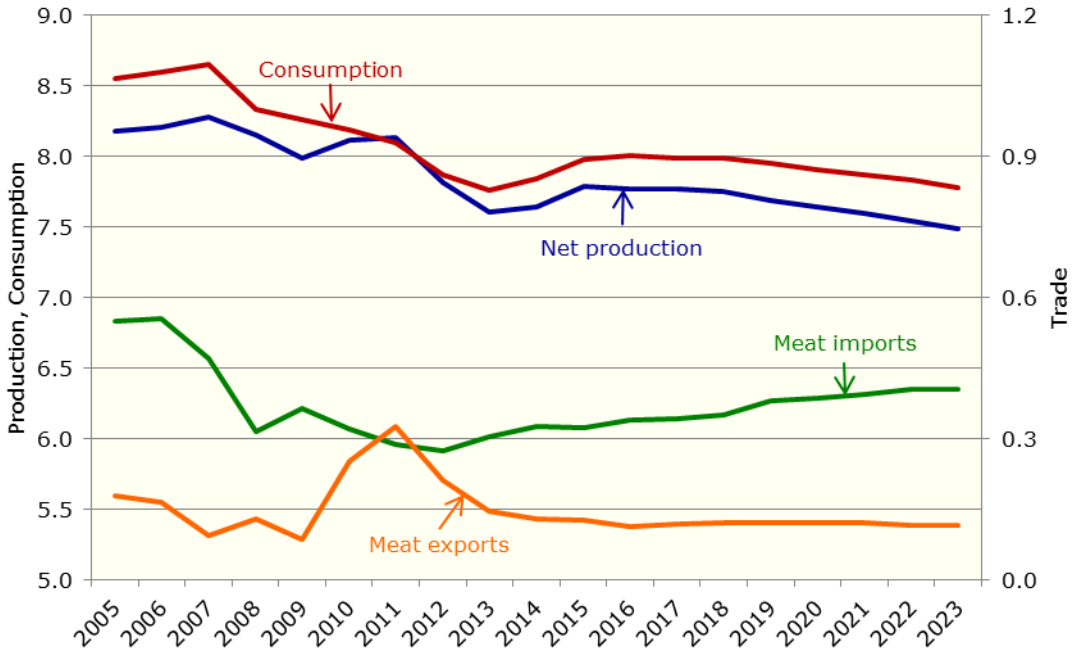
After many years of contraction in the EU cattle herd, 2012 marked a break in the trend, with a slight increase in dairy cow numbers as farmers started to recapitalise in view of the upcoming abolition of milk quota (see Chapter 4), and a stabilisation of suckler cow numbers. However, the increase in the dairy herd is not expected to last and already in 2013 the numbers are expected to decrease again, at first at a slower pace and then in line with recent trends.

The EU-15 suckler cows herd (notably concentrated in France, Spain, Ireland and the United Kingdom) is expected to remain stable over the projection period at around 12 million heads. Further to the end of the quota system, some mixed activity farmers may specialise more in dairy and decrease suckler cow herd. However, the firm beef meat prices projected in the medium term should provide sufficient incentives for beef farmers to take over these suckler cows.

Due mainly to developments in the dairy herd (which represents around 2/3 of beef production), beef production is projected to decline by around 7% from the 2010-12 average to a low 7.6 million tonnes in 2023 (Graph 3.3).

[6] In January 2013, Turkey decided to block the imports from the EU requesting sanitary certificates ensuring that animals are born and slaughtered in the same Member State. Russia introduced a ban on livestock products imports from several EU Member States complaining on the veterinary inspection system. Beef trade has been the most affected by this restriction.

Graph 3.3 EU beef market developments (million tonnes)



In the context of decreasing supply, exports will steadily shrink to 116 000 tonnes (less than 50% of the exceptional 2010-12 average). A shift in key destinations seems likely:

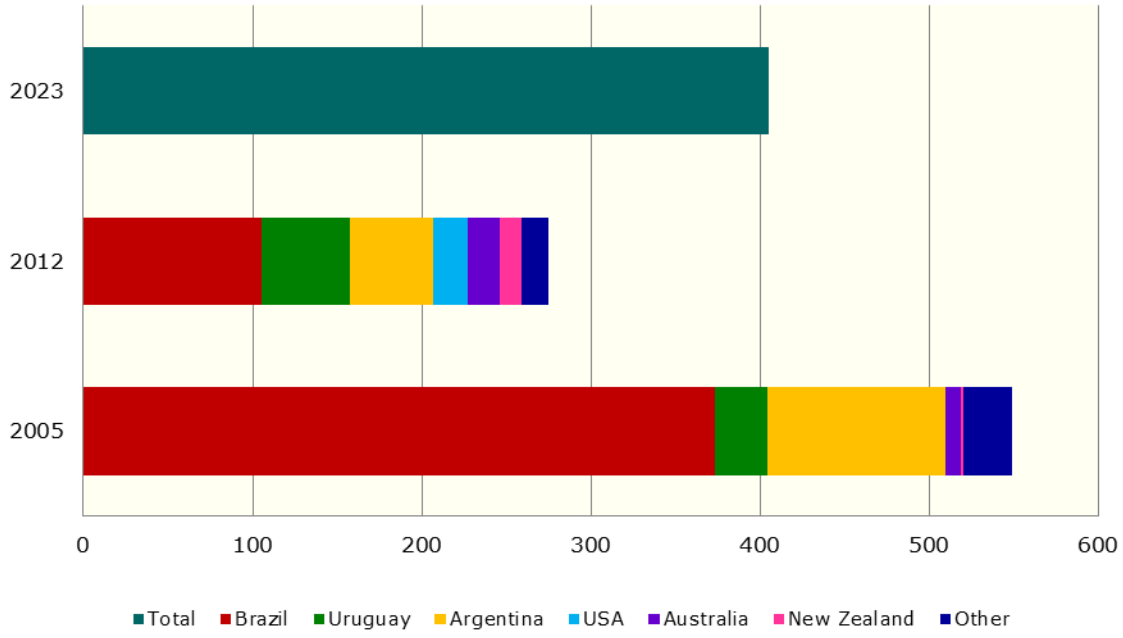
- Russia and Turkey are expected to import less from the EU due, respectively, to increased domestic production and lower demand (in addition to their recent trade measures – see above); while
- demand from South Korea, the Middle East and Egypt could create new opportunities.

Import volumes in 2023 are expected to be higher than in 2012 although significantly lower than in 2005, when they still largely exceeded tariff rate quotas (Graph 3.4). Increased production in Brazil and Argentina, together with an expected strengthening of Uruguay's performance, will translate into higher imports into the European market (close to 400 000 tonnes). However, imports from South America are not expected to reach the record 2005 - 07 levels, because:

- the price gap with the EU has closed somewhat;
- South America is increasingly supplying other markets; and
- with the good economic growth, consumption in South America has increased and less meat is available for export.

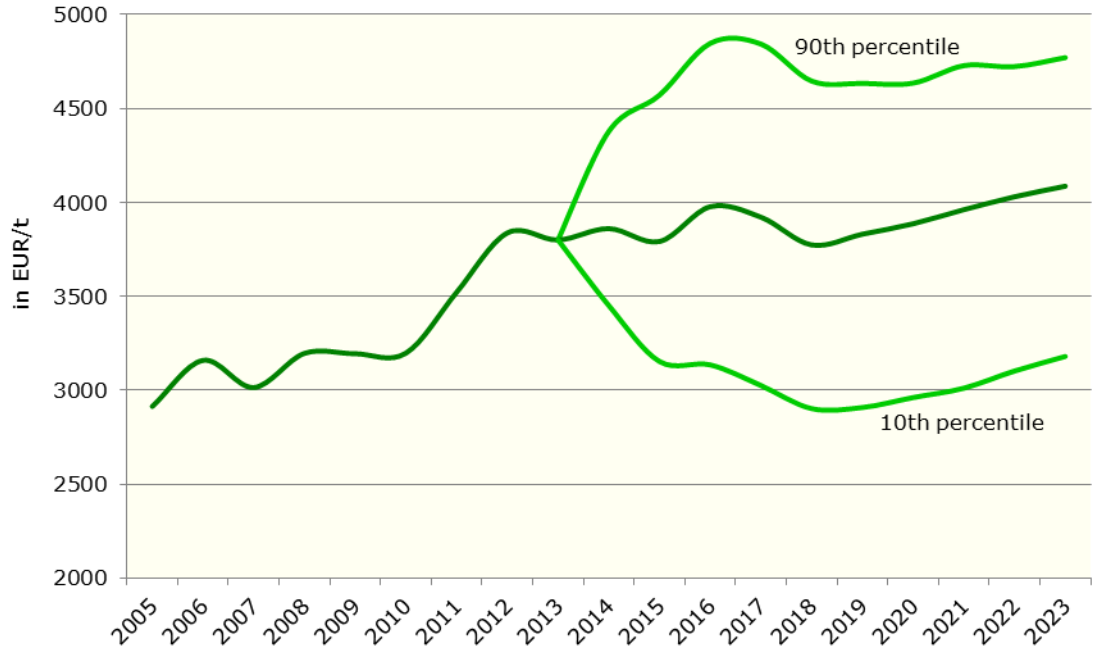
A possible increase of Brazilian exports in case of a slower economic growth and a devaluation of the real is analysed in Chapter 9. The present outlook does not take account of a possible increase in imports once the bilateral agreement with Canada enters into force.

Graph 3.4 EU beef imports developments ('000 tonnes)



As consumption remains closely tied to availability and price, its 2023 level is projected to fall by 5.7% against the 2010-12 average, to a very low 10.5 kg *per capita*. This figure hides a continuing big gap between old and new Member States (EU-15: 12.2 kg; EU-N13: 3.8 kg).

Graph 3.5 Projected price and possible price paths for EU beef (EUR/tonne)



Tight supply is expected to keep prices firm at 4 086 EUR/t in 2023 close to the record 2012 and 2013 levels (+16.1% in 2023 as compared to the 2010-12

average). The price path, however, may not necessarily be as smooth as indicated here, given the uncertainties relating to crop yields and the macroeconomic environment (see Box 2.1). Each year, in 80% of the simulations ran to depict the expected uncertainties, the price oscillates between the 10th and 90th percentiles presented in the graph.

3.2. Pig meat

Recent developments

Like the cattle herd, the pig herd has been decreasing since 2006 and stood at 147 million heads in 2012 (a reduction of 16 million heads or 10%, in seven years), while breeding sow numbers fell even more steeply, by 19% (3 million heads). The downward trend is explained by:

- restructuring process in some of the most important producers;
- increased productivity;
- higher feed costs;
- lower profitability in the sector; and
- (more recently) the need to adapt to new welfare rules.

In spite of the decline in herd, carcass weight gains implied that meat production increased slightly in the period to 2011. However, the new welfare rules in place accelerated the decline in animal numbers (as reflected in the December 2011 and 2012 surveys) and inevitably led to shorter supply on the European market in 2012 and 2013 (by -2% and -1.2%, respectively).

Despite this, exports performed relatively well in 2012 and 2013, with higher volumes (around 2.2 million tonnes) shipped to Asia and the Far East countries in particular; Russia remained the top destination (more than 600 000 tonnes per year), with second place going to Japan (over 250 000 tonnes per year).

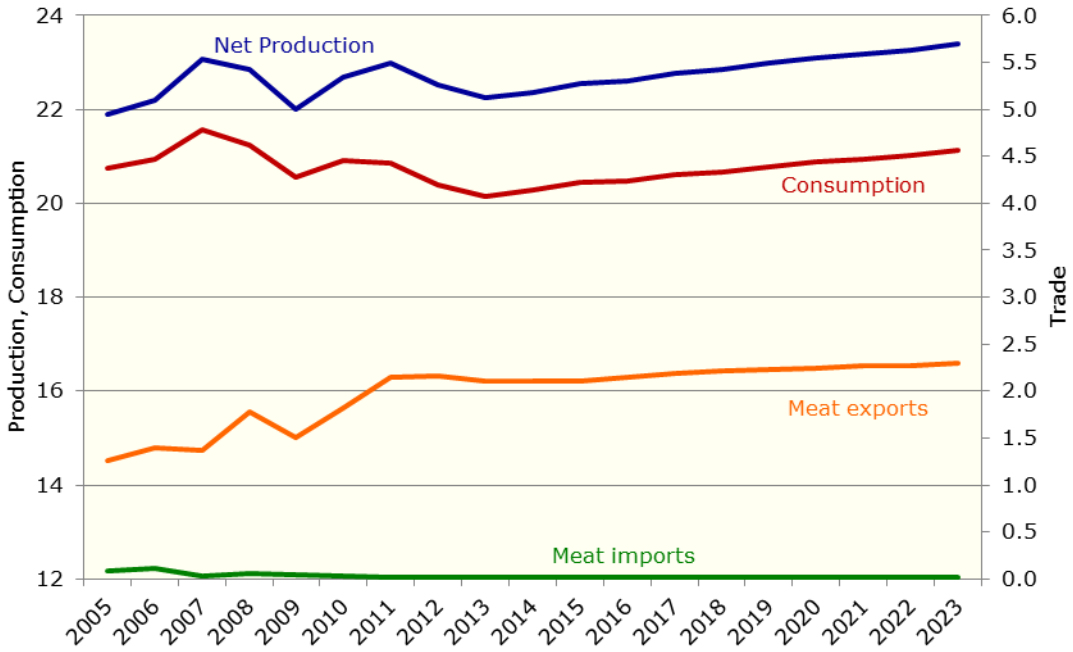
Supply shortages and high prices put pressure on consumption, which fell by 2.3% in 2012 and 1.1% in 2013. *Per capita* consumption fell significantly, from 32.1 kg (retail weight) in 2011 to 30.8 kg in 2013.

Market outlook: rebound in production as of 2015 to benefit from export opportunities

It is expected that the new welfare rules will force some less competitive farmers out of production and a higher proportion of pig meat will come from more productive farms. This is expected to boost production from 2014 onwards to 23.4 million tonnes by 2023 (+2.8% against the 2010-12 average; Graph 3.6).

The increase will be kept at moderate levels by environmental constraints in some of the main producer countries (e.g. the Netherlands and some parts of France).

Graph 3.6 EU pig meat market development (million tonnes)



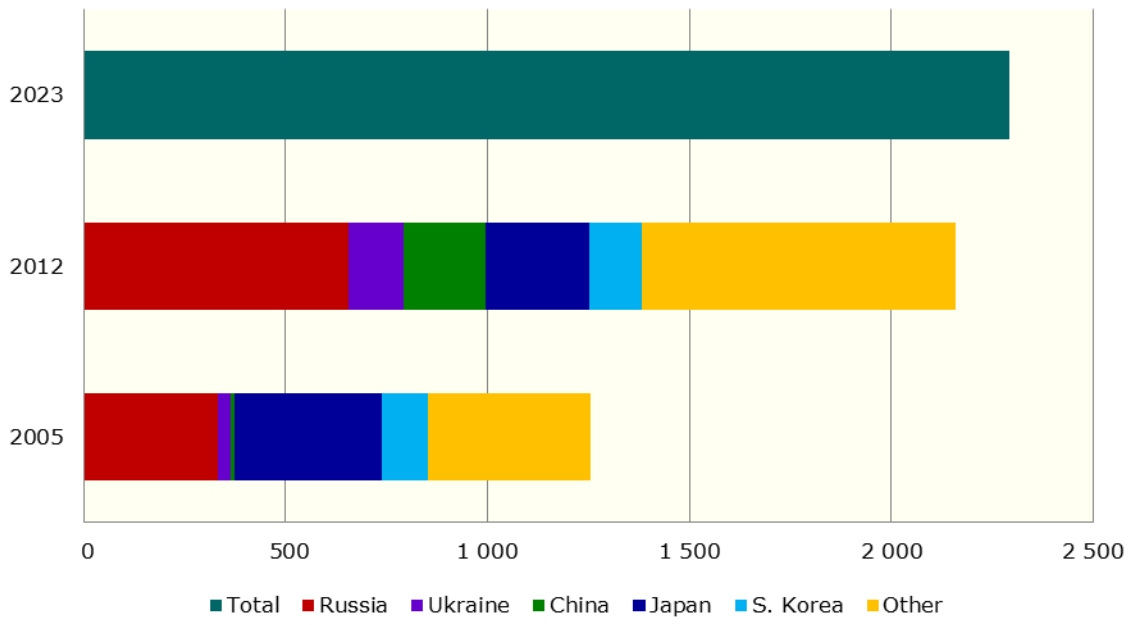
Exports[7] are projected to increase by 2023 by 12.4% against the 2010-12 average and 6.3% against 2012 levels (Graph 3.7). The annual growth of 1% for 2012-23 is substantially lower than the corresponding rate for 2001-11 (+6%). This development should be driven by increased competition from the US and Brazil, where production is likely to increase over the projection period (by 18% and 24% by 2023 as compared with 2010-13 average).

Russia and China are expected to remain the main destinations for EU pig meat exports with a projected increase of the Chinese import demand. It is important to bear in mind that, if the Chinese authorities would lower their self-sufficiency objectives, the impact could be significantly higher imported quantities; for example, if in 2012, self-sufficiency objectives would have been 1% lower, that could have implied additional pig meat imports of around 500 000 tonnes. On the other hand, higher domestic production thanks to generous subsidies in pig meat production might reduce import demand in Russia.

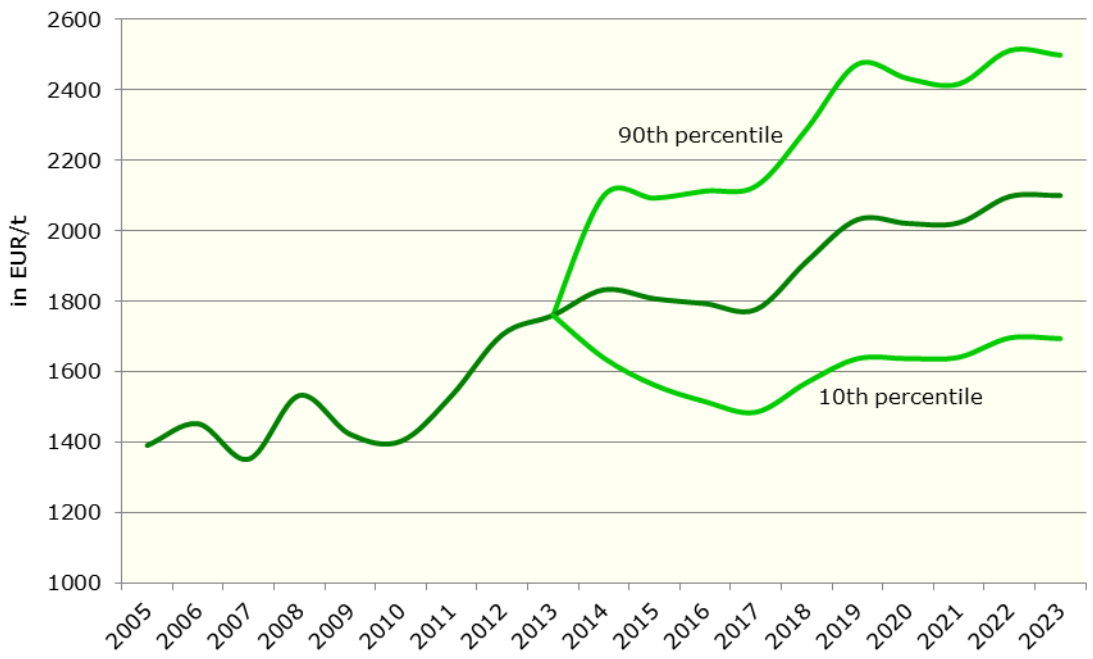
Over the projection period, consumption is expected to recover slowly from the very low 2013 level, reversing the decreasing trend observed since 2007 because of the economic crisis and the limited supply. However, even under this condition, consumption is still not expected to exceed 31.8 kg *per capita* by 2023, which would keept it below the 2011 level.

[7] Offal and fat (except lard) are not taken into account.

Graph 3.7 EU pig meat exports developments ('000 tonnes)



Graph 3.8 Projected price and possible price paths for EU pig meat (EUR/tonne)



Tight supply and higher grain prices led pig meat prices in 2012 and the first part of 2013 well above their 2011 level (which was already a record); they subsequently fell somewhat in the second half of 2013 on the back of lower feed prices. Over the outlook period, EU pig meat prices should follow developments on the world market and could rise at the same pace as in the past decade to reach 2 100 EUR/t in 2023 (Graph 3.8).

However, uncertainties relating to crop yield and the macroeconomic environment could imply price fluctuation around their projected average level by up to 9% with a consequent impact on EU export competitiveness and demand (Box 2.1).

3.3. Poultry meat

Recent developments

Poultry meat has partly made up for the reduced availability of beef and pig meat. Thanks to short rearing times and the fact that it is relatively easy to invest in the sector, poultry meat production has maintained its recent steady upward trend, though at a slower rate than before. Again, higher feed costs and the economic environment had a significant impact, reflected in slower growth in 2011-13.

In a context of growing world demand, EU exports grew substantially in 2010 (+24%) and 2011 (+12%). Nevertheless, respective export growth was much weaker in 2012 (+2%) and 2013 (+1%), as strong demand in some African countries (mainly South Africa and Benin) and the Middle East (Saudi Arabia) was offset by fewer shipments to Hong Kong and Russia (Graph 3.10). Lower export refunds in October 2012 and their complete removal in January 2013 for chicks and in July for frozen poultry carcasses seem not to have had a noticeable effect on exports.

2012 imports remained rather stable at around the same level as in the previous year, but increased by 3.4% in 2013 in response to firm growth in domestic consumption. Higher imports from Thailand (for which a quota for salted raw poultry meat was opened in July 2012) compensated for the shortage of supply from Brazil (a result of production constraints and exporters focusing more on Asian markets).

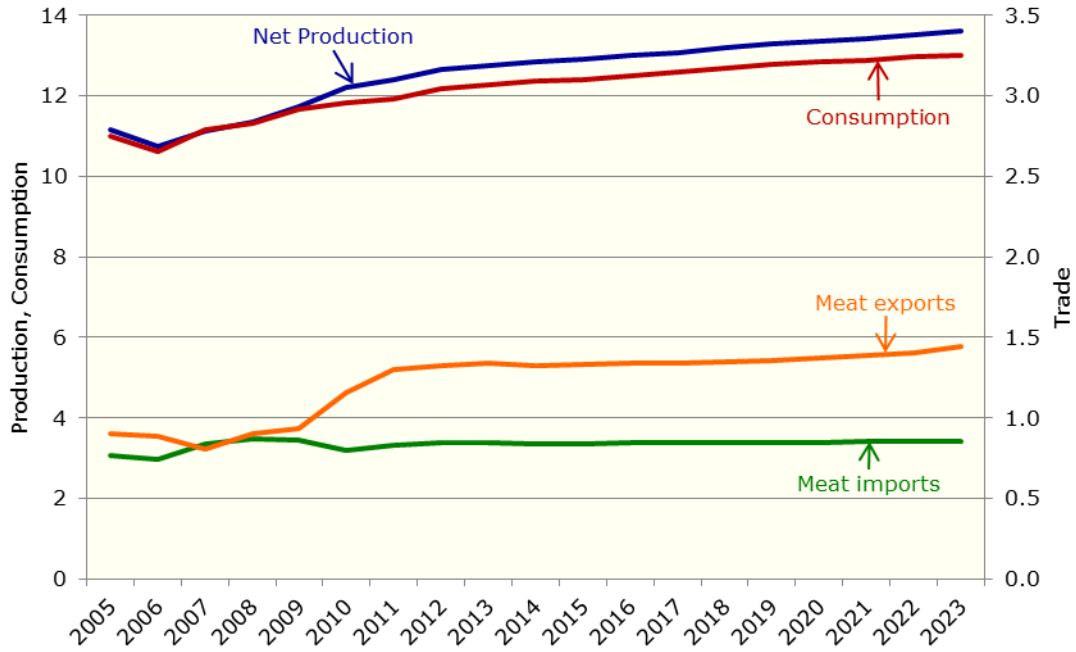
Cautious spending in an uncertain economic environment saw consumption slowing down in 2011 and 2013 (unlike 2012, when consumption of other meat fell sharply). *Per-capita* consumption in both the EU-N13 and EU-15 is around 20 – 21 kg.

Market outlook: filling the gap left by other meats

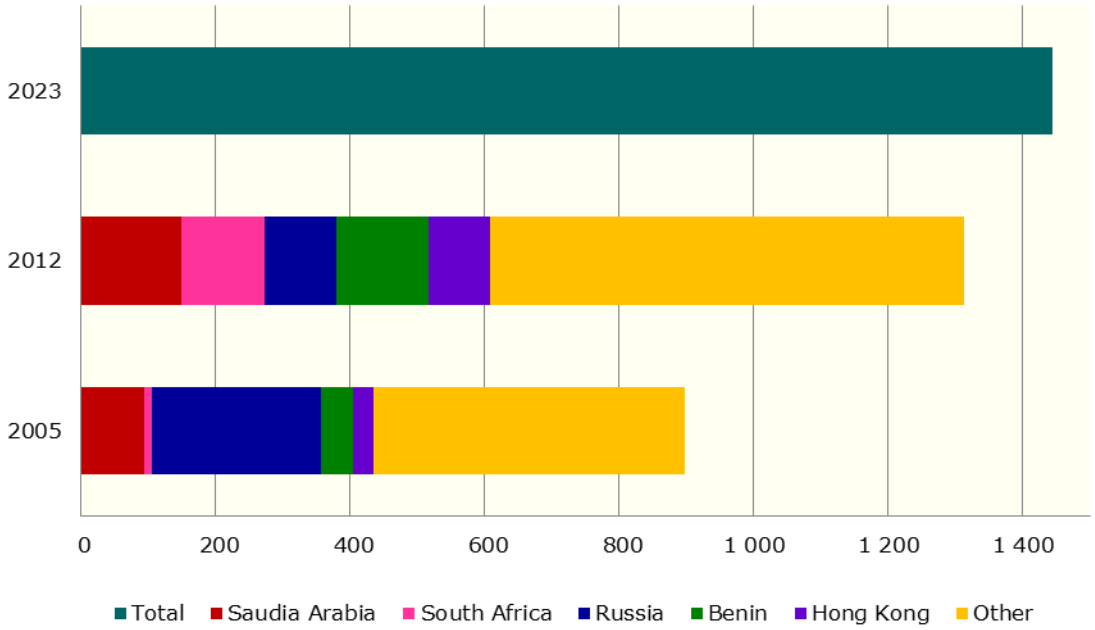
The increase in poultry production is expected to be hindered by feed costs staying relatively high though below the record 2011 and 2012 levels. Poultry meat will remain the most dynamic meat and expand at a rate of 0.8% per year in 2012-23. By 2023, production is expected to reach 13.6 million tonnes (Graph 3.9).

According to current projections, the dynamic import demand in the Middle East (especially Saudi Arabia) and China is expected to continue and should boost EU exports to 1.4 million tonnes in 2023 (15% above the 2010-12 average). Exports are expected to grow by 120 000 tonnes as compared to 2012, with greater demand also from South Africa and Ghana. On the other hand, projected production increases in Russia will lead to a contraction in import demand there. EU imports should fluctuate around the tariff rate quota level (~800 000 tonnes).

Graph 3.9 EU poultry meat market developments (million tonnes)



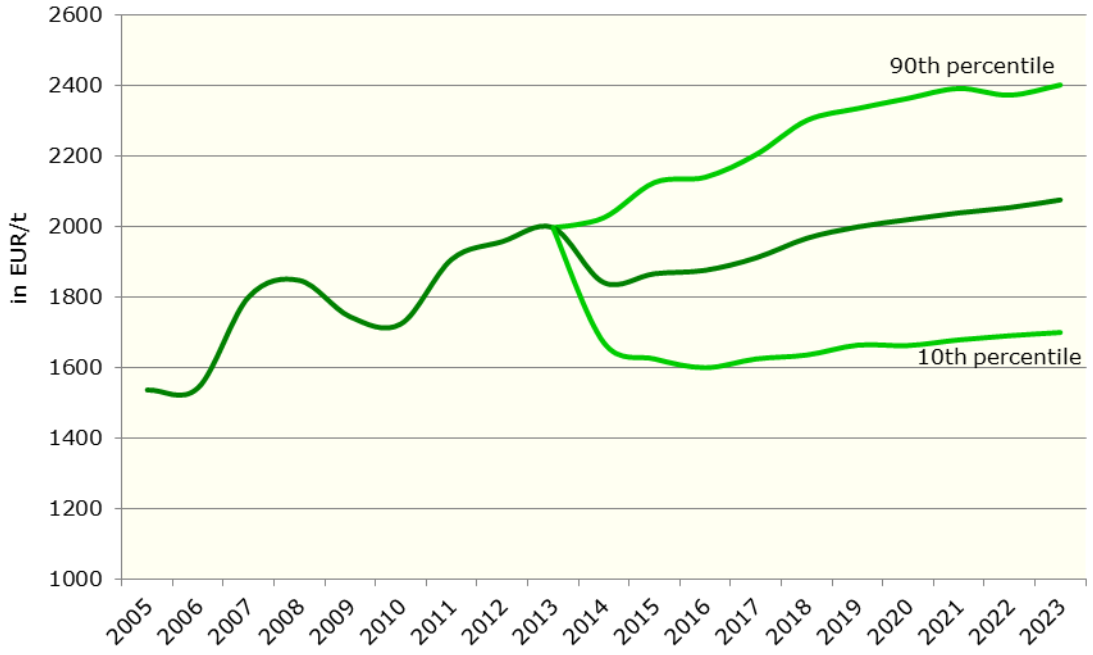
Graph 3.10 EU poultry export developments ('000 tonnes)



In 2012 and 2013, poultry meat prices followed the same pattern as pig meat prices; after recording very high levels (2 000 EUR/t on average) in 2012 and during the summer months of 2013, they started to ease somewhat in the second half of the year as feed prices fell thanks to the availability of the new harvest. As feed prices are projected to stay high over the outlook period (albeit below the record levels of previous years), and domestic and export demand is on the rise, poultry prices are expected to recover steadily from a drop in 2014, and exceed the

2012 high by the end of the projection period (Graph 3.11). As explained in Box 2.1 price path development may not be as smooth as depicted in Graph 3.11.

Graph 3.11 Projected price and possible price paths for EU poultry meat (EUR/tonne)



3.4. Sheep and goat meat

Recent market developments

In recent years, the EU sheep and goat flock has shrunk steadily reflecting the ongoing concerns related to profitability in the sector and to the alleged effect of decoupling of direct payments under the 2003 CAP reform. However, the pace of decline has slowed down since 2010 and indeed in 2013 gross indigenous production is expected to increase because several years of high prices have increased profitability. Imports increased in 2013 driven by higher availability in New Zealand. Meat exports are always marginal (around 30 000 tonnes in 2013), though on an increasing path, while strong live exports took place towards Libya, Jordan and Lebanon (totalling 26 000 tonnes in 2013).

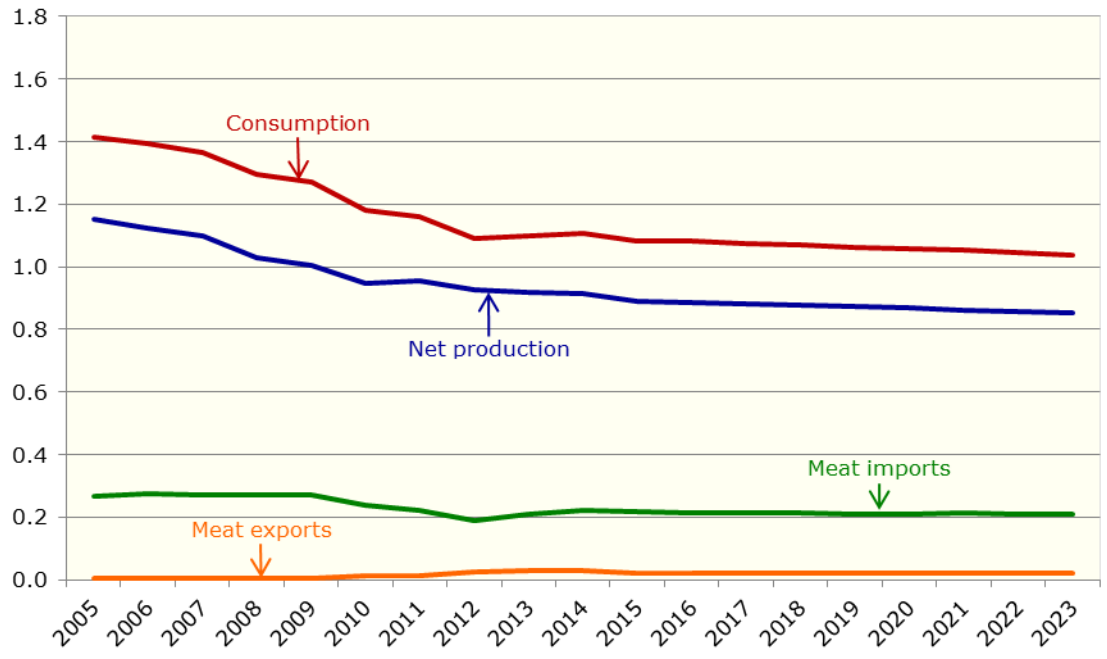
Market outlook: slowdown in the declining trend

Production is projected to continue on its historical downward trend for the decade ahead, though at a much slower rate. This relatively positive projection assumes that Member States will keep the existing coupled payments for sheep following the new CAP reform, a likely scenario given that coupled payments could increase under the CAP reform.

Imports are expected to grow marginally towards 2023, but still remain well below quota levels. Despite forecasts of higher production, New Zealand and Australia are not expected to fill their quota because of growing opportunities in non EU-markets.

Less sheep meat is consumed in the EU than any other meat, accounting for only 2.7% of total meat consumption. As a result of a short-supplied market, EU sheep meat consumption will probably remain under pressure and may fall further (Graph 3.12).

Graph 3.12 EU sheep and goat meat market developments (million tonnes)



4. Milk and dairy products

The medium-term prospects for milk and dairy commodities are favourable on both the world and domestic markets. World demand remains dynamic (especially in the emerging economies), despite the slowdown in economic growth, with a higher proportion of middleclass households dairy products are featuring more prominently in people's diets. On the supply side, feed prices are projected at lower levels than those observed since 2010. These positive drivers will maintain prices at relatively high levels and boost EU milk production.

However, and despite strong demand and the end of the quota system, expansion in milk production is expected to face limitations stemming from environmental constraints, which will play an increasing role in certain Member States. Production will also depend on the pace of consumption increase in both the EU and on the world market. In addition, the EU will face competition on the world market from Oceania but also from the US and Argentina whose contribution to world exports is expected to increase.

Recent market developments

EU milk production in 2012 and 2013 has been affected by adverse weather conditions. In 2012, the drought in the US and the Black Sea region led to a sharp rise in feed prices, resulting in cow milk production increasing only slightly (+0.4%), despite a 1% quota increase. In 2013, the wet winter and cold spring delayed forage and grass availability and hit milk production in the first few months of the year. However, lower feed prices combined with high milk prices due to tight world supply boosted deliveries from the summer onwards. It is still not clear to what extent production in the second half of the year will catch up from the slow start of the year, but 2013 cow milk production is estimated at 148.9 million tonnes, close to the 2012 level.

The unfavourable conditions led to a 6.0% underutilisation of the EU-27 delivery quota in the 2012/13 quota year, although Austria, Cyprus, Denmark, Germany and (for the first time) Poland all overshot their quota. Quota utilisation still varies considerably between Member States: in 2012/13 the underutilisation averaged 4.8% in the EU-15, with France at 7.4% and Greece at 26.5%. In the EU-N12[8], deliveries have been far below the quota (-12.5%), with the Czech Republic at -11.7%, for example, Hungary at -23.7% and Bulgaria at -55.3%.

In 2013, dairy industries have preferred to process the limited available milk into cheese (rather than skimmed milk powder (SMP), butter or fresh dairy products), because of its higher added value and good export performance. With relatively tight world milk supply, 2013 has been characterised by robust commodity prices, especially in the first half of the year. In a reverse of recent years' trend, whole milk powder (WMP) production could increase in 2013 on the back of record prices and export opportunities due to limited supply in New Zealand.

[8] i.e. countries that have joined the EU since 2004, minus Croatia.

Market prospects

The fact that high feed prices have caused cow milk production to increase only slightly, despite the additional quota available in 2012, illustrates that dairy farmers already react strongly to market signals, especially to strong world demand.

Similarly, deliveries increased as soon as weather conditions improved in 2013, a development supported by high prices. This shows that dairy production in the EU (especially from grass-fed systems) is also affected not only by drought, but also by wet and cold weather. Our projections assume normal weather conditions, but it has to be borne in mind that weather is a strong determinant of milk production growth – not only in Europe. The second part of this report illustrates alternative outcomes when weather uncertainty is taken into account.

4.1. Milk production development

2014/15 is the last year of the quota system and will not see the 1% quota increase that has applied in previous years[9]. Nonetheless, compared to the slow start of 2013, milk deliveries should increase already significantly in 2014 (+1.3%), driven by lower feed costs and firm (though not higher) milk prices. Till the end of the quota-system, production increase will be constrained by the quota in certain Member States, leading to the increase in milk quota prices observed in Denmark, Germany and the Netherlands, where deliveries increased sharply in 2013 further to the milk price increase.

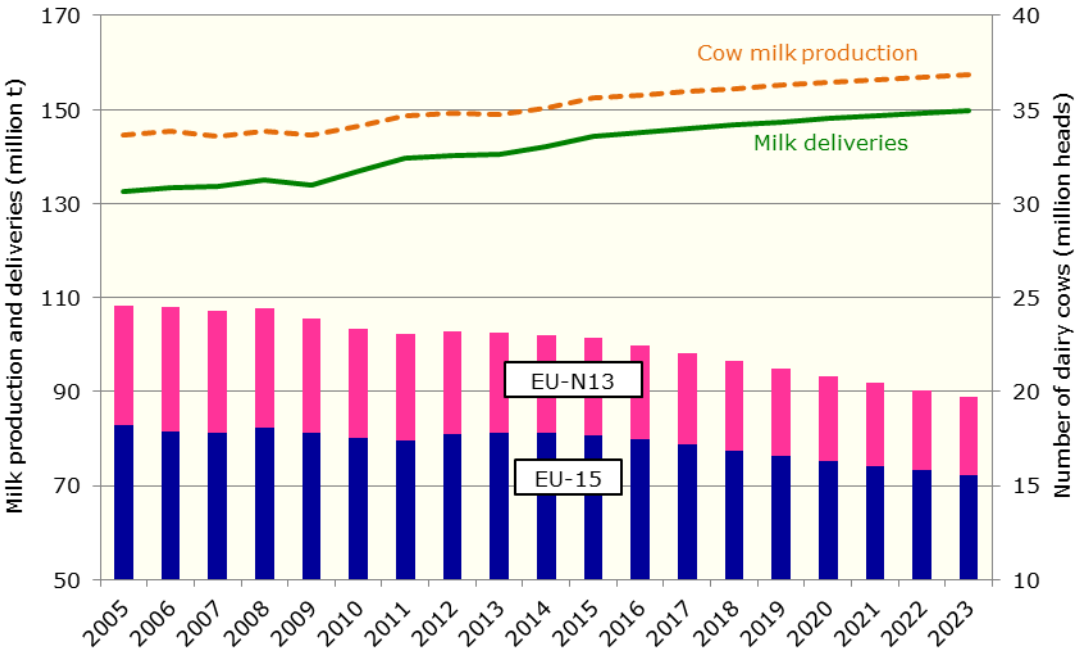
While the increase in production should continue in 2015 (+1.6%), a big jump in milk deliveries is not expected. Part of the increase resulting from the lifting of quotas is expected to have already fed through the year before. Also, in Member States where the quota was in any case significantly underutilised, there is no reason to expect a strong reaction to its abolition. Bigger increases can be expected in those currently restricted by the quota (e.g. the Netherlands, Denmark, Germany, Austria and Cyprus).

After 2015, milk deliveries are expected to increase further, but at a slower pace, to reach 150 million tonnes in 2023 (Graph 4.1), i.e. 9.6 million tonnes more than in 2012. Most of the growth will take place in the EU-15; the EU-N13 could produce an additional 1.2 million tonnes. (The potential change in milk deliveries at Member State level is analysed in Chapter 10.)

By the end of the projection period, the annual increases in milk deliveries are expected to slow down because of narrower operating margins. Given the strong world demand for dairy commodities and feed price projections 15 % below 2010-12 levels, the nominal EU price should be quite stable, but steady increases in other operating costs (especially for energy) are likely to squeeze margins. In addition, environmental constraints will limit production expansion in some Member States (see Chapter 10).

[9] To facilitate a soft-landing for the end of the milk-quota system in April 2015, the 2008 CAP Health Check set a gradual increase in quotas (5 times +1% every year) up to and including the milk quota year 2013/14.

Graph 4.1 EU cow milk supply and dairy herd developments



Over the projection period, the production of milk for own consumption and on-farm processing (including that from subsistence farming in Romania and Bulgaria and sheep and goat milk) is expected to fall off slightly faster than in the past decade in the EU-N13, while remaining stable in the EU-15. A slower declining trend in direct sales is assumed, while slightly less milk might be used to feed animals. Feed use depends a lot on the milk price: the higher the price the lower the feed use. As a consequence, the delivery rate should increase, reaching 93.4 % by 2023. Very little sheep and goat milk is produced in the EU-15: volumes are expected to remain stable and amount to 200 000 tonnes in 2023. EU-N13 production could fall by more than 350 000 tonnes to 2.9 million tonnes in 2023.

Higher yields and fewer dairy cows

The projected production increase will come from further yield improvements to 8 500 kg/cow in the EU-15 in 2023 and 6 050 kg/cow in the EU-N13, where the average yield is expected to grow by 2.7% a year. This growth, which is much faster than that in the previous decade (+1.1%), is linked to the fact that less of the production will take place in Romania and Bulgaria where yields are low (3 340 kg/cow and 3 710 kg/cow in 2012 respectively) and the significant remaining scope for improving productivity. In the EU-15, the trend is also expected to accelerate slightly, as production becomes more concentrated in the most productive countries (the exception is Ireland, where the average yield is lower because of the higher proportion of grass-based production, though it could increase significantly if farmers use more compound feed).

In 2012, according to Eurostat's livestock survey, the number of dairy cows increased for the first time after 20 years of continuous decline. This decline was the result of the presence of milk quotas, which restricted milk production expansion, and the continuous increase in yields. While the apparent increase is particularly marked in Italy, due to a statistical adjustment without correction of the

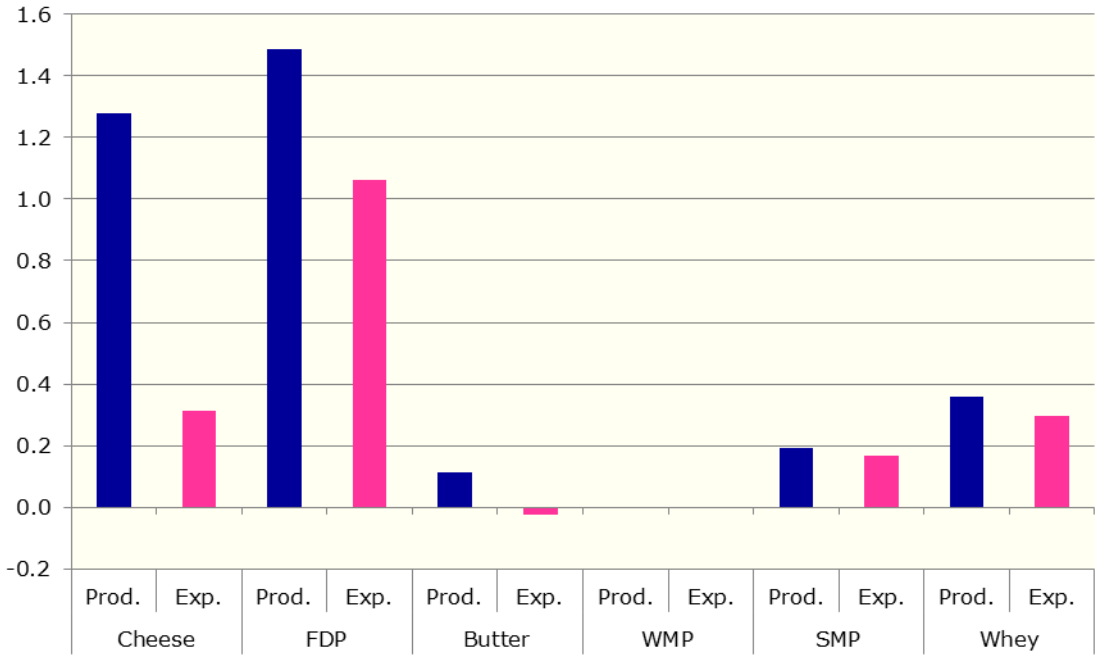
historical figures, the number of dairy cows is higher or stable in several other main producing countries, e.g. Spain, the Netherlands, the UK, Luxembourg and Ireland. However, this is not expected to reverse the trend, as EU dairy cow numbers should start to fall again as from 2013. Annual decreases could be small initially, but reach -1.9 % by the end of the projection period.

4.2. Dairy products

The additional milk goes mainly into cheese consumption and exports

It is expected that the cheese sector will be buoyed by a dynamic world market and steady growth in domestic demand. In the EU-15, it seems that the cheese market is not yet saturated, but *per capita* consumption is expected to grow more slowly than in the last decade, at 0.4% a year (0.2 percentage points less than in 2000-12). Faster growth (2.2% a year) is expected in the EU-N13, where *per capita* consumption (12.0 kg in 2012) is comparatively low; here, it could reach 15.3 kg by 2023, as against 19.8 kg in the EU-15.

Graph 4.2 Main dairy commodities – production and exports in 2023 as compared with 2010-12 average (million tonnes)



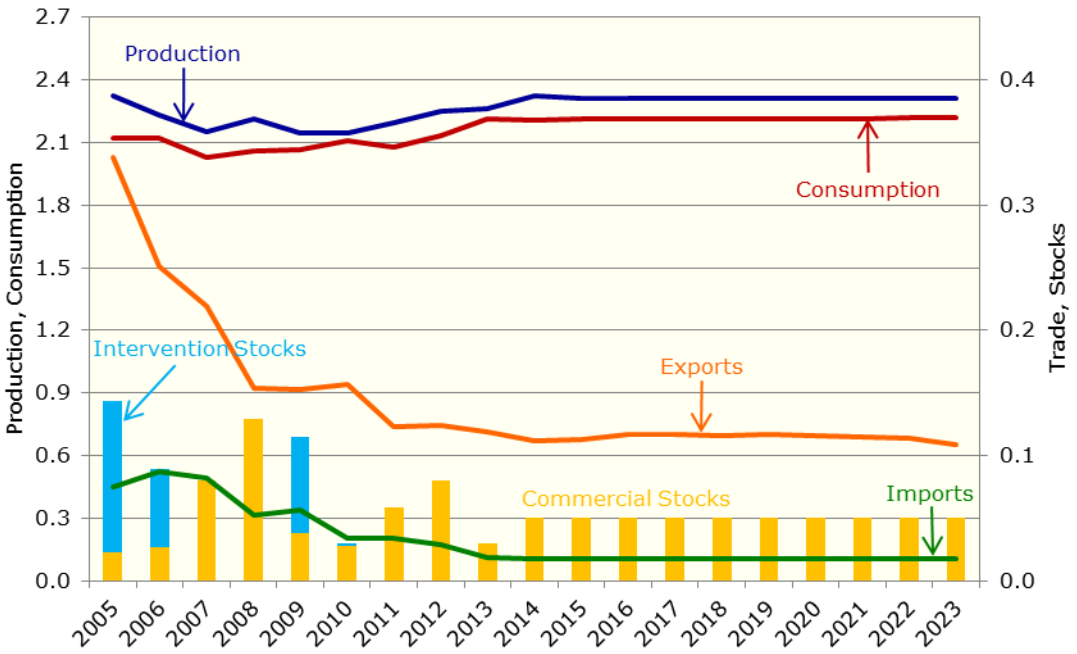
Cheese production is therefore expected to absorb most of the additional milk delivered to dairies, with production projected at 10.7 million tonnes by 2023, with exports close to 1 million tonnes and imports remaining very low, at around 75 000 tonnes (Graph 4.2). This represents 1.1% annual growth in production over the projection period, i.e. somewhat less than the 1.6 % rise over the past decade.

Whey powder is in high demand for use mainly as a specific nutrient, in infant formula and in sports drinks. Market projections are very positive especially for exports, which could grow by 3.9% a year - and production is expected to increase by 1.5% annually.

By 2023, the production of fresh dairy products is expected to have increased by 3% as compared with 2012 to reach 48.3 million tonnes. As illustrated above (Graph 4.2) exports are developing positively. As regards domestic consumption, perhaps surprisingly given its high fat content, cream for cooking is a particularly dynamic segment. The EU-15 yoghurt consumption is already very high but in the EU-N13 it could increase significantly. More generally, the current gap of over 50 kg in *per capita* consumption of FDP is expected to decrease by close to 10 kg between EU-15 and EU-N13 mainly due to increased consumption in the latter.

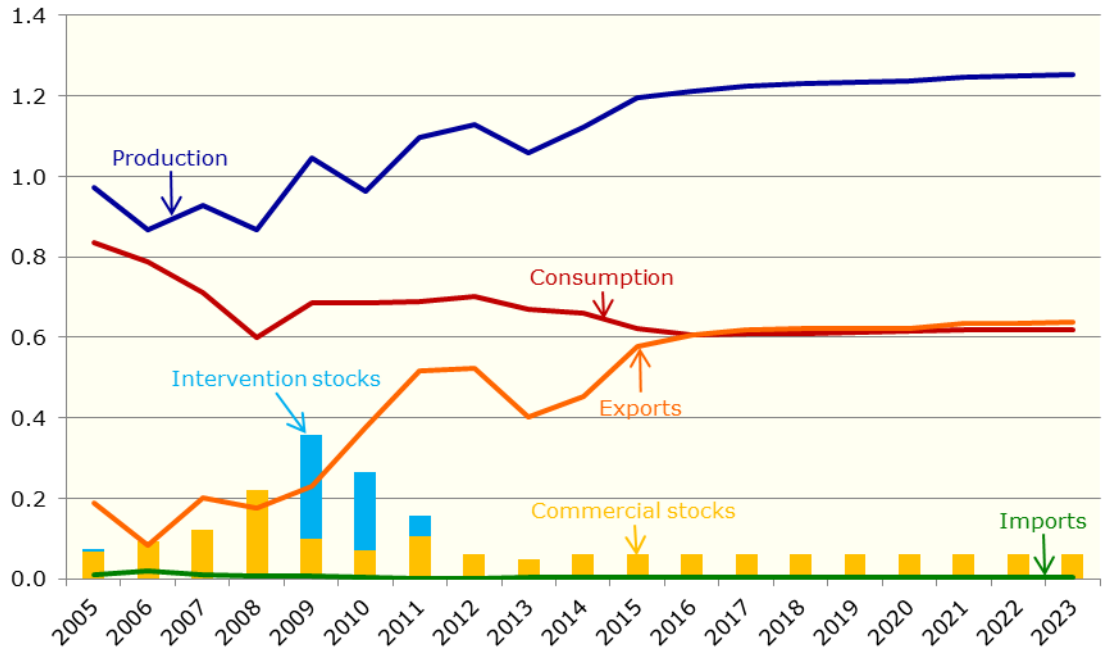
For butter, no clear market trends are discernible from recent years; after several years of decline, production and consumption stabilised in 2007 and started to increase in 2010 along with the higher milk production (Graph 4.3). Further growth is expected in 2014 because of the good market conditions in 2013. Production is expected to stabilise from 2015 onwards, at 2.3 million tonnes, as operators prefer to use dairy fat for cheese (also, the fat content of cheese is expected to rise), reducing availability for butter processing. Following high estimated levels in 2013, *per capita* consumption is projected to fall slightly, to 4.28 kg, by 2023.

Graph 4.3 EU Butter market developments (million tonnes)



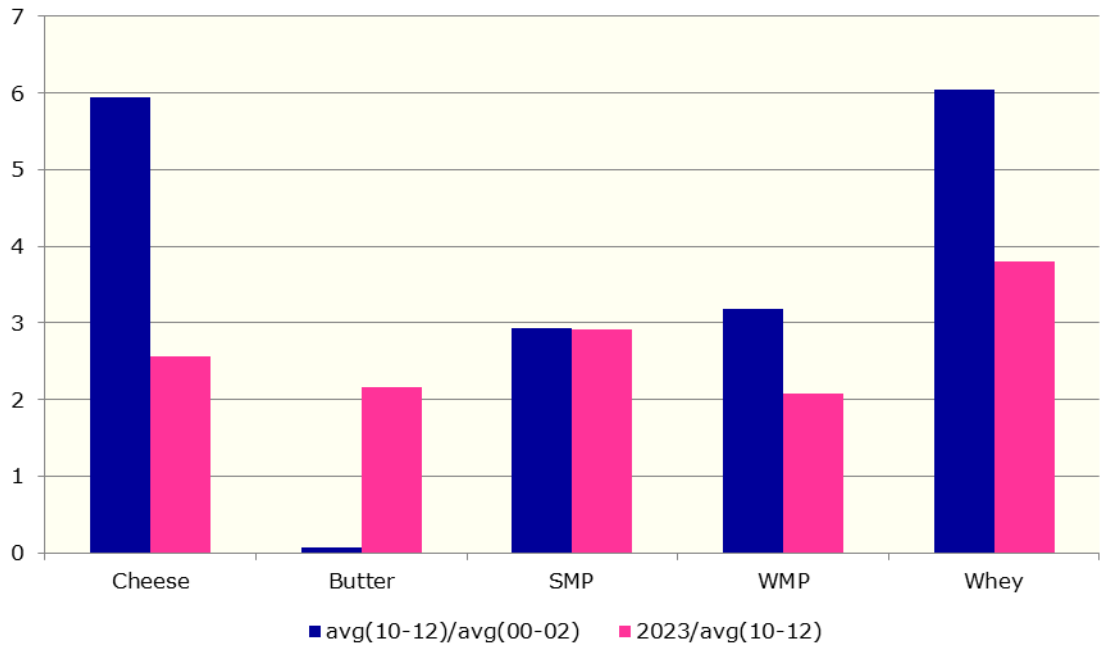
SMP production is expected to rebound from the 2013 decrease thanks to the higher milk availability. Continued growth is projected after 2015, albeit at a slower pace, with production of 1.25 million tonnes by 2023. As witnessed since 2006, the SMP market is driven mainly by export demand – from 2016, half of the production will be exported (Graph 4.4). EU market developments will therefore be largely determined by the performance of competitors, such as the US and Oceania. The EU may stabilise its position on the world market, accounting for 30% of world exports.

Graph 4.4 EU SMP market developments (million tonnes)



Over the projection period, the main uses of dairy proteins will be channelled into cheese/whey, primarily, and SMP. However, increased milk availabilities should result in WMP production declining more slowly than in the past decade, down to 604 000 tonnes by 2023.

Graph 4.5 Annual growth of world trade (%)



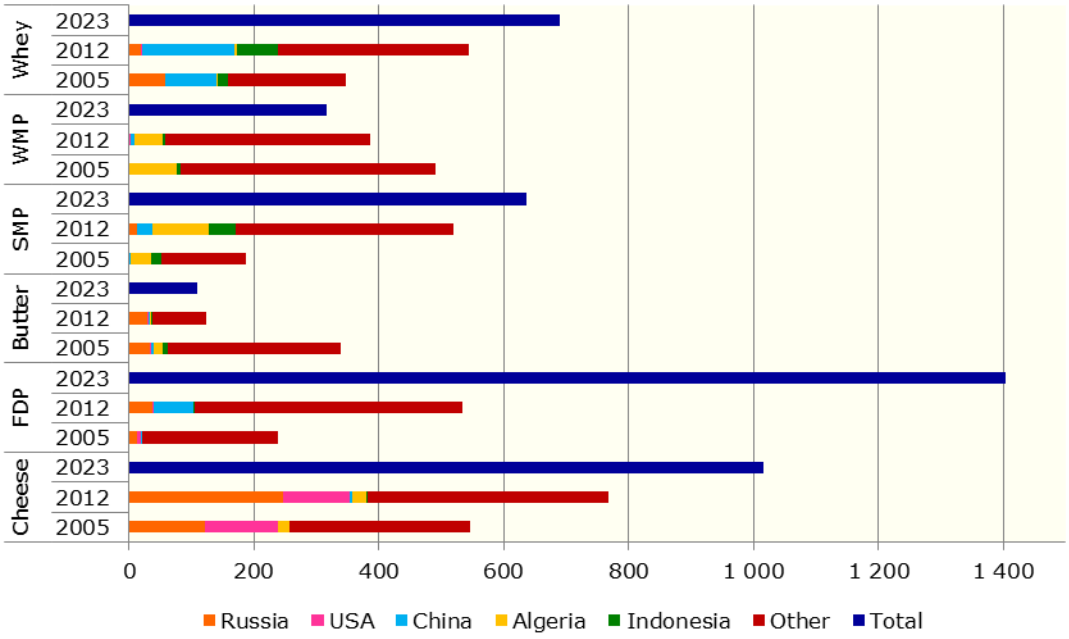
A dairy market supported by a strong world demand

World imports will grow more slowly over the projection period than in the previous decade (except in the cases of SMP and butter), but still offering great opportunities for EU traders (Graph 4.5). In terms of quantities, by 2023, it represents additional world imports of close to 850 000 tonnes of cheese, more than 650 000 tonnes of SMP and 600 000 tonnes of WMP and close to 250 000 tonnes of butter.

Dynamic EU exports of cheese and fresh dairy products expected

EU cheese exports increased by 250 000 tonnes (41%) between 2005 and 2012 (Graph 4.6) and are expected to continue to perform well in the next ten years. Semi-hard cheeses (e.g. Gouda/Cheddar, Grana Padano and Parmigiano Reggiano) and fresh cheeses have seen particularly significant growth. Russia, currently the main destination for EU cheeses, is expected to see slower import growth overall but still to source more from the EU. However, Belarus could represent an important competitor of the EU on the Russian market. Since 2005, EU cheese exports to the US have decreased by 7% further to the increase in US domestic production. The exports to Japan have decreased by 8% on the same period because the share of the EU in Japan imports decreased. Therefore, shipments to the US and Japan are not expected to rise. On the other hand, EU dairy processors are prospecting promising new markets especially in Asia but also Brazil and potentially Algeria and Egypt where exports increased notably in the last years.

Graph 4.6 EU exports by main destination (million tonnes)



Fresh dairy products (FDP), in particular drinking milk, are often considered too costly to trade, given the high water content. However, recent trade figures show an exponential increase in drinking milk exports to China, which grew 30-fold between 2005 and 2012 to reach 64 000 tonnes and are still growing in 2013 – by a factor of 2.3 in the first eight months of the year. Given the premium for imported milk in China (following various safety scandals relating to domestic production)

and the low freight price, this trade could develop yet further. Russia imports mainly from neighbouring Baltic countries, especially Lithuania.

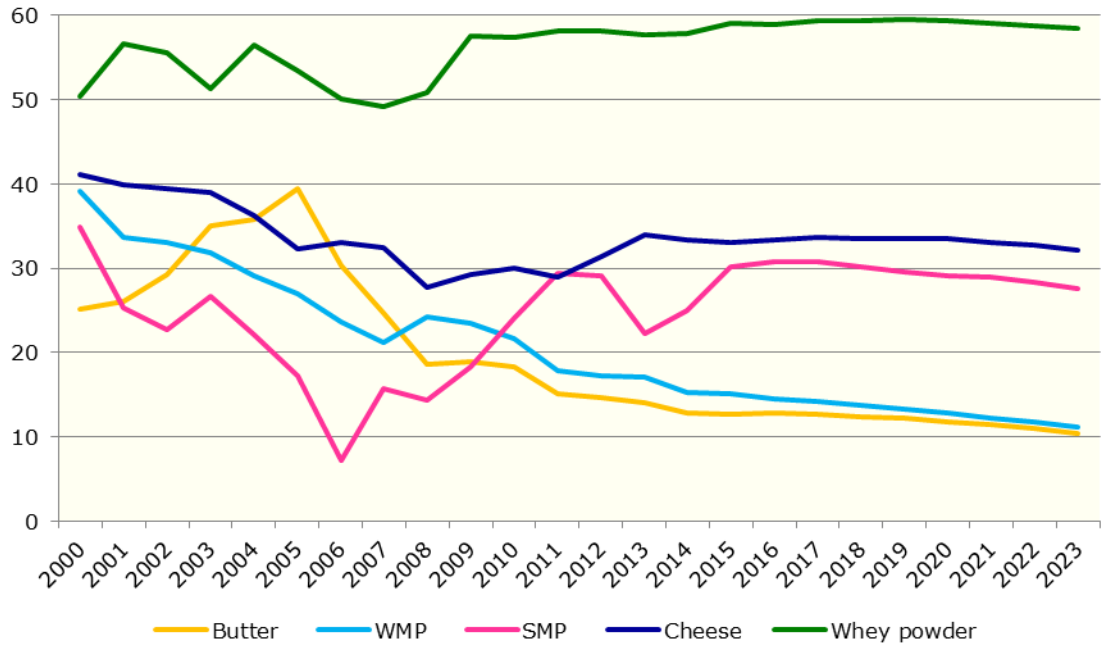
More EU exports of SMP and whey powder and less WMP

Export developments for powders are less certain. Dairy processors have made numerous investments recently to modernise drying towers and build new capacity in view of the expected increase in milk production and dynamic world demand for SMP, whey and infant formula. EU SMP exports rose from less than 200 000 tonnes in 2005 to over 500 000 tonnes in 2012. However, the US is also expected to export significantly more SMP over the projection period and will be a major competitor. As a result, while the EU's SMP exports are projected to increase further to 637 000 tonnes by 2023, its share of the world export market is forecast to decrease slightly (to 28%) towards the end of the projection period (Graph 4.7).

EU operators are projected to continue to prefer to produce and export SMP rather than WMP. New Zealand will dominate this market and should supply half of all world imports. Argentina could increase its market share from the current 10% to 20% by 2023.

The EU accounts for almost 50% of world cheese production and is therefore the main supplier of whey powder (a by-product of cheese production). China is an expanding market and the destination for 27% of EU exports in 2012. Whey powder exports are projected to grow further by 47% by 2023 as compared with 2012 and the EU's share in world exports should remain close to 60%.

Graph 4.7 EU share in world exports (%)



New dairy commodities

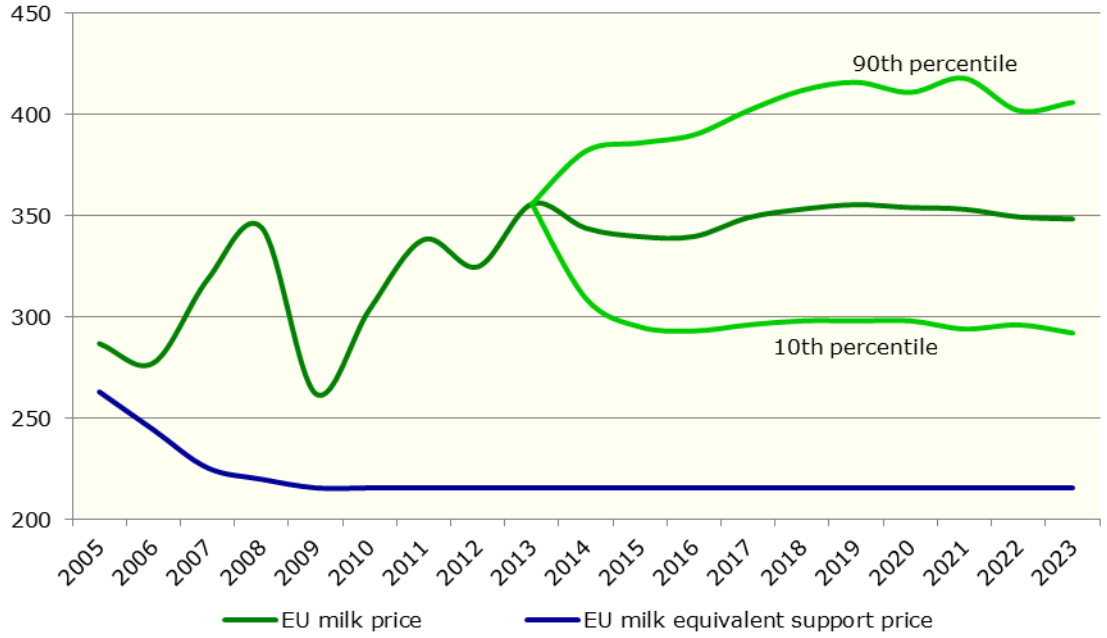
Among several new dairy commodities that develop dynamically are fat-filled powders (in which the dairy fat has been replaced with vegetable fat, mainly coconut or palm oil) and analogue 'cheese' with vegetable fat. These products have emerged mainly due to the high price of dairy fat in comparison with vegetable fat. Fat-filled powder is used as cheap animal feed in Europe but also in food processing in Asia or America or as a replacement for milk in Africa.

The 'new commodities' phenomenon is very difficult to quantify because no statistics are available. Some broad estimates, mainly based on interviews, put EU production of fat-filled powders at over 1 million tonnes in 2012, i.e. over half of world production.

Firm dairy prices over the medium term except for butter

After a small decrease between 2013 and 2016, the EU milk farm gate price (in real fat content) is expected to stay firm at around 350 EUR/t, driven by robust world prices for cheese and SMP. However, taking into consideration uncertainties about future crop yield developments and macroeconomic indicators, the EU milk price could vary and follow alternative paths, given that milk prices can vary in case of higher feed costs or export performances are better driven by a weaker Euro or a higher economic growth worldwide (Box 2.1). The uncertainty analysis (Chapter 8 for more detail) does not take account of the impact of variable grass availability on milk production in the EU or New Zealand.

Graph 4.8 Projected price and possible paths for EU farm gate milk price and EU support price in milk equivalent (real fat content, EUR/tonne)



Given the dynamic world and domestic demand, cheese prices should remain firm. In the short term, they could fall from their recent high levels in view of increased milk and cheese production. In the long term, the price of Cheddar could reach

3 500 EUR/t, which is close to the 2013 level. SMP prices are not projected to stay at 2013 levels, but they should stabilise at a high level (about 2 700 EUR/t towards the end of the projection period). Given the variables mentioned above, SMP and cheese prices could vary around these levels by up to 9%.

The prospects for butter are less bullish and prices are expected to be below the record 2010-13 levels, probably coming down even further towards the end of the projection period in line with developments on the world market.

5. Agricultural income

5.1. Historical developments

Between 2000 and 2012, agricultural income per annual working unit in the EU-28 increased in both nominal and real terms. This development is the result of a moderate expansion of nominal income, accompanied by a strong reduction in the total workforce employed in agriculture.

On average during this period, the growth in agricultural income per annual working unit has been quite modest in real terms with an increase of 2.9% per year. However, the income pattern has been relatively volatile. After increasing by 16.9% between 2000 and 2004, real agricultural income per worker declined in 2005 by 9.4% due to strong contraction in the larger EU-15 Member States. Between 2005 and 2007 it rose again by 16.6% mainly because of increasing commodity prices. But with the burst of the price bubble and the beginning of the economic recession, agricultural income decreased over the following two years (-8.2% in 2009 alone). Due to a noteworthy income recovery between 2009 and 2012 (+26.2%), driven by the increase in agricultural prices, real agricultural income per worker in 2012 ended 40.2% higher compared to the income in 2000 and above the previous record level of 2007.

The increase in the EU-28 agricultural income per worker is mainly driven by the income rise in the EU-N13. While real agricultural income per annual working unit in the EU-15 in 2012 settled 12.8% above the level of the year 2000, agricultural income in the EU-N13 more than doubled. The significant increase in the EU-N13 is mainly a result of higher market prices prevailing in the EU single market, greater public support for the farm sector and a substantial decline in the workforce employed in agriculture. Although the difference in agricultural income between the EU-15 and EU-N13 reduces, the gap in absolute value in 2012 remains very wide; EUR 21 560 per working unit in the EU-15, as compared with EUR 4 320 in the EU-N13.

5.2. Income prospects

The medium-term prospects for the income of the agricultural sector have been extrapolated from the projections for the main agricultural markets presented in the earlier chapters. The economic accounts for agriculture (EAA) constitute the statistical basis of this outlook for agricultural income.

The results should be interpreted in the light not only of the economic and policy setting underlying the market projections but also of additional caveats specific to the income estimation. Certain key assumptions had to be made as regards the prospects for agricultural sectors are not covered by the modelling tools used for the baseline projections, these include the rate of fixed capital consumption, the total level of subsidies and the pace of future structural change.

In the EAA, the term 'subsidies' covers all coupled and decoupled payments, including state aids and production-related rural development support (e.g. for less favoured areas) but not investment subsidies. Over the projection period, the subsidy component of agricultural income changes in line with direct payment

ceilings following the CAP reform[10]. The share between coupled and decoupled payments is assumed to be similar to the current situation as Member States are to notify their choices to the Commission by August 2014.

The value of production for the main arable crops and animal products is derived directly from the change in producer prices and quantities produced over the projection period. For products not covered in the model (e.g. fruit, vegetables, wine and olive oil) the value of production is assumed to follow the growth in GDP and the projected changes for the modelled commodities.

Based on these assumptions, agricultural income in nominal terms is estimated to decrease by 0.8% by 2013 as compared with 2012. Taking into consideration the inflation rate and the 0.9% reduction in agricultural labour input, agricultural income per working unit in real terms in the EU-28 will decrease by 1.0% in 2013 compared to 2012. This decrease is driven by a decline in the value of production (-1.2%) and a modest drop in expenditure on intermediate consumption (-1.7%). The value of production develops different for animal products and crops. While the value of production for animal products increases because of higher prices observed in 2013, the value of production for crops is expected to decrease. This reduction is led by the significant decline in producer prices for almost all crops, which offsets the increase in quantity produced. While crop prices will be significantly lower, expenditure on feed will not decrease to the same extent (-3.7%) because it includes a broader range of commodities and the high 2012 prices also influence the 2013 feed expenditure[11].

The medium-term trend for agricultural income is expected to be positive. In 2023, real agricultural income per labour unit is projected at 46.8% above the 2003-07 average, which is an increase of 1.8% per year from 2013 to 2023 (Table 5.1). This positive trend is the result of a continuous decrease in the workforce employed in agriculture (-42.3%), which more than compensates the expected deterioration of total factor income in real terms (-15.1%). This reduction arises from an increase in the corresponding nominal income (+14.7%) which is below the general rate of inflation.

The development of the EU-28 average income hides significant differences between the EU-15 and EU-N13 aggregates. In the EU-15, real agricultural income per working unit is expected to increase by 17.5% by 2023, whereas in the EU-N13 it more than doubles. As a consequence, the gap between the absolute levels of agricultural income per worker in the EU-15 and the EU-N13 will narrow further but will still remain substantial.

[10] Net ceilings are set out in Annex III to the direct payments regulation to be published in early 2014.

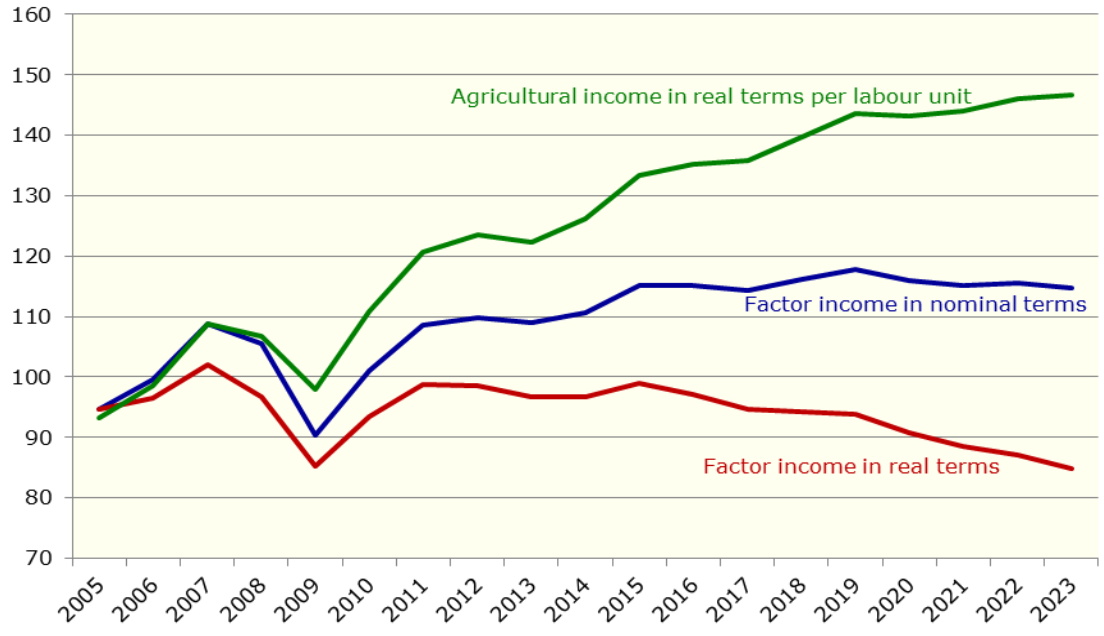
[11] Feed expenditure in year N is calculated as an average of feed use and prices in marketing year N and year N-1. The feed components used for the calculation are low protein feed commodities (coarse grains, milling by-products, molasses, beet pulp, and manioc), medium protein feed commodities (dried distillers grain, corn gluten feed, field peas and whey powder) and high protein feed commodities (protein meal, fish meal, meat and bone meal and skim milk powder). The feed prices are weighted according to the use of the different feedstock.

Table 5.1 Outlook for agricultural income in the EU, 2010-23 (2003-07 average = 100)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Factor income in nominal terms														
EU-28	**101.0**	**108.6**	**109.9**	**109.0**	**110.6**	**115.1**	**115.1**	**114.3**	**116.1**	**117.8**	**116.0**	**115.2**	**115.5**	**114.7**
EU-15	97.7	101.0	105.4	104.1	105.8	109.7	109.7	108.7	110.1	111.6	109.9	109.0	109.3	108.5
EU-N13	121.5	155.4	137.3	139.4	140.6	148.5	148.2	148.9	152.9	155.6	154.1	153.8	153.9	153.2
Factor income in real terms														
EU-28	**93.5**	**98.8**	**98.6**	**96.7**	**96.7**	**98.9**	**97.1**	**94.6**	**94.3**	**93.9**	**90.8**	**88.5**	**87.1**	**84.9**
EU-15	92.2	95.0	96.1	94.7	94.9	96.9	95.2	92.6	92.1	91.7	88.6	86.3	85.0	82.8
EU-N13	101.5	122.0	113.8	108.8	107.5	111.4	108.7	106.9	107.4	107.1	103.9	101.6	99.6	97.1
Labour input														
EU-28	**84.3**	**81.7**	**79.7**	**79.0**	**76.5**	**74.1**	**71.8**	**69.5**	**67.4**	**65.3**	**63.3**	**61.4**	**59.5**	**57.7**
EU-15	90.1	88.2	87.2	85.7	84.0	82.4	80.8	79.3	77.7	76.2	74.7	73.3	71.9	70.5
EU-N13	79.2	76.1	73.2	73.1	69.9	66.9	63.9	61.1	58.5	55.9	53.5	51.1	48.9	46.7
Agricultural income in real terms per labour unit														
EU-28	**110.8**	**120.7**	**123.6**	**122.3**	**126.3**	**133.4**	**135.1**	**135.8**	**139.8**	**143.5**	**143.2**	**143.9**	**146.0**	**146.8**
EU-15	102.3	107.7	110.2	110.5	112.9	117.5	117.7	116.7	118.5	120.3	118.5	117.7	118.2	117.5
EU-N13	127.7	159.7	154.9	148.3	153.3	166.1	169.5	174.3	183.2	190.9	193.7	198.0	203.1	207.1

The difference in income development between the EU-15 and EU-N13 is mainly due to stronger structural adjustment taking place in the new Member States and the greater shrinkage of the agricultural workforce expected in the EU-N13 over the projection period (Table 5.1). Agricultural workforce developments (a key factor for estimating agricultural income per working unit) are assumed to follow the same exponential trend as in 2005-12, in both the EU-15 and the EU-N13. In contrast to longer-term trends, as a result of the economic crisis the decrease in labour force has recently slowed down in some Member States such as Italy, while in Ireland the labour force in agriculture even increased.

Graph 5.1 Development of agricultural income in the EU (2003-07 average = 100)



Real agricultural income per labour unit in the EU-28 is not expected to follow a steady pattern. In 2014 producer prices are expected to decrease, especially for crops (-11.2%). The fall in the value of production is offset by a sharper decrease of the intermediate costs, which are driven by the lower expenditure on feed, energy and fertilisers, and result in an increase in nominal income. In 2015, the value of production is expected to develop steadily, while intermediate costs would continue to decline, causing income to rise in both nominal and real terms. After a period of stable nominal total factor income, income should rise again in 2018 and 2019 due to increasing prices for most commodities (especially for pork). In the last four years of the projection period volumes produced increase slightly for all products. Producer prices rise moderate for crops and meat whereas producer prices for milk are expected to decrease. Given the assumed increase in energy and fertiliser prices, intermediate costs will continue to rise, and together with the rising fixed capital consumption, outweigh the increase in the value of production so that total factor income in nominal terms decreases between 2019 and 2023.

6. Statistical Annexes

Table 6.1 Area under arable crops in the EU, 2010-23 (million ha)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Cereals	**56.3**	**56.4**	**57.7**	**57.8**	**57.8**	**57.9**	**57.8**	**57.8**	**57.7**	**57.7**	**57.7**	**57.8**	**57.8**	**57.8**
of which EU-15	34.3	34.2	34.9	35.0	35.0	35.1	35.0	34.9	34.9	34.9	34.9	34.9	35.0	35.0
of which EU-N13	21.9	22.2	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.9	22.9
Common wheat	23.2	23.3	23.2	23.3	23.5	23.6	23.6	23.6	23.6	23.7	23.7	23.8	23.9	24.0
Durum wheat	2.9	2.5	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5
Barley	12.2	11.9	12.5	12.4	12.4	12.3	12.3	12.2	12.2	12.2	12.1	12.1	12.1	12.0
Maize	8.3	9.3	9.9	10.0	10.0	10.0	10.0	10.1	10.1	10.1	10.1	10.2	10.2	10.2
Rye	2.6	2.2	2.4	2.6	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4
Other cereals	7.1	7.1	7.0	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.7	6.7	6.7	6.7
Rice	**0.5**	**0.5**	**0.5**	**0.4**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.4**	**0.4**	**0.4**	**0.4**
Oilseeds	**11.3**	**11.5**	**10.9**	**11.4**	**11.4**	**11.4**	**11.4**	**11.4**	**11.5**	**11.5**	**11.5**	**11.6**	**11.6**	**11.6**
of which EU-15	6.0	6.2	6.0	6.1	6.1	6.1	6.1	6.1	6.2	6.2	6.2	6.2	6.2	6.2
of which EU-N13	5.3	5.4	4.9	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.4	5.4	5.4
Rapeseed	7.1	6.7	6.2	6.6	6.6	6.6	6.6	6.6	6.7	6.7	6.7	6.7	6.8	6.8
Sunseed	3.8	4.4	4.3	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.3
Soyabeans	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Sugar beet	1.6	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Potatoes	1.9	1.9	1.8	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6
Protein crops	1.2	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
other arable crops	5.9	6.0	6.0	5.6	5.6	5.6	5.6	5.5	5.5	5.5	5.5	5.4	5.4	5.4
Fodder (green maize, temp. grassland etc.)	19.7	19.8	19.9	19.9	19.8	19.7	19.8	19.8	19.8	19.8	19.7	19.7	19.6	19.6
Utilised arable area	**98.3**	**98.9**	**99.3**	**99.4**	**99.3**	**99.2**	**99.1**	**99.1**	**99.0**	**99.0**	**99.0**	**98.9**	**98.9**	**98.9**
set-aside and fallow land	8.9	7.9	7.8	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
Total arable area	**107.2**	**106.8**	**107.1**	**107.1**	**107.0**	**106.9**	**106.9**	**106.8**	**106.8**	**106.7**	**106.7**	**106.6**	**106.6**	**106.6**
Permanent grassland	59.4	59.0	58.8	58.7	58.6	58.5	58.4	58.2	58.1	57.9	57.8	57.7	57.5	57.4
Orchards and others	12.0	12.2	12.1	12.1	12.1	12.1	12.1	12.1	12.0	12.0	12.0	12.0	12.0	12.0
Total utilised agricultural area	**178.6**	**178.0**	**178.0**	**177.9**	**177.7**	**177.5**	**177.3**	**177.1**	**176.9**	**176.7**	**176.5**	**176.3**	**176.1**	**175.9**

Table 6.2 EU cereals market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**280.5**	**291.6**	**281.2**	**304.3**	**300.5**	**302.5**	**303.9**	**305.2**	**306.9**	**308.8**	**310.7**	**312.8**	**314.8**	**316.1**
of which EU-15	199.3	202.0	202.1	212.7	210.5	211.4	211.6	211.8	212.3	213.0	213.8	214.6	215.4	216.0
of which EU-N13	81.2	89.6	79.1	91.6	90.0	91.1	92.2	93.4	94.5	95.7	96.9	98.2	99.4	100.2
Consumption	**279.8**	**279.5**	**276.0**	**279.8**	**284.2**	**285.7**	**287.5**	**289.9**	**292.2**	**294.7**	**297.5**	**297.7**	**297.7**	**297.9**
of which EU-15	221.7	219.4	219.0	221.3	225.2	226.5	228.1	230.1	232.0	234.1	236.5	236.6	236.5	236.6
of which EU-N13	58.1	60.2	57.0	58.6	59.0	59.2	59.4	59.8	60.2	60.6	61.0	61.1	61.2	61.2
of which food and industrial	102.8	102.3	102.8	104.3	104.5	104.7	105.0	105.7	106.2	106.7	107.4	107.9	108.3	108.9
of which feed	167.5	167.0	163.2	165.4	168.2	168.5	168.5	168.6	168.2	168.2	168.2	168.3	168.4	168.3
of which bioenergy	9.5	10.3	10.0	10.1	11.5	12.4	14.1	15.6	17.8	19.7	21.9	21.4	21.0	20.6
Imports	13.1	14.3	16.6	14.0	9.9	10.0	11.5	11.8	13.4	13.2	13.1	12.9	12.7	12.4
Exports	31.7	25.6	31.7	27.4	25.7	26.8	25.7	26.1	26.0	26.4	27.5	28.6	30.1	31.1
Beginning stocks	54.5	36.7	37.5	27.6	38.7	39.1	39.1	41.3	42.3	44.3	45.3	44.1	43.6	43.4
Ending stocks	36.7	37.5	27.6	38.7	39.1	39.1	41.3	42.3	44.3	45.3	44.1	43.6	43.4	42.9
of which intervention	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stock-to-use ratio	13%	13%	10%	14%	14%	14%	14%	15%	15%	15%	15%	15%	15%	14%

Note: the cereals marketing year is July/June

Table 6.3 EU wheat market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**137.2**	**138.8**	**134.1**	**144.7**	**139.7**	**140.8**	**141.2**	**141.5**	**142.1**	**143.0**	**144.0**	**145.0**	**146.0**	**146.5**
of which EU-15	104.9	103.1	100.9	105.8	104.0	104.7	104.7	104.6	104.8	105.2	105.6	106.2	106.7	107.1
of which EU-N13	32.3	35.7	33.2	38.9	35.7	36.1	36.5	36.9	37.3	37.8	38.3	38.8	39.3	39.4
Consumption	**124.6**	**129.7**	**119.4**	**127.2**	**128.1**	**128.6**	**129.2**	**129.8**	**130.4**	**130.8**	**131.6**	**131.2**	**130.8**	**130.7**
of which EU-15	102.5	106.6	97.1	104.9	105.2	105.6	106.1	106.6	107.2	107.5	108.1	107.7	107.3	107.1
of which EU-N13	22.1	23.2	22.3	22.3	22.9	23.0	23.1	23.1	23.2	23.3	23.5	23.5	23.5	23.6
of which food and industrial	68.4	69.1	70.1	70.3	70.4	70.6	70.9	71.1	71.3	71.5	71.8	72.0	72.1	72.2
of which feed	51.1	55.4	45.2	52.7	53.0	53.0	52.9	52.8	52.5	52.1	51.9	51.7	51.6	51.7
of which bioenergy	5.2	5.2	4.1	4.3	4.7	4.9	5.5	5.9	6.6	7.2	7.8	7.5	7.1	6.8
Imports	4.4	7.1	5.0	6.2	5.4	5.3	5.3	5.4	5.5	5.4	5.4	5.3	5.3	5.4
Exports	22.4	16.0	21.9	19.4	16.4	17.8	16.5	16.9	16.8	17.2	18.2	19.2	20.5	21.1
Beginning stocks	16.1	10.7	10.8	8.7	13.0	13.6	13.2	14.0	14.2	14.6	15.1	14.6	14.6	14.7
Ending stocks	10.7	10.8	8.7	13.0	13.6	13.2	14.0	14.2	14.6	15.1	14.6	14.6	14.7	14.7
of which intervention	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: the wheat marketing year is July/June

Table 6.4 EU coarse grains market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**143.3**	**152.8**	**147.1**	**159.6**	**160.8**	**161.7**	**162.7**	**163.7**	**164.7**	**165.8**	**166.7**	**167.8**	**168.8**	**169.6**
of which EU-15	94.4	98.9	101.2	106.9	106.5	106.7	107.0	107.2	107.5	107.8	108.1	108.4	108.7	108.9
of which EU-N13	48.9	53.9	45.9	52.7	54.3	55.0	55.7	56.5	57.2	57.9	58.6	59.4	60.1	60.7
Consumption	**155.1**	**149.8**	**156.6**	**152.6**	**156.2**	**157.1**	**158.3**	**160.1**	**161.8**	**163.9**	**165.9**	**166.5**	**166.9**	**167.2**
of which EU-15	119.2	112.8	121.9	116.4	120.1	120.9	122.0	123.4	124.9	126.6	128.3	128.9	129.2	129.6
of which EU-N13	35.9	37.0	34.7	36.3	36.1	36.2	36.3	36.7	36.9	37.3	37.6	37.6	37.6	37.6
of which food and industrial	34.4	33.2	32.7	34.1	34.0	34.1	34.1	34.7	34.9	35.3	35.6	36.0	36.3	36.7
of which feed	116.4	111.6	118.0	112.7	115.3	115.5	115.6	115.8	115.7	116.1	116.2	116.6	116.8	116.6
of which bioenergy	4.3	5.0	5.9	5.8	6.9	7.5	8.6	9.6	11.2	12.5	14.1	14.0	13.8	13.8
Imports	8.7	7.2	11.6	7.8	4.6	4.7	6.1	6.4	7.9	7.8	7.7	7.6	7.4	7.0
Exports	9.3	9.6	9.9	8.0	9.3	9.0	9.1	9.2	9.2	9.2	9.3	9.4	9.6	9.9
Beginning stocks	38.4	26.1	26.6	18.9	25.7	25.6	25.9	27.3	28.1	29.7	30.2	29.5	29.0	28.7
Ending stocks	26.1	26.6	18.9	25.7	25.6	25.9	27.3	28.1	29.7	30.2	29.5	29.0	28.7	28.3
of which intervention	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: the coarse grains marketing year is July/June

Table 6.5 EU common wheat market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**128.0**	**130.3**	**125.6**	**136.0**	**131.2**	**132.4**	**132.7**	**133.1**	**133.7**	**134.6**	**135.5**	**136.5**	**137.5**	**137.9**
of which EU-15	96.0	94.8	92.5	97.4	95.8	96.5	96.5	96.4	96.6	97.0	97.4	98.0	98.4	98.8
of which EU-N13	32.0	35.4	33.0	38.6	35.4	35.9	36.2	36.7	37.1	37.6	38.1	38.6	39.1	39.2
Consumption	**115.1**	**120.9**	**110.4**	**118.2**	**119.1**	**119.7**	**120.2**	**120.8**	**121.4**	**121.8**	**122.6**	**122.2**	**121.8**	**121.6**
of which EU-15	93.3	98.1	88.5	96.3	96.6	97.1	97.6	98.1	98.6	98.9	99.6	99.1	98.7	98.5
of which EU-N13	21.8	22.8	21.9	21.9	22.5	22.6	22.6	22.7	22.8	22.8	23.0	23.0	23.1	23.2
of which food and industrial	59.1	60.4	61.4	61.5	61.7	61.9	62.1	62.3	62.5	62.6	63.0	63.1	63.2	63.3
of which feed	50.8	55.2	45.0	52.5	52.8	52.8	52.7	52.6	52.3	51.9	51.7	51.5	51.4	51.5
of which bioenergy	5.2	5.2	4.1	4.3	4.7	4.9	5.5	5.9	6.6	7.2	7.8	7.5	7.1	6.8
Imports	2.4	5.4	3.6	4.3	3.6	3.5	3.5	3.6	3.6	3.6	3.6	3.5	3.5	3.5
Exports	20.3	14.6	20.5	18.0	15.1	16.5	15.2	15.6	15.5	15.9	16.9	17.9	19.2	19.9
Beginning stocks	14.9	9.9	10.1	8.3	12.4	12.9	12.6	13.3	13.6	14.0	14.4	13.9	14.0	14.0
Ending stocks	9.9	10.1	8.3	12.4	12.9	12.6	13.3	13.6	14.0	14.4	13.9	14.0	14.0	14.0
of which intervention	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU price in EUR/t	219	201	243	198	182	175	176	176	182	184	185	185	185	186
World price in EUR/t	227	219	258	227	187	181	182	181	186	189	190	191	191	192
World price in USD/t	301	305	331	293	253	246	247	247	254	261	265	268	268	270
EU intervention price in EUR/t	101	101	101	101	101	101	101	101	101	101	101	101	101	101

Note: the common wheat marketing year is July/June

Table 6.6 EU durum wheat market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**9.2**	**8.5**	**8.5**	**8.7**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.5**	**8.6**
of which EU-15	8.9	8.2	8.4	8.5	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.3	8.3	8.3
of which EU-N13	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Consumption	**9.6**	**8.9**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.1**
of which EU-15	9.2	8.5	8.6	8.6	8.5	8.5	8.5	8.6	8.6	8.6	8.6	8.6	8.6	8.6
of which EU-N13	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
of which food and industrial	9.3	8.7	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.9
of which feed	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
of which bioenergy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Imports	2.0	1.7	1.5	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Exports	2.0	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Beginning stocks	1.2	0.8	0.8	0.4	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6
Ending stocks	0.8	0.8	0.4	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6

Note: the durum wheat marketing year is July/June

Table 6.7 EU barley market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**53.1**	**52.0**	**54.8**	**60.1**	**57.9**	**57.9**	**57.8**	**57.8**	**57.8**	**57.8**	**57.8**	**57.8**	**57.8**	**57.8**
of which EU-15	43.3	41.7	44.2	50.0	48.1	48.0	48.0	48.0	48.0	47.9	47.9	47.9	47.8	47.8
of which EU-N13	9.8	10.3	10.6	10.1	9.8	9.8	9.8	9.9	9.9	9.9	9.9	9.9	10.0	10.0
Consumption	**54.5**	**49.0**	**50.3**	**50.7**	**51.2**	**51.2**	**51.1**	**51.2**	**51.2**	**51.4**	**51.5**	**51.4**	**51.3**	**51.2**
of which EU-15	45.5	41.6	42.1	42.5	42.9	42.9	42.9	43.0	43.1	43.2	43.3	43.3	43.2	43.1
of which EU-N13	9.0	7.3	8.3	8.2	8.3	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.1	8.1
of which food and industrial	12.0	12.3	12.4	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6
of which feed	42.0	36.1	37.2	37.5	37.9	37.8	37.7	37.7	37.7	37.8	37.8	37.8	37.8	37.7
of which bioenergy	0.5	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	1.0	1.1	1.0	1.0	1.0
Imports	0.2	0.4	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Exports	7.6	5.7	7.8	5.8	6.8	6.5	6.5	6.6	6.6	6.6	6.7	6.9	7.0	7.3
Beginning stocks	18.5	9.5	7.2	4.0	7.9	8.1	8.6	9.0	9.4	9.7	9.9	9.9	9.7	9.5
Ending stocks	9.5	7.2	4.0	7.9	8.1	8.6	9.0	9.4	9.7	9.9	9.9	9.7	9.5	9.1
of which intervention	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU price in EUR/t	184	196	224	183	151	153	157	158	162	163	164	165	165	166

Note: the barley marketing year is July/June

Table 6.8 EU maize market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**59.5**	**70.6**	**59.7**	**64.5**	**71.1**	**72.0**	**72.9**	**73.7**	**74.7**	**75.6**	**76.5**	**77.4**	**78.3**	**79.3**
of which EU-15	35.4	41.7	39.5	38.0	40.7	41.0	41.2	41.5	41.8	42.1	42.3	42.6	42.9	43.2
of which EU-N13	24.1	29.0	20.2	26.5	30.4	31.0	31.6	32.2	32.9	33.5	34.1	34.8	35.4	36.1
Consumption	**66.8**	**69.9**	**72.8**	**68.5**	**72.7**	**73.7**	**74.9**	**76.5**	**78.1**	**79.9**	**81.7**	**82.3**	**82.8**	**83.1**
of which EU-15	52.8	52.3	59.1	53.3	57.5	58.4	59.5	60.8	62.1	63.7	65.2	65.7	66.1	66.5
of which EU-N13	14.0	17.5	13.6	15.1	15.2	15.3	15.4	15.7	15.9	16.2	16.5	16.6	16.7	16.7
of which food and industrial	13.8	12.5	11.8	13.1	13.1	13.2	13.2	13.8	14.1	14.6	14.9	15.3	15.6	16.0
of which feed	50.2	54.0	57.0	51.5	54.9	55.3	55.5	55.6	55.5	55.8	55.8	55.8	55.8	55.6
of which bioenergy	2.8	3.3	3.9	3.9	4.7	5.2	6.2	7.1	8.4	9.6	11.0	11.2	11.3	11.5
Imports	7.5	6.2	11.0	7.0	3.8	4.0	5.4	5.6	7.2	7.0	7.0	6.8	6.7	6.3
Exports	1.4	3.6	1.8	2.0	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Beginning stocks	14.7	13.5	16.9	12.9	14.0	13.9	13.8	14.8	15.2	16.6	16.9	16.3	15.9	15.8
Ending stocks	13.5	16.9	12.9	14.0	13.9	13.8	14.8	15.2	16.6	16.9	16.3	15.9	15.8	15.8
of which intervention	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU price in EUR/t	212	205	232	193	156	167	170	171	176	177	178	179	179	181
World price in EUR/t	208	205	229	183	150	152	157	158	163	163	163	165	165	167
World price in USD/t	275	285	294	237	204	207	214	216	223	226	228	231	232	236

Note: the maize marketing year is July/June

Table 6.9 EU other cereals* market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**30.8**	**30.2**	**32.6**	**35.0**	**31.8**	**31.9**	**32.0**	**32.1**	**32.2**	**32.3**	**32.4**	**32.5**	**32.6**	**32.6**
of which EU-15	15.7	15.6	17.5	18.8	17.6	17.7	17.7	17.8	17.8	17.8	17.9	17.9	17.9	17.9
of which EU-N13	15.1	14.6	15.2	16.1	14.1	14.2	14.3	14.4	14.4	14.5	14.6	14.6	14.7	14.7
Consumption	**33.8**	**31.0**	**33.5**	**33.4**	**32.2**	**32.2**	**32.3**	**32.4**	**32.5**	**32.6**	**32.7**	**32.8**	**32.8**	**32.8**
of which EU-15	20.9	18.8	20.7	20.5	19.6	19.5	19.5	19.6	19.7	19.8	19.9	19.9	19.9	20.0
of which EU-N13	12.9	12.1	12.8	12.9	12.6	12.7	12.7	12.8	12.8	12.9	12.9	12.9	12.9	12.8
of which food and industrial	8.6	8.3	8.4	8.5	8.3	8.3	8.3	8.2	8.2	8.1	8.1	8.1	8.1	8.1
of which feed	24.2	21.5	23.8	23.7	22.4	22.4	22.4	22.4	22.5	22.6	22.7	23.0	23.1	23.3
of which bioenergy	1.0	1.1	1.3	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	1.8	1.6	1.4
Imports	1.1	0.5	0.6	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0.4	0.4
Exports	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Beginning stocks	5.2	3.0	2.5	1.9	3.8	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.4	3.4
Ending stocks	3.0	2.5	1.9	3.8	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.4	3.4	3.4

Note: the other cereals marketing year is July/June; * Rye, Oats and other cereals

Table 6.10 EU rice market balance, 2010-23 (million tonnes milled equivalent)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**1.8**	**1.9**	**1.9**	**1.7**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**
of which EU-15	1.8	1.8	1.8	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.8	1.8
of which EU-N13	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Consumption	**2.6**	**2.6**	**2.6**	**2.6**	**2.7**	**2.7**	**2.7**	**2.7**	**2.8**	**2.8**	**2.8**	**2.8**	**2.9**	**2.9**
of which EU-15	2.2	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.3	2.3
of which EU-N13	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6
Imports	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.2
Exports	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Beginning stocks	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Ending stocks	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
EU price in EUR/t (paddy rice)	360	323	336	394	350	337	334	334	342	353	365	376	382	390
World price in EUR/t	314	363	336	362	300	293	292	294	300	308	317	325	331	335
World price in USD/t	416	505	432	458	407	397	398	402	411	426	442	456	465	472

Note: the rice marketing year is September/August

Table 6.11 EU oilseed* (grains and beans) market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**28.8**	**28.9**	**27.2**	**29.7**	**29.5**	**29.6**	**30.2**	**30.7**	**31.3**	**31.8**	**32.3**	**32.8**	**33.4**	**33.8**
of which EU-15	17.9	17.5	17.3	17.2	18.1	18.2	18.6	18.9	19.3	19.6	20.0	20.4	20.8	21.1
of which EU-N13	10.9	11.3	9.9	12.6	11.4	11.5	11.7	11.8	12.0	12.1	12.3	12.4	12.6	12.7
Rapeseed	20.6	19.2	19.2	20.5	19.9	20.0	20.5	20.8	21.3	21.7	22.1	22.5	23.0	23.4
Sunseed	7.0	8.5	7.0	8.2	8.5	8.5	8.6	8.7	8.8	8.8	8.9	9.0	9.1	9.1
Soyabeans	1.2	1.2	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3
Consumption	**44.1**	**44.4**	**43.0**	**44.6**	**45.1**	**45.6**	**46.2**	**46.7**	**47.2**	**47.7**	**48.3**	**48.7**	**49.2**	**49.5**
of which EU-15	37.2	37.1	37.0	37.3	37.8	38.2	38.7	39.1	39.5	39.9	40.4	40.7	41.1	41.4
of which EU-N13	6.9	7.3	6.0	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2
of which crushing	40.9	40.7	40.1	41.2	41.7	42.2	42.7	43.3	43.8	44.3	44.8	45.2	45.7	46.0
Imports	16.1	16.8	14.7	16.3	16.1	16.4	16.4	16.5	16.5	16.5	16.5	16.4	16.4	16.3
Exports	0.8	0.8	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6
Beginning stocks	4.0	4.0	4.5	2.8	3.6	3.5	3.5	3.4	3.3	3.3	3.3	3.3	3.3	3.3
Ending stocks	4.0	4.5	2.8	3.6	3.5	3.5	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.3
EU price in EUR/t (rapeseed)	464	474	441	395	367	371	360	374	372	380	377	380	379	376
World price in EUR/t	434	412	518	425	355	353	344	355	355	361	359	364	363	362
World price in USD/t	575	574	666	552	481	480	469	485	486	499	501	510	511	511

Note: the oilseed marketing year is July/June; * Rapeseed, soybeans, sunflower seed and groundnuts

Table 6.12 EU oilseed meal* market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**25.4**	**25.4**	**25.0**	**25.5**	**25.9**	**26.2**	**26.5**	**26.8**	**27.1**	**27.4**	**27.7**	**27.9**	**28.2**	**28.4**
of which EU-15	22.0	21.8	22.1	21.9	22.4	22.6	22.9	23.1	23.4	23.6	23.8	24.0	24.2	24.4
of which EU-N13	3.4	3.6	2.9	3.5	3.6	3.6	3.7	3.7	3.8	3.8	3.9	3.9	4.0	4.0
Consumption	**48.8**	**49.2**	**41.2**	**48.1**	**48.5**	**48.5**	**48.6**	**48.9**	**49.1**	**49.3**	**49.6**	**49.8**	**50.1**	**50.4**
of which EU-15	40.2	40.6	32.6	39.5	39.9	39.9	40.0	40.2	40.5	40.7	40.9	41.2	41.5	41.7
of which EU-N13	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.7	8.7
Imports	24.4	25.0	17.0	23.8	23.7	23.4	23.2	23.1	23.0	23.0	23.0	23.0	23.0	23.1
Exports	1.0	1.3	0.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Beginning stocks	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Ending stocks	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
EU price in EUR/t (soybean meal)	304	360	418	357	302	295	294	299	305	311	313	313	314	316
World price in EUR/t	291	308	386	350	288	281	280	285	291	297	298	298	300	301
World price in USD/t	386	429	496	454	390	381	381	390	399	410	416	419	422	425

Note: the oilseed meal marketing year is July/June; * Rapeseed, soybeans, sunflower seed and groundnuts based protein meals

Table 6.13 EU oilseed oil* market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**14.2**	**14.2**	**13.9**	**14.6**	**14.6**	**14.8**	**15.0**	**15.2**	**15.4**	**15.6**	**15.8**	**16.0**	**16.2**	**16.3**
of which EU-15	11.8	11.6	11.9	12.0	12.0	12.1	12.3	12.5	12.7	12.8	13.0	13.1	13.3	13.4
of which EU-N13	2.4	2.6	2.1	2.6	2.6	2.6	2.7	2.7	2.8	2.8	2.8	2.9	2.9	2.9
Consumption	**15.7**	**14.9**	**13.8**	**14.5**	**14.6**	**14.8**	**15.5**	**16.1**	**16.6**	**17.1**	**17.6**	**17.4**	**17.3**	**17.2**
of which EU-15	13.1	12.4	11.4	11.9	12.1	12.3	12.8	13.4	13.8	14.3	14.6	14.5	14.5	14.3
of which EU-N13	2.6	2.5	2.4	2.5	2.5	2.5	2.6	2.7	2.8	2.9	2.9	2.9	2.9	2.8
Imports	2.4	1.9	1.3	1.5	1.4	1.5	1.4	1.6	1.7	2.0	2.2	2.2	2.1	1.9
Exports	0.9	1.2	1.4	1.1	1.1	1.0	1.0	0.8	0.8	0.7	0.7	0.7	0.8	0.8
Beginning stocks	0.8	0.8	0.8	0.8	1.4	1.8	2.2	2.3	2.1	1.9	1.4	1.0	1.0	1.1
Ending stocks	0.8	0.8	0.8	1.4	1.8	2.2	2.3	2.1	1.9	1.4	1.0	1.0	1.1	1.2
EU price in EUR/t (rapeseed oil)	980	969	859	817	696	743	712	743	738	752	757	754	746	739
World price in EUR/t	956	845	915	860	672	703	689	704	701	704	705	708	699	688
World price in USD/t	1 268	1 177	1 175	1 096	912	955	939	961	961	972	983	993	984	971

Note: the oilseed oil marketing year is July/June; * Rapeseed, soybeans, sunflower seed and groundnuts based oils

Table 6.14 EU vegetable oil* market balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**14.3**	**14.3**	**14.1**	**14.7**	**14.7**	**14.9**	**15.1**	**15.3**	**15.5**	**15.7**	**15.9**	**16.1**	**16.3**	**16.4**
of which EU-15	11.8	11.7	12.0	12.1	12.1	12.2	12.4	12.6	12.7	12.9	13.1	13.2	13.4	13.4
of which EU-N13	2.4	2.6	2.1	2.6	2.6	2.6	2.7	2.7	2.8	2.8	2.8	2.9	2.9	2.9
Consumption	**21.9**	**21.2**	**20.1**	**19.9**	**19.9**	**20.2**	**20.7**	**21.3**	**22.1**	**22.6**	**23.2**	**23.0**	**22.9**	**22.8**
of which EU-15	18.9	18.4	17.3	17.0	17.0	17.2	17.7	18.2	18.9	19.4	19.8	19.7	19.6	19.5
of which EU-N13	2.9	2.8	2.8	2.9	2.9	2.9	3.0	3.1	3.2	3.3	3.3	3.3	3.3	3.3
of which food and other use	12.8	12.8	11.9	12.4	12.6	12.4	12.6	12.4	12.5	12.3	12.3	12.4	12.4	12.5
of which bioenergy	9.1	8.4	8.2	7.5	7.2	7.7	8.1	9.0	9.6	10.3	10.9	10.7	10.5	10.3
Imports	8.6	8.1	7.6	7.0	6.7	6.9	6.8	7.0	7.2	7.5	7.9	7.9	7.7	7.5
Exports	1.1	1.4	1.6	1.2	1.2	1.1	1.1	1.0	0.9	0.9	0.9	0.9	0.9	1.0
Beginning stocks	1.0	1.0	1.0	1.0	1.6	2.1	2.4	2.5	2.4	2.1	1.7	1.2	1.2	1.3
Ending stocks	1.0	1.0	1.0	1.6	2.1	2.4	2.5	2.4	2.1	1.7	1.2	1.2	1.3	1.5

Note: the vegetable oil marketing year is July/June; * Rapeseed, soybeans, sunflower seed and groundnuts based oils plus cottonseed oil, palm oil, palmkernel oil and coconut oil

Table 6.15 EU sugar market balance, 2010-23 (million tonnes white sugar equivalent)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Sugar beet production (million tonnes)	**105.0**	**127.4**	**114.7**	**110.2**	**110.7**	**111.0**	**111.3**	**113.5**	**115.0**	**115.7**	**116.7**	**117.6**	**118.5**	**119.3**
of which EU-15	87.4	107.1	95.1	90.9	91.3	91.5	91.9	93.4	94.9	95.6	96.5	97.3	98.1	98.9
of which EU-N13	17.6	20.3	19.5	19.3	19.4	19.4	19.5	20.0	20.1	20.1	20.2	20.3	20.4	20.5
of which for ethanol	14.1	14.1	14.0	14.2	15.5	16.2	17.0	14.8	14.8	14.7	14.7	14.6	14.6	14.5
of which processed for sugar	91.0	113.3	100.6	96.0	95.2	94.7	94.4	98.7	100.2	101.0	102.0	103.0	103.9	104.8
Sugar production*	**15.9**	**18.0**	**16.4**	**15.7**	**15.6**	**15.5**	**15.4**	**16.1**	**16.4**	**16.5**	**16.7**	**16.8**	**17.0**	**17.1**
Sugar quota	*13.5*	*13.5*	*13.5*	*13.5*	*13.5*	*13.5*	*13.5*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
of which EU-15	13.4	15.1	13.6	12.9	12.8	12.7	12.7	13.3	13.5	13.7	13.8	14.0	14.1	14.2
of which EU-N13	2.5	2.9	2.8	2.8	2.8	2.8	2.7	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Consumption	**19.1**	**18.2**	**18.3**	**17.7**	**17.8**	**17.8**	**17.4**	**17.4**	**17.5**	**17.5**	**17.4**	**17.3**	**17.2**	**17.1**
Imports	3.9	3.6	3.9	3.7	3.3	3.7	3.6	2.4	2.3	2.3	2.2	2.1	2.0	1.9
Exports	1.0	2.2	1.5	1.9	1.8	1.8	1.8	1.2	1.2	1.3	1.4	1.6	1.8	1.9
Beginning stocks**	1.6	1.2	2.4	2.9	2.7	1.9	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Ending stocks**	1.2	2.4	2.9	2.7	1.9	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
EU price in EUR/t	522	691	726	627	584	594	572	408	416	420	416	413	409	405
World price in EUR/t	543	440	413	376	344	368	354	356	377	380	377	375	371	367
World price in USD/t	720	612	531	478	467	500	482	487	516	526	526	526	522	518
EU support price in EUR/t	404	404	404	404	404	404	404	404	404	404	404	404	404	404

Note: the sugar marketing year is October/September; * Sugar production is adjusted for carry forward quantities and does not include ethanol feedstock quantities; ** Stocks include carry forward quantities.

Table 6.16 EU isoglucose balance balance, 2010-23 (million tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Isoglucose production	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**1.1**	**1.3**	**1.5**	**1.7**	**1.9**	**2.1**	**2.4**
of which EU-15	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.6	0.6	0.7	0.8	0.9	1.0
of which EU-N13	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6	0.7	0.8	1.0	1.1	1.2	1.3
Isoglucose quota	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isoglucose consumption	**0.7**	**0.7**	**0.7**	**0.7**	**0.6**	**0.6**	**0.6**	**1.0**	**1.2**	**1.4**	**1.6**	**1.8**	**2.0**	**2.2**
share in Sweetener use (%)	*3.5*	*3.6*	*3.5*	*3.5*	*3.4*	*3.4*	*3.5*	*5.2*	*6.2*	*7.3*	*8.3*	*9.4*	*10.5*	*11.5*
Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exports	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2

Table 6.17 EU biofuels market balance, 2010-23 (million tonnes oil equivalent)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**11.7**	**11.5**	**11.5**	**11.3**	**11.8**	**12.8**	**13.7**	**14.9**	**16.1**	**17.4**	**18.6**	**18.5**	**18.5**	**18.3**
Ethanol	3.2	3.3	3.3	3.4	3.8	4.0	4.5	4.7	5.2	5.7	6.2	6.2	6.1	6.1
…based on wheat	1.0	1.0	0.8	0.8	0.9	0.9	1.1	1.1	1.3	1.4	1.5	1.5	1.4	1.4
…based on other cereals	0.9	1.0	1.2	1.2	1.4	1.6	1.8	2.1	2.4	2.7	3.0	3.0	3.0	3.0
…based on sugar beet	0.7	0.7	0.7	0.7	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7
…2nd-gen.	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
Biodiesel	8.5	8.1	8.2	7.9	8.0	8.8	9.2	10.2	10.9	11.7	12.4	12.3	12.3	12.2
…based on vegetable oils	7.7	7.1	6.9	6.3	6.1	6.5	6.9	7.6	8.1	8.7	9.2	9.0	8.9	8.7
…based on waste oils	0.9	1.0	1.2	1.6	1.8	2.2	2.3	2.5	2.7	2.9	3.1	3.2	3.3	3.4
…other 2nd-gen.	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Consumption	**13.8**	**14.8**	**14.5**	**13.3**	**14.6**	**15.8**	**16.9**	**18.2**	**19.7**	**21.0**	**22.5**	**22.3**	**22.1**	**21.9**
Ethanol for fuel	2.7	2.7	2.8	2.7	3.4	3.4	4.0	4.3	5.2	5.6	6.6	6.4	6.1	6.0
non fuel use of ethanol	*1.1*	*1.5*	*1.1*	*1.2*	*1.1*	*1.1*	*1.1*	*1.1*	*1.1*	*1.1*	*1.1*	*1.1*	*1.1*	*1.1*
Biodiesel	9.9	10.6	10.6	9.3	10.1	11.3	11.8	12.8	13.4	14.2	14.8	14.8	14.9	14.8
Net trade	**-2.1**	**-3.4**	**-3.0**	**-1.9**	**-2.8**	**-3.0**	**-3.2**	**-3.3**	**-3.6**	**-3.6**	**-3.9**	**-3.8**	**-3.6**	**-3.6**
Ethanol imports	0.8	0.9	0.6	0.6	0.8	0.5	0.7	0.7	1.1	1.1	1.5	1.3	1.1	1.1
Ethanol exports	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Biodiesel imports	1.5	2.6	2.5	1.6	2.2	2.6	2.6	2.7	2.6	2.6	2.5	2.6	2.7	2.6
Biodiesel exports	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Petrol consumption	96.0	92.3	89.8	89.2	89.2	89.1	89.1	89.4	89.5	89.5	89.4	89.1	88.8	88.3
Diesel consumption	205.4	206.7	200.6	201.2	201.5	201.4	202.1	203.0	203.7	204.1	204.2	203.9	203.4	202.8
Energy shares:														
Biofuels (% RED counting)	**4.5**	**4.8**	**5.1**	**4.8**	**5.4**	**5.9**	**6.3**	**6.8**	**7.4**	**7.9**	**8.5**	**8.5**	**8.5**	**8.5**
1st-gen.	3.9	4.2	4.2	3.6	4.0	4.3	4.6	5.0	5.4	5.7	6.2	6.1	6.0	5.9
based on waste oils	0.3	0.3	0.4	0.5	0.6	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.2
other 2nd-gen.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ethanol in Petrol	2.9	3.0	3.2	3.1	3.9	3.9	4.6	4.9	5.9	6.4	7.5	7.3	7.0	7.0
Biodiesel in Diesel	4.9	5.2	5.3	4.7	5.0	5.6	5.9	6.3	6.6	7.0	7.3	7.3	7.4	7.3
Ethanol producer price in EUR/hl	59	58	60	56	56	56	60	60	63	63	66	65	64	65
Biodiesel producer price in EUR/hl	71	96	91	84	71	76	72	76	76	78	78	78	79	79

Table 6.18 EU beef and veal meat market balance, 2010-23 ('000 tonnes c.w.e.)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Gross Indigenous Production	**8 224**	**8 282**	**7 969**	**7 721**	**7 759**	**7 915**	**7 902**	**7 896**	**7 883**	**7 821**	**7 776**	**7 723**	**7 671**	**7 619**
of which EU-15	7 309	7 298	6 998	6 805	6 831	6 997	6 985	6 983	6 975	6 920	6 883	6 837	6 795	6 753
of which EU-N13	914	984	971	915	927	918	917	914	908	901	893	886	876	866
Imports of live animals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports of live animals	104	147	158	118	112	130	130	130	130	130	130	130	130	130
Net Production	**8 120**	**8 134**	**7 811**	**7 603**	**7 647**	**7 785**	**7 773**	**7 767**	**7 754**	**7 692**	**7 647**	**7 593**	**7 541**	**7 489**
Consumption	**8 188**	**8 094**	**7 874**	**7 761**	**7 840**	**7 982**	**8 002**	**7 989**	**7 985**	**7 951**	**7 910**	**7 868**	**7 830**	**7 778**
of which EU-15	7 614	7 455	7 292	7 165	7 252	7 395	7 417	7 405	7 402	7 369	7 329	7 288	7 250	7 200
of which EU-N13	573	639	582	596	588	587	586	584	583	582	581	580	580	579
per capita* consumption (kg r.w.e.)	**11.35**	**11.19**	**10.86**	**10.68**	**10.76**	**10.93**	**10.93**	**10.89**	**10.86**	**10.79**	**10.72**	**10.65**	**10.58**	**10.50**
of which EU-15	13.41	13.08	12.75	12.48	12.59	12.80	12.79	12.73	12.69	12.60	12.50	12.40	12.31	12.20
of which EU-N13	3.73	4.17	3.80	3.90	3.85	3.85	3.85	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Imports (meat)	321	286	275	304	325	324	338	341	350	381	387	395	405	405
Exports (meat)	253	327	211	146	128	126	113	119	120	121	122	120	116	116
Net trade (meat)	-68	41	-63	-158	-197	-198	-226	-222	-230	-260	-265	-275	-289	-289
EU price in EUR/t	3 197	3 521	3 838	3 800	3 860	3 792	3 977	3 921	3 774	3 831	3 886	3 961	4 030	4 086
World price in EUR/t (Brazil)	2 241	2 649	2 413	2 512	2 369	2 334	2 441	2 454	2 360	2 391	2 415	2 426	2 411	2 424
World price in USD/t (Brazil)	2 971	3 687	3 100	3 184	3 215	3 167	3 323	3 353	3 234	3 305	3 367	3 402	3 393	3 422

* r.w.e. = retail weight equivalent; Coefficients to transform carcass weight into retail weight are 0.7 for beef and veal

Table 6.19 EU sheep and goat meat market balance, 2010-23 ('000 tonnes c.w.e.)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Gross Indigenous Production	**958**	**977**	**953**	**959**	**955**	**928**	**925**	**921**	**916**	**912**	**907**	**902**	**896**	**891**
of which EU-15	831	843	811	806	803	779	775	771	766	761	757	751	746	741
of which EU-N13	127	134	142	152	152	150	150	150	150	150	150	150	150	150
Imports of live animals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports of live animals	10	22	27	39	40	40	40	40	40	40	40	40	40	40
Net Production	**948**	**956**	**926**	**919**	**915**	**889**	**885**	**881**	**876**	**872**	**868**	**862**	**856**	**851**
Consumption	**1 176**	**1 163**	**1 092**	**1 098**	**1 108**	**1 085**	**1 081**	**1 075**	**1 070**	**1 063**	**1 059**	**1 054**	**1 048**	**1 040**
of which EU-15	1 075	1 057	979	975	979	955	951	945	940	933	929	923	917	909
of which EU-N13	101	106	113	122	129	130	130	130	130	130	130	130	130	130
per capita* consumption (kg r.w.e.)	**2.05**	**2.02**	**1.89**	**1.90**	**1.91**	**1.87**	**1.86**	**1.84**	**1.83**	**1.81**	**1.80**	**1.79**	**1.78**	**1.76**
of which EU-15	2.38	2.33	2.15	2.14	2.14	2.08	2.06	2.04	2.03	2.00	1.99	1.97	1.96	1.94
of which EU-N13	0.83	0.87	0.93	1.01	1.06	1.07	1.07	1.08	1.08	1.08	1.08	1.08	1.09	1.09
Imports (meat)	240	222	190	208	222	216	216	214	214	211	212	212	211	208
Exports (meat)	12	15	25	29	29	20	20	20	20	20	20	20	20	20
Net trade (meat)	-228	-207	-166	-179	-193	-196	-196	-194	-194	-191	-192	-192	-191	-188
EU price in EUR/t	4 360	4 930	5 000	4 800	4 534	4 685	4 782	4 869	4 904	4 696	4 715	4 737	4 818	4 927
World price in EUR/t	2 540	3 530	4 010	3 100	2 928	3 029	3 096	3 146	3 207	3 193	3 206	3 229	3 273	3 353
World price in USD/t	3 368	4 920	5 156	4 063	3 974	4 111	4 215	4 297	4 393	4 413	4 470	4 529	4 606	4 733

* r.w.e. = retail weight equivalent; Coefficients to transform carcass weight into retail weight are 0.88 for sheep and goat meat

Table 6.20 EU pig meat market balance, 2010-23 ('000 tonnes c.w.e.)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Gross Indigenous Production	**22 753**	**23 055**	**22 562**	**22 272**	**22 392**	**22 562**	**22 630**	**22 802**	**22 878**	**23 012**	**23 132**	**23 208**	**23 297**	**23 433**
of which EU-15	19 299	19 609	19 336	19 102	19 175	19 325	19 390	19 541	19 600	19 709	19 806	19 865	19 934	20 045
of which EU-N13	3 454	3 447	3 226	3 170	3 216	3 237	3 241	3 262	3 278	3 303	3 325	3 343	3 363	3 389
Imports of live animals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports of live animals	67	62	36	22	22	25	25	25	25	25	25	25	25	25
Net Production	**22 686**	**22 993**	**22 527**	**22 250**	**22 370**	**22 538**	**22 605**	**22 777**	**22 853**	**22 987**	**23 107**	**23 183**	**23 272**	**23 408**
Consumption	**20 900**	**20 860**	**20 388**	**20 158**	**20 286**	**20 453**	**20 476**	**20 615**	**20 659**	**20 773**	**20 883**	**20 939**	**21 015**	**21 135**
of which EU-15	16 382	16 306	16 091	15 808	15 954	16 095	16 135	16 253	16 317	16 421	16 529	16 594	16 673	16 779
of which EU-N13	4 518	4 554	4 297	4 350	4 332	4 357	4 341	4 362	4 342	4 352	4 354	4 345	4 342	4 356
per capita* consumption (kg r.w.e.)	**32.29**	**32.14**	**31.34**	**30.91**	**31.03**	**31.22**	**31.18**	**31.32**	**31.31**	**31.42**	**31.53**	**31.57**	**31.64**	**31.79**
of which EU-15	32.16	31.88	31.35	30.69	30.87	31.04	31.01	31.14	31.17	31.28	31.40	31.45	31.53	31.67
of which EU-N13	32.78	33.11	31.30	31.73	31.65	31.88	31.79	31.98	31.87	31.98	32.04	32.03	32.07	32.24
Imports (meat)	29	18	19	20	22	21	21	21	21	21	21	20	20	20
Exports (meat)	1 815	2 151	2 158	2 113	2 106	2 106	2 150	2 183	2 214	2 235	2 244	2 264	2 277	2 293
Net trade (meat)	1 786	2 133	2 139	2 093	2 084	2 085	2 130	2 163	2 194	2 214	2 224	2 244	2 257	2 273
EU price in EUR/t	1 402	1 532	1 705	1 760	1 833	1 807	1 793	1 776	1 913	2 032	2 021	2 023	2 097	2 100
World price in EUR/t (Brazil)	1 161	1 155	1 081	1 292	1 302	1 276	1 271	1 258	1 363	1 447	1 441	1 449	1 518	1 517
World price in USD/t (Brazil)	1 539	1 607	1 389	1 715	1 767	1 732	1 731	1 719	1 867	2 000	2 009	2 033	2 136	2 142
World price in EUR/t (US)	1 272	1 454	1 456	1 657	1 679	1 660	1 632	1 610	1 713	1 818	1 803	1 782	1 832	1 839
World price in USD/t (US)	1 686	2 024	1 871	2 199	2 279	2 254	2 222	2 199	2 346	2 512	2 513	2 500	2 578	2 596

* r.w.e. = retail weight equivalent; Coefficients to transform carcass weight into retail weight are 0.78 for pig meat

Table 6.21 EU poultry meat market balance, 2010-23 ('000 tonnes c.w.e.)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Gross Indigenous Production	**12 202**	**12 408**	**12 660**	**12 756**	**12 854**	**12 899**	**13 001**	**13 087**	**13 200**	**13 285**	**13 353**	**13 428**	**13 519**	**13 602**
of which EU-15	9 531	9 714	9 793	9 802	9 863	9 869	9 921	9 961	10 027	10 067	10 092	10 122	10 167	10 206
of which EU-N13	2 671	2 694	2 867	2 953	2 991	3 029	3 081	3 126	3 172	3 218	3 261	3 306	3 353	3 397
Consumption	**11 840**	**11 942**	**12 181**	**12 262**	**12 373**	**12 406**	**12 507**	**12 592**	**12 700**	**12 778**	**12 835**	**12 895**	**12 970**	**13 013**
of which EU-15	9 377	9 498	9 630	9 762	9 842	9 870	9 967	10 048	10 146	10 218	10 271	10 325	10 393	10 433
of which EU-N13	2 463	2 444	2 551	2 500	2 531	2 535	2 540	2 544	2 554	2 560	2 564	2 570	2 577	2 580
per capita* consumption (kg r.w.e.)	**20.64**	**20.76**	**21.12**	**21.21**	**21.35**	**21.36**	**21.48**	**21.58**	**21.72**	**21.81**	**21.87**	**21.94**	**22.03**	**22.08**
of which EU-15	20.77	20.95	21.17	21.38	21.48	21.48	21.62	21.72	21.87	21.96	22.02	22.08	22.18	22.22
of which EU-N13	20.16	20.04	20.96	20.57	20.87	20.93	20.99	21.04	21.15	21.23	21.29	21.38	21.47	21.54
Imports (meat)	797	832	845	845	841	842	844	844	847	849	850	852	854	855
Exports (meat)	1 159	1 298	1 324	1 338	1 322	1 335	1 338	1 339	1 347	1 356	1 368	1 385	1 403	1 445
Net trade (meat)	362	466	479	493	481	493	494	495	500	507	518	533	549	590
EU price in EUR/t	1 724	1 908	1 958	1 997	1 842	1 867	1 877	1 912	1 967	2 000	2 021	2 040	2 055	2 077
World price in EUR/t	844	1 108	1 101	1 046	958	974	980	1 001	1 030	1 047	1 059	1 068	1 076	1 089
World price in USD/t	1 118	1 542	1 414	1 367	1 301	1 322	1 335	1 368	1 411	1 447	1 476	1 499	1 515	1 537

* r.w.e. = retail weight equivalent; Coefficients to transform carcass weight into retail weight are 0.88 for poultry meat

Table 6.22 Aggregate EU meat market balance, 2010-23 ('000 tonnes c.w.e.)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Gross Indigenous Production	**44 137**	**44 723**	**44 144**	**43 707**	**43 959**	**44 304**	**44 459**	**44 707**	**44 877**	**45 030**	**45 168**	**45 260**	**45 383**	**45 546**
of which EU-15	36 970	37 464	36 938	36 516	36 672	36 970	37 071	37 256	37 369	37 458	37 539	37 575	37 642	37 744
of which EU-N13	7 167	7 258	7 206	7 192	7 287	7 334	7 388	7 451	7 509	7 572	7 630	7 685	7 742	7 802
Imports of live animals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports of live animals	181	231	221	179	174	195	195	195	195	195	195	195	195	195
Net Production	**43 957**	**44 492**	**43 924**	**43 528**	**43 786**	**44 110**	**44 264**	**44 512**	**44 683**	**44 835**	**44 974**	**45 066**	**45 189**	**45 352**
Consumption	**42 104**	**42 058**	**41 535**	**41 278**	**41 607**	**41 925**	**42 066**	**42 271**	**42 414**	**42 565**	**42 687**	**42 756**	**42 863**	**42 966**
of which EU-15	34 449	34 315	33 992	33 710	34 027	34 315	34 470	34 651	34 805	34 941	35 058	35 131	35 234	35 321
of which EU-N13	7 655	7 743	7 543	7 568	7 580	7 609	7 597	7 620	7 609	7 624	7 629	7 626	7 629	7 645
per capita* consumption (kg r.w.e.)	**66.33**	**66.12**	**65.22**	**64.70**	**65.06**	**65.38**	**65.45**	**65.63**	**65.72**	**65.84**	**65.93**	**65.95**	**66.04**	**66.13**
of which EU-15	68.72	68.25	67.42	66.69	67.08	67.39	67.49	67.64	67.75	67.84	67.91	67.90	67.98	68.02
of which EU-N13	57.50	58.20	56.99	57.21	57.43	57.73	57.70	57.94	57.93	58.12	58.25	58.33	58.47	58.71
of which Beef and Veal meat	11.35	11.19	10.86	10.68	10.76	10.93	10.93	10.89	10.86	10.79	10.72	10.65	10.58	10.50
of which Sheep and Goat meat	2.05	2.02	1.89	1.90	1.91	1.87	1.86	1.84	1.83	1.81	1.80	1.79	1.78	1.76
of which Pig meat	32.29	32.14	31.34	30.91	31.03	31.22	31.18	31.32	31.31	31.42	31.53	31.57	31.64	31.79
of which Poultry meat	20.64	20.76	21.12	21.21	21.35	21.36	21.48	21.58	21.72	21.81	21.87	21.94	22.03	22.08
Imports (meat)	1 386	1 358	1 329	1 377	1 409	1 403	1 419	1 419	1 431	1 462	1 469	1 480	1 490	1 489
Exports (meat)	3 239	3 791	3 718	3 626	3 585	3 586	3 621	3 662	3 702	3 732	3 755	3 789	3 816	3 874
Net trade (meat)	1 853	2 433	2 389	2 250	2 175	2 184	2 203	2 242	2 271	2 270	2 286	2 309	2 325	2 385

* r.w.e. = retail weight equivalent; Coefficients to transform carcass weight into retail weight are 0.7 for beef and veal, 0.78 for pig meat and 0.88 for both poultry meat and sheep and goat meat

Table 6.23 EU milk market balance, 2010-23

	2010	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Dairy cows (million heads)	**23.3**	**23.1**	**23.2**	**23.1**	**23.0**	**22.8**	**22.5**	**22.1**	**21.6**	**21.2**	**20.8**	**20.5**	**20.1**	**19.7**
of which EU-15	17.6	17.4	17.7	17.8	17.8	17.7	17.4	17.2	16.9	16.6	16.3	16.1	15.8	15.5
of which EU-N13	5.8	5.6	5.5	5.4	5.2	5.1	5.0	4.9	4.8	4.6	4.5	4.4	4.3	4.2
Milk yield (kg/cow)	**6 278**	**6 444**	**6 429**	**6 439**	**6 533**	**6 679**	**6 818**	**6 976**	**7 140**	**7 306**	**7 471**	**7 643**	**7 817**	**7 986**
of which EU-15	6 941	7 119	6 991	6 982	7 068	7 206	7 339	7 497	7 663	7 829	7 994	8 165	8 338	8 504
of which EU-N13	4 257	4 363	4 616	4 638	4 721	4 861	5 009	5 148	5 288	5 434	5 582	5 735	5 894	6 052
Cow milk production (million t)	**146.4**	**148.5**	**149.2**	**148.9**	**150.4**	**152.4**	**153.2**	**153.8**	**154.5**	**155.1**	**155.7**	**156.3**	**156.9**	**157.3**
of which EU-15	121.8	123.9	123.8	124.1	125.6	127.5	128.0	128.7	129.3	129.9	130.5	131.1	131.7	132.1
of which EU-N13	24.5	24.6	25.3	24.8	24.8	25.0	25.1	25.2	25.2	25.2	25.2	25.2	25.2	25.2
Total milk production (million t)	**149.9**	**151.9**	**152.6**	**152.3**	**153.8**	**156.0**	**156.7**	**157.3**	**157.9**	**158.4**	**159.0**	**159.5**	**160.0**	**160.4**
of which EU-15	122.1	124.1	124.0	124.3	125.8	127.7	128.2	128.9	129.5	130.1	130.7	131.3	131.9	132.3
of which EU-N13	27.8	27.8	28.6	28.0	28.0	28.3	28.5	28.4	28.4	28.3	28.3	28.2	28.1	28.0
Delivered to dairies (million t)	**136.9**	**139.6**	**140.2**	**140.4**	**142.2**	**144.4**	**145.2**	**146.0**	**146.7**	**147.4**	**148.1**	**148.7**	**149.3**	**149.9**
of which EU-15	118.2	120.4	120.2	120.5	122.0	123.8	124.3	125.0	125.7	126.3	126.9	127.6	128.1	128.6
of which EU-N13	18.8	19.2	20.0	19.9	20.1	20.6	20.9	21.0	21.0	21.1	21.1	21.2	21.2	21.3
On-farm use and direct sales (million t)	13.0	12.3	12.4	11.9	11.7	11.5	11.4	11.3	11.2	11.0	10.9	10.8	10.7	10.5
of which EU-15	3.9	3.7	3.9	3.7	3.8	3.8	3.9	3.9	3.8	3.8	3.8	3.8	3.8	3.7
of which EU-N13	9.1	8.6	8.5	8.2	7.9	7.7	7.6	7.5	7.3	7.2	7.1	7.0	6.9	6.8
Delivery ratio (%)	93.6	94.0	94.0	94.3	94.5	94.8	94.8	94.9	95.0	95.0	95.1	95.2	95.2	95.3
of which EU-15	97.0	97.2	97.0	97.2	97.2	97.1	97.1	97.2	97.2	97.2	97.2	97.3	97.3	97.3
of which EU-N13	76.5	78.0	79.1	80.0	81.2	82.5	83.2	83.4	83.6	83.8	84.0	84.1	84.3	84.5
Fat content (in %)	4.04	4.03	4.04	4.04	4.04	4.03	4.03	4.03	4.03	4.03	4.02	4.02	4.02	4.02
Non-fat solid content (in %)	9.33	9.30	9.31	9.31	9.31	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29	9.29
EU milk producer price in EUR/t (real fat content)	305.6	339.9	326.7	355.8	343.8	339.7	339.7	349.1	353.3	355.5	354.0	353.2	349.4	348.4

Table 6.24 EU fresh dairy product supply, 2010-23 ('000 tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**46 904**	**46 680**	**46 813**	**46 816**	**46 980**	**47 163**	**47 326**	**47 488**	**47 642**	**47 798**	**47 927**	**48 054**	**48 174**	**48 284**
of which EU-15	40 590	40 441	40 350	40 270	40 357	40 464	40 574	40 683	40 787	40 897	41 004	41 110	41 212	41 308
of which EU-N13	6 314	6 239	6 462	6 546	6 623	6 699	6 752	6 805	6 855	6 901	6 923	6 944	6 962	6 975

Table 6.25 EU cheese market balance, 2010-23 ('000 tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**9 344**	**9 406**	**9 566**	**9 669**	**9 735**	**9 925**	**10 087**	**10 239**	**10 339**	**10 443**	**10 545**	**10 596**	**10 660**	**10 716**
of which EU-15	8 061	8 117	8 217	8 279	8 341	8 497	8 633	8 762	8 847	8 935	9 023	9 066	9 125	9 177
of which EU-N13	1 283	1 289	1 349	1 390	1 393	1 429	1 454	1 477	1 492	1 508	1 522	1 529	1 536	1 540
Consumption	**8 760**	**8 808**	**8 877**	**8 938**	**8 984**	**9 148**	**9 270**	**9 394**	**9 467**	**9 544**	**9 621**	**9 659**	**9 719**	**9 774**
of which EU-15	7 509	7 545	7 596	7 637	7 679	7 815	7 905	7 997	8 038	8 081	8 124	8 128	8 154	8 176
of which EU-N13	1 252	1 264	1 281	1 301	1 305	1 333	1 365	1 397	1 429	1 463	1 496	1 531	1 564	1 598
***per capita* consumption (kg)**	**17.35**	**17.40**	**17.49**	**17.57**	**17.62**	**17.90**	**18.09**	**18.30**	**18.40**	**18.51**	**18.63**	**18.67**	**18.76**	**18.85**
of which EU-15	18.90	18.91	18.97	19.01	19.05	19.32	19.48	19.65	19.68	19.74	19.79	19.75	19.77	19.79
of which EU-N13	11.65	11.78	11.96	12.16	12.22	12.51	12.81	13.13	13.45	13.78	14.12	14.47	14.81	15.16
Imports	84	75	78	75	75	74	74	74	73	73	73	73	73	74
Exports	667	673	768	806	826	851	890	918	945	972	998	1 010	1 015	1 016
EU price in EUR/t (Cheddar)	2 895	3 227	3 396	3 620	3 220	3 243	3 291	3 379	3 460	3 482	3 494	3 504	3 489	3 489
World price in EUR/t	3 022	3 103	2 969	2 912	2 764	2 866	2 932	3 014	3 090	3 112	3 123	3 134	3 121	3 115
World price in USD/t	4 007	4 319	3 815	3 784	3 751	3 890	3 992	4 118	4 233	4 301	4 353	4 397	4 391	4 397

Table 6.26 EU butter market balance, 2010-23 ('000 tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**2 147**	**2 197**	**2 249**	**2 265**	**2 326**	**2 312**	**2 312**	**2 312**	**2 313**	**2 315**	**2 314**	**2 314**	**2 315**	**2 312**
of which EU-15	1 895	1 946	1 975	1 984	2 047	2 037	2 037	2 037	2 038	2 039	2 039	2 039	2 041	2 040
of which EU-N13	252	251	275	280	278	275	275	275	275	276	275	275	274	272
Consumption	**2 108**	**2 078**	**2 134**	**2 215**	**2 210**	**2 216**	**2 213**	**2 214**	**2 215**	**2 216**	**2 216**	**2 217**	**2 219**	**2 221**
of which EU-15	1 835	1 815	1 854	1 925	1 919	1 931	1 928	1 928	1 929	1 930	1 930	1 931	1 933	1 934
of which EU-N13	273	262	279	289	291	285	285	285	285	286	286	286	286	286
***per capita* consumption (kg)**	**4.18**	**4.10**	**4.20**	**4.35**	**4.34**	**4.34**	**4.32**	**4.31**	**4.30**	**4.30**	**4.29**	**4.28**	**4.28**	**4.28**
of which EU-15	4.62	4.55	4.63	4.79	4.76	4.77	4.75	4.74	4.72	4.71	4.70	4.69	4.69	4.68
of which EU-N13	2.54	2.45	2.61	2.71	2.73	2.68	2.67	2.68	2.68	2.69	2.70	2.70	2.71	2.71
Imports	34	34	29	18	17	18	18	18	18	18	18	18	18	18
Exports	157	124	124	119	111	113	117	117	116	117	116	115	114	109
Ending Stocks	30	59	80	30	51	51	51	51	51	51	51	51	51	51
of which private	28	59	80	30	51	51	51	51	51	51	51	51	51	51
of which intervention	2	0	0	0	0	0	0	0	0	0	0	0	0	0
EU price in EUR/t	3 337	3 766	3 064	3 840	2 958	3 068	3 053	3 117	3 103	3 121	3 089	3 045	2 973	2 930
World price in EUR/t	3 051	3 222	2 569	2 636	2 332	2 425	2 423	2 472	2 457	2 471	2 437	2 400	2 340	2 287
World price in USD/t	4 045	4 485	3 301	3 405	3 166	3 292	3 299	3 377	3 365	3 415	3 398	3 367	3 293	3 228
EU intervention price in EUR/t	2 218	2 218	2 218	2 218	2 218	2 218	2 218	2 218	2 218	2 218	2 218	2 218	2 218	2 218

Table 6.27 EU SMP market balance, 2010-23 ('000 tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**965**	**1 096**	**1 130**	**1 058**	**1 121**	**1 195**	**1 210**	**1 224**	**1 229**	**1 233**	**1 237**	**1 248**	**1 250**	**1 253**
of which EU-15	844	954	973	905	971	1 026	1 038	1 050	1 052	1 053	1 055	1 064	1 063	1 063
of which EU-N13	121	142	156	153	150	169	172	175	178	180	182	184	187	190
Consumption	**686**	**689**	**703**	**671**	**662**	**621**	**606**	**609**	**611**	**614**	**616**	**617**	**618**	**619**
of which EU-15	635	625	604	582	577	542	526	529	531	534	537	538	539	540
of which EU-N13	50	64	99	90	84	80	80	80	79	79	79	79	79	79
Imports	4	0	2	4	4	3	3	3	3	3	3	3	3	3
Exports	376	516	523	403	454	576	607	619	622	623	624	634	635	637
Ending Stocks	265	157	62	50	60	60	60	60	60	60	60	60	60	60
of which private	70	107	62	50	60	60	60	60	60	60	60	60	60	60
of which intervention	195	50	0	0	0	0	0	0	0	0	0	0	0	0
EU price in EUR/t	2 219	2 420	2 349	2 990	2 657	2 535	2 543	2 622	2 680	2 697	2 693	2 704	2 695	2 703
World price in EUR/t	2 351	2 629	2 472	2 574	2 701	2 599	2 608	2 691	2 754	2 773	2 767	2 780	2 775	2 786
World price in USD/t	3 117	3 660	3 176	3 416	3 666	3 527	3 551	3 676	3 773	3 833	3 858	3 899	3 905	3 933

Table 6.28 EU WMP market balance, 2010-23 ('000 tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**702**	**680**	**665**	**678**	**647**	**647**	**642**	**636**	**631**	**627**	**622**	**618**	**614**	**604**
of which EU-15	645	622	602	620	591	591	587	581	576	572	568	564	561	552
of which EU-N13	57	57	62	57	56	56	56	55	55	55	54	54	54	53
Consumption	**258**	**293**	**281**	**288**	**292**	**291**	**291**	**291**	**291**	**291**	**291**	**291**	**291**	**292**
of which EU-15	216	249	239	251	256	256	256	256	256	256	256	256	256	256
of which EU-N13	43	44	42	37	36	35	35	35	35	35	35	35	35	35
Imports	2	2	3	4	4	3	3	3	3	3	3	3	3	3
Exports	445	388	386	394	359	359	355	348	343	339	334	330	326	316
EU price in EUR/t	2 677	2 973	2 742	3 480	2 792	2 793	2 803	2 892	2 926	2 952	2 939	2 941	2 924	2 919
World price in EUR/t	2 610	2 786	2 695	2 693	2 632	2 635	2 637	2 711	2 734	2 752	2 732	2 727	2 705	2 683
World price in USD/t	3 460	3 878	3 463	3 575	3 573	3 576	3 591	3 704	3 745	3 803	3 808	3 825	3 807	3 787

Table 6.29 EU whey market balance, 2010-23 ('000 tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Production	**1 767**	**1 743**	**1 866**	**1 887**	**1 920**	**1 971**	**2 002**	**2 040**	**2 065**	**2 094**	**2 119**	**2 131**	**2 143**	**2 151**
of which EU-15	1 564	1 534	1 619	1 633	1 664	1 709	1 733	1 766	1 788	1 813	1 836	1 848	1 859	1 867
of which EU-N13	204	209	247	255	255	262	269	275	277	281	283	283	283	284
Consumption	**1 383**	**1 280**	**1 393**	**1 402**	**1 417**	**1 415**	**1 421**	**1 422**	**1 431**	**1 437**	**1 446**	**1 451**	**1 457**	**1 461**
Imports	68	63	71	77	86	88	91	94	97	100	103	106	109	112
Exports	453	526	544	562	589	645	672	712	732	757	776	786	795	802
EU price in EUR/t	719	896	965	1 013	940	942	941	957	962	971	973	984	987	1 000
World price in EUR/t	648	872	820	859	861	865	865	879	884	892	894	904	906	918
World price in USD/t	859	1 214	1 053	1 140	1 169	1 174	1 177	1 201	1 211	1 233	1 246	1 269	1 276	1 296

7. Introduction - Uncertainties

The baseline provides a projection of agricultural markets based on a set of consistent assumptions concerning the key drivers of these markets, namely certain macroeconomic variables, agricultural policies, demand and yield trends. The projections do not forecast future outcomes, but rather describe what may happen given the specific assumptions about underlying conditions that, at the time of making the projections, were judged most plausible by experts. As such, they serve as a reference scenario for policy simulations.

As a complement to the baseline, uncertainty analysis (partial stochastic analysis and sensitivity analysis) is also undertaken. Stochastic analysis quantifies the range of possible outcomes around the central baseline value that might occur, given the uncertainty observed in some of these key drivers in recent years. The analysis aims to identify which of these sources of uncertainty are more important for each market and which variables are more exposed to these uncertainties. The exogenous drivers affecting the baseline whose uncertainty is taken into account include a number of general macroeconomic variables and deviations of yields from their trends, for example because of weather or other reasons such as plant disease outbreaks. This variability is estimated statistically based on past observations and is a key input into the partial stochastic analysis.

Apart from these aspects, the baseline may of course be affected by other kinds of uncertainty, whose variability is difficult to estimate statistically from the past. These uncertainties include unforeseen future policy changes that may profoundly affect future baseline values, other uncertainties such as animal disease outbreaks and changes in trends themselves (e.g. more rapid feed cost increases or a 'green revolution' in African agriculture). For the most part in this exercise, policies are taken as given, based on those currently in place and future legislated policy changes. As for possible shifts in other exogenous trends, here sensitivity analysis or scenario analysis are used to explore how baseline values would be affected by a specific assumed change in future underlying conditions.

The uncertainty analysis was performed by JRC-IPTS using four models, namely the Commission's updated agricultural sector models AGLINK-COSIMO[12], CAPRI[13], ESIM[14] and the general equilibrium model MAGNET[15]. These models are part of the iMAP modelling initiative[16]. As described in the report 'Prospects for Agricultural Markets and Income in the EU: Background information on the baseline construction process and uncertainty analysis'[17], CAPRI and ESIM are calibrated to

[12] The results of analysis based on the use of the AGLINK-COSIMO model by parties outside the OECD are not endorsed by the OECD Secretariat, and the Secretariat cannot be held responsible for them. It is therefore inappropriate for outside users to suggest or to infer that these results, or interpretations based on them, can in any way be attributed to the OECD Secretariat or to the Member countries of the Organisation.

[13] Britz, W., H.-P. Witzke (eds.) (2012): 'CAPRI Model Documentation 2012', Institute for Food and Resource Economics, University of Bonn. http://www.capri-model.org/docs/capri_documentation.pdf.

[14] Grethe, H. (ed.) (2012), European Simulation Model (ESIM): Documentation (Model Code, Parameterization, Database). December 11, Hohenheim.

[15] Woltjer, G., M. Kuiper (2013): 'The MAGNET model, Module description', LEI, February 2013.

[16] M'barek, R., W. Britz, A. Burrell, J. Delincé (2012): 'An integrated Modelling Platform for Agro-economic Commodity and Policy Analysis (iMAP)'. JRC Scientific and Policy Report, European Commission, JRC 69667. http://ftp.jrc.es/EURdoc/JRC69667.pdf

[17] For more details, refer to iMAP modelling team (2011): 'Prospects for Agricultural Markets and Income in the EU. Background information on the baseline construction process and uncertainty

the deterministic baseline obtained with updated and augmented AGLINK-COSIMO to ensure consistency. These models enrich the AGLINK-COSIMO deterministic baseline with results at the Member State and regional (NUTS2) levels, thereby capturing some of the diversity of impact across various regions in Europe.

The following chapters are organised according to the different methodological approaches and each focuses on one or more of the sources of uncertainty affecting the markets covered in this report. This presentation mode should facilitate the reader's understanding and interpretation of the methodological issues related to the uncertainty analysis.

Chapters 8 and 9 present the results of partial stochastic analysis done with AGLINK-COSIMO, covering the uncertainties related to arable crop yields and to macroeconomic assumptions. Chapter 8 discusses the methodology adopted and the uncertainties evaluated, as well as the implications of these uncertainties for EU agricultural markets. The sensitivity of the deterministic market projections to particular uncertainties is explored in Chapter 9 by selecting groups of simulations that capture specific uncertain 'states of the world'. The four selected subsets consider the consequences for the baseline of (a) a lower oil price relative to the value assumed in the baseline, (b) a stronger Euro relative to the US dollar than in the baseline, (c) a weaker Real and lower Brazilian GDP than in the baseline, and (d) a stronger oil price, together with either higher or lower US maize yields than assumed for the baseline.

Chapter 10 analyses the consequences of milk quota abolition at Member States level using the ESIM model. The assumptions and trends used for the modelling exercise are explained and the uncertainty around these is highlighted. The consequences of such decision at MS level are uncertain. The chapter aims to provide some details on their drivers and to highlight the uncertainty around them.

Chapter 11 shows the possible impact of an increase in feed costs in the EU that could be caused by a loss of competitiveness within the EU in relation to the rest of the world. Direct and indirect effects on feed composition and EU balance sheets are presented, as well as changes in the main economic indicators at regional level. The focus is on the effects in the pig and poultry sectors.

Chapter 12 widens the scope beyond the EU and presents the effects of a potential African "green revolution" in a global CGE framework using the MAGNET model. Africa is a continent for which strong agricultural productivity growth has been expected for a long time and for which such development would impact on the African, the EU and the rest of the world economies. The results are compared to the baseline, which is calibrated to the GDP and population growth assumed in the deterministic baseline. The focus of the chapter is on African regions and the trade flows between them and the EU-28.

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analysis'. JRC Technical Report, European Commission, JRC 67803. http://ftp.jrc.es/EURdoc/JRC67803.pdf

8. General consequences of macroeconomic and yield uncertainties

This chapter has two objectives. First, it summarises the methodological approach used for the partial stochastic simulations. Second, it illustrates the implications of these uncertainties for the baseline presented in the first part of this report.

8.1. Scenario setting

The main sources of systematic uncertainty in agricultural markets (macroeconomic conditions and yields) are selected and analysed. It must be borne in mind that the analysis is only partial in that it does not fully capture all the variability observed in the past, given that the uncertainties in the selected drivers are not the only ones affecting EU commodity markets.

The selection of which variables to treat stochastically was motivated by two considerations, namely the need to cover the major sources of uncertainty for EU agricultural markets whilst keeping the analysis simple enough to be able to identify the main contributors of uncertainty in each market.

In total, 40 country-specific macroeconomic variables and 77 country- and crop-specific yields are treated as uncertain in the partial stochastic runs. The selected macroeconomic and yield variables are shown in Table 7.1 and Table 7.2. A greater number of macroeconomic variables are considered than in similar exercises in previous years: not only those of the EU but also those in the main OECD (United States of America, Canada, Japan, Australia and New Zealand) and BRIC countries (Brazil, Russia, India and China). The list also includes crops and countries not covered previously, for example several crops in Canada, China and India, rice in the US, Vietnam and Thailand or soybeans in Brazil.

The stochastic procedure consists of three steps: (i) the approximation of the past uncertainty for selected variables treated as uncertain (stochastic variables); (ii) the generation of 700 sets of possible values for these stochastic variables; and (iii) the execution of the AGLINK-COSIMO model for each of these 700 alternative 'uncertainty' scenarios. These 3 steps are explained more in detail below.

Step (i): Past variability around trend is quantified for each macroeconomic and yield variable separately:

For macroeconomic variables, this is based on forecast errors, determined as the difference between the one-year-ahead forecast (based on the Economic Outlooks of the OECD and the International Monetary Fund) and the observed outcome, for the period 2004-12. In addition, the correlation between the forecast errors *in each year* for the different variables is considered; forecast errors correlations is used as a proxy to replicate the correlation of macroeconomic variables. However, the autocorrelation of stochastic variables *over time* is not considered.

Table 8.1 summarises the simulated variability for macroeconomic variables in 2023. The BRIC countries have greater GDP and price level uncertainty than elsewhere. This is due to rapid economic change and development in these countries, which makes their income forecasts more subject to error. Exchange

rates and especially the world market oil price have been much more variable than GDP.

The statistic used to measure the variability of each outcome is the coefficient of variation[18] of the simulated outcomes in 2023 (CV_{2023}). It is defined as the ratio of the standard deviation of the variable relative to its mean and is calculated using the values for 2023 between the 10th and 90th percentiles of all alternative uncertainty scenarios. The stochastic variables being assumed to follow a multivariate normal distribution, a few extreme values are inevitably drawn: this is dealt by excluding values below the 10th percentile and over the 90th percentile from the analysis.

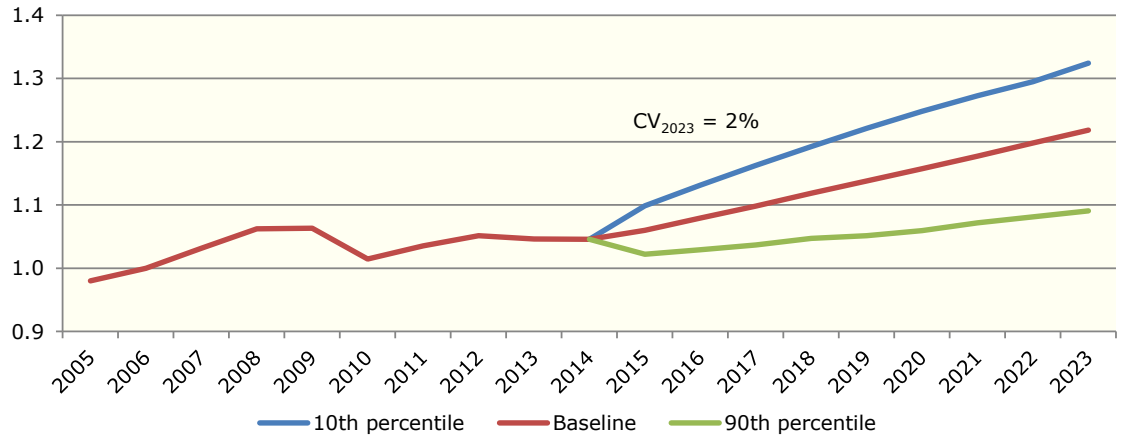
Table 8.1 Coefficients of variation in 2023 (%) for macroeconomic variables

	CPI (Consumer Price Index)	GDP Deflator	GDP	Exchange Rate (national currency/USD)	Oil Price
Australia	4	5	3	13	-
Brazil	13	9	6	20	-
Canada	3	4	4	8	-
China	13	16	8	5	-
EU	3	2	5	23	-
India	18	13	7	10	-
Japan	3	4	8	9	-
New Zealand	5	3	5	15	-
Russia	14	19	17	14	-
US	2	4	4	-	-
World	-	-	-	-	28

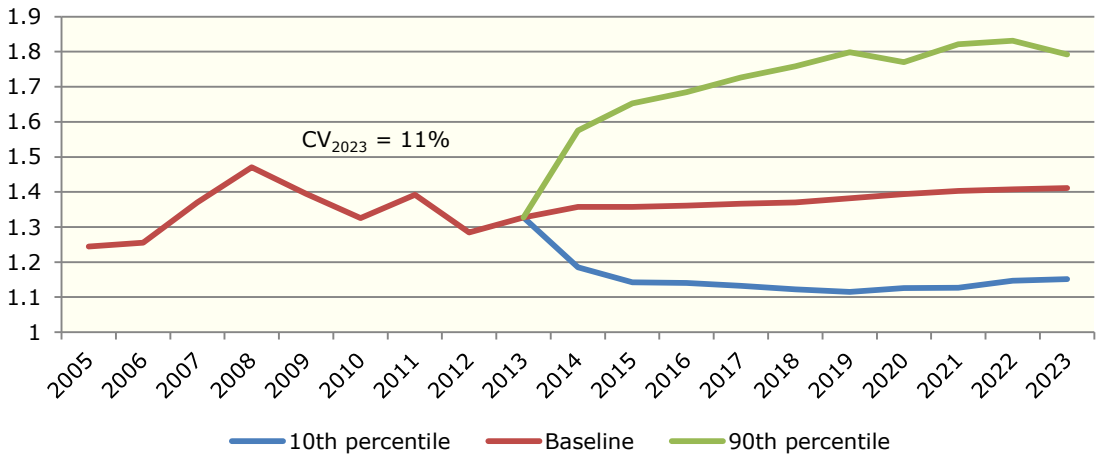
The coefficients of variation given in Table 8.1 show the variability relative to the mean of the stochastic runs and do not provide information about the level of the actual value itself. It is therefore also useful to look at the baseline values and the 10th and 90th percentiles of the stochastic simulations (see Graph 8.1 to Graph 8.3).

[18] To obtain this statistic, a coefficient of variation (CV) is calculated, for each year, based on the simulated values between the 10th and 90th percentiles, i.e. over the 80% 'central' values out of the total number of simulation runs for which the model solved, and ignoring the lowest and highest 10% of the spread of values in order to eliminate extreme outliers. These annual CVs measure the variability of the variable relative to its mean in the corresponding year (see Burrell, A., Z. Nii-Naate (2013)). Throughout this report the CV for year 2023 (CV_{2023}) is displayed. The average annual coefficient of variation (ACV) is calculated as the average of these annual CVs over all years within the projection period. In general, the ACV and the CV2023 are similar for outcome variables depending principally on yield uncertainty (as the latter remains constant over the years) but differ for outcome variables depending more on macroeconomic uncertainty (for which there is accumulation of uncertainty as explained above).

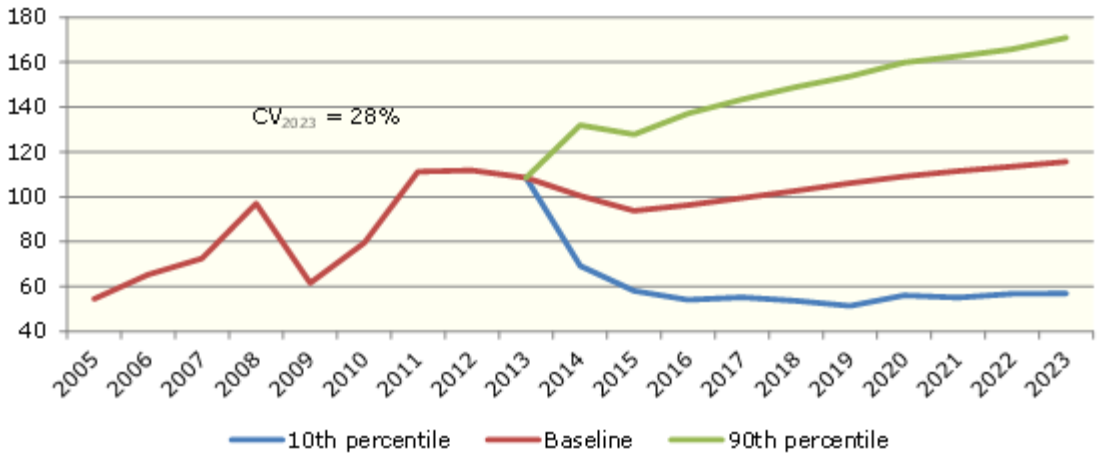
Graph 8.1 EU-15 Gross Domestic Product Deflator (GDPI), (index 1 = 2006)



Graph 8.2 EUR/USD Exchange Rate



Graph 8.3 World Market Oil Price (USD/barrel)



For yields, the approximated uncertainty is based on the difference between the yield predicted by the trend, input and output prices and the actual yield. The time period used for this analysis is 1996 to 2012. Correlation between yield errors, for a given crop, is calculated for pairs of countries in the same regional block, but is assumed to be zero for countries in different regional blocks. Regional blocks are shown in Table 8.2, as well as the coefficient of variation for the yields in year 2023 for the stochastic yield variables. This does not mean that the other yields are fixed: they also react to the model outcomes.

Table 8.2 Coefficients of variation in 2023 (%) for crop yields

CV2023	Europe		Black Sea area			South America				North America			South East Asia						
	EU-15	EU-N13	Kazakhstan	Ukraine	Russia	Argentina	Brazil	Paraguay	Uruguay	Canada	Mexico	US	Indonesia	Malaysia	Thailand	Vietnam	Australia	China	India
Common wheat	5	14	32	30	14	18	19	23	37	7	9	8					42	5	6
Durum wheat	13	20																	
Coarse grains				16				19	15										
Barley	5	10				21				7							36		
Maize	7	33				14	9			5	6	9						7	
Oats	7	12								5									
Rye	12	12																	
Other cereals	7	12																	
Rice	5											5			3	2		2	6
Oilseeds			24	15				25											
Rapeseed	8	15								7							36		
Soybean	13	45				27	9			11		7							
Sunflower seed	8	19			12	17													
Palm oil													8	7					
Sugar beet	5	5			18							8						13	
Sugar cane						7	4					8			14		11	10	6

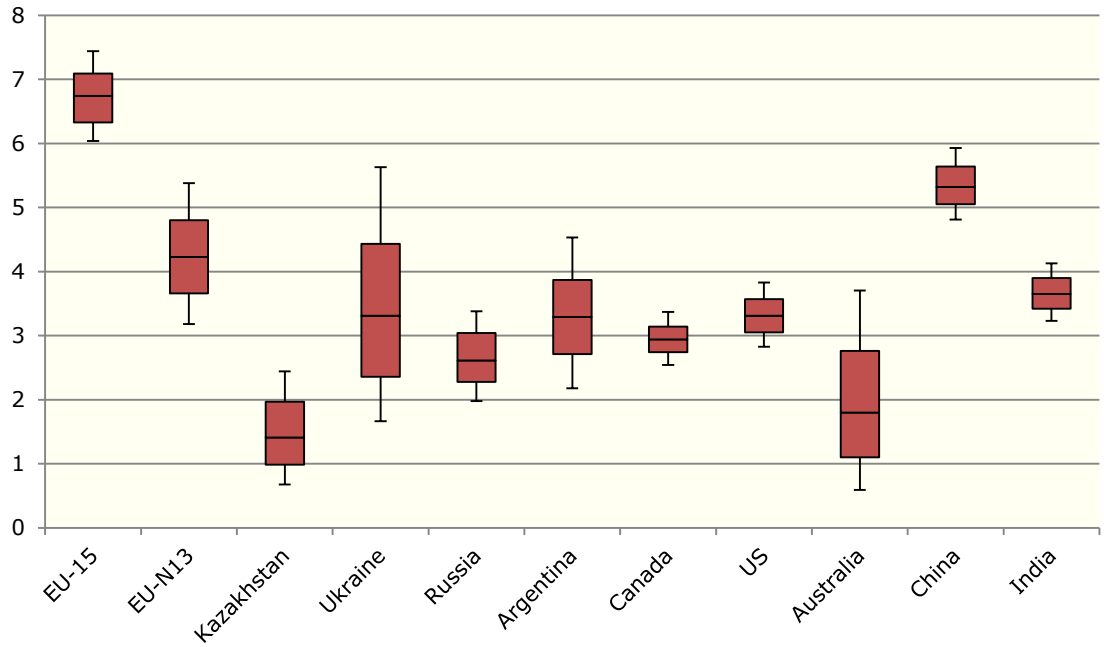
The variability of yields can be represented graphically by boxplot with whiskers from 10th to 90th percentiles (see the example of wheat in Graph 8.4). Depending on the regions of the world, the variability is more or less important (for example, in the case of wheat, variability is higher in Australia or Ukraine taking into account past climatic events, while it is more certain in the EU or North America.)

Step (ii): 700 sets of possible values are generated for the stochastic variables:

The second step involves generating 700 sets of possible values for the stochastic variables, which simulate variability determined in step (i) for each of the years of the period 2014-23. During this period, macroeconomic forecast errors are allowed to accumulate over the time, which result for some sets (e.g. runs a and c in Graph 8.5) in increasing uncertainty (other runs on the contrary might stay close to the mean, e.g. run b). By contrast, yield variations in a given year are independent of

what occurred in the previous year. The difference of approach between the macroeconomic and the yield variables is exemplified in Graph 8.5.

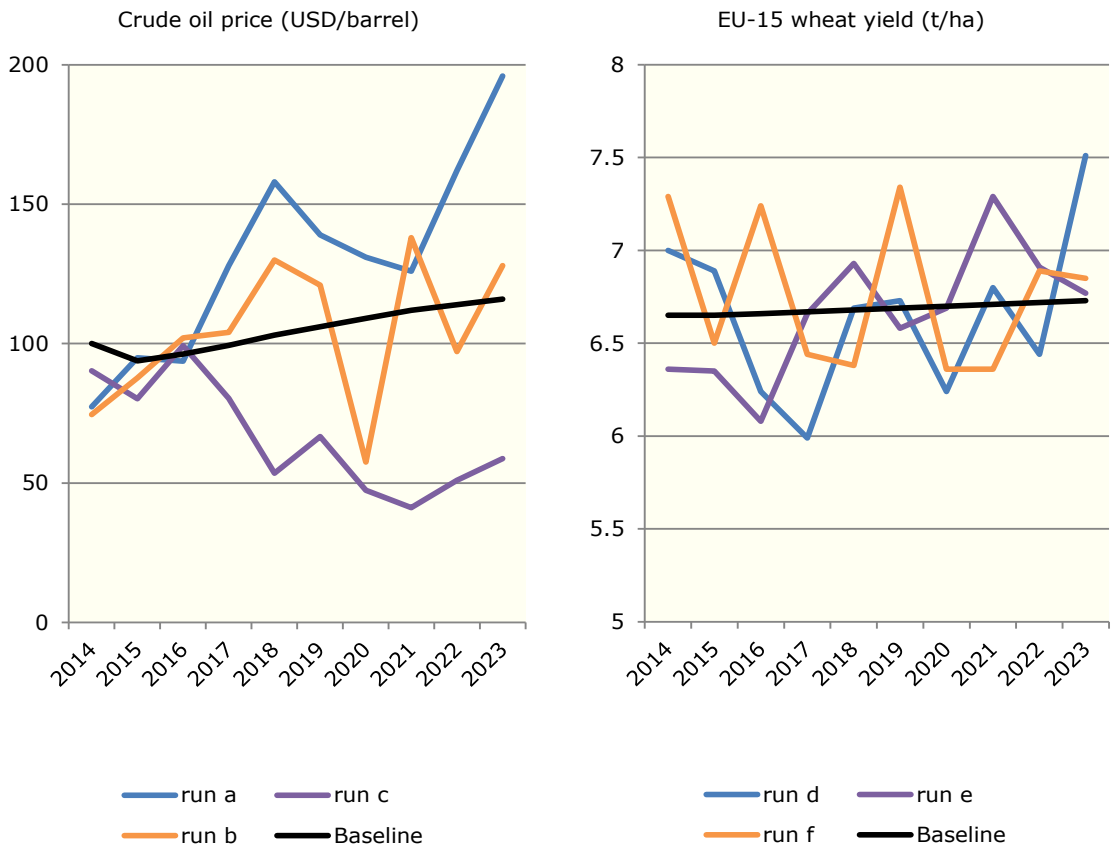
Graph 8.4 Wheat yield uncertainty



Step (iii): the AGLINK-COSIMO model is run for each of the 700 alternative 'uncertainty' scenarios.

The third step involves running the updated and augmented AGLINK-COSIMO model for each of the 700 alternative 'uncertainty' scenarios generated in step (ii). In this exercise, this procedure yielded 599 successful simulations (a success rate of over 85%). The results presented in the next section are based on these 599 solutions. In some cases the model does not solve: this occurs since the model is a complex system of equations and policies which in response to shocks must find the equilibrium of production, consumption, exports, imports and stocks through the adaptation of prices, which when exposed to extreme situations may not find a solution.

Graph 8.5 Examples of crude oil prices and EU-15 wheat yield in the stochastic runs and the baseline



8.2. General uncertainties

Section 8.2.1 summarises the main impacts of the uncertainties that were modelled on the various items of the EU agricultural commodity balance sheets. Thereafter, sections 8.2.2 to 8.2.5 examine the results by commodity group (arable crops, biofuels, dairy products and meat). Results concerning prices have been presented partly in the first part.

8.2.1. Main impacts of macroeconomic and yield uncertainties

The coefficients of variation for year 2023 are presented in Graph 8.6 and Graph 8.7 for the most relevant crops and attributes. More detailed tables (Table 13.1 to Table 13.3) are available in Annex, showing the total cumulated impact of all uncertainties, as well as the disaggregated impacts of macroeconomic uncertainties and impact of yield uncertainties.

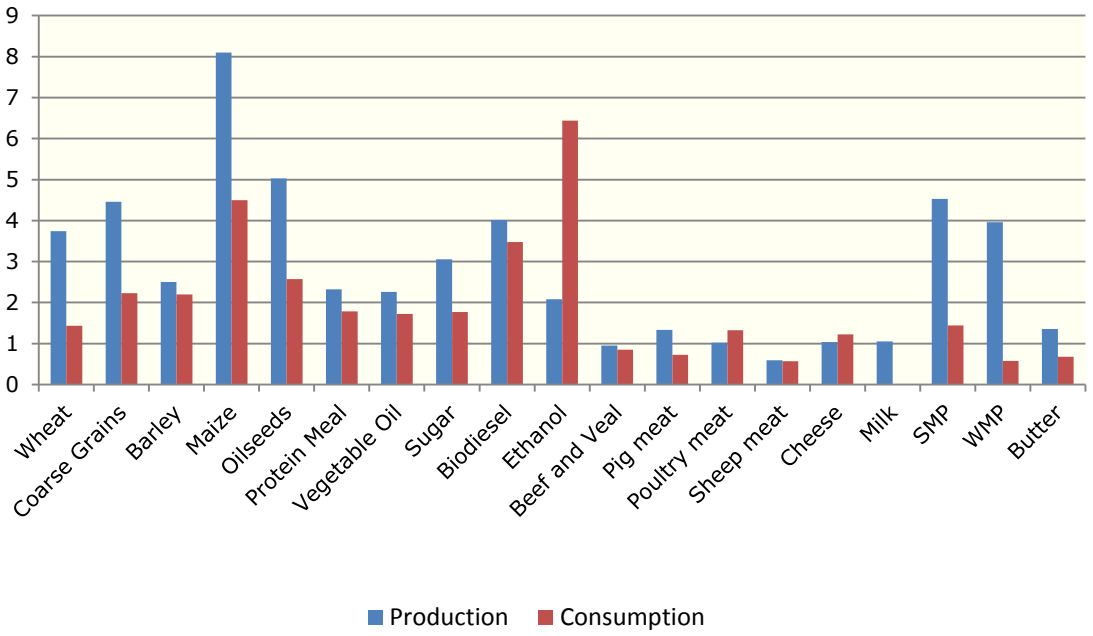
Production and consumption of crops are more subject to variability than animal productions

EU production and consumption in 2023 are generally not strongly affected by the uncertainty analysed (which does not include all sources of uncertainties; for example, the likelihood of animal or plant diseases outbreaks is not considered),

with yearly CVs nearly always below 5%, and in some cases even around 1% (milk, cheese, meat products).

When looking at the combined macroeconomic and yield uncertainty, consumption is very often more certain than production. However this is less true for biofuels (in particular ethanol) and commodities related to them (cereals, in particular maize, oilseeds) for which the variability of oil price and exchange rate has a direct or indirect impact on consumption. For production, crops, biofuels and some dairy products (SMP and WMP) are more vulnerable to uncertainty than the other commodities shown.

Graph 8.6 Impact of combined macroeconomic and yield uncertainties on production and consumption of the main agricultural commodities (CV_{2023}, %)



Yield uncertainties are the predominant source of variability for crop products whereas macroeconomic uncertainty is more important for the production of dairy products. The two sources of uncertainty have more balanced impacts for other commodities (biofuels, meat). In a previous exercise (2011-2021 outlook), macroeconomic uncertainty had a stronger impact, and dominated the effects of yield uncertainties, for meat and biofuels.

In the current exercise, the effect of the macroeconomic variables is not so strong since macroeconomic variables from more countries in the world have been included to the uncertainty analysis. The simultaneous simulation of uncertainty in different regions in the world often results in a reduction of the variability of results. This supports the conclusion that the macroeconomic context of the EU is not disconnected from the rest of the world and that variability of the major EU macroeconomic indicators can be partially compensated by the macroeconomic evolution in the rest of the world. The observed correlation of the forecast errors in the past of all macroeconomic variables is included in the modelling framework.

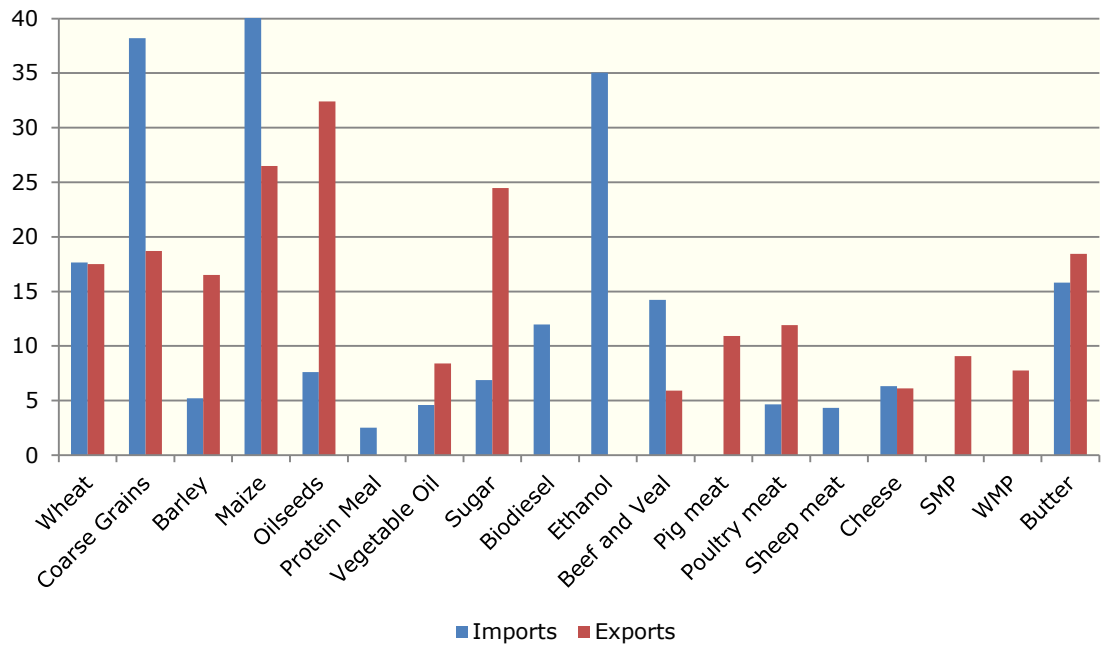
The more pronounced impacts of uncertainty on biofuel consumption are largely due to macroeconomic uncertainties, in particular those of the oil price and exchange rates. This is transmitted to the consumption of coarse grains and oilseeds (and hence to plant products in general) because of their use as biofuel feedstock. The consumption of animal products (largely for human consumption rather than industrial use), are much less influenced by macroeconomic and yield uncertainties, reflecting low price elasticity of demand.

Trade is more affected by uncertainty than production and consumption

With the impacts of uncertainty being generally greater for production than for consumption, trade volumes have to adjust. In the case of SMP and WMP, the causality is probably inverse: production is more variable than for other animal products, because adjusting to the export performance subject to macroeconomic uncertainty. Consequently, the coefficients of variation of imports and exports are significantly higher than those for production and consumption. This reflects not only greater absolute variability, but also that it is measured relative to a smaller mean.

In the case of crops (cereals and oilseeds), not surprisingly the yield uncertainties have a larger effect than macroeconomic uncertainties. Since food and feed use are rather inelastic, production variability means that imports and exports can vary widely (e.g., as shown in the tables in annex, in the case of coarse grain imports, CV_{2023} due to macroeconomic uncertainty is of 36.2% and explains most of the variability).

Graph 8.7 Impact of combined macroeconomic and yield uncertainties on trade of the main agricultural commodities (CV_{2023}, %)



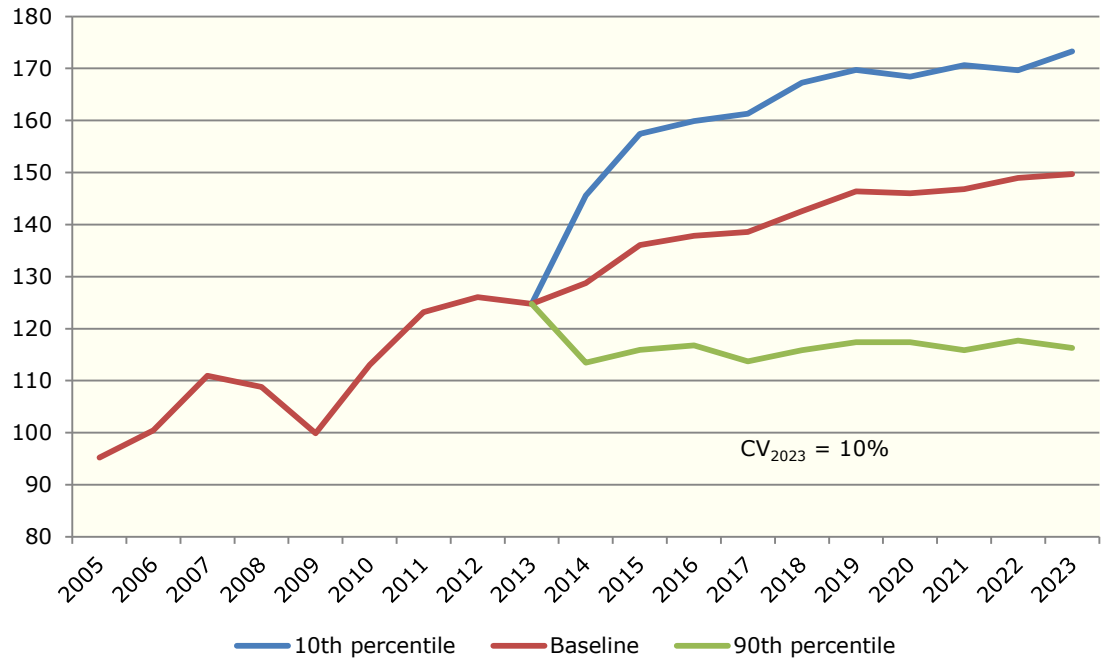
For other products (vegetable oil, biofuels and animal products), macroeconomic uncertainty (related to the oil price and exchange rates) has more impact than yield uncertainty. Exchange rates affect the competitiveness of all EU products, while the

oil price impacts the demand for biofuels which has to be fulfilled by imports (of both biofuels and feedstocks) in case of steep increase.

Income is significantly impacted by uncertainty

The implications of macroeconomic and yield uncertainty for the EU-28 farm income in nominal terms in total and expressed per Annual Working Unit (AWU) are reported in Graph 8.8. The coefficient of variation for 2023 is 10%. The simulations show that 10th and 90th percentiles in 2023 lay 22% below and 16% above the non-stochastic baseline, respectively. This asymmetric development at the 10th and 90th percentiles relative to the baseline over the projection implies that macroeconomic and yield uncertainties are more likely to lead to a lower path of farm income per AWU around the baseline than the contrary, based on past uncertainties.

Graph 8.8 Impact of combined macroeconomic and yield uncertainties on EU farm income per AWU in real terms, (index 100 = average 2003-07)



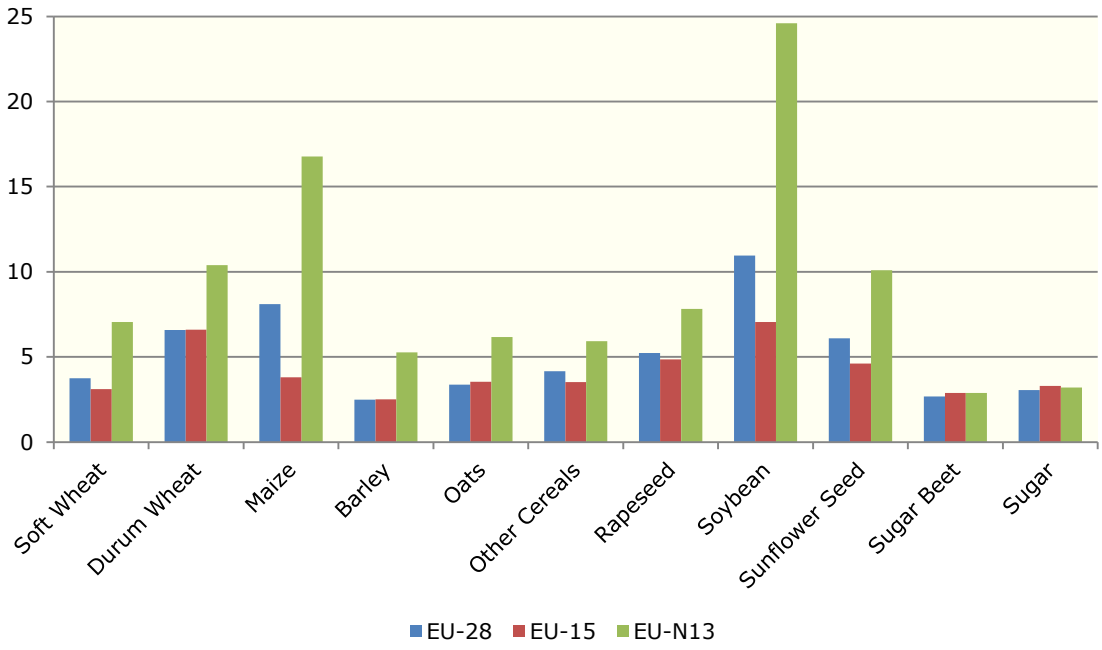
8.2.2. Crops

There are different pathways by which macroeconomic and yield uncertainties are transmitted to the markets for EU crop products. Crop yield uncertainty has a direct impact on yield and hence production. Uncertainty from macroeconomic sources (including exchange rates and the crude oil price) has an indirect impact on yield via the production cost index. Uncertainty about income and prices within the EU is transmitted to domestic consumption, whereas uncertain income and prices in third countries contribute to trade flows uncertainty. Yield uncertainty outside the EU, and hence the degree of self-sufficiency of trading partners, also affects these trade flows. Finally, exchange rate uncertainty also affects the level of imports and exports. The relative importance of these pathways differs greatly by crop product and region. Therefore, the extent of the impact of exogenous uncertainty on crop markets also varies by crop and region.

In the EU-N13, uncertainty in coarse grain production is mainly driven by maize, which represents 21% of total coarse grain production for the EU-28. Other coarse grains such as barley and oats are less subject to uncertainty.

Uncertainty regarding wheat production originates largely from common wheat in the EU-N13, which represents about 27% of total wheat production in the EU-28 in 2023 (of which only 6% is durum wheat). The most uncertain individual component of oilseeds is soybean production in the EU-N13. However for 2023, EU-N13 soybean production accounts for less than 2% of total EU oilseed production. Rapeseed, whose production in the EU-15 and EU-N13 represents 49% and 20% of the total EU oilseed production respectively, is the commodity that drives uncertainty in oilseed production. By contrast, sugar beet and sugar production are relatively unaffected by macroeconomic and yield uncertainty in both EU-15 and EU-N13.

Graph 8.9 Impact of combined macroeconomic and yield uncertainties on production of the main arable crops (CV_{2023}, %)



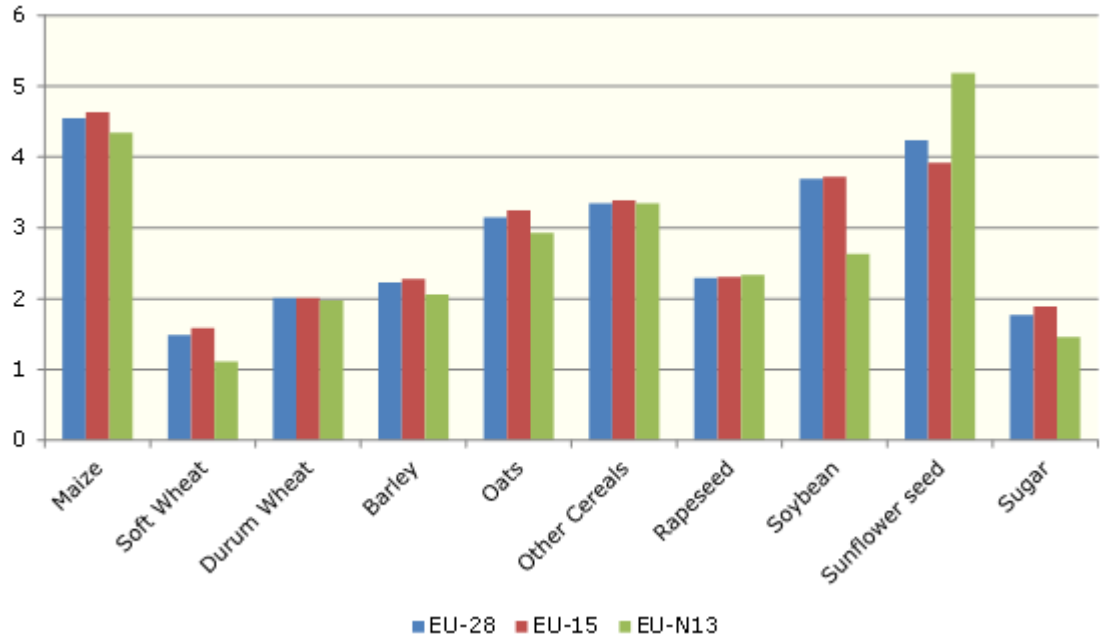
Consumption of crop products is less subject to uncertainty than production. The main pathway whereby macroeconomic and yield uncertainty affects consumption is via market price whilst income elasticity of demand for these products is low. There might be however substitution effects concerning feed.

The crop with the most uncertainty on the demand side is maize. This is linked to the production uncertainty and to its importance for biofuels and animal feed. While maize can be replaced by other grains like wheat in these two uses, the degree of substitution is not high enough to dilute this effect fully.

Sunflower seed, which represents 20% of the total demand for oilseeds in the EU-28 for the year 2023, is the oilseed whose demand is most exposed to macroeconomic and yield uncertainty. Indeed, sunflower seed is mainly used for animal feed and substitutes well for other oilseeds such as soybean and rapeseed.

Thus, some of the uncertainty in sunflower seed demand is transmitted from the markets for these other oilseeds.

Graph 8.10 Impact of combined macroeconomic and yield uncertainties on consumption of the main arable crops (CV_{2023}, %)



Since coarse grains, wheat and oilseeds can to some extent substitute for each other on the demand side; it is interesting to look at the impact of uncertainty on their production and consumption at a more aggregated level (see Graph 8.6 above). Clearly, the commodity aggregates are less subject to uncertainty than are the individual single crops. Oilseeds and coarse grains are the most subject to uncertainty, followed by wheat, sugar and rice. Interestingly, the uncertainty in the oilseed market is not fully transmitted to the markets for protein meals and vegetable oils. This is because EU protein meal and vegetable oil processing relies not only on domestic production but also on oilseed imports for crushing.

Concerning imports (Graph 8.11), coarse grains are the crop commodity most affected by uncertainty. This is mainly driven by maize; in 2023 it accounts for 90% of total EU-28 coarse grain imports.

The composition of wheat imports in 2023 is one third durum wheat and two thirds common wheat. Both have similar exposure to uncertainty (the CV_{2023} for wheat imports is around 17%); nonetheless, the impact of this uncertainty on the domestic market is limited since imports account only for 4% of domestic consumption.

The impact of uncertainty on rice imports is low (a CV_{2023} of 1.5%) and similar to the world markets uncertainty. This is because rice imports account for close to 40% of total consumption which is rather inelastic.

The impact of uncertainty on oilseed imports is considerable. Although sunflower seed imports are the most subject to uncertainty it is soybeans which account for 77% of EU-28 imports in 2023 that dominates the uncertainty of the aggregate.

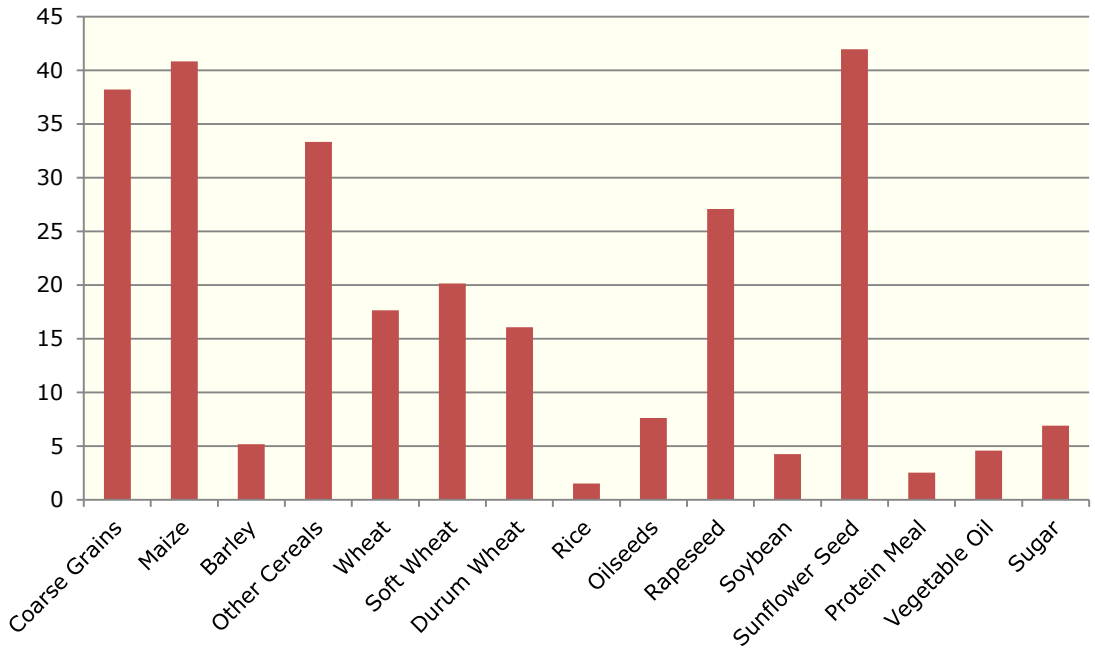
Since imports account for 33% of domestic oilseed consumption, uncertainty from world markets can contribute to the uncertainty affecting EU domestic markets. Much of the uncertainty in the world oilseed markets comes from major exporters (Brazil, Argentina and the US).

Protein meal imports uncertainty is the same as in the world markets, both with a CV_{2023} of 3%, this is because of two reasons. First, imported protein meal projections for the year 2023 in the EU-28 are 48% of the total protein meal consumed in the EU-28. Secondly soybean is the main crop used in the crushing for producing protein meal in the world markets and the EU. Domestic sources of uncertainties are not relevant and therefore the EU market reflects the world variability.

In the baseline, vegetable oil imports account for 33% of the domestic consumption in the EU-28 in 2023, uncertainty in the world market exports is of 2% and imports variation in the EU-28 is of 5%. The differences are because the main source of vegetable oil in the EU is rapeseed oil while in the world markets palm oil is more concerned.

Finally, sugar imports represent 11% of the domestic consumption and have a CV_{2023} of 7%, which is higher to the world markets uncertanity (CV_{2023} of 5%). This is because the share of raw sugar imports and white sugar import in the EU-28 and the world markets are different.

Graph 8.11 Coefficients of variation for imports of main crops in the EU in 2023 (CV_{2023}, %)



The impact of uncertainty on EU commodity exports is in general greater than the impact on imports. This is because imports are driven by domestic consumption which is quite inelastic whereas export performance depends on the quantity harvested and on the EU competitiveness on the world market.

The CV_{2023} of coarse grain exports at 19% is the net result of those of maize, barley and oats exports. In year 2023, barley accounts for the largest share (73%) of coarse grain exports, followed by maize (23%). As EU barley production is more stable than the other coarse grains, its exports are less uncertain. The CV_{2023} of EU wheat exports (17.5%) is close to that of EU wheat production (18%) and much greater than that of world wheat exports (3.5%), suggesting that the uncertainty in EU wheat exports is generated on the EU market and that the uncertainties affecting third countries' wheat exports partly offset each other.

Concerning sugar exports, which represent 11% of domestic production, since the EU world market share is only 3%, uncertainty generated within the EU is not transmitted to the world markets.

In conclusion, the variation is larger in production than in consumption; this is because production is affected directly by yield uncertainty, as well as indirectly by macroeconomic uncertainty (via production costs). By contrast, consumption responds mainly to uncertainty in GDP and CPI, but is less elastic in response to price changes, so that overall it is less subject to uncertainty. Concerning imports the crops for which imports represent a large share of the EU domestic production (e.g. soybean, protein meals and rice) the variation is similar to the world level and lower than for crops where variation in the domestic production has a stronger effects on trade (e.g. maize).

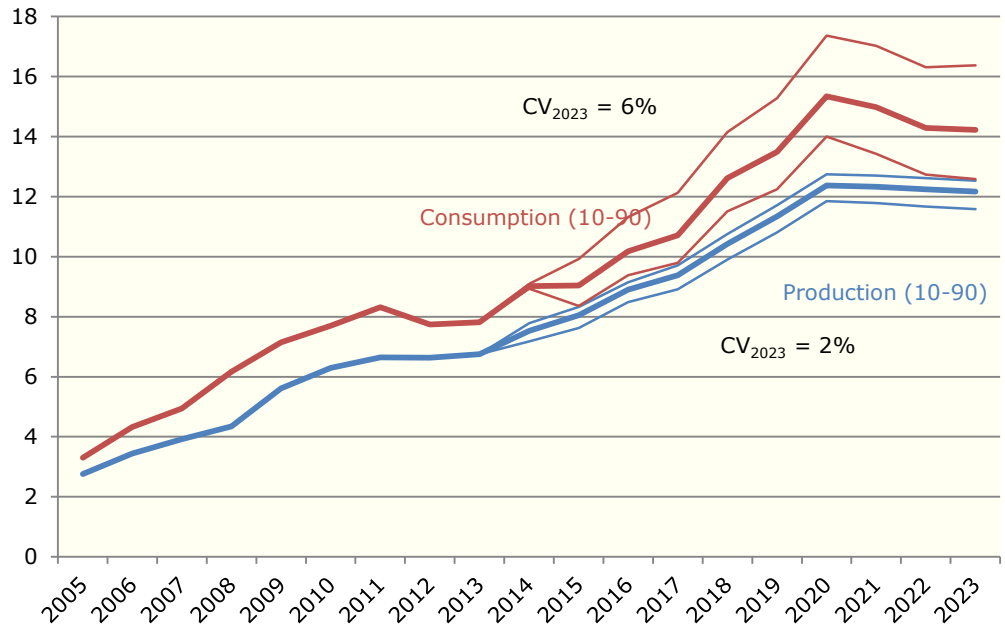
8.2.3. Biofuels

As described in the first part of this report we assume that within an unchanged mandate (10% of transport energy consumption from renewable sources), biofuels will contribute to 8.5% and the remaining energy used will come from other renewable sources (e.g. electricity). In addition, more macroeconomic variables are treated to be uncertain than in previous outlook exercises. The result is that EU production and consumption of biofuels are found to be less subject to uncertainty.

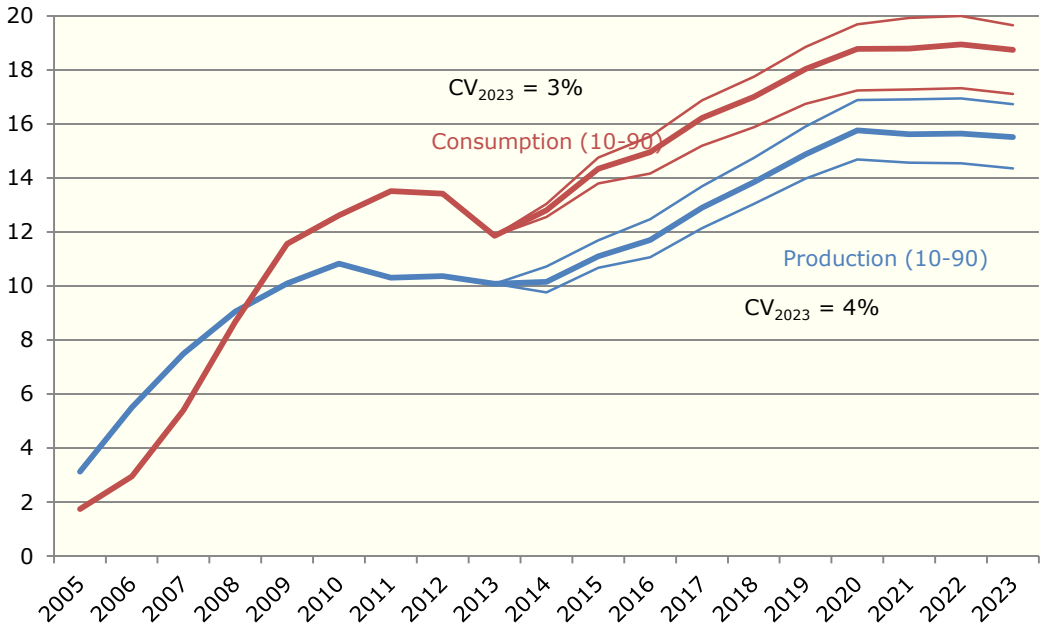
Graph 8.12 and Graph 8.13 show the evolution of EU production and consumption of ethanol and biodiesel over the projection period.

Consumption, within the 80% draws around the baseline is more uncertain than production because of the impact of oil price on the total fuel consumption. In most cases, the EU does not manage to fulfil the part of the mandate assumed (8.5% of total energy for transport by biofuels) with its domestic biofuel production. In only a very few number (0.2% of the cases) of extreme situations, the ethanol production exceeds the domestic consumption and this is never the case for biodiesel.

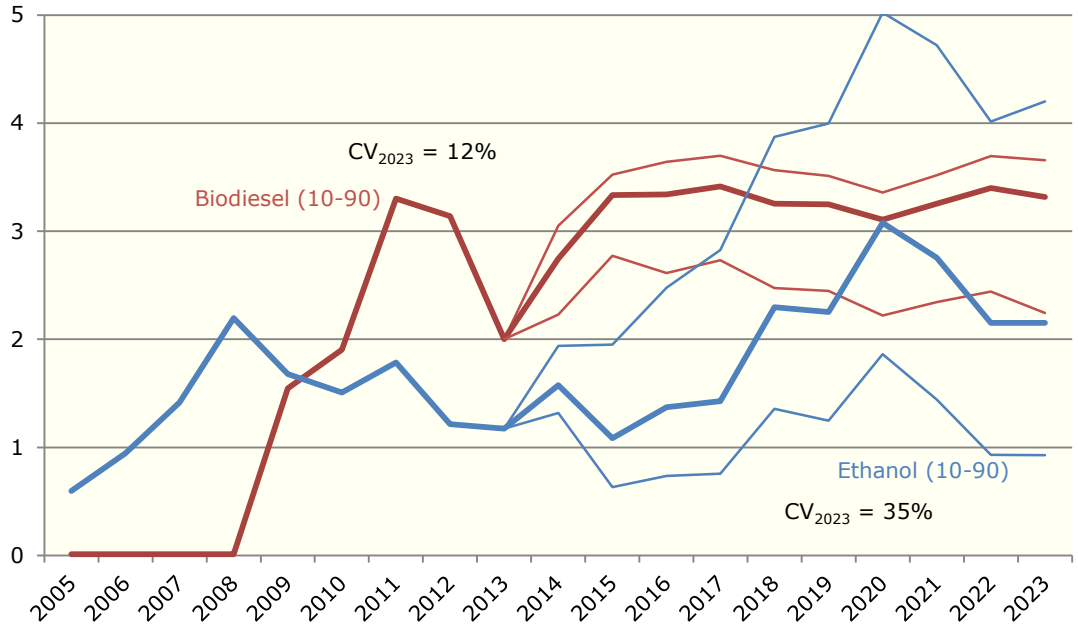
Graph 8.12 EU production and consumption of ethanol (Baseline, 10th percentile and 90th percentile), (billion litres)



Graph 8.13 EU production and consumption of biodiesel (Baseline, 10th percentile and 90th percentile), (billion litres)



Graph 8.14 EU imports of ethanol and biodiesel (Baseline, 10th percentile and 90th percentile), (billion litres)



This situation implies an adjustment via trade (Graph 8.14), particularly imports of biofuels, which is much more uncertain than production and consumption. This is particularly true for ethanol imports, whose CV_{2023} due to macroeconomic and yield uncertainties combined is 35%. The specific import peak in 2020 corresponds to the moment when the maximum energy share of biofuels is expected to be reached. In addition, with increasing contribution of double-counted second generation (including waste oil based) less biofuels are needed to obtain the same calculated energy share as from this moment.

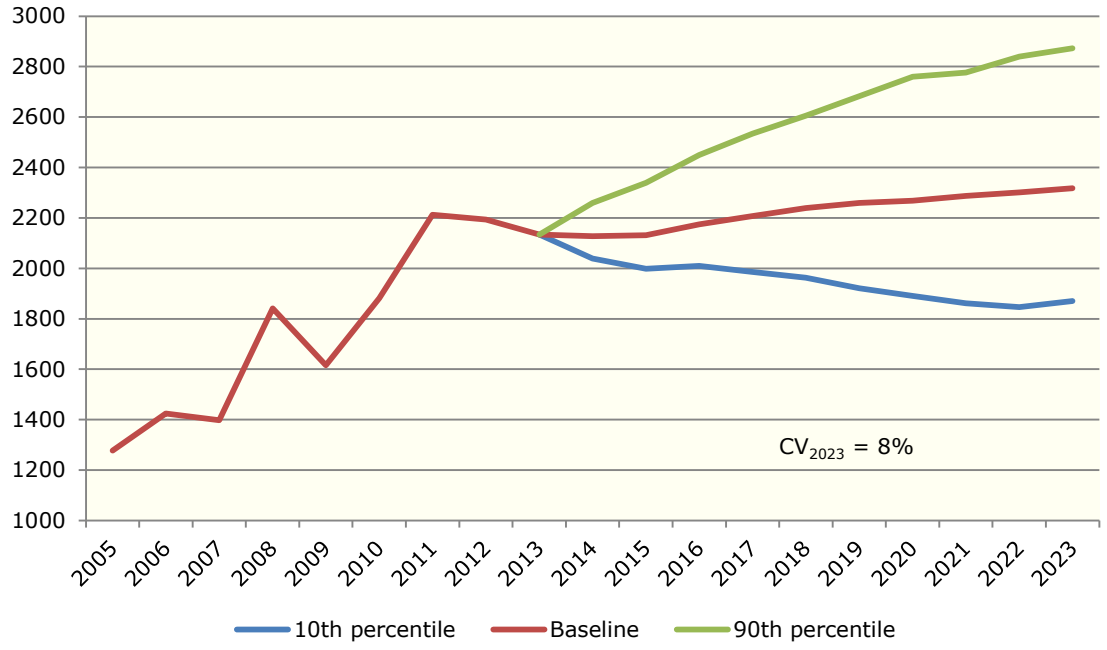
8.2.4. Meat

As already seen, meat production and consumption are not subject to a large uncertainty due to macroeconomic or yield uncertainties. For ruminants, this is partly due to supply lags and multi-period herd dynamics. However, as in the other sectors, meat trade volumes are subject to more uncertainty, as this is the variable that adjusts faster than supply and demand. In addition, important sources of uncertainty for meat sectors are no covered, such as the impact of animal health crisis or other food safety concerns.

The EU remains a large net pig meat exporter

The EU is a net exporter of pig meat, for which macroeconomic conditions are the greater source of uncertainty. Even in the worst cases, for example in case of a strong appreciation of the Euro, export prospects in 2023 do not fall below the 2008-10 level.

Graph 8.15 EU pig meat export and uncertainties ('000 tonnes)



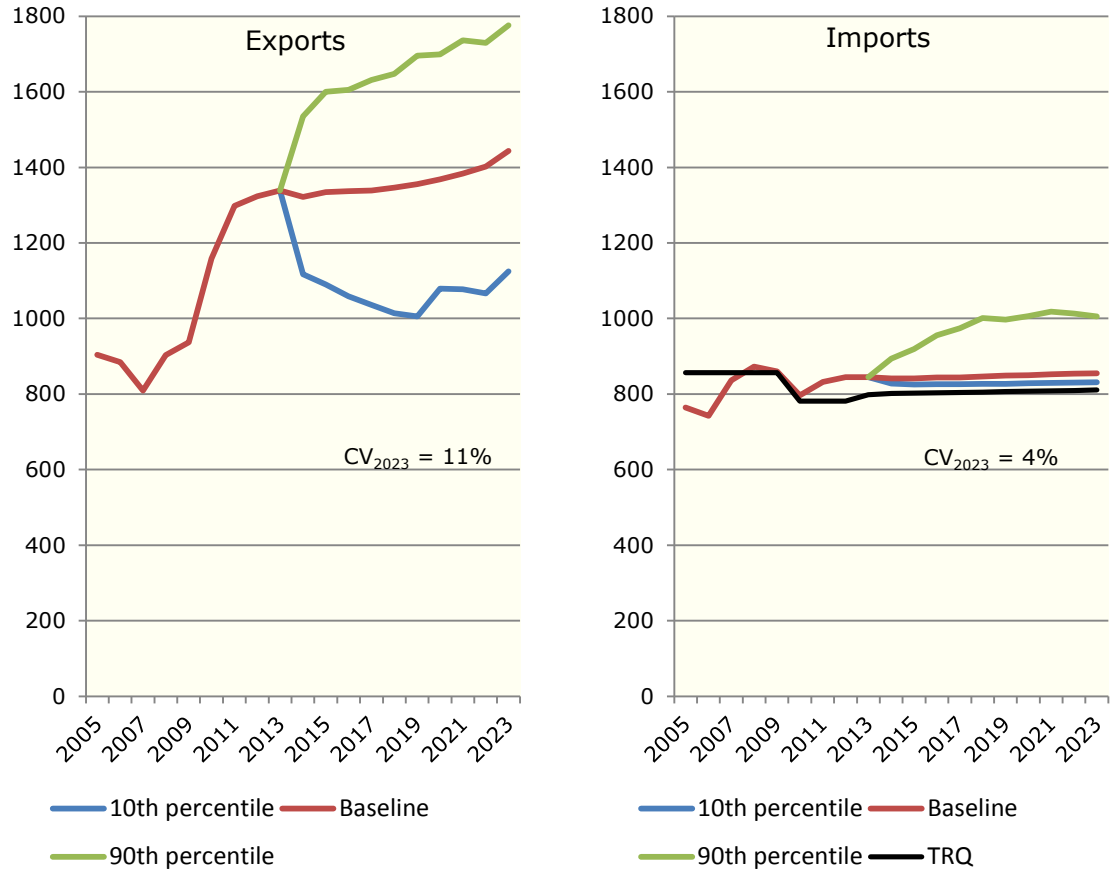
EU Poultry meat exports are always likely to exceed imports

The EU both imports and exports significant quantities of poultry meat, although in fact the two trade flows do not relate to a homogeneous product: the EU exports cuts which are not so much consumed in the EU (like wings) and imports 'noble' cuts like breast. Moreover, imports are limited by preferential tariff quotas (TRQs), as shown in Graph 8.16. In 2023, the EU poultry meat imports exceed the TRQ by more than 5% in more than half of the cases; the 90th percentile of simulated imports for this year report representing a 25% overshoot of the TRQ limit. EU exports, on the other hand, are more uncertain, with a CV_{2023} of 12% that derives principally from macroeconomic uncertainties that create fluctuations in the relative competitiveness of the main competitors (US, Brazil) on the dynamic Middle Eastern and Asian markets. In any case, the EU would remain a net exporter throughout the period in all macroeconomic and yield contexts.

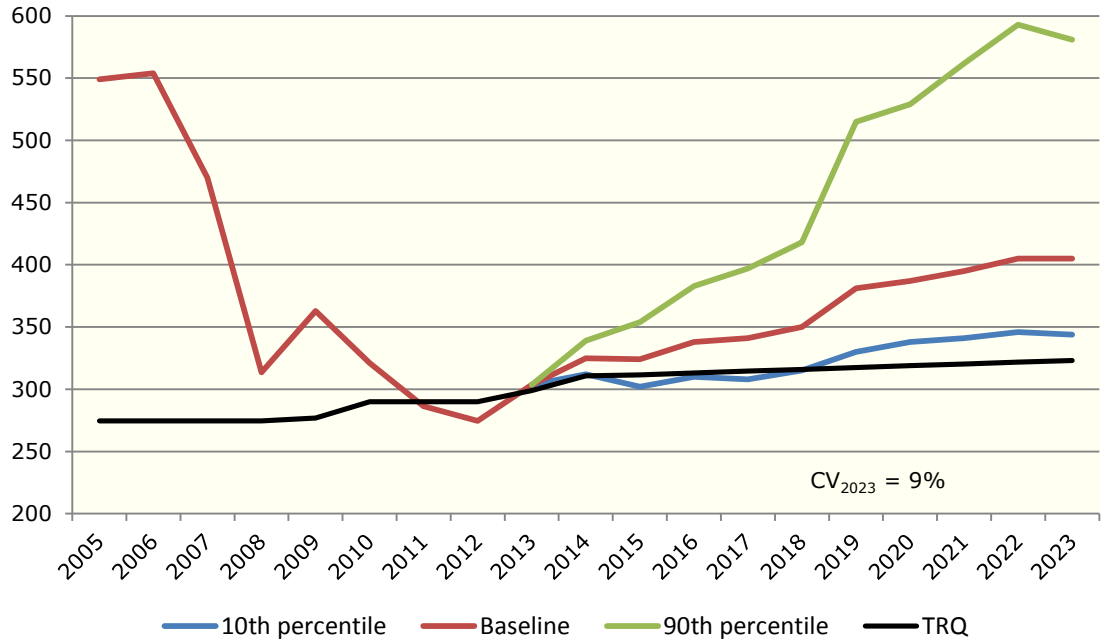
The EU Beef and veal meat imports are likely to increase

The EU is likely to remain a net importer of beef throughout the period 2014-23, whatever the macroeconomic and yield context. Imports are subject to a TRQ: however, as shown on Graph 8.17. EU-28 total beef meat imports often exceed the aggregate TRQ limit. Processed meat imports are always imported outside TRQs; therefore it does not mean that all the TRQ of fresh and frozen beef meat would be filled every year. With time, the frequency with which the total beef meat imports exceed the TRQ for fresh and frozen meat is increasing and, in 2023, this is nearly systematically filled, showing that imports of fresh and frozen beef meat outside TRQs is likely to occur as it did, and to a large extent, before 2007.

Graph 8.16 EU exports and imports of poultry meat ('000 tonnes)



Graph 8.17 EU imports of beef and veal meat ('000 tonnes)



EU Sheep and goat meat imports are staying lower than in the past

Unlike poultry meat and beef, the TRQ of sheep and goat meat is not expected to be filled in any of the macroeconomic and yield contexts simulated, and imports are likely to continue slightly decreasing. However, the EU remains a net importer in all cases and in addition, the main uncertainty of Oceania grass-fed sheep meat production is related to grass production, uncertainty not considered in this exercise.

8.2.5. Dairy products

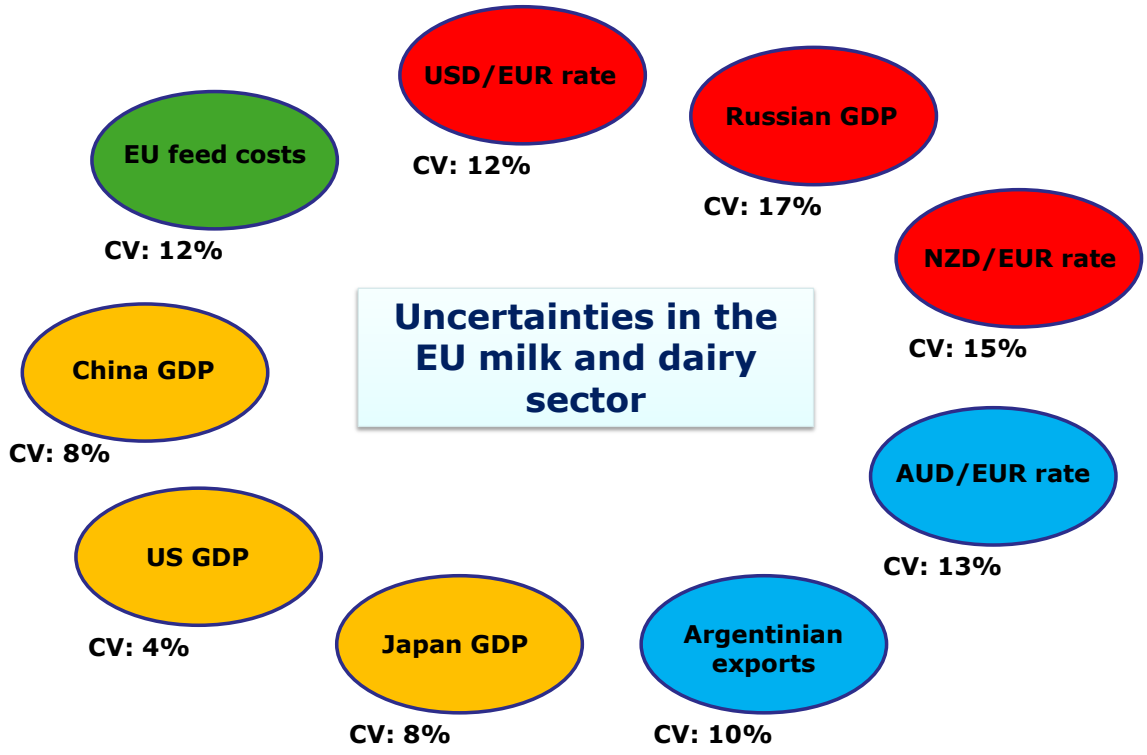
The major sources of uncertainty for milk and dairy products indicated by the analysis come from the USD/EUR exchange rate and from economic developments outside the EU. The EU dairy products are significantly traded internationally, in particular powders and, to a lesser extent, cheese and the domestic market situation depends strongly on the economic development of main importers and main competitors in the world market of dairy products. Graph 8.18 gives an overview of the uncertainties to which the sector is exposed. The key drivers (identified through an analysis of correlation of exports of dairy products with the stochastic variables) drivers are in red: the EU exchange rate has a strong and direct effect on the competitiveness of dairy exports; Russian GDP is the indicator of the purchase power of the consumers in Russia, the major market of EU cheese exports; and the New Zealand exchange rate towards the US dollar affects strongly the competitiveness of the main competitor in the world market. The diagram also presents other important competitors (in blue) and consumers (in yellow) of the EU dairy products, as well as the estimated uncertainty around the feed costs in the EU. It can be observed that the sector is exposed to sources of high uncertainty (i.e. USD/EUR, CV2023: 12%; Russian GDP, CV2023: 17%; and USD/NZD, CV2023: 15%).

Graph 8.19 presents the estimated uncertainty for production, consumption and exports of the products in the sector. It can be observed that supply and demand present low uncertainty while exports expose higher uncertainty. However, SMP and WMP present a higher CV_{2023} than other dairy products. This occurs because the shares of exports with respect to domestic production is large for powders (around 50%), because the prices of these products present higher uncertainty and the reaction of these products to those price changes is strong.

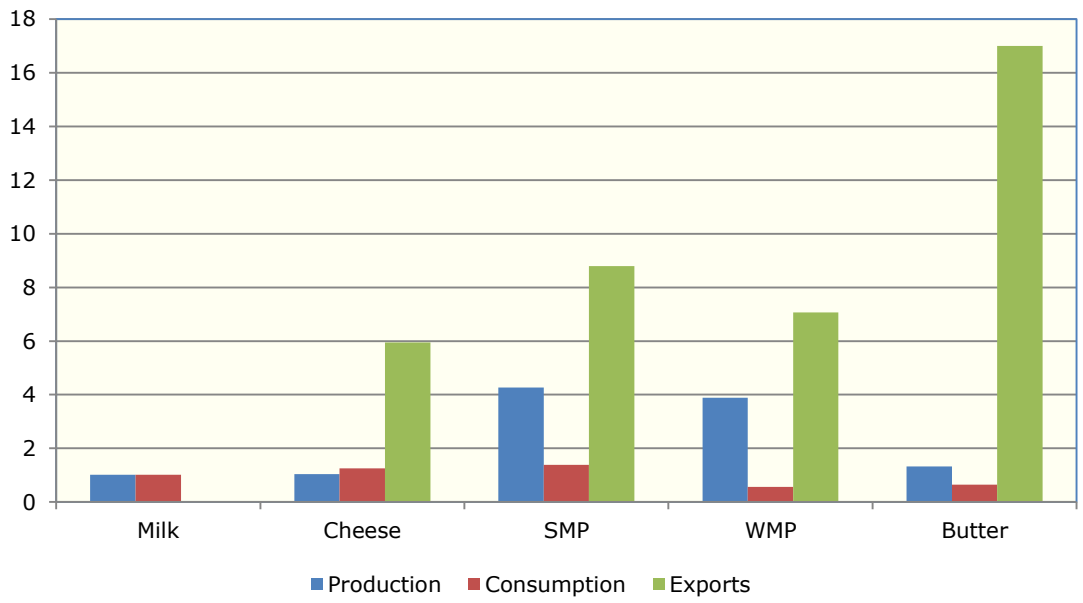
Butter presents high variation of exports in percentage but the quantities exported are not large (+34 000 tonnes compared to the baseline in the 90th percentile). Moreover, the projected share of butter exports with respect to domestic production is small; thus, export variability has lower effects on domestic prices than for SMP and WMP.

Variability of milk production is low. Milk main sources of uncertainty are the output prices which are connected to the developments of the dairy products and the uncertainty of feed costs. It has to be born in mind that the uncertainty around pasture and fodder which affects directly the supply of milk has not been considered in the partial stochastic analysis.

Graph 8.18 Main sources of uncertainty and their coefficient of variation (CV_{2023}) for milk and dairy products



Graph 8.19 Impact of combined macroeconomic and yield uncertainties on production, consumption and exports of milk and dairy products in 2023 (CV_{2023}, %)



9. Analysis of specific uncertainty scenarios

9.1. Definition and choice of the uncertainty scenarios

As well as considering the full range of uncertainty depicted by the 599 simulations analysed in the last section, it is also of interest to consider how baseline values might be affected if certain key stochastic variables were to take specific values within their spectrum of uncertainty in a given period. This involves selecting a subset of the 599 simulations for which the selected variable or variables fall within a given range and examining what this implies for market and trade outcomes. Thus, the direction and magnitude of deviations from the baseline that would occur if 'less likely' conditions[19] were to prevail can be assessed.

The first step in this analysis is to identify the situations of interest (scenarios) and translate them into range of values for specific variables. This then permits the selection of the corresponding subset of simulation runs representing each scenario. With such approach, many different alternative scenarios to the baseline projection can be assessed. In defining these ranges, it is always assumed that 'appreciably lower/higher' excludes situations characterised by 'extremely low/high' values. Hence, simulations for which the values of the variable of interest fall below its 10th percentile or above its 90th percentile are never included. It must also be decided whether to define the situation in terms of the values taken in a given year (say, 2023) or the average value over several years. Ultimately, this choice would be made by the user. For the analysis presented here, the subset is always defined for the year 2023 alone.

It should be borne in mind that the statistical distributions of some stochastic variables are correlated and these correlations are reflected in the 599 simulation results. For example, if a subset corresponding to higher-than-average US maize yields is selected, US soybean yields will also be above average in this subset because of the strong positive correlation between these two yields, even though the values taken by US soybean yield have not been constrained in the subset. It would therefore be important not to interpret the whole deviation from baseline outcomes to less usual US maize yields alone. It is also possible to combine conditions on several variables in order to explore what happens when less likely states of the world overlap (e.g. higher-than-average US maize yields and appreciably higher world market oil price).

The four different subsets chosen for the analysis are the following: (i) lower than expected oil price, (ii) stronger than expected euro relative to the US dollar, (iii) combination of lower growth than expected and a weaker national currency in Brazil and (iv) combination of a stronger than expected oil price with either unusually good or depressed maize yields in the US. For each subset, the corresponding simulation results for the most relevant products are summarised and compared with the baseline outcome.

[19] Burrell and Nii-Naate, 2013

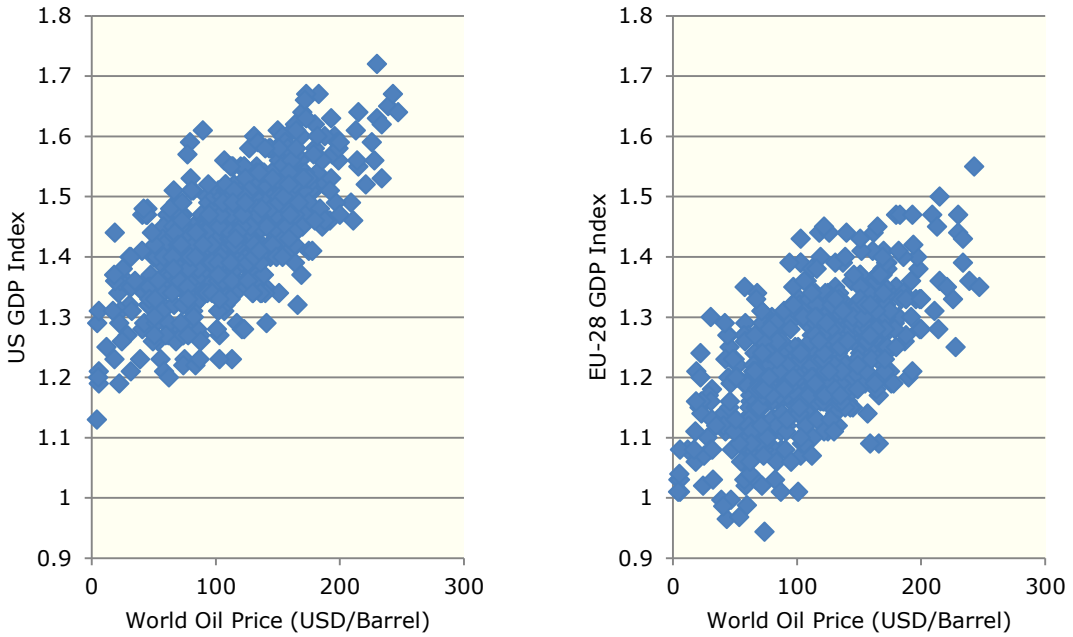
9.2. Lower crude oil price

The development of the oil price is positively correlated with the overall economic performance of most countries. Furthermore, it affects their terms of trade depending on the mix of goods that they export and import. Agricultural commodities are influenced by the oil price via two routes: the oil price is a driver of agricultural production costs (e.g. fertiliser, machinery costs), but is also positively correlated with commodity prices, via the current link between agricultural and energy markets mainly due to biofuel policies.

Despite the general assumption that the oil price will continue its upward trend at least in nominal terms, oil- exporting countries have been quite conservative or even negative about future trends. For example, the Russian Ministry of Finance see oil price going down to 80 USD/barrel in 2030, whereas Saudi Arabia and Venezuela expect close to the 100 USD/barrel (for an unspecified future).

In this analysis, we define 'weaker oil prices' in 2023 to mean a range of values between the 20th and 40th percentiles of this variable, which translates into the range 72-102 USD/barrel (in comparison with the baseline assumption of 116 USD/barrel). Imposing this condition on the results for 2023 yields a subset of 118 simulations, for which the average oil price is 87 USD/barrel (25% below the baseline). As a direct result of the lower oil price, average fertiliser price within the subset is 14% below that of the baseline. Depending on the fertiliser requirement for each crop, this impact is passed through to crop and feed prices.

Graph 9.1 Relationship between the World Oil Price and the GDP Index in the US and the EU, 2023



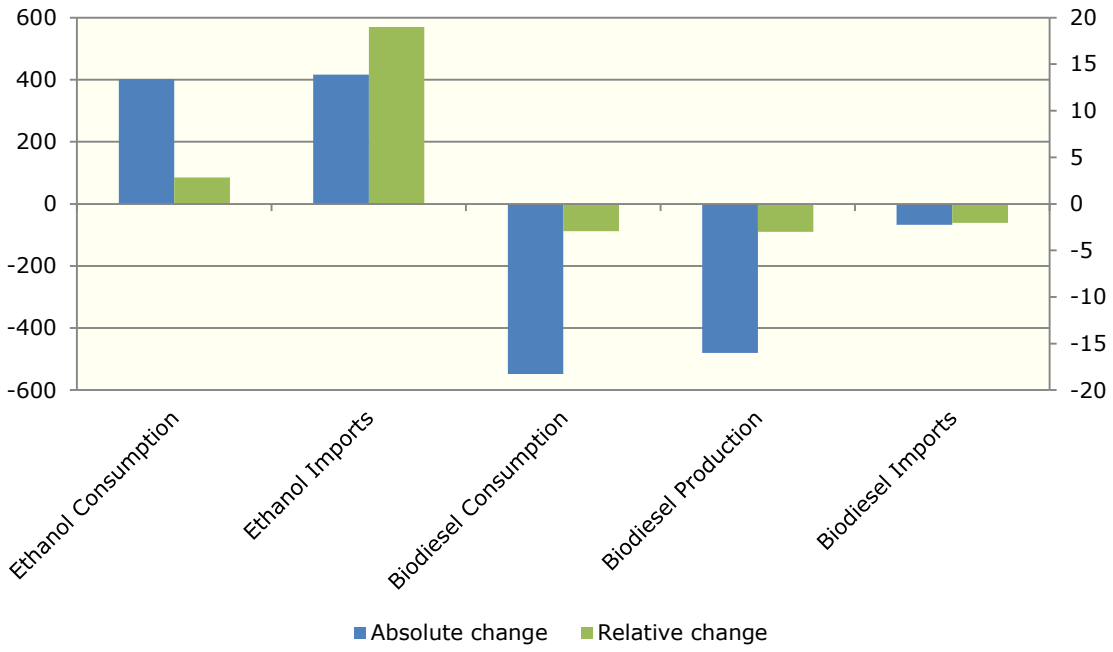
Although in this scenario only the oil price has been constrained to lie within certain boundaries in 2023, other macroeconomic indicators in this subset will also tend to be pushed away from their assumed baseline values because of their strong correlation with the oil price. Specifically, GDP growth across the world is below assumed baseline values and this is particularly so for large economies including

the EU-28, Canada, the US and Russia. Thus, although the low oil price might be expected to reduce input costs and hence boost production, the correlations between macroeconomic variables observed in the past and incorporated into the analysis provide an overwhelmingly different picture. Graph 9.1 shows these correlations for the US and the EU-28 in 2023.

Therefore, the deviations from the baseline in this subset not only show the impact of a weaker-than-expected oil price, but also of changed underlying conditions for other macroeconomic indicators that tend to move with the oil price. Hence, the impacts on market outcomes are net impacts, which take account of a number of underlying changes that may partially offset each other.

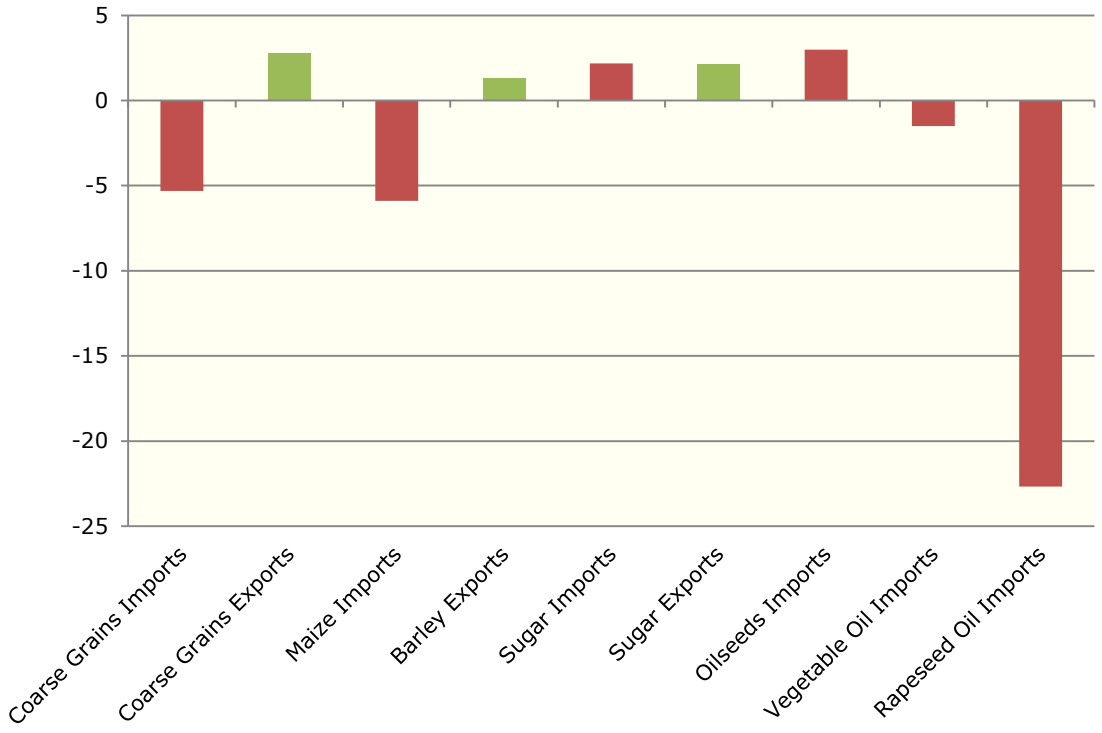
A weak oil price increases EU ethanol consumption by 3% in 2023 with respect to the baseline; this is equivalent to 417 million Litres (see Graph 9.2). The increase in the demand affects the EU ethanol imports, which increase by 19% or 402 million litres in the same year. As most of the extra demand is satisfied by imports, EU ethanol production and its feedstocks (coarse grains, wheat and sugar beet) for producing biofuels are only marginally affected. Concerning biodiesel, the weak oil prices drive both consumption and production downwards by 3% in 2023 with respect to the baseline, equivalent to respectively 550 and 480 million litres for consumption and production. The gap between biodiesel production and consumption is reduced by 70 million litres, which represents roughly- 2% for biodiesel imports. This is because weaker oil prices imply that biodiesel is substituted by ethanol, because the gap between the world and the EU-28 market price for ethanol increases (Graph 9.4). The overall share of energy coming from biofuels is not affected. Importing ethanol becomes more attractive, while for biodiesel, the gap between EU domestic and world market prices is stable and there is no incentive to import more biodiesel.

Graph 9.2 Average absolute (primary axis) and relative change (secondary axis) to the baseline in biofuel production, consumption and trade, 2023 (million litres, %)



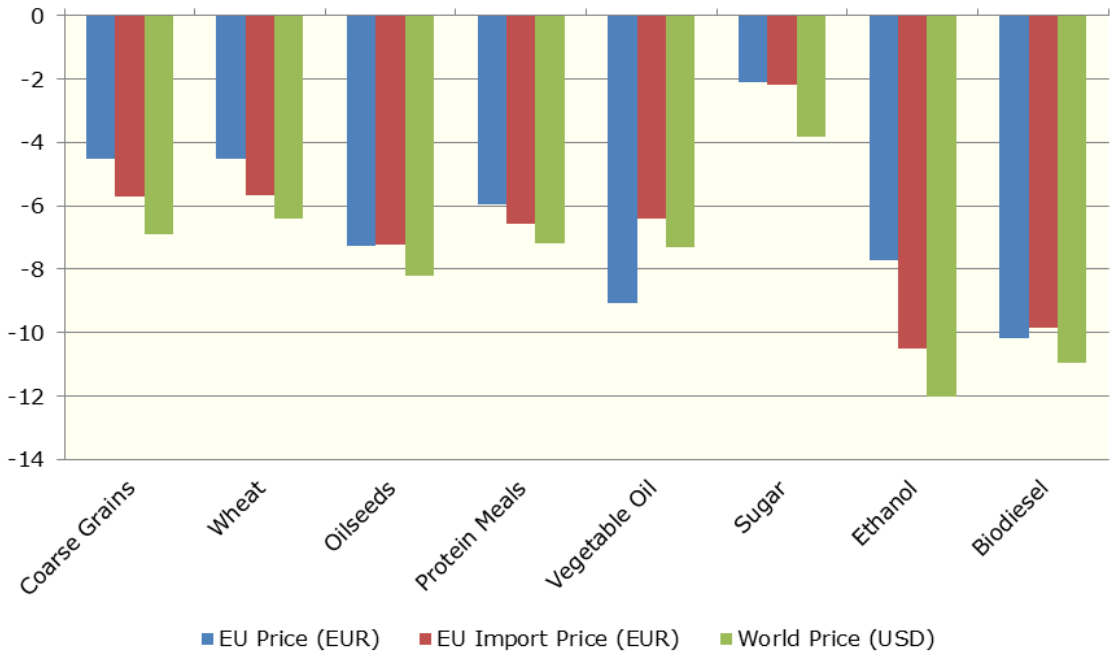
Nonetheless, the weak oil price has an effect on coarse grains trade (Graph 9.3): EU imports decrease by 5% and exports increase by 3%. The changes are mainly linked to maize for which imports decrease by 6% and exports increase by 4.5%; barley and sugar trade balance are not much affected. The effect on oilseeds and vegetable oils production is small, and overall the amount of vegetable oils used in biodiesel production decrease by 3% in the EU-28. Since less vegetable oil is used for biodiesel production, the EU imports of vegetable oils (mainly rapeseed oil) decrease by 1.5%.

Graph 9.3 Average changes relative to the baseline for crops EU imports and exports, 2023 (%)



Overall, with the exception of vegetable oil, world market prices (of the three prices shown in Graph 9.4) are the most affected by weaker oil prices; the slightly smaller change in EU import prices, which are in euros, reflects the fact that, based on historical correlations, the euro tends to appreciate somewhat against the dollar when the oil price weakens.

Graph 9.4 Average price changes relative to the baseline, 2023 (%)



For grains, the fall in EU domestic price is always less than 5%. However, impacts on all prices for oilseeds, meals and oils are greater than those for cereals. This is partly because oilseeds require more fertiliser input than grains and hence benefit more from the lower oil price. Only for vegetable oil is the EU market price fall greater than that of the world market price. However, a cautious interpretation is needed here; the composition of this aggregate in the EU is dominated by rapeseed while on the world market palm oil is the reference crop. Overall, palm oil production is more responsive to oil price and GDP changes than EU rapeseed oil production, especially in the EU-N13. This is because the production of rapeseed is driven by the biofuels mandate. By contrast, sugar is less responsive, both globally and in the EU, to a weak oil price.

The impact of a lower oil price and slower GDP growth is greatest for biofuel prices. Since fossil fuel is now cheaper, biofuel prices will depress in the cases where there is market competition between fossil fuel and biofuel. The mandates operating in many countries tend to reduce this impact insofar as they sustain demand for biofuel even when it becomes less competitive. However, when mandated targets are fixed as a share of transport fuel consumption (as in the EU), lower GDP growth reduces the mandated target. It is notable that for biodiesel, the impact on the EU price is closer to that on the world market price than for ethanol. This is because, relative to ethanol, the EU biodiesel market is more closely integrated into world markets because of greater reliance on imported feedstock, a greater share of imports in final domestic consumption and lower tariffs.

Regarding EU farm income, a weaker oil price lowers farm input prices (energy, fertilisers), thereby reducing production costs. However, these reductions are outweighed by lower commodity prices and the overall value of output, resulting in a 5% decline in real income per AWU, linked to the decrease in all crop prices.

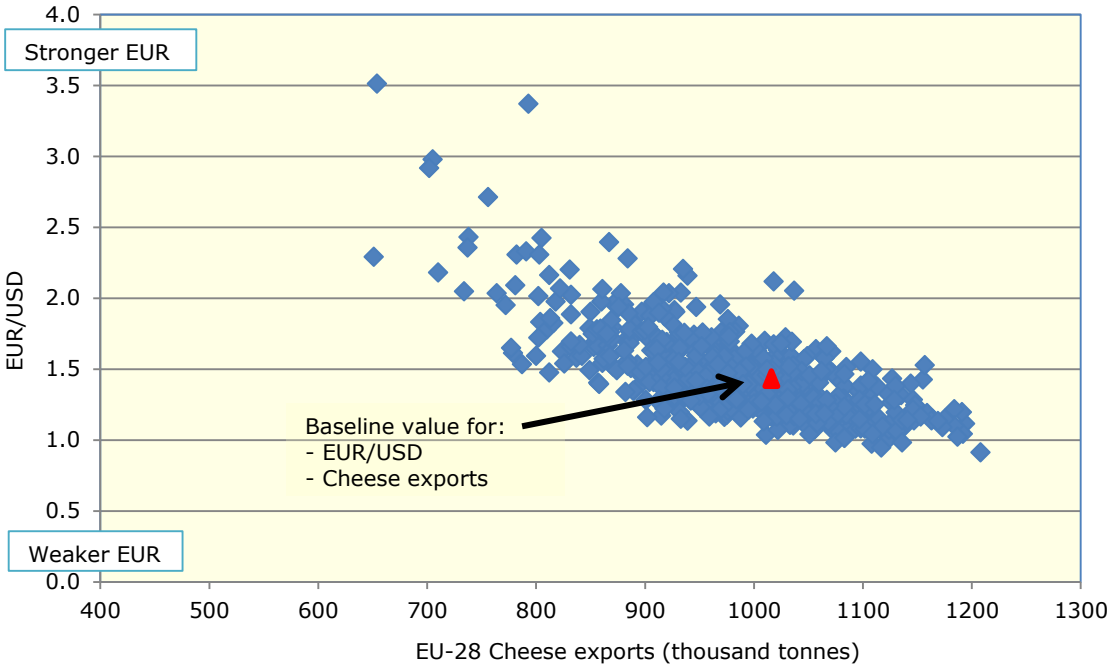
In conclusion, weak oil prices increases ethanol consumption and imports in the EU, such that ethanol substitutes biodiesel. The prices and trade flows for crops are

affected, but such changes are not driven by biofuel production, but rather by the direct effect of weak oil prices on input costs as well as the effect of other macroeconomic uncertainties.

9.3. Stronger Euro (with respect to the US dollar)

The EUR/ USD exchange rate has direct consequences for the capacity to export of the sector. Moreover, it is one of the most uncertain macroeconomic variables for the EU (CV_{2023}=11.5%). However, the magnitude of the impact of a variation in the Euro exchange rate is different for each agricultural commodity, depending also of parallel developments of other macroeconomic variables in the world and EU domestic economies. As an example of the importance of the EUR/USD exchange rate, Graph 9.5 shows how the exchange rate is crucial for one of the EU flagship exports (cheese).

Graph 9.5 EU cheese exports at different levels of the EUR/USD exchange rate, 2023

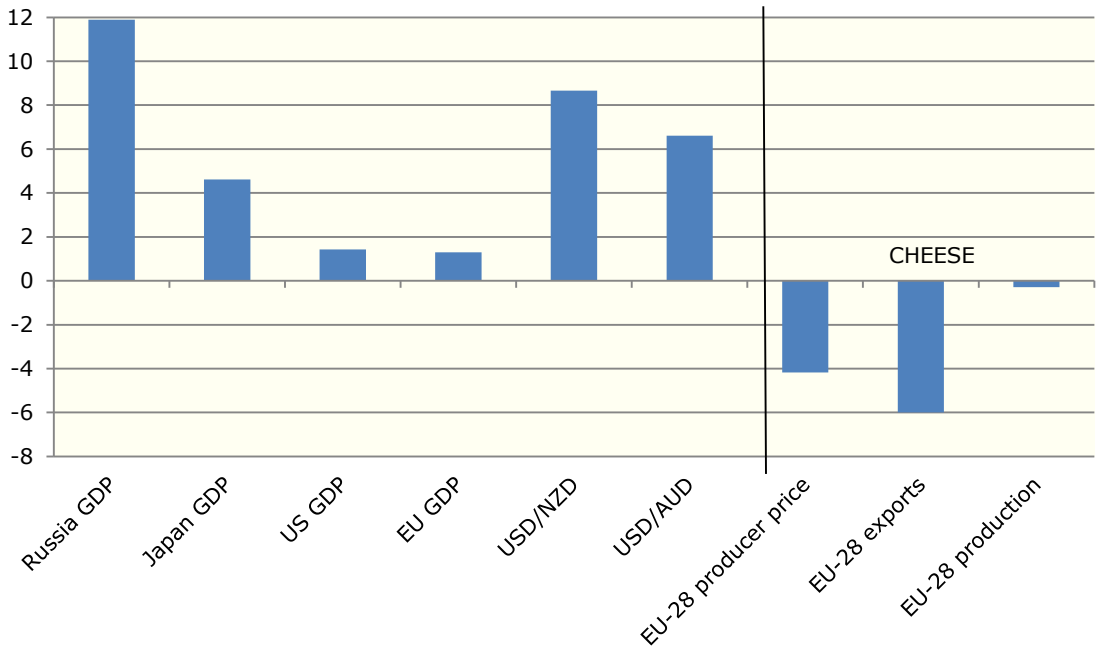


In a possible positive perspective in the EU economic development as well as of uncertain developments in some third countries (e.g. debt issue in the US or slower growth in Brazil), the consequences of a stronger EUR in 2023 with respect to the baseline are analysed. In order to examine this scenario, the subset of simulations for which the USD/EUR exchange rate takes values between its 60th and 80th percentiles is selected, which correspond to the range 1.54 – 1.79 EUR/USD. The subset contains 120 simulation runs.

In the selected subset, other stochastic macroeconomic variables also take different values from those in the baseline, due to the correlations between the distributions of these variables. Changes in these other variables also contribute to pushing outcome variables away from their baseline values. Graph 9.6 shows these differences, relative to the baseline assumptions, for a selection of these other

stochastic variables averaged within this subset, on the basis of past developments. A stronger euro coincides with higher GDP in three of the main markets for EU cheese (US, Japan, Russia) and in the EU and stronger New Zealand and Australian dollars; as an example, these latter changes should have a positive impact on demand for EU cheese imports, thus counteracting the loss in their price competitiveness. The net consequence for EU cheese exports is a fall of about 6%. In summary, the movement of other stochastic variables is important for explaining the results obtained.

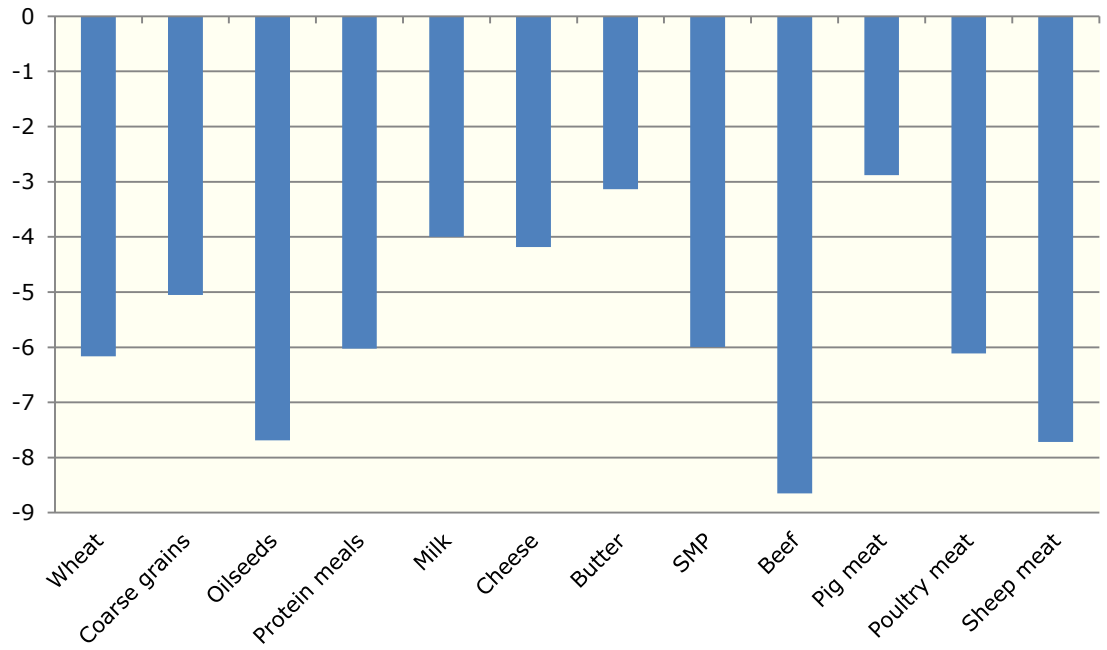
Graph 9.6 Changes relative to the baseline for stochastic variables other than EUR exchange rate and EU cheese outcomes, 2023 (%)



Lower prices and income with a stronger Euro

Graph 9.7 shows the changes with respect to the baseline of agricultural commodities prices. The EU's loss of export competitiveness due to a stronger euro means that, in general, EU exports decrease and EU imports increase, thereby putting pressure on EU domestic prices. However, the size of the decrease for each product depends on the share of trade in its production and consumption. Commodities for which the EU trade is important compared to its production and/or for which internal demand is inelastic (wheat, oilseeds, protein meals, beef, sheep, SMP) are more impacted by exchange rate fluctuations than others. For example, wheat is a heavily traded commodity, but the domestic demand reaction to price changes is low due to its use for food and feed; thus, the stronger Euro has a large effect on wheat prices. Conversely, butter is not traded very much and domestic demand presents a higher sensitivity to price changes; thus, there is low transmission of the world market price uncertainty into the EU domestic market.

Graph 9.7 Change in EU prices relative to the baseline, 2023 (%)



With the general price decrease and despite the decline in input prices and feed costs, average EU income per annual working unit (in real terms) in this subset is 8% lower than the baseline level in 2023.

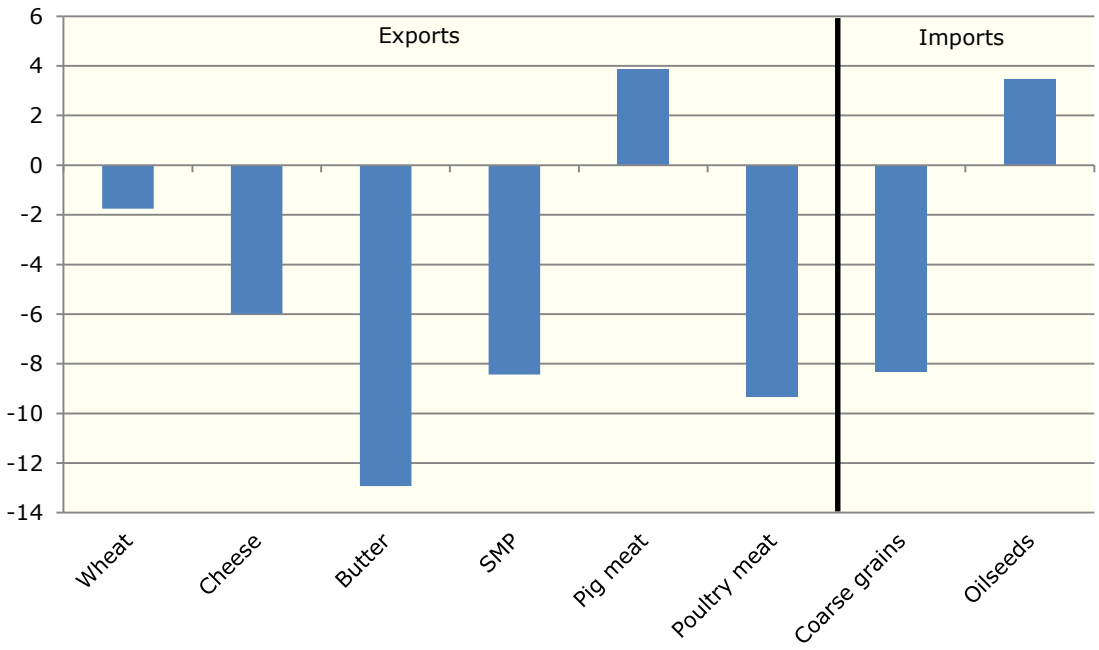
Trade in dairy products and poultry meat negatively affected by a stronger Euro

Exports and imports of different commodities are directly affected in a scenario of a stronger Euro since the world market price expressed in Euro is lower. However, world market prices and relative prices between commodities may be affected simultaneously.

The reaction of EU exports of dairy products and poultry meat to a stronger Euro is clearly negative (Graph 9.8). The EU is a large exporter of dairy products, i.e., 32% and 27% of world exports of cheese and SMP respectively. Thus, even though other macroeconomic variables might partly compensate the effect of the stronger Euro, the net effect on dairy exports is negative. The share of EU poultry meat exports on world exports is not as large (9% in 2023) however the effect of the stronger Euro is not compensated by the developments in other stochastic variables. On the contrary EU pig meat exports are not affected by a stronger Euro. In this case, the parallel increase of GDP in Russia, Japan, China and the US is sufficient to offset the negative impact of the Euro appreciation.

Imports of coarse grains are decreasing in the situation of a stronger Euro. This may be linked to substitution with wheat (more wheat may be used for feed reducing the demand for coarse grain for feed and therefore their imports) and to a decrease of EU meat production.

Graph 9.8 Change in EU-28 trade relative to the baseline, 2023 (%)



9.4. Growth slowdown and currency depreciation for a major exporting country: an illustration with the case of Brazil

The purpose of this scenario is to assess the impact of a change in the position of a major agricultural products' exporter and the example of Brazil illustrates this situation. Brazil enjoyed a dynamic growth and saw an appreciation of its national currency in the first ten years of the 21st century. However, more recently, the growth rate slowed down in particular in 2009 and 2012, in addition the country experienced some social unrest, and, since 2011, the Brazilian real (BRL) started to depreciate itself relative to the USD. Given the importance of Brazil in world agricultural markets, it is interesting to explore a situation where Brazil would face a slower economic growth and a weaker currency than expected until 2023. The combination of these phenomena implies slower domestic consumption growth and increased competitiveness for Brazilian exports.

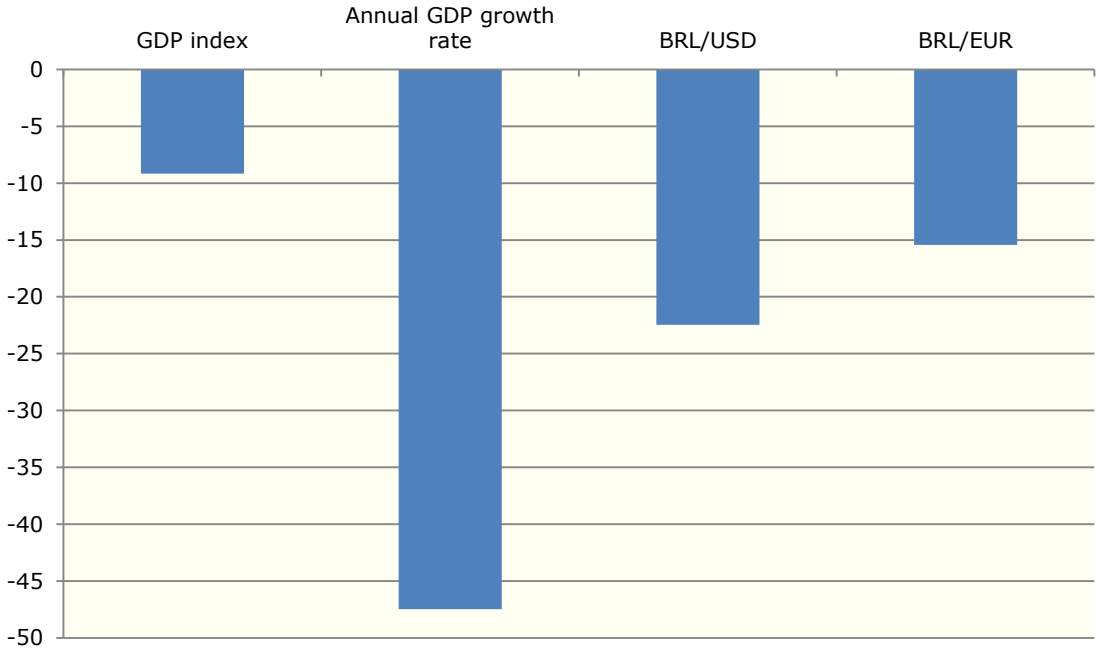
The subset designed to represent this situation comprises 44 observations. Its exact boundaries are described in Table 9.1. The averages within the subset for Brazil's GDP index and the BRL/USD exchange rate are 9% and 22%, respectively, below their 2023 baseline values.

Table 9.1 Subset Brazil lower growth and weaker national currency

	BASELINE (2023)	SUBSET (2023)		
		Mean	Lower boundary 10th percentile	Upper boundary 30th percentile
BRL/USD	0.38	0.29	0.27	0.32
GDP Index	1.93	1.75	1.67	1.82

Because the draws of the stochastic variables are correlated on the basis of past developments, other macroeconomic variables are different from their baseline values. In this subset, the euro and the Russian rouble are also weaker against the US dollar: overall, the real is also weaker against the euro and the rouble. For the BRL/EUR exchange rate, the depreciation is around 15% in 2023 relative to the baseline. GDP in other emerging countries is also different from the baseline in this subset, in particular for Russia (-6%) and China (-10%), as well as in the EU-15 (-4%).

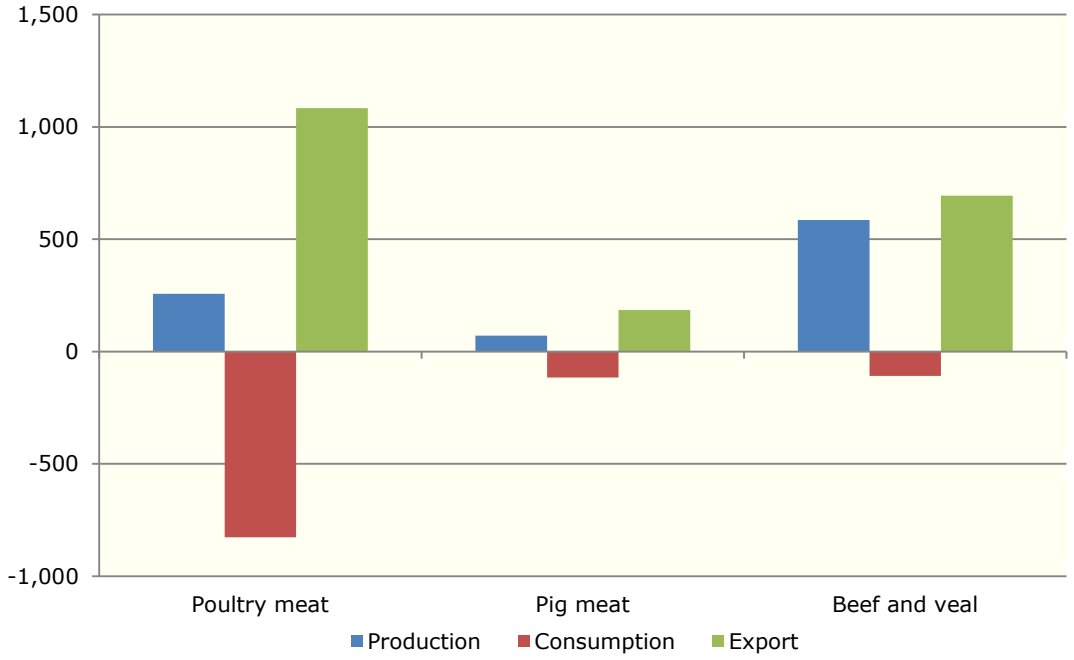
Graph 9.9 Difference (%) between the subset and the baseline for the exchange rates (BRL/USD, BRL/EUR), GDP index and annual growth rate in Brazil, 2023



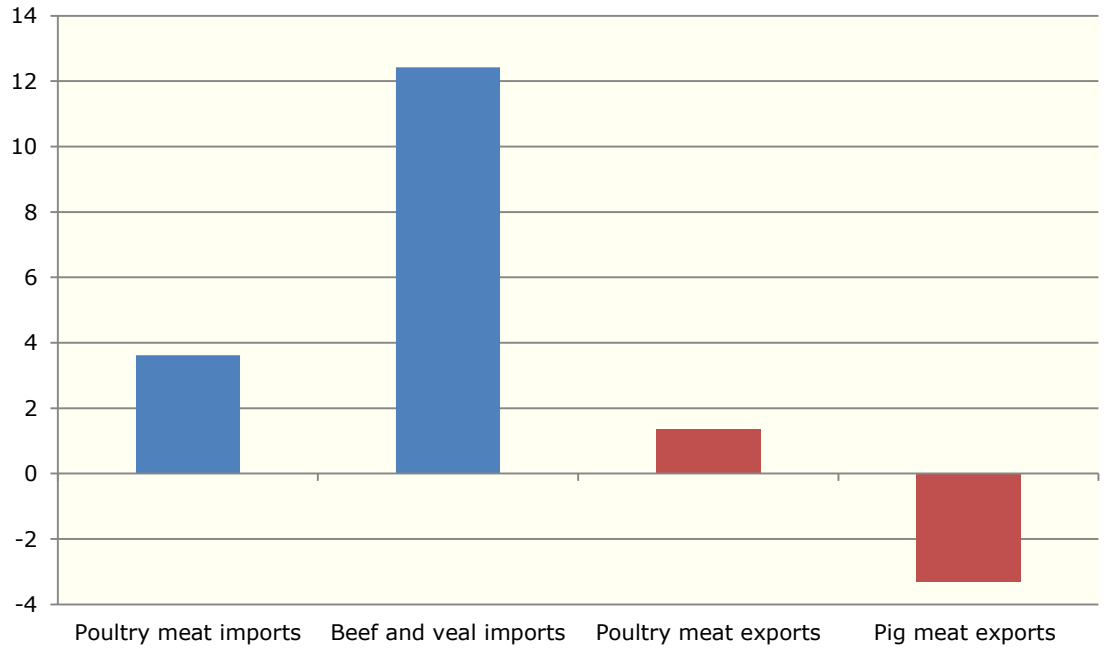
The following discussion concentrates on the consequences for EU meat products, including trade flows and prices, because Brazil is a key player in these sectors, particularly poultry and beef. As the scenario relies on macroeconomic variables for which the uncertainty is cumulating over the time, the variation in 2023 captures the effects of the scenario which applies as from the beginning of the projected period.

In Brazil (Graph 9.10) the meat consumption decreases, as expected due to the lower disposable income, for all types of meat, but more for poultry meat (-830 000 tonnes, which means -7%). On the contrary, production increases for all types of meat, particularly for beef (+ 685 000 tonnes, which means +6%), driven by a rise in Brazilian exports of all types of meat boosted by the depreciation of the Brazilian currency.

Graph 9.10 Evolution of production, consumption and exports of meat products in Brazil relative to the baseline, 2023 ('000 tonnes)



Graph 9.11 Changes in EU total meat trade relative to the baseline, 2023 (%)

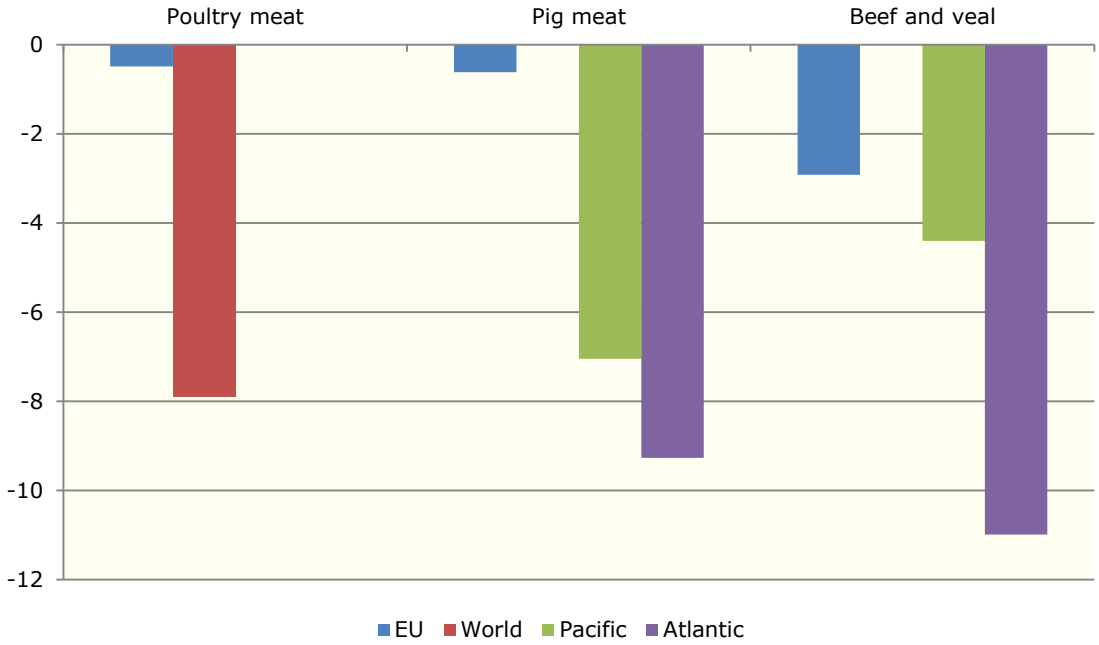


The state of the Brazilian economy assumed in this scenario has different impacts on individual EU meat markets (Graph 9.11), with an overall slight increase in EU meat net imports. However, the loss of export markets by European producers at the benefit of Brazilians implies a negative impact on EU domestic prices. Concerning poultry, both EU imports and EU exports increase and, overall, net EU

exports decrease slightly by 2% in 2023 (-12 000 tonnes). EU pig meat exports decrease by 3.6% (-87 000 tonnes). EU beef imports are more affected, increasing by more than 12% (+50 000 tonnes above the baseline), meaning that fresh and frozen meat is entering the EU also at full tariff like what happened between 2005 and 2007. For all types of meat, the EU production decreases, by respectively 0.5% for pig meat, 0.8% for poultry meat and 0.7% for beef and veal.

In terms of prices (Graph 9.12), the large increase in Brazilian exports is accompanied by a significant decrease in prices on international markets, more pronounced than on the EU domestic market because the EU market is still protected by strong tariffs in the meat sector and only in the beef sector significant imports at full tariff take place. Within the EU-28, the decrease in domestic prices is slight for poultry meat and pig meat (respectively -0.5% and -0.6%), and larger for beef and veal (-3%), while on the world market and third-country regional markets[20] the decrease is stronger for poultry meat, pig meat and certain markets for beef and veal. The pig meat and beef 'Atlantic' world markets are more affected because Brazil belongs to these 'regions', although the price also decreases in the 'Pacific' markets, in particular for pig meat, as some exporting countries can export to both regions.

Graph 9.12 Evolution of domestic EU and world prices for meat products



Similar impacts (increased Brazilian exports, increased EU imports or net imports and lower world prices) can be seen in other sectors where Brazil is a large player, such as for example sugar (world price fall by around 10% and EU imports higher by 5%), oilseeds (world price 14% lower, EU imports up by 8 %) or protein meals (world price 12 % lower, Brazilian exports 8% higher and EU imports up by 1.8%).

[20] For beef and pig meat, the world market is subdivided in different regional markets, depending on their veterinary status for example regarding foot and mouth disease. The 'Pacific' pig meat market includes Europe, North America, Oceania and Asia while the 'Atlantic' one includes Africa, Europe, Russia and South America. The 'Pacific' beef market includes North America, Oceania and Asia while the 'Atlantic' one includes Africa, Europe, Russia, Middle East, South East Asia and South America.

However, this has a marginal impact on the EU feed costs. Overall, the impact on the total EU value of production is small (-0.3%), but the price drops recorded in many sectors result in average farm income being 4% lower relative to the baseline.

9.5. Stronger oil price and different maize yields in the US

As long as policy incentives for producing and consuming biofuels remain high, the level of availability of biofuel feedstocks from agriculture is likely to be a key factor influencing outcomes on agricultural commodity markets. To examine this issue, two subsets representing different conditions than expected for US maize yields have been selected (Table 9.2). Both subsets feature a stronger-than-expected oil price.

The two subsets contain respectively 35 observations (higher maize yield) and 31 observations (lower maize yield). Their exact boundaries are described in Table 9.2. The average within the subset for the world oil price is 31% over its 2023 baseline value. As in previous cases, because the draws of the stochastic variables are correlated, other macroeconomic variables are different from their baseline values. In this subset, the euro and the Brazilian Real are stronger against the US dollar. In terms of GDP growth, the deviations to the baseline are smaller: the EU-15 shows a stronger GDP index (+2.7% or +1.6% relative to the baseline depending on the scenarios), the US a similar level and Brazil a weaker one (-0.7% to -1.8%).

Table 9.2 Boundaries for subsets combining a stronger oil price and higher or lower US maize yields

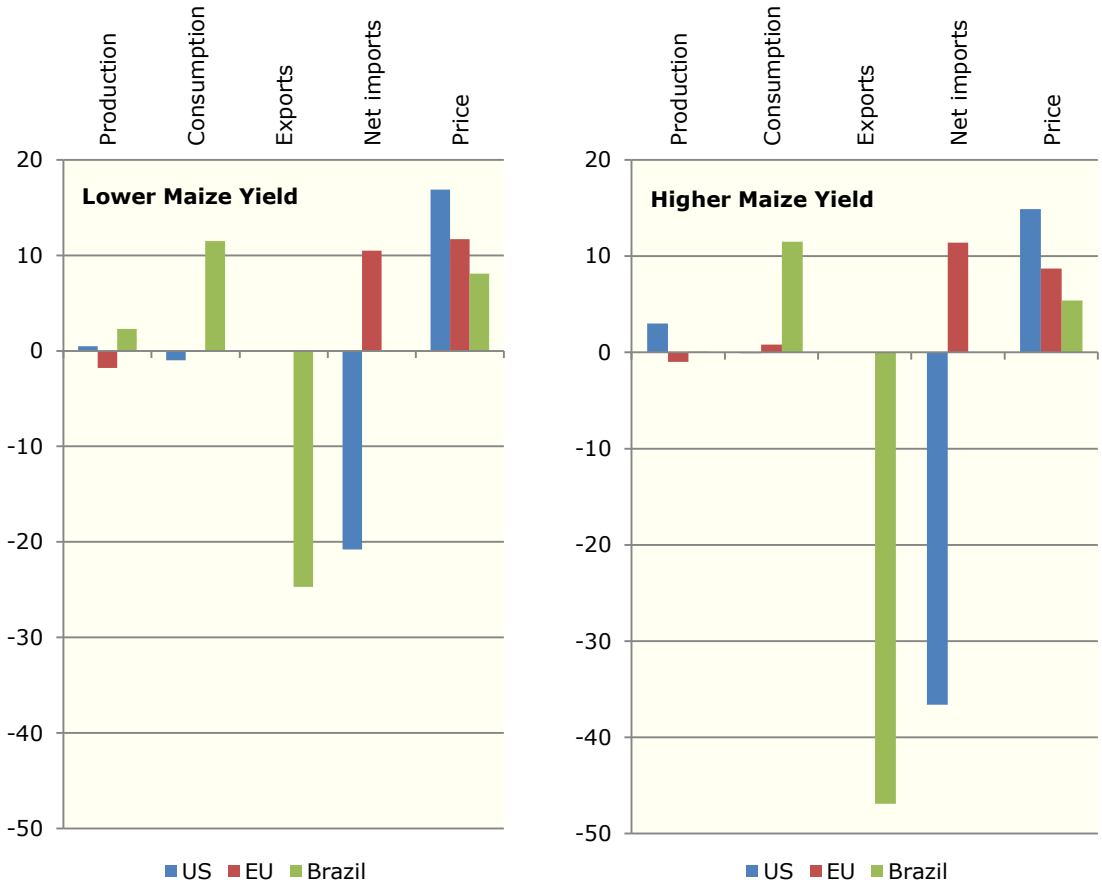
	Baseline (2023)	Subset Higher maize yield (2023)			Subset Lower maize yield (2023)		
		Mean	Lower boundary 60th percentile	Upper boundary 90th percentile	Mean	Lower boundary 10th percentile	Upper boundary 40th percentile
US maize yield	11	12.2	11.4	13.1	10	9.2	10.6
	Baseline (2023)	Mean		Lower boundary 70th percentile		Upper boundary 90th percentile	
Oil price	116	152		136		171	

In general, the results under this scenario are principally explained by the fact that world oil price is high. Throughout the analysis, the relative impact in different US maize yield conditions is then further presented and analysed.

Brazil's consumption of ethanol increases drastically in both subsets, by respectively 17% and 12% in cases of high and low US maize yield (Graph 9.13) because with a higher oil price, ethanol gains competitiveness towards fossil fuels. By contrast, the impact in the US and EU is, however, modest in terms of ethanol production and consumption. The total world consumption of ethanol increases in both scenarios, by respectively 5% (higher maize yield) and 3% (low maize yield). EU production of ethanol decreases slightly in both scenarios. In terms of trade, Brazilian exports fall by 25% (lower maize yield) and 47% (higher maize yield), and the differences with respect to the baseline in the US mirror those in Brazil, with strong reductions in net imports of ethanol, by 21% and 37% respectively, although the US remains a

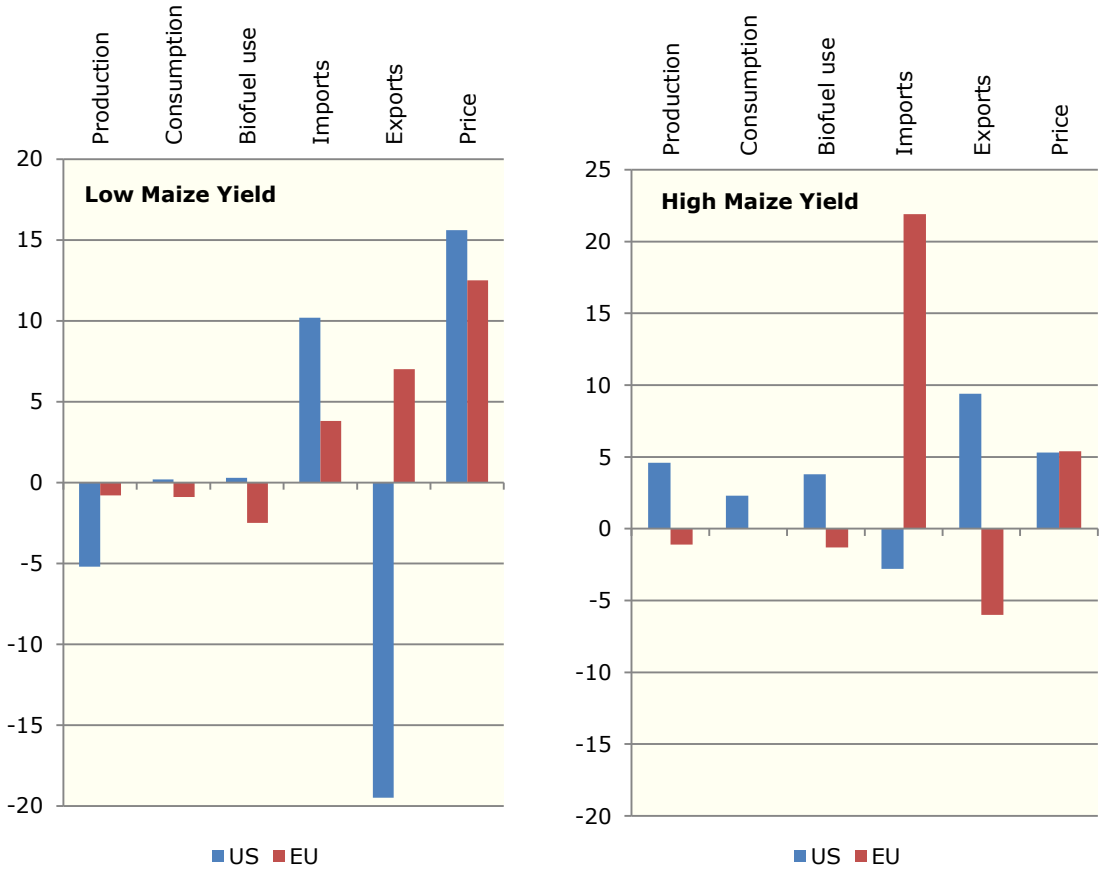
net importer. In terms of prices, the higher level of oil prices (around 30% above baseline) implies a high level of biofuel prices in general. World ethanol and biodiesel prices are 15-20% above baseline, and in the EU, Brazil and the US, ethanol domestic prices are higher when the US has reduced availability of maize. However, as shown in Table 9.2, the world oil price in these scenarios is more than 30% above the baseline: even with an increased price, there are still incentives in these scenarios to use biofuels.

Graph 9.13 Ethanol balance sheet and price in the US, the EU and Brazil (deviations relative to the baseline), 2023 (%)



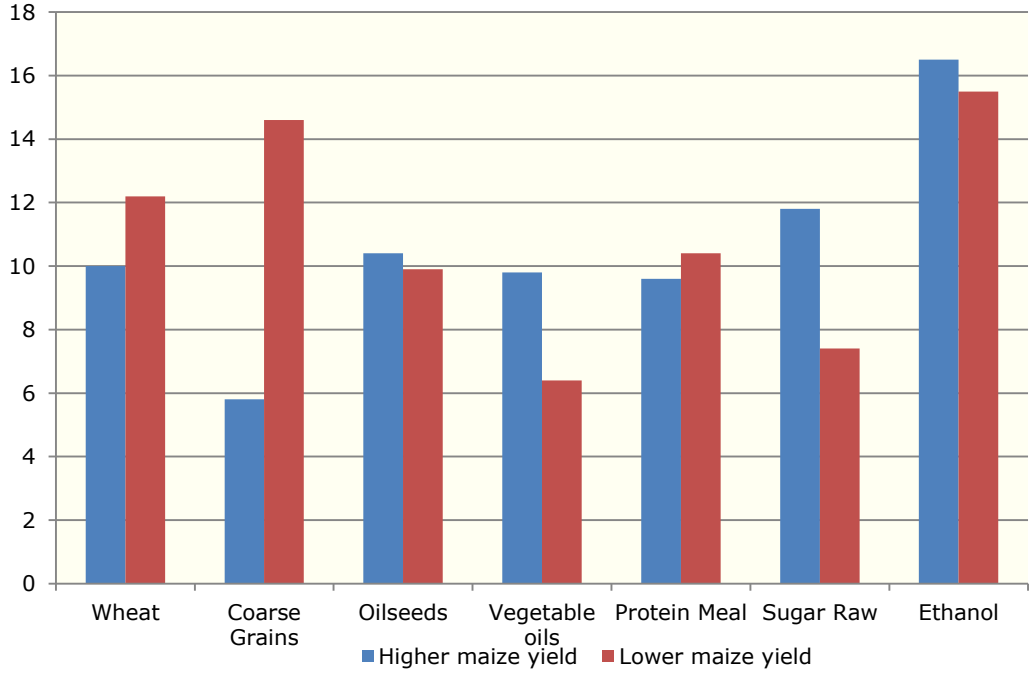
The slight decrease of ethanol production in the EU should be seen in conjunction with the evolution of the US and EU balance sheets (Graph 9.14) and prices (Graph 9.15) in coarse grains in the EU and the US. When the US maize yield is low, the increase in world and domestic prices of coarse grains is more important (+15% for the world price), boosted by the scarcity of maize. Therefore, the use of coarse grains for biofuels decreases in the EU (-3% relative to baseline). And when there is maize availability, the world prices increase is lower (+5%), but imports are not sufficient to cover the increased consumption in food and feed.

Graph 9.14 Coarse grain balance sheet in the US and the EU (deviations relative to the baseline), 2023 (%)



The impacts on other crops is variable: where the share of food and/or feed is significant, shortage in supply provoked by lower yields in the US implies strong increase of prices (for coarse grains primarily, but this is also transmitted to other cereals such as wheat and protein meals), with direct impact on livestock sectors. The situation is different for sugar, oilseeds and vegetable oil, as with a higher availability of coarse grain, there seems to be relatively less incentive to process them into biofuels.

Graph 9.15 Evolution of the world prices of selected crops and plant products relative to the baseline, 2023 (%)



Finally, in terms of total value of production, both scenarios imply a significant increase of the EU total value of production by respectively 4.5% and 6.6% in the cases of higher US maize yield and lower maize yield, driven by the important price increase on the EU domestic market these scenarios imply. But in the case of a higher availability of maize in the US, the farm income in the EU would decrease by 5.4% (less price increase) while it would increase by 1.8% in the case of lower US maize yield.

10. Abolition of milk quota at Member State level with ESIM

The consequences of EU milk quota abolition at Member State level are uncertain and, given the absence of an unconstrained market for milk for many years in the EU, it is difficult to model these consequences empirically since key parameters on unconstrained supply responses are lacking especially in the Member States bound by the quota. The quota system has masked the underlying competitiveness of the individual Member States, which in a no-quota situation will drive market outcomes at Member State level. Also, due to these differences in competitiveness and in dairy product quality (value added), it is likely that the milk and dairy sector in the most competitive countries will expand, while contracting elsewhere.

This section presents a modelling exercise based on assumptions that are based, as far as possible, on observed data. It aims to provide more detail on the main drivers behind the baseline in the EU milk and dairy sector[21].

10.1. Derivation of main assumptions

Competitiveness

Any model designed to simulate EU dairy policy reform needs accurate information on competitiveness at Member State level (Kempen et al., 2011[22]). For countries that have been constrained by a quota system for some years, it is not easy to judge whether producers would freely choose to supply the amount of milk they do at the current price, or whether they would expand if they could. In other words (given that supplying more milk usually involves a higher cost per unit), for producers who *would* expand at the current price if not constrained, how far below the current level would price have to fall before they would choose to *reduce* their supply below the current level? It is the size of this gap, between the minimum price at which their supply would remain unchanged and the actual price, that indicates their degree of competitiveness.

For this study, we have estimated the pattern of 'competitiveness price gaps' using evidence on Member State reactions to the development in milk price and the progressive quota increases from 2007 to 2012 (soft landing).

a) When no expansionary reaction to the quota increase is observed then it is assumed the price received is already the minimum price needed to secure the observed level of supply. In this case, the minimum necessary price is 100% of the price received in 2012 and the 'competitiveness' price gap is zero.

b) For Member States that showed an expansionary reaction to the soft landing, even though they did not overshot their quota, the size of their price gap is estimated from production margins (a combination of gross margins, net margins and net economic margins per tonne of milk according to FADN data from 2007 to

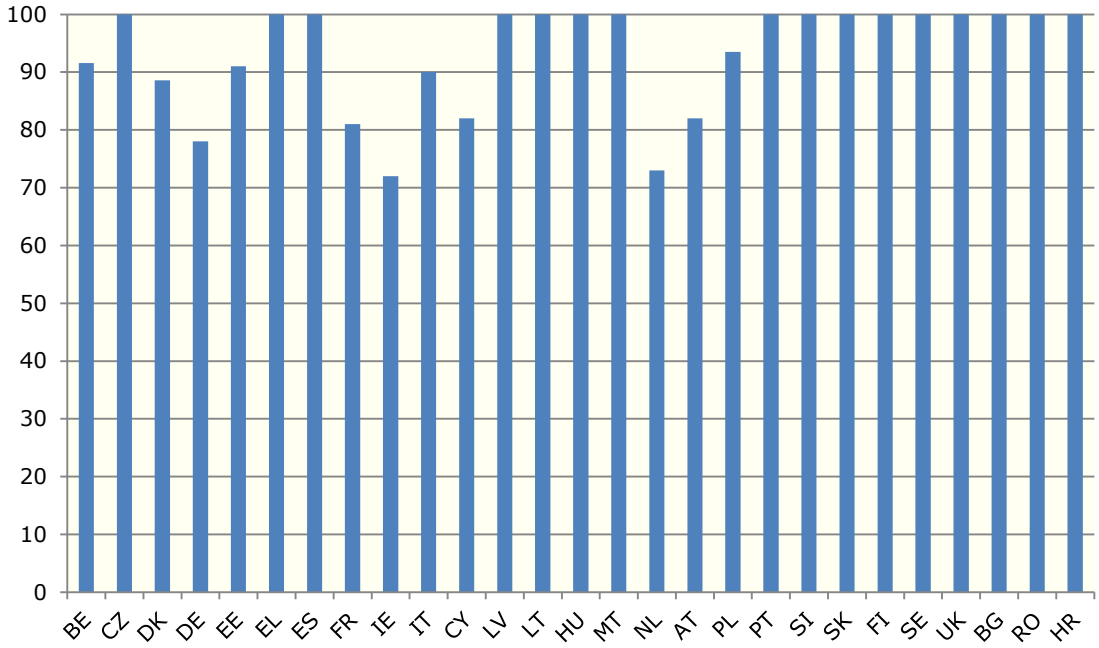
[21] It should be noted that although this version of ESIM covers all 28 Member States, Luxembourg is not included in the dairy module.

[22] Kempen, M., P., Witzke, I., Pérez Domínguez, T., Jansson, and P. Sckokai, 2011, 'Economic and environmental impacts of milk quota reform in Europe', Journal of Policy Modeling 33, 299-52.

2011[23]). These countries are assigned a value below 100%, representing the percentage of the 2012 market price that they require as a minimum to cover their marginal cost.

The final pattern of these price gaps is given in Graph 10.1. Sixteen Member States are estimated to require the full current milk price to produce at current levels. Eleven Member States (of which nine are belonging to the EU-15) have marginal costs below the 2012 price level. The most competitive, according to these estimates, are Ireland, the Netherlands and Germany. These estimated price gaps are incorporated into the model.

Graph 10.1 Percentage of 2012 price required to cover marginal cost by Member State (%)



The future milk price developments (2013-23) in the ESIM model are consistent with those projected in the baseline described in the first part of this report. However, prices at MS level are allowed to vary in response to different market evolutions.

Autonomous trends

In the past, some countries have shown positive or negative trends that appear to be independent of other factors like prices. These are treated in this exercise as autonomous trends and their values are computed from the Member States' time series of milk deliveries. These changes can be interpreted as structural changes (expansions or contractions) of the milk and dairy sectors.

[23] The values and definitions can be found in 'EU dairy farms report 2012 based on FADN data' available at http://ec.europa.eu/agriculture/rica/pdf/Dairy_report_2012.pdf.

In Bulgaria, Romania, Croatia, Hungary, Greece, Slovakia, Sweden, Finland, the Czech Republic, Lithuania and Malta a negative trend has been introduced. The magnitude of the trend depends on the decrease in deliveries observed in the past years. For example, in Bulgaria an annual autonomous trend of -3.45% has been introduced to reflect the assumption that the restructuration of the dairy sector in this MS will result in a continuing decline in deliveries despite the rather good level of margin per tonne of milk in this country. By contrast, a positive trend has been introduced in Poland and Estonia to depict the dynamic increase of milk deliveries.

Investments in the sector and other technical progress

In Denmark, the net and economic margins are very low because of important investments weakening the financial situation of farmers. Therefore if they were only relying on the competitiveness price gap calculated based on the margins, Denmark milk deliveries would not increase significantly after the end of the quota system. Therefore, an additional annual increase in deliveries is assumed after the end of the quota system in Denmark in order to take into account the increased capacity of production at a lower price resulting from investments in this Member State.

Similarly to Denmark, because milk margins are not high enough in Ireland, the model would not lead to the expected increase in deliveries. Therefore, to reflect the positive perspectives for milk production in this country, an annual increase in deliveries (unrelated to price) is assumed. This can also be justified by the possible improvement in feed conversion rates over the projection period.

In the United Kingdom, farmers are assumed to require the full current milk price to produce at current levels. However, recently major companies invested in this country. This should stimulate demand for milk and an annual increase of demand from dairies has been incorporated in the model.

Environmental constraints

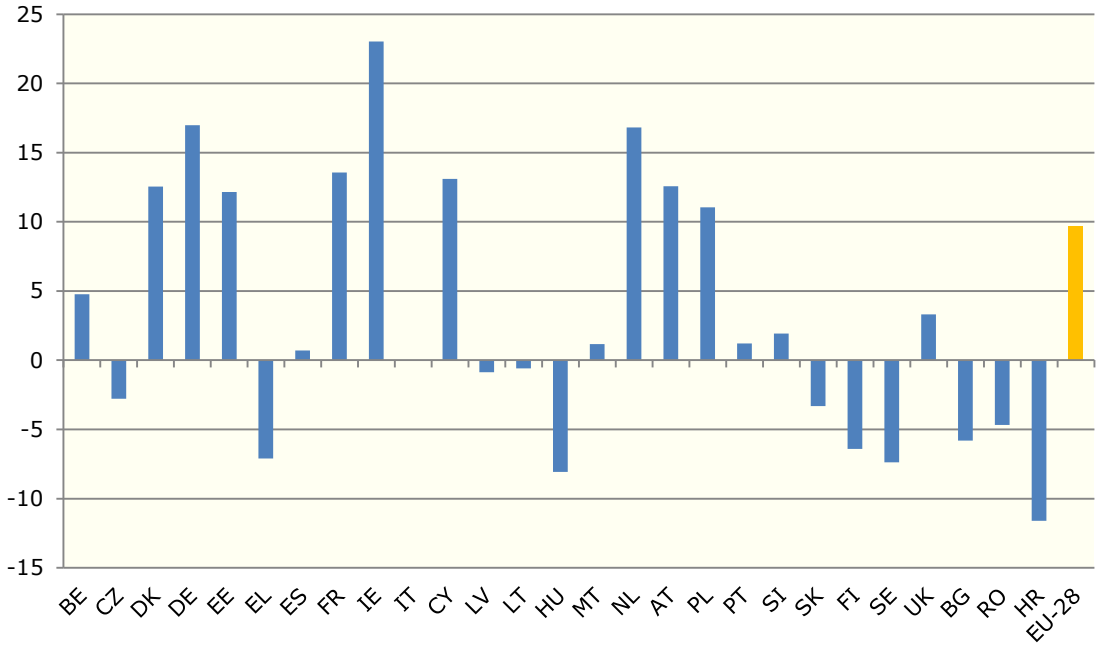
Finally, environmental constraints are introduced for the Netherlands and Italy in order to reflect the possible restriction in milk deliveries expansion that could derive from the Nitrates Directive requirements. These are implemented as milk production ceilings in the modelling framework.

For Ireland, production expansion might be constrained by obligations to reduce greenhouse gas and ammonia emissions. The technical progress parameter introduced for Ireland (as explained above) accounts for this constraint.

10.2. Results

Graph 10.2 presents the changes in Member State milk deliveries between 2012 and 2023, as simulated by ESIM on the assumption that milk quotas are removed in 2015. Further to the quota abolition, production increases in most competitive regions leading to a decrease in milk price in the first years after quota abolition and to a production decline in least competitive regions.

Graph 10.2 Change in milk deliveries (2012-23) projected by ESIM (%)



The ability of models to incorporate information about competitiveness and underlying structural trends in a systematic, homogeneous and transparent way for each of the Member States is exemplified by this exercise. This does not necessarily mean that actual outcomes will turn out to be exactly those simulated by ESIM because the macroeconomic environment might be different until 2023 and also because contrary to the normal weather conditions assumed exceptional weather events cannot be excluded over the next ten years and will affect the deliveries as observed recently.

Furthermore, a modelling exercise can not include all the market expertise available, which takes into account other types of information and expectations about the future than the assumption described above.

In some cases, these projections may seem optimistic. For example, contrary to the positive change in the Spanish and Portuguese milk deliveries simulated by the model because of the strengthening of dairy prices on world markets, many market experts expect a decrease of milk deliveries due the structure of the milk production and processing in these countries. In France, the increase in deliveries could be smaller because some major private companies have already announced their willingness to restrain milk collection expansion in order to concentrate their activity in value added products without the need to produce powders.

In other cases, they might be seen as too pessimistic. Irish authorities announce 50% higher milk deliveries by 2020, other experts bet more on an increase between 30% and 40%. This modelling exercise concludes on a lower increase because of possible environmental constraints and also because cold and wet weather conditions similar to those observed in 2012/13 could happen once or twice over the projection period and slow down the increase. Certain market experts argue that milk deliveries in the United Kingdom could increase more, given recent investments in the dairy industry. Another example is the projected decrease in Bulgaria and Romania, which is based on past observation. However, the decrease

in milk deliveries in these two countries could slow down if part of the decline in subsistence farming would be compensated by farmers working with dairies. Given the recent developments observed in Estonia and market opportunities on the Russian market, deliveries could increase more in that country but anyhow it will not translate into major additional quantities on the EU market. The performance of Estonia will affect particularly the neighbouring countries - Lithuania and Latvia - where a small decrease in deliveries is projected. The decrease in milk deliveries in Hungary could be lower, if Poland performes less than projected.

Last but not least, the effect of environmental constraints and their implementation by national authorities implies a significant uncertainty on the development of milk deliveries in particular in the Netherlands, France (Brittany) and Italy. In the latter, milk valorisation is good because of the importance of cheeses production for which prospects are positive. Nevertheless, some domestic milk could be displaced by imported milk.

Most importantly, the differences summarised here serve to underline the difficulty of projecting, by whatever means, the consequences for markets when supply controls are lifted after a long period.

Conclusions

ESIM tries to capture the main drivers of Member States' changes in milk deliveries after the abolition of the milk quota system in 2015, which are the competitiveness of milk production, autonomous trends present in production and processing demand, investments, environmental constraints and domestic prices.

The increase in production in the more competitive Member States may result in lower domestic milk prices. This will be accompanied, in less competitive countries, by a contraction of milk deliveries and an increase in dairy products imports.

The level of prices will play a fundamental role. For countries without autonomous trends or constraints, prices are the major determinant of the outcome. The general reduction in prices expected in the majority of Member States may be transmitted to the remaining Member States, due to the smoothing effect of trade flows. At the same time, the world market context is expected to be buoyant, which will mitigate internal price falls, again through the arbitrage of trade flows.

11. Analysis of the impact of a higher compound feed prices in EU regions

In recent years, farm input costs have been rising due to greater competition for production resources in both the EU and worldwide. Eurostat data show that real purchase prices of key agricultural inputs, like fuel and fertilisers, increased between 20% and 60% over the period 2000-10, with most of the increase occurring in the last four years. The movements in feed costs closely follow the upward and downward movements of cereal and oilseed prices. The USDA feed price index shows an increase from 180 to 270 points between 2010 and 2013 (1990-92=100).

11.1. Methodology and scenario setting

The objective of this exercise is to show how the situation described by the current baseline for 2020[24] would be different if compound feed prices were substantially higher than expected in the EU. This could be due for example to an increase of the processing costs in the EU due to a stricter sanitary or environmental legislation in the EU or a price increase of inputs other than the raw ingredients specific to the EU, which would imply a loss of competitiveness for the EU in relation to the rest of the world. The partial equilibrium model CAPRI is used for the analysis, which allows the impact to be assessed both at EU level and regional level (NUTS2). Compound feed is defined in this context as feed based on cereals, oilseeds and oilcakes. Grass, fodder crops and straw for feed are indirectly affected through the price feedback and the subsequent substitution effects. CAPRI models separately the various animal feed requirements (crude protein, energy, dry matter) which limits the substitution between different sources of animal feed.

Feed costs are endogenous in the CAPRI model. The price of feed depends on the price of the feed ingredients (cereals, oil cakes, etc.), produced locally or imported, with an extra processing margin, and on feed demand from the livestock sector. These linkages are explicitly modelled. Therefore, an exogenous change has to be introduced in order to provoke an increase in the feed costs. To this end, the processing margins of the conversion from raw material to compound feed are increased in the EU by 20%, which represents an important shock, more illustrative of the potential changes in a similar situation of lesser magnitude than representing some plausible scenario. This leads to an increase in the EU feed price of 10% for protein-rich feed and between 18-20% for other compound feed relative to the baseline. Substitution effects and lower feed demand explain why the new equilibrium feed price is below the 20% shock that was introduced.

11.2. Scenario results

With the higher price for compound feed, there is some substitution by cheaper grass and forage maize for ruminants (Table 11.1). The different price changes of compound feed and the limits of the dietary requirements of each animal category influences the level of change within the group of compound feeds. As demand for

[24] In the CAPRI model the simulation year is 2020, not 2023 as in the Aglink model. Also Croatia is not yet included in the EU aggregate.

fodder increases, the price is also higher. In the case of forage maize, competition means that the more profitable animal activities, like dairy cows, get more of this feed component compared to suckler cows. For granivores and especially for poultry, the substitution possibilities are limited or even non-existent. These sectors are therefore more sensitive to feed price changes and adjustments fall more heavily on production volumes. The regional potential to substitute feed cereals by other feed plays an important role.

Table 11.1 EU-27 changes in feed composition, 2020 (% change relative to baseline)

	Feed cereals*	Feed rich protein*	Feed rich energy*	Feed other*	Grass	Forage maize	Roots	Other fodder	Straw
Dairy cows	-20.5	-0.6	-2.4	-21.5	10.0	32.5	43.3	5.5	1.7
Suckler cows	-43.2	-14.8	-10.2	-26.5	4.2	-4.6	38.5	3.1	-13.9
Pig fattening	-2.5	1.1	4.8	-10.9		15.8			
Pig breeding	-10.0	2.5	-1.1	-21.9		36.8			
Laying hens	0.1	0.3	3.1	-10.4					
Poultry fattening	0.6	0.7	2.0	-13.3					

Note: * These feed items were changed in the uncertainty scenario

EU market balances deteriorate

Table 11.2 Changes in EU balance sheet for pig meat and poultry, 2020 (% relative to baseline)

		% change
Pig meat	Production	-3.2
	Consumption	-0.9
	Imports	56.1
	Exports	-21.4
Poultry meat[25]	Production	-6.0
	Consumption	-1.6
	Imports	90.9
	Exports	-41.7

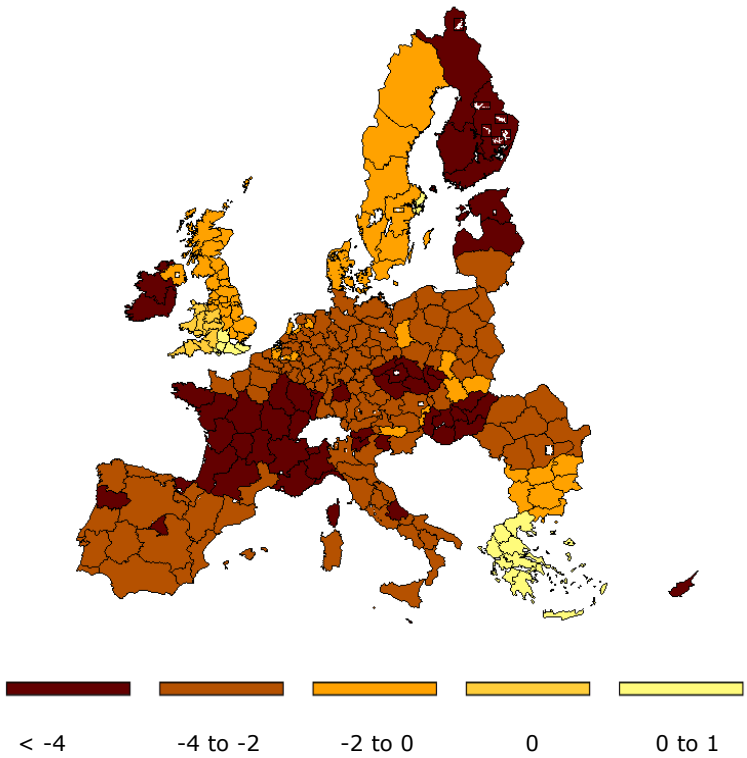
Due to the profit margin squeeze, total EU-27 pig meat production decreases by 3% in comparison to the baseline, while the decrease for poultry reaches 6%. As a consequence of the EU production decline, internal prices rise relative to non-EU regions and give scope for increasing imports which nevertheless remain low (see

[25] Calculated on the base of part of the total poultry meat (processed and semi-processed products excluded)

Table 11.2), while consumption declines in reaction to the same price increase. The loss of competitiveness on the world markets also has an effect on the trade balance. For pig meat, the adjustment occurs mainly through a decrease in exports to third countries and to a lesser extent by increased imports, which remain however at a low level, around 50 000 tonnes. The poultry sector experiences more competition on the EU market than the pig sector and therefore, imports rise significantly in quantity. The main origin of the extra imports is Brazil, which can enter the EU market after payment of the full out-of-quota tariff given the price increase in the EU.

Pig meat production declines in almost all regions, with falls ranging between 7% and 1%, and in aggregate by 3% at EU level (Map 11.1). Pig meat production in the UK, the Netherlands (Zuid and Oost), Belgium and Denmark shows more resilience compared to Spain (Cataluña and Aragon), Italy (Lombardia) and Germany (Niedersachsen, Nordrhein-Westfalen) and even more France in particular (Bretagne). One of the reasons is that the share of feed costs in the total production costs are lower in the case of the UK and Denmark (50-65%) than in France and Germany (>75%). The higher share of protein-rich feed in total feed in the UK production of pig meat softens the cost increase. The lower profitability of pig meat production in France in the baseline makes it more vulnerable to increases in feed costs compared to the other three countries mentioned.

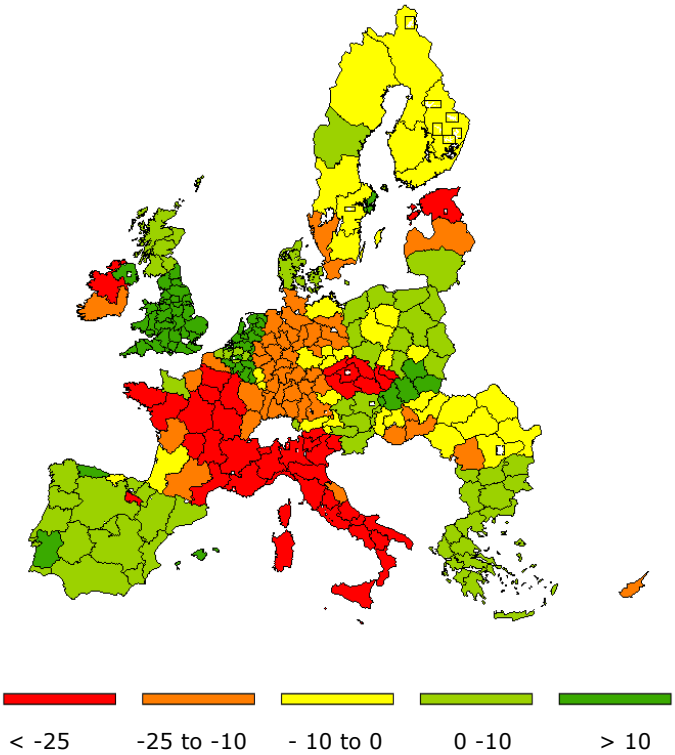
Map 11.1 Regional changes in pig meat production, 2020 (% relative to baseline)



Winners and losers in the pig fattening sector

Total income in the pig sector at EU-27 level is lower by EUR 1.7 billion, Germany, France and Italy being the bigger losers (see map 1.2), in particular some of larger production areas of Europe such as Bretagne and Lombardia, and to a lesser extent in the producing regions of North Germany. Some EU regions where the drop of pig meat production is relatively low take advantage of the higher producer prices despite the cost increase. The higher producer price compensates the loss in production. This is particularly the case for the Netherlands, Belgium and the UK, and to a lesser extent to Denmark and Spain (Cataluña and Aragon).

Map 11.2 Changes in total regional income from pig fattening, 2020 (% relative to baseline)



Conclusion

The results presented here show clearly that the consequences for commodity balances and sectoral income of the uncertainty relating to feed costs could be substantial. Pig and poultry production is more sensitive to feed cost increases than ruminant production. Production systems with a high share of compound feed in total feed and few substitution possibilities experience a greater negative impact on production. On the other hand, fodder production benefits from a price increase, resulting in an important shift in revenues from the meat producing to the fodder producing activities. Therefore, the total effect at farm level depends greatly on the exact combination of in-farm feed production and dependence on off-farm feed.

The higher producer price can offset the loss in production and cost increases in some EU regions. Whether a region gains or loses depends on the balance between the relative increases in revenues and feed costs together with the initial degree of profitability of the production system.

12. African 'green revolution'

Africa is a continent for which strong agricultural productivity growth has been expected for a long time and for which such development would impact on the African, the EU and the rest of the world economies. A 'green revolution' in Africa would affect world commodity markets by changing global supply of agricultural commodities and therefore world prices. Furthermore, the increase in African production will contribute to more food availability and self-sufficiency in Africa.

Total factor productivity (TFP) in African agriculture lags behind the global average. As mentioned at the recent IATRC symposium "Productivity and Its Impacts on Global Trade"[26] , there has been an impressive growth of agricultural productivity since the mid-1980s, but the levels achieved so far only allowed to catch up the levels of the 60's with very little technical change[27]. For example, average grain yields remained at one third to one half of the global average between 2000 and 2010[28]. This signals a scope for increasing productivity in Africa and promoting growth in African countries, where the average GDP *per capita* is 3 025 USD at purchasing power parity (PPP), among the lowest in the world. An increase in agricultural productivity would favour a path to prosperity as this sector is the most important source of income for most African countries. Moreover, 80% of households live in rural areas and around 70% of them depend on agriculture for their livelihood. There was a jump in agricultural TFP in Africa after the 80s (up to 3% annually) and it is not inconceivable that another 'green revolution' could occur in the near future.

Given this background, the main purpose of this chapter is to analyse the effects of a potential African 'green revolution' on the different regions in Africa and African trade including with the EU-28. This is done using a global computable general equilibrium model, MAGNET (Modular Applied General Equilibrium Tool)[29].

12.1. Model and scenario settings

MAGNET is a global, dynamic general equilibrium model, which is based on the GTAP model and extended with various modules to better implement different agri-food policies. The analysis uses the GTAP database. It covers 129 regions and 57 commodities, aggregated for the purpose of this study to 6 regions (North, West, East and Southern Africa, EU-28 and rest of the world)[30] and 32 commodities, 19 related to agri-food sectors: The agricultural sectors are wheat, other cereals, oilseeds, fruit and vegetables (including roots and tubers such as cassava), raw sugar (sugar beet and cane), plant fibres (cotton, etc.), other crops (an aggregate sector containing plant products not elsewhere mentioned such as cocoa, coffee, tea, flowers), livestock (live cattle, sheep, horses etc.) and raw milk. The food sector is composed of beef and sheep meat products, pork and chicken meat

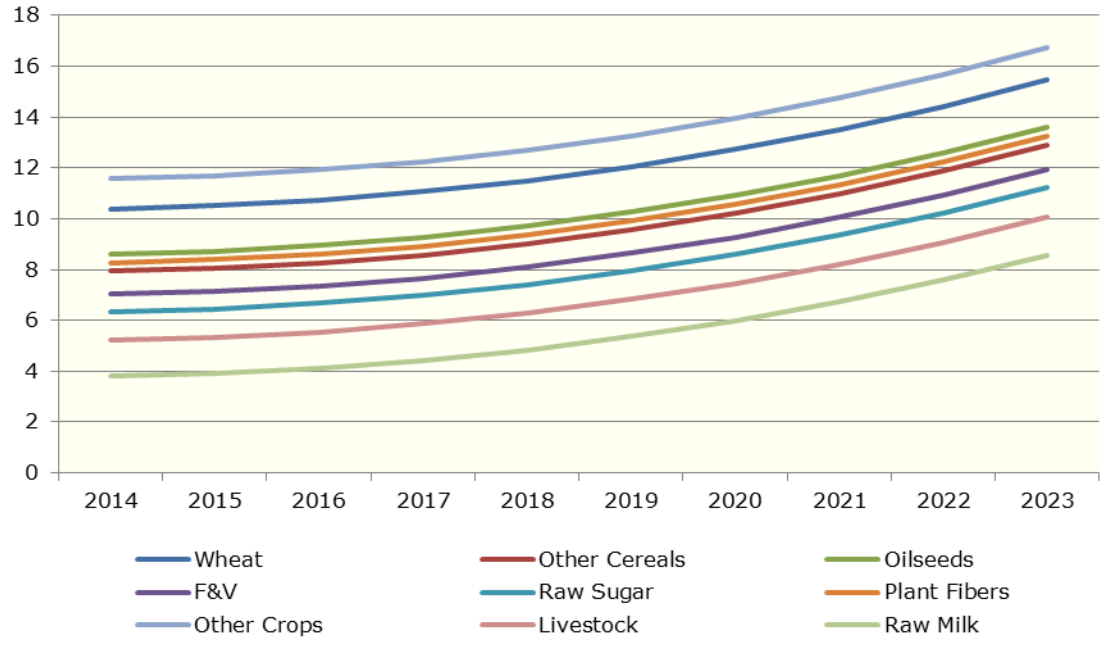
[26] http://ec.europa.eu/agriculture/events/iatrc-productivity-impact-global-trade-2013_en.htm
[27] Torero, M., 2013, Productivity in Sub Saharan Africa, Presentation at the 2013 IATRC Symposium Productivity and Its Impacts on Global Trade, Seville Spain June 2-4
[28] Alliance for a Green Revolution in Africa (AGRA), 2013, Africa Agriculture Status Report: Focus on Staple Crops, Nairobi, Kenya
[29] *Van Meijl, H. et al., 2006, The impact of different policy environments on land use in Europe, Agriculture, Ecosystems and Environment, Vol. 114, pp. 21-38
[30] South Africa is left out of the study since the general characteristics of South Africa are very different from the rest of the Southern Africa region.

products, dairy products, sugar, vegetable oils, beverage and tobacco and other food (an aggregate sector in GTAP composed of prepared and preserved food, flours, starches, sugar syrups etc.).

For the purpose of this study, a baseline is constructed for two periods, 2007 (base year)-13 and 2014-23. The baseline describes how the world economy has evolved until 2013 and how it will evolve under the assumed GDP and population growth rates, in a way that is consistent with the baseline discussed in the first part of this report. A scenario involving a hypothetical African green revolution is then compared to this baseline. Hence, all results presented are over the period of 2014-23 relative to the baseline.

The main assumption of the scenario is that the African 'green revolution' translates into the model as a 14% higher African agricultural TFP during the period 2014-23 than in the baseline, or a total TFP growth of 3.2% annually as from 2014, compared to 1.8% annually in the baseline during the same period, which is in line with other previous 'green revolutions'. The average increase in yields due to this higher TFP growth is shown in Graph 12.1 for Africa as a whole (except for South Africa). The shock increases yields for all the agricultural sectors. For example, wheat yields are 10% higher in 2014 and up to 15% higher in 2023 compared to the baseline.

Graph 12.1 Effect of TFP shock on yields in Africa relative to baseline, 2014-23 (%)



12.2. Results

African GDP is boosted by agricultural TFP growth

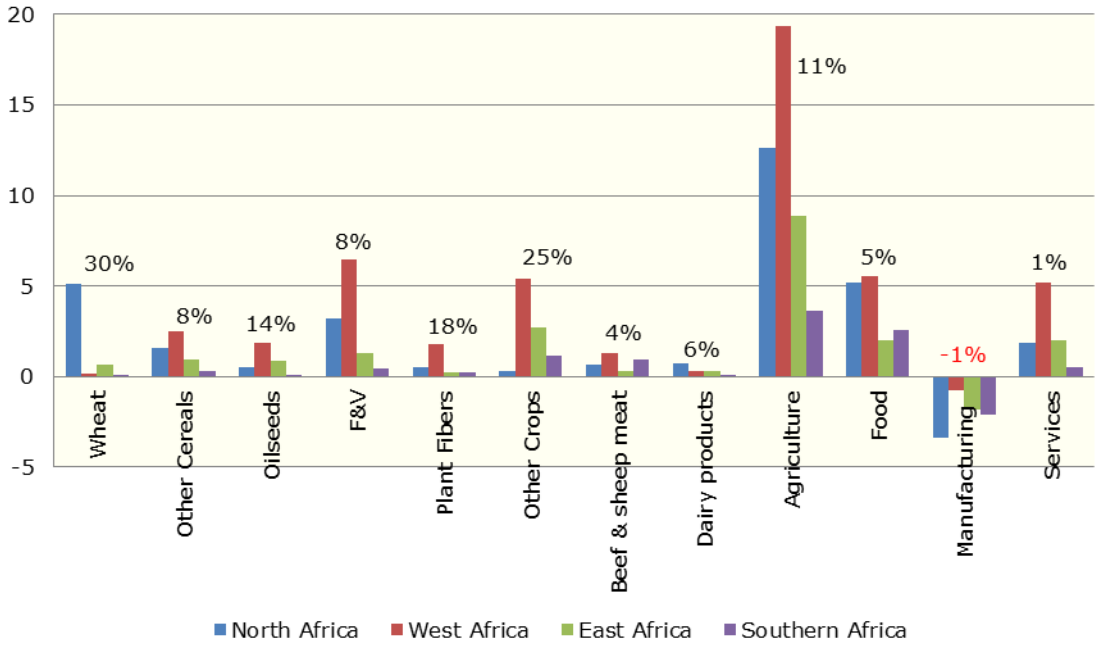
The overall impact of a potential 'green revolution' in Africa is significant (GDP is 2.3% higher than in the baseline by 2023). West Africa benefits most from the TFP

increase with a 3.5% increase in GDP. East and North Africa follow, with increases of 2.7% and 1.5% respectively. The smallest increase is observed for Southern Africa with a 1.3% increase (where South Africa is excluded from this region). Changes in *per capita* GDP also follow the same pattern. The welfare gains for households are parallel to the GDP increases.

Increase in African Production

The immediate impact of increasing TFP growth in agricultural activities is an increase in production (Graph 12.2). The total change in the value of agricultural production relative to the baseline is highest in West Africa (19 billion USD, or 9%) while it is lowest in Southern Africa (4 billion USD, or 12%). The downstream sector, food production, is also affected due to the greater abundance of primary agricultural inputs. However, the increase is well below that of agricultural production.

Graph 12.2 Change in African production level relative to the baseline, 2014-23 (billion USD)



Note: The numbers over the bars represent the Africa average percentage change in each sector relative to baseline for the period 2014-23.

The magnitude of the increase in agricultural production varies across African regions and crops, although the assumed increase in TFP is the same. It comes from the fact that different regions have comparative advantage in the production of different commodities. In North Africa, the largest changes are for wheat and fruits and vegetables production, where the former is mostly composed of durum wheat and the latter consists of export-oriented commodities like tomatoes and olives. In West Africa, fruits and vegetables and other crops increase the most. Change in production in East Africa is smaller than in North and West Africa: the highest increase is in the production of other crops and fruits and vegetables. The smallest changes in production are recorded in Southern Africa, which is

characterised by a lower starting point in terms of value of production (South Africa is not included in this region) with relatively higher increases in the output of other crops and beef and sheep meat sector. Overall, the changes in food sectors are smaller compared to the agricultural sectors. Change in beef and sheep meat and dairy production is generally small in all regions.

On the other hand, manufacturing output declines in all African regions, since factors of production are mobilised towards the agricultural sector which has become more productive; nevertheless, the fall in manufacturing production is quite small relative to the increase in agricultural output, in both value and percentage terms. Lastly, the output of the services sector increases (+1%) mainly due to increased demand since a higher share of increase in household income is spent on services as income elasticity of this sector's output is relatively higher.

African domestic prices decrease favours increased consumption

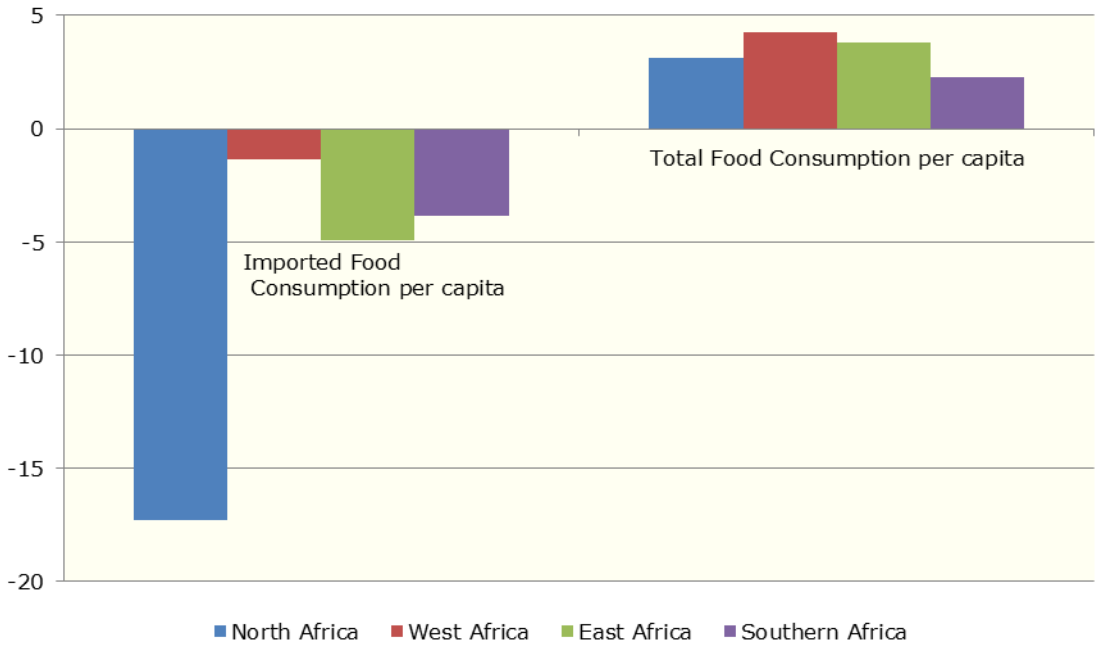
Domestic prices of agricultural commodities are significantly lower with the expansion in production. The effect is the greatest in West Africa (-18%) and the smallest in Southern Africa (-13%). Food prices also decline much less than the agricultural ones, by 3% in North Africa and 1% in East Africa. Consequently, the food consumption *per capita* is on average 4% higher in Africa relative to the baseline (Graph 12.3). Furthermore, *per capita* consumption of imported food products declines significantly. Hence, the expansion in domestic production is used both to substitute for imports and to meet the increase in consumption. The decline in the imported food consumption *per capita* is greatest in North Africa (+15%), where the increase in production mostly substitutes for imports, while it is modest in West Africa (+2%), where the increase in production is mostly exported.

An improved African agri-food trade balance

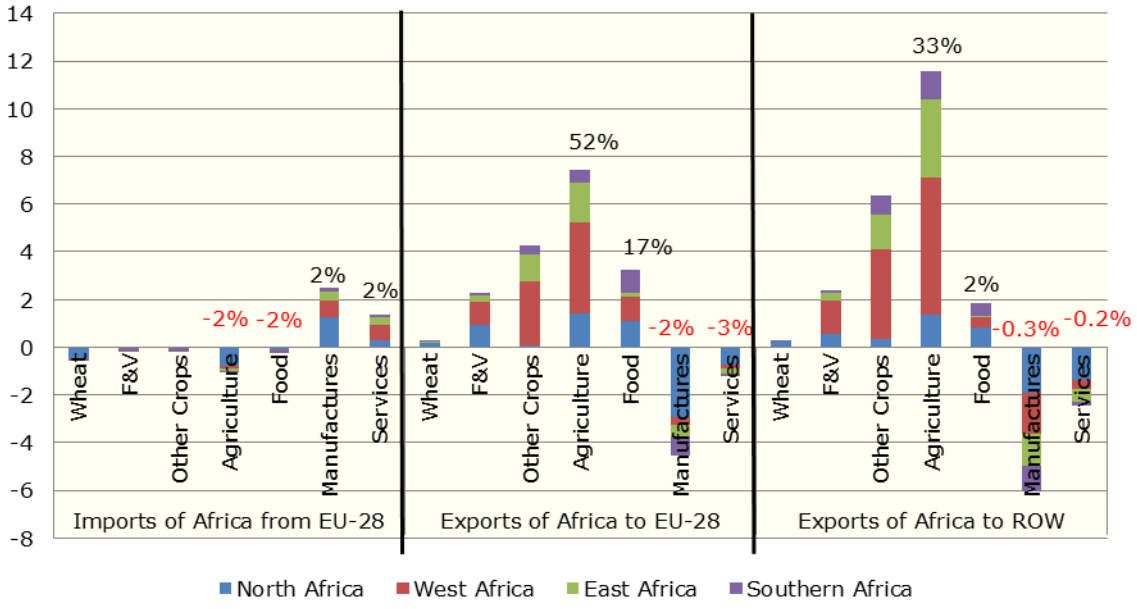
Total agri-food trade balance of Africa improves significantly by 30 billion USD over 2014-23 period compared to the baseline. This is mostly due to significant increase of African agri-food exports both to the EU-28 and the rest of the world.

Africa’s agricultural trade balance with EU-28 improves substantially with faster growth in African TFP. Agri-food exports from Africa to the EU-28 increase by more than 10 billion USD (52% higher for agriculture, 17% up for food). Most of the increase comes from West and East African fruits and vegetables and other crops imports. On the other hand, African agri-food imports from EU-28 decline slightly by less than 1 billion USD. However, concerning manufacturing goods and services, Africa’s imports from EU-28 increase by more than 2 billion USD. On the other hand manufacturing exports of Africa to EU-28 decline by 4 billion USD. Thus, with faster agricultural TFP growth, African regions substitute domestic production of manufacturing and service by increasing imports. Therefore, the improved agri-food African trade balance is accompanied by a larger trade deficit in manufacturing and services.

Graph 12.3 Percentage change in food consumption *per capita* relative to the baseline, 2014-23 (%)



Graph 12.4 Difference in Imports and Exports of African Regions with EU-28 and ROW relative to the baseline (Unit)



Note: The numbers over the bars represent the average percentage change in each sector relative to baseline for the period 2014-23.

In North Africa, increasing exports of agricultural products do not compensate for the higher imports of manufacturing and services. The total fall in the trade balance over the whole period is 1.7 billion USD. On the other hand, West Africa improves

its overall trade balance by more than 3 billion USD thanks to the increased exports of other crops and fruits and vegetables. East and Southern Africa also improve their total trade balance with relatively modest increases of around 400 million USD.

The effect on EU-28 markets is also significant. EU-28 agri-food imports from African countries increase by 30% and this causes the value of total EU-28 agricultural imports to increase by 9%. EU-28 food imports from African countries increase significantly by 17% causing a 2% increase in total EU-28 food imports but food production is not affected. The greater part of the increase in EU-28 imports is due to diversion of trade from the rest of the world to the African countries rather than trade creation between EU-28 and African countries. On the other hand, EU-28 exports of manufactured goods to the African countries also rise (2.1%). The combined effect of these changes on the overall EU-28 trade balance is quite small, with a deterioration of less than 0.06% relative to the baseline. The impact in EU-28 is relatively small, with some decrease in agricultural production (-1%) and a small increase in manufacturing (0.03%) and services (0.02%) production.

Concluding remarks

The findings suggest that a 'green revolution' scenario in Africa could result in an increase of agricultural production by 11%, which would allow to cover both an increased food consumption *per capita* by 4% and an improved agri-food trade balance for Africa with substitution of imports by local products and boosted exports. The self-sufficiency of Africa is significantly improved, with a decrease of the total agri-food imports *per capita*, by 2 to 15% depending on the regions.

13. ANNEX

Detailed consequences of macroeconomic, yield and cumulated macro-economic and yield uncertainties

Table 13.1 Impact in 2023 of macroeconomic and yield uncertainties on production, consumption and trade of agricultural commodities, CV_{2023} (%)

CV_{2023} (%)	Production			Consumption			Exports			Imports		
	Macro	Yield	Combined	Macro	Yield	Combined	Macro	Yield	Combined	Macro	Yield	Combined
Cereals	**0.4**	**3.8**	**3.8**	**0.5**	**1.2**	**1.3**	**4.4**	**16.2**	**16.8**	**6.**	**26.2**	**27.2**
Wheat	0.8	3.8	3.7	0.7	1.2	1.4	4.3	17.4	17.5	3.7	17.0	17.7
Coarse grains	0.3	4.5	4.5	0.5	2.1	2.2	6.2	16.7	18.7	11.5	36.2	38.2
Barley	0.4	2.6	2.5	0.7	2.1	2.2	5.7	14.6	16.5	1.3	4.7	5.2
Maize	0.2	8.1	8.1	0.9	4.2	4.5	8.1	24.1	26.	12.3	38.3	40.8
Oilseeds	**0.9**	**5.0**	**5.0**	**0.6**	**2.4**	**2.6**	**11.3**	**30.6**	**32.4**	**2.4**	**7.1**	**7.6**
..Sunflower	1.0	6.0	6.1	1.	4.0	4.2	14.2	37.2	39.8	14.6	37.0	42
..Rapeseed	0.5	5.2	5.2	0.5	2.2	2.3	6.8	29.0	28.8	6.8	27.1	27.1
Soybean	1.3	10.9	11.0	1.5	3.1	3.7				1.7	3.6	4.3
Protein meal		2.2	2.3	0.9	1.4	1.8	1.3	2.5	2.9	1.7	1.9	2.5
Veg. oils	0.4	2.2	2.3	1.6	0.7	1.7	6.1	5.7	8.4	3.7	2.8	4.6
Sugar	1.1	2.8	3.1	1.7	0.5	1.8	17.8	15.9	24.5	4.9	4.3	6.9
Ethanol	1.0	2.6	2.1	5.1	4.1	6.4	12.8	5.6	14.8	28.0	22.9	35.0
Biodiesel	3.8	1.2	4.0	3.1	1.8	3.5	2.7	1.7	3.1	10.4	6.5	12.0
Meat	**0.8**	**0.3**	**0.9**	**0.6**	**0.1**	**0.6**	**6.8**	**3.1**	**7.5**	**5.5**	**3.1**	**6.1**
Beef	0.6	0.8	1.0	0.8	0.3	0.8	5.2	3.0	5.9	12.7	8.5	14.2
Sheep meat	0.6	0.1	0.6	0.5	0.2	0.6	0.1	0.0	0.1	4.2	1.1	4.3
Pig meat	1.2	0.4	1.3	0.7	0.2	0.7	9.8	3.5	10.9	2.7	0.8	2.9
Poultry meat	0.7	0.7	1.0	1.3	0.3	1.3	10.9	4.8	11.9	4.0	1.3	4.7
Milk	**1.0**	**0.4**	**1.1**									
Butter	1.	0.7	1.4	0.6	0.3	0.7	16.5	8.8	18.5	11.0	10.7	15.8
Cheese	1.0	0.3	1.0	1.2	0.1	1.2	5.4	3.1	6.1	5.0	3.7	6.3
SMP	4.0	2.1	4.5	0.9	1.1	1.4	7.9	4.5	9.1			
WMP	3.0	2.7	3.5	0.5	0.1	0.6	6.0	5.0	8.0			

Table 13.2 Impact in 2023 of macroeconomic and yield uncertainties on consumption by type of use of agricultural commodities, CV2023 (%)

CV_{2023} (%)	Consumption			Food use			Feed use			Biofuel use		
	Macro	Yield	Combined	Macro	Yield	Combined	Macro	Yield	Combined	Macro	Yield	Combined
Cereals	**0.4**	**3.8**	**3.8**	**0.3**	**0.3**	**0.4**	**0.7**	**1.5**	**1.7**	**1.4**	**2.2**	**2.9**
Wheat	0.8	3.8	3.7	0.3	0.4	0.5	1.4	3.0	3.4	2.0	4.5	5.5
Coarse grains	0.3	4.5	4.5	0.4	0.7	0.9	0.8	2.6	2.8	1.6	2.7	3.2
Oilseeds	**0.9**	**5.0**	**5.0**	**0.4**	**0.5**	**0.7**						
Protein meal		2.2	2.3				0.9	1.4	1.8			
Vegetable oils	0.4	2.2	2.3	1.7	1.1	2.1				3.9	1.3	4.1
Sugar	1.1	2.8	3.1	1.7	0.5	1.8						
Sugar beet										0.7	0.2	0.8
Meat	**0.6**	**0.1**	**0.6**	**0.6**	**0.1**	**0.6**						
Beef and veal	0.8	0.3	0.8	0.8	0.3	0.8						
Sheep meat	0.5	0.2	0.6	0.5	0.2	0.6						
Pig meat	0.7	0.2	0.7	0.7	0.2	0.7						
Poultry meat	1.3	0.3	1.3	1.3	0.3	1.3						
Butter	0.6	0.3	0.7	0.6	0.3	0.7						
Cheese	1.2	0.1	1.2	1.2	0.1	1.2						
SMP	0.9	1.1	1.4	0.3	0.1	0.3	5.2	6.1	8.4			
WMP	0.6	0.1	0.6	0.5	0.1	0.6						

Table 13.3 Impact in 2023 of macroeconomic and yield uncertainties on EU domestic and world prices of agricultural commodities, CV2023 (%)

CV_{2023} (%)	EU-28 domestic price			World price		
	Macro	Yield	Combined	Macro	Yield	Combined
Cereals	**9.2**	**8.4**	**12.8**	**9.4**	**6.9**	**11.9**
Wheat	9.7	8.4	13.1	9.0	7.4	11.8
Coarse grains	8.8	8.9	12.9	9.9	7.3	12.8
Barley	9.3	7.8	12.3			
Maize	8.7	10.0	13.6			
Oilseeds	**10.4**	**12.6**	**16.9**	**11.0**	**13.2**	**17.4**
..Sunflower	9.0	12.3	15.8			
..Rapeseed	10.9	13.1	17.7			
..Soybean	11.0	12.3	17.3			
Protein meal	10.1	6.3	12.2	11.3	6.4	13.2
Vegetable oils	11.5	5.5	12.9	9.1	3.6	9.8
Sugar (White)	10.0	3.3	10.8	9.4	2.0	9.9
Ethanol	11.2	3.8	11.9	14.3	2.0	14.6
Biodiesel	12.7	5.3	13.9	14.0	4.5	14.9
Meats	**9.0**	**2.9**	**9.3**			
Beef and veal	9.8	4.3	10.5			
Sheep meat	8.5	1.5	8.6	8.0	1.5	8.1
Pig meat	10.0	2.7	10.1			
Poultry meat	8.4	3.1	8.8	8.5	3.2	9.1
Milk	**7.9**	**3.3**	**8.8**			
Butter	7.3	3.7	8.4	9.6	2.2	9.8
Cheese	8.3	3.2	9.0	9.2	2.0	9.3
SMP	8.7	2.6	9.1	8.7	1.9	8.8
WMP	8.4	2.4	8.8	9.6	1.6	9.8