International trade and the environmental benefits of diet change in the United Kingdom

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1 Introduction

The research presented in this report focuses on how, in the context of transitioning consumption patterns motivated by improving health and environmental sustainability, an internationally integrated agriculture sector provides both opportunities and challenges. The analysis contributes to a broader objective: developing a coordinated set of policy interventions to support the transition to healthy and sustainable diets in the United Kingdom (UK). The findings are from one of several workstreams within Realigning UK Food Production and Trade for Transition to Healthy and Sustainable Diets, a project commissioned by the Transforming UK Food Systems Strategic Priorities Fund. Information about the additional workstreams within the project can be accessed from the project website.

An economic model is used to anticipate how production, prices, and international trade in agricultural commodities could change if the population adopted alternative eating patterns over the next ten years. The analysis compares results across a range of diet transitions and compares the impact of unilateral UK adoption with outcomes when the European Union (EU) follows these diet changes, but to a lesser extent. The production and trade impacts of diet change in the UK are then evaluated against global and local environmental risk factors, namely greenhouse gas emissions and nutrient surpluses.

Counter-factual scenario analysis provides several findings relevant to the transition to healthy and environmentally sustainable diets in the UK.

(1) Price signals will not always be in line with the desired direction of dietary change. For example, foods considered 'over-consumed' in current diets, that are targeted for reduction in the transition, could become *more* affordable compared to substitutes.

(2) Production changes tend to be driven by the indirect effects of changing diets. For instance, livestock production will be impacted by changes to the UK's international trade position, and cereal and oilseed production will be impacted by changes to livestock feed demand.

(3) UK integration within international commodity markets moderates price signals. Aligning the diet transition across trade partners generates more positive outcomes in terms of reducing environmental risk factors within the UK.

The next section summarises the methodology applied, outlines the diet transitions modelled, and explains how these are incorporated into counter-factual scenario analysis. Section 3 summarises the relative impacts on UK agricultural production, prices and international trade compared to the *status quo* counterfactual. The impacts on the UK's main greenhouse gas emissions from agriculture (methane and nitrous oxide emissions), and nutrient imbalances (nitrogen and phosphorus) are presented in Section 4. The potential impacts on crop areas and breeding stock across England, Wales, Scotland and Northern Ireland are presented in Section 5. Section 6 concludes with key messages. An appendix provides additional tables and figures.

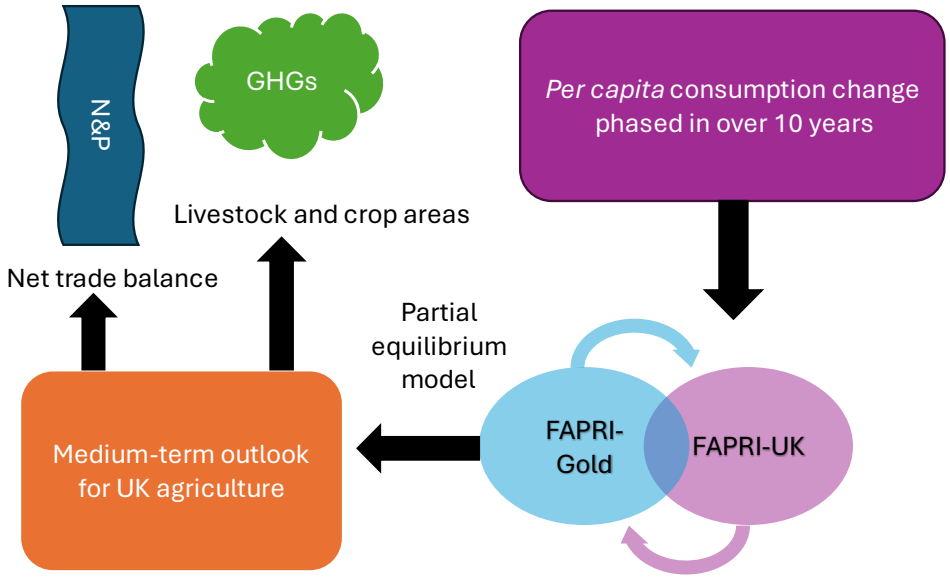
2 Modelling approach and scenario design

This section provides an overview of the methodology applied, how the *status quo* counterfactual pathway of production, prices and international trade was generated, and the specific scenarios used in the analysis.

2.1 Summary of the methodology

The impacts of diet change on UK agriculture are anticipated using partial equilibrium modelling. These models are based on neoclassical economic theory assuming price signals will result in behaviour change by producers and consumers, moving markets towards a state of equilibrium, such that supply is equal to demand. A system of mathematical equations, defined to represent production and consumption decision-making processes, are calibrated using historical information. In this way, the responses observed in the past are used to *project* what a reasonable response might be in the future.

Figure 1. Overview of modelling and how diet transitions are compared



The FAPRI-UK modelling system generates a medium-term outlook for UK agriculture assuming business-as-usual which means no policy changes, no structural shifts in preferences, no market or geopolitical shocks, and average weather conditions (a *status quo* projection out ten years). FAPRI-UK is a longstanding collaboration between the Agri-Food and Biosciences Institute and the Food and Agriculture Policy Research Institute. The UK model is solved simultaneously with a model covering EU-27 agriculture, the largest trading partner for UK agricultural commodities. The flow of commodities in and out of the UK provides *status quo* nutrient balances, and, crop areas and livestock populations are used to project forward key greenhouse gases (Figure 1).

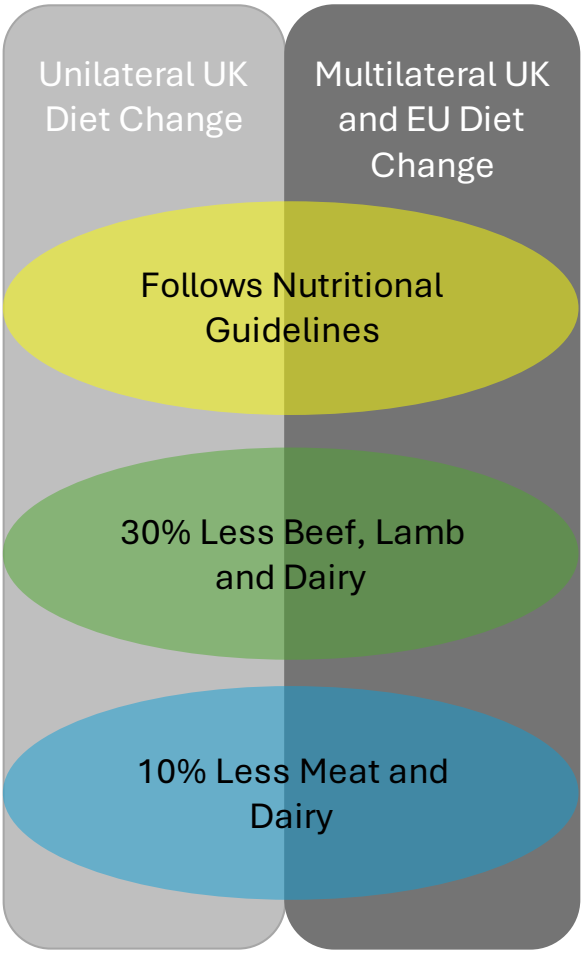
Counter-factual scenario analysis is carried out by comparing the *status quo* medium-term outlook for the sector to alternative projections, with a shift in per person consumption, either increasing or decreasing the share of cereals, oilseeds, dairy, eggs, meat, fish, and beans and peas. The *scenario* projections assume a revised pattern of consumption per person is phased in over ten years. The change in diets is treated as a structural change in consumption, assuming that the behaviour change is driven by factors external to the model, such as shifts in social and cultural norms, rather than factors internal to the model, such as price changes caused by taxes and subsidies on particular foods.

2.2 Description of hypothetical diets used in scenarios

Three dietary transitions are modelled. The assumed consumption per person for food commodities, and the percent difference from *status quo* consumption in the tenth year of the projection period, are provided in Table 1.

The *Nutritional Guidelines* diet transition adjusts UK diets to be consistent with official nutritional advice while limiting the amount of change required compared to current consumption patterns. A detailed analysis of the required change from 2019 consumption to meet published nutritional guidance was carried out within another workstream for the project and the research report is available here. The resulting diet is mapped to the agricultural commodities modelled by FAPRI-UK, and additional commodities added to the model to improve the coverage. Compared to the *status quo* projection, in *Nutritional Guidelines* scenarios, per person consumption of cereals, potatoes, peas and beans, and white fish increases, and that of oils, sugar, meat, eggs, cheese, butter and oily fish decreases.

Figure 2. Representation of the six scenarios



A further two diet transitions are modelled to provide sensitivity analysis to the pattern of diet change assumed. These diets are determined by restricting consumption of some commodities and replacing the foregone calories and protein by increasing consumption of approved substitutes. The first alternative restricts per person consumption of beef, lamb, milk, and cheese by 30% compared to the year 2025. Assumed replacement calories and protein are drawn mostly from pigmeat and poultry, with some increase in white fish and beans and peas (*30% Less Beef, Lamb and Dairy*). The second alternative diet restricts beef, lamb, pigmeat, poultry, milk and cheese by 10% of per person consumption in 2025. White and oily fish, eggs, and peas and beans provide protein and calories to compensate for the changes (*10% Less Meat and Dairy*).

In addition to the pattern of diet transition, scenarios also vary the degree to which a similar trend in consumption patterns is adopted by the UK's main trading partners within the EU. Each of the three diet transitions is modelled twice. Assuming the diet transition only takes place within the UK (*Unilateral UK Diet Change*) and that the EU-15 countries adjust diets in the same pattern, but by only half of the magnitude as in the UK, so a 30% change in UK diets triggers a 15% change in the EU-15 (*Multilateral UK and EU Diet Change*). This results in six scenarios compared to the *status quo* projection included in the analysis (Figure 2).

Table 1. Assumed consumption per person of agricultural commodities in the tenth year and percent difference from the *status quo*

Commodity	Follows Nutritional Advice		30% Less Beef, Lamb and Dairy		10% Less Meat and Dairy	
	Assumed *per capita* consumption	Percent difference from *status quo*	Assumed *per capita* consumption	Percent difference from *status quo*	Assumed *per capita* consumption	Percent difference from *status quo*
Wheat	170.9	40%	122.6	0%	120.8	-1%
Barley	30.9	23%	26.1	4%	26.1	4%
Maize	20.6	61%	11.8	-7%	11.8	-7%
Oats	10.3	25%	7.6	-7%	7.6	-7%
Rapeseed oil	7.3	-35%	10.7	-5%	10.7	-5%
Sunflower oil	3.5	-25%	4.5	-3%	4.5	-3%
Soy oil	2.9	-41%	4.7	-4%	4.7	-4%
Potatoes	116.5	37%	81.9	-4%	81.9	-4%
Peas and beans	23.1	127%	11.5	12%	13.6	34%
Sugar	0.0	-100%	29.1	-3%	29.1	-3%
Beef	12.9	-15%	10.2	-33%	13.6	-10%
Sheepmeat	2.6	-35%	2.7	-31%	3.7	-8%
Pigmeat	14.8	-26%	23.3	17%	17.7	-11%
Poultry	27.3	-9%	35.0	17%	26.6	-11%
Eggs	12.2	-22%	15.1	-4%	19.9	27%
Milk	87.7	5%	57.8	-31%	77.4	-7%
Cheese	5.1	-54%	7.3	-34%	9.8	-12%
Butter	1.3	-62%	3.2	-3%	3.2	-3%
White fish	4.8	34%	3.7	4%	5.0	39%
Oily fish	4.4	-39%	6.2	-15%	8.3	14%

3 Production, prices and international trade

3.1 Production

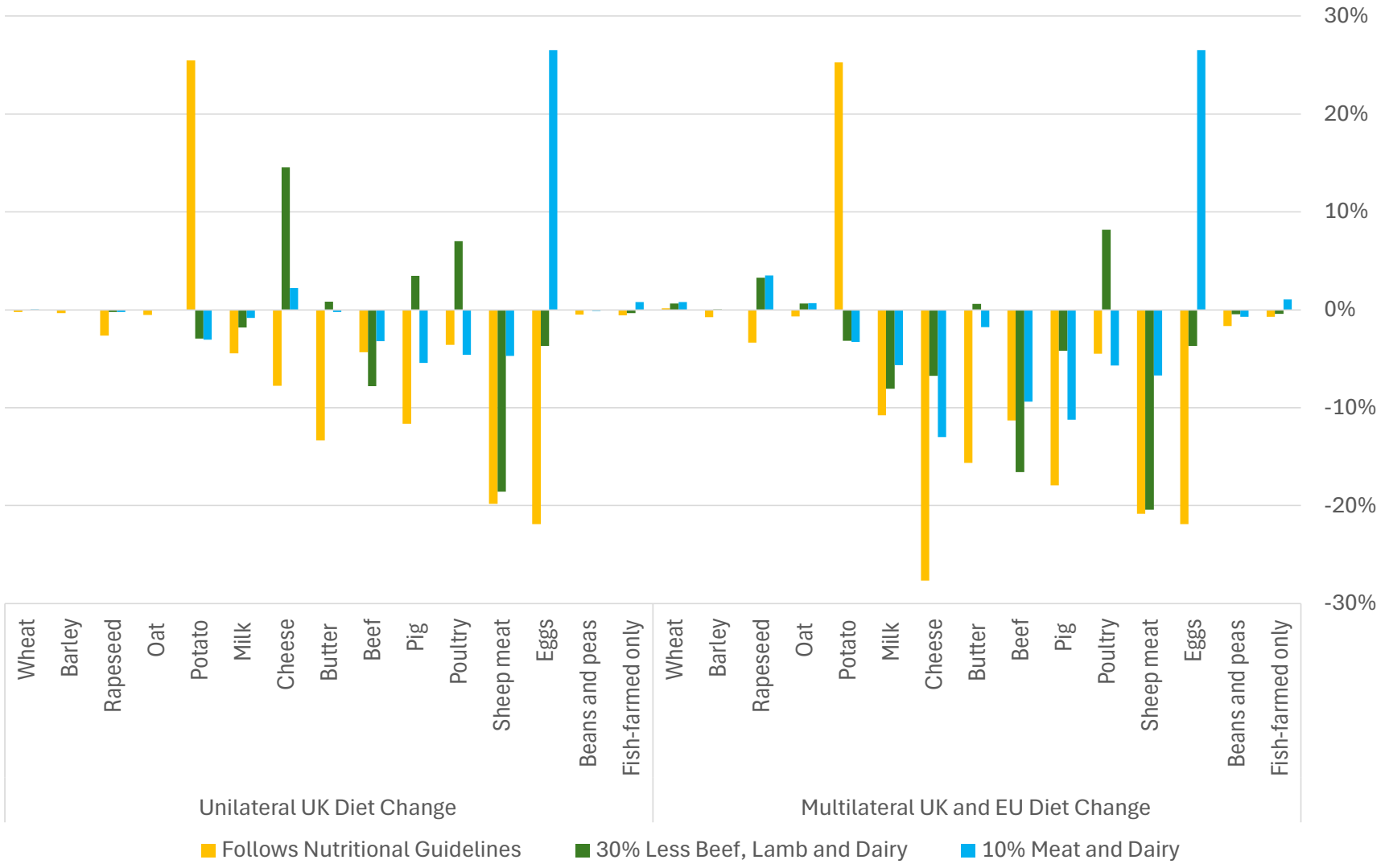
The percent difference in projected UK production compared to the *status quo* in the tenth year is shown for all scenarios in Figure 3. Despite a marked increase in per person consumption of cereal-based foods in the *Nutritional Guidelines* scenarios, there is a small difference for UK cereals production relative to the *status quo*. Cereal commodities are well integrated into international markets, mitigating price signals arising from domestic demand changes. Additionally, cereals grown in the UK mainly feed livestock, so the reduction of livestock-derived human foods dominates, putting downward pressure on production. In the *Unilateral UK Diet Change* scenarios, cereal production is barely impacted when there is *30% Less Beef, Lamb and Dairy* and *10% Less Meat and Dairy*. There are small (at most 3.5%) increases in the case of *Multilateral UK and EU Diet Change* for these two diets. In contrast when potato consumption per person increases in the *Nutritional Guidelines* scenarios, this is largely met with additional UK production.

Although liquid milk consumption increases relative to the *status quo* in the *Nutritional Guidelines* scenarios, the decreases in cheese and butter push overall milk production down. Milk and cheese consumption are also restricted in the other two diet change patterns (although by different magnitudes). Counter-intuitively, cheese production increases in the case of *Unilateral UK Diet Change*. This is because, the relative decrease in milk consumption is greater than that of milk production, leading to additional liquid milk going into cheese for export. In the case of *Multilateral UK and EU Diet Change* milk and cheese production reduce regardless of the dietary pattern.

Consumption of beef and lamb is restricted in all three dietary patterns (although at different magnitudes) and production levels relative to the *status quo* are lower across all scenarios. Pig and poultry meat production is lower compared to the *status quo* for the two diet patterns that restrict their consumption (*Nutritional Guidelines and 10% Less Meat and Dairy*). However, in the *30% Less Beef, Lamb and Dairy* scenarios, they are treated as a substitute. Pig and poultry meat production is relatively higher in the *Unilateral UK Diet Change scenario,* and in the *Multilateral UK and EU Diet Change* poultry meat production increases compared to the *status quo*. Eggs are a substitute in the *10% Less Meat and Dairy* scenarios and increased per person consumption leads to a similar increase in production to fill domestic demand.

Beans and peas consumption is relatively higher than the *status quo* in all three dietary patterns (at different magnitudes). However, production levels exhibit very small and often negative differences. This is because pea and bean production largely serve domestic livestock feed demand, and so concurrent reductions in meat and dairy consumption dominates, as with cereals. Fish consumption (both white and oily fish) has a net increase in the *10% Less Meat and Dairy* scenarios, and this leads to a small increase in farmed fish relative to the *status quo.*

Figure 3. Production - percent difference from the status quo in the tenth year



3.2 Prices

The percent difference in commodity prices from the *status quo* in the tenth year of each scenario is provided in Table A-1. The most varied price changes occur for potatoes and eggs, commodities that are oriented to the domestic food, rather than feed, market. Cereals experience minimal to moderate price decreases, with a stronger impact in *Multilateral UK and EU Diet Change* scenarios. Dairy prices decrease across all scenarios, less so in the case of *Unilateral UK Diet Change* (ranging between -2 and -35%) and more significantly with assumed *Multilateral UK and EU Diet Change* (ranging between -13 and -52%). Beef and lamb prices are also lower than the *status quo* in all diet change scenarios (ranging between -4 and -53%). Pigmeat prices are relatively lower in five out of six scenarios, increasing in the case of the *30% Less Beef, Lamb and Dairy - Unilateral UK Diet Change* scenario. Poultry prices are relatively higher in both *30% Less Beef, Lamb and Dairy* scenarios, and lower in the remaining four scenarios.

3.3 International trade

The relative difference in domestic use and net exports (exports less imports) between scenarios and the *status quo* in the tenth year of the projection are provided in Tables A-2 and A-3. Domestic use of cereals increases compared to the *status quo* in the *Nutritional Guidelines* scenarios, due to the increase in per person consumption. The additional food demand is filled by imports, as opposed to domestic production, deepening the UK's position as a net-importer (UK imports exceeding UK exports) of cereals. In the other dietary pattern scenarios, domestic use of cereals is relatively lower than the *status quo* as reduced livestock feed demand is not countered by increased food demand. Self-sufficiency, defined here as the ratio of UK production to UK domestic use, therefore tends to be relatively higher than the *status quo* and *Nutritional Guidelines* scenarios (Figure 4).

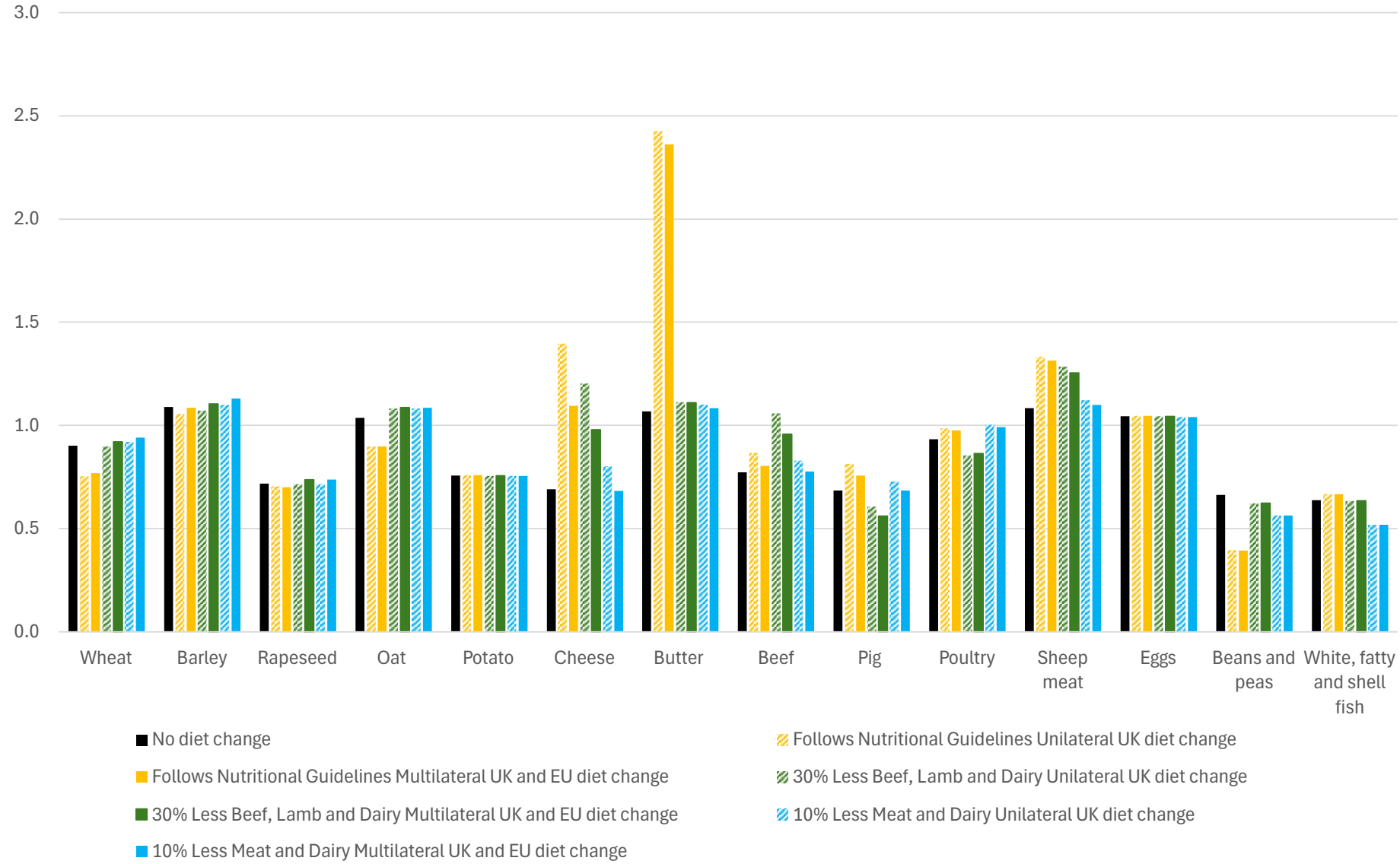
Domestic use and net exports of dairy commodities are relatively lower across all scenarios. The most extreme reduction in per person cheese and butter consumption is in the *Nutritional Guidelines* scenarios, and self-sufficiency in cheese and butter moves well above 100%. In the *30% Less Beef, Lamb and Dairy* and *10% Less Meat and Dairy – Unilateral UK Diet Change* scenarios cheese self-sufficiency increases to a lesser extent, and, is very close to the *status quo* in the *10% Less Meat and Dairy – Multilateral UK and EU Diet Change* scenario.

Beef and lamb domestic use is relatively lower than the *status quo* in all scenarios. The UK increases net-exports of beef, remaining less than 100% self-sufficient, except for the *30% Less Beef, Lamb and Dairy - Unilateral UK Diet Change* scenario. The UK deepens its net-exporter position in lamb, and self-sufficiency, already above 100% in the *status quo*, is relatively higher across all scenarios.

Domestic use and imports of beans and peas increase in all scenarios. This reduces self-sufficiency compared to the *status quo* because peas and beans for human consumption tend to be imported. The net-trade of fish depends on the dietary pattern. Consumption increases most notably in the *10% Less Meat and Dairy*, and this deepens the UK's net-importer position compared to the *status quo* reducing the self-sufficiency ratio.

Additional figures, combining price, domestic use, and trade impacts are presented for selected commodities (wheat, cheese, beef, pigmeat) in the appendix (Figures A1 – A4).

Figure 4. Self-sufficiency ratio (UK production: UK domestic use) in the tenth year

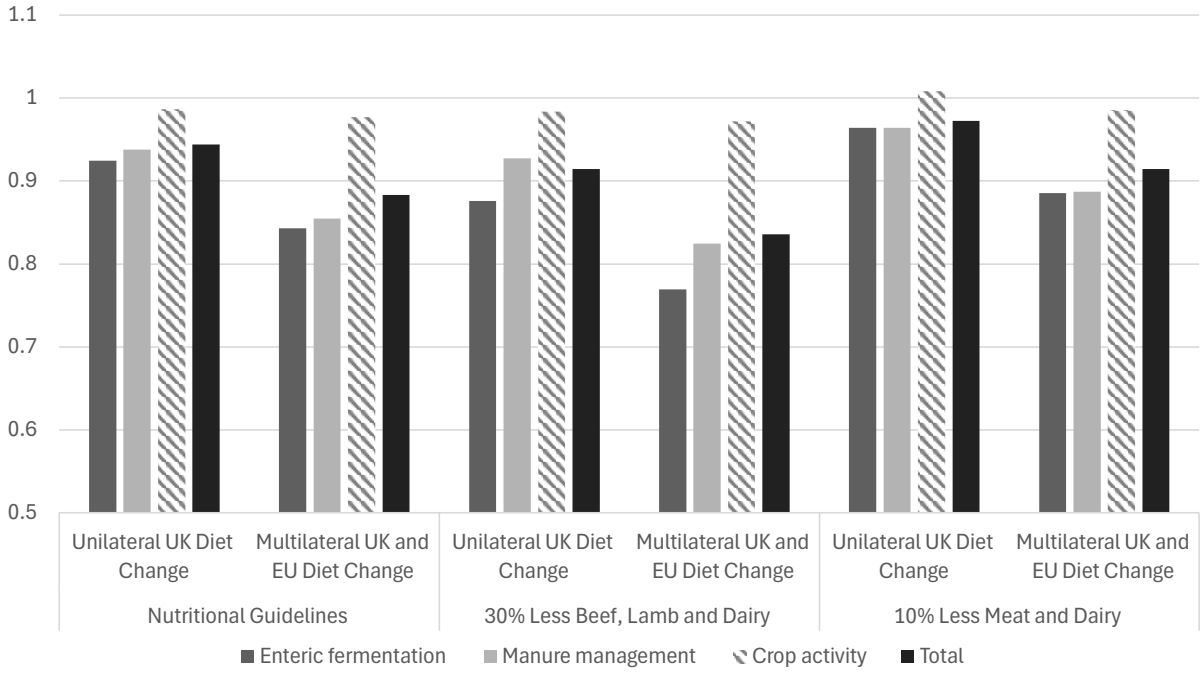


4 Environmental risk factors

The analysis considers two indicators of environmental risk: greenhouse gas emissions and ecosystem nutrient loading. These are projected forward to illustrate trade-offs that may arise between mitigating global climate change and localised air and water pollution as part of the counter-factual scenario analysis.

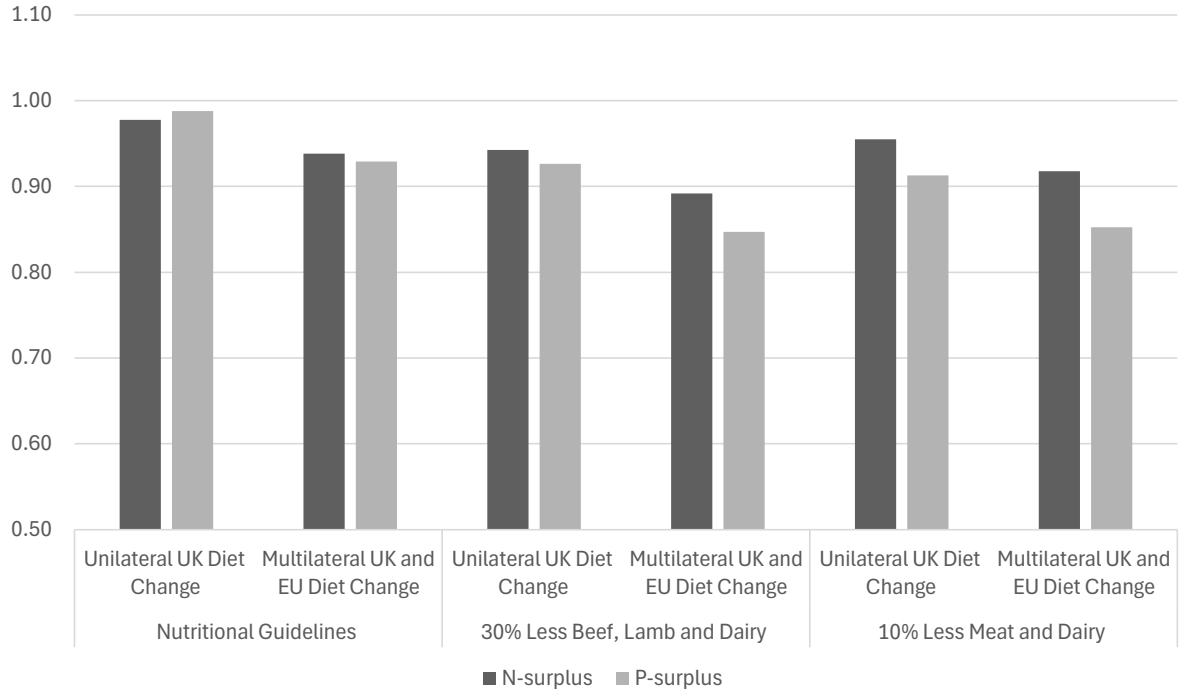
Model variables are combined with information on emission factors to estimate the methane (CH_4) and nitrous oxide (N_2O) emitted from enteric fermentation, manure management, and crop activity for each year of the projection period within the UK (territorial-based emissions). Expressed in carbon dioxide equivalent (CO_2 eq), the emissions generated in the tenth year for each scenario, as a proportion of the *status quo* level of emissions, is provided in Figure 5.

Figure 5. Methane and nitrous oxide emissions (CO_2 eq) in the tenth year as a proportion of the status quo



Nitrogen and phosphorus are essential nutrients for plant and animal health. The amount of these nutrients entering the UK in fertilizers and imported commodities less the amount leaving the UK in exported commodities is the nutrient balance. A nutrient surplus, meaning there is more nutrient available than plant and animal growth requires, increases the risk of those nutrients being lost to air and water causing pollution. The UK is a net-importer of fertilizers and agricultural commodities and therefore the historic and *status quo* balances are both in surplus. Projected trade flows in and out of the UK are combined with information on nutrient content to estimate the nitrogen and phosphorus surplus for each year of the projection period. The nutrient surplus for the tenth year of each scenario, as a proportion of the surplus in the *status quo*, is provided in Figure 6.

Figure 6. Nitrogen and phosphorus surplus in the tenth year as a proportion of the status quo



Greenhouse gas emissions and surplus nutrients are relatively lower in all dietary transition scenarios. Methane and nitrous oxide emissions (combined into CO_2 eq) range between 84% and 97% of the *status quo*. The minimal impact of diet change on crop activities means most emission mitigation is related to enteric fermentation and manure management due to lower stocking. Surplus nitrogen ranges between 89% and 98%, and surplus phosphorus 85% and 99% of the *status quo*. For all dietary transition patterns, the reduction in emissions and excess nutrients was more pronounced in the *Multilateral UK and EU Diet Change* scenarios.

5 Crop areas and breeding stock

Crop areas of wheat, barley, oats and rapeseed in the tenth year for England, Wales, Scotland and Northern Ireland are provided in Figures A-5 and A-6. Cereal areas are not very different from the *status quo* (less than 1% change). Oilseed rape area is relatively lower in the *Nutritional Guidelines* scenarios (-2.6 and -3.3%) and relatively higher for the other two dietary patterns when there is *Multilateral UK and EU Diet Change*, (3.6 and 3.8%).

The number of dairy cows, beef cows, ewes and sows in the tenth year for England, Wales, Scotland and Northern Ireland are provided in Figures A-7 and A-8. Averaging across scenarios the dairy herd is least impacted by the dietary transitions (-3.2%). The most severe reduction in dairy cows is -6.6% in the case of the *Nutritional Guidelines - Multilateral UK and EU Diet Change*. Beef cows are the most impacted on average across scenarios (-17.5%). As with dairy cows, there is a larger impact in *Multilateral UK and EU Diet Change* scenarios compared to *Unilateral UK Diet Change* scenarios. The *30% Less Beef, Lamb and Dairy - Multilateral UK and EU Diet Change,* the most restrictive scenario for per person beef consumption, projects -32% difference in beef cow numbers relative to the *status quo*. Ewe numbers, on average, are projected -8% below the *status quo* in the tenth year. Lamb consumption per person is restricted by around 30% in both the *Nutritional Guidelines* and *30% Less Beef, Lamb and Dairy* scenarios and there are similar changes to ewe numbers (-10 to -11%). The impact on ewe numbers is less sensitive

to whether there is *Unilateral UK Diet Change* or *Multilateral UK and EU Diet Change* than other breeding stock. In the *30% Less Beef, Lamb and Dairy - Unilateral UK Diet Change* scenario sow numbers are projected to be 3% higher in the tenth year compared to the *status quo*. However, on average the dietary transitions result in sow numbers -6% below the *status quo*.

6 Key messages

Economic modelling of UK and EU agriculture was applied to illustrate the complex relationship between dietary change, international trade, and the impact of UK agriculture on environmental risk factors linked to climate change and nutrient pollution. A common pattern across the dietary transitions modelled is the moderation of livestock-based foods to address over consumption, either on nutritional, or environmental sustainability, grounds. In this analysis, it is assumed social and cultural factors motivate a change in consumer behaviour. Note that this report does not consider how easy or hard it might be to effect such a change. Prices adjust to move towards a new equilibrium, accounting for the shift in demand. If policy changes such as taxes and subsidies were used to achieve the desired levels of consumption the results of the analysis would be different. The modelling carried out has provided several key messages useful for thinking through the challenges and opportunities related to dietary transition in the context of UK agriculture.

Overall, diet change in the UK may not produce a proportional or desirable response from the domestic agricultural sector, raising significant policy implications for food security, environmental sustainability, and consumer affordability.

The more internationally integrated the market for a given commodity, and localised the change in diets, the more muted the price signal. In the case price changes are minimal, the weakness of the market signal can lead to a production response out of line with the new consumption pattern. A limited positive production response to increased demand for healthy foods can reduce self-sufficiency, as additional demand is partially satisfied by imports (as with cereals). Conversely, a limited negative production response to decreased demand of GHG-intensive foods compromises sustainability goals, as supply not consumed in the UK is exported (as with lamb). Strong price signals are more successful in changing producer behaviour in line with the new diets. However, they also create an affordability challenge. A demand-driven increase in price, while incentivising an increase in supply, can make nutritionally and environmentally desirable foods less affordable.

The complexity and inherent structural rigidities in agriculture can constrain the speed and nature of response to market signals. In the medium-term, change is shaped by technical constraints (such as climactic conditions impacting wheat quality) and inherent lags in production processes (such as breeding and finishing cycles for livestock). Interdependence within the sector can trigger counter-intuitive impacts. Intermediate inputs (such as cereals for feed) or valorisation of biproducts (such as beef from dairy cows) can generate knock-on impacts, even for commodities not directly affected by the dietary transition.

Relatively barrier-free international trade of many agricultural commodities means diet transition has the potential to shift international competitiveness and provide arbitrage opportunities, favouring either UK producers (as with pigmeat), or foreign producers (as with wheat). Aligning the diet transition across trade partners reduces the trade balance effects and leads to more positive outcomes in terms of reducing environmental risk factors within the UK.

Appendix

Table A - 1. Prices - percent difference from status quo in the tenth year

Scope of diet change	Commodity	Follows Nutritional Guidelines	30% Less Beef, Lamb and Dairy	10% Less Meat and Dairy
Unilateral UK Diet Change	Wheat	0.5%	0.0%	-0.2%
	Barley	0.6%	0.0%	-0.3%
	Rapeseed	-2.2%	-0.2%	-0.5%
	Oat	0.5%	0.0%	-0.2%
	Potato	83.1%	-7.1%	-7.4%
	Milk	-15.8%	-6.5%	-3.1%
	Cheese	-9.4%	-9.8%	-4.1%
	Butter	-35.7%	-2.3%	-2.6%
	Beef	-7.0%	-24.7%	-4.4%
	Pig	-20.6%	6.9%	-10.7%
	Poultry	-3.8%	8.1%	-5.4%
	Sheep meat	-23.2%	-22.5%	-6.6%
	Eggs	-58.6%	-9.7%	70.1%
	Beans and peas	-1.0%	-0.1%	-0.2%
Multilateral UK and EU Diet Change	Wheat	-3.4%	-4.8%	-5.9%
	Barley	-4.1%	-5.8%	-7.2%
	Rapeseed	-7.7%	-2.2%	-3.4%
	Oat	-3.4%	-4.9%	-6.1%
	Potato	82.5%	-7.7%	-8.1%
	Milk	-40.5%	-30.9%	-23.1%
	Cheese	-41.3%	-43.5%	-30.5%
	Butter	-52.5%	-13.2%	-13.6%
	Beef	-32.7%	-53.3%	-30.1%
	Pig	-39.6%	-11.2%	-25.6%
	Poultry	-9.3%	4.2%	-12.1%
	Sheep meat	-25.9%	-24.7%	-9.4%
	Eggs	-60.1%	-12.0%	64.6%
	Beans and peas	-3.7%	-1.1%	-1.6%

Table A - 2. Domestic use - percent difference from status quo in the tenth year

Scope of diet change	Commodity	Follows Nutritional Guidelines	30% Less Beef, Lamb and Dairy	10% Less Meat and Dairy
Unilateral UK Diet Change	Wheat	19.5%	0.3%	-1.9%
	Barley	2.9%	1.6%	-0.9%
	Rapeseed	-0.6%	0.0%	0.0%
	Oat	14.9%	-4.2%	-4.2%
	Potato	25.2%	-2.8%	-2.9%
	Cheese	-54.4%	-34.3%	-12.0%
	Butter	-61.8%	-3.2%	-3.2%
	Beef	-14.8%	-32.8%	-9.9%
	Pig	-25.8%	17.0%	-11.2%
	Poultry	-8.8%	16.8%	-11.3%
	Sheep meat	-34.8%	-31.4%	-8.0%
	Eggs	-22.1%	-3.7%	26.8%
	Beans and peas	66.4%	6.5%	17.6%
Multilateral UK and EU Diet Change	Wheat	17.5%	-1.4%	-3.5%
	Barley	-0.3%	-1.3%	-3.7%
	Rapeseed	-0.9%	0.8%	0.7%
	Oat	14.8%	-3.9%	-3.8%
	Potato	24.9%	-3.0%	-3.1%
	Cheese	-54.4%	-34.3%	-12.0%
	Butter	-61.8%	-3.2%	-3.2%
	Beef	-14.8%	-32.8%	-9.9%
	Pig	-25.8%	17.0%	-11.2%
	Poultry	-8.8%	16.8%	-11.3%
	Sheep meat	-34.8%	-31.4%	-8.0%
	Eggs	-22.1%	-3.7%	26.8%
	Beans and peas	65.4%	5.9%	16.8%

Table A - 3. Net exports (thousand tonnes) in the status quo and percent difference in the tenth year

Scope of diet change	Commodity	Exports - imports in the *status quo*	Follows Nutritional Guidance	30% Less Beef, Lamb and Dairy	10% Less Meat and Dairy
Unilateral UK diet change	Wheat	-1,675	189.1%	3.2%	-18.6%
	Barley	567	-37.9%	-19.2%	9.5%
	Rapeseed	-492	4.2%	0.4%	0.3%
	Oat	33	-458.6%	122.1%	122.1%
	Potato	-1,928	28.6%	-2.4%	-2.6%
	Cheese	-250	-158.3%	-142.9%	-43.6%
	Butter	16	697.7%	59.4%	43.0%
	Beef	-249	-50.2%	-117.2%	-32.8%
	Pig	-457	-56.3%	46.2%	-23.6%
	Poultry	-148	-80.7%	150.8%	-102.9%
	Sheep meat	24	162.4%	136.5%	35.6%
	Eggs	-102	-22.1%	-3.7%	26.8%
	Beans and peas	-565	167.2%	17.3%	45.0%
	Fish, including meal and oils	-522	-22.5%	-13.2%	32.8%
Multilateral UK and EU diet change	Wheat	-1,675	167.2%	-18.8%	-39.9%
	Barley	567	-5.9%	15.7%	41.5%
	Rapeseed	-492	4.8%	-5.1%	-6.0%
	Oat	33	-461.6%	132.6%	133.0%
	Potato	-1,928	28.3%	-2.7%	-2.8%
	Cheese	-250	-114.0%	-95.6%	-9.7%
	Butter	16	661.6%	56.0%	19.1%
	Beef	-249	-26.6%	-87.6%	-11.8%
	Pig	-457	-42.7%	62.8%	-11.1%
	Poultry	-148	-68.6%	135.2%	-87.6%
	Sheep meat	24	148.9%	112.2%	9.4%
	Eggs	-102	-22.1%	-3.7%	26.8%
	Beans and peas	-565	-9.2%	16.4%	27.1%
	Fish, including meal and oils	-522	-22.5%	-13.2%	32.7%

Figures A – 1 to A – 4 combine information on historic and projected prices with *supply* (production plus imports) and *use* (domestic use and exports). The left axis relates to prices, expressed in Great British Pounds (£) per tonne. The grey line tracks prices during a historic period (2021 to 2024) and the *status quo* projected price (2025 to 2034). The blue and red lines show the projected prices for *Unilateral UK Diet Change* and *Multilateral UK and EU Diet Change* respectively. The bars on the graphs relate to the right axis measuring quantity in thousand tonnes. A positive number indicates a source of *supply* of that commodity and a negative number indicates a *use*. The solid bars show the quantity produced (always positive). The transparent bars are the amount used domestically (always negative). Although international trade includes bi-directional flows (both imports and exports of the same commodity), the net balance of trade flows is shown. Trade is a net *supply* if a commodity is imported more than exported, represented by a positive quantity for the striped bar. If exports of a commodity exceed imports trade is expressed as a negative quantity because it functions as a net *use*. While stock change and losses not reported here can also contribute to the *supply and use*, these charts can be interpreted such that the quantities on the positive *supply* side of the right axis and negative quantities on the *use* side of the axis will balance to zero.

Figure A – 1 shows the supply, use and prices for wheat. Comparing the diet transitions with the *status quo* there is very little impact on price. In the *Nutritional Guidelines* scenario, the UK deepens its net-importer-position, holds a similar net-importer-position in the *30% Less Beef, Lamb and Dairy* scenario, and switches to a net-exporter-position in the *10% Less Meat and Dairy* scenario. Cheese supply, use and price are provided in Figure A – 2. In the *Unilateral UK Diet Change* scenarios, price is relatively lower compared to the *status quo,* but much lower again in the *Multilateral UK and EU Diet Change* scenarios. The UK switches from a net-importer-position to a net-exporter position in three out of the six scenarios. The supply, use and prices for beef can be found in Figure A – 3. The most extreme decrease in price relative to the *status quo* are in the *30% Less Beef, Lamb and Dairy* scenarios. The UK also switches from a net-importer-position to a net-exporter-position. Figure A – 4 presents pigmeat supply, use and price. The strongest impact on price is in the *Nutritional Guidelines – Multilateral UK and EU Diet Change* scenario, well below the *status quo*. In contrast, price increases in the *30% Less Beef, Lamb and Dairy - Unilateral UK Diet Change*. The UK maintains a net-importer-position across all scenarios.

Figure A - 1. Wheat supply and use (right axis) and price (left axis)

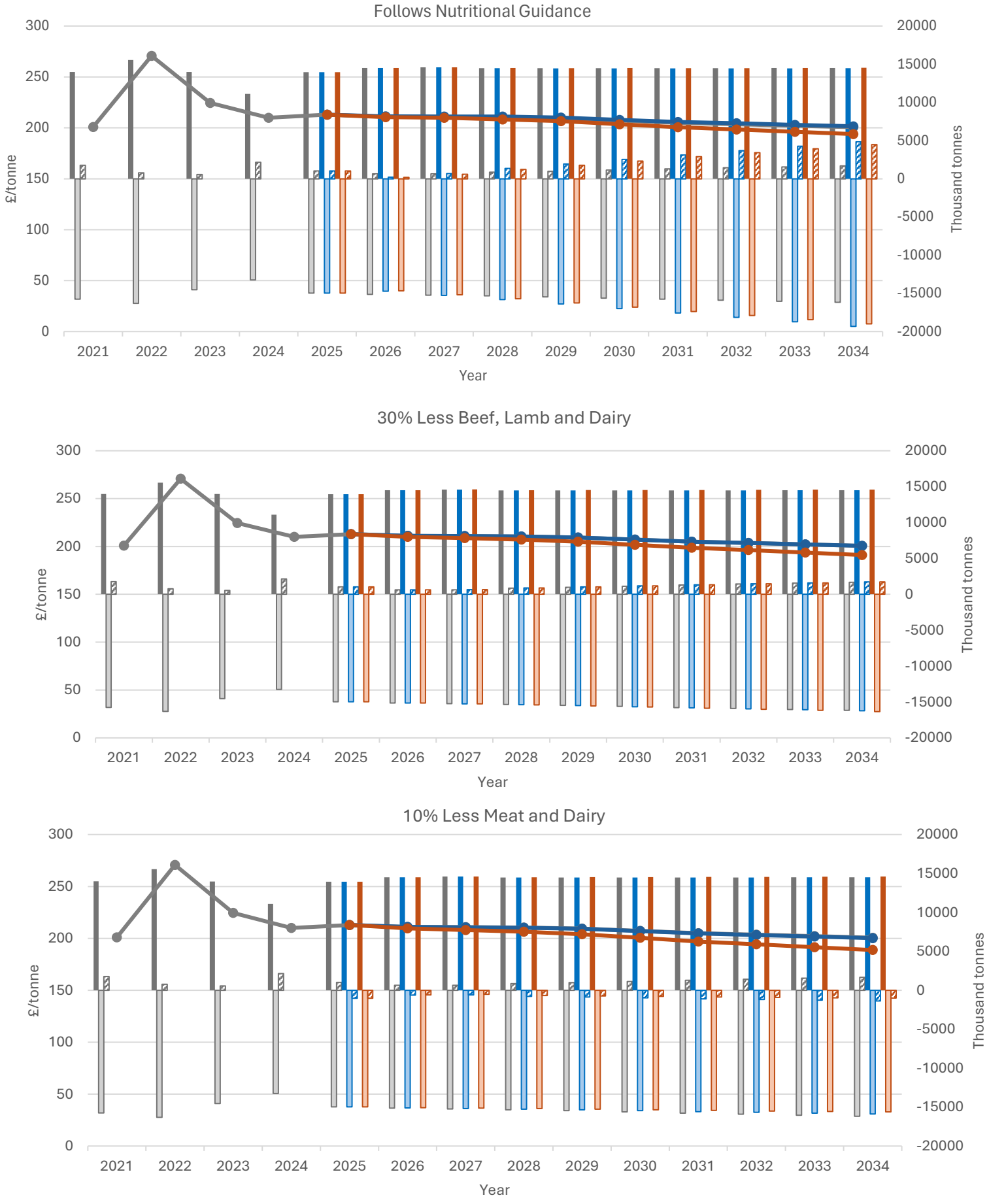


Figure A - 2. Cheese supply and use (right axis) and price (left axis)

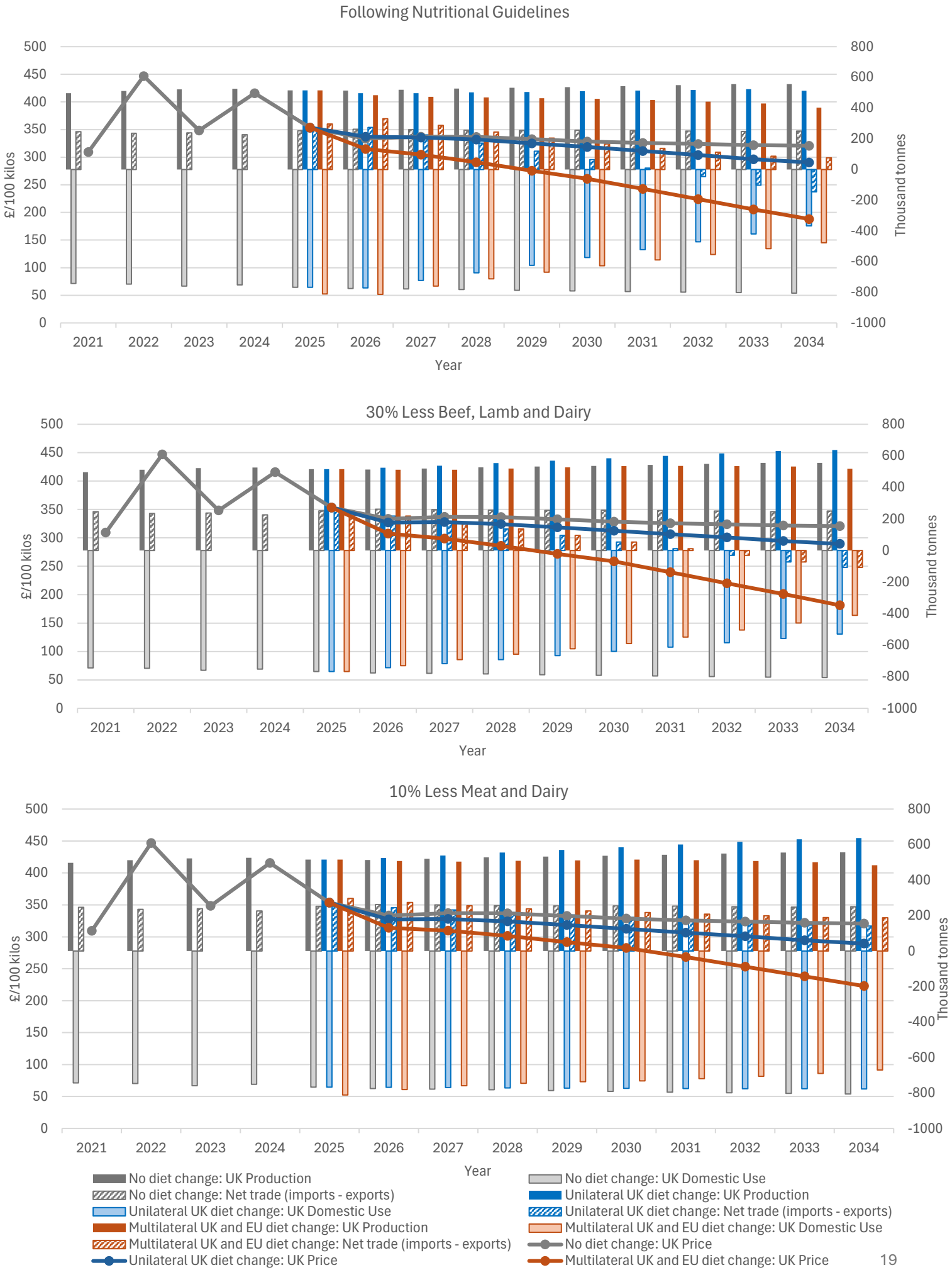


Figure A - 3. Beef supply and use (right axis) and price (left axis)

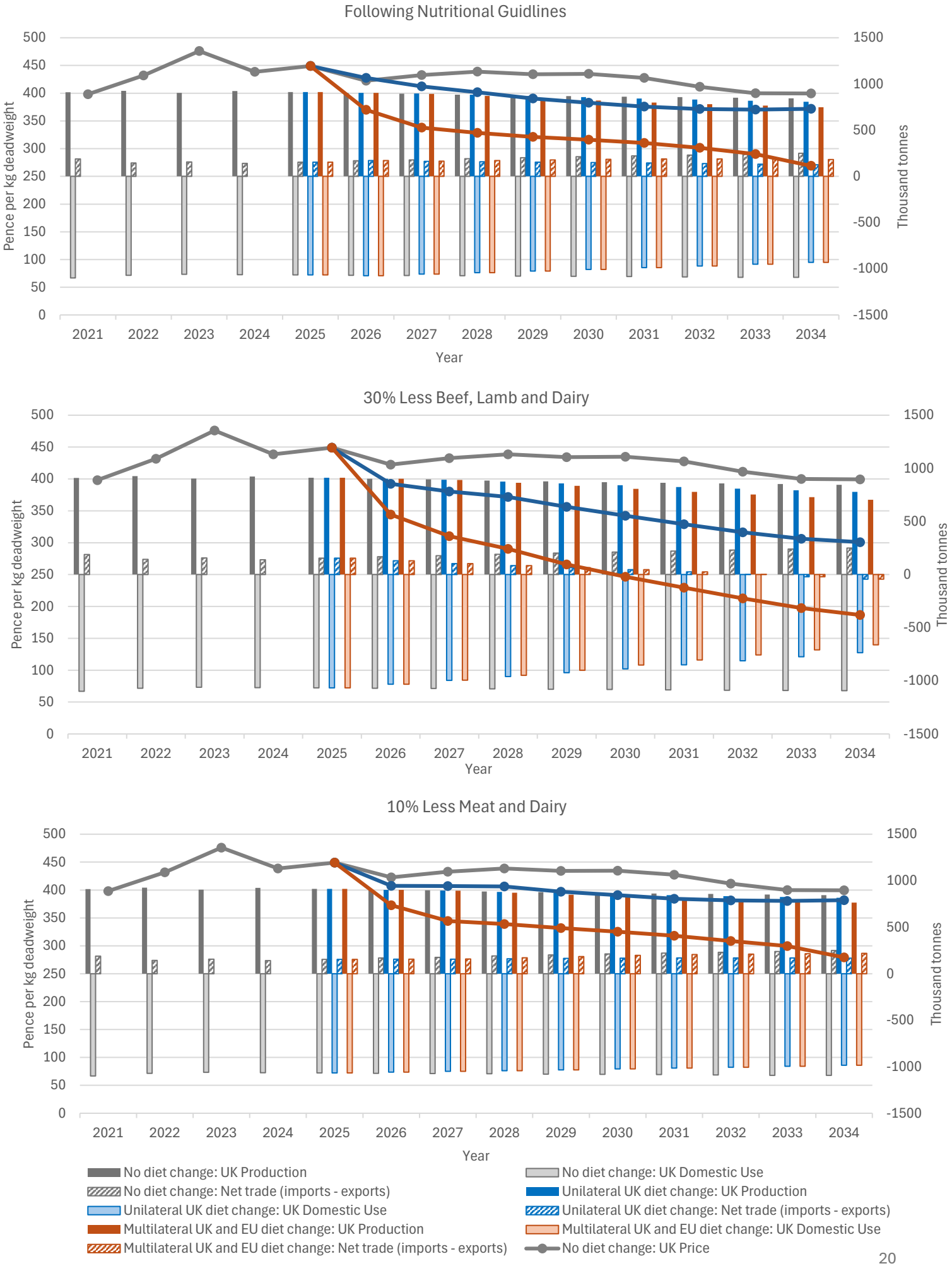


Figure A - 4. Pigmeat supply and use (right axis) and price (left axis)

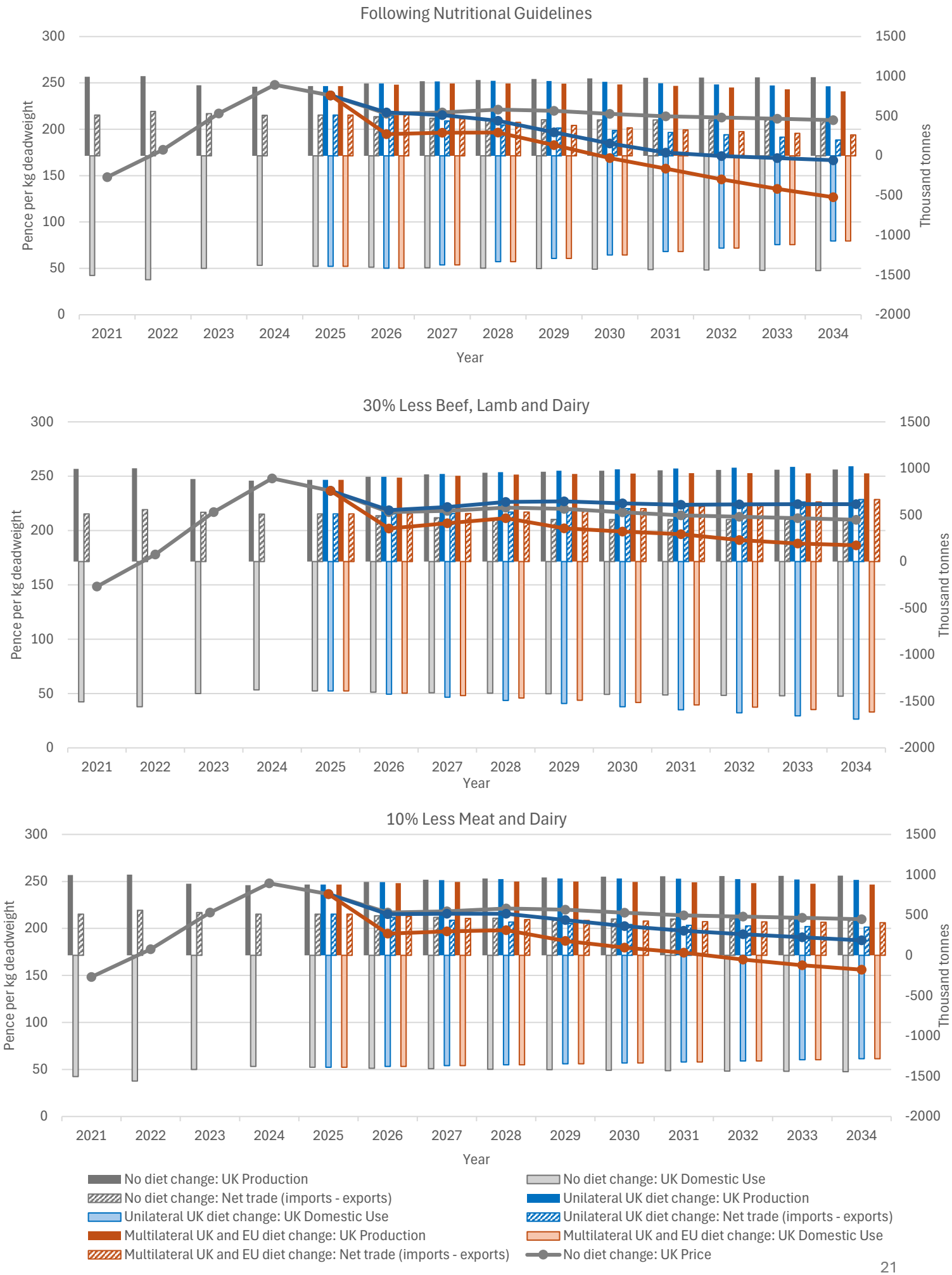


Figure A - 5. Wheat and barley area (thousand hectares) and percent difference from the status quo

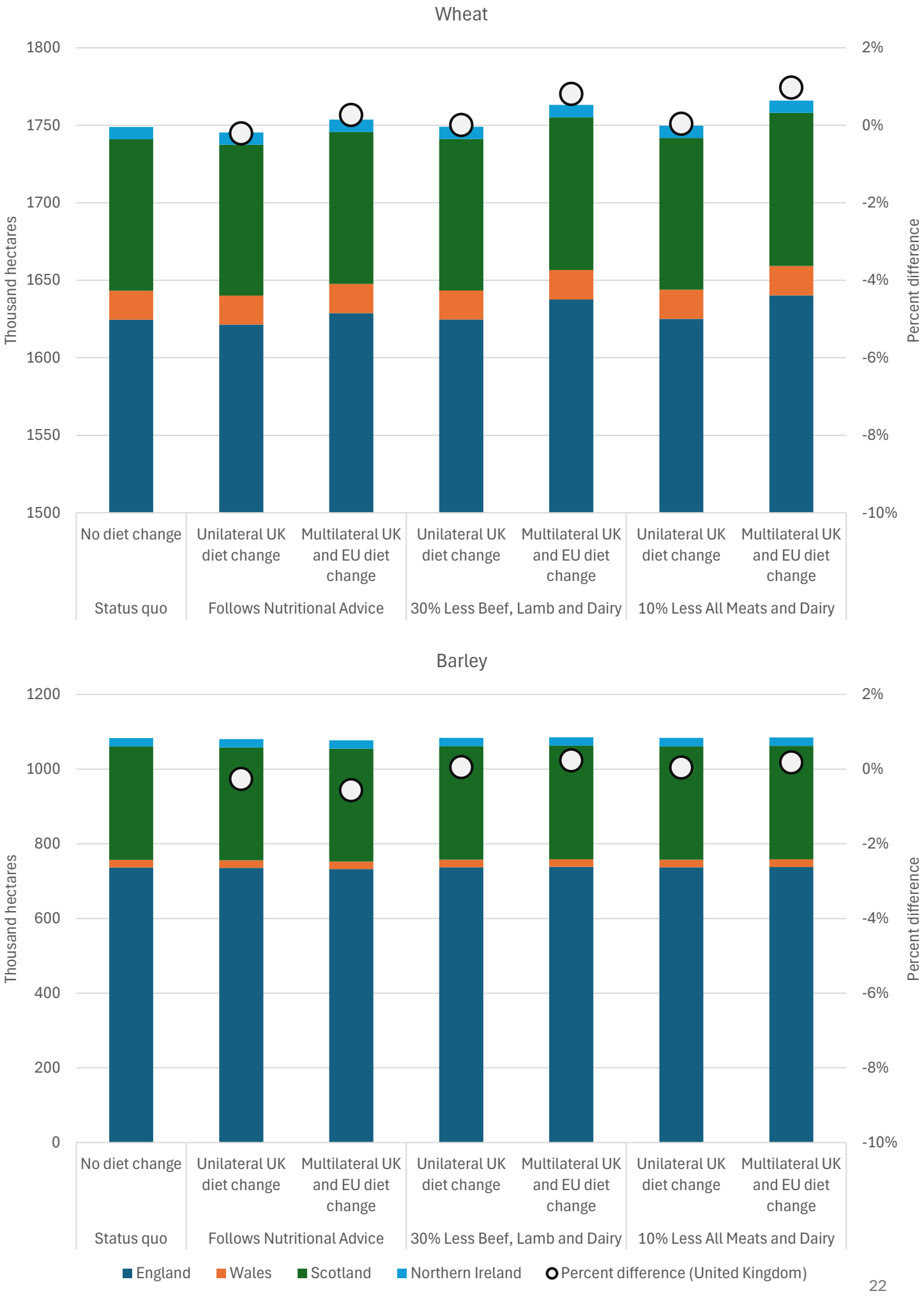
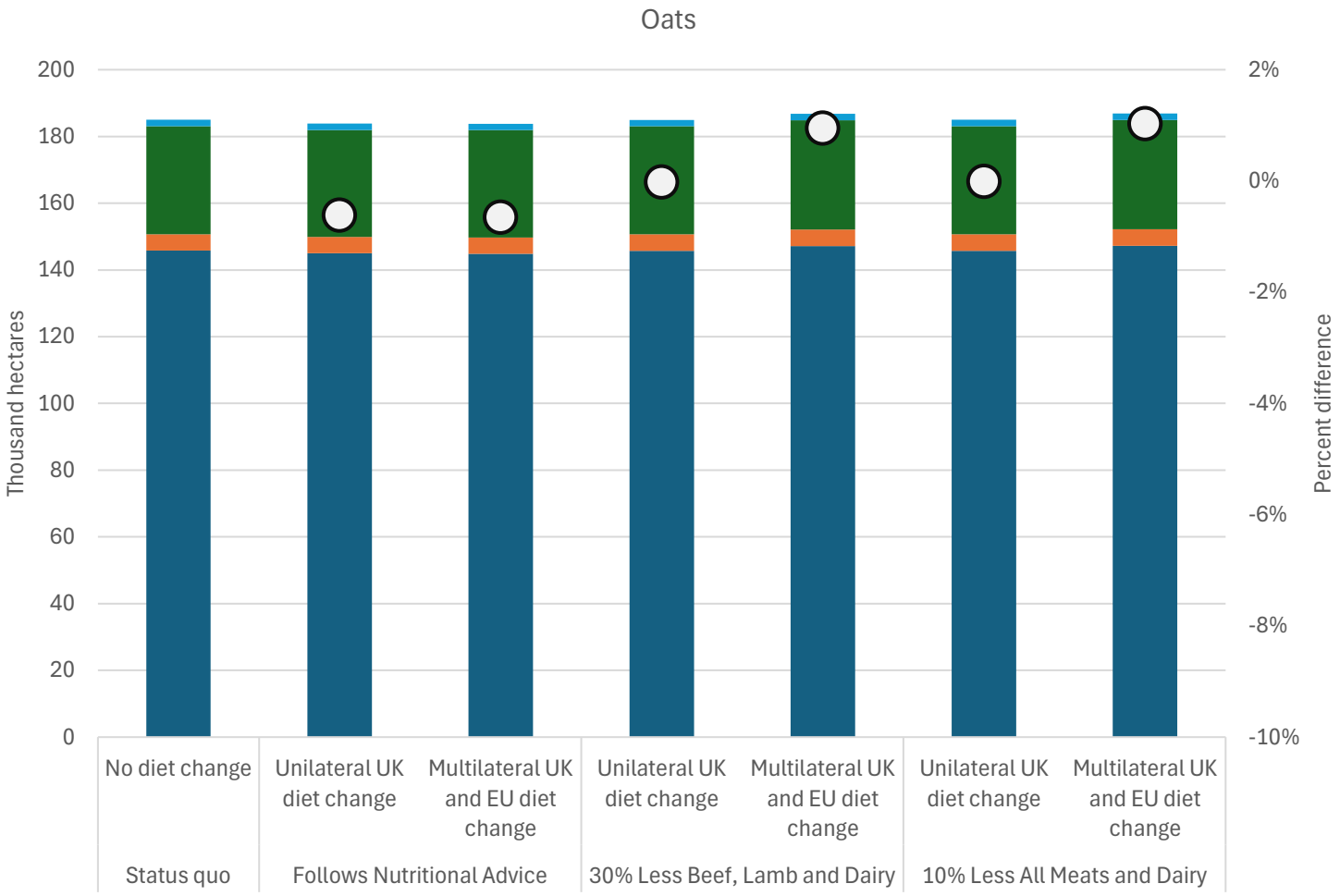


Figure A – 6. Oat and oilseed area (thousand hectares) and percent difference from the status quo



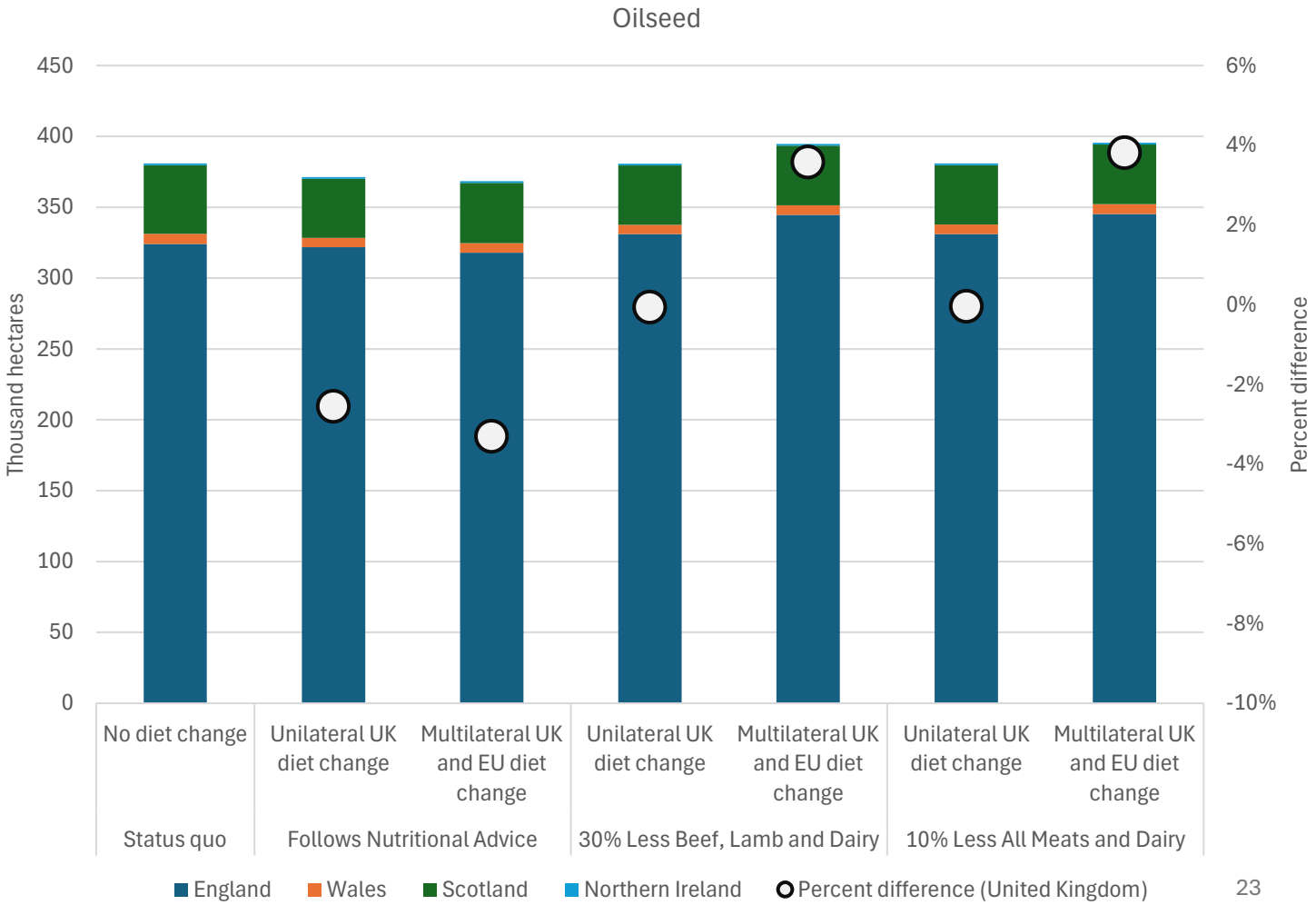


Figure A – 7. Cow number (thousand head) and percent difference from the status quo

Figure A – 8. Ewe and sow number (thousand head) and percent difference from the status quo