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Unveiling diversity in agricultural markets projections: from EU to Member States

*A medium-term outlook
with the AGMEMOD model*

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Foreword

The Directorate-General for Agriculture and Rural Development (DG AGRI) has a long history in carrying out and publishing agricultural outlook for EU agricultural markets. The increased subsidiarity and flexibility at Member State level in implementing the agricultural policy implies the need to better capture national specificities. Expertise at local level has a special role to play in gathering the most accurate and relevant data, in modelling more specifically national policies and in better interpreting the results. This is why, together with the AGMEMOD model, which we have supported from the beginning, we value very much the expertise brought by the network.

Tassos Haniotis

Director for Strategy, Simplification and Policy Analysis

European Commission, Directorate-General for Agriculture and Rural Development

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Abstract

Every year the European Commission provides mid-term projections for agricultural markets. These projections are reported for the EU-28 aggregate and split into EU-15 and EU-N13 to reflect the diversity existing between the pre- and post-2004 Member States. However, the diversity of European agriculture goes beyond these two aggregates. This report presents the results of projections for agricultural markets in the EU Member States by 2026, generated using the AGMEMOD (Agriculture Member State Modelling) model. The projections are consistent with the European Commission's 2016 Mid-Term Outlook and represent production, consumption, yields, and trade for the main commodity groups (cereals, oilseeds, dairy and meats). In addition, the main characteristics of the model and the partnership that manages it are described. The report also provides examples of further analysis that can be performed with AGMEMOD in terms of country- or region-specific developments, focusing on agricultural markets in the EU-N13, and in terms of the relations between a single Member State and the rest of the EU, in this case focusing on the United Kingdom and the EU. Furthermore, an analysis of the implementation of coupled support in the EU Member States is presented. The report finishes with some testimonies of policy makers about the role AGMEMOD plays in their policy analysis, and sketching how AGMEMOD might develop in the mid-term.

1 Introduction

Thomas Fellmann, Guna Salputra, Jesús Barreiro-Hurlé

1.1 Background of the AGMEMOD model

Since 2001 AGMEMOD (Agriculture Member State Modelling) has been developed and sustained by a partnership ⁽¹⁾ comprising research institutes, government agencies and universities in European Union (EU) Member States, later extended to include partners in new Member States as well as other countries (such as the former Yugoslav Republic of Macedonia, Russia, Turkey and Ukraine). AGMEMOD has been funded under the European Commission 5th and 6th Framework Programmes ⁽²⁾ and by contributions from partner institutes. The AGMEMOD model is managed in a flexible manner as, depending on the specific task in hand, different AGMEMOD partners build up a consortium around the main developers of the AGMEMOD model. Moreover, the academic network has been extended to include broader society; the result is the AGMEMOD network, involving market experts and stakeholders interested in the results of the AGMEMOD Outlook.

The development of the AGMEMOD model and partnership has been continuously supported by the European Commission's Joint Research Centre (JRC). Apart from support for the model's general development and updating, AGMEMOD has been used for analysis of the Common Agricultural Policy (CAP) reform (see AGMEMOD Partnership, 2007), analysis of the European milk and dairy market (see AGMEMOD Consortium, 2009), potential impacts of Turkish EU membership (see Salamon et al., 2010), as well as for market outlook studies for Ukraine (see van Leeuwen et al., 2012) and Russia (see Salputra et al., 2013). The AGMEMOD model has also been applied and further developed in the 7th Framework Programme project, Agricistrade ⁽³⁾. The results of these projects have provided the basis for numerous publications in scientific journals and conference proceedings (see Salamon et al., 2008; Erjavec et al., 2011; Salputra et al., 2011; Banse et al., 2012).

The AGMEMOD Partnership currently involves the following active members (who have contributed during the past 5 years) from research institutes in the EU (listed in alphabetical order of the EU Member States represented):

- Nedka Ivanova — Institute of Agricultural Economics, Bulgaria
- Magdalena Zrakic — University of Zagreb, Croatia
- Klara Novotna, Iveta Boskova, Ondrej Chaloupka, Marie Pechrova — Institute of Agricultural Economics and Information (UZEI), Czech Republic
- Jorgen Dejgaard Jensen — University of Copenhagen, Department of Food and Resource Economics, Denmark
- Ants-Hannes Viira — Estonian University of Life Sciences (EULS), Estonia
- Jyrki Niemi, Lauri Kettunen — MTT Agrifood Research, Finland
- Fabrice Levert, Alex Gohin — Institut National de la Recherche Agronomique (INRA), France
- Martin Banse, Petra Salamon, Verena Laquai, Marlen Hass, Aida Gonzalez — Thünen Institute of Market Analysis (TI), Germany
- Ioanna Reziti — Center of Planning and Economic Research (KEPE), Greece

⁽¹⁾ The AGMEMOD Partnership was formulated by a Memorandum of Understanding signed by all Partners. The Memorandum continued in full force until 31 December 2015.

⁽²⁾ Projects QLRT-2001-02853 and SSPE-CT-2005-021543.

⁽³⁾ Agricistrade — "Exploring the potential for agricultural and biomass trade in the Commonwealth of Independent States", Collaborative Project, Grant Agreement 612755, Call KBBE.2013.1.4-10.

- Andras Molnar — Research Institute of Agricultural Economics (AKI), Hungary
- Trevor Donnellan, Kevin Hanrahan — Irish Agriculture and Food Development Authority (TEAGASC), Ireland
- Alessandro Antimiani — Istituto Nazionale di Economia Agraria (INEA), Italy
- Sandija Zeverte-Rivza, Agnese Krievina — Latvia University of Agriculture (LLU), Latvia
- Aiste Galnaityte, Irena Krisciukaitiene — Lithuanian Institute of Agrarian Economics (LAEI), Lithuania
- Myrna van Leeuwen, Roel Jongeneel — Wageningen Economic Research Institute (WEcR), Netherlands
- Mariusz Hamulczuk — Warsaw University of Life Sciences, Poland
- Manuela Unguru — Institute for World Economy, Romania
- Jan Pokrivcak, Ema Lazorcakova, Natalia Pasekova — Slovak University of Agriculture in Nitra, Slovakia
- Emil Erjavec, Marjeta Pintar — University of Ljubljana (LJUB) and Agricultural Institute of Slovenia (KIS), Slovenia
- Francisco Sineiro — University of Santiago de Compostela, Spain
- Guna Salputra, Thomas Fellmann, Jesus Barreiro-Hurle, Robert M'barek — European Commission, Joint Research Centre (JRC), Spain

Because of the dynamic nature of the AGMEMOD Partnership, this list does not reflect all partners that have been involved in the creation and development of the model. For example, in *The future of agricultural markets by AGMEMOD* (Chantreuil et al., 2012), one of the main publications of the AGMEMOD Partnership, one can find the names of AGMEMOD members at the time when this was published.

1.2 AGMEMOD in the context of iMAP

The AGMEMOD model is an integral part of the Integrated Modelling Platform for Agro-economic Commodity and Policy Analysis (iMAP) hosted by the JRC (M'barek et al., 2012; M'barek and Delincé, 2015). Together with CAPRI and AGLINK, AGMEMOD is one of the three core partial equilibrium (PE) models in the platform. In the PE model family, AGMEMOD provides a unique advantage in combining other models' approaches in two ways (Figure 1). First, from a spatial point of view, it provides projections at the Member State level, establishing a bridge between AGLINK's⁽⁴⁾ aggregate projections and CAPRI's⁽⁵⁾ regional ones. Second, from a calibration perspective, AGMEMOD combines the information provided by AGLINK for the various EU aggregates, together with market intelligence gathered by the modelling teams in direct discussion with national market experts and at a specific validation workshop, organised by the European Commission together with the AGMEMOD consortium.

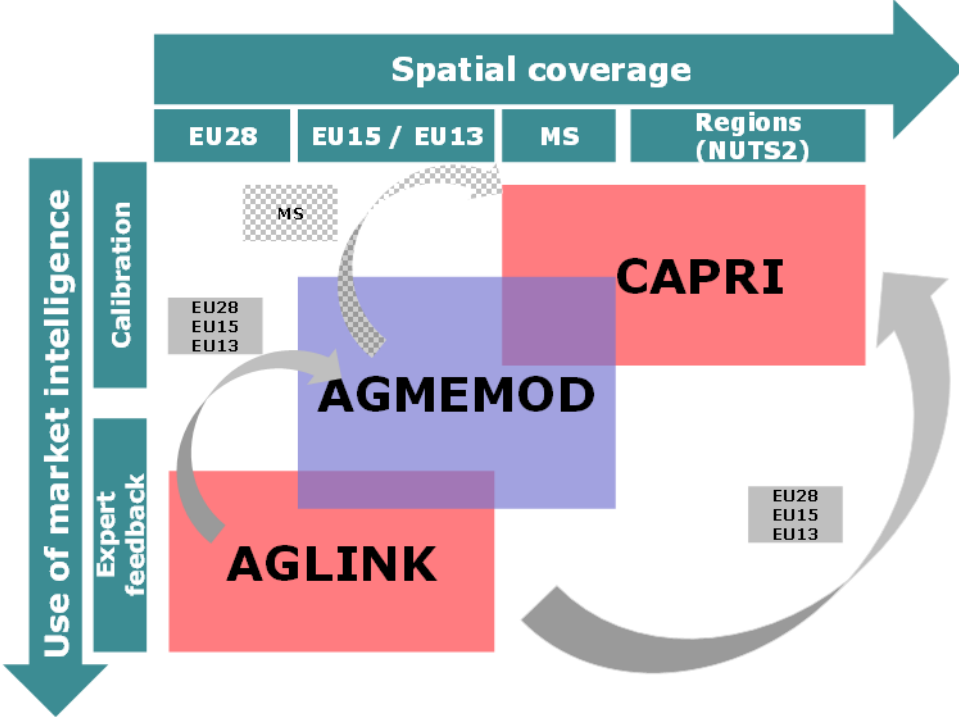
Currently there is only one validation workshop for the AGMEMOD Outlook; however, it is envisaged that regional or national validation workshops will also be organised to best capture the specific differences between Member State projections. Moreover, it is

⁽⁴⁾ AGLINK provides projections for the 28 Member States of the EU (EU-28) and two subsets of Member States, the 15 countries that were Member States prior to the accession of 10 candidate countries in 2004 (EU-15), and the 13 Member States that acceded to the EU between 2004 and 2013 (EU-N13). AGLINK projections are published annually by the Directorate-General for Agriculture and Rural Development (DG AGRI) in the form of the EU Agricultural Outlook (see EC, 2016a).

⁽⁵⁾ CAPRI is an economic large-scale comparative-static agricultural sector model with a focus on the EU (at NUTS2, Member State and aggregated EU level), also covering global trade in agricultural produce (Britz and Witzke, 2014).

envisaged that the calibration process of CAPRI, which relies mainly on AGLINK aggregates split by the different historical weights of the various Member States (Himics et al., 2014), will move towards a more informed calibration, using the Member State-specific projections from AGMEMOD.

Figure 1. The role of AGMEMOD in the framework of the iMAP modelling platform at the JRC



Source: own elaboration.

1.3 Process of arriving at the AGMEMOD agri-food projections for EU Member States

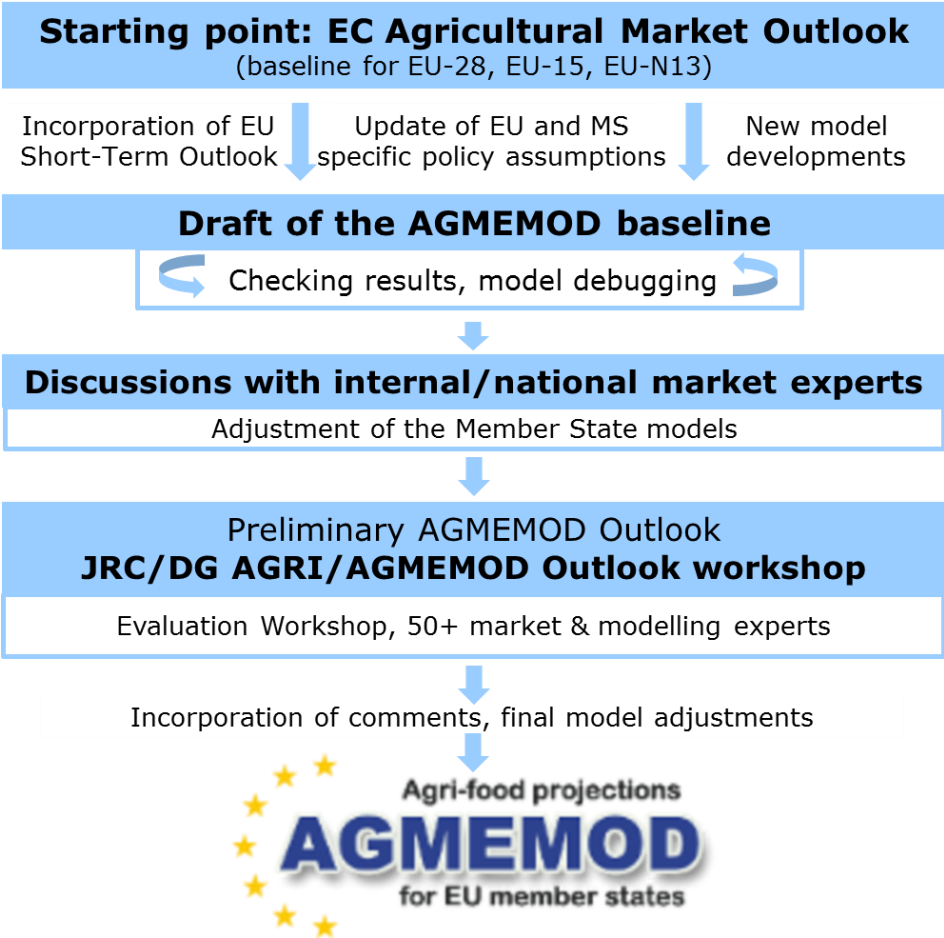
This publication is based on the output of the process leading to the 2017 AGMEMOD Outlook. The work was undertaken by partners of the AGMEMOD consortium, with financial support from and in close cooperation with the JRC and the Directorate-General for Agriculture and Rural Development.

The process of arriving at the final AGMEMOD agri-food projections for EU Member States is outlined in Figure 2. The process mimics that which leads to the European Commission’s EU Agricultural Outlook (see, for example Nii-Naate, 2011), which is the starting point for the AGMEMOD Outlook process, providing aggregate projections for the 28 Member States of the EU (EU-28), the 15 countries that were Member States prior to the accession of 10 candidate countries in 2004 (EU-15), and the 13 Member States that acceded to the EU between 2004 and 2013 (EU-N13). AGMEMOD is updated first with the latest assumptions used for the EU Agricultural Outlook regarding the development of macroeconomic conditions (gross domestic product (GDP) growth, inflation, exchange rates, population growth). These data are complemented with Member State-specific macroeconomic data obtained from national sources in the Member States. The AGMEMOD Member State models are then updated with the latest EU policy assumptions regarding the CAP and its specific implementation at Member State level. As far as possible, national policies with a potential impact on the national agricultural sector beyond the CAP are also taken into account. An example of such an additional national policy is an environmental policy that constrains dairy, pig and poultry production. This is

explicitly implemented in the models of the Netherlands (including the recent phosphate reduction measures), Germany and Denmark. Complementing the EU Agricultural Outlook medium-term projections, the latest EU agricultural short-term outlook (for the publication at hand this was DG AGRI, 2017) is taken into consideration when carrying out the first AGMEMOD baseline runs.

The results of this first run are checked and when implausible figures are obtained the model is debugged and rerun, until a coherent draft of the AGMEMOD baseline projections for EU Member States is available. This draft baseline result is then discussed with internal AGMEMOD and external national agricultural market experts. The feedback obtained in these discussions is used to revise and adjust the Member State models. The next step in the validation process is the organisation of the AGMEMOD Outlook workshop by the AGMEMOD consortium, the JRC and DG AGRI, which is held in Brussels around the end of February/beginning of March. The workshop gathers about 50 policymakers, modelling and market experts from the EU (see Annex 1 for the agenda and list of participants of the 2017 workshop). The aim of the workshop is to present and discuss the preliminary results of the agricultural outlook at EU Member State level. As far as possible, comments made during the workshop about expected market developments are then incorporated and final model adjustments are made, leading to the final AGMEMOD agri-food projections for EU Member States.

Figure 2. Process to achieve the AGMEMOD agri-food projections for EU Member States



Source: own elaboration.

1.4 Structure of the report

The report is organised around six chapters. Following this introduction to the report, Chapter 2 describes the AGMEMOD model approach, including characteristics of the tool, data use and sources, model simulation and validation processes, and a new approach to extend AGMEMOD to include the sweetener market. Chapter 3 presents the AGMEMOD 2017 Outlook results, including assumptions and AGMEMOD model projections for selected agricultural commodities in the EU Member States up to 2026. Chapter 4 provides some examples of analysis that can be performed with AGMEMOD in terms of country- or region-specific developments, focusing on agricultural markets in the EU-N13, and in terms of the relations between a single Member State and the rest of the EU, in this case focusing on the United Kingdom and the EU. Furthermore, an analysis of the implementation of coupled support in the EU Member States is presented. In Chapter 5, the report provides a panorama of how stakeholders view the potential use and strengths of the AGMEMOD model and network. Chapter 6 provides a vision of the development of the AGMEMOD model and consortium in the medium term.

2 The AGMEMOD model approach

Petra Salamon, Martin Banse, Verena Laquai, Myrna van Leeuwen, Roel Jongeneel

This chapter presents the AGMEMOD model approach to obtaining the agricultural production and markets outlook, as follows:

- model developments, revisions and extensions as described in section 2.1;
- exogenous information used in the model (section 2.2);
- model simulation based on the chosen assumptions (section 2.3);
- validation by experts and subsequent model revisions (section 2.4).

The full outlook process also involves defining baseline assumptions (described in section 3.1). A new approach to represent sweetener markets in AGMEMOD is included in Box 1 at the end of section 2.1.

2.1 The tool

The primary objective in developing and maintaining AGMEMOD is to have a partial equilibrium modelling system with the capacity to undertake model-based economic analysis of the impact of policy or other changes on the agri-food sector of each EU Member State and the EU as a whole. The AGMEMOD Partnership's approach is a bottom-up one based on country-level models, using a common country model template, and their subsequent combination in a composite EU model (Chantreuil et al., 2012). In the ideal case, the country models are updated, maintained and used by economic modellers in the relevant countries. This is a unique approach, as other agricultural sector models are maintained within one or a few institutions. The AGMEMOD Partnership also aims to establish an advisory circle of market experts in the agricultural sector in each country to review model projections. That approach will be described in more detail below. In total, the combined process intends to provide a core competency in the economic modelling of agricultural commodity markets and agricultural policy analysis, enhancing the quality of analytical results available for policymaking and decision-making at all levels (Chantreuil et al., 2012).

At its core, AGMEMOD is an econometric, dynamic, partial-equilibrium, multi-country, multi-market model, initially developed for EU agri-food markets covering most EU Member States⁽⁶⁾ at national level. Based on a set of commodity-specific model templates, country-specific models are developed to reflect the details of agriculture at Member State level and at the same time to allow their combination in an EU model. Later, the model has been extended to capture other countries and a stylised version of the rest of the world (ROW), which neglects any detailed representation and policies. A close adherence to templates assures analytical consistency across the country models, essential for aggregation purposes. In addition, the adherence to model templates and a common modelling approach also facilitates comparisons of the impact of a policy change across different countries (Salamon et al., 2008).

AGMEMOD provides significant detail on the main agricultural sectors in each EU Member State. Generally, the system has been econometrically estimated at individual Member State level and produces results for the EU as a whole, the EU-15 and the EU-N13, as well as for individual countries. In some cases, parameters have been calibrated, where estimation was not feasible or meaningful. The country models contain the behavioural responses of economic agents to changes in prices and in policy instruments and to other exogenous variables in the agricultural market. Commodity prices adjust so as to clear all commodity markets considered on the world market. Quantitative baseline projections are generated for a medium-term horizon on an annual basis. These econometrically

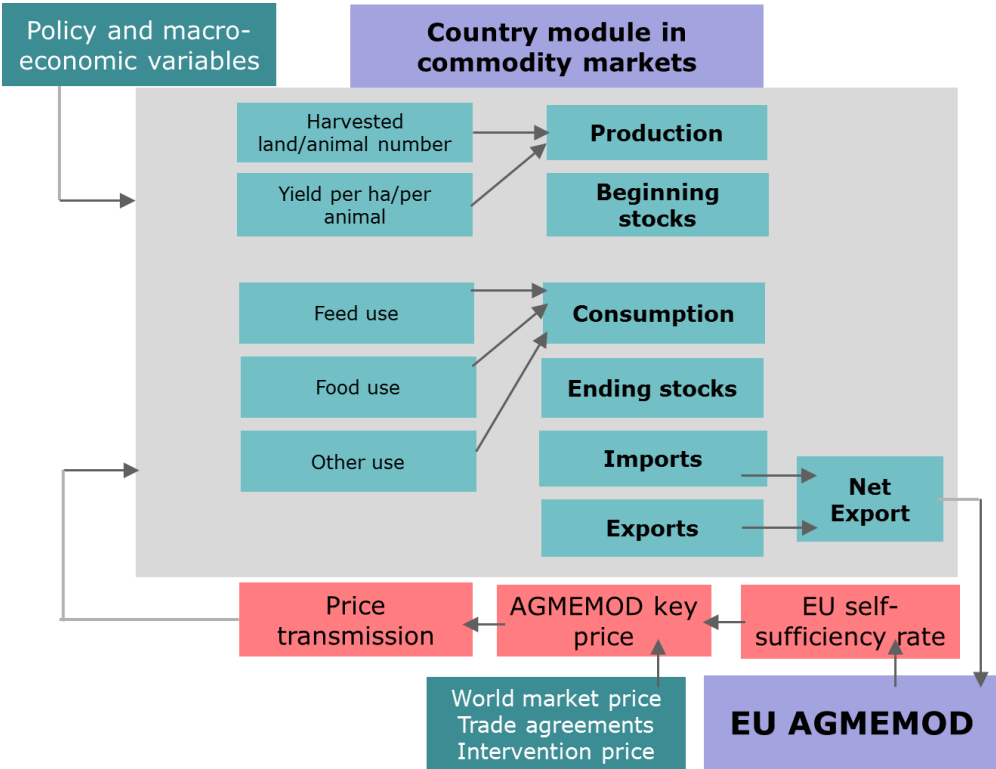
⁽⁶⁾ Luxembourg is combined with Belgium, and Malta and Cyprus with Greece.

estimated country-specific agricultural market models provide a sound basis for analysing the impacts of changes facing EU agri-food markets in the future.

The models comprise equations for those commodities that represent the majority of the agricultural output in each country. In general, six types of cereals, three types of oilseeds and their processed products — oil and meal — sugar beet and sugar, protein crops and potatoes are depicted. For animal sectors, live animals (cattle, pigs, sheep and goats) and meats (beef, pig meat, poultry, sheep and goat meat) are covered separately, while the dairy sector covers raw milk as well as processed products (drinking milk, cream, fresh dairy products, butter, skimmed milk powder (SMP), whole milk powder (WMP) and cheese, plus other dairy products).

For each the crops mentioned, figures are projected on area and yield and implicitly on production, use, trade, stocks and domestic prices (see Figure 3). In the case of oils and meals, figures for crushing of oilseeds and processing into oils and meals, as well as relevant trade, stocks and prices, are also generated. In the crop sector, first, land (e.g. arable land) is allocated across crops by a pure top-down approach, i.e. changes in various land categories on different levels affect the land available for crop production. The behavioural equations for land allocation are expressed as proportions of the higher level. For example, changes in forest area or other land determines the usable agricultural area, all expressed as a proportion of total land. Usable agricultural area is then further split into subcategories, until finally the producers choose the proportion allocated to the various crops, e.g. soft wheat. The most important explanatory variables are expected (moving average) gross margins of the categories or crops, as well as competing categories or crops at the same level. These expected gross margins include expected yields and expected prices, including a policy support component. Further explanatory variables in the land proportion equations can be trend variable, own-lagged proportions and others.

Figure 3. Stylised market representation in AGMEMOD



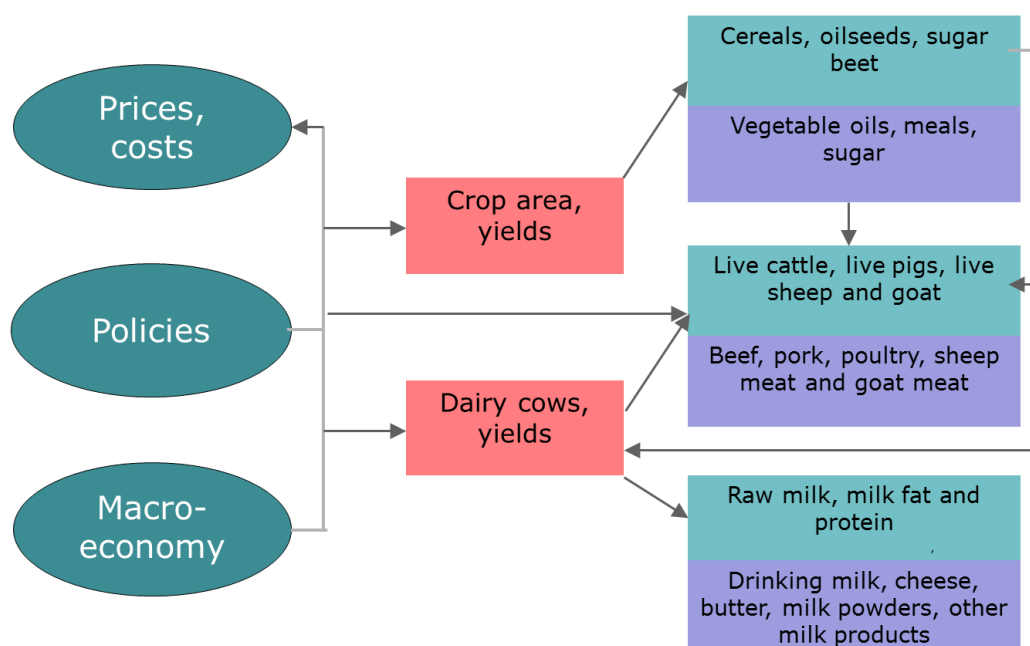
Source: own elaboration.

Animal products cover projections on stocks of live animals, slaughter and trade in live animals. The key in all livestock models is to determine the ending numbers of breeding animals, considering among other things price and cost variables, such as coupled or decoupled payments, and specific national policy instruments. Also essential is the number of animals produced by breeding under consideration of the productivity. Ending stocks of each type of animals (breeding and non-breeding) are derived by capturing beginning stocks, animals produced, exports and imports of live animals, slaughtering and other losses (Chantreuil et al., 2012). Within each livestock group there is a category of animals to be slaughtered. Those animals and their simulated average slaughter weight allow meat production per category to be determined, while domestic use, per capita use, trade in meat and domestic prices are other main items projected for animal markets.

The dairy sub-model comprises two levels: on the first level, milk production, milk imports, exports, on-farm use and deliverables to dairies are determined, with the last of these closing the balance. Milk production is defined by an equation considering prices, costs, an assumption on quota rents under the pre-quota abolition phase and assumptions on elasticities. In addition, milk yield per cow is determined by an equation capturing productivity by a trend and a price. As a consequence, dairy cow ending numbers are defined as an identity. Quota rents based on Requillart et al. (2008) have been used; further details can be found in Chantreuil et al. (2008). At a second level, the AGMEMOD model allocates fat and protein to different dairy products based on assumptions or estimates concerning the fat and protein content of raw milk and other dairy commodities. Allocation of fat and protein depend on the prices of dairy commodities and other exogenous and endogenous variables (Chantreuil et al., 2012).

In principle, equations to determine endogenous variables describe the behavioural responses of economic agents (farmers, consumers, etc.) to changes in, for example, market prices, policy instruments and other exogenous variables, as well as in lagged endogenous variables. The lagged variables induce a recursive model structure. For each commodity, sets of behavioural equations describe the supply side (beginning stocks, production and imports) and demand sides (domestic use, exports and ending stocks) of the market. Supply and demand equations define how, in any given year, equilibrium (i.e. supply equals demand) is found within the single commodity market. Lagged endogenous variables introduce (recursive) dynamic behaviour when entered as determinants in the next period's equilibrium supply and/or demand (Chantreuil et al., 2012). Different sectors are linked in supply and demand (see Figure 4). Detailed information on the general structure of the AGMEMOD country model equations can be found in Hanrahan (2001), Esposti and Camaioni (2007) and Chantreuil et al. (2012). To solve the modelling system in prices, the supply and utilisation balances of each product at both the EU and the Member State level must hold and take into account the international trade and other commitments of the EU, such as tariff rate quotas (TRQs). The AGMEMOD composite model requires equations that impose the market equilibrium or closure (supply equals demand) for any commodity at global level, which is achieved by the integration of a stylised ROW model, where international prices are formed by closing global balances. Various domestic commodity markets are linked to each other by substitution or complementary parameters on the supply or demand side. There is competition between the various crops to use the available land. Interactions between the crops and livestock sub-models are captured via the derived demand for feed. In addition to raw milk and dairy products, the dairy sector provides calves that are exported or raised as cattle to produce beef. The various meat types, dairy products and crops are partly substitutes in demand, while cattle, pig, sheep and goat, and poultry compete for feed.

Figure 4. Linkage between sectors in supply



Source: own elaboration.

Prices in AGMEMOD are formed essentially in three ways: for most Member States and commodities, they are defined by a price transmission equation, whereas a domestic price in a given country is driven by an external price in the so-called key-price country or the ROW region. In principle, the national price of a commodity is explained by the key price of that commodity and a vector of exogenous variables, including the self-sufficiency rate (production divided by domestic use) in the relevant country and the self-sufficiency rate for the same commodity in the key-price market (Chantreuil et al., 2012).

With a key-price country that normally corresponds to the most important market for that commodity (e.g. France for soft wheat), the price formation equation links the domestic market to the world market and captures all exogenous variables affecting price formation and the dynamic structure at the EU combined level. In particular, next to the world market price, price policies (e.g. intervention prices) and trade measures (e.g. TRQs) are included in the key-price equation, thus indirectly affecting all country prices via price transmission equations. In addition, key-price equations include as a determinant the EU self-sufficiency rate, thus making the key-price (and other linked prices) responsive to the EU supply and use balance of the commodity concerned (Chantreuil et al., 2012).

In addition, the AGMEMOD model requires equations that impose market equilibrium or closure (supply equals demand) for any commodity at a global level, implying that production plus beginning stocks plus imports must always equal domestic use plus ending stocks plus exports. AGMEMOD commodity models, however, do not represent closed economies, so that the ROW markets play a role in the domestic markets modelled. To achieve this objective, a regional module covers the ROW. As a result of data restrictions and the obvious extreme heterogeneity of the aggregate, it is established in a stylised way and does not capture any policy measures affecting consumption, production and trade. The ROW's production and consumption are driven directly by world prices, without driving any wedges between world and producer or consumer prices. Parameters of the behavioural supply and demand equations are not estimated econometrically but are derived from existing partial equilibrium models, e.g.

the European Simulation Model (ESIM) ⁽⁷⁾. World market prices clear the commodity market on a global level, while the EU key markets are then linked to the ROW market. The total net trade of EU and the other represented markets affects the domestic use of commodities in the ROW and, thus, the EU affects the relevant world price formation. To deal with a changing number of countries included in the model, data cover the world total figures and the ROW is then calculated as the difference between world total and the countries included in the model.

Box 1. New approach to represent sweetener markets in AGMEMOD

Marlen Hass

In March 2013, the EU agricultural ministers agreed to remove the EU quota system for sugar and isoglucose by the end of the sugar marketing year 2016/2017, as part of a major reform of the CAP. From 1 October 2017, EU sugar and isoglucose producers are allowed to sell unrestricted quantities of sugar and isoglucose on the EU domestic market and thus competition on the European sweetener market will intensify. In the former versions of AGMEMOD, the EU sugar sector is depicted at EU Member State level, but supply quantities of sugar have been fixed to the quota level for most Member States and the isoglucose sector is not modelled at all. Therefore, a new sweetener module for AGMEMOD was developed. It covers both sugar and isoglucose and has been implemented so far for Germany and Poland.

1 Approach

Within the context of the abolition of the quota system, the main challenge in modelling the European sweetener market is to project the supply behaviour of sugar beet growers as well as sugar and isoglucose producers. In an unregulated market, the supply behaviour of producers will be determined by production costs and prices. But as long as binding quotas are in place, market prices incorporate the quota rent and therefore do not reflect the marginal cost of production. Hence, observed historical prices cannot be used to calibrate the supply functions of the model, if information on the quota rent is not available. Therefore, in the revised sweetener module of AGMEMOD, supply functions are calibrated to production costs per unit of output, endogenously calculated following the approach developed by LMC (2013). In line with the overall AGMEMOD approach, which determines supply behaviour based on expected values, production costs are derived from expected prices and yields, which are a weighted or simple average of previous years. In contrast to other crop sectors modelled in AGMEMOD, the updated AGMEMOD sweetener module uses calibrated instead of estimated function for the supply equations, as well as for the demand, import and export equations. However, other equations, for example yield and prices, are estimated by least squares regression.

1.1 Linkages to other sectors

As a partial equilibrium model covering the entire agricultural sector, AGMEMOD allows linking the sweetener module with other agricultural commodity markets. One important linkage is to relate the sugar sector to other competing crop sectors in AGMEMOD, i.e. grains, oilseeds, protein crops and other crops. This linkage has been established by calculating production costs used to calibrate the supply functions of sugar and isoglucose based on the expected gross margin or prices of wheat, maize and rapeseed, which are endogenously determined within the model. As a result, changes in the wheat, maize and rapeseed market affect the supply of sugar and isoglucose. In turn, it is also

⁽⁷⁾ Synthetic demand and production equations for ROW have been established for the base period 2013-2015 with a set of assumed price and income elasticities, shifters for technical progress, and growth in income and population. Demand figures were calculated as production in ROW corrected for trade (net import or net export) so that, in the base period, market clearing conditions hold. The equations are calibrated so that the price in the base period equals the observed world market price. For projections, equations are shifted into the future. For current purposes, world market prices are additionally calibrated to the EU Commission's world market prices, as published in their Outlooks (EC, 2016a), using yearly dummies.

important to model the effect of changes in the sugar and isoglucose market on other crop markets. Therefore, two additional sectoral linkages have been implemented:

1. The change in sugar beet area compared with the base year is allocated to the aggregates of grains, oilseeds, protein crops and other crops. This is done in a way that ensures that the change in sugar beet area compared with the base year is allocated in the same way as a change in total crop area.

2. The change in demand for maize or wheat compared with the base year resulting from a change in wheat- or maize-based isoglucose production is added to the food demand of the respective cereal. As a result, changes in isoglucose production affect the self-sufficiency rate of maize or wheat and thus the domestic market price, which, in turn, affects the costs of producing isoglucose.

2 Database

Wherever possible, EU statistics, which are available for all EU countries, are used to update the database of the AGMEMOD sweetener module. The following sections describe the data sources for prices, market balance positions, production costs and parameters in detail.

2.1 Prices

World market prices of raw and white sugar are taken from USDA (2017) for historical years. Since world market prices are exogenous information in the AGMEMOD baseline, projections of world market prices are also needed. For the white sugar price, the same development as projected in the EU Agricultural Outlook is assumed (EC, 2016a). The raw sugar price is derived from the white sugar price, assuming a constant white sugar premium equal to the average premium of the last 3 years. The world market price of curd oil is based on EIA (2017) for historical years. For the projection period, AGMEMOD again uses the price projection of the EU Agricultural Outlook.

The EU sugar price is obtained from EC (2016b) for historical years and from EC (2016a) for the projection period. Unfortunately, unlike EU domestic sugar prices, EU isoglucose prices are not reported to the European Commission by Member States. Therefore, the EU isoglucose price is from the Organisation for Economic Co-operation and Development and Food and Agricultural Organization of the United Nations (OECD-FAO) database for historical years (OECD-FAO, 2017). In the projection period, the EU isoglucose price is derived assuming the same price ratio of the EU sugar price to the EU isoglucose price as projected by the OECD-FAO Outlook 2016-2015.

Domestic prices of sugar beet are directly extracted from Eurostat (2017a), whereas domestic prices of sugar and isoglucose are calculated as import unit values based on Eurostat trade data (Eurostat, 2017b).

2.2 Market balances

Sugar beet: Data on area harvested and the sugar content of beet are based on CEFS (2016). For ethanol use and feed use, national sources are used (BMEL, 2015; GUS, 2016). All other positions are derived. Production equals the sum of sugar beet required for the production of sugar plus feed and ethanol use. Beet yields are calculated as production divided by area harvested. Since sugar beets are not traded between countries, domestic use equals production.

Sugar: Data on production, consumption, trade and stocks are taken from FO Licht (2017). Since in FO Licht's market balances domestic use is not broken down into subcategories, national sources are used for industrial sugar use (BMEL, 2015; GUS, 2016). Food use is calculated as the residual of domestic use and industrial use.

Isoglucose: Data on production are obtained from the sugar balance sheets published by the European Commission (EC, 2016c). Trade data are extracted from Eurostat (2017b), aggregated and converted from commercial weight into white sugar equivalent (dry basis). Domestic use is calculated as residual.

2.3 Production costs

Fixed and variable processing costs, as well as all data and exogenous coefficients required to derive total production costs per tonne of sugar or isoglucose, e.g. growing costs, byproduct yields and prices, are based on LMC (2013).

2.4 Other parameters

In the new sweetener module, the supply of sugar is limited to the maximum production capacity of sugar per country. This capacity limit has been calculated based on CEFS (2016). For the supply of isoglucose, no capacity limit has been implemented, since data on isoglucose production capacities were not available. Moreover, unlike sugar producers, isoglucose producers invest currently in new production capacities to increase isoglucose output, following the abolition of the EU quota system. Hence, the future development of isoglucose production capacities is subject to a high level of uncertainty.

Voluntary coupled hectare premiums for sugar beet and the total amount of aid for the sugar beet sector are obtained from EC (2015).

The elasticities used to calibrate the model function, which are not estimated equations, are either based on the literature or set by assumption in a plausible range. Supply elasticities for the sugar supply functions are taken from Poonyth et al. (2000). Since supply elasticities are available only for the EU-15, for Poland the average over the EU-15 Member States is applied. For isoglucose supply, a supply elasticity of 0.12 is assumed, which has been estimated for the US market (Tanyeri-Abur et al., 1993). The elasticities used to calibrate equations for imports and exports and for ending stocks are assumed to be in a similar range to the supply elasticities. For the calibration of the isoglucose demand function, an own price elasticity of 0.48 and a cross-price elasticity of 0.27 is used, as reported by Miao et al. (2010) for the US market ⁽⁸⁾.

3 Conclusions

Within the context of the expiry of the EU sugar quota system, it is of particular interest to project the supply behaviour of sugar beet growers and sugar and isoglucose producers in the future. In terms of modelling, this means that special attention must be given to the specification and calibration of the supply functions. Since market prices do not reflect the marginal cost of production as long as the quota system is in place, the approach applied in the revised sweetener module of AGMEMOD uses supply functions for sugar and isoglucose, which are calibrated to unit costs of production endogenously calculated within the model. The first simulation results generated by the extended and improved AGMEMOD model version, including the new sweetener module for Germany and Poland, suggest that both countries would expand sugar and isoglucose production following the abolition of production quotas and would be able to strengthen their position as net exporters of sugar. Clearly, as with all model-based analysis, these results depend strongly on certain assumptions, such as the development of world market prices. Nevertheless, the approach developed to depict the sweetener market of Germany and Poland provides plausible results and can be used as a template for other AGMEMOD country models.

2.2 Data for endogenous variables

The tool described above requires extensive datasets for the countries covered, so establishing a modelling database is a key task. The data demand of the AGMEMOD modelling approach is high, as time series are required for parameter estimation purposes, not only for the supply side of agricultural commodity markets but also for the various types of uses and processing demands. Each country model is based on a database template of annual time series, which — depending on the country — ranges

⁽⁸⁾ Since cross-price elasticities are reported by Miao et al. (2010) for various sectors (e.g. soft drinks, processed fruits and vegetables, milk), we have used a simple average over all sectors.

from as early as 1973 to the latest available (2016 for this report). AGMEMOD's database is partly made up of supply and use balance sheets for all commodities, covering data on opening stocks, production, imports, human food consumption, feed use, processing and industrial use, exports, and ending stocks, at the level of primary agricultural commodities and, often, also at the level of their first processing level (e.g. meats, dairy products or cakes). These commodity balance variables, together with production data and commodity prices, are determined inside the model and belong to the set of endogenous variables of the AGMEMOD model (Salamon et al., 2008).

Where possible, the AGMEMOD Partnership uses Eurostat sources such as the Agricultural Information System and NewCronos to populate the AGMEMOD database (Levert and Chantreuil, 2006). As Eurostat no longer provides supply and use balances, data compilation has become more complicated, time-consuming and fragmented. National teams responsible for country models and data compilation are required to turn to diverse national data sources with very limited options for data harmonisation. So for certain circumstances a more generalised procedure – the “simplified supply and use balances” – has been established, in particular for country models not supported by national teams, but also to achieve improved alignment with EU Agricultural Outlook data. In the “simplified supply and use balances”, production data comes from the “Short-term outlook for EU arable crops, dairy and meat markets” (STO), which is published three times a year (in February, June and September) (EC, 2017). The STO provides the latest available production figures as well as expert estimates by Member State for the next marketing or calendar year. Import and export data are retrieved from Eurostat at an 8-digit level from the dataset “EU trade since 1988 by CN8 (DS-016890)”. These are converted and aggregated to raw product equivalents by conversion factors provided by BMEL (2015). Estimates of use (apparent consumption) at Member State level are derived by adding aggregated imports to the production and by subtracting aggregated exports for the relevant product. The calculated quantity is called “domestic use (including stock changes) or apparent consumption” (see also Salamon and Wolf, 2017).

In addition, market prices have become scarce or have not been provided on time. To be able to capture the most recent market developments, the latest price data are often extracted from the European Commission's “Commodity price dashboard” (EC, 2017), which provides monthly data that is then aggregated to data for calendar years (animal products) or marketing years (crops).

2.3 Model simulation

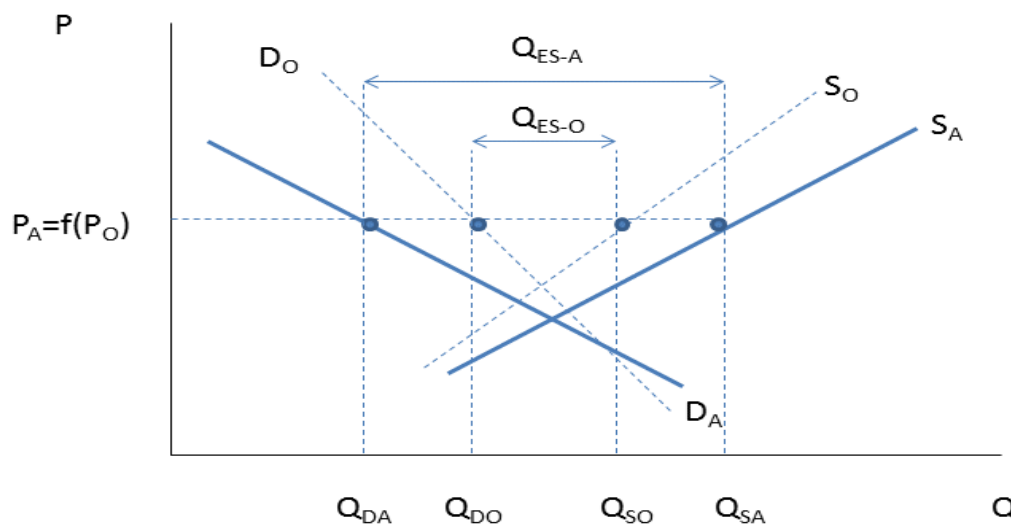
Commodity balance items, such as production, domestic use, stocks, exports and imports, as well as the associated prices, are projected and simulated up to a 15-year time horizon by making use of the underlying quantitative and qualitative assumptions on macroeconomic and other exogenous variables. Those variables are harmonised with the assumptions of the EU Agricultural Outlook, and all domestic agricultural policy and trade measures remain unchanged, as defined under the Agricultural Outlook.

The Member State outlook by AGMEMOD is embedded in the EU Agricultural Outlook. The Agricultural Outlook covers two regions for the total EU as provided in AGLINK, the aggregated EU-15 and the aggregated EU-N13, and a procedure of upscaling is applied so that the total of individual country results match the results for these sub-region totals.

Figure 5 displays a typical outcome when running the AGMEMOD model (AGMEMOD variables have subscript A) and comparing its results with the external outlook (variables have subscript O). The differences between the models can be seen when looking at the different slopes (implying differences in response of suppliers and consumers between the models). But the “location” of the curves in the price (P)-quantity (Q) space is also likely to be different. As a result, the endogenous equilibria, as calculated from both

models, are likely to be different. For the case displayed in Figure 5, when compared with AGLINK, the AGMEMOD model overestimates EU supply and underestimates EU demand. As a result, the excess supply or ES (or trade or exports) estimated by the AGMEMOD model is also overestimated relative to the external outlook (e.g. $ES-A > ES-O$). As mentioned above, this initial outcome of AGMEMOD is already based on the same world market price level as that assumed in AGLINK. This is indicated in Figure 5 by expressing the “equilibrium” price of AGMEMOD with an associated price level, as projected under the OECD-FAO Outlook, e.g. $P_A = f(P_O)$.

Figure 5. Comparing outcomes from two market outlook models for a specific country or region



Source: own elaboration.

The required scaling factors on the demand and supply sides will lower the supply and increase the demand in the AGMEMOD model, until the excess supply under AGMEMOD matches the projected excess supply in AGLINK. In the scaling procedure the following steps are involved:

- AGMEMOD outcomes for domestic use, production, area use and animal stocks at Member State level are aggregated to EU-N13 and EU-15 levels;
- scaling factors for EU-N13 and EU-15 levels are calculated so that AGMEMOD figures match domestic use, production, area use and animal stocks with the relevant figures from AGLINK;
- for those products that show a large difference in results, the behavioural equations (re-estimation of parameters) in AGMEMOD are adjusted.

Note that it is assumed, for convenience’s sake, that the external outlook (e.g. EU Agricultural Outlook) provides the “right values”, to which the AGMEMOD quantities have to be matched. Based on the above calculated scaling factors, the adjustment of model outcome is implemented as an *ex post* model calculation; scaling factors are then considered as an *ex post* shift in the model results, without affecting the equilibrium.

2.4 Validation and market experts’ involvement

The validation of the model-based outcomes is intended to improve AGMEMOD’s capacity to generate plausible and sensible market outlooks and to contribute to impact assessment analysis of different policy options. This is achieved by different layers. In the first, an initial validation is carried out by the country teams (Erjavec et al., 2007);

country teams check the consistency of the estimated behavioural production and consumption equations with theoretical requirements, necessary biological constraints and standard statistical tests. Usually, this process takes place at the final stage of the estimation, as a self-validation initiative, and is applied until estimates provide satisfying statistical results. It also involves preparation of country reports and templates to be used for external validation. The main components of a validation report are a summary of model results, an indication of outcome drivers, and a list of actions to improve the reliability of the model's results.

Country teams are encouraged to review and improve their country models, with the support of agricultural market experts within their Member State. This interaction between partners and national market experts is a key element in the achievement of plausible baseline and scenario analysis of country-level agricultural commodity markets. One approach that has been developed is for market experts to provide feedback with the help of "fact sheets" and an integrated questionnaire. This questionnaire summarises model outcomes in an accessible manner and asks for market experts' feedback in a qualitative fashion ("much too high", "too high", "about right", "too low", "much too low"), while at the same time they are asked for information on drivers and game changers. Based on these insights, amendments are introduced by re-estimations, calibrations or the implementation of new or updated data. A long-term aim is to bring together a group of pan-national market experts to provide regular support and assistance in market modelling of individual countries (Salamon et al., 2008). Implicitly, a second validation procedure may take place. Some countries establish sector outlooks based on different types of models, such as farm models, regional models or general equilibrium models with aligned assumptions and outcomes across models (Berkhout et al., 2011; Offermann et al., 2016). Comparison of the different model results also provides a validation process, which may lead to model revisions and amendments.

A second phase of validation takes place within the European validation process for commodities across EU Member States at a European-level workshop. A list of experts is compiled to cover all commodities and the key Member States for specific commodities under consideration. From this list, experts for the validation are invited, receive results for the relevant commodities for all Member States and are asked to comment on them in the workshop. This normally takes place at the beginning of March. A short presentation is given on the respective commodity projections, and market experts then provide oral review of those projected market outcomes. Transcripts of expert remarks are taken, serving as entry points for further improvement of the models and model outcomes by re-estimations, calibrations or the implementation of new or updated data.

Finally, the implementation of a revised country version in the combined model must follow a strict procedure, in which the country team specifies its amendments. This means that the individual responsible for model combination can check the outcome and identify problems related to the new version. Only if the evaluation results are judged to be satisfactory will the new combined model be made available on the website for use by the wider partnership.

3 The AGMEMOD 2017 Outlook

In this chapter the results of the AGMEMOD Outlook for the EU Member States are presented:

- Baseline assumptions are described in section 3.1.
- Results for cereals and oilseeds are included in section 3.2.
- Results for milk and dairy products are included in section 3.3.
- Results for the livestock and meat markets are presented in section 3.4.

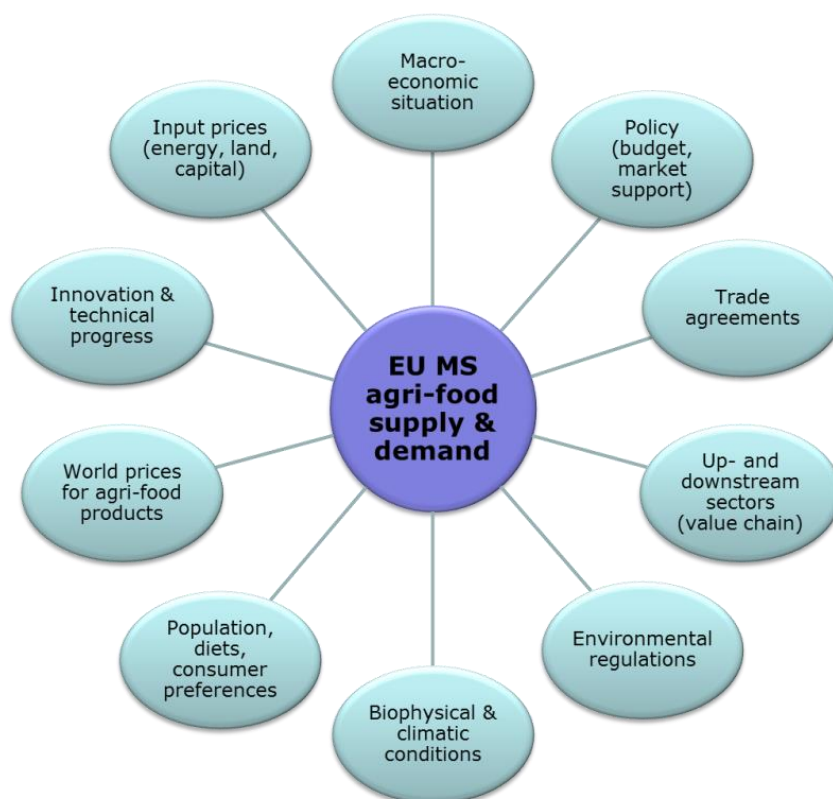
For the interpretation of the outlook results, it is important to keep in mind that the baseline projections are neither “forecasts” nor “predictions”, but are conditional projections based on a well-defined set of assumptions and a set of models of EU agricultural commodity markets in AGMEMOD. As the model structure and parameters are, in general, based on observed data from the past, a more general assumption considers the absence of structural breaks unless specific measures are taken. In addition, in general, projection outcomes tend to be relatively smooth and can be interpreted as medium-term developments, contrasting with the more jagged patterns depicted by observed historical data. But one needs to reflect that historical variations are often produced by unexpected supply or demand shocks in markets. Typical supply-side shocks can be due to abnormally favourable or unfavourable weather conditions, wars, or animal or plant disease, either via yield changes or via variations in animal stocks or in area harvested. On the demand side, shocks also give rise to variability, but in most cases they are less pronounced than the supply-side shocks and are caused, among other things, by human health concerns, economic recession or new uses for commodities (e.g. the emergence of biofuel production). In addition, unforeseeable policy actions such as bans will make an obvious mark in historical data.

3.1 Baseline assumptions

Thomas Fellmann, Myrna van Leeuwen

The AGMEMOD baseline results are driven by several underlying assumptions and exogenous variables, which are determined outside the model. The baseline assumes normal biophysical and climatic conditions, steady demand and yield trends, and no market disruption (provoked by, for example, the outbreak of animal diseases, food safety issues, extreme weather events). Consequently, all assumptions imply relatively smooth market developments, although in reality markets tend to be much more volatile. Therefore, the baseline scenario cannot be considered as a forecast, but rather as a possible pathway that the agri-food market is expected to follow given unchanged policies, a steady development of demand and technological progress, and a continuation of normal geopolitical, macroeconomic and weather conditions. The several drivers for the AGMEMOD Outlook are depicted in Figure 6, and in the following we present some information on the most important drivers.

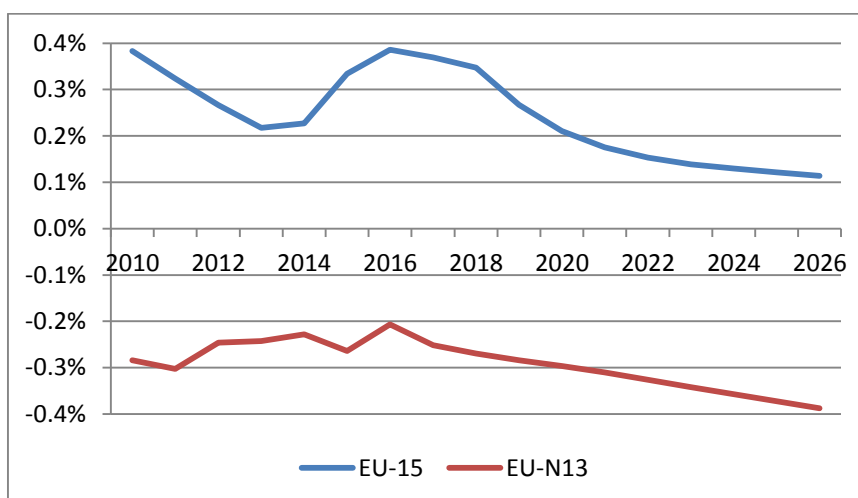
Figure 6. Drivers underlying the AGMEMOD Outlook



Source: own elaboration.

Population and economic growth are important drivers for demand and supply developments in agricultural commodity markets. Following the assumptions of Global Insight, population growth is assumed to slow in Europe, mainly because the depopulation trend observed in the EU-N13 partly offsets continued population growth in the EU-15. At the world level, population growth is also assumed to slow in North America, Russia and China, whereas it is expected to continue in Africa and Asia. The assumed development of the EU is presented in Figure 7.

Figure 7. Assumed EU population growth (%/year)

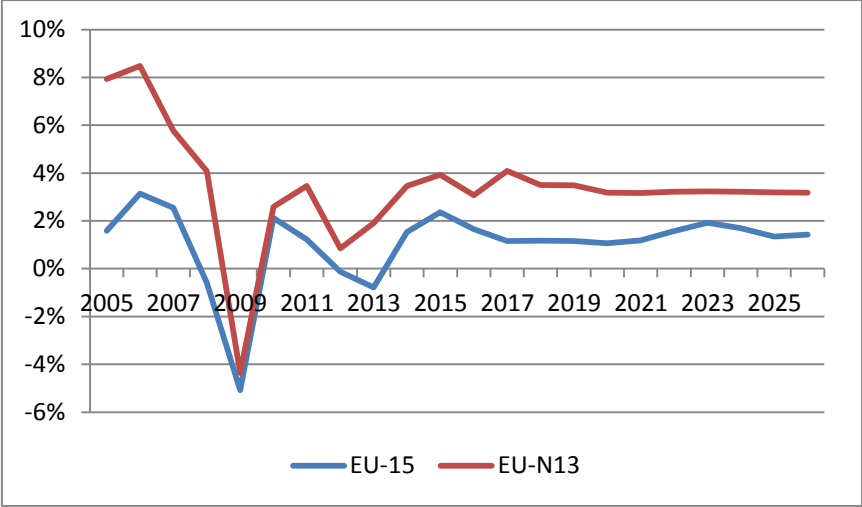


Source: Global Insight (2016).

For assumptions on the development of macroeconomic conditions, the AGMEMOD Outlook uses the same sources as the EU Agricultural Outlook (EC, 2016a), which itself relies on a combination of the European Commission’s short-term outlook, forecasts from IHS Markit and other sources including the International Monetary Fund, the World Bank and the OECD. Their respective major assumptions include data on economic growth, inflation and exchange rates (EC, 2016a).

With respect to GDP development in the EU, after a period of zero real GDP growth in 2013, the EU’s GDP growth level has gradually recovered to about 2%. GDP growth at EU-28 level reflects different GDP growth rates in various Member States. The assumed average annual growth rates for the economies of the EU-15 and EU-N13 aggregates are presented in Figure 8.

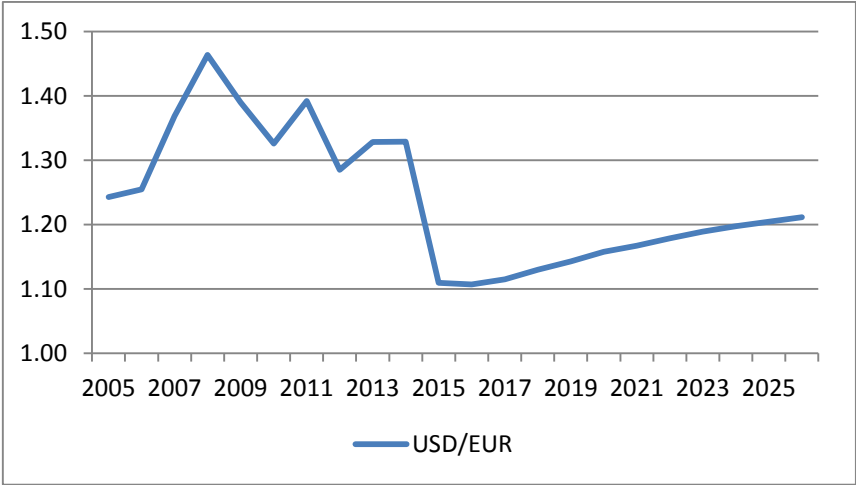
Figure 8. Assumed average annual GDP growth rates in the EU (%)



Source: EC (2016a).

The AGMEMOD baseline scenario adopts the USD/EUR exchange rate development assumed in EC (2016). Following the depreciation of the euro against the US dollar in the period 2015-2017, recovery of the euro is expected from 2018 onwards, with an USD/EUR exchange rate of about 1.21 from 2021 onwards (Figure 9).

Figure 9. Assumed USD/EUR exchange rate and annual economic growth rate (%)



Source: EC (2016a).

Regarding the CAP, the baseline outlook includes the following aspects of the CAP 2014-2020 reform ⁽⁹⁾:

- Milk quotas expired in 2015.
- Decoupled payments scheme: future budget envelopes are used to calculate average per hectare decoupled payments for EU Member States.
- Voluntary coupled support (VCS): Member States can couple up to 8% of their direct payments envelope (in some cases up to 13%), and the corresponding Member State decisions with regard to VCS are specifically taken into account.
- “Greening” of the CAP: the goal is to pay for some public goods produced by farmers when they comply with three specific requirements.
- Maintenance of pasture: it has to be ensured that the ratio of land under permanent grassland to total agricultural area does not decrease by more than 5% (compared with the reference year).
- Ecological focus area (EFA): 5% of the farm area must remain un-cropped.
- Expiry of the quota system for sugar and isoglucose in 2017 ⁽¹⁰⁾.

National environmental policies that constrain dairy, pig and poultry production are implicitly taken into account in each Member State, but they are explicitly implemented in the Member State models of the Netherlands (such as the Dutch phosphate reduction plan approved by the European Commission in February 2017) and Denmark.

With regard to international trade negotiations and agreements, the AGMEMOD Outlook assumes a continuation of the current commitments of the Uruguay Round Agreement on Agriculture. No assumptions are taken with respect to a potential outcome of the Doha Development Round. Only free trade agreements (FTAs) already signed and in place are considered, i.e. bilateral and regional agreements still not signed or ratified are not taken into account. The Russian food embargo against imports from EU countries is considered until the end of 2017.

The AGMEMOD 2017 Outlook assumes that the United Kingdom will remain part of the EU-28 over the whole projection period until 2026, i.e. Brexit — the prospective withdrawal of the United Kingdom from the EU — is not taken into account. Nothing is so far known about how Brexit will be implemented, and accordingly no assumptions could be made. However, section 4.1 is dedicated to shedding some light on the importance of trade in agricultural products between the United Kingdom and the rest of the EU under current conditions (i.e. with the United Kingdom being part of the EU).

The outlook version of the AGMEMOD model is calibrated to world market prices and scaled to aggregated production and use presented for the EU-15 and EU-N13 in the EU Agricultural Outlook for 2016-2026 (EC, 2016a). The world market prices are an important driver for agricultural markets in the EU Member States (see also Chapter 2).

3.2 Cereals and oilseeds

Verena Laquai

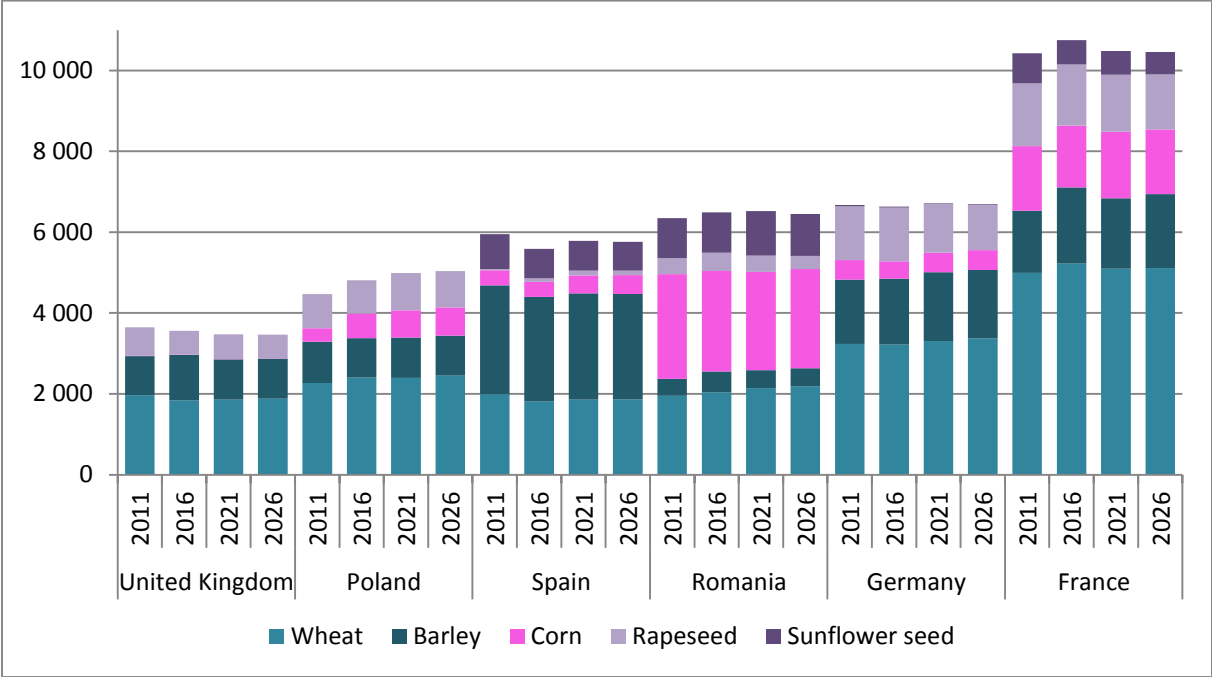
Cereal and oilseeds markets interact with each other through competition for land as well as their substitutability, especially in feed rations. Additionally, their development depends on the development of the livestock sector within the EU as, besides imported feedstocks such as soybean meal, they are the main input for feed used in pork, poultry, and beef and dairy production. The main cereals and oilseeds markets in the EU-28 are

⁽⁹⁾ For detailed information on the CAP 2014-2020 reform, see: http://ec.europa.eu/agriculture/cap-post-2013/index_en.htm

⁽¹⁰⁾ So far this has been implemented only for Poland and Germany, as the other Member State models do not yet include the sugar market.

projected, namely soft wheat, barley, maize, rapeseed and sunflower seed. For cereals, wheat has the largest proportion of the area harvested, followed by barley and maize. However, it varies between the Member States, e.g. barley dominates in Spain and maize in Romania. For oilseeds, rapeseed area dominates in the northern Member States of the EU, while the sunflower seed area dominates in the southern Member States (see Figure 10). The largest production in terms of area harvested for these five crops is in France, followed by Germany, Romania, Spain, Poland and the United Kingdom.

Figure 10. Area allocation in 1 000 hectares, 2011-2026, for main cereals and oilseeds in the largest Member States of the EU



Source: AGMEMOD 2017 Outlook.

Over the projected period to 2026, the area for the presented cereals is projected to remain relatively stable in the EU-28 compared with the 2014-2016 3-year average, while the area for the presented oilseeds is projected to decrease by around 10%. As a result of increases in yields over the projection period, the production of these cereals increases until 2026, while the production of these oilseeds decreases by around 8%.

The following paragraphs present the market outlook for each crop individually. They focus on production, consumption and trade, as well as on the largest Member States in each category in the EU-28.

3.2.1 Cereals

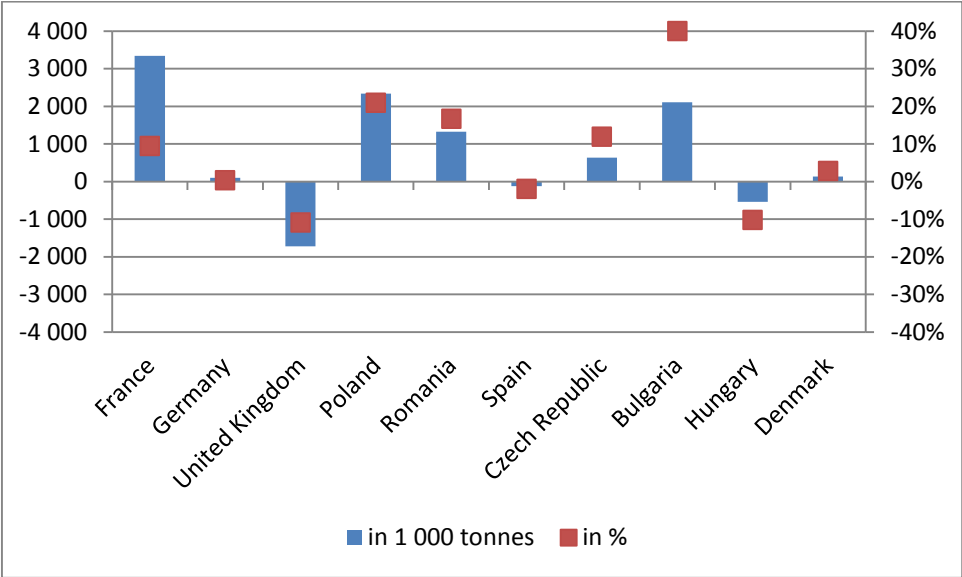
Soft wheat

Total EU-28 soft wheat production is projected to increase from 146 million tonnes in the reference period to 154 million tonnes in 2026, i.e. a 6% increase in the 10-year projection period, according to the EU Agricultural Outlook (EC, 2016a). France and Germany are by far the largest producers of soft wheat in the EU-28, with proportions of total EU production of 24% and 18% respectively, averaged over the 3 market years 2014-2016, and followed by the United Kingdom, Poland and Romania. These five countries produced 66% of EU-28 soft wheat.

AGMEMOD baseline results show quite a diverse development of soft wheat production at Member State level, due to changes in both yield and area allocation (see Figure 11 for the largest producers). Production increases in the projected 10-year period are highest

in France, Poland, Bulgaria and Romania. All four countries increase their yields by more than 10% over the period. In addition, the soft wheat area expanded in Poland, Bulgaria and Romania, while remaining stable in France. The increase in France is distorted because of the devastating harvest in 2016, which is included in the reference period. Hence, it is worth noting that French production is projected to be 39 million tonnes in 2026 and yield to be 7.6 tonnes per hectare, which is below the observed values for the record year 2015. The main production decreases can be observed in the United Kingdom and Sweden. While in the United Kingdom the decrease is due to a decrease in yield, in Sweden both yield and area declined. Both countries had high yields in the reference period 2014-2016. For example, the United Kingdom reported a yield of 9 tonnes per hectare in 2015, which is not expected to be reached again until 2026, because our projections are an average and do not represent the highest yields achievable.

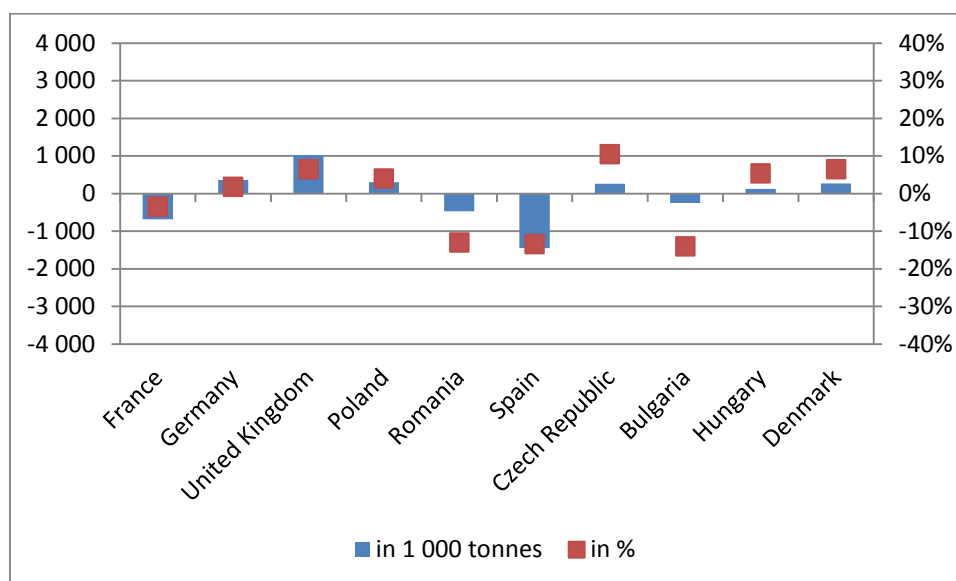
Figure 11. Soft wheat — change in production, 2026 versus average 2014-16, in 1 000 tonnes and percentage; largest producing countries displayed (from left to right)



Source: AGMEMOD 2017 Outlook.

Total EU-28 soft wheat consumption is projected to remain rather stable at 120 million tonnes. In the Member States, wheat consumption changes less than production (compare Figure 11 and Figure 12). The largest wheat consumers are Germany, France, the United Kingdom, Spain and Italy (together representing 62% of total EU consumption). Feed and food demand are the main drivers for consumption changes. While food demand depends largely on population development and changes in dietary preferences, feed demand depends on changes in the livestock sector as well as the relative price of soft wheat compared with other substitutable grains in the feed ration. In the EU-28, food use is projected to decrease while feed use is projected to increase (EC, 2016a). In contrast to this general trend, food use increases in some Member States, e.g. the Czech Republic, Austria, the United Kingdom and France, while feed use decreases in others, e.g. Spain, Hungary, Belgium and Romania.

Figure 12. Soft wheat — change in domestic use, 2026 versus average 2014-16, in 1 000 tonnes and percentage



Source: AGMEMOD 2017 Outlook.

Most Member States maintain their trade position as net importers or net exporters of soft wheat over the projection period. The main exporters in terms of quantity are France, Germany, Romania, Poland and Bulgaria over the reference period. All increase their exports until 2026, with Bulgaria surpassing Poland in terms of export quantity. The main importers are the Netherlands, Italy, Spain, Belgium and Portugal, with the Netherlands increasing its imports until 2026 and Spain and Belgium decreasing them. In addition, the United Kingdom becomes a large net importer of soft wheat, while the market was more or less balanced, i.e. net trade was less than 10% of production, in the reference period.

Maize

Total EU-28 maize production is projected to increase from 65 million tonnes (average 2014-2016) to 74 million tonnes (2026), i.e. an increase of 13% in the 10-year projection period, according to the EU Agricultural Outlook (EC, 2016a). This growth occurs mainly in the EU-N13, with production increasing by 28%, driven mostly by Romania, Poland, Bulgaria and Hungary. France is the largest producer of maize, followed by Romania, Hungary, Italy and Spain. These five countries produced 68% of EU-28 maize in the reference period. Over the projected period, France and Italy reduce their maize production, mainly because of area reductions, while most other countries increase their production because of yield increases and, in the case of Spain, Germany and Poland, additional area increases.

Total EU-28 maize consumption is projected to increase from 75 million tonnes to 84 million tonnes (2026), i.e. by 12.5% (EC, 2016a). The largest maize consumer is Italy, followed by Spain, France, Germany and Romania (together representing 63% of total EU consumption). Consumption is driven mainly by feed demand. Only Spain, Romania and Portugal decrease maize consumption, in contrast to the general trend.

As a result of the larger increase in consumption than in production, the EU-28 net-import position grows in the projection period. On a Member State level, the largest exporters are and remain France, Hungary, Romania and Bulgaria. However, France and Hungary decrease their net exports over the projection period by 22% and 13%, respectively, while Romania and Bulgaria increase them by 92% and 80%. The largest net importers in the reference period are Spain, Italy, Germany and the Netherlands, while in 2026 Italy becomes the largest net importer, followed by Germany, the

Netherlands and Spain. The only net-trade position changes are in Lithuania, from net-importer status to a broadly balanced market, and in Poland, from a broadly balanced market to net-exporter status.

Barley

Total EU-28 barley production is projected to increase from 61 million tonnes to 63 million tonnes (2026), i.e. an increase of 4% in the 10-year projection period, according to the EU Agricultural Outlook (EC, 2016a). France and Germany are the largest producers of barley, followed by Spain and the United Kingdom. These four countries produced 62% of EU-28 barley in the reference period. The largest decreases in barley production over the projection period occur in the United Kingdom, Germany and Slovakia. This decrease is due to yield and area decreases in the United Kingdom and Slovakia, while area expands in Germany but yield decreases. The largest increases occur in France, Poland and Denmark. These three countries increase barley yields and also expand barley area.

Total EU-28 barley consumption is projected to increase from 49 million tonnes to 53 million tonnes (2026), i.e. by 8% (EC, 2016a). The largest barley consumers are Spain, Germany, the United Kingdom, Poland and France (together representing 65% of total EU consumption). The largest increases in barley consumption over the projection period can be observed in Spain and Denmark, while the largest decreases occur in Ireland and the United Kingdom.

As in the case of corn, barley consumption grows more strongly than production. Hence, the EU-28 net-export position shrinks in the projection period. On a Member State basis, France is by far the largest exporter, followed by Germany, the United Kingdom, Denmark and Romania. Of these, only France and Denmark increase their net exports until 2026. The largest net importer is Spain, followed by Poland and the Netherlands. Trade positions change from a broadly balanced market in the reference period to a net-importing position for Austria, Greece, Latvia and Slovakia. Croatia switches from a net-exporter status to a broadly balanced market.

3.2.2 Oilseeds

Rapeseed

Total EU-28 rapeseed production is projected to decrease from 22 million tonnes (average 2014-2016) to 20 million tonnes (2026), i.e. a decrease of 11% in the 10-year projection period, according to the EU Agricultural Outlook (EC, 2016a). Germany and France are the largest producers of rapeseed, followed by Poland and the United Kingdom. These four countries produced 70% of EU-28 rapeseed in the reference period. All EU-28 countries decrease their production over the projected period, except Germany, Finland and the Netherlands. The largest decreases are projected for the Czech Republic, the United Kingdom and France. Areas decrease in all EU-28 countries except Hungary, Spain, Finland, Latvia and the Netherlands. The three largest producers realise an increase in yields over the projected period; however, this does not compensate for the reduction in area in France and Poland.

Total EU-28 rapeseed consumption is projected to decrease from 24 million tonnes to 22 million tonnes (2026), i.e. by 8% (EC, 2016a). This decrease is caused by an assumed decrease in rapeseed-based biofuel demand, which is the main driver for the rapeseed market. Germany and France are the main rapeseed consumers, with proportions of EU-28 rapeseed consumption of 39% and 18%, respectively, in the reference period, and 42% and 17% in 2026. Consumption decreases over the projection period in all countries except the United Kingdom, Finland and Belgium.

Most rapeseed is crushed in the country where it is produced. Exceptions are Bulgaria and Romania. They export more than 80% of their rapeseed. Besides these two countries, France and Hungary are also net exporters of rapeseed. The main importers of rapeseed are Germany, Austria, the Netherlands and Belgium. Of the large importers,

only Belgium increases its net-import volume until 2026. Trade positions change from net-exporter status in the reference period to a broadly balanced market for the Czech Republic, Estonia, Croatia and the United Kingdom.

Sunflower seed

The sunflower seed market is rather small compared with the markets presented above. Total EU-28 sunflower seed production is projected to remain rather stable at 8.4 million tonnes, however, shifting slightly from the EU-15 to the EU-N13 (EC, 2016a). Sunflower seed is produced mainly in the southern Member States of the EU, with the largest producers being Romania, Bulgaria, Hungary, France and Spain. They produced 89% of the EU-28 sunflower seed in the reference period. Of the large producers, only Romania expands its production in the projection period by area and yield expansion. In the other countries, production decreases, mainly because of area reductions, while in Hungary and Spain yields also decline slightly.

Total EU-28 sunflower seed consumption is projected to increase slightly from 8.3 million tonnes (average 2014-2016) to 8.4 million tonnes (2026), i.e. by 1% (EC, 2016a). The large producers of sunflower seed are also the large consumers of sunflower seed, i.e. processing sunflower seeds into oil and meal before consumption or export. While France and Bulgaria reduce their consumption until 2026, Hungary and Romania increase it.

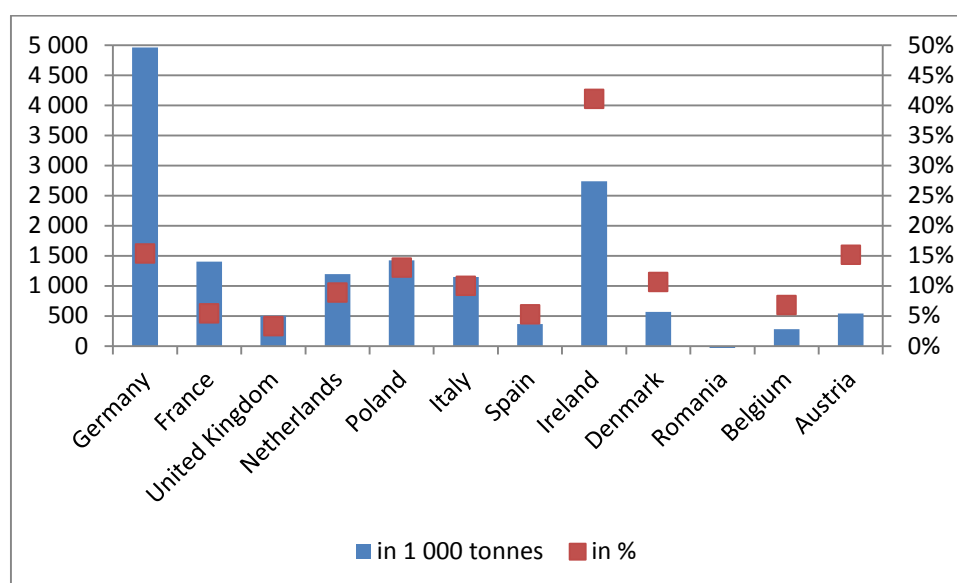
As with rapeseed, Bulgaria and Romania export quite a large amount of their production directly, i.e. 44% and 51%, respectively, in the reference period. In 2026, these proportions increase to 58% and 54%. The largest net importers are the Netherlands, Spain and Germany. Hungary turns from a net exporter in the reference period to a net importer in 2026, as a result of increased domestic consumption and decreased production.

3.3 Milk and dairy products

Roel Jongeneel, Myrna van Leeuwen, Willy Baltussen, Petra Salamon, Trevor Donnellan

Dairying is an important and spatially dispersed activity in the EU. The value of milk production in 2015 final primary agricultural production is about 14%, which makes dairy the second most important sector, after fruits and vegetables. Milk is produced in every single Member State, and for some it represents a significant proportion of the value of agricultural output. EU 2016 dairy cow milk production is estimated to be about 160 million tonnes. The EU 2015 dairy herd comprised 23.4 million dairy cows and has recently increased after years of decline. The milk yield per dairy cow (EU average, 2106) is about 6 850 kg and shows an average annual increase of about 100 kg per dairy cow (about 1.5% per annum). The EU's main dairy-producing Member States are Germany, France, the United Kingdom, Poland, the Netherlands, Italy and Spain, which together account for more than 70% of the value of EU dairy production. Moreover, the dairy sector is important because of its interlinkage with the beef sector, as the inflow of calves not entering the dairy herd and dairy cows that are replaced provide part of the beef sector.

Figure 13. Projected evolution of milk supply for selected Member States, 2026 versus 2016, in 1 000 tonnes and percentage

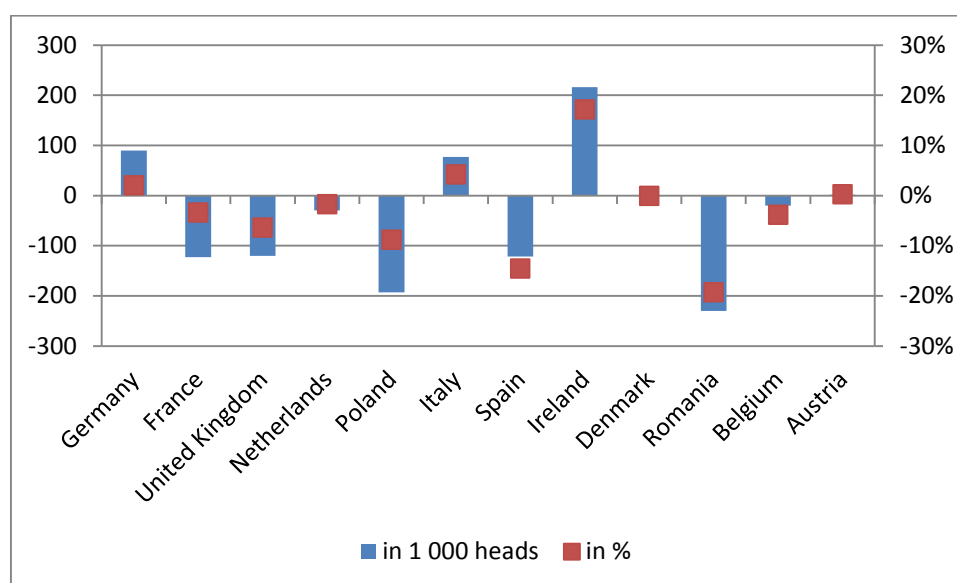


Source: AGMEMOD 2017 Outlook.

Figure 13 provides an overview of the estimated changes in EU milk production for the coming decade and selected main producing EU Member States. A significant part of the increase in total EU milk production in the period 2016-2026, around 14 million tonnes, comes from four EU Member States: Germany, France, the United Kingdom and Ireland. For Ireland, the projected strong increase is widely expected by experts. The projection for the United Kingdom is driven by the positive impact of exchange rate adjustments on farm gate milk prices and by the impact on direct payments received by dairy farmers. It may be too high, as there is great uncertainty about this estimate. For Germany, an increase of about 9% is projected, which is similar to the average EU milk supply growth as projected by the European Commission in the latest medium-term outlook (EC, 2016a). The projected supply growth for France is about 6-7%, and it is slightly lower than the EU average. This estimate is a result of the impact of milk prices on French milk supply, taking into account the poor competitiveness of dairy production in some regions in France. For the Netherlands, we project an increase in milk supply for the coming decade, but it has been lowered significantly relative to previous estimates. This is because of the reduction in phosphate use, which will imply a reduction in the Netherlands' 2017 dairy herd of an estimated 90 000 dairy cows. After this, in 2018, a phosphate quota system will be imposed on dairy farmers. For Italy, growth is driven by sustained demand for special products.

The projected changes in milk production have implications for the expected evolution of EU dairy cow herds. A decline in the dairy cow herd in the coming decade is projected for most Member States, with a few exceptions (see Figure 14). Ireland is the outstanding exception to this rule. For the United Kingdom and Italy, a potential slightly positive growth of the dairy herd is projected, but these estimates are uncertain. A slightly different yield growth estimate may change indications of expected herd development for these countries, but this is not the case for Ireland.

Figure 14. Projected dairy herd evolution for selected EU Member States, 2026 versus 2016, in 1 000 heads and percentage



Source: AGMEMOD 2017 Outlook.

Figure 15 provides a summary of the main drivers of milk supply in various Member States. The yield growth and herd size have been referred to above. The competitiveness indicator is based on the observed milk supply response during the milk crisis years 2015 and 2016, for which low milk prices were observed. Member States for which milk production did not decline during these years are indicated to be strongly competitive (in green). For the Netherlands, the environmental constraints discussed above are likely to impose limits on future development. However, the importance of constraints from environmental regulation was also detected for several other EU Member States, in particular in those regions (of Member States) where production is very intensive. We also see that social concerns about animal welfare are increasing (e.g. in Germany).

Figure 15. Overview of the drivers of milk production for selected EU Member States

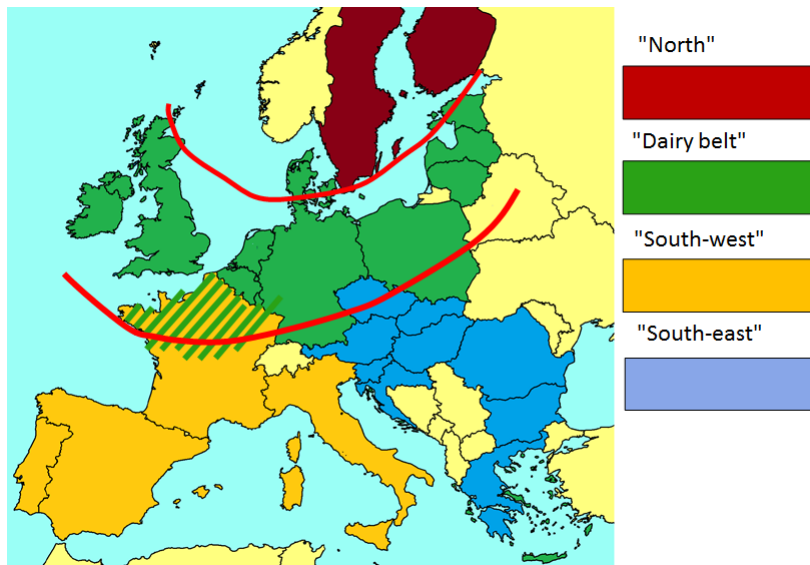
	Germany	France	United Kingdom	Netherlands	Poland	Italy	Spain	Ireland	Denmark	Romania	Belgium	Austria
Estimated supply growth, %	15.4	5.4	3.3	8.9	13.1	10.0	5.3	41.1	10.7	-9.2	6.8	15.2
Yield growth	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Yellow
Dairy herd	Yellow	Red	Yellow	Yellow	Red	Yellow	Red	Green	Yellow	Red	Yellow	Yellow
Competitiveness	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Green	Green	Green	Yellow	Yellow
Environment	Yellow	Yellow	Green	Red	Green	Green	Green	Yellow	Yellow	Green	Green	Green

Legend: traffic light colour code used to indicate "positive" (green), "average" (yellow) or "negative" (red) trends in production.

Source: AGMEMOD 2017 Outlook.

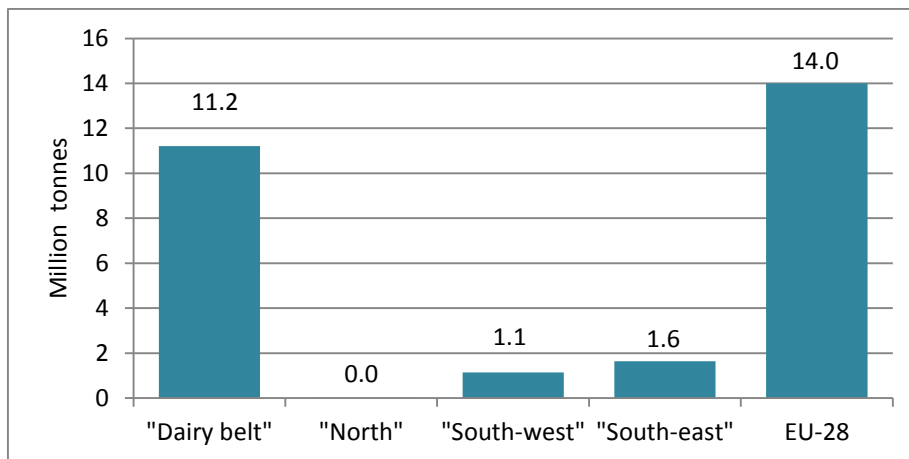
Figure 16 and Figure 17 show the regionalisation of EU milk production. Four regions are distinguished: the northern part of Europe, which is composed primarily of the Scandinavian states; the dairy belt, which includes the Baltics, Poland, Denmark, Germany, part of France, the United Kingdom and Ireland; and the two southern regions, the south-west and the south-east.

Figure 16. The regionalisation of EU milk production



Source: own elaboration.

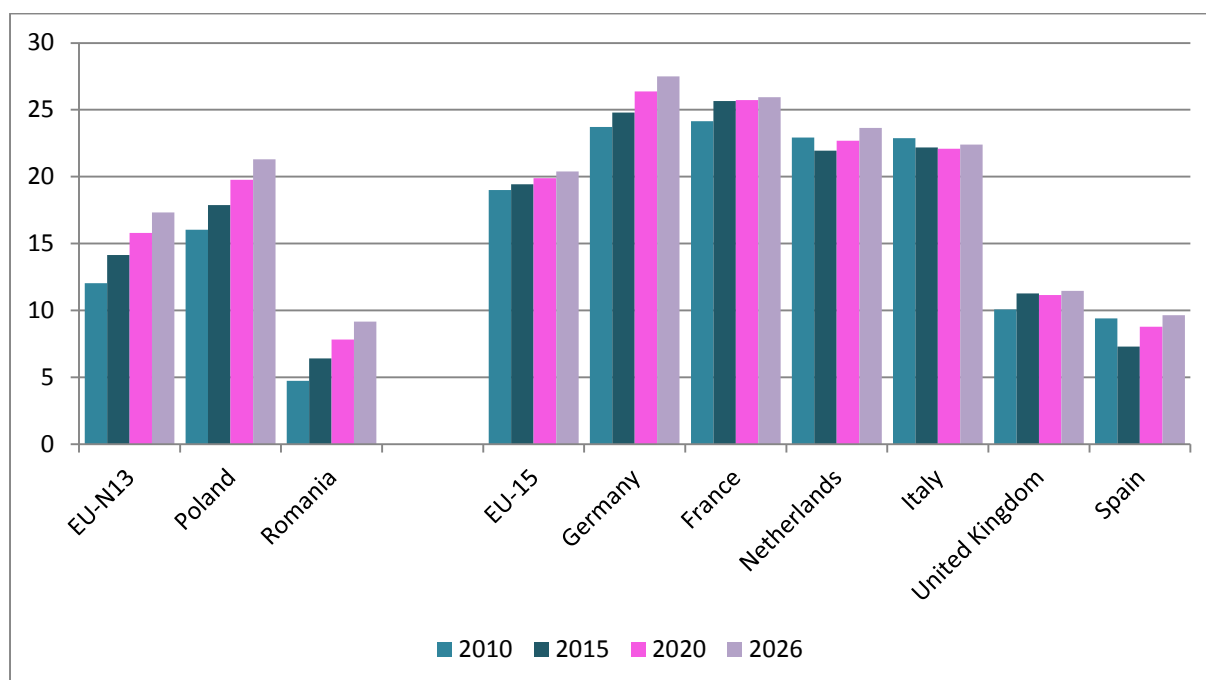
Figure 17. The projected increase of EU milk production and its estimated regional distribution in 2026 compared with 2016, million tonnes



Source: AGMEMOD 2017 Outlook.

Figure 18 provides an overview of the projected demand for cheese, which is one of the most dynamic components of EU demand for dairy products. A strong increase in cheese consumption is projected, in particular in the EU-N13, with Poland and Romania being important for the growth in consumption. An increase in cheese consumption is projected in the EU-15, although this is less strong than in the EU-N13 (Italy, where demand is almost stable, being an exception). Cheese is a very important factor in explaining the demand and also the value creation in the EU dairy sector.

Figure 18. Expected evolution of EU cheese demand, kg/per capita consumption



Source: AGMEMOD 2017 Outlook.

Figure 19 provides an overview of the identified drivers of demand for dairy products. Per capita income is one of the key drivers of demand for dairy products. Whereas the average increase ranges from 1.2% to 1.5% per annum, larger increases are observed for specific Member States (e.g. a cumulative increase of 23% in Poland for the coming decade). In the EU-N13 Member States in particular, income growth is a factor that explain the evolution of demand. A second driver is population growth. Population is often considered as a rather stable variable for most Member States, but notable changes over time have been identified, and are likely to affect demand for dairy products (e.g. in the United Kingdom a 6.3% increase in population is predicted over the coming decade, partly due to migration).

The expected evolution of consumer demand varies by type of dairy product. Whereas the evolution of demand for cheese is generally positive for drinking milk, the situation varies. For some Member States (notably Poland and the Czech Republic), an increase in drinking milk consumption is expected, while for other Member States a decline is projected (e.g. France and the Netherlands). This decline has to do with changes in consumption patterns (lifestyle changes). Butter has in recent years increased its profile as a healthy and desirable dairy product, leading to an expansion in consumption and demand in several Member States.

Figure 19. Drivers and trends in consumption of EU dairy products (selected Member States)

		Germany	France	United Kingdom	Netherlands	Italy	Poland	Spain	Denmark	Czech Republic
Cumulative growth 2016-2026	Income/capita	15.4	15.3	15.1	12.2	17.9	23.1	15.9	12.0	20.4
	Population	-0.7	4	6.3	3.6	-0.2	-1.7	-0.2	4.1	2.7
Consumption per capita trend	Drinking milk	Yellow	Red	Yellow	Red	Yellow	Green	Red	Yellow	Green
	Butter	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Cheese	Yellow	Yellow	Yellow	Green	Green	Green	Yellow	Green	Green

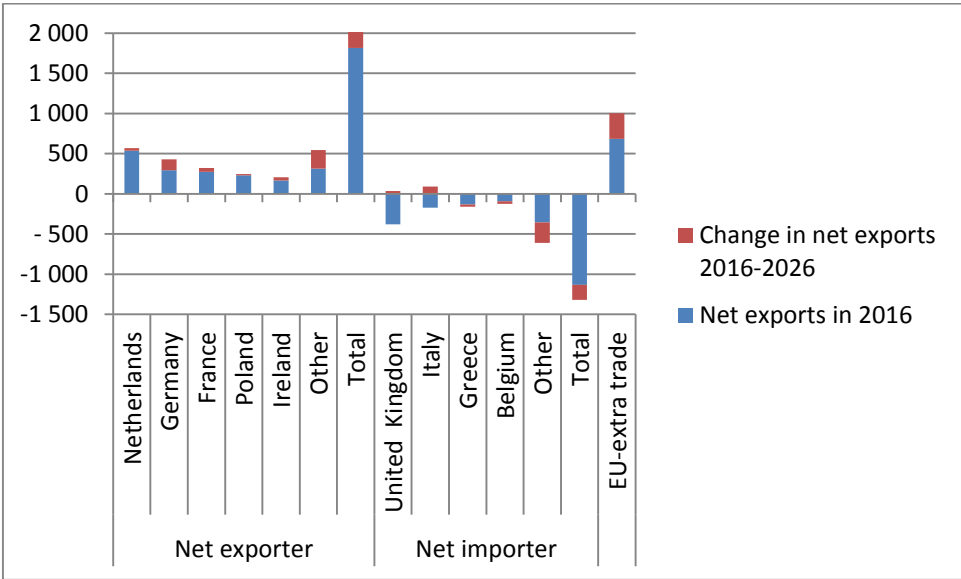
Legend: traffic light colour code used to indicate "positive" (green), "average" (yellow), or "negative" (red) trends in per capita consumption.

Source: AGMEMOD 2017 Outlook.

For the main commodities (SMP, WMP, and whey), increases in EU domestic consumption or use and EU exports (trade) are projected for the coming decade. For SMP and WMP, the annualised increase in domestic use is higher than 3% (the annualised growth in consumption of consumer products is less than 1%).

With respect to trade in butter and cheese, no major changes are projected (relative to current net-trade positions). Figure 20 provides some detail about cheese net exports in various EU Member States. On the left side are countries that have a positive net export in 2016, and on the right are importing countries. What the figure shows is that about half of the increase in cheese supply is used by the net exporters to serve other EU Member States (delivering about 309 000 tonnes of cheese to them). The other half of it goes to the rest of the world. This underscores the importance of the domestic market as an outlet for EU cheese production and the increase in production.

Figure 20. Trade in cheese — net exporting and importing EU Member States, and extra-EU trade, 1 000 tonnes



Source: AGMEMOD 2017 Outlook.

In summary, the following picture emerges for the dairy outlook. Cow’s milk production is either stable or increasing. Of the projected increase in EU milk production (9% in the period 2016-2026), 75% is realised by five member states: Germany, Ireland, the Netherlands, France and the United Kingdom. After a period of several years in which an increase in the dairy cow herd was observed, a decline across the Member States is now projected. In the Nordic countries (Finland), milk production is under downward pressure, but coupled support may have contributed to preventing real production decline. For other Member States, it is difficult to assess the impact of VCS on dairying, but according to our first estimates the impacts are in general limited. Even when the aggregate production numbers are relatively stable, there are other factors to take into account, such as continuing specialisation and increases in farm scale. There is a steady milk yield increase of, on average, about 100 kg of milk per dairy cow (with a range of 1-2% per animal). Even with the high milk yield level that has been achieved, there is no evidence of this yield growth rate slowing. As indicated above, several Member States face environmental constraints, and we see that societal concerns regarding dairy produce are increasing in some Member States. A slight reorientation in milk production towards the dairy belt region has been projected. Finally, as regards consumption it was found that the growth of dairy product consumption per capita increases more strongly in the eastern than in the western part of the EU. Cheese consumption in particular continues to grow across the EU. Whereas income growth is stronger in the EU-N13 than in the EU-

15, population growth in the former is slightly lower, creating differentiated impacts on the evolution of dairy demand. Projected annualised growth rates for consumption or use of dairy commodities (SMP, WMP) have an average order of magnitude of about 3% and are much larger than comparable rates for the domestic consumption of consumer products (cheese, butter, fresh dairy products). Annual growth rates for trade in dairy products (exports) are usually much stronger than those for domestic consumption, which reflects the importance of trade and export demand for facilitating the growth of the EU dairy sector. Cheese turns out to be a key growth engine for demand, while trade (EU exports) is also an important driver for demand and the valuation of EU raw milk.

As a response to the EU milk crisis during the period 2015-2016, a series of short-term exceptional measures have been implemented. Farmers responded late to this and it has been estimated to have led to a decline in the EU's 2016 production of about 1% relative to a situation without such measures. The dairy sector benefits from direct payments, but since these payments are largely decoupled from production and no major changes were observed in these payments for the projection period, no impact on the milk supply has been identified. However, when future changes in direct payments take place (e.g. as a result of CAP reforms), this may have an impact on EU milk supply and the structure of the EU dairy sector. A major uncertainty remains with respect to the impacts of Brexit on the EU's milk supply and dairy product markets. In particular, the projected milk supply increase for the United Kingdom should be treated with caution.

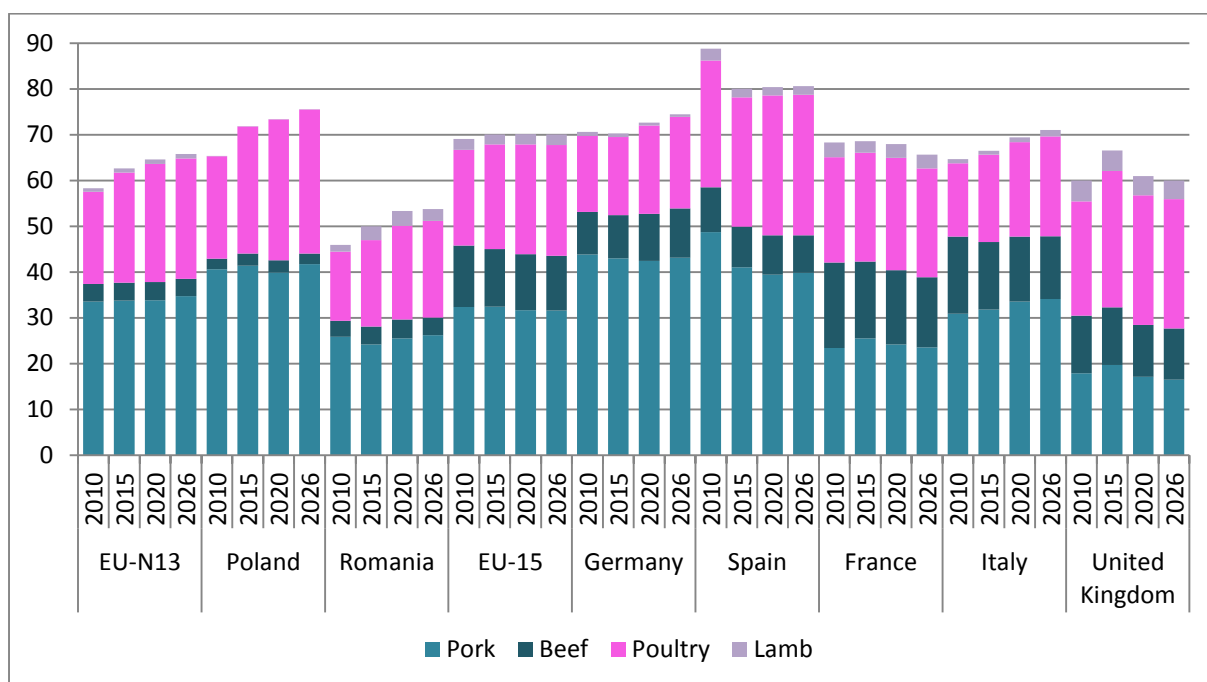
3.4 Livestock and meat markets

Petra Salamon, Martin Banse, Josef Efken, Myrna van Leeuwen, Roel Jongeneel, Willy Baltussen, Kevin Hanrahan

While livestock numbers and meat production have grown in most EU Member States over the past decade, the rate of growth will slow over the coming decade, because of more severe environmental constraints (especially in western Europe) and citizens' changing attitudes towards animal husbandry. While aggregate meat domestic use is expected to increase over the period from 2014-16 to 2026, most of this growth is due to growth in demand for poultry meat, with sluggish if not negative growth in demand for other meat types.

The proportion of people not eating or limiting their intake of meat (vegans, vegetarians and flexitarians) in the population, and especially among younger consumers, is increasing in most EU-15 Member States, while generally ageing societies will be reflected in lower demand for meats in general. For the EU-15, close to no increase in per capita meat consumption is projected, while some growth is expected in the EU-N13, particularly in Poland and Romania (see Figure 21). In both countries, most of the additional meat consumption will be accounted for by growth in pork and poultry. In some of the EU-15 Member States, e.g. Germany and Italy, small increases in consumption per head are projected. In other Member States, e.g. France and Spain, meat consumption per capita is expected to decline. In the EU-15, the composition of meat consumption across the Member States is quite different. In some countries, e.g. Germany, Spain and Italy, the dominant meat type is pork, while in the United Kingdom poultry is the most important meat type, with the proportion of poultry in meat consumption continuing to grow over the period to 2026. In France, the proportion of poultry in overall meat consumption is also expected to increase; by 2026, the proportion of poultry meat in total French meat consumption is projected to exceed that of pork. Beef will remain the third most important meat in the EU meat consumption basket, and its proportion is not expected to change significantly over the coming decade; only limited declines in the share of beef in total meat consumption are projected in most countries.

Figure 21. Total meat consumption in kg per capita, 2010-2026, for EU-N13 and EU-15 and some major EU Member States



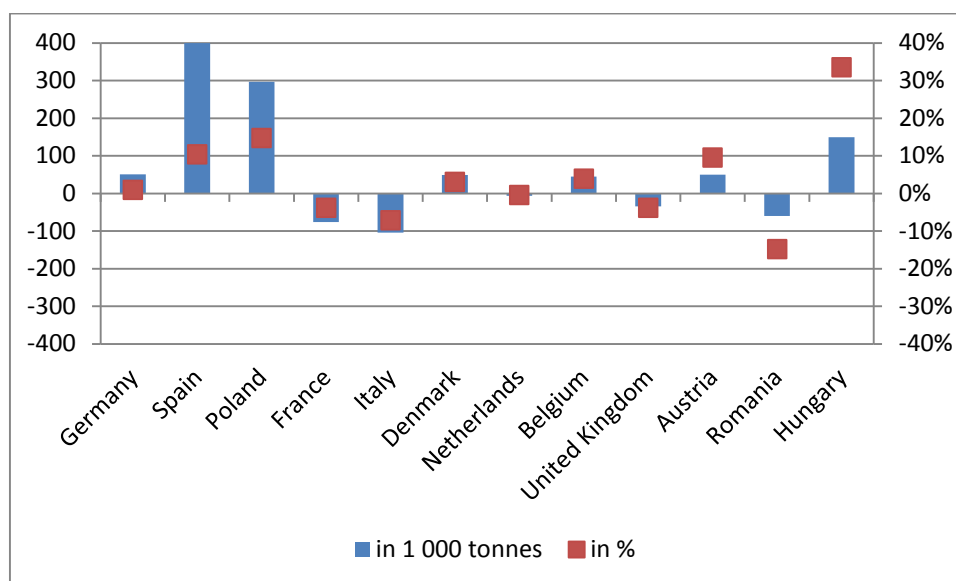
Source: AGMEMOD 2017 Outlook.

Due to minor changes in demand, additional production growth will need extra EU export demand. To achieve those exports, dependency on customers in third countries increases and competition may intensify. Painful experiences in trade relations with Russia have demonstrated the risks connected with high shares of exports in production. There will be a need for multi-channel distribution strategies. In addition to these issues, it will be questionable to what extent — if at all — non-Member State importers will be willing to pay for official higher environmental and animal welfare requirements in the EU.

3.4.1 Pork

The EU pork market on aggregate is a satiated and well-served market; however, in only two Member States, Spain and Poland, are dynamic developments in production expected in the medium term. The generally limited growth in EU production projected over the period to 2026 (Figure 22) is due to pressure on real prices, environmental constraints and societal concerns, which are expected to reduce investment in new facilities in many Member States. Seven Member States, namely Germany, Spain, France, Poland, Denmark, Italy and the Netherlands, together account for more than 75% of the total EU pork supply.

Figure 22. Changes in pork production for selected Member States between 2014-16 and 2026



Source: AGMEMOD 2017 Outlook.

Pig meat production is expected to increase in some Member States and decline in others. The most dynamic developments in production are projected to occur in Spain and Poland, where growth in excess of 15% over the period to 2026 is expected. Pig meat production is also projected to increase marginally in Germany but to decline in France, the Netherlands, Denmark and Italy. Minor changes in countries such as Germany may hide underlying structural changes. For example, in Germany between 2010 and 2016 the number of pig farms decreased significantly by 26%, and the number of farms with breeding sows decreased by 44%, as the number of breeding sows decreased by 15%. The relevant drivers are productivity gains and the requirements for about 1 000 places for fattening or 250 for breeding sows, to generate a minimum income.

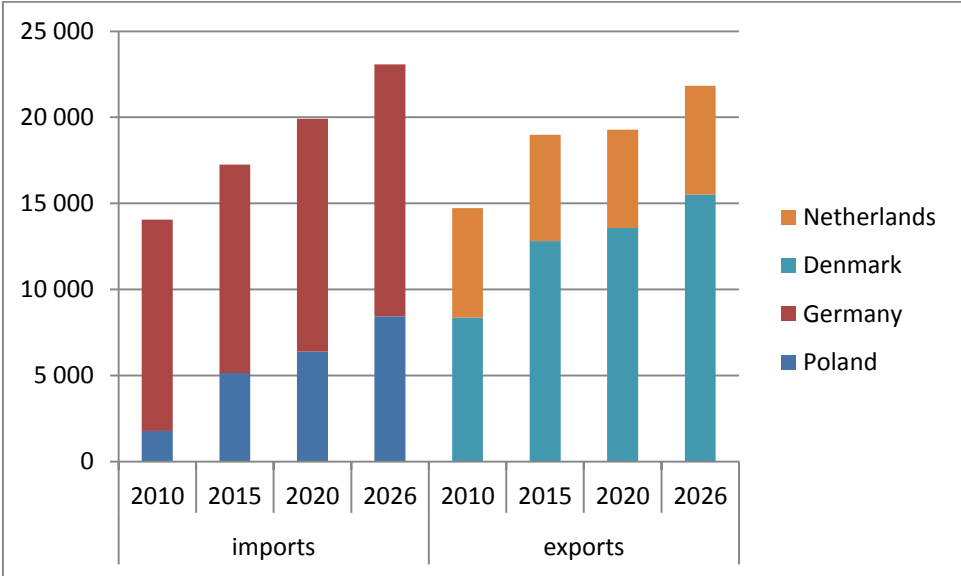
In total, the production increase in Poland and Spain is sufficient to outweigh the projected reduction in pork production in other Member States, such as France, Italy and the United Kingdom. The magnitude of projected growth in production is sensitive to the base year (here 2014-2016); pork production in Spain and Poland increased by more than 10% between 2013 and 2015, whereas over the same period the increase was less than 2% in the other EU Member States. Given that domestic demand for pig meat in the EU-28 is declining, additional production growth in the EU implies that the EU pig sector over the medium term is expected to become more dependent on non-Member State markets.

Pork consumption per capita in EU-N13 Member States is on average higher than in EU-15 Member States; traditional consumption attitudes with respect to meat will mean that convergence between EU-N13 and EU-15 consumption patterns is expected to be limited. In Poland and Romania, per capita consumption of pig meat is still increasing, while in most EU-15 Member States, levels of per capita consumption are projected to decline over the period to 2026. As a consequence of these projected developments, EU-28 domestic pig meat consumption is projected to remain stable. In the EU-N13, growth in per capita consumption is offset by a projected decline in population, while in the EU-15 contraction in consumption per capita is projected to be offset with respect to total domestic use by growth in the EU-15 population.

Changes in the pork supply and demand balance only partly explain the ongoing shifts in EU Member State pig markets and pig production activity levels. There is a growing tendency towards specialised pig production and towards separating pig production processes (production of piglets and pig fattening) across Member States. This dynamic

is expected to continue and may accelerate. The trend of intra-EU division of pig and pig meat production is driven mainly by differences across Member States in local regulations such as minimum wages or environmental regulation, in the costs associated with surplus manure management, in shortages of land and by the various degrees to which neighbourhood concerns impinge on the freedom to expand production in various Member States. The increase in the volume of intra-EU trade in live animals (piglets and pigs) is especially concentrated in some northern EU countries, namely Poland, Germany, Denmark and the Netherlands (see Figure 23). Germany and Poland are the main importers of live animals, accounting for more than 75% of the total of 21.4 million head of young pigs that were traded live across borders within the EU-28 in 2016 (Eurostat, 2017c). Imports of piglets by Polish farmers over the medium term are projected to increase by 1.8 million head by 2026, a 33% increase on the level of trade observed in 2015.

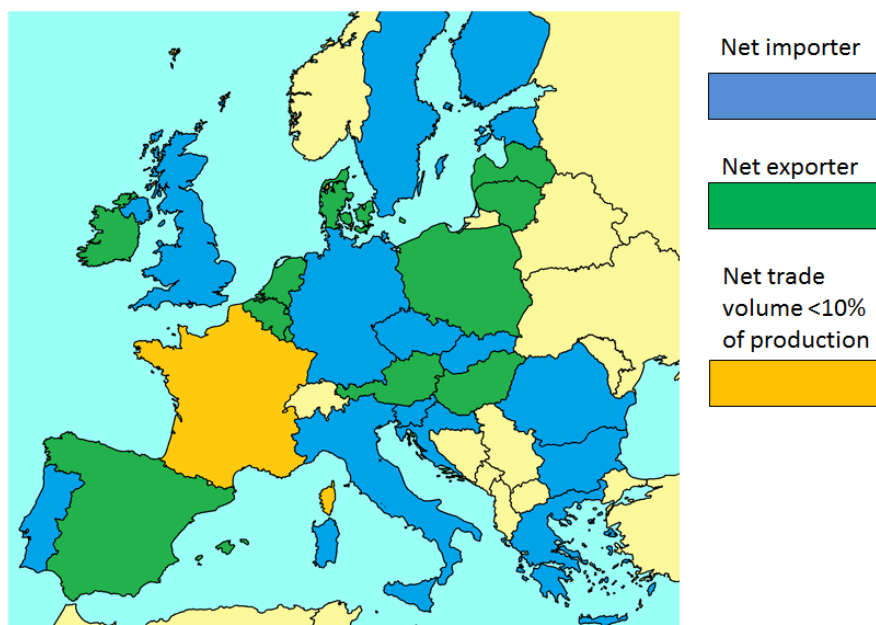
Figure 23. Exports and imports of live pigs for main trading Member States (1 000 head)



Source: AGMEMOD 2017 Outlook.

Denmark and the Netherlands are the two main exporters of live animals, and live exports of pigs from Denmark are projected to further increase. Uncertainties exist regarding productivity gains in the Netherlands, which might lead to increased meat production rather than an increase in live pig exports, although environmental constraints, especially those relating to management of manure, may be a factor that limits future growth here. Denmark and the Netherlands will further specialise in piglet production and will increasingly play an incubator role for the wider north European region. As the German fertiliser directive was adopted only in March 2017, the impacts of this regulatory change are not captured in this baseline and, *ex post*, this regulation may affect the outlook for German demand for live pig imports. The projections of live pig imports in Figure 23 also include trade in numbers of fattened pigs, which are less important than trade in pigs for fattening. Trade in fattened pigs is driven primarily by the current spatial allocation and capacity of slaughterhouses within the north European region, reflecting lower labour costs (e.g. Dutch-fattened pigs slaughtered in Germany). A similar pattern in the trade of live animals occurs in the south-western EU Member States (Spain, France and Portugal), but at a much smaller scale.

Figure 24. Pork net exporters and net importers in the EU-28 in 2026



Source: AGMEMOD 2017 Outlook.

With largely stable domestic consumption and a slight increase in production of pig meat projected, the self-sufficiency of the EU is expected to increase over the next decade. Member States such as Germany, Denmark, Belgium and the Netherlands, which are already net exporters of pork, will continue to be net exporters; however, other Member States such as Poland, Spain and France, which are currently net importers, will transition to self-sufficient/net-exporter status over the period to 2026. In Figure 24, the projected net-exporter and net-importer status of the EU-28 Member States in 2026 is shown.

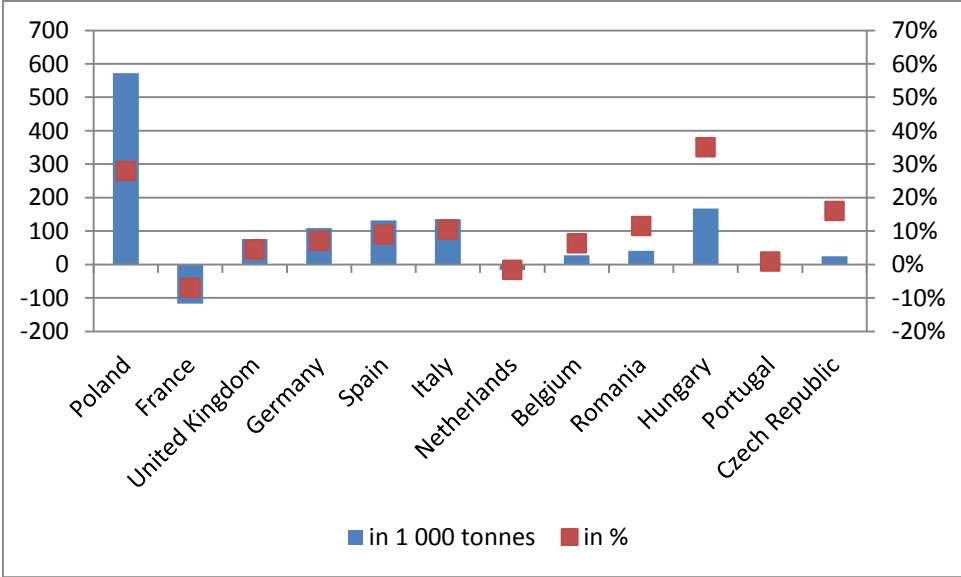
3.4.2 Poultry

The medium-term development of EU poultry production is expected to be driven by developments in one Member State, namely Poland. Over the medium term, growth in consumption of poultry is projected for most Member States. As already noted regarding the outlook for pig meat demand, in western EU Member States the projected increase in poultry domestic use is often supported by population growth. Regarding trade, some changes are likely to occur over the next decade. Some Member States, e.g. Spain, are projected to lose their clear net-exporter status, while others, e.g. Poland, are expected to increase their net exports of poultry meat.

Over the period to 2026, Polish poultry meat production is projected to increase by 30% or 650 000 tonnes (see Figure 25). The projected increase in Polish poultry production over the next decade will account for 90% of the total projected increase in EU poultry production. In contrast, production in France (the second largest producer) is expected to decline over the period to 2026; however, this seemingly negative development is likely to be combined with a switch towards high-value production processes such as “red labels”, organic agriculture or AOC Bresse (*appellation d'origine contrôlée* high-welfare chickens). Production growth in other Member States will still be realised over the medium term, but at a lower rate than in the past decade. In some Member States, environmental and animal welfare issues are likely to mean that production increases will be below 10% between 2015 and 2026 (Germany, Spain and Italy). In other Member States, poultry production may even decline (the Netherlands). This negative production is likely to be associated with changes to production systems, such as the “Scharrel” chicken production system in the Netherlands. Constraints to be mentioned are not only

environmentally driven but might also be based on public opinion and governmental restrictions, e.g. those leading to difficulties in receiving building permits for sheds and slaughter houses, inducing higher production costs which limit growth. Additional production increases are likely in some central and eastern European countries such as Romania, Hungary and the Czech Republic, where less onerous environmental constraints and the availability of feedstuffs will drive growth in production.

Figure 25. Poultry — change in production for main EU countries, 2026 versus 2014-16, in 1 000 tonnes and percentage

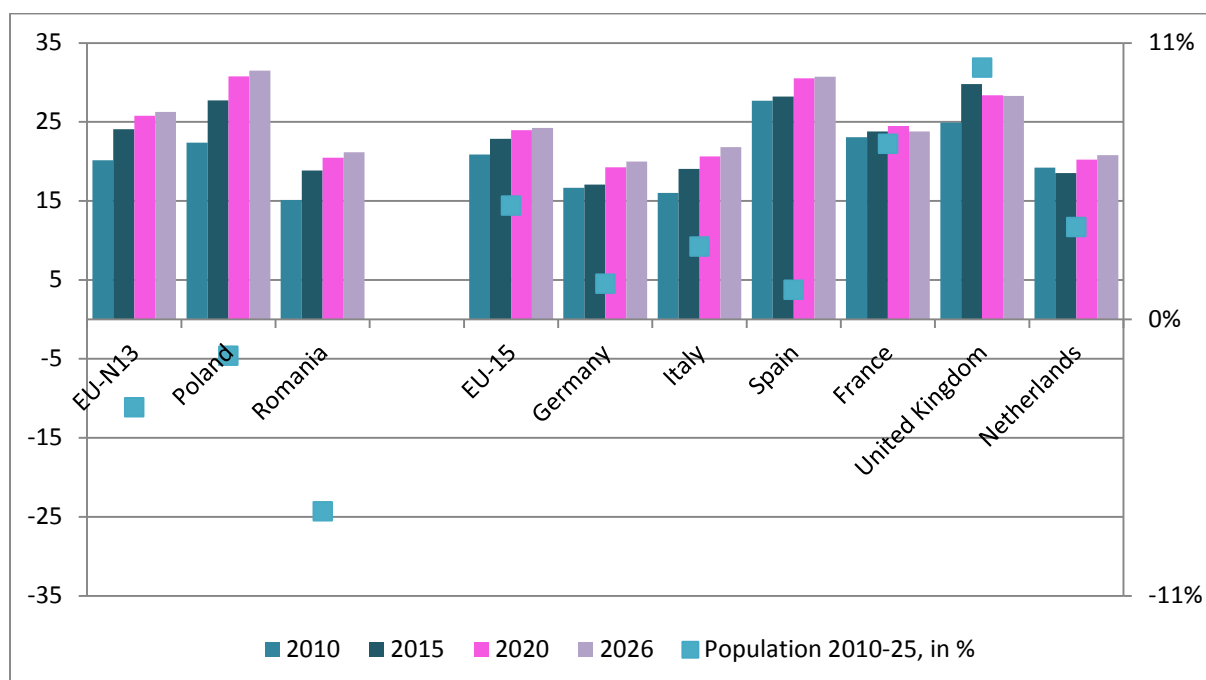


Source: AGMEMOD 2017 Outlook.

Although a significant proportion of European citizens state that they are opposed to intensive animal production ⁽¹¹⁾, current per capita consumption of poultry is relatively high and is projected to increase over the period to 2026. However, the rate of growth is expected to slow between 2020 and 2026. In central and eastern Europe, the highest per capita consumption of poultry meat is in Poland and Romania. Polish per capita consumption is projected to grow significantly because of the projected continuation of strong rates of economic growth and the relatively low price of poultry meat (Figure 26). However, growth in aggregate demand for poultry meat in central and eastern European Member States is dampened by the projected decline in population in these Member States. In most EU-15 Member States, per capita consumption of poultry is projected to increase but at a slower rate than in EU-N13 Member States. However, population growth in the EU-15 is projected to lead to further growth in the total demand for poultry meat.

⁽¹¹⁾ According to Eurobarometer (<http://ec.europa.eu/commfrontoffice/publicopinion/index.cfm/General/index>) animal welfare is valued by the European population with a rate of 7.8 on a scale of 10, and 77% state that improvements are needed. Animal welfare in husbandry is defined as the fourth most important issue for European agriculture.

Figure 26. Poultry — consumption in selected EU Member States, in kg per capita, 2010-2026



Source: AGMEMOD 2017 Outlook.

3.4.3 Beef

The medium-term outlook for beef markets in various EU Member States is driven by a number of quite different factors, and this is reflected in a complex set of Member State-level results:

- Beef is produced both from the offspring of specialised beef cow herds and as a byproduct of milk production from dairy cows. Because of the importance of dairy cows in the overall EU breeding cow herd, there is very strong interaction between milk and beef production developments in most Member States. In most Member States, milk production strongly influences beef production. However, as in the pig sector, not all adult cattle and calves are reared where born but can be traded across borders.
- As beef production is to be found on specialised farms as well as on farms with a mixed production portfolio, the profitability of beef production is quite mixed across EU Member States. Often beef production is associated with less favoured areas and contributes positively to the production of public goods such as the rural landscape. But where beef production is linked to dairy production, it may be associated with negative environmental impacts, and further expansion may be hampered by environmental restrictions.
- Beef markets and market segments are quite diverse, ranging from high-quality beef to low-quality products used in further processing. This diversity can pose challenges to analysis where only aggregated figures across all market categories are available.
- In general, the sector is strongly influenced by a diverse set of policy measures, including, among other things, EU dairy policy, environmental restrictions, bilateral and multilateral trade agreements (and associated provisions for tariff rate quotas for beef), the impact of the CAP with its provisions for specific aid packages targeting beef meat and dairy sectors, and support measures contained within the first and second pillars of the CAP.
- The VCS provisions of the first pillar of the CAP are often focused on beef and/or dairy production, and in certain Member States they can have a significant impact on beef

production. In general, the reliance of European beef farms on CAP payments is quite high, and they often account for more than 100% of income on some beef farms.

Figure 27 provides an overview of the VCS to beef and milk production under the first pillar of the CAP, which is available across various Member States. No and low support is marked in green, medium support in yellow, and high levels of support are indicated by orange and red. There are some Member States that provide no VCS, e.g. Germany and Ireland, while others have high levels of VCS for beef and milk production, e.g. Finland, Hungary and Romania. In general, VCS for beef production is higher than that provided for milk production.

Figure 27. Comparison of voluntary coupled support across Member States, 2015

	Beef	Milk		Beef	Milk		Beef	Milk	
Austria	-	-	France	-	-	Netherlands	+	-	
Belgium	+	--	Greece	+/-	--	Poland	-	-	
Bulgaria	+/-	+/-	Croatia	-	-	Portugal	+/-	-	
Germany	--	--	Hungary	++	++	Romania	++	++	
Denmark	-	--	Ireland	--	--	Sweden	--	-	
Estonia	+/-	+/-	Italy	+/-	-	Slovenia	-	--	
Spain	+	+/-	Lithuania	+	-	Slovakia	+	++	
Finland	++	+++	Luxemburg	--	--	United Kingdom	+/-	--	
Czech Republic	++	+/-	Latvia	-	+				
	--	no		-	low		+/-	middle	
							+	high	
									very high
									++
									high

Source: based on EC (2015).

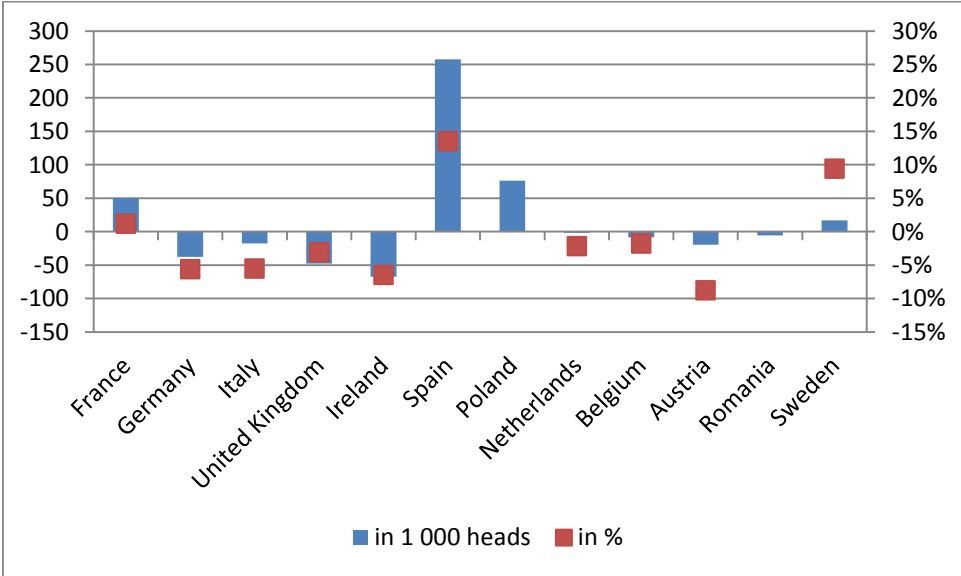
When considering the outlook for beef, it is necessary as noted earlier to take account of developments over the medium term for both the dairy cow herd (see Figure 14 in section 3.3) and the beef cow herd (see Figure 28). Another factor influencing total quantity of beef produced is the share of slaughtered calves in total calf supply. Slaughter weight of calves is less than half that of bulls, heifers or cows. For most Member States, production of beef will be driven by developments in their dairy cow herds. The outlook for dairy cow inventories is a decline in herds over the period to 2026. The exceptions to this development within the EU-15 are Ireland, Germany and Italy. While the projected increases in dairy cow numbers are relatively minor in Germany and Italy, in Ireland an increase of about 17% over the period to 2026 is projected. This strong increase in Irish dairy cow numbers and associated milk output is projected despite the absence of any VCS for milk production in Ireland. The dynamic growth in Ireland over the medium term is driven by the competitiveness of Irish grassland-based milk production and by the strong expansion of the Irish milk-processing industry's capacity. For all other countries in the EU-15 and in the EU-N13, the medium-term outlook is one in which dairy cow herds contract. The French dairy cow herd is projected to decline by 3% over the period to 2026, while the Spanish dairy cow herd is projected to decline by 14%. Among EU-N13 Member States, Polish dairy cow herd numbers are projected to decline by 11% over the period to 2026, while Romanian dairy cow herds are expected to decline by 17%. In many Member States, considerable scope exists for productivity increases, so that declining cow herds are not reflected in contracting milk production. The provision of VCS to milk production in EU-15 Member States is limited and is generally insufficient to reverse market-driven negative production developments. Compared with the EU-15, voluntary coupled payments are significantly higher in the selected EU-N13 Member States; however, the drop in dairy cow herds in Romania will not be reversed, as other factors such as poor farm and milk-processing infrastructure are expected to continue to hinder expansion in the size of the milking herd.

Over the outlook period, projections for the evolution of Member State beef cow herds are negative, with declines in the aggregate EU-15 suckler cow inventory. In most countries the projected changes, while negative, are quite limited in scale (see Figure

28). In contrast with the general development, beef cow herds are projected to expand over the medium term in Spain (by 13%), France (1%) and Sweden (2%). The outlook for Spanish suckler cow numbers is quite positive, and it is unclear to what extent water availability will constrain this development. In most other EU-15 Member States, beef herds are projected to decline despite the provision of VCS to specialised beef production in many Member States. In Ireland, the impact of the decline in beef cows (-6%) on beef meat production will be offset by projected increases in dairy cow numbers. In Poland, the projected increase in beef cow numbers over the medium term is not expected to be sufficient to prevent a decline in total cow herds and in Polish beef production.

Developments in cow herds and average slaughter weights are together leading indicators of the evolution of beef production; however, because a significant number of calves and adult cattle are traded as live animals between EU Member States and with non-Member States, projected developments in meat production (Figure 29) can diverge from the developments in breeding animal inventories. German farmers, for example, each year export nearly 700 000 calves to the Netherlands, where there is a strong calf-fattening industry; this equates to 16% of all calves each year. For the EU Member States in total, the medium-term outlook is that beef production will decline in both the EU-15 and EU-N13. For the largest beef producers, France (-7%), Germany (-7%) and Italy (-6%), production is expected to decline over the period to 2026. Beef production in Poland and Romania is also projected to decline over the medium term. For those countries where production is expected to increase, the changes in production are expected to be on a relatively small scale (e.g. in Austria, Spain and the United Kingdom).

Figure 28. Change in beef cow herds in main EU countries, 2026 versus average 2014-16, in 1 000 head and in percentage

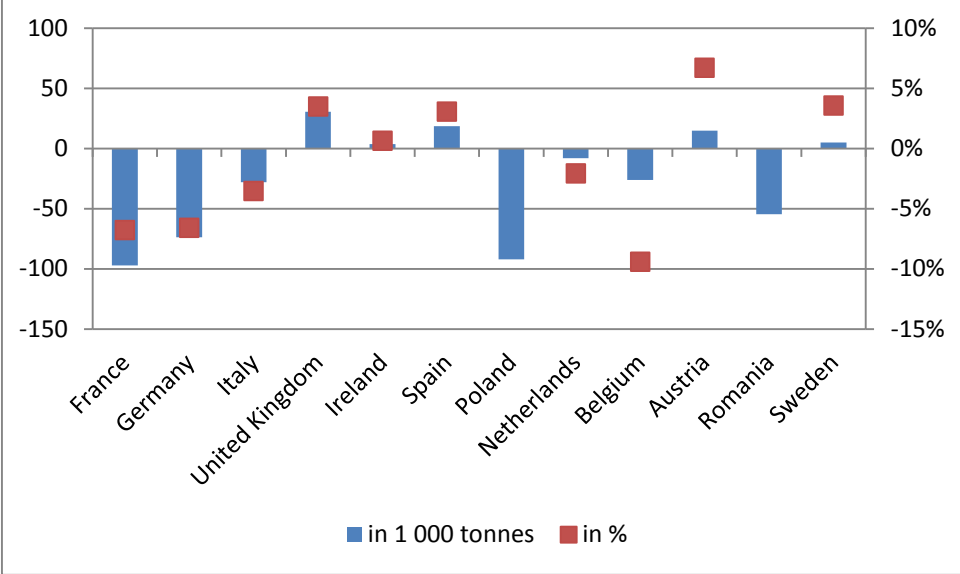


Source: AGMEMOD 2017 Outlook.

In Figure 30, developments in beef consumption per capita are presented, and the large difference between the level of consumption in the EU-N13 and EU-15 Member States is evident. In the EU-N13, per capita consumption is projected to increase slightly until 2020, and then to decline. In the EU-15, the outlook is for consumption of beef in most Member States to decline over the next 10 years. The rates of contraction in per capita consumption will continue to differ between Member States, based on differences in habits and dietary preferences. An exception to the general pattern of declining beef consumption per capita across EU-15 Member States is Germany, where migration

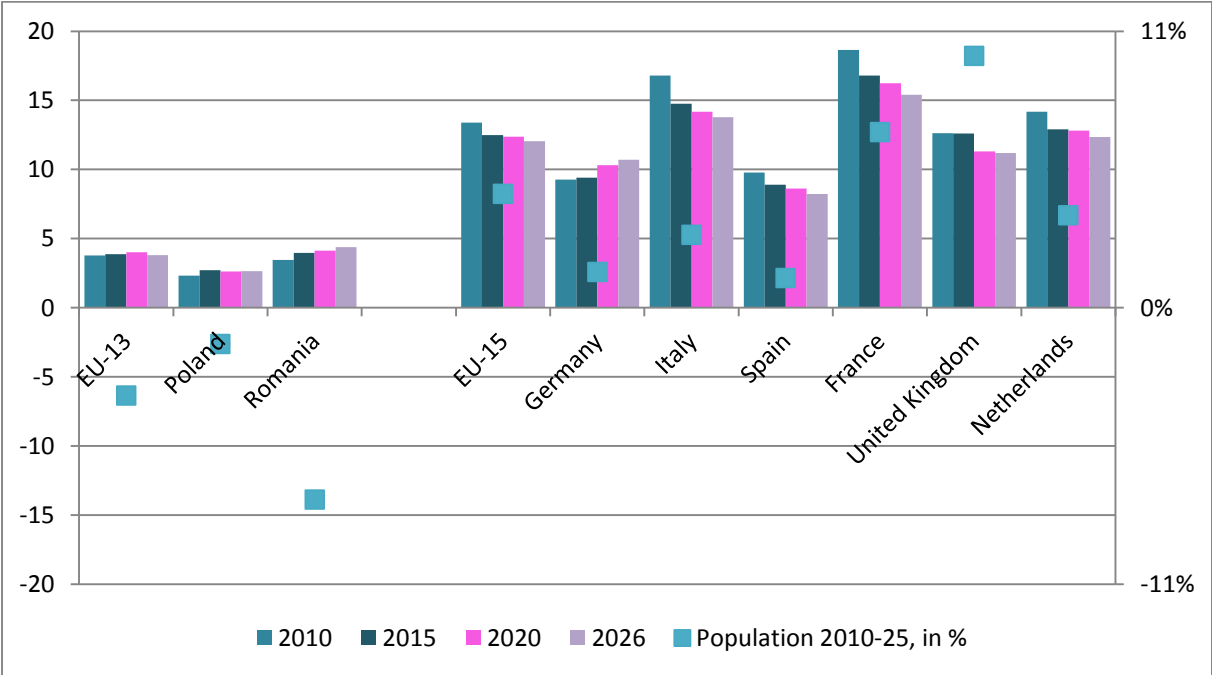
inflows, preferences for high-quality beef and the increase in the popularity of restaurants selling processed minced meat may have finally overcome a decade-long decline in consumption. In most EU-15 Member States, projections of population for the period to 2026 are positive; this growth in population is likely to at least partially compensate for declining per capita consumption. In contrast, the projected contraction in the population of EU-N13 Member States will be reflected in the total domestic use of beef contracting more than per capita consumption.

Figure 29. Change in beef production for main EU Member States, 2026 versus average 2014-16 in 1 000 tonnes and in percentage



Source: AGMEMOD 2017 Outlook.

Figure 30. Change in beef consumption (in kg per capita) and in population (%)



Source: AGMEMOD 2017 Outlook.

4 Selected examples of the potential of AGMEMOD for further analysis

In the following sections, we present a closer look at the agri-food trade relationship between the EU and United Kingdom (section 4.1), growth patterns and production structure changes for agriculture in the EU-N13 (section 4.2) and impacts on production of uncoordinated coupled beef support in the EU (section 4.3).

4.1 The EU-United Kingdom agri-food trade relationship

Trevor Donnellan, Kevin Hanrahan, Martin Banse

This chapter focuses on the development of the United Kingdom agri-food sector as projected under the current AGMEMOD Outlook. Under this baseline, the United Kingdom remains a Member State of the EU under a CAP as currently applied over the period to 2026. Its economy is assumed to grow at an annual rate of 1.4%, while the United Kingdom's population increases by 1.1% annually up to 2026. The exchange rate between the United Kingdom pound and the euro is assumed to remain unchanged relative to the level observed in 2016.

The following sections do not provide an analysis with respect to the exit of the United Kingdom from the EU and possible impacts on the agri-food sectors in the United Kingdom or on the remaining 27 Member States (EU-N27). All necessary policy assumptions are still too unclear to conduct such an analysis. Instead, we show trends in the United Kingdom's agri-food supply and shed some light on intra-EU agri-food trade relations. How will the food markets develop in the British Isles? Will British self-sufficiency in food commodities improve or further deteriorate over the next decade?

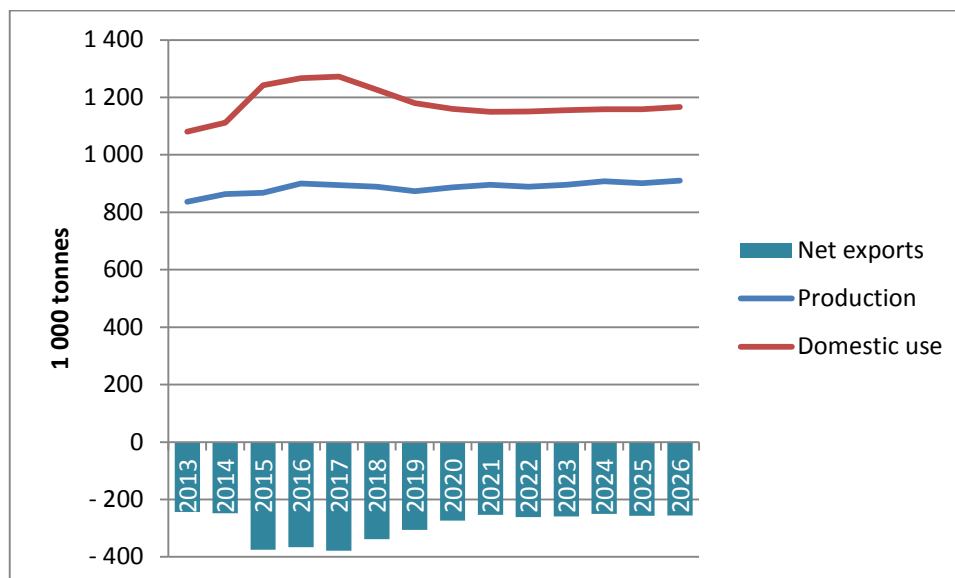
For a detailed analysis of the consequences of Brexit, assumptions are needed on the future direction of agricultural policies in the United Kingdom, the CAP under the EU-N27 and the future trade policies applied to internal trade between the EU-N27 and the United Kingdom.

4.1.1 Beef

Under the baseline, the United Kingdom sees growth in dairy cow numbers that more than offsets contraction in the numbers of beef cows. Overall inventories of cattle are marginally higher by 2026 compared with the average for 2014-2016. The growth in the breeding animal inventory is augmented by a projected increase in imports of live cattle.

Higher cattle numbers are reflected in an increased volume of cattle slaughtered. The growth in the proportion of the cow inventory accounted for by dairy cows is reflected in a projected decline in the average cattle slaughter weight. The reduction in slaughter weight is not sufficient to offset the impact of higher cattle inventories on overall beef production. Under the baseline, United Kingdom beef production is projected to grow and to exceed domestic use (Figure 31). Lower per capita consumption of beef is more than offset by the positive impact of ongoing growth in the population. With growth in production higher than growth in domestic use, net imports of beef are projected to contract over the projection period. Prices are projected to decline from the average level achieved in 2014-2016.

Figure 31. Baseline United Kingdom beef supply and use, 1 000 tonnes

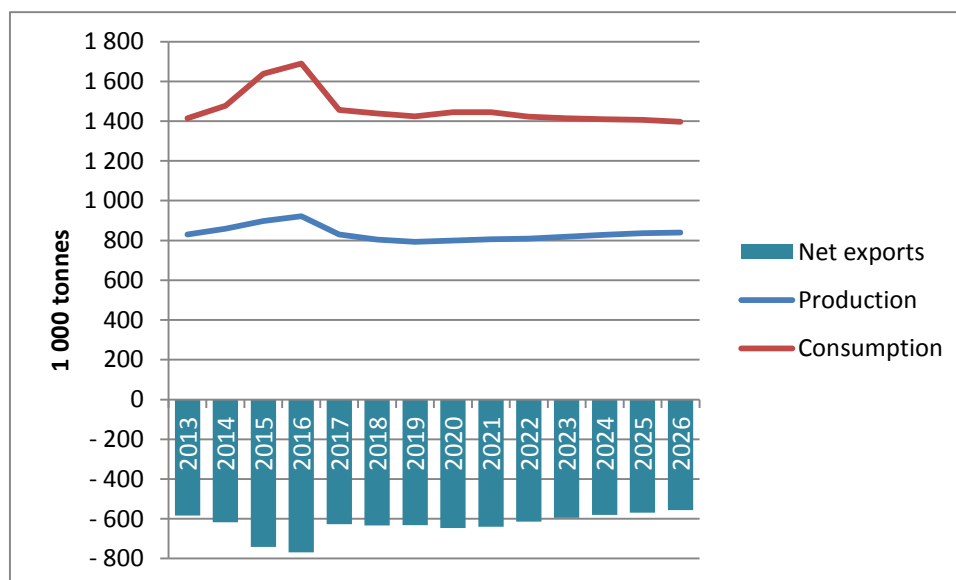


Source: AGMEMOD 2017 Outlook.

4.1.2 Pig meat

Under the baseline, United Kingdom pig meat production is projected to remain largely stable (Figure 32). Lower inventories of sows are offset in terms of their impact on meat production by growth in numbers of pigs per sow and in the average pig slaughter weight. By 2026, United Kingdom pig meat production is projected to be less than 1% lower than in the baseline reference period of 2014-2016. The United Kingdom’s domestic use of pig meat is projected to contract under the baseline, although the negative impact of declining per capita consumption is mitigated by the impact of population growth. With the contraction in domestic use of pig meat exceeding the decline in production, net imports of pig meat by the United Kingdom are projected to decline. By 2026, net imports are expected to be almost 5% lower than in the period 2014-2016.

Figure 32. Baseline United Kingdom pig meat supply and use balance (1 000 tonnes)

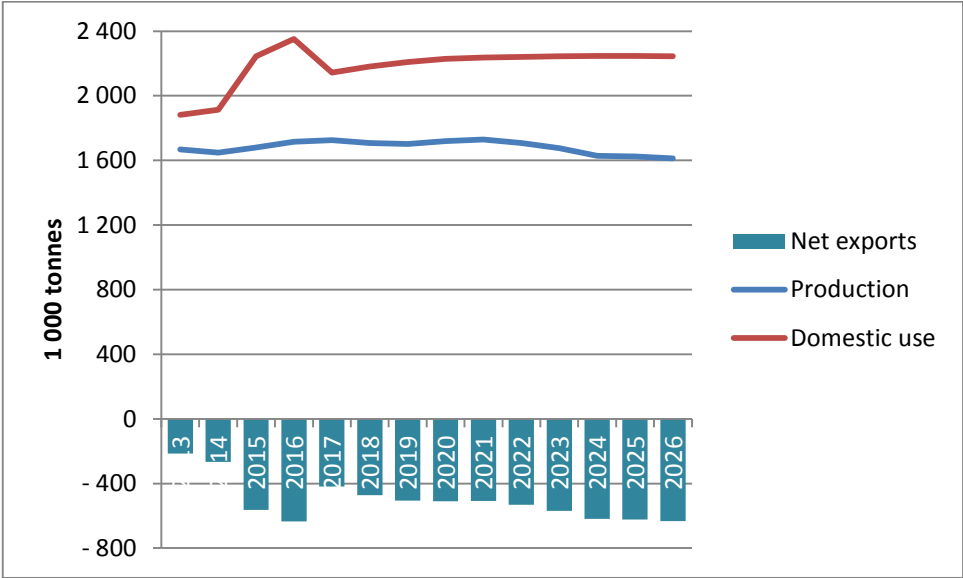


Source: AGMEMOD 2017 Outlook.

4.1.3 Poultry

In contrast to projected baseline developments for other meats, for poultry, growth in per capita consumption and aggregate domestic use is projected to be in excess of growth in the United Kingdom’s imports, so that net imports of poultry meat in 2026 will be more than 40% higher than in the reference period 2014-2016.

Figure 33. Baseline United Kingdom poultry meat supply and use balance



Source: AGMEMOD 2017 Outlook.

In general, under the baseline, United Kingdom meat net imports are projected to decline. Declining production of beef, pig meat and sheep meat is expected to be only partially offset by lower levels of domestic use. Poultry meat is an exception (Figure 33). The long-term trend of increased per capita consumption of poultry meat at the “expense” of other meats is projected to continue. Strong growth in domestic use of poultry meat is reflected in growth in both United Kingdom domestic production and net imports of poultry meat.

4.1.4 Grains and oilseeds

Under the baseline, the United Kingdom grains and oilseed area harvested is projected to decline, with a slight shift from land used for arable crop production to grassland. While the wheat area is projected to expand by over 4%, the barley and rapeseeds area — currently the major crops in the United Kingdom — are projected to contract. With yields across all crops returning to historically average levels from what were historically high levels in the baseline reference period (2013-2015), total United Kingdom production of all grains and oilseeds is projected to decline. The decline in soft wheat production is less than that projected for barley and rapeseed.

Domestic use of wheat is projected to grow strongly, while domestic use of barley is projected to contract because of the projected increase in the price of barley relative to wheat. Overall, feed demand for grains is projected to grow, driven by projected growth in aggregate meat production (largely poultry) and milk output. Crushing demand for oilseeds is also projected to grow under the baseline. With demand for grains and oilseeds on aggregate projected to grow, and production projected to contract, net exports of barley are projected to decline over the baseline projection period, while net imports of both soft wheat and rapeseed are projected to increase.

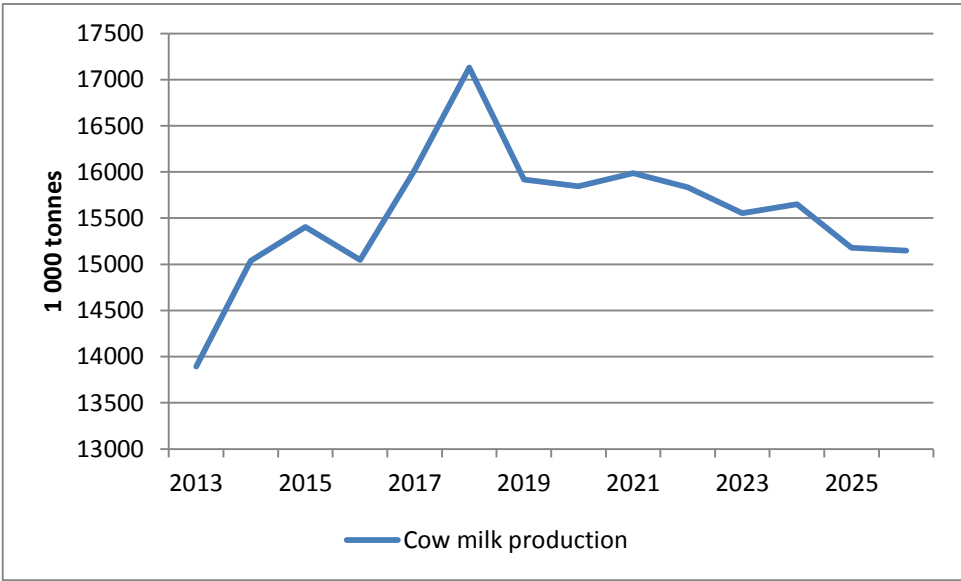
4.1.5 Milk and dairy commodities

Production of milk in the United Kingdom entered a pronounced decline in the 2000s. The United Kingdom is unique among EU Member States for the high percentage (> 50%) of its milk production that is consumed as fresh drinking milk. Because it needs to be purchased regularly, drinking milk is considered a supermarket essential and has been the subject of intense price competition.

The lack of a cooperative structure in the dairy sector in the United Kingdom has hence left dairy farmers with little market power and vulnerable to price pressures from further along the supply chain. Low farm milk prices have contributed to dairy farmers continuing to leave the sector and declining milk production. However, greater public awareness of the competitive pressures faced by dairy farmers has led to more sustainable milk pricing and a recovery in milk production in the past 5 years. Nevertheless, the sector was adversely affected by the dairy surplus in the EU that emerged when milk quotas were abolished, and this led to a contraction in production that is projected to be short term and therefore expected to be reversed.

The baseline outlook is for a short-term recovery in United Kingdom milk production, followed by a stabilisation towards the end of the horizon period (Figure 24). Increased domestic demand, however, driven largely by population growth, will mean that the United Kingdom’s dairy import requirements will increase, particularly for butter and to a lesser extent cheese.

Figure 34. United Kingdom’s cow milk production outlook, 1 000 tonnes

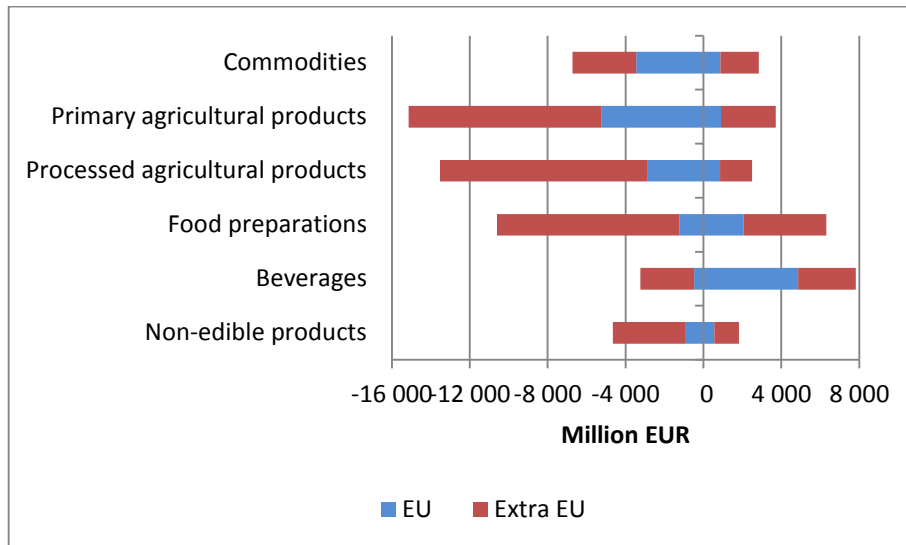


Source: AGMEMOD 2017 Outlook.

4.1.6 Who delivers food products to the United Kingdom?

The United Kingdom is a net importer on aggregate of most agricultural commodities. The EU is its principal source of agri-food imports. The United Kingdom also exports agri-food products, with United Kingdom agri-food exports dominated by beverages and prepared food products. In Figure 35, United Kingdom agri-food imports and exports values in 2016 are classified into the 6 categories used by the EU. The United Kingdom is clearly a significant net importer of agri-food products. Trade with the rest of the EU dominates both United Kingdom agri-food imports and exports.

Figure 35. The United Kingdom’s agri-food 2016 imports by source and exports by destination

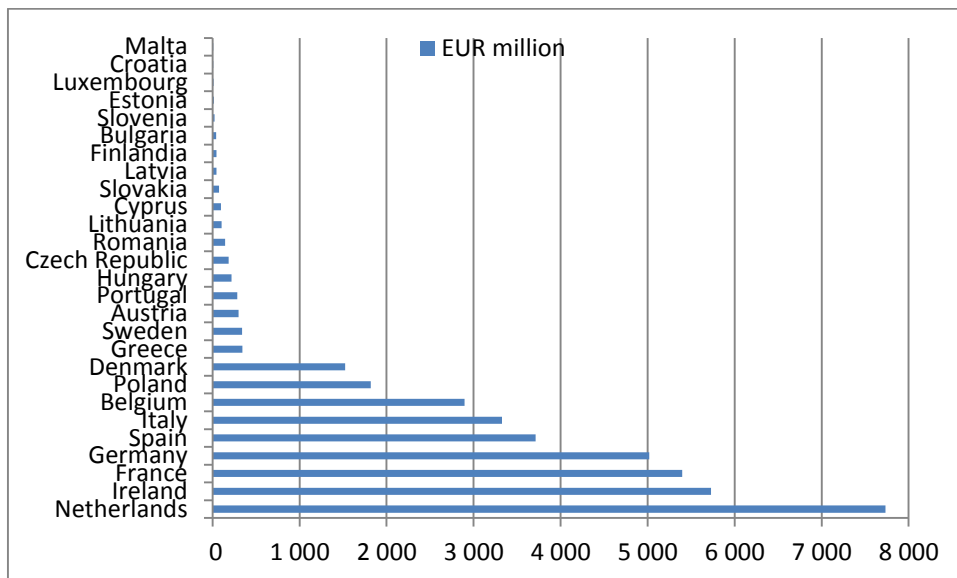


Source: Eurostat Comext.

United Kingdom agri-food exports and agri-food imports are presented in Figures 36 and 37. These illustrate that agri-food trade is dominated, as one would expect, by the larger EU economies, but that trade with smaller economies such as Ireland, the Netherlands, Denmark and Belgium is also very important.

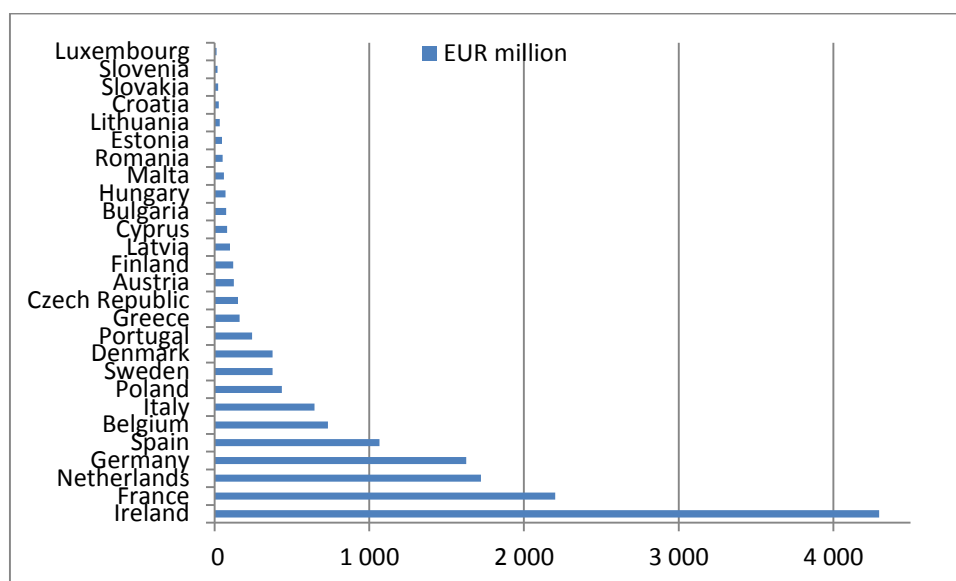
Relative to the overall size of the agricultural and food sector in Ireland, the size of United Kingdom imports from Ireland and United Kingdom exports to Ireland are very large and reflect the deep integration of Irish and United Kingdom agri-food markets. The importance of the Netherlands and Belgium in United Kingdom agri-food imports and exports may be affected by the entrepôt role of Antwerp and Rotterdam — but probably also reflects the important role these countries play in supplying United Kingdom markets with fresh vegetables. Eight Member States (Ireland, Belgium, the Netherlands, France, Germany, Italy, Spain and Poland) in 2016 accounted for more than 94% of United Kingdom agri-food imports from the EU and for more than 88% of United Kingdom agri-food exports to other EU Member States.

Figure 36. The United Kingdom’s agri-food imports from the EU, by Member State in 2016



Source: Eurostat Comext.

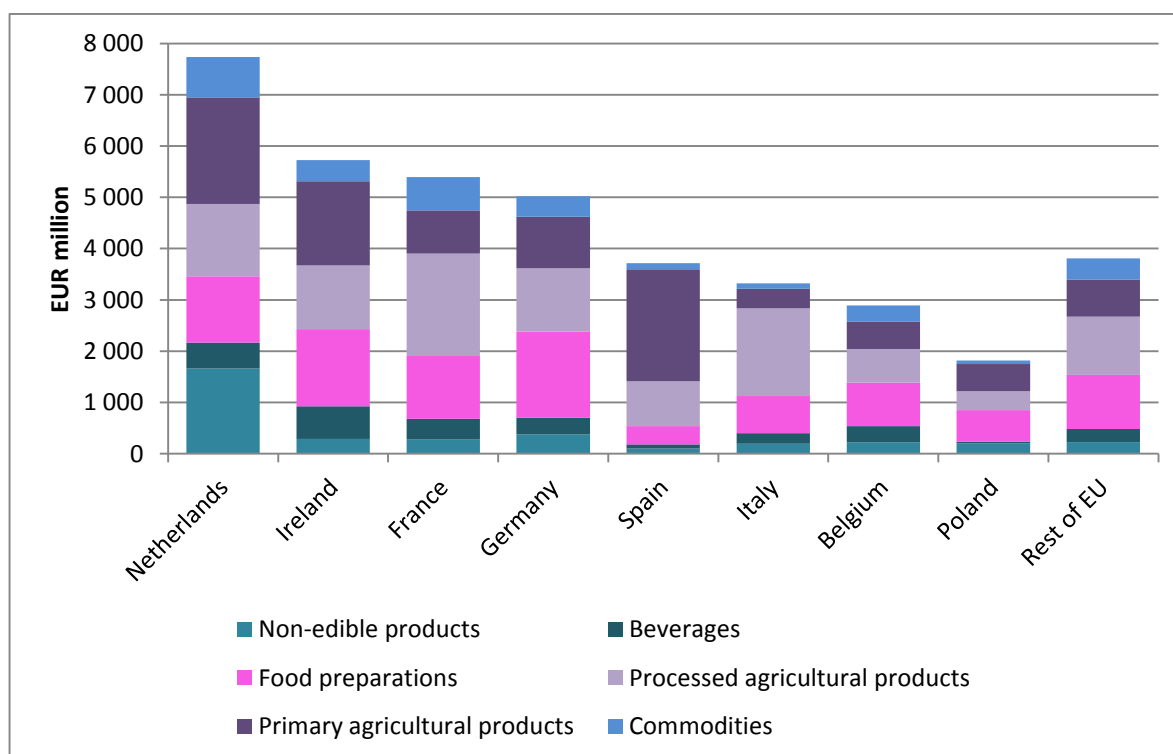
Figure 37. The United Kingdom's agri-food exports to the EU, by Member State in 2016



Source: Eurostat Comext.

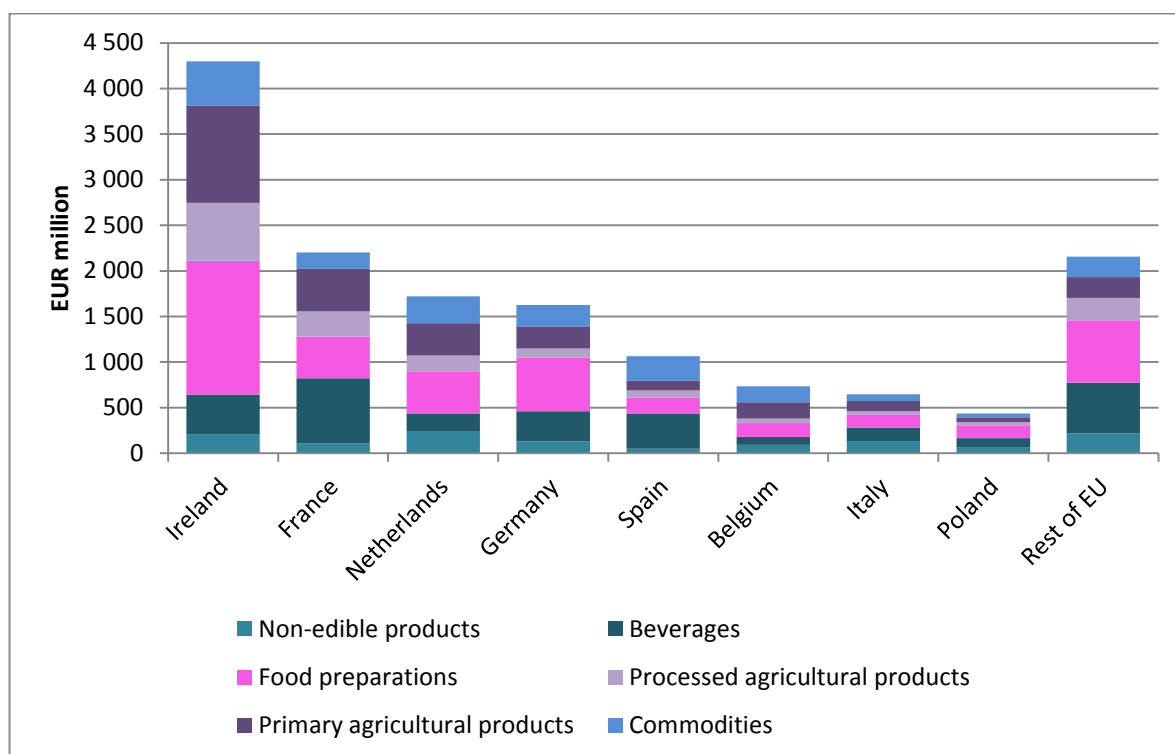
The sectoral composition of agri-food trade by Member State differs and reflects the structure of the agricultural and food industries in those Member States. For Ireland, Belgium, the Netherlands, Poland, France, Germany, Italy and Spain, and an aggregate of the rest of the EU, the composition of United Kingdom agri-food imports and exports is presented in Figures 38 and 39. United Kingdom imports of agri-food products are in general dominated by agricultural commodities and primary and processed agricultural products, whereas United Kingdom exports are dominated by processed food preparations and beverages.

Figure 38. Composition of the United Kingdom's agri-food imports from EU Member States in 2016



Source: Eurostat Comext.

Figure 39. Composition of United Kingdom agri-food exports to EU Member States in 2016



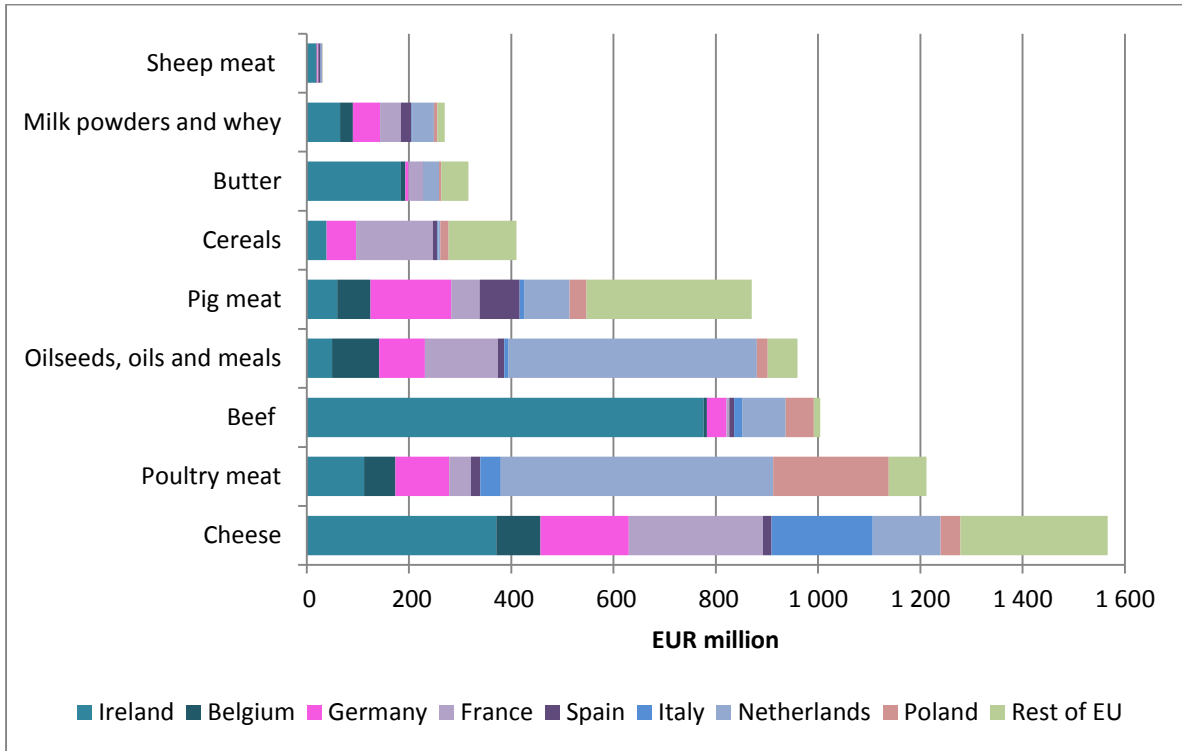
Source: Eurostat Comext.

The United Kingdom's trade in the first three categories of agri-food trade (agricultural commodities, other primary agricultural products and processed agricultural products including wine) includes all of the commodities that are modelled within the AGMEMOD modelling system. United Kingdom agri-food trade with the EU in 2016 for the commodities modelled within AGMEMOD is represented in the next series of figures. The commodities represented are beef, pig meat, poultry meat, sheep meat, cereals, oilseeds and the dairy commodities butter, cheese, milk powders and whey.

As is clear from Figure 40, United Kingdom imports of beef and butter from the EU are dominated by imports from Ireland, while Ireland is also the largest supplier of cheese to the United Kingdom market. France is the dominant EU supplier of cereals to the United Kingdom market, and it accounts for a large share of its cheese imports. The Netherlands dominates United Kingdom imports of oilseeds, oilseed oils and cakes, and poultry meat. United Kingdom imports of pig meat are dominated by other EU Member States, reflecting the large proportion of United Kingdom pig meat imports accounted for by Denmark.

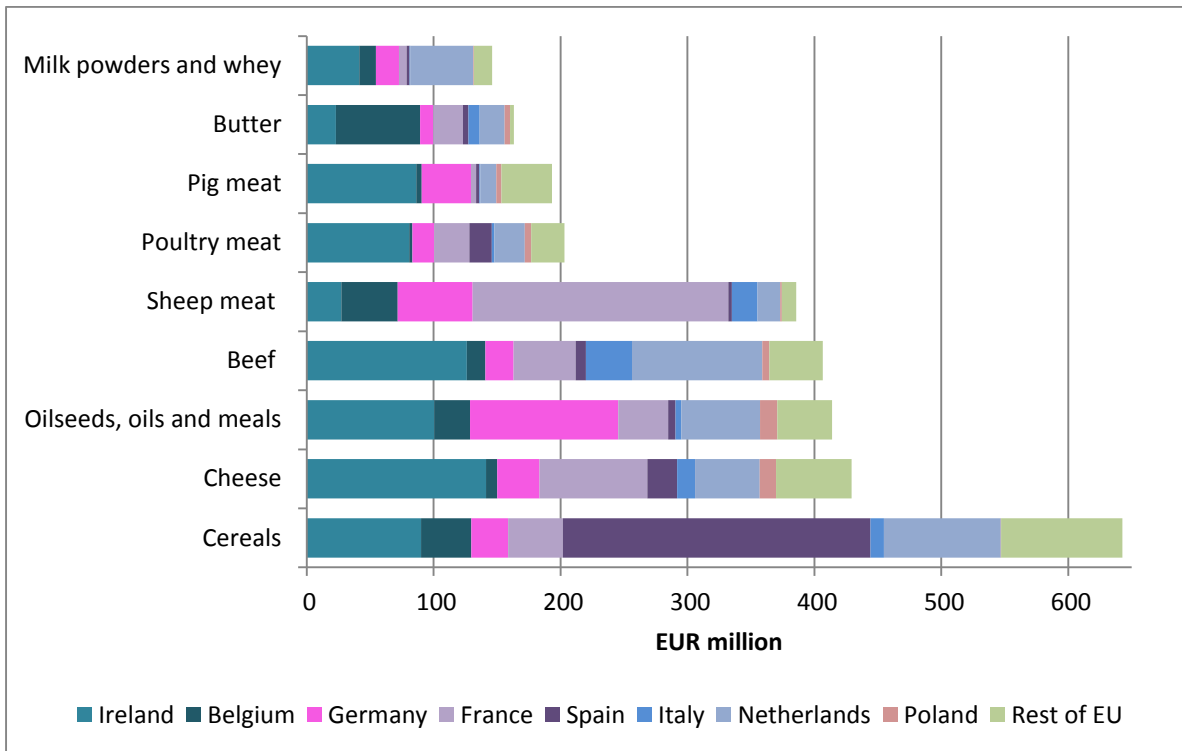
United Kingdom exports of agricultural commodities covered by the AGMEMOD model are in general significantly lower than their imports — an important exception is sheep meat. United Kingdom sheep meat exports are dominated by trade with France, with close to half the value of United Kingdom sheep meat exports arising from trade with France. United Kingdom imports of sheep meat are dominated by imports from outside the EU. United Kingdom imports of sheep meat from the EU are dominated by Ireland.

Figure 40. The United Kingdom's imports of agricultural commodities by origin in 2016



Source: Eurostat Comext.

Figure 41. The United Kingdom's exports of agricultural commodities by destination in 2016



Source: Eurostat Comext.

As is clear from Figure 41, United Kingdom imports of beef and butter from other EU Member States are dominated by imports from Ireland, while Ireland is also the largest

supplier of cheese to the United Kingdom market. France is the dominant EU supplier of cereals to the United Kingdom market, and it accounts for a large proportion of United Kingdom cheese imports. The Netherlands dominates United Kingdom imports of oilseeds, oilseed oils and cakes and poultry meat. United Kingdom imports of pig meat are dominated by other EU Member States, reflecting the large proportion of United Kingdom pig meat imports accounted for by Denmark.

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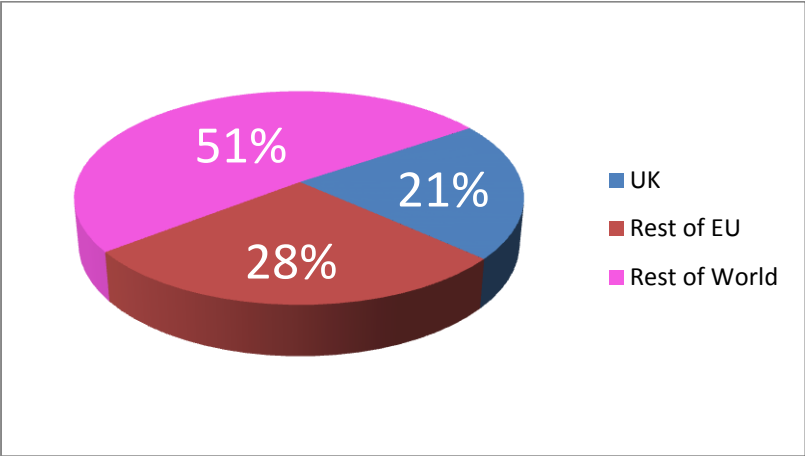
4.1.7 Irish dairy and Brexit

The Irish dairy sector is highly export focused, with dairy product exports in milk-equivalent terms in excess of 80% of Irish milk production. Irish milk production is on a strong upwards growth trajectory and therefore its dairy export capacity is increasing rapidly.

The principal Irish dairy exports in value terms are butter, cheese (predominantly cheddar), infant formula and fat-filled milk powder. Other dairy exports of lesser importance, in value terms, include WMP, SMP and casein-type products.

In value terms, total Irish dairy exports in 2016 were split relatively evenly between the EU-28 market and the ROW (Figure 42). In terms of EU-28 dairy exports, the United Kingdom is by far the largest market.

Figure 42. Irish dairy exports by value in 2016



Source: Adapted from Eurostat COMEXT dataset.

The proportion of Irish dairy exports destined for the United Kingdom has already declined since Brexit was announced — it was 27% in 2014 and had declined to 21% by 2016. Within this trade, certain dairy products have a particular dependence on the United Kingdom market and hence would be more exposed in the event of a “hard Brexit” (involving the imposition of World Trade Organization (WTO) most favoured nation (MFN) tariffs). For example, in 2016, 27% of Ireland’s dairy exports to the United Kingdom were in the form of cheddar cheese (83 000 tonnes), representing over half of Ireland’s cheddar exports. In the event of a hard Brexit, these cheddar exports could face a WTO MFN tariff of EUR 1 671 per tonne, which would be equivalent to a 62% *ad valorem* tariff at 2016 export prices.

The United Kingdom is also Ireland’s main export market for milk, cream, yogurt, ice cream, butteroil, non-cheddar cheese varieties and processed cheeses. While the United

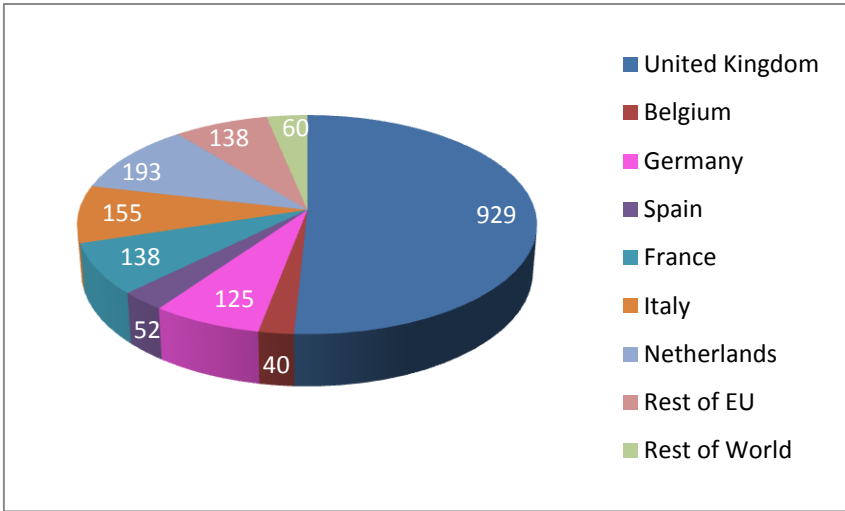
Kingdom is not the main export destination for Irish butter and dairy spreads, exports to the United Kingdom were still more than 50 000 tonnes in 2016.

Within specific tariff lines, tariffs range from about 10% to close to 100%. On the basis of the level of dairy exports from Ireland to the United Kingdom in 2016, the weighted average tariff for dairy exports would be 43%, equivalent to EUR 365 million in tariffs. It is difficult to see how Ireland’s dairy export trade with the United Kingdom, which was valued at over EUR 850 million in 2016, could continue at anything like the same scale in the presence of such tariffs. Therefore, a considerable proportion of these exports would be displaced on to rest of EU and ROW markets.

4.1.8 Irish beef and Brexit

As is clear from Figure 41, United Kingdom imports of beef are dominated by imports from Ireland. In 2016, more than EUR 800 million worth of Irish beef was imported by the United Kingdom. The United Kingdom currently absorbs approximately half of all Irish beef exports. With exports of beef from Ireland accounting for around 90% of Irish beef production, changes to the nature of the trade relationship between the United Kingdom and the EU have the potential to dramatically alter the outlook for the Irish beef sector. Given the magnitude of Irish exports to the United Kingdom (around 250 000 tonnes of carcass weight equivalent, Figure 43), and in the event of this trade being diverted from the United Kingdom market to continental EU markets, this could have the capacity to alter the supply and use balance on the EU market.

Figure 43. Irish beef exports (value) in 2016



Source: Eurostat Comext.

Irish exports of beef to the United Kingdom are dominated by trade in deboned fresh and chilled bovine meat (tariff number 02013000) which in 2015 was worth more than EUR 500 million (more than 92 000 tonnes carcass weight equivalent). The *ad valorem* equivalent of the WTO MFN tariffs that would apply to this product in the event of a hard Brexit would be in excess of 65%. At any plausible import demand elasticities, tariffs of such a magnitude would destroy this bilateral trade flow.

Irish beef is currently, like most other EU beef production, uncompetitive at a global level. There is little prospect of Irish exports to non-EU markets such as the United States, China and Japan taking a significant tonnage of Irish beef production. In this context, Irish beef exports to other EU markets will be likely to increase in the event of a hard Brexit – with negative consequences for EU cattle and beef prices.

4.1.9 Production chain considerations

As the only EU Member State with a land border with the United Kingdom, it is not surprising that the Irish agri-food sector has a higher level of integration with the sector in the United Kingdom, in comparison with other Member States. While this integration is obvious in terms of trade in finished products, movement of goods across the border between Ireland and the United Kingdom at intermediate stages of production is also prevalent. The creation of the single market in 1992 greatly reduced the frictions that previously hindered the establishment of cross-border businesses and facilitated the creation of cross-border production chains between Ireland and the United Kingdom, in particular for live animals, meat, milk and dairy products, whereby products could traverse borders on a number of occasions. A hard Brexit would create obstacles within these production chains, which would inflate production costs for food businesses.

4.1.10 Non-tariff trade concerns

The foregoing discussion has illustrated the extent of the tariff wedge that would be created in exporting to the United Kingdom under WTO MFN tariffs. These tariffs alone would be a serious impediment to trade with the United Kingdom, but they would not represent the only obstacle to continued trade between the EU and the United Kingdom.

Regulatory issues associated with food standards and food safety, unless resolved, would present a challenge to trade. The preparation of customs documentation, the requirement for increased infrastructural capacity and staffing at customs facilities, and the time-consuming nature of the customs checks themselves would increase the cost for EU Members of trading with the United Kingdom, and vice versa.

Longer shipping times would represent an increase in transport costs, but would also have an impact in other ways on the trade in fresh products. Just-in-time inventory management practices requiring next day delivery could become challenging for exporters trading with the United Kingdom. In particular, where fresh products are concerned, longer transport times imply a reduction in product shelf life and again this could limit the feasibility of trade.

All of these considerations suggest that the consideration of tariff barriers alone does not fully reflect the increased cost of trade in the event of a hard Brexit. Non-trade barriers represent an additional cost that would also need to be factored in.

4.1.11 Summary and conclusions

To understand the future implications of the exit of the United Kingdom from the EU, a close look at the medium-term projection of the development of the agri-food sectors provides first insights. In general, under the baseline, United Kingdom meat net imports are projected to decline, while net imports of dairy products are growing. Declining United Kingdom production of beef, pig meat and sheep meat is expected to be only partially offset by lower levels of domestic use, with the exception of poultry meat. Strong growth in United Kingdom domestic use of poultry meat is reflected in growth in both domestic production and net imports of poultry meat. Similar trends can be observed in the projected development of the dairy and crop sectors, where the area of grains and oilseeds harvested is projected to decline, with a slight shift of land from arable crop production to grassland. With a rather stable level of human consumption overall, domestic use for grains is projected to increase due to growth in the demand for grains for feed. Therefore, with growing demand for grains and oilseeds on aggregate, and a contraction of production over the baseline projection period, the United Kingdom's trade position will continue to deteriorate for crop products.

With regard to the origin and destination of traded agricultural products, Irish exports are strongly targeted at the United Kingdom markets. The importance of the Netherlands and Belgium in United Kingdom agri-food imports and exports may be affected by the entrepôt role of Antwerp and Rotterdam — but it probably also reflects the important role

these countries play in supplying United Kingdom markets with fresh vegetables. Eight Member States (Ireland, Belgium, the Netherlands, France, Germany, Italy, Spain and Poland) in 2016 accounted for more than 94% of United Kingdom agri-food imports from the EU, and over 88% of United Kingdom agri-food exports to other EU Member States.

Further detailed analyses of the implication of Brexit on intra- and extra-trade effects for the EU will shed light on the economic impact on the EU-N27. But the current focus of trade relations between the EU-N27 Member States and the United Kingdom already indicates that, next to Belgium, the Netherlands, France, Germany and Ireland will be most affected.

4.2 Growth patterns and production structure changes in agriculture in the EU-N13

Emil Erjavec, András Molnár, Ilona Rac, Petra Salamon, Ondrej Chaloupka, Marie Pechrová

4.2.1 Definition of issues

New Member States that entered the EU between 2004 and 2013, are, with the exception of Malta and Cyprus, post-communist countries of central and eastern Europe (CEECs). In general, CEECs are heterogeneous with respect to the role of agriculture and food in their economies, as well as market developments and perspectives. A common feature of these countries is that, during the communist experiment between 1945 and 1990, their agricultural sectors were subject to varying degrees of collectivisation, planned economy and specific mechanisms of agricultural policy instruments, which stimulated production and certain forms of management (Lipton et al., 1990).

The transition to the market economy brought about an initial output decline in agriculture in the CEECs, caused by a distorted system of inputs, outputs and trade relations (a legacy of the communist system), trade and price liberalisation, and subsidy cuts during the early years of transition (Swinnen, 2002). After the structural break, production recovered, especially in the crop sector, and to a lesser extent in livestock production (OECD, 2002). The growth, mainly in productivity, can be explained by the formation of a suitable market environment and of support mechanisms, increasingly adjusted to the CAP policy. In the EU, the agriculture sectors of candidate states generally integrated with significant lags in productivity, lower prices and support levels, less efficient agri-food organisation, and a dual farm structure comprising larger corporate farms and also, in most of the region, a high proportion of small farmers (Pouliquen, 2001).

Since accession to the EU, the productivity lag of the CEECs in comparison with the EU-15 has decreased, but it remains significant. Accession has reinforced growth in production but also supported restructuring of production (Csaki and Jambor, 2013), resulting in a decline in the animal husbandry sector in the region. As expected, the value of the agri-food trade has measurably increased in nominal terms, and in some countries also in real terms. With increased prices, budgetary support, market opportunities and pressures, EU accession has had a significant impact on agriculture in the new Member States, although the CEECs capitalised on their opportunities in different ways, as a result of different initial conditions and pre- and post-accession policies.

This chapter will provide a closer look at developments in agricultural markets in the EU-N13, with the help of the AGMEMOD model. We aim to assess the quality of the results and use them to address the following issues:

- whether or not the EU-N13 is catching up with the rest of the EU;
- how each Member State's agricultural sector is specialised, if at all;
- identifying areas to which special attention should be paid in the future;

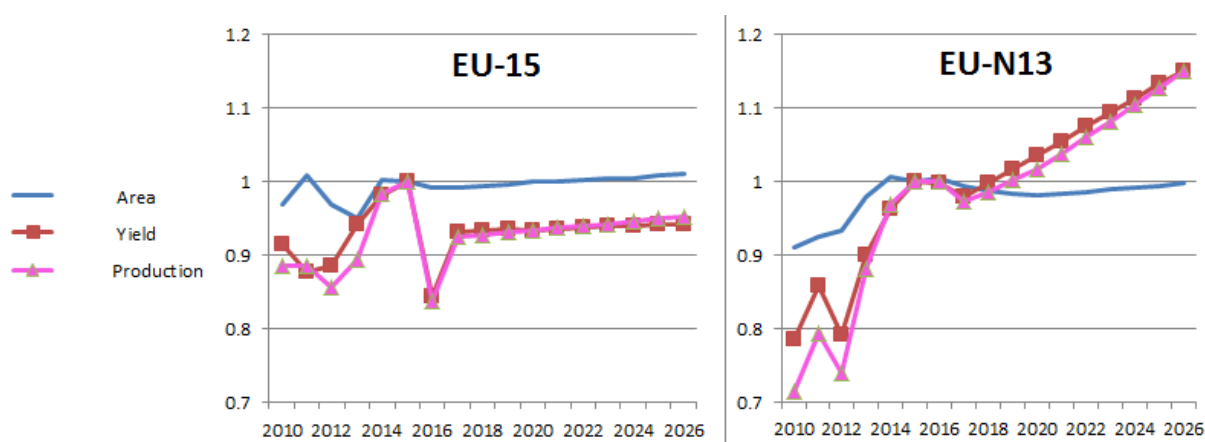
- differences within the EU-N13, speed of country growth in particular markets and stagnation in particular sectors;
- the key determinants behind the simulated trends.

The existing AGMEMOD model provides a wide range of results (AGMEMOD Partnership, 2017). While the graphs represent production only in individual sectors, the text provides additional commentary on other elements of market balances (particularly changes in trade). In the following sections, we present the most important or interesting agricultural market products. In the first group, crop products, we focus on soft wheat, maize and sunflower seeds. In the second group, meat production, namely beef/veal, pork and poultry, is depicted. The third group covers cow's milk and cheese. Within each of the groups, each section is divided into two parts. In the first part we present relative changes and compare the EU-N13 and EU-15. In the second part we deal with production in a group of selected new Member States. The most important agricultural countries in terms of agricultural area and farm population are Poland and Romania. To these we have also added Hungary and Bulgaria, which have significant market potential, as well as Slovakia and the Czech Republic.

4.2.2 Positive development patterns in crop production

Taking 2015 as a reference point, we can clearly see that the production of major arable commodities has experienced significant fluctuation in the past, mainly as result of variation in weather conditions. However, there are several general trends. Firstly, the sown area has not changed significantly and, according to AGMEMOD results, is not expected to do so in the future. This can be explained by the sum of multiple counteractive effects such as urbanisation, natural constraints and climate change impacts. However, the production of wheat and maize for the EU-N13 is expected to increase by 15% and 50% respectively by 2026, driven almost entirely by increased yields. There is still a significant difference between the EU-N13 and EU-15 in output per area; projections for the EU-15 are — at the end of the observed period — still around 40% higher than for the EU-N13, in particular for soft wheat and considerably more so for maize. The EU-N13 started its productivity rise from a low point, so naturally progress is easier to achieve and more significant, reflecting several factors, or a mix of them: increased intensity of input use, technological changes such as precision agriculture, and land use concentration (most of this production growth is tied to larger corporate or family farms). Among the EU-N13 Member States, the importance of these factors is different, and, as a result, the paths they follow differ.

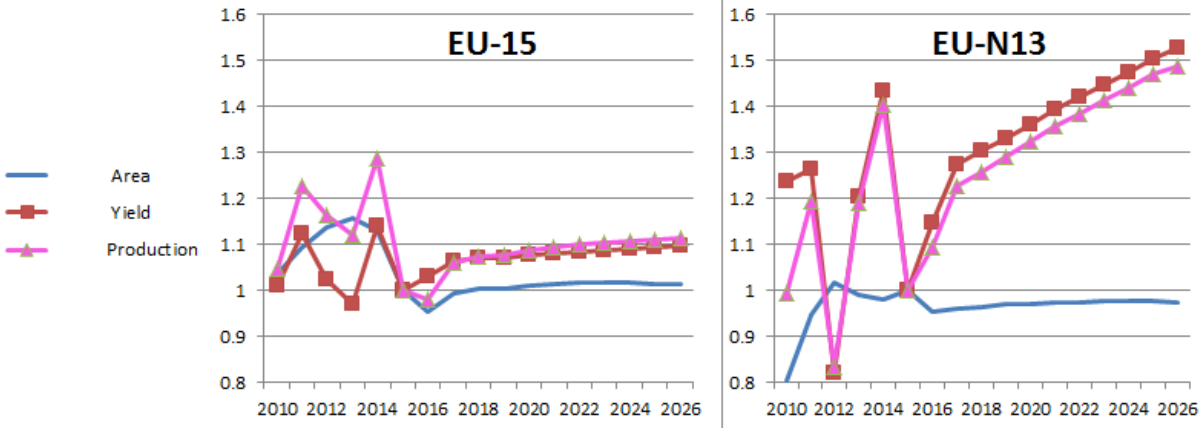
Figure 44. Outlook of the production of soft wheat in the EU-N13 and EU-15 in 2026 (2015 = 1)



Source: AGMEMOD 2017 Outlook.

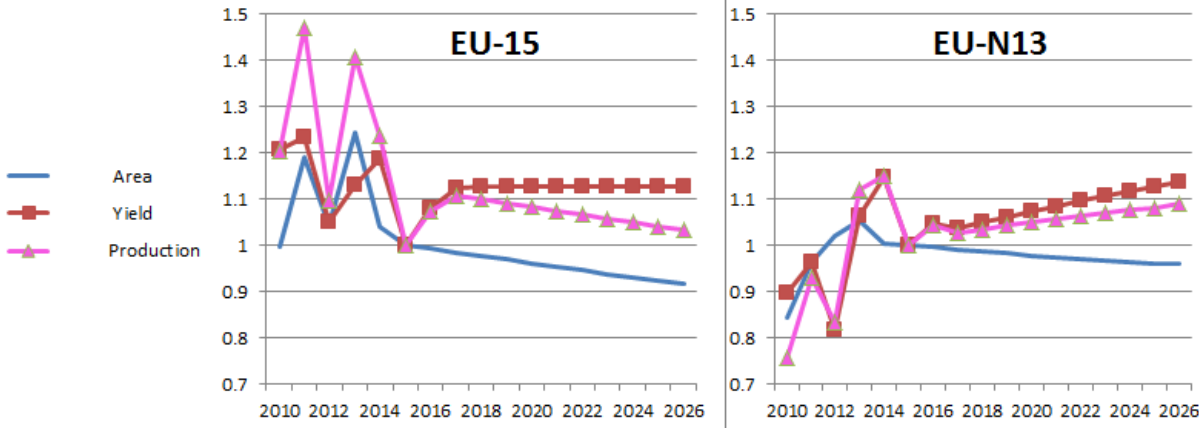
Simulations show that, for the crops selected, the biggest changes will arise with maize, as the most intensive and irrigation-responsive crop. Taken as one region, the EU-N13 is already a net exporter of this crop and could increase that status significantly in the future. However, additional growth will not cover the growing needs of EU-15 livestock production. Of course, we should not disregard maize’s sensitivity to weather conditions. Similar effects can be observed with respect to the increase in the productivity of soft wheat. Simulations indicate that the proportion accounted for by the EU-N13 in the overall production of the EU-28 will increase from 29% in 2015 to 33% and net export from the EU-N13 by approximately 30%. These are not very big changes, but they are significant enough that the EU-N13 is gaining in maize and soft wheat area in comparison with the EU-15.

Figure 45. Outlook of the production of maize in the EU-N13 and EU-15 in 2026 (2015 = 1)



Source: AGMEMOD 2017 Outlook.

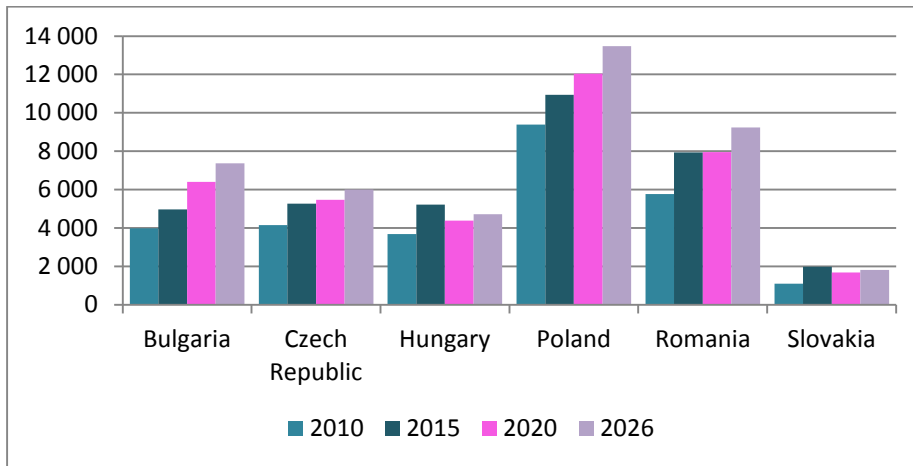
Figure 46. Outlook of the production of sunflower seeds in the EU-N13 and EU-15 in 2026 (2015 = 1)



Source: AGMEMOD results.

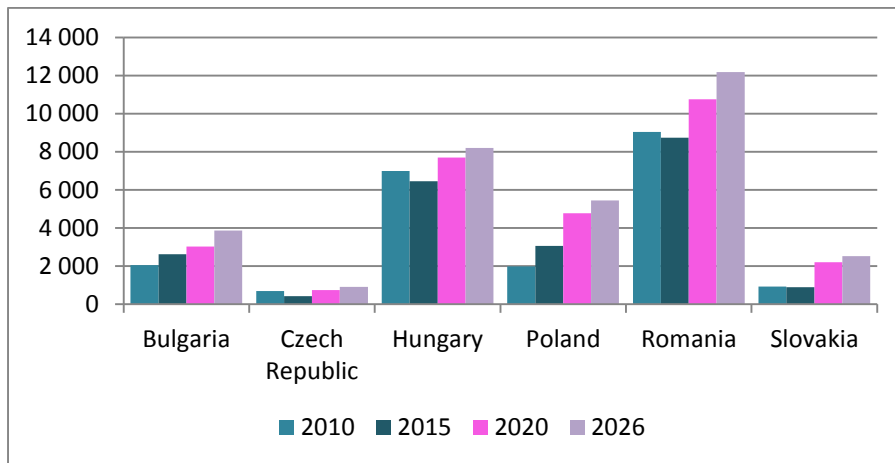
Production of oilseeds is strongly tied to the existence of contracts and options for further processing. In the following section we concentrate on sunflower seeds. The EU-28 covers its domestic needs: the EU-15 is a net importer, while the majority of imports are covered by increasing production in the EU-N13, which already produces more than the EU-15. This example also indicates a trend in intra-industry trade between the EU-N13 and EU-15 in the crop sector.

Figure 47. Outlook for soft wheat for selected EU-N13 Member States (production in 1 000 tonnes)



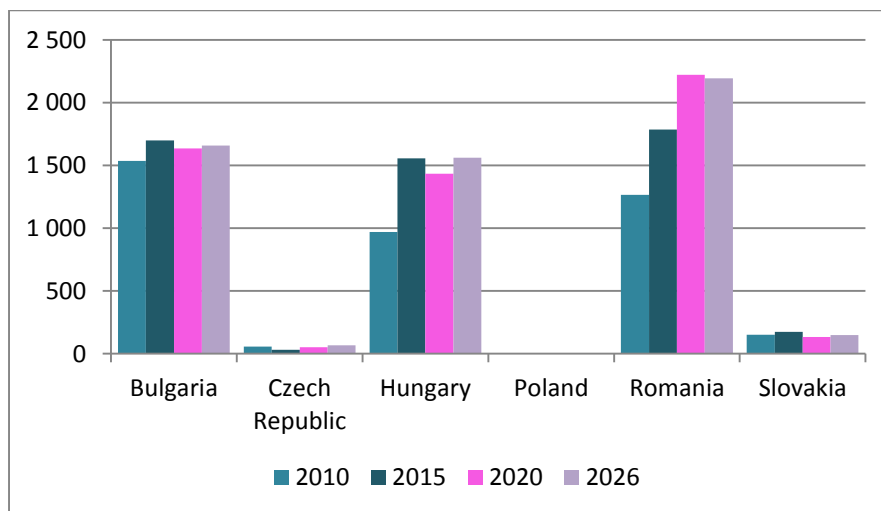
Source: AGMEMOD 2017 Outlook.

Figure 48. Outlook for maize for selected EU-N13 Member States (production in 1 000 tonnes)



Source: AGMEMOD 2017 Outlook.

Figure 49. Outlook for sunflower seeds for selected EU-N13 Member States (production in 1 000 tonnes)



Source: AGMEMOD 2017 Outlook.

Among the countries considered, Poland stands out, with respect to the production of wheat, and Romania, with respect to maize and sunflower seeds. Across the EU-N13 Member States, different dynamics in the production of particular crops are expected. In the case of Poland and Bulgaria, wheat production is projected to grow steadily, while only a modest increase is anticipated in the Czech Republic and Romania. In contrast to this growth, some decrease in production is expected in Hungary and Slovakia. Based on the simulations, the reason behind this decline is the improvement in other major crops such as maize, which will increase profitability and therefore the propensity to grow this crop in a larger proportion of the available area. However, this trend might be undermined if the speed of climate change increases and the amount and distribution of precipitation changes in favour of winter crops.

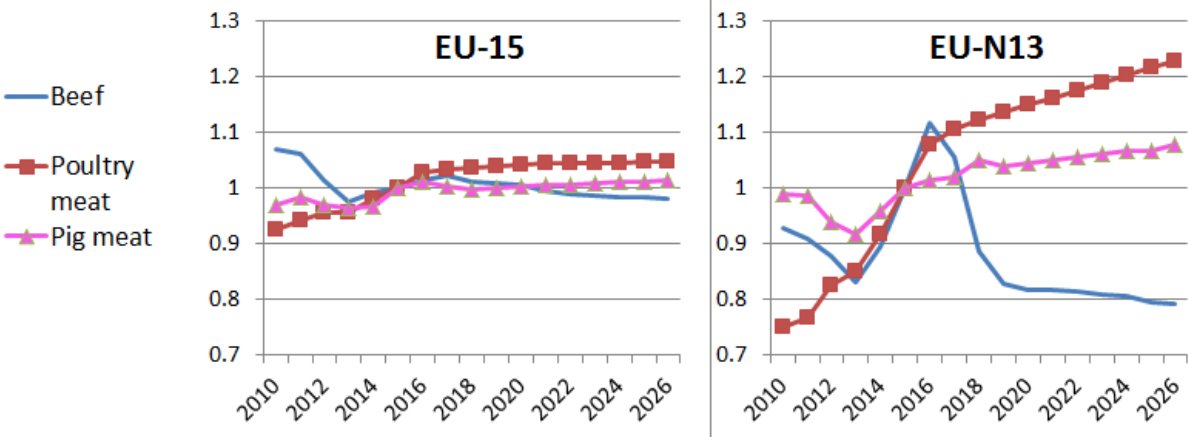
A steady and significant increase in crop production is expected in all major producer countries except Hungary, where only a modest increase is projected, and the Czech Republic, where no real change is expected. Sunflower seed production is projected to remain at current levels, except in Romania, which is expected to double its production.

These developments will also result in changed net-trade positions. All countries remain net exporters of wheat. Bulgaria, Poland and Romania increase their net exports significantly, while Hungary’s exports are expected to stagnate. Similar trends can be observed in the outlook for maize, whereby all countries, including the Czech Republic, become net exporters of maize at the end of the period. Notably, Romania is expected to double its maize exports and even surpass Hungary, which was still the biggest EU-28 producer of maize in 2015. Results from the model do not indicate any special changes in the sunflower seed sector, which is logical for the production of an industrial crop, as the production of such a crop is critically dependent on the development of additional processing capacity.

4.2.3 Different growth patterns in the EU-N13 meat sectors

While current trends are projected to continue in the case of pork and poultry, the recent increase in EU-N13 beef production will reverse; production is projected to drop by 20%, a far more significant decrease than for the EU-15. Causes of this development may lie in the economic attractiveness of other sectors and in the typical nature of beef production in the EU-N13. While rearing of specialised beef breeds is expanding, the main production is based on dual-purpose beef and dairy breeds, and calves belonging to these breeds are also important export items. If we also consider that both domestic consumption and producer prices are lower in the EU-N13 than in the EU-15, then this is a logical explanation for the simulation results.

Figure 50. Outlook of meat production for the main sectors in the EU-N13 and EU-15 in 2026 (2015 = 1)

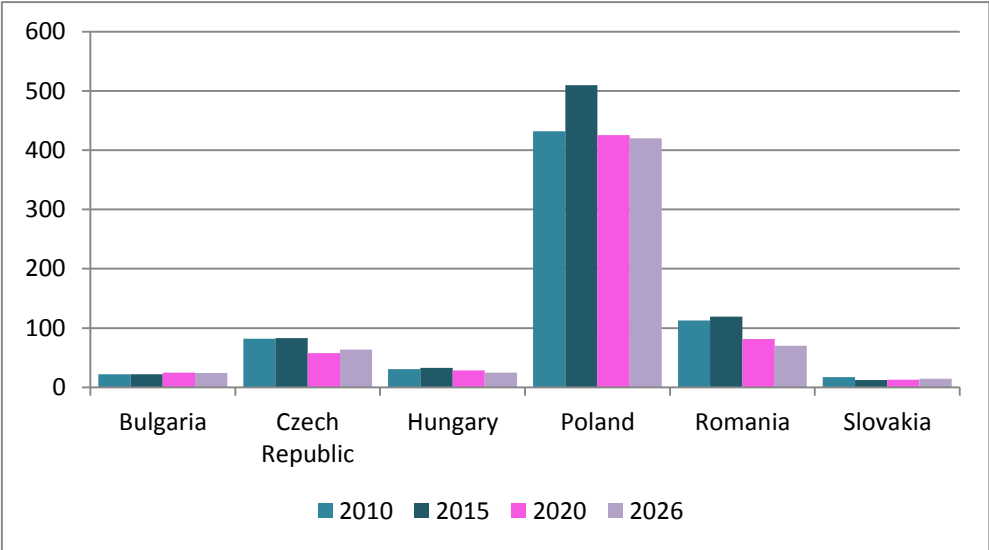


Source: AGMEMOD 2017 Outlook.

Poultry production in the EU-N13 is projected to increase steadily because of significant investment in recent years, and it is also fostered by Rural Development Programme (RDP) interventions, increasing demand and a relatively favourable cost structure characterised by cheaper grains and lower labour costs. Poultry production is highly specialised and demands high capital investments, but it can be established relatively quickly and its production increased, if economic conditions are attractive, which is undoubtedly true for the EU-N13. The trend in the EU-15 is significantly less prominent, because markets there are saturated and costs less favourable.

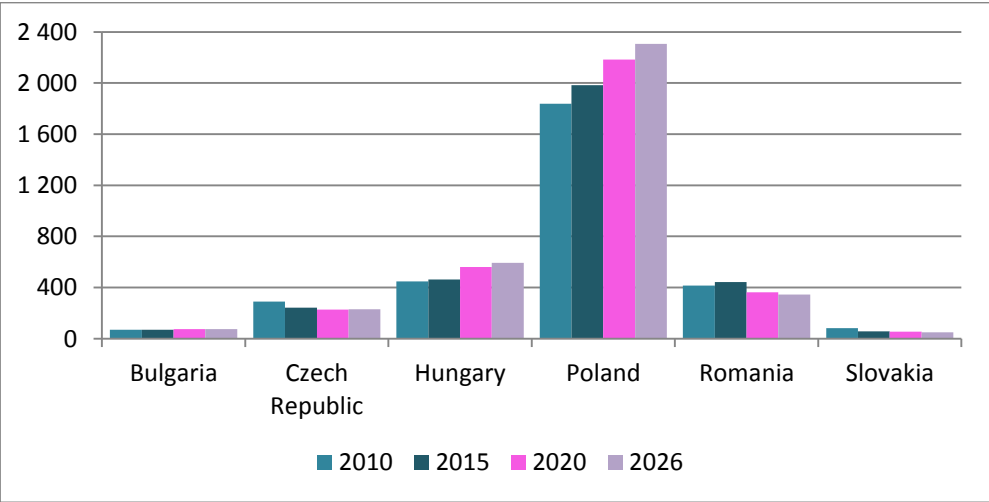
The EU-N13 also has the potential for growth in pork, but it demands the formation of effective production systems, substantial investments, and effective horizontal and vertical organisation requiring considerable investment in human capital. There are substantial differences between countries and in the ways that supply chains are organised. There is also the transfer of piglets from west to east, as well as the formation of large farms with agglomerations of animals, up to a million or more, in one place. Pork production in the EU-15 is under significant market pressures. Because of this, the prospects for production growth in the EU-15 are significantly worse than for the EU-N13.

Figure 51. Outlook for beef/veal for selected EU-N13 Member States (production in 1 000 tonnes)



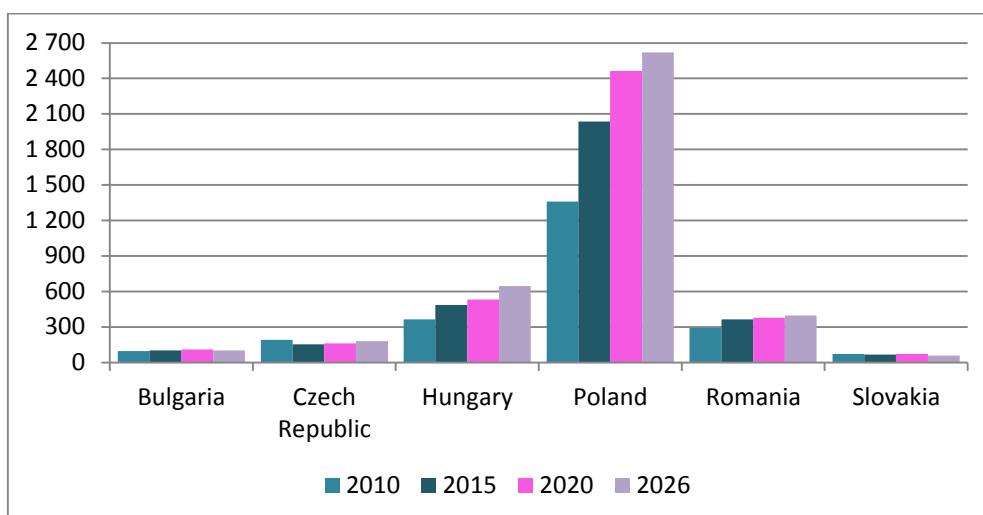
Source: AGMEMOD 2017 Outlook.

Figure 52. Outlook for pork for selected EU-N13 Member States (production in 1 000 tonnes)



Source: AGMEMOD 2017 Outlook.

Figure 53. Outlook for poultry for selected EU-N13 Member States (production in 1 000 tonnes)



Source: AGMEMOD 2017 Outlook.

Beef production in Poland, the biggest producer of the EU-N13, is expected to drop to 2010 levels at the end of the observed period, and a significant decline is also projected for Romania, the second largest beef producer in the EU-N13 block. These two countries also contribute most to the fall in production at the EU-N13 level. In the other EU-N13 Member States, beef production is less significant and is expected to remain at current levels. All selected countries should have the status of net importers of beef/veal at the end of the period, with the exception of Poland. One of the reasons for this is Poland's intensive exports of calves, which reduces the potential for its own production of beef.

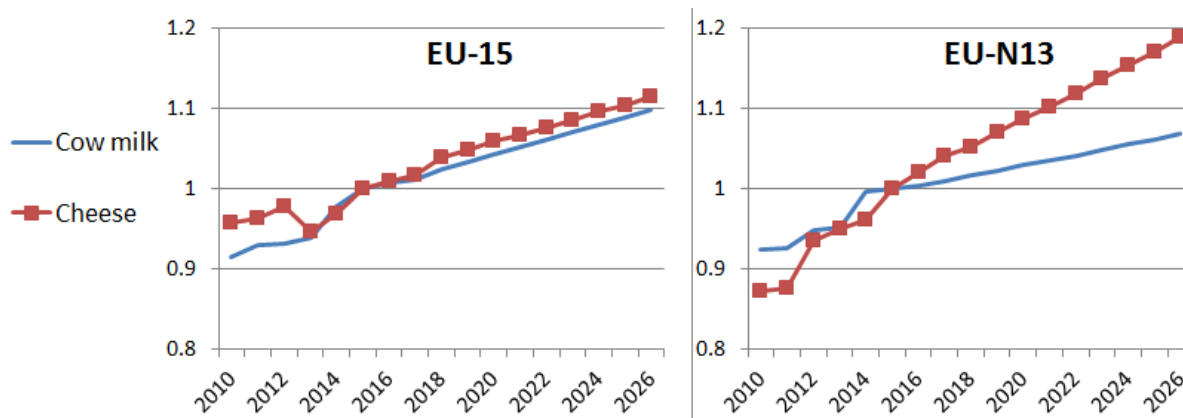
In the case of pork, the simulations project that the largest EU-N13 producers (Poland and Hungary) will increase their production significantly, while the small players remain at their current output levels, or even lose production because of problems with competition (Romania). This can be explained through the successful formation of modern production systems in individual countries. Because of positive changes, Hungary and Poland are also becoming net exporters of pork meat (AGMEMOD Partnership, 2017), while the rest, including Romania, are stagnating or increasing their net imports.

Model results for poultry production show a positive trend in practically all EU-N13 Member States, with markedly strong growth in Poland. Globally, Poland is among the countries with the most favourable cost structure and competition in the production of poultry meat; in contrast to the situation in the EU-15, societal concerns do not play a role. Despite these positive trends, Bulgaria, Romania and the Czech Republic remain net importers of poultry meat, while Poland's net exporter status is strengthening (AGMEMOD Partnership, 2017), regardless of the generally growing demand for poultry in the EU-N13 Member States.

4.2.4 Modest growth for the EU-N13 dairy sector

Projections show moderate growth in cow's milk production until 2026 in the EU-15 and EU-N13. Growth is slightly more intensive in the EU-15, where, according to the AGMEMOD model results, it should increase by 10% between 2015 and 2026. Production growth is mainly the result of an increase in milk yield, which in relative terms is significantly higher in the EU-N13; production growth in the EU-N13 is substantially higher (by 20%, compared with 10% growth in the EU-15). Driven by this productivity gain, the dairy herds in the EU-N13 will face a substantially bigger decrease than those in the EU-15, where the stock will remain practically the same.

Figure 54. Outlook for cow milk and cheese production in the EU-N13 and EU-15 (2015 = 1)



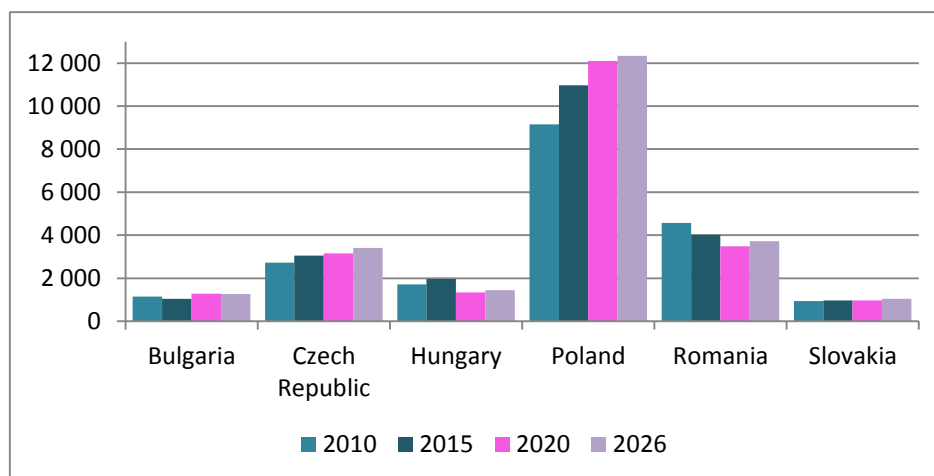
Source: AGMEMOD 2017 Outlook.

The modest growth of cow's milk and cheese production in the EU-N13 is driven by projected favourable developments in Poland. It is worth mentioning that the trends in cow's milk and cheese production do not necessarily follow the same pattern. In both Hungary and Romania, cow's milk production is projected to decrease by 2026, while cheese production increases slightly. This could be explained by the excess cow's milk produced in the main EU-28 dairy producers and by limited competition in domestic processing capacities.

The differences between the observed EU-N13 Member States can be explained by production characteristics (milk yields, economy of size and farm management), investments in the dairy sector and above all by the competitiveness of the entire dairy supply chain. Model results show strong growth in Poland, which could be realised if trends for investment in family farms through the RDP and private financial sources are prolonged. The competitiveness of the dairy industry is projected to remain. More moderate growth trends in other countries are realistic.

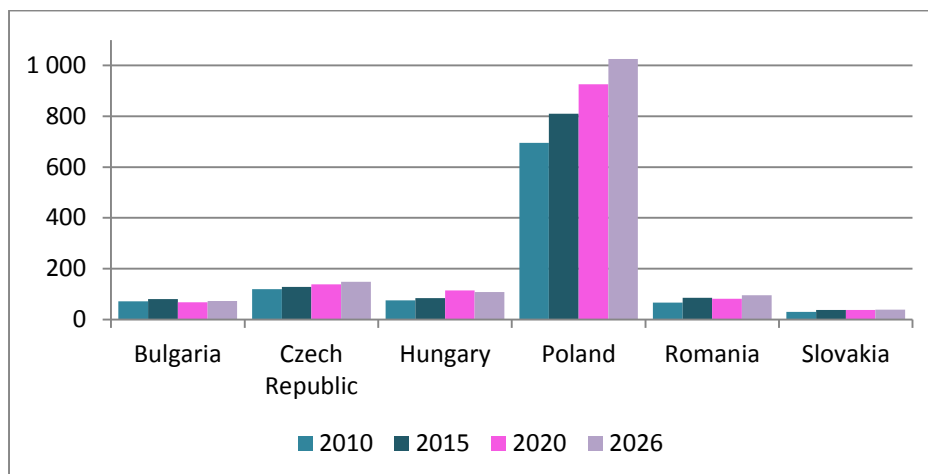
Changes in cow's milk production will also be reflected in the production and trade of dairy products. We illustrate this with changes in the cheese sector, which represents the most important group of dairy products in the region besides fresh dairy products. The EU-N13 remains a net importer of cheese, with the exception of Poland (AGMEMOD Partnership, 2017). According to these projections, Poland will further consolidate its net-exporter status.

Figure 55. Outlook for cow's milk for selected EU-N13 countries (1 000 tonnes)



Source: AGMEMOD 2017 Outlook.

Figure 56. Outlook for cheese production for selected EU-N13 countries (1 000 tonnes)



Source: AGMEMOD 2017 Outlook.

4.2.5 Discussion and open issues

The results of the AGMEMOD projection show that production trends and changes that were under way before the accession of the EU-N13 to the EU will be consolidated in the next 10 years. This will mean higher growth in production in crop and some livestock sectors (pork, poultry and — in most countries — milk) than in the EU-15, driven by growth in productivity narrowing the yield gap with the EU-15 (average crop yields still lag 30% or more behind the EU-15 average), relatively favourable natural conditions, and low costs of labour and inputs for livestock production. These advantages are realised in particular where production is organised by larger corporations or larger family farms, and where an easier and simpler adoption of modern technology is possible (e.g. by purchasing production inputs such as seeds, equipment and mechanisation, often also with area-based CAP support). Therefore, it is understandable that development in the EU-N13 is faster and that the block is taking over important proportions of EU-28 production and trade in soft wheat and maize.

We can make a similar claim for poultry as we can for key crop products; however, we see less progress in more complex production systems, such as pork and dairy, where the advantage provided by economies of scale is smaller and it is more difficult and complex to form efficient supply chains. Progress often also depends on foreign direct investments, which, in the best of cases, also bring rapid progress in technological development and open trade channels.

Beef is the only sector where it is estimated that the scale of production might shrink in the EU-N13. This stems from various factors, ranging from producer prices — still lower in the EU-N13 than in the EU-15 — to a lack of historical payments through CAP support, a weaker tradition for breeding beef, the sale of calves to the EU-15 markets, a reduction in the number of dairy cows, etc.

The situation in the dairy sector is also diverse within the EU-N13 (AGMEMOD Partnership, 2017). This is especially evident in smaller EU-N13 agricultural producers (the Baltic countries, Slovenia and Croatia), which have not been addressed in this section. For example, after its transition, productivity and market organisation in the dairy sector in Estonia reached the level of the most developed EU-28 countries.

However, despite this absolute and relative growth in production for the products discussed above, the EU-N13 in general still does not have a decisive role in EU markets or in exports to non-Member State markets. Naturally, this also depends on the size of countries and economies. However, in certain segments, some agri-food chains are gradually assuming a prominent role in production and trade (e.g. Poland with poultry, Romania with maize).

To understand the situation and market perspectives of the EU-N13, some production and agri-food chain characteristics should be mentioned. The fact is that agriculture in the EU-N13 has a distinct dual image. On the one hand, we have growing agricultural companies and farms that are catching up with the most efficient in the EU-15. On the other hand, a large part of the region is still dominated by small semi-subsistence farms that have poor market organisation, low productivity and poor economic and social outlooks. The potential of EU-N13 agriculture will not be realised without a larger developmental push, which the RDP is unable to provide.

It is worth pointing out that the EU-N13 has significant potential in terms of increasing sown area, as large areas are currently either in permanent set-aside or have been converted to grassland. The model addresses this issue, but the question is how much of the potential dynamic in this area it can capture. Because of this, the potential for growth in production and trade is almost certainly underestimated for some countries. It is also a fact that, in some sectors, development is highly dependent on technological and industrial structural breaks. New investments in processing or provision of inputs (e.g. poultry, industrial crops) can change market conditions and increase production overnight.

A particular value of the AGMEMOD approach is that it allows detailed analysis of results for individual Member States. The model contains a complete outlook of market balances for 11 Member States of the EU-N13. Malta and Cyprus are not included in the model in detail, but they are small island countries and less important to the analysis of dynamics and changes in the structure of production and trade. Considering the production scale, trade, economic power and potential of the agricultural sector, the most important representatives of the group are Poland and Romania, which are closely followed by Hungary in terms of natural resources. The results show exceptional growth in most sectors, especially for Poland. This result lies on the upper limit of expectations and is probably a consequence of the transfer of past linear-trend relations into the outlook for the future. In the past 10 years, Poland has raised its production and trade significantly in some sectors, and these results have been transferred into projections for the future with the help of model equations and regression coefficients. A critical reader might say that the results are perhaps overly optimistic and even unrealistic, particularly for dairy and pork. While it is difficult to give a final judgement on this, the fact is that we must also be aware of all the limitations of such approaches.

On the other hand, the rigidity of development up to this point has considerably limited the development of the potential of the agricultural markets in other countries observed. The Czech Republic, Slovakia, Hungary and Bulgaria do not have such significant positive changes as Poland in most markets. It is hard to judge to what extent this is the result of the model or of the approach of those who built it, and to what extent it is the result of frictions inherent to these agricultural sectors. All in all, the projections presented are probably more realistic than those for Poland.

In conclusion, the results of the projections provide an interesting image of future changes in production and trade structures of the EU-28, where the EU-N13 is gradually gaining, and notably within the EU-N13 certain Member States and sectors. This is probably the best possible assessment using tools of this sort, but it should be cross-referenced with market experts, who are lacking in this part of the EU. This sort of knowledge is less developed and should also be strengthened with these sorts of activities.

The quality of the model and use of the results should also be strengthened. This analysis hopefully confirms that the model provides relevant results, and especially that it enables a discussion about key development trends, changes and causes for the changes in production and trade. Presenting the results in EU-N13 Member States would probably also attract additional comments and help improve the quality of the model. Investing in a modelling network would contribute to even more intensive work on models, which can be strengthened with detailed parameter calibration and choice of the most suitable factors that affect individual attributes.

4.3 Impacts on production of uncoordinated coupled beef support in the EU

Guna Salputra, Jesús Barreiro-Hurle, Thomas Fellmann

Following the 2013 reform, the CAP offers increased freedom for Member States to implement specific policy measures, including VCS for the period 2014-2020. The VCS has been chosen by Member States mainly for livestock-related activities. Of the 28 Member States, 24 have some level of VCS in place for this sector (EC, 2017). The policy background for coupled EU livestock payments can be summarised as follows:

- Before the 2003 CAP reform, coupled payments in the livestock sector had the same rates in all Member States for the reference amount of production or animals.
- The 2003 CAP reform (Fischler reform) introduced decoupled payments together with the option to retain some coupled livestock support. Not all Member States opted to continue coupling. Because of this previously unobserved situation, the potential effect on the market was not really clear.
- The 2014-2020 CAP reform allowed Member States to couple direct payments up to a maximum of 15% of the national envelope. For the first time, payment rates and reference amounts for livestock are not the subject of a common regulation.

A simple calculation using equation (1) gives the coupled cattle support attributed to actual beef production, which varies between Member States in all policy periods (the results of the calculation are included in Table 1):

$$com_t = cpt_t / spr_t \quad (1)$$

where com_t is coupled support per kg of beef produced in year t , cpt_t is coupled payments for cattle in year t , and spr_t is beef production in year t .

Table 1. Policy background — coupled support for cattle attributed to actual beef production (EUR/kg)

Country	2003 (Before Fischler reform)	2009 (Fischler reform)	2015 (CAP towards 2020)
Spain	3.51	0.65	0.36
United Kingdom	2.02	0	0.05
Ireland	1.30	0	0
Greece	1.15	0.15	0.58
Portugal	1.10	0.97	0.67
France	0.91	0.62	0.45
Austria	0.84	0.42	0.05
Denmark	0.78	0.26	0.20
Finland	0.74	0.43	0.65
Germany	0.61	0	0
Sweden	0.61	0.25	0.63
Netherlands	0.37	0.26	0.01
Belgium	0.37	0.39	0.30
Italy	0.33	0.03	0.14
Slovenia	0.59	0.57	0.12
Czech Republic	0.40	0.81	0.43
Latvia	0.19	0.34	0.51
Lithuania	0.05	0.28	1.56
Hungary	0.00	0.62	1.32

Source: Own calculation based on AGMEMOD 2017 database.

The variance of coupled support per kg beef produced was more pronounced in EU-15 Member States before the Fischler reform (due to production exceeding a reference range), and in EU-N13 Member States in the CAP period towards 2020, when many new Member States are using more coupled payments for beef output than in the pre-accession period.

The asymmetric implementation of coupled support increases the uncertainty of its impact at EU level. While individual Member States would expect that coupled support maintains activity levels interactions between the different schemes and different countries in the market can lead to other outcomes. The final situation results from contradicting drivers, with convergence of total envelopes between the Member States, but an asymmetric implementation of coupled payments.

In this section we analyse the impact of subsidiarity in VCS for the EU beef sector by quantifying the effects of the mixture of decoupled and non-harmonised coupled payments. This section presents the use of the policy harmonised (PH) evaluation approach ⁽¹²⁾ implemented in the AGMEMOD model and the use of updated multipliers to weight the impact of coupled and decoupled payments on production, focusing on the EU beef sector. The values of multipliers after 10 years of application of the mix of coupled and decoupled payments have been re-estimated compared with those formerly used, from the OECD (2006) ⁽¹³⁾. It is important to mention that further analysis covers full diversion of production and not a simple *ex post* calculation in which the amount of subsidies is divided by actual beef production.

The impact of coupled and decoupled payments on production decisions is not always straightforward and depends on several structural (composition of farm income, farm size and specialisation, etc.) and policy factors. The regional heterogeneity in impacts can be more pronounced than analysis aggregated at European and national scale would suggest; however, previous research (OECD, 2011; Ciaian et al., 2012; Galcko et al., 2011) shows that decoupling of direct payments has the following general effects:

- Fully decoupled subsidies result in lower production, while decoupled subsidies combined with partially coupled schemes lead to higher production.
- Decoupled area payments provide higher incentives for crop production, whereas area payments related to livestock production have only an indirect link and therefore lower production incentives.
- The EU's single market is affected by the different implementation choices of Member States, and this has subsequent impacts on particular Member States through price and trade effects, independently of Member States' own decisions.

From a policy perspective, AGMEMOD includes all types of direct payments that are allowed under the CAP through the implementation of the PH approach (for a more general description of the model, see Chapter 2). Direct payments are recalculated in the form of policy add-ons to market prices, increasing the margin between the producer price and input costs to form a reaction price. Equations (2)-(4) show how coupled, historical and regional payments are recalculated per unit of expected meat production, j :

$$cprc_{ij} = (cpt_{ij} / cct_{t-1,j}) / slw_{ij} \quad (2)$$

$$hprc_{ij} = (hpt_t / ah_{t-1} / utr_{t-1}) / slw_{ij} \quad (3)$$

$$rprc_{ij} = (rpt_t / ah_{t-1} / utr_{t-1}) / slw_{ij} \quad (4)$$

⁽¹²⁾ In the PH approach all type of direct payments are recalculated as add-on to the relevant producer price. Policy impact coefficients (multipliers) for each type of payments are applied.

⁽¹³⁾ OECD (2006) used the following multipliers: 1 for coupled payments, 0.5 for historical payments, 0.3 for regional payments.

where $cprc_{tj}$ is price add-on from coupled payments, $hprc_{tj}$ is price add-on from historical payments, $rprc_{tj}$ is price add-on from regional payments, cpt_{tj} is the ceiling for total coupled payments envelope in year t for commodity j , hpt_t is total historical payments envelope in year t , rpt_t is total regional payments envelope in year t , cct_{tj} is ending stocks in year t for livestock group j , ah_t is area harvested in year t , utr_t is average livestock density in year t and slw_{tj} is average slaughter weight in year t for livestock group j .

The reaction price accounts for the effect of decoupled direct payments through the application of coefficients, the multipliers, which adjust the share of budgetary support in the reaction price. The magnitude of the multipliers applied to different types of decoupled subsidies depends on the nature of these support payments. Greater detail on policy add-ons to be included in reaction prices, which are then used as explanatory variables in supply-side equations of the country-level AGMEMOD models, can be found in Salputra et al. (2011). By using the PH approach, we can analyse the development of the total amount of direct payments that can be attributed to any sector.

In this section we focus on cattle and beef, and our analysis shows that the total support (before application of adjusting coefficients) to the cattle sector increased after countries started decoupling payments during the period 2004-2006. This might also explain why Ireland, for example, did not choose to couple any payments, as indirect support for the Irish dairy sector in the form of grassland payments was even higher. If Ireland had chosen coupled payments, e.g. for ewes and crops, the decoupled grassland payment would have been lower than it actually was without these coupled payments. The direct support attributed to the cattle and beef sector, including both live and slaughtered animals, is presented in Table 2.

Table 2. Total direct support attributed to potential beef production (calculated based on number of cattle at the beginning of the year), EUR/kg

Country	2003 (Before Fischler reform)	2009 (Fischler reform)	2015 (CAP towards 2020)
Spain	1.58	1.34	2.30
United Kingdom	0.44	0.97	0.82
Ireland	0.38	0.64	0.67
Greece	0.54	4.56	9.37
Portugal	0.34	1.18	0.79
France	0.26	0.58	0.49
Austria	0.28	0.92	0.64
Denmark	0.27	0.33	0.27
Finland	0.26	0.14	0.21
Germany	0.18	0.57	0.52
Sweden	0.19	0.37	0.43
Netherlands	0.18	0.71	0.61
Belgium	0.11	0.42	0.41
Italy	0.21	0.80	0.80
Latvia	0.06	0.47	0.49
Lithuania	0.02	0.67	1.00

Source: Own calculation based on AGMEMOD 2017 database.

To estimate the parameters for the impact of decoupled and coupled payments, we use data from EU-15 countries. The reference period of the data is 2003-2016. A first result worth mentioning is that the parameters presented in Table 3 are highly heterogeneous, indicating that assuming the homogeneous values — as was previously the case in AGMEMOD — might lead to biased results when analysing agricultural policy impacts. Coefficient a (Table 3) reflects an average or initial value of beef production in 2003. From the results we can conclude that (i) in many cases the price effect is less than 1,

(ii) the price effect can be different from coupled support effects, and (iii) the effect of historical and especially regional payments on production is in most cases negative which is in contrast to assumptions previously applied in AGMEMOD. A negative price coefficient can explain why the increase in input costs is higher than the price increase.

Table 3. Estimated parameters for direct payments included as explanatory variables in beef production equation

Country	Coefficient <i>a</i>	Coefficient of price and/or coupled payments		Coefficient of historical payments (Hpm ₁)	Coefficient of regional payments (Rpm ₁)	Direct payments and application period in 2003-2016	Beef production trend from 2003 (increasing, decreasing, stable or fluctuating)
		Cpm ₁ (price)	Cpm ₂ (coupled payments)				
Ireland	552	0.08		-0.24		Coupled 2003-2004, historical 2005-2016, regional 2015-2016	Fluctuating/ slightly increasing
United Kingdom	850	0.12		-0.17		Coupled 2003-2004 and 2015-2016, historical 2005-2011, regional 2005-2016	Increasing
Germany	1172	0.03	3.51	0.78	-1.09	Coupled 2003-2004, historical 2005-2012, regional 2005-2016	Fluctuating/ slightly decreasing
Denmark	131	-0.01	0.64	-1.34	0.07	Coupled 2003-2011 and 2015-2016, historical 2006-2016, regional 2005-2016	Slightly decreasing
Netherlands	262	0.42	0.70	-0.11		Coupled 2003-2011 and 2015-2016, historical 2006-2016, regional 2015-2016	Fluctuating/ slightly increasing
Finland	85	-0.001	0.19	0.88	-2.96	Coupled 2003-2016, historical 2006-2016, regional 2006-2016	Slightly decreasing
Greece	61	-0.02	0.10	0.004		Coupled (minor level) 2003-2014, historical 2010-2014, regional (minor level) 2005-2014	Decreasing
France	1507	-0.22	3.92	-0.11	-0.56	Coupled 2003-2016, historical 2005-2016, regional (minor level) 2010-2016	Fluctuating/ decreasing
Austria	174	0.11	0.09	0.11		Coupled 2003-2014, historical 2005-2014, regional 2010-2014	Increasing
Italy	1128	-0.02	0.10	-1.15		Coupled 2003-2014, historical 2005-2014, regional 2010-2014	Decreasing
Portugal	106	0.002	0.30	-0.26		Coupled 2003-2014, historical 2005-2014, regional 2010-2014	Decreasing
Spain	667	0.08		-0.60		Coupled 2003-2014, historical 2006-2014, regional 2010-2014	Slightly decreasing
Belgium	276	0.01	0.97	-0.53		Coupled 2003-2016, historical 2005-2016, regional 2015-2016	Stable
Sweden	140	-0.002	0.18	-0.01		Coupled 2003-2014, historical 2005-2014	Fluctuating around the same level

Source: Own calculation based on AGMEMOD 2017 database.

The re-estimated coefficients have to be used for setting up the multipliers to be included in the calculation of the policy component in reaction price equations in AGMEMOD. The very different estimated coefficients are harmonised to a similar scale, which also provides robustness for evaluating future changes in direct payments, including switches back to coupled payments and/or sharp changes in subsidy levels, which might cause a shock in the model. We retain the assumption that the effect of coupled payments is equal to 1, and adjust the coefficients of other payments according to their estimated magnitude.

Equation (5) presents the final use of multipliers and specifications for the price reaction component for beef:

$$prc_t = (cpm \cdot cpt_t / cct_{t-1} + (hpm \cdot hpt_t + rpm \cdot rpt_t) / ah_{t-1} / utr_{t-1}) / slw_t \quad (5)$$

where prc_t is the price reaction component from all direct payments, and cpm , hpm and rpm are multipliers of coupled, historical and regional payments.

5 AGMEMOD as seen by stakeholders

5.1 Directorate-General for Agriculture and Rural Development

Sophie Helaine and Fabien Santini

The European Commission has been publishing medium-term projections for the main agricultural products (arable crops, meat, dairy) for more than 10 years. Such projections are made at EU level (identifying EU-15 and EU-N13 aggregates) and are communicated to the OECD and the FAO for their world agricultural outlook (with the same aggregation level). Therefore, they do not provide information on production localisation in the EU. Within the internal market, however, there are differences in prices and costs of production, consumption patterns, productivity gains, policies (different options for coupled support, programming of rural development envelopes, state aid, etc.), and in some cases in exchange rates (for those Member States outside the euro area) that can lead to different production, consumption and trade flow developments.

When elaborating the EU baseline, the possibility of validating the underlying national assumptions with a model balancing out the different posts of the balance sheet in each Member State reinforces the credibility of the global projection. Experts on each national market tend to be biased by their reduced scope of expertise, not properly taking into account expectations in other countries and interactions between markets. Similarly, when elaborating a projection at aggregate level, one tends not to fully contemplate the consequences for each national market (sometimes projecting unlikely national developments to explain what might seem to be a plausible aggregated projection). In addition, national and even European policymakers and stakeholders, when confronted with an EU projection, naturally ask how this projection would manifest itself in the different Member States. Accordingly, experience gained in the two last EU Agricultural Outlooks by the AGMEMOD projections at Member State level for pig meat (2015) and dairy products (2016) was very welcomed.

Therefore, by supporting the AGMEMOD project, the European Commission aims to improve the robustness of the EU Agricultural Outlook. To that end, expertise at Member State level is key because policies and shocks have different impacts on Member States. The recent Russian ban most affected the Baltic and Finnish dairy sectors because of their proximity to and dependence on the Russian market. The decision of the United Kingdom to leave the EU will have more impact in Ireland than in other Member States, for similar reasons. This does not mean that these events will not have an impact over the whole single market, but a proper analysis implies taking these asymmetric impacts into account. In addition, changes in policies implemented differently in various Member States, such as VCS, cannot be assessed without each national market being represented. For these questions, aggregated models are not usually able to provide precise answers and a Member State-level tool is needed.

Last but not least, building databases and expertise for 28 Member States, in the context of lower availability of Eurostat data (balance sheet), is complex and resource intensive. This is why the European Commission supports the AGMEMOD project and relies on it to develop a motivated network of experts to share the burden and develop market and outlook intelligence, which can in turn be used by contributors for their national purposes.

5.2 Federal Ministry of Food and Agriculture, Germany

Oliver von Ledebur, Jobst Jungehülsing

After internal deliberations in Germany's Federal Ministry of Food and Agriculture, it was decided in 1996 to ask the former Federal Agricultural Research Centre (FAL) to develop analysis tools to evaluate the impact of various policy scenarios. This decision was induced by the complexity of long discussions held in the course of the Uruguay Round of WTO negotiations. The resources for the development of an own-modelling system obviously required reallocation of resources and training of experts in the relevant institutes, to allow for the linkage of traditional market analysis with quantitative reproduction of Europe-wide and internationally connected agricultural market analysis. The focus was set on the estimation and evaluation of the impact of multilateral and bilateral trade liberalisation decisions on the CAP, agricultural markets, production structures and farmer income. This work continues to be undertaken by a modelling group comprising the three economic departments of the Thünen Institute, using analysis tools that have been developed in accordance with the reforms of the CAP in the course of the evolution of the international agricultural trading system. Scientific and technical exchange with academic experts in Germany and abroad was of great importance, as was interaction with similar governmental institutions at national and international level. This closeness to the politically relevant questions and institutions has remained in place — the network of researchers is continually increasing.

To remain relevant and closely linked to the political agenda, researchers involved with the analysis and the staff of the Federal Ministry of Food and Agriculture established communication channels and regular exchanges to guarantee that questions proposed by the ministerial administration are understood by the researchers and equally that the constraints when analysing them are understood by colleagues in the administration.

With the increasing complexity of multilateral and bilateral trade negotiations, and the relationships between the supply and demand sides of agri-business, modelling tools that were once sufficiently powerful for analysis of the impacts of trade liberalisation and policy changes on a smaller number of Member States of the European Community needed to be continually adapted. If necessary, the analysis toolkit was amended or parts completely substituted. From the perspective of the Federal Ministry, and in the framework of the Thünen modelling group, this is the story behind AGMEMOD.

From the very beginning, AGMEMOD was conceived as a partnership in which resources and expertise from the EU Member States would be bundled around a common mechanism for elaborating policy impact analysis — a common scientific language. The restored opportunity to obtain results at national level in the EU — a perspective that was for good reasons lost in the course of the development of the toolkits — was and is highly valued.

The baseline for the German agricultural markets has been published periodically since 2008. Its elaboration is prepared in the framework of an iterative discussion process between researchers and ministerial staff. Based on huge amounts of carefully compiled data, it provides, firstly, a detailed description of the status quo of national agricultural markets and structures, and secondly a 10-year agricultural market outlook, based on relevant national and international drivers. The first of these is a very important tool for ministerial staff to capture simultaneously the status of the agricultural sector and all of its interconnections. The second stimulates recurrent demands for impact analysis — fundamental to discussion and communication of political decision-making. AGMEMOD is the backbone for both aspects, and together with the other analysis tools available to the Thünen modelling group it allows highly fruitful discussion and clarification of the state of the German agricultural sector in its most relevant aspects and in the European and international framework.

6 “Don’t look back in anger”: reflections after nearly two decades of AGMEMOD

In contrast to Oasis (¹⁴), we do not claim to have started a revolution from our beds but, after nearly two decades of model development and applications, AGMEMOD has proved to be providing solid medium-term projections of agri-food market development, both at the aggregated EU and at individual Member State level. AGMEMOD enables us to simulate agri-food markets following a bottom-up approach, allowing model application with relatively low entry barriers and costs. Econometric estimation of parameters also allows capture of market structures appropriate to individual Member State conditions. The network of modellers from Member States is extended by market experts, who provide feedback and validation of model outcomes from AGMEMOD. A particular value of the AGMEMOD approach is the opportunity to conduct detailed analysis of the results at EU Member State level. The model contains a complete outlook of market balances for the 28 EU Member States, although Luxembourg is presented together with Belgium, and Greece, Malta and Cyprus form an aggregate.

Cereal production is projected to increase thanks to yield improvements, while oilseed production will decline until 2026, because of area reductions. The largest growth in wheat production is expected in France, Poland, Bulgaria and Romania. Wheat consumption stays nearly stable in these countries, hence their exports increase. Even though maize production grows in the EU, especially in Romania, Poland, Bulgaria and Hungary, maize imports increase because of a higher demand for feed use in all countries except Spain, Romania and Portugal. In the barley market, consumption increases, surpassing production increases and resulting in a shrinking net-export position for the EU. Of the large exporters, only France and Denmark increase their exports in the projection period. Because of reduced demand for rapeseed-based biofuel, production of rapeseed declines, particularly in France. Of the large producers, only Germany increases rapeseed production slightly. In the sunflower market, production stays relatively stable but shifts from France and Spain to Romania and Bulgaria.

Cow’s milk production is either stable or increasing. Of the projected increase in EU milk production (9% in the period 2016-2026), 75% is realised by five Member States: Germany, Ireland, the Netherlands, France and the United Kingdom. After a period of several years of observed increases in the dairy cow herd, a decline across the Member States is now projected. In the Nordic countries (Finland), milk production is under downwards pressure, but coupled support may have contributed to preventing a real decline in production. For other Member States, it is difficult to assess the impact of VCS in dairy, but according to our first estimates the impacts on dairy are in general likely to be rather limited. A steady milk yield increase of, on average, about 100 kg of milk per dairy cow (ranging from 1-2% per animal) is projected. Even with the high levels of milk yield that have already been achieved, there is no evidence of this growth rate slowing down. As indicated above, several Member States face environmental constraints, and we see that societal concerns regarding dairy produce are increasing in some Member States. A slight reorientation in milk production towards the dairy belt region has been projected. Finally, as regards consumption, it was found that the growth in dairy product consumption per capita increases more strongly in the eastern than in the western part of the EU. Cheese consumption in particular continues to grow across the EU. Whereas income growth is stronger in the EU-N13 than in the EU-15, population growth in the former is slightly lower, creating differentiated impacts on the evolution of dairy demand. Projected annualised growth rates for consumption or use of dairy commodities (SMP, WMP) have an average order of magnitude of about 3% and are much larger than comparable rates for the domestic consumption of consumer products (cheese, butter, fresh dairy products). Annual growth rates for trade in dairy products (exports) are usually much stronger than those for domestic consumption, which reflects the importance of trade and export demand for facilitating the growth of the EU dairy sector.

¹⁴ Oasis (1995), “Don’t Look Back in Anger”. Track 4 of the album (*What’s the Story*) *Morning Glory?*.

Developments regarding meat sectors are quite complex; while total per capita domestic use of meat is projected to be relatively stable or to decline slightly until 2026 in most EU-15 Member States, there is an increase in per capita use in the EU-N13 countries. In the EU-15 Member States, however, increases in population moderate this development, in contrast to the EU-N13 Member States where the increase in total per capita domestic use is augmented by declines in population. The composition of the use varies considerably across the Member States, with relatively low per capita use of beef in Poland, Romania and Germany in 2026. Pork will remain the most important meat in the food basket of most Member States (the exceptions are the United Kingdom and Ireland), although its share is continuously declining while that of poultry is increasing. Growth in the production of poultry and pork will slow until 2026, particularly in EU-15 Member States, driven by environmental obligations and constraints and by societal concerns that prevent administrations from issuing building permits for slaughterhouses and other facilities. In contrast, those limitations are negligible in the EU-N13; in Poland, poultry and to a lesser degree pork production will grow significantly. Pork production in the EU is characterised by increasingly international division of labour, so that piglet production and pig fattening are separated. Germany and to an increasing degree Poland will import piglets from the Netherlands and Denmark.

To understand the implications of the exit of the United Kingdom from the EU, known as Brexit, a close look at the medium-term projection of the development of the agri-food sectors provides first insights. In general, under the baseline, United Kingdom net imports of meat are projected to decline. Declining production of beef, pig meat and sheep meat is expected to be only partially offset by lower levels of domestic use, with the exception of poultry meat. Strong growth in domestic use of poultry meat in the United Kingdom is reflected in growth in both domestic production and net imports of poultry meat. Similar trends can be observed in the projected development of the crop sector, where the area harvested of grains and oilseeds is projected to decline, with a slight shift in land use from arable crop production to grassland. With a rather stable level of human consumption overall, domestic use of grains is projected to increase due to growth in the demand for grains for feed. Therefore, with growing demand for grains and oilseeds on aggregate, and a contraction of production over the baseline projection period, the United Kingdom's trade position will continue to deteriorate for crop products.

Similar developments, with a stable or even declining level of livestock products and a tendency towards growing domestic use, can be observed for meat and dairy products. The projection of the medium-term development of agri-food markets indicates a decline in the level of self-sufficiency in almost all agricultural and food products, i.e. net imports of agricultural products are projected to increase. With regard to the origin and destination of traded agricultural products, Irish exports are strongly targeted at the United Kingdom markets. The importance of the Netherlands and Belgium in United Kingdom agri-food imports and exports may be affected by the entrepôt role of Antwerp and Rotterdam, but it is also likely to reflect the important role these countries play in supplying United Kingdom markets with fresh vegetables. In 2016, eight Member States (Ireland, Belgium, the Netherlands, France, Germany, Italy, Spain and Poland) accounted for more than 94% of United Kingdom agri-food imports from the EU and for more than 88% of United Kingdom agri-food exports to other EU Member States. Detailed analysis of the implications of Brexit is required to calculate the economic impact on the Member States of the EU-N27. But the current focus of trade relations already indicates that, next to Belgium, the Netherlands, France, Germany and Ireland will be the most affected Member States.

Comparing projections of agricultural and food production across the EU, it seems that the EU-N13 Member States show a more dynamic development than those in western Europe. In the latter region, expansion of agricultural production faces strong restrictions for environmental reasons, particularly regarding livestock production.

Taking into account the production scale, trade value, economic power and potential of the agricultural sectors of the EUN-13 Member States, the most important

representatives of this group are Poland and Romania, which are closely followed by Hungary in terms of natural resources. The results show exceptional growth in most sectors, particularly for Poland. This result lies on the upper limit of expectations and is probably a consequence of the transfer of past linear trend relations into the outlook for the future. In the past decade, Poland has raised its production and trade significantly in some sectors, and these results have been transferred into projections for the future with the help of model equations and regression coefficients. A critical reader might say that the results are perhaps overly optimistic and even unrealistic, particularly for dairy and pork.

On the other hand, the rigidity of development up to this point has considerably limited the development of agricultural markets in the other countries observed. The Czech Republic, Slovakia, Hungary and Bulgaria do not have such significant positive changes as Poland in most markets. It is not always easy to judge the extent to which this is the result of the model or of the approach of those who built it, and to what extent it is the result of frictions inherent to these agricultural sectors. Both examples show the urgency for (i) regular training sessions (such as summer schools) for newcomers in the modelling and data teams, and (ii) application of additional procedures to validate the pure model outcomes (such as through interaction with market experts and comparison with the results of other, similar models). In conclusion, the results of the projections provide an interesting image of future changes in production and trade structures of the EU-28, whereby the EU-N13 is gradually gaining, and notably within the EU-N13 certain Member States and sectors. This is probably the best possible assessment using tools of this sort, but it should be cross-referenced with market experts, who are lacking in this part of the EU. This sort of knowledge is less developed than in the EU-15, and it should be strengthened.

This analysis confirms that AGMEMOD provides relevant results, and in particular that it enables discussion about key development trends, changes and causes of changes in production and trade. Presenting results for the EU-N13 Member States would probably attract additional comments and help improve the quality of the model. To summarise, both the quality of the model and use of the results should be further strengthened.

So, what kind of lessons have been learned in the nearly two decades of development and application of AGMEMOD? Where should AGMEMOD go for the next two decades, and what are the plans of our modelling consortium?

Using an econometric approach estimating behavioural parameter and calibration towards a base period, AGMEMOD is a powerful and flexible tool for representing agri-food markets across European countries. However, econometric estimates of parameters do not guarantee solid and reliable simulation outcomes. Segments of the agri-food sector often change quite dynamically to adapt to new conditions, so that parameter estimates lag behind the actual adaptation of markets. This is especially the case for countries with small-scale agriculture and less developed agri-food chains, which are often combined with distorted markets due to market power relations. Therefore, careful calibrations of model parameters and assumptions, as well as validation of the model's outcomes, are required. Such work is time and resource consuming; it enables more realistic market projections but creates only a limited amount of academic credibility and visibility.

Nevertheless, stronger emphasis on intensified collaboration with agri-food market experts in Member States appears to be a fruitful investment. It will enable a detailed integration into AGMEMOD of market intelligence based on latest developments, which in turn will contribute to a further strengthening of model enhancements and adaptation to new trends. To achieve that objective, a long-term concept for the market expert network is required, to be supported by regular seminars and conferences on an EU and regional basis, with market experts across all relevant markets as well as for specific topics. Development of adaptive web-based tools for the first step in the validation process may limit necessary efforts to integrate required adjustments.

As market experts always aim to include the latest market knowledge in their work, the AGMEMOD model database has to be as up to date as possible, which requires the development of tools to integrate market information within an automated approach. It also requires overcoming limitations within official public data as market information becomes quite scarce, which can happen for several reasons. Public institutions may reduce their data provision (e.g. market balance sheets) because of costs, there may be data privacy issues in connection with a low number of market participants hindering publication (e.g. prices), or there may be issues with the enormous cost of privately available big data. Harmonisation of data available from Member State institutions also needs to be achieved. Although both activities demand intensive efforts, the data quality, the model outcomes and their credibility among market experts will improve significantly.

At the same time, market experts as well as political stakeholders are strongly interested in a boarder coverage of value chains, with various levels of processing, raw material flows and a more detailed disaggregation of the use side, either to capture new technological developments such the bio-economy or to obtain a better grip on market segments such as the meat sector. In total, that will require a deeper representation of products, which asks for the development of clever concepts and strategies. In addition, new datasets and market information need intelligent calibration approaches to reduce resources required for their integration into AGMEMOD. Improved commodity coverage with updates for selected Mediterranean products, potatoes and protein crops will raise awareness of their importance.

Another topic to be pursued with AGMEMOD is the better integration of environmental issues such as indicators on greenhouse gas emissions or leakages of residues into the environment. The performance of the modelling system could also be improved by the integration of a weather index or a set of weather indicators. Although projected future values are not available, their integration will improve parameter estimates on the one hand and on the other will enable scenario analysis with respect to weather effects.

More emphasis on the modelling of technical progress will allow better capturing of dynamics in the various markets. At the same time, AGMEMOD has to be prepared for new and more targeted policy instruments. The aim will be achieved by a combination of two approaches: enhancing AGMEMOD itself, and improving and extending dynamic interfaces with other models. In the same way, improved modelling of other big players outside Europe, and of bilateral trade relations with the most important trade partners, will be dealt with, although approaches will depend on available partners. All these steps will form the "road ahead" for AGMEMOD to maintain its status as the best model for baseline analysis at Member State level.

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List of abbreviations

AGMEMOD	Agriculture Member State Modelling
BMEL	Federal Ministry of Food and Agriculture, Germany
CAP	Common agricultural policy
CAPRI	Common Agricultural Policy Regional Impact Analysis
CEEC	Central eastern European countries
CEFS	European Association of Sugar Producers
DG AGRI	Directorate-General for Agriculture and Rural Development
EC	European Commission
EFA	Ecological focus area
EIA	US Energy Information Administration
EU	European Union
EU-15	EU including the 15 Member States before 2004
EU-28	EU including the current 28 Member States
EU-N13	EU Member States of the 2004, 2007 and 2013 enlargements
EU-N27	EU including 27 Member States (excluding UK)
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GUS	Central Statistical Office of Poland
iMAP	Integrated Modelling Platform for Agro-economic Commodity and Policy Analysis
JRC	Joint Research Centre
LMC	LMC International, London
MFN	Most favoured nation
OECD	Organization for Economic Co-operation and Development
PH	Policy harmonised (approach)
PDP	Rural Development Programme
ROW	Rest of the world
STO	Short-term outlook
TRQ	Tariff-rate quota
USD	US dollar
VCS	Voluntary coupled support
WTO	World Trade Organization

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Annexes

Annex 1. Programme of the 2017 workshop and list of participants



Workshop on 'Medium-term development of agri-food markets in EU Member States'

Brussels, 01 March 2017

Venue: DG AGRI, Rue de la Loi 130, Brussels, Belgium
11th floor, Room A (J-M. Gazagnes)

Organisers: AGMEMOD Consortium, JRC (Seville) and DG AGRI (Brussels)

AGENDA		
08:30	Registration and welcome coffee	
09:00 – 09:45	Background of the workshop and introduction to AGMEMOD	
Session 1	Chair: Jesús Barreiro-Hurle (JRC)	
(10 min)	Welcome and background of the workshop	Pierluigi Londero (DG AGRI) Martin Banse (AGMEMOD Consortium)
(10 min)	EU CAP and the Commission's agricultural market outlook	Fabien Santini (DG AGRI)
(10 min)	AGMEMOD set-up, macroeconomic assumptions and world market prices	Myrna van Leeuwen (AGMEMOD Consortium)
(15 min)	Open discussion	All participants
09:45 – 11:15	Cereals and oilseeds	
Session 2	Chair: Louisa Follis (Bunge)	
(20 min)	Outlook: EU Baseline based on AGLINK and EU Member States based on AGMEMOD	Verena Wolf (AGMEMOD Consortium)
(30 min)	Feedback on current work and new trends	Benoît Pages (Arvalis) Philippe Dusser (Groupe Avril)
(40 min)	Open discussion	All participants
11:15 – 11:45	Coffee break	
11:45– 13:15	Milk and dairy products	
Session 3	Chair: Monika Wohlfahrt (ZMB)	
(30 min)	Changes in the model + Outlook EU Baseline based on AGLINK and EU Member States based on AGMEMOD	Roel Jongeneel (AGMEMOD Consortium)
(30 min)	Feedback on current work and new trends	Alberto Lancellotti (CLAL) Conor Mulvihill (IDIA)
(30 min)	Open discussion	All participants
13:15 – 14:15	Networking lunch	

14:15–15:00		Beef
Session 4		Chair: Jean-Pierre Garnier (AHDB)
(10 min)	Outlook: EU Baseline based on AGLINK and EU Member States based on AGMEMOD	Petra Salamon (AGMEMOD Consortium)
(20 min)	Feedback on current work and new trends	Philippe Chotteau (Institut de l'Elevage) Kees De Roest (CRPA)
(15 min)	Open discussion	All participants
15:00 – 16:30		Pork and poultry
Session 5		Chair: Pablo Bernardos Hernández (MAGRAMA)
(20 min)	Outlook: EU Baseline based on AGLINK and EU Member States based on AGMEMOD	Martin Banse (AGMEMOD Consortium)
(30 min)	Feedback on current work and new trends	Karsten Flemin (Danish Agriculture & Food Council) Antonio Tavares (Copa-Cogeca) Peter van Horne (Wageningen Economic Research)
(40 min)	Open discussion	All participants
16:30 – 17:00		Coffee break
17:00 – 17:45		Improving the AGMEMOD market experts network
Session 6		Chair: Fabien Santini (DG AGRI)
(10 min)	The quest for MS agricultural models: the AGMEMOD experience	Emil Erjavec (AGMEMOD Consortium)
(15 min)	Stakeholders point of view	Arnaud Petit (Copa-Cogeca)
(20 min)	Open discussion	All participants
17:45 – 18:15		Wrap-up, conclusions & recommendations of the workshop
Session 7		
(10 min)	Wrap-up, conclusion and further steps	Martin Banse (AGMEMOD Consortium)
(20 min)	Conclusions and recommendations for the ongoing work	Thomas Fellmann (JRC) Fabien Santini (DG AGRI)

Workshop

"Medium-term development of agri-food markets in EU Member States"

1st March 2017

DG AGRI, Rue de la Loi 130, Brussels

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