*Bio-based and Applied Economics* 6(1): 37-56, 2017
DOI: 10.13128/BAE-16372

Full Research Article

# What if meat consumption would decrease more than expected in the high-income countries?

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*Date of submission: 2015 30th, June; accepted 2017 2nd, January*

**Abstract.** Changes in meat consumption patterns could induce significant adjustments in agricultural markets. In this paper alternative scenarios envisaging lower meat consumption over the coming decade in high income countries and some selected emerging economies have been tested, with or without compensation by other sources of proteins. From a European perspective, results show a livestock farming sector having to deal with contradictory market signals. On the one side, the reduction in feedstuffs prices is an incentive to produce more, with lower output prices affecting positively the trade balance with developing countries, where demand keeps increasing. However, on the other side, the lower domestic demand for meat would affect profitability of meat production in the EU. Overall, the European beef meat sector would be the most affected, with some higher demand for dairy products. This possible evolution of European diets is a challenge for European livestock farmers, which will be required to adapt their production mix and rely on the portfolio of policies the CAP offers.

**Keywords.** Meat consumption, agricultural markets, agro-economic modelling, agricultural commodities

**JEL codes.** Q13, Q17, Q18

## 1. Introduction

The nutrition transition worldwide has been extensively described since Popkin's seminal article (Popkin, 1994). Associated with income growth and higher food availability, predominantly starchy diets firstly diversify with the integration of fruits and vegetables as well as animal proteins. It then ensures a new stage of the nutrition transition characterised by increased per capita consumption of fat (particularly animal fat), refined carbohydrates and sugar. This stage of the nutrition transition has been first observed in western countries in the first half of the 20th century. It then occurred in low- and middle-income

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ISSN 2280-6180 (print)
ISSN 2280-6172 (online)

countries from the early 1980's onwards, and by then it is often referred to as a "westernisation of diets". Here, the adoption of a "western" dietary pattern is mainly an urban phenomenon associated with the adoption of sedentary lifestyles, although it is increasing also in rural areas. As a consequence, many regions and countries, both in the developing and developed world, are experiencing a lower dietary intake of legumes, vegetables and coarse grains and a higher intake of refined carbohydrates, added sugars, fats, processed foods and animal-source foods (Popkin *et al.*, 2012). Sign of economic development and opening markets, it has also been subject to early warnings with regards to its corollary health effects: development of overweight, obesity, diabetes and coronary heart diseases (Popkin, 1994; Popkin, 1999; Tsolekile, 2007; Schmidhuber, 2004).

In response, "health conscious behavioural changes" emerged, especially among better educated groups of population who tend to substitute part of their animal-based consumption by plant-based products (Popkin, 1994). Ethical concerns in relation to animal welfare in farming/marketing practices or the growing uptake of philosophical and/or religious conceptions recognising a *status* to animals were other reasons for a growing number of people to exclude meat in their diet. Moreover, especially with the release of the FAO livestock's long shadow report (Steinfeld *et al.*, 2006) and with the spread of life-cycle assessments (LCA) in the early 21st century, the adverse effects of intensive meat production systems - in terms of land use, greenhouse gas emissions and biodiversity losses – were pointed out in environmental assessments, determining the scaling up of the vegetarianism linked to concerns with the environmental and ecological impact (Ruby, 2012). Concerning climate change, livestock are a major source of greenhouse gas (GHG) emissions within the agricultural sector, mainly carbon dioxide, nitrous oxide and in particular methane. Methane is 25 times more powerful than carbon dioxide and is estimated to be responsible for approximately one-fifth of man-made global warming (Reay *et al.*, 2010). On a global scale, livestock contributes about 15% of the total global anthropogenic greenhouse gas emissions (Steinfeld *et al.*, 2006) and ruminants, in particular, represent more than 80% of total GHG emissions related to livestock (Herrero et al., 2013; Hristov et al., 2013).

In the wake of such concerns, medias and NGOs conveyed the health, environmental and ethical benefits of lowering individual meat consumption including 'Meatless day campaigns', pro-vegetarianism and pro-flexitarianism communications (Laestadius *et al.*, 2013). The rationale of the meatless day campaigns was to rely on responsible citizen to achieve mass effects from small individual changes. In other words, cutting out meat only one day a week equals to a 14% reduction in meat consumption, which can be highly significant in terms of health, environmental and animal welfare impacts. These campaigns also claimed for governmental support to educate and inform the targeted "responsible citizens" (Gold, 2004). But, this strategy has been later judged at risks in the sense that "a simple 'eat less meat' message alienates some people and could have unintended consequences, not least on farmers' livelihoods" (Sutton and Dibb, 2013). That led to the emergence of 'less-but-better' recommendations still oriented towards a reduction of individual meat consumption but jointly with purchases favouring meat proceeding from more extensive farming systems and/or of higher quality (de Boer *et al.*, 2014; Sutton and Dibb, 2013; National Food Administration, 2009).

The impact of current western diets also moved up in the policy agenda. This was motivated by a context of implementation of sustainability principles, of fixing green-

house gas reduction targets, and of growing costs for public health systems. In 2009, the government of Sweden was the first government to officially recommend to lower meat consumption as one 'environmentally effective food choice' among others and to notify such a proposal to the European Union (EU)[1] (National Food Administration, 2009). In this case, the health perspective argument was not put forward but reducing meat consumption appeared as a win-win option for both human health and the environment in the recommendations to government of the Sustainable Development Commission of the United Kingdom (2009) as well as the ones of the Health Council of the Netherlands (2011) and more recently the recommendations of the Dietary Guidelines Advisory Group (GDAP) of USA (2015) (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2015; Sustainable Development Commission, 2009; Health Council of the Netherlands, 2011).

All these activities resulted in the rise of people's awareness and in the growth of vegetarian population over time. Nevertheless, data on the development of vegetarianism and / or flexitarianism behaviour is scarce. First because the definition of vegetarianism is not stabilised, giving space to a co-existence of various typologies of vegetarians in the scientific literature (Phillips, 2005; de Bakker and Dagevos, 2012; Ruby, 2012). Vegetarian types range from flexitarians (still eating meat but reducing their meat consumption) to vegans (not eating any product of animal origin). In between, a large diversity of vegetable-based diets can be found: lacto-, lacto-ovo-vegetarianism, macrobiotic, and pescatarians (or pesco-vegetarians) according to the variety of personal motivations for adopting a lower meat or meat-free diet. Few surveys have been conducted in the United States in particular by the Vegetarian Research Group, which commissions a yearly poll, showing that 4 to 5% of the adult population can be defined as vegetarian and that up to 15% of the population do not eat meat at more than half of the meals (Stahler, 2011; Casalena, 2011). Similarly, the European Vegetarian Union compiled in 2008 estimations on the number of vegetarians in developed countries. The share of vegetarians among European countries ranged between less than 1% in Poland and Portugal and close to 10% in Germany (Pichler and Blackwell, 2008). The same source estimated 3% vegetarians in Australia, 3.2% in USA and 4% in Canada. Finally, empirical observations like the increased numbers of vegetarians in western societies (Gossard and York, 2003) and in particular growing flexitarianism (Dagevos, 2014; de Boer *et al.*, 2014; Friends of the earth, 2014) motivated the analysis of two simplified alternative protein consumption scenarios, mainly resulting in a stronger reduction of per capita meat consumption in developed countries, compared to the baseline projections of the European Commission (European Commission, 2014).

In the first section, the quantitative framework and the market projections resulting are described and in the second section the alternative scenarios implemented in order to capture the nutritional pattern changes anticipated are analysed. The model ouputs for the main agricultural markets concerned by the alternative scenarios are discussed in the third section and finally, in the fourth section, a reflection on policy implications and on the limitations of the present work is presented

[1] Proposal notified to the EU 15.05.2009.

## 2. Methodology and modelling approach

Annually, the OECD and the FAO jointly release a ten-year horizon assessment of medium-term projections of national, regional and global agriculture commodity markets (OECD/FAO, 2015a). The baseline scenario is taken from the European Commission contribution to the latter published as "prospects for EU agricultural markets and income" (European Commission, 2014) which is produced within the Aglink-Cosimo modelling framework. The modelling framework ensures that the overall set of equations balances with plausible outcomes.

Aglink-Cosimo is a global economic recursive-dynamic, partial equilibrium, supply demand modelling framework which covers the main agricultural commodities (Araujo Enciso *e. al.*, 2015; OECD, 2015). The model is a collaborative work integrating the OECD's Aglink and FAO's Cosimo sub-modules. It is used to simulate the developments of annual supply, demand and prices for the main agricultural commodities produced, consumed and traded worldwide. The Aglink-Cosimo model covers 44 individual countries and 12 regions, 93 commodities and 40 world market clearing prices with a total of around 36000 equations.

Most behavioural equations in Aglink-Cosimo can be linearised in logarythms (i.e. "double-log" functions), including those for estimating production and demand functions, where the underlying relationship between $y$ and $x$ resembles a logarithmic function (e.g. $y$ experiences diminishing marginal returns with respect to increases in $x$):

$$ln(y_i) = a_i + \xi_{ij} \bullet ln(x_{ij}) + \gamma_i \bullet t + ln(e_i)$$

where $i$ and $j$ correspond to the agricultural commodities covered in the model. The relationship between $x$ and $y$ is parameterized through the introduction of a constant term $\alpha_i$ a slope term $\xi_{ij}$ which corresponds to the elasticity between $y$ and $x$ (Araujo Enciso *et al.*, 2015) and a term trend ($\gamma_i$). The residual is captured by the error term ($e_i$) which is frequently referred to as 'calibration term'.

For the purpose of this paper, we focus our attention on the demand side of the model. Total consumption is modelled as an aggregate of different uses including food, feed, biofuels and industrial uses. For meat, consumption only covers food use (FO), and is modelled as a function of the relative ratio consumer prices ($CP_{c,r,t}$) for each commodity and the total consumer price index ($CPI_{r,t}$) the GDP index ($GDPI_{r,t}$) and the population ($POP_{r,t}$) with a constant, a trend and an error term. For any region and time period, the food demand equation can be expressed as:

$$ln(FO_c) = \alpha + \sum^{c} \xi_{FO_c,CP_{ci}} \bullet ln\left(\frac{CP_c}{CPI}\right) + \xi_{FO_c,DGPI} \bullet ln\left(\frac{GDPI}{POP}\right) + ln\,(POP) + \gamma_c \bullet t + ln\,(e_c) \quad (1)$$

The trend serves to depict changes in the consumption patterns; the population serves to model changes due to demographic changes and the GDPI the income effect on food consumption.

### *2.1 Reference scenario*

The reference scenario (REF) is taken from the European Commission "prospects for EU agricultural markets and income" (European Commission, 2014). Such a scenario is the so-called baseline and it is the result from an interactive process between market analysts, policy analysts and modellers. The reference scenario reflects the expert knowledge on the possible developments of each agricultural commodity market in view of the recent trends and anticipated developments. Noteworthy, it is built upon a certain number of exogenous assumptions deemed most plausible at the time of the analysis concerning macro-economic and energy conditions, agricultural and trade policy arrangements in force, as well as yield trends under 'normal' climatic conditions.

For the meat markets, the assumptions of REF reflect a stabilisation or lower growth of per capita meat consumption in the richest countries (a limited growth in meat consumption is exclusively attributable to a continuing increase of consumption of poultry meat) and, on the other hand, a further development of the nutrition transition in developing countries (i.e. an upward trend in sweeteners and animal-based products consumption). These assumptions are reflected by the trends in the model for different meat consumption and selected countries. Accordingly, in terms of total meat consumption, the 'baseline' projections foresee some relative stability in developed countries, while the total consumption per capita is projected to keep on increasing in the ten coming years in developing countries (Figure 1).

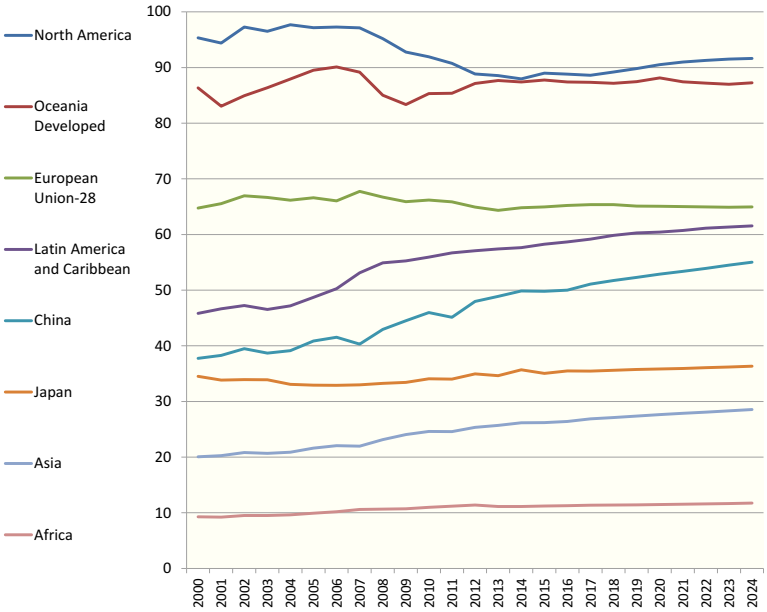
As a result, domestic EU meat demand is projected to slightly decrease while exports are expected to increase, mainly due to the population and economic growth in low-income countries and driven by a sustained growth in poultry meat. The medium term outlook of EU and world prices is accordingly rather positive, in particular for EU poultry and pig meat. The gap between EU and world prices is projected to significantly reduce over the projection period, as shown in Figure 2 comparing the level of prices for three periods 2005-07, 2012-14 and 2022-24.

The use of such partial equilibrium model for a ten years ahead projections of a change in consumption patterns does not take into account possible changes in price and income elasticities over the period. To this respect, such a tool represents a simplification of what is likely to happen in the event of lower meat consumption. In addition, such a model considers each meat product as one single commodity, while the reality is likely to be characterised by segmentation into different types of meat products, each of them reacting differently to the shock. Organic or ethically claimed products are going to follow another path of development and this could nuance the results. In addition, each country is considered as a whole, while consumption preferences will depend on regional and/or population (gender, demography) characteristics. Lastly, the scenario by essence does not take into account the possibility of external unforeseen events (e.g. an animal health related problem).

### *2.2 Low meat consumption scenarios*

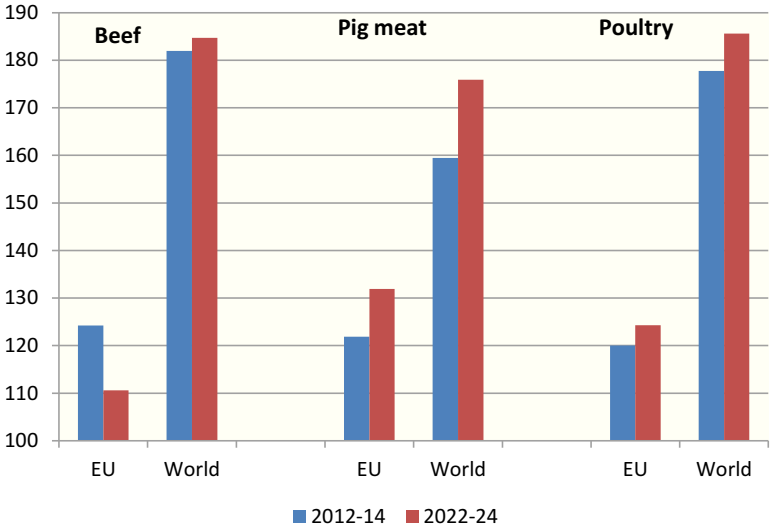
In order to assess the impact of lower meat consumption on agricultural commodity markets, two "lower meat consumption scenarios" are designed: LOWMEAT1 and LOWMEAT2 (see Table 1).

**Figure 1.** Baseline total meat consumption (kg per capita).




Source: OECD-FAO world outlook, 2015a.

**Figure 2.** World and EU producer meat price development indices (base 100 = 2005-2007) in the baseline (EU in EUR, World in USD).




Source: own elaboration from European Commission (2014).

**Table 1.** Scenario characteristics.

| Scenarios | LOWMEAT1 | LOWMEAT2 |
|---|---|---|
| Common elements | Linear decrease of meat consumption for :<br>- all meat types (i.e. beef and veal, sheep, pig, poultry) meat consumption (food use) in the EU, USA, Canada, Australia and New Zealand by -11% over ten years and,<br>- certain (beef and veal, pig) meat consumption (food use) in Argentina, Brazil, Mexico and Uruguay by -5% over ten years | |
| Distinctive elements | No compensation with non-meat proteins | Linear increase of non-meat protein sources human consumption (food use) in the EU, USA, Canada, Australia and New Zealand<br>- Wheat, other cereals, fresh dairy products and butter, cheese, eggs: +5% over the whole period<br>- Oilseeds and pulses: +2% over the whole period<br>Reduced (by half) linear increase of the same products in Argentina, Brazil, Mexico and Uruguay. |

In line with the nutrition transition theory, meat consumption projections are based on steady path, which is depicted with the trend. The alternative scenarios presented in this study are precisely based on a change of consumer preferences towards lower meat consumption. These changes are assumed to happen in high income countries, and in developing countries where the protein intake is higher than the "safe level of protein intake"[2] defined by WHO/FAO/UNU (2007). The high income countries considered are the United States, Canada, Australia, New Zealand and the European Union, altogether representing 29.1% of the total world meat consumption (2011-13). Given the high levels of protein intake in certain Latin American countries and the rising concerns on health in particular and other issues, the scenarios are also implemented to three MERCOSUR partners where meat consumption is the highest per capita (Argentina, Brazil, Uruguay) and Mexico as North American OECD country only for specific types of meat (bovine and pig meat), poultry being considered to keep on following the reference scenario. Such countries represent an additional 10.5% of the total meat consumption. Various dietary guidelines for high-income countries confirm that in general the average per capita level of meat consumption is high enough to recommend lower meat consumption without putting people at risks of nutrient deficiencies (National Food Administration, 2009; Health Council of the Netherlands, 2011). In the rest of the world, it is assumed that these trends are not yet likely to express themselves within the time horizon chosen (ten years ahead) and therefore the baseline trends are not changed in the scenarios. Per capita meat consumption, especially poultry, would continue to increase in these countries as shown in Figure 1.

[2] The safe level for a population is defined as the average protein requirement of the individuals in the population, plus twice the standard deviation (SD) (WHO/FAO/UNU 2007).

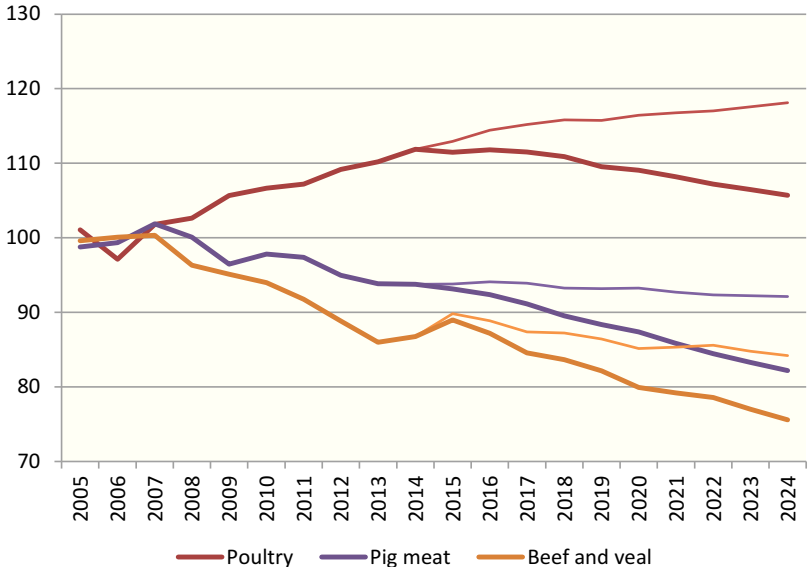
Concerning the magnitude of the meat consumption decrease in the two scenarios, the basic assumption reflects a possible doubling of vegetarians and flexitarians over the 10 coming years in high income societies. Concretely, estimating that around 3% of the population of high-income countries is vegetarian in 2014 and does not consume any meat products, we assume that this share would double (6%) by 2024 in our alternative scenarios. Concerning flexitarians, we assume the conservative assumption that 15% of the population of these countries eat 50% of the average per capita meat consumption and that this share would double by 2024. Under these assumptions, the total meat consumption per capita decreases by 11% by 2024 relative to the baseline in the EU, United States, Canada, Europe and Oceania.

Concerning the three MERCOSUR countries and Mexico, information on the development of vegetarianism and flexitarianism is even scarcer than for high income countries, which tends to confirm that these trends are less developed for a series of social, economic, ethical and political reasons. Therefore, we assume a lower total meat consumption decline in these countries than in the other countries included in the scenario. Per capita meat consumption is reduced by only 5% by 2024 relative to the baseline in these countries, and in addition, the decrease is only applied to beef and veal meat as well as pig meat (see Table 1).

In both scenarios, meat consumption reduction is uneven among types of meat. As the baseline foresees a stronger poultry meat consumption trend than for other types of meat (+5% above the average 2005-07 in the EU, see Figure 3), these assumptions correspond to a stability / slight increase of poultry meat consumption in developed countries over the projected period. On the contrary, the baseline scenario implies strong reduction in pig meat and beef meat per capita consumption. Therefore the two scenarios result in an even stronger decrease of consumption of those types of meat. In the case of the EU, the 2024 level of consumption is close to 20% below the average 2005-07 for pig meat and to 25% for beef and veal meat.

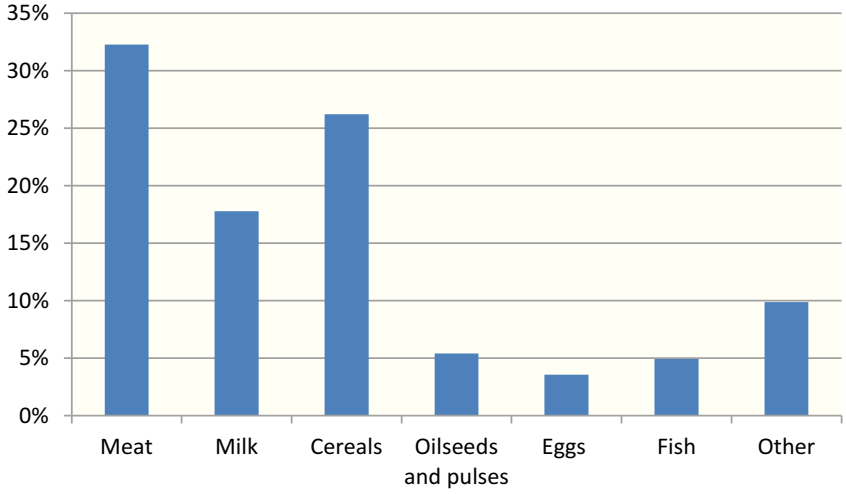
Over the period 2002-11, 32% of the protein intake comes from meat and derived products in the high income countries (see Figure **4**). Population turning to vegetarianism or reducing its consumption of meat would see their intake in protein reduced, unless different sources of protein intake are envisaged. This significant source of proteins is likely to be compensated by an increase of consumption of other sources of proteins. In the LOWMEAT2 scenario, a partial compensation of protein intake losses by other sources is envisaged, corresponding to an increased food consumption of cereals, eggs, dairy products and oilseeds-pulses. In total, these four groups of products represent 53% of the total protein intake in the countries concerned, therefore the increased protein intake from these products should be of 6.7% to fully compensate the 11% decrease of meat consumption. Fish, fruit and vegetables intake, although they represent around 15% of the total protein intake of high-income countries, were not considered because not covered by the modelling tool used. Given the fact that some commodities are richer in weight (oilseeds and pulses in particular) than others in protein and that the scenario only aims to represent a partial compensation (being reasonable to assume that in countries where the daily protein intake is well above recommendations, a full compensation will not occur), the assumption tested is of a 5% increase in cereals, dairy and eggs food use over the period and of 2% for oilseeds and pulses food use (see Table 1).

**Figure 3.** Scenarios LOWMEAT1 and LOWMEAT2 (in bold) and baseline (in thin) – Meat consumption per capita index (EU-28), Base 100 = 2005-2007.




Thin lines are for the baseline and bold lines for the LOWMEAT1 and LOWMEAT2 scenarios. As the two scenarios are equal in terms of meat consumption assumptions (see table 1), both scenarios are represented by the same bold line.
Source: own calculations from Aglink-Cosimo database.

**Figure 4.** Average protein intake in high income countries (% of total protein intake, 2002-11).




Source : Author's calculations from FAO Food Balance Sheets.

Both scenarios LOWMEAT1 and LOWMEAT2 do not claim to fully reflect plausible pathways in their complexity but were designed to mainly capture simplified elements of what could imply for commodity markets the decrease of meat consumption and their partial compensation by consumption of other protein sources, as well as the contribution of each aspect of both scenarios (meat / other protein sources).

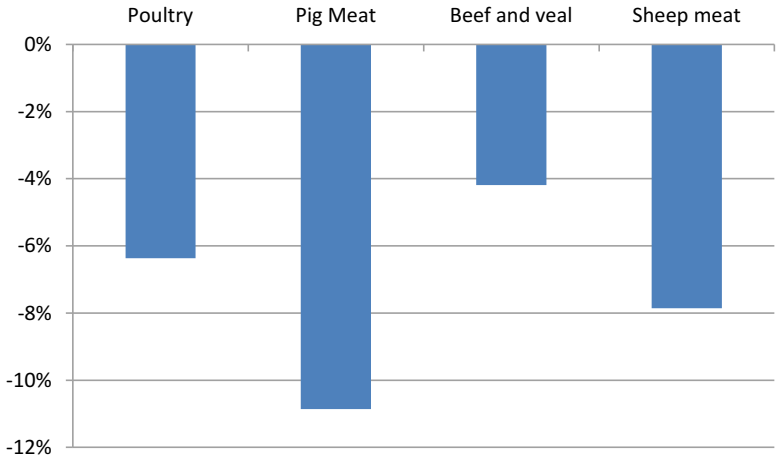
## 3. Results

In scenario LOWMEAT1, meat consumption reduction in selected countries results on a moderate meat demand reduction at global level. In terms of world prices, the difference to the baseline trend ranges between 4% and 12% by 2024, depending on the types of meat (Figure **5**). Lower world prices for meat provoke meat consumption increase in the rest of the world, mitigating overall the impact on world prices.

The subsequent analysis of results focuses on the situation on the EU markets. At EU level, the meat price difference to the baseline is wider than at global level. Indeed, with a decrease in the domestic consumption and domestic meat prices (significantly higher in general than world prices), the EU faces difficulties to fully compensate losses of domestic demand only by additional exports. As a consequence the price gap between the EU and world meat markets is closing down, depending on the type of meat considered. Poultry, pig and sheep meat domestic prices are below the baseline level in 2024, but they remain 10 to 25% above the average price 2005-2007. EU domestic price of beef and veal meat results to be more affected, but remains around 10% below the average 2005-2007 domestic price level (Figure 6).

At EU level, the decrease of domestic demand is expected to induce an adjustment either through a drop in meat production and/or a drop in EU meat imports and/or a

**Figure 5.** Impact of the LOWMEAT1 scenario on the world price for different meat (% difference to the baseline in 2024).



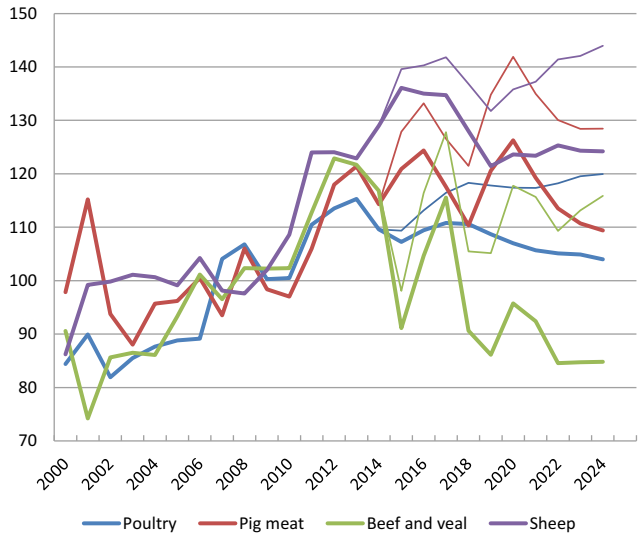

Source: own calculations from scenarios results.

boost of extra-EU exports. However, in scenario LOWMEAT1, meat markets respond differently. For poultry and pig meat, the decrease of consumption is compensated in the EU by both a decrease of domestic production and increased exports in similar proportions (Figure 7). This market response is favoured by domestic prices not too far away from the world prices and a reasonable degree of competitiveness of the EU industry in these sectors. On the contrary, concerning beef and veal meat, the price wedge between the EU and world markets remains too important and the adjustment to reduced consumption is mostly achieved through a reduced EU production. Finally, sheep meat consumption reduction results almost entirely in an import reduction.

These impacts result in an improved self-sufficiency ratio and trade-balance for meat in the EU (see Table 2). The EU would become self-sufficient for beef meat and would be very close for sheep meat. The positive trade balance would also amplify significantly for poultry and pig meat.

A reduction in meat consumption also implies a contraction in feed demand, resulting in price decrease for these commodities. Prices are particularly affected for coarse grains and protein meals (i.e. commodities mainly used for feed) but less for wheat and oilseeds (i.e. commodities used for both animal and human consumption as well as for the industry). Overall the feed cost index[3] calculated in the Aglink - Cosi-

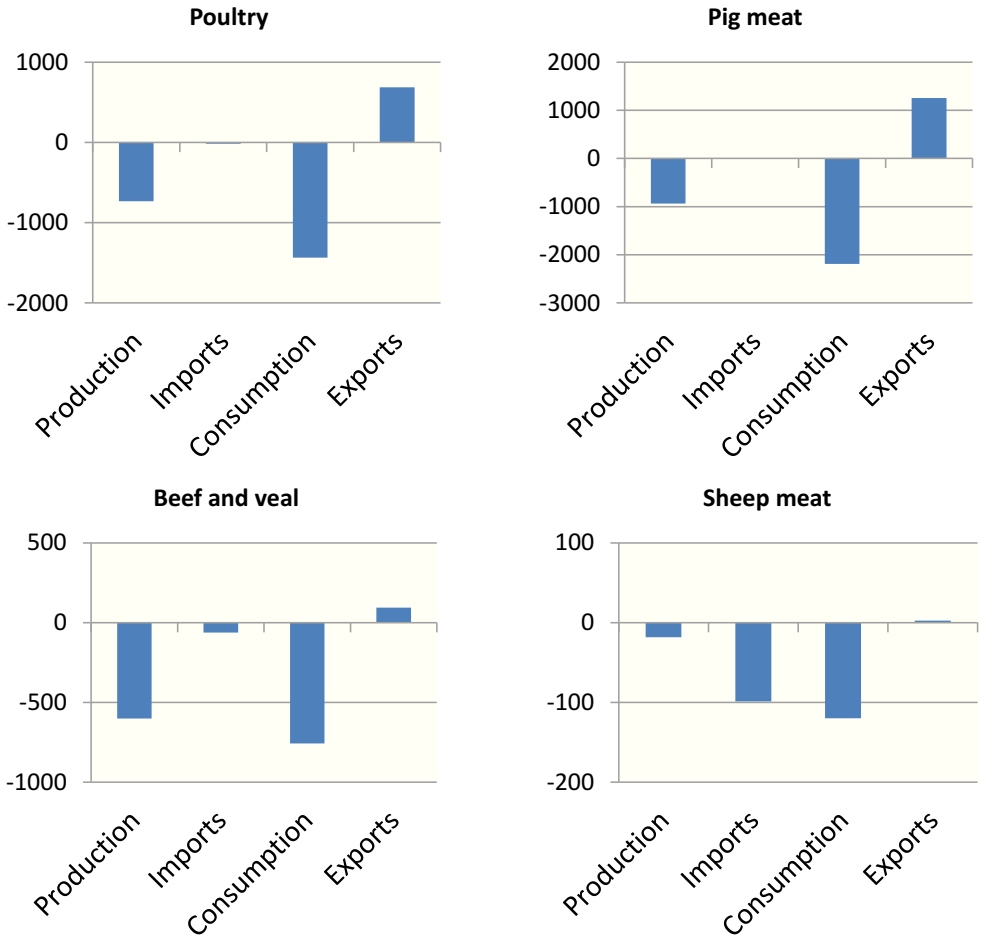
**Figure 6.** Evolution of EU meat domestic price index in the baseline compared to the LOWMEAT1 scenario (Base 100= 2005-07).




Thin lines are for the baseline and bold lines for the LOWMEAT1 and LOWMEAT2 scenarios.
Source: own calculations from scenarios results.

[3] Defined as the average price of all types of commodities potentially used as feed weighed by the actual quantities of each commodity used for feed ; only commercial feed bulks considered.

**Figure 7.** EU market balances for meat markets in the LOWMEAT1 scenario (change in 1000T relative to the baseline).




Source: own calculations from scenarios results

**Table 2.** EU Self-sufficiency ratio and net exports (in % of production).

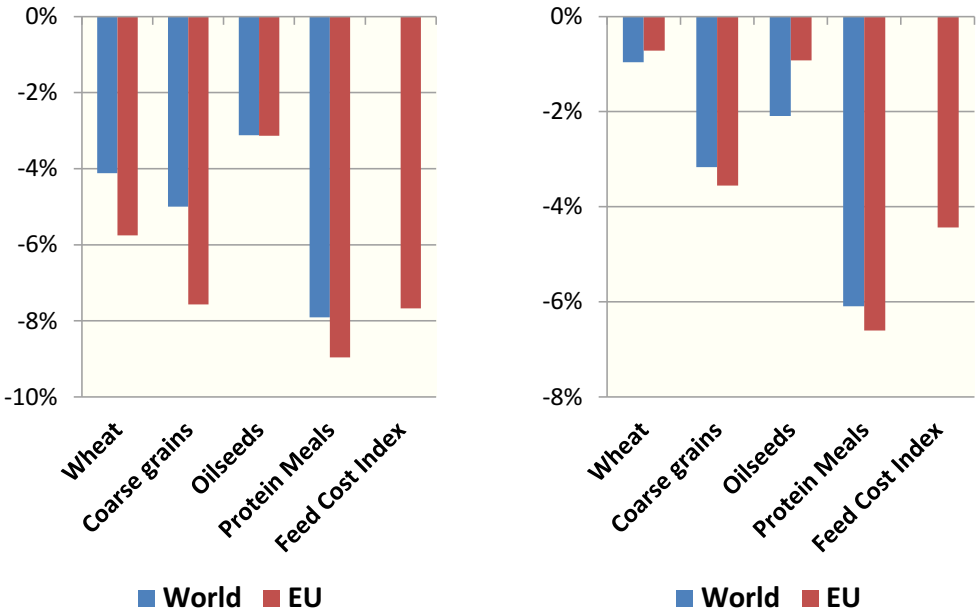
| | Self-sufficiency ratio | | Net Exports | |
|---|---|---|---|---|
| | Baseline | Scenario LOWMEAT1 | Baseline | Scenario LOWMEAT1 |
| Poultry | 113 | 121 | +11% | +17% |
| Pig meat | 104 | 110 | +4% | +9% |
| Beef and veal | 99 | 101 | -1% | +1% |
| Sheep meat | 88 | 97 | -13% | -3% |

Source: own calculations from scenario results.

mo for the EU would decrease by nearly 8% over the period relative to the baseline (Figure 8).

Concerning the meat market, the LOWMEAT2 scenario (with partial protein compensation) shows similar results as the scenario LOWMEAT1, although most prices (except for beef meat) are slightly higher than in the scenario LOWMEAT1. The impacts in crop markets are significantly contrasted in the two scenarios. As in LOWMEAT2 meat proteins are partially substituted in the diet with other products - crop or animal - the demand in cereals and oilseeds is less affected than in the first scenario: the increased dairy and eggs production is associated with a higher demand in feed, and food demand for cereals and oilseeds also increases. All in all, EU domestic and world prices for these commodities tend to decrease less than in the scenario LOWMEAT1 (without protein compensation). The feed cost index in the EU would only be 4% below the baseline in this second scenario.

**Figure 8.** EU domestic and world prices for crops and EU feed cost index (Difference to baseline in % change, 2024).




Source: own calculations from scenarios results

It is to be noted that the LOWMEAT2 scenario includes higher dairy products consumption in compensation for the meat consumption reduction, and it would therefore translate into higher EU milk and cheese prices above baseline trends, already quite positive. This scenario with protein compensation leads to particular market stress: on the one hand the domestic demand for beef meat is reduced, but on the other hand beef meat

production is stimulated by the boost in milk domestic demand as an output of dairy farming. This explains why the beef meat price is the only one to be more affected in scenario LOWMEAT2 than in scenario LOWMEAT1. This is also the reason why in the EU in scenario LOWMEAT2, the herd itself would evolve towards less suckler cows (-3%) and more dairy cows (+1%), which would put under pressure those livestock systems specialised in beef meat production.

## 4. Discussion on policy implications

These two scenarios depict a ten-year transition during which individual changes in food consumption patterns could induce market adjustment and changes in relative prices. The European livestock farming sector would have to cope with contradictory market signals: the reduction in feedstuffs prices is an incentive to produce more at lower costs of production, but at the same time domestic demand for meat is losing momentum and lower domestic price would affect profitability of meat production in the EU.

This is particularly the case for cattle breeders specialised in meat, who cannot take advantage of the higher demand for milk and dairy products. Some elements of the new CAP might be relevant to help producers facing such challenges, for instance in terms of support to livestock farming systems and in particular for extensive grazing livestock farming systems or through its rural development.

First, the CAP 2014-2020 provides recoupling possibilities to EU Member States for livestock (regulation (EU) No 1307/2013[4]). Considering that 24 out of 28 Member States[5] opted for the voluntary coupled support for Beef and Veal (Agra Europe, 2015), it is likely that the majority of EU cattle farmers will receive direct coupled support in the future. Beef and veal meat coupled support is expected to represent 10.2 billion euros over the period 2015-20, which represents over 40% of the total voluntary coupled support granted by Member States to farmers. Sheep and goat meat coupled support (around 12% of the total) would add to this. Other meat sectors would not represent a significant share (European Commission DG-AGRI, 2015). Thus, recoupling support could play a role of partial safety net for livestock farmers and especially for suckler-cow based farming systems. However, such recoupling possibilities might delay the structural adaptations .

Second, as highlighted in the introductory section, civil society organizations are conveying the message to eat "less-but-better" meat. Thus, extensive grazing system and/or quality cuts might benefit from niche markets, based on specific voluntary labelling, quality schemes or simply further market segmentation, for example on the base of breeds specific to one or the other areas of production. Extensive grazing systems are also acknowledged to deliver substantial environmental positive externalities. Some instruments of the new CAP other than recoupled support can then play a role in the reorientation of the EU meat sector. Grazing livestock systems should first mechanically be the prime beneficiaries of the redistribution of direct payments for internal convergence envisaged in the new

[4] Regulation (EU) No 1307/2013 of the European Parliament and the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009.
[5] Only Ireland, Germany, Cyprus and Luxembourg did not recouple support for beef and veal.

CAP 2014-2020. Also, grassland-based farms are over-represented in less-favoured areas (LFAs) and areas of natural constraints (ANCs) eligible for specific CAP supports, which may therefore indirectly contribute to foster the extensive livestock systems. In addition, the rural development component of the current CAP contemplates a list of measures relevant for the development of "high quality" livestock systems (Regulation (EU) No 1305/2013[6]), among others support to quality or agri-environment-climate measures (e.g. on the maintenance or introduction of extensive livestock management).

The promotion of extensive livestock systems within or without the CAP would also have some benefits for the farming sector. In addition to the environmental adverse effects, intensive meat production systems might face biological risks (such as infectious diseases) and high costs if practices aimed at protecting animals' wellbeing and safety are not put in place (Hinchliffe *et al*., 2013; Tilbrook and Hemsworth, 2015).

It should be also mentioned that most policy measures presented above will be implemented differently in the Member States. The ability to target financial resources to different categories of breeders according to specific policy or local objectives is the strength of RDPs as a policy tool. However the impact assessment CAP 2020 showed that RDPs sometimes suffer from path dependence (authorities tend to favour past successful measures over new ones) and unbalanced ability of areas/groups to weight in the process of defining RDPs (European Commission, 2011). From these observations, we can anticipate that in our scenarios livestock producers will receive uneven support across Member States.

Noteworthy, most of the policy tools mentioned above are either not designed for the benefit of non-ruminant meat sectors (pig and poultry) or not targeted by Member States to such sectors. EU farmers active in these sectors therefore find less policy tools in the CAP than the ones involved in ruminant livestock breeding.

## 5. Conclusion

This paper analyses the possible impacts on agricultural markets of a significant change in meat consumption in high income countries and selected Latin American countries. The scenarios described here have to be considered as two single and subjective alternative pathways among many other possible and plausible ones. The level of uncertainty concerning the pace and features of future development of meat demand and of the development of alternative sources of protein intake in the EU, in other developed countries or in developing countries remains high. Also, the baseline and the two scenarios presented consider a certain set of macroeconomic and yield conditions and the absence of any 'black swan' events, like the emergence of new zoonoses or food scares.

Furthermore, the scenarios have been elaborated with the same modelling tool as the baseline. Since the alternative scenarios encompass nutritional issues, they could justify that the model is improved by including relevant missing commodities (fish products, fruit and vegetables) for this purpose.

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[6] Regulation (EU) No 1305/2013 of the European Parliament and the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005.

Actually, including the fish commodity would allow for a deeper analysis of protein substitution in lower meat consumption scenarios. But fish inclusion is not straightforward. It would also require further investigation to correctly integrate fish linkages with feed in aquaculture. Another model improvement could be the conversion of quantity of commodities produced and traded into quantities of calories or nutrient equivalent. This would allow to better assess the nutritional value in each scenario: are we modelling healthy purchase behaviours/diets or not? are we correctly simulating protein substitution options? Linking the different food uses of the different commodities by specific equations (developing nutritional module) could be a way forward.

Finally, as one of the drivers of a lower meat consumption choice is the individuals' concerns of their food impact on the environment, an interesting field of research would be to couple the agro-economic model with environmental indicators like the commodities' virtual content in water or land (like for example in (Wirsenius *et al.*, 2010). In the same perspective, agricultural production could be linked with greenhouse gas emissions (Garnett, 2011; Tukker *et al.*, 2011) or biodiversity losses and other environmental impact indicators (as in (Tukker *et al.*, 2011)). Indeed, reducing animal production and/or improving its efficiency may be key in the mitigation and adaptation to climate change. The reduction in numbers and enhancement of productivity of animals would represent an important mitigation strategy that might have side effects on animal welfare and other environmental issues (Gerber et al., 2013). Further assessment of the environmental and climate impact of nutritional changes as explored by Wolf et al. (2011) would also complement the present analysis.

As a conclusion, it is clear that a shift in the meat consumption trends in developed countries would impact on global meat markets, with stronger consequences at EU level. The impact appears to be stronger for beef and veal meat than for non-ruminant livestock sectors, in particular because of the linkage of this sector with dairy products. There are also significant spill-overs to the crops markets through the feed use (and to a lesser extent possible increased human consumption). A broad range of policy tools could be of importance for farmers affected at EU level by such evolutions. Some tools might allow a swifter transition and/or facilitate a redistribution of the production at EU level between geographical areas and/or farming systems; others might be used for reinforcing competitiveness of the EU meat sectors and/or manage diversification where needed.

The views expressed are purely those of the author and may not in any circumstances be regarded as stating an official position of the European Commission.

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## Annex – Summary results for meat markets (2024)

**Poultry meat**

| | REF | LOWMEAT1 | LOWMEAT2 |
|---|---|---|---|
| World price (USD/t) | 1600 | 1498 | 1516 |
| EU producer price (EUR/t) | 2076 | 1800 | 1827 |
| EU production (1000t) | 13977 | 13298 | 13244 |
| EU imports (1000t) | 1018 | 1002 | 1003 |
| EU consumption (1000t) | 13466 | 12052 | 12030 |
| per capita ($kg^1$/cap/yr) | 22.8 | 20.4 | 20.4 |
| EU exports (1000t) | 1529 | 2249 | 2217 |

**Pig meat**

| | REF | LOWMEAT1 | LOWMEAT2 |
|---|---|---|---|
| World price (USD/t) | 1924 | 1715 | 1734 |
| EU producer price (EUR/t) | 1857 | 1581 | 1596 |
| EU production (1000t) | 22779 | 21824 | 21843 |
| EU imports (1000t) | 21 | 18 | 18 |
| EU consumption (1000t) | 20211 | 18031 | 18018 |
| per capita ($kg^2$/cap/yr) | 30.3 | 27.1 | 27.0 |
| EU exports (1000t) | 2590 | 3812 | 3843 |

**Beef and veal meat**

| | REF | LOWMEAT1 | LOWMEAT2 |
|---|---|---|---|
| World price (USD/t) | 3022 | 2895 | 2894 |
| EU producer price (EUR/t) | 3618 | 2649 | 2641 |
| EU production (1000t) | 7443 | 6827 | 6843 |
| EU imports (1000t) | 334 | 272 | 271 |
| EU consumption (1000t) | 7530 | 6759 | 6772 |
| per capita ($kg^2$/cap/yr) | 10.1 | 9.1 | 9.1 |
| EU exports (1000t) | 252 | 346 | 347 |

**Sheep and goat meat**

| | REF | LOWMEAT1 | LOWMEAT2 |
|---|---|---|---|
| World price (USD/t) | 4948 | 4560 | 4593 |
| EU producer price (EUR/t) | 5779 | 4986 | 5023 |
| EU production (1000t) | 957 | 939 | 939 |
| EU imports (1000t) | 205 | 106 | 107 |
| EU consumption (1000t) | 1083 | 964 | 964 |
| per capita ($kg^2$/cap/yr) | 1.8 | 1.6 | 1.6 |
| EU exports (1000t) | 79 | 82 | 82 |