Technical Note 2021-1

Model Revisions to Reflect the United Kingdom's Exit from the European Union

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Highlights

The overall objective is to document and test the sensitivity of changes to assumptions related to UK trade and agricultural policy outside the Common Agricultural Policy in the FAPRI UK model system[1]. The model revisions discussed include:

- The degree to which direct payments are assumed to influence production levels in England
- Change price transmission mechanism so EU prices are no longer used to solve for UK specific prices for all commodities - with the exception of milk powders.
- Incorporation of a mechanism to allow non-tariff costs to trade between the UK and EU (when appropriate)
- Incorporation of a mechanism to allow volume reduction in trade flows between the UK and EU (when appropriate)

The model revisions applied have the following impacts on the Baseline projections:

- Adjusting the influence of direct payments on production in England changes UK production levels by less than 1% in all sub-sectors
- Removing price transmission in the way UK prices are solved for in the model and implementing assumed non-tariff costs on trade between the UK a and the EU results in Baseline projections with:
    - relatively lower red meat prices, and sheep production on average
    - relatively higher pork prices and production on average

[1] The Model Documentation can be accessed here (https://www.afbini.gov.uk/publications/fapri-uk-model-documentation)

Contents

1 Introduction

The objective of this technical note is to test the sensitivity of assumptions used to generate Baseline projections related to the new trading arrangements between the UK and the EU and, where sufficient information is available, introduce changes in agricultural policy at the level of individual UK administrations.

This is accomplished by running a series of scenarios. The first assumes that agricultural policy changes in England reduce the production-impacts of direct payments (in England). Three scenarios, assuming three different levels of non-tariff costs to engage in trade, or, Trade Facilitation Cost (TFC), are also undertaken. As well as one further scenario that restricts the volume of trade flows.

The assumptions tested and resulting impacts on the Baseline projections of these illustrative scenarios are provided, followed by some comments to consider when deciding model adjustments and scenario analysis going forward.

2 Agricultural policy transition

In November 2020, the Department for Environment, Food and Rural Affairs (DEFRA) set out changes to agricultural policy in England with changes taking effect from 1st January 2021. The new agricultural policy will gradually phase out the Basic Payment Scheme, with a plan for the last Direct Payment to be made in 2027. Instead of area-based payments, farmers will be paid to improve the environment, improve animal health and welfare, and reduce carbon emissions. After an initial transition period from 2021 to 2023, there will be a full roll out of new schemes in 2024. The main scheme will be the Environmental Land Management Scheme (ELMS). It is made up of three component parts; Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery.

The FAPRI-UK model incorporates a link between direct payments and production, based on an assumption that direct payments bolsters production. Historically all sub-sectors and all regions in the model are set up to allow 30% of direct payments to feed through to price, and therefore influence production levels. Real world decisions on future production volumes are taken some time in advance and are influenced by a variety of factors, mainly future price expectations but also anticipated subsidy payments. As farmers in England are aware that Basic Payment will reduce to zero by 2027, it is rational to expect that the influence of these payments on production decisions will also reduce. To do otherwise assumes that an expected fall in revenue has no impact on how much farmers plan to produce in future. In addition, the gradual reduction and elimination of Basic Payments might be expected to induce different behaviour on how remaining Basic Payment is utilised during the phase out period. It may be saved to create a buffer against future uncertainty, used to invest in farm diversification or put to some other non-supply inducing use. To reflect this, the degree to which these payments act as a stimulus to production is reduced slightly each year (by 3%). Therefore, by the end of the 10 year projection period it has reduced from 30% to 10% in the England sub-model.

The extent to which Basic Payment is substituted by payments for public goods in the new support framework in England, is as yet unknown, as is detail on eligibility criteria or likely farmer uptake. Agri-environment (public good) payments have not been assumed to influence production decisions previously within the FAPRI-UK baseline and scenario analysis and that approach is continued here. These changes relate only to England, but as agricultural policy changes are made elsewhere in the UK, further model adjustment may be required.

A comparison (percent change) between implementing the policy adjustment (reducing the price impact of area based payments gradually over the period to 10% for England) and not implementing the adjustment (keeping 30% for England over the period) is available in Table 1. In all sub-sectors, UK production levels change by less than 1%.

3 Exit from the European single market

In December 2020, the UK and EU concluded a Trade and Cooperation Agreement. The UK is no longer part of the EU single market, but the UK and EU have agreed to no tariffs or quotas on the movement of goods between the two territories when the goods meet the relevant rules of origin. The rules of origin clause outlines that only originating goods are able to benefit from free trade. To accommodate the fact that the UK is no longer in the single market, the model now solves for an independent UK price for most livestock products, instead of assuming a more rigid relationship with the EU price (a price transmission approach).

The Northern Ireland Protocol (NIP) was developed in tandem with the Trade and Cooperation Agreement between the UK and the EU. The NIP is designed to prevent any customs operations between Northern Ireland and the Republic of Ireland. To achieve this, Northern Ireland has remained in the EU single market for goods, whereas England, Wales and Scotland have left the single market. The NIP could have asymmetric impacts on trade between Northern Ireland and Great Britain, as the UK government has indicated it will apply 'light touch' Sanitary and Phytosanitary (SPS) and customs checks to goods flowing from Northern Ireland to Great Britain. The full border regime to be applied to goods moving from Great Britain to Northern Ireland is, at time of writing, unclear. A grace period during which the NIP requirements are not fully implemented currently applies and negotiations between UK and EU authorities continue on how the NIP should be implemented in future. Both parties have stated that they want to minimise the disruption to existing trade flows while maintaining the integrity of their respective customs zones.

In the model, international trade is determined at the UK-level, not regionally within the UK. This means that any frictions introduced need to be implemented at UK-level as well. In order to apply differentiated trade frictions, specifically for Northern Ireland – EU, Scottish – EU, Welsh – EU and English – EU trade flows, the model would need to be rebuilt, and to fully account for each region's international, as well as intra-national, trade flows. This would require extensive model development, and severe dependency on assumptions to compensate for data gaps and uncertainty about sub UK-trade flows with the EU. Therefore, it is preferable to use a UK-level approach, until the implementation and impact of the NIP is more certain. Then the trade-offs of re-developing the model can be carefully considered.

Although there is a Free Trade Agreement between the UK and EU, changes to the costs and ease of trade are expected due to non-tariff barriers, such as procedures to meet legal requirements and inspections at the border. This is explored by running a series of scenarios that provides some illustration of how the model responds to assumed trade frictions in the form of an additional cost, and, a restriction on the volume of trade.

3.1 Option 1: costs of doing trade

The Trade Facilitation Cost (TFC) for each commodity in the model is calculated using a reference value. Reference values are based on average historic prices (from the years 2015 to 2019). In the case of UK exports, UK historic prices are used, and for UK imports, EU prices. The TFC is calculated as a percentage of this reference value to represent the additional cost which is added into the trade equations.

To analyse the impact of the additional TFC, a range of assumed cost levels are considered, by varying the percentage of the reference value used. Four levels of TFC are illustrated: *No TFC, Low TFC, Moderate TFC,* and *High TFC.* The proportion of the reference value assumed to represent the TFC is set to 0%, 5%, 15%, and 30% respectively. The TFCs are applied to livestock and dairy products excluding powders (poultry, sheepmeat, pigmeat, beef, cheese and butter)[2]. The value of the TFC by commodity and magnitude are presented in Table 2.

When the new trading arrangements first came into force, there were fewer border requirements for EU to UK flows, than UK to EU flows. For this reason, an asymmetric approach has been taken when applying the TFCs at the start of the projection period (such that the EU only faces half the magnitude of TFC). We assume that in the year 2022, both the UK and EU will face the same checks when exporting goods, and therefore the same magnitude of TFC (5%, 15%, or 30%) apply to both.

Detailed results are presented in Figure 1 to 6, and, Table 3. The impact for *Low TFC* and *Moderate TFC* on producer prices is small. In the extreme scenario (*High TFC*) sheep and beef UK producer prices settle 11% and 5% below those estimated in a *No TFC* scenario respectively, and poultry at 2% below. Cheese and butter prices show a relatively small increase (2% and 5%), with pigmeat price settling at 12% above the *No TFC* price. For the most part, there is very little difference in domestic production between *No TFC* and *High TFC* with the exception of sheep, with a decrease of 5%, and pigmeat, with an increase of 12%.

3.2 Option 2: restriction on trade volume

The trade volume scenario captures the impact of trade friction by restricting trade flows (imports and exports) between the UK and EU. The initial observed impact of the new trading relationship has been asymmetric, characterised by a relatively larger impact on UK exports compared to imports. This is reflected in the illustrative scenario assumptions, with a larger volume adjustment imposed on UK exports than imports in the first part of the projection period. In the year 2021, the magnitude of the incorporated volume reduction in UK exports is 70% of the average volume in the previous five-years, and a lower rate, of 40% in the case of imports. The volume shock on exports decreases gradually during the first three years of the projection period, settling at 20% of the historic average starting from the year 2023. Import restrictions also decline over the first three years and converge with exports to a restriction of 20% of the historic average from the year 2023. The trade restrictions described above are applied to livestock and dairy products excluding powders (poultry, sheepmeat, pigmeat, beef, cheese and butter).

Details of the impacts under these scenarios can be found in Figure 7 to Figure 12 and Table 4. The volume shock is layered over the TFC assumptions applied in the April 2021 baseline: 5% for beef and sheepmeat, 3% for cheese, butter and pigmeat, and, 2% for poultry. The results tables show the difference between the baseline projections (with the TFCs assumed), and the scenarios, with volume shocks also applied. Comparing the trade volume shock to the baseline TFC assumptions alone, price changes settle to less than 4% difference in all cases, by the second half of the projection period. Beef and cheese see the largest producer price change, both increasing by 3.5%. Pigmeat, poultry, and butter all increase in price up to 2%. Sheepmeat price declines 1.8% compared to the baseline. Over the second half of the projection period, domestic production averages to within -2.3% and +1.2% of the baseline for all commodities.

[2] It has been assumed that international trade in the crop sector is not directly impacted by the change in the trading relationship with EU.

4 Commentary

Before Brexit, agricultural policy in the UK evolved in a direction and at a pace dictated by successive CAP reforms. Now there is the potential for policy to develop in ways that reflect the needs and aspirations of each of the UK administrations. This new policy environment means that the assumptions around direct support need regular review and revision as changes are made in each of the UK administrations.

In the Baseline projections, policy reforms that have been decided for England have been incorporated into the modelling system, while existing policy arrangements are continued for Scotland, Wales and Northern Ireland. The impact of the policy change on baseline production levels is very small (less than 1% for all sub-sectors). However, making this adjustment to the model means that if there is a future scenario analysis whereby direct payments see a considerable change from existing levels, the difference in farmer (producer) expectations of future income from this source between England and other UK countries, can be accommodated.

There is also potential for considerable change related to international trade. While there are new barriers to trade and more changes anticipated, the longer-term impacts on the pattern of UK-EU trade is still uncertain - as industry is still reacting to additional costs and other non-tariff friction. This uncertainty is compounded by the effects of COVID on production and trade. There is also uncertainty around the implementation of the NIP, and the degree to which this will impact agriculture at UK level. Therefore, assumptions underpinning new frictions in trade will require regular review and adjustment to reflect the most recent evidence.

The results of the trade scenario illustrations show that the impacts on the UK domestic market are sensitive to the nature of the change and the manner in which it is investigated in the FAPRI-UK model. For UK domestic market impacts, both the degree of symmetry in trade friction faced by the UK and the EU and the magnitude of that friction are relevant considerations. Whether the impact on trade is investigated as a cost or a reduction on volumes has a material effect on the outcome. However, based on the results of the investigation both methods are feasible and therefore available to undertake future analysis, as appropriate.

When considering the significance to UK producer prices and production volume (with only a couple of exceptions) it is important to note that when the shock is symmetric, there is a substitution impact on the UK domestic market. In the domestic market foregone exports are replacing foregone imports. Therefore the modest price impacts observed do not capture the impacts of disruption to existing trading patterns and supply chains, especially for seasonal products or those sectors with differentiated products not captured in the model. This is because in reality, foregone exports may not be available when domestic demand was previously met by foregone imports (e.g. in the case of lamb), or consumer preferences may not align with the domestic supply (e.g. chicken breasts versus chicken thighs). Going forward, available evidence on the magnitude of trade frictions, if these manifest as additional costs or direct volume constraints, and the degree of substitutability between UK exports and EU imports, will all need to be reviewed in determining the appropriate assumptions around the new trading relationship in preparation for any scenario analysis.

5 Charts and tables

Table 1. Percent difference between decrease in production stimulating impact of direct payments in England, and no change

Year	2021	2022	2023	2024-2030 (average)
Beef				
Total Suckler Cows	0.0%	-0.1%	-0.2%	-0.6%
Production	0.0%	0.0%	0.0%	-0.1%
Net Exports	0.0%	-0.1%	-0.1%	0.2%
Price	0.0%	0.0%	0.0%	0.1%
Sheep				
Total Sheep	0.0%	-0.1%	-0.2%	-0.5%
Production	0.0%	0.1%	0.0%	-0.5%
Net Exports	-0.3%	-1.1%	-0.1%	13.6%
Price	0.0%	0.0%	0.0%	0.2%
Cheese				
Production	0.0%	0.0%	0.0%	0.0%
Net Exports	0.0%	0.0%	0.0%	0.0%
Price	0.0%	0.0%	0.0%	0.0%
Butter				
Production	0.0%	0.0%	0.0%	0.0%
Net Exports	0.0%	0.0%	0.0%	0.0%
Price	0.0%	0.0%	0.0%	0.0%
Pig				
Total Pigs	0.0%	0.0%	0.0%	0.0%
Production	0.0%	0.0%	0.0%	0.0%
Net Exports	0.0%	0.0%	0.0%	0.0%
Price	0.0%	0.0%	0.0%	0.0%
Poultry				
Production	0.0%	0.0%	0.0%	0.0%
Net Exports	0.0%	0.1%	0.1%	0.2%
Price	0.0%	0.0%	0.0%	0.0%
Wheat				
Production	0.0%	-0.1%	-0.1%	-0.2%
Net Exports	0.6%	0.8%	1.1%	1.7%
Price	0.1%	0.1%	0.2%	0.3%
Barley				
Production	0.0%	-0.1%	-0.1%	-0.1%
Net Exports	-0.3%	-0.6%	-0.9%	-1.4%
Price	0.0%	0.1%	0.1%	0.2%

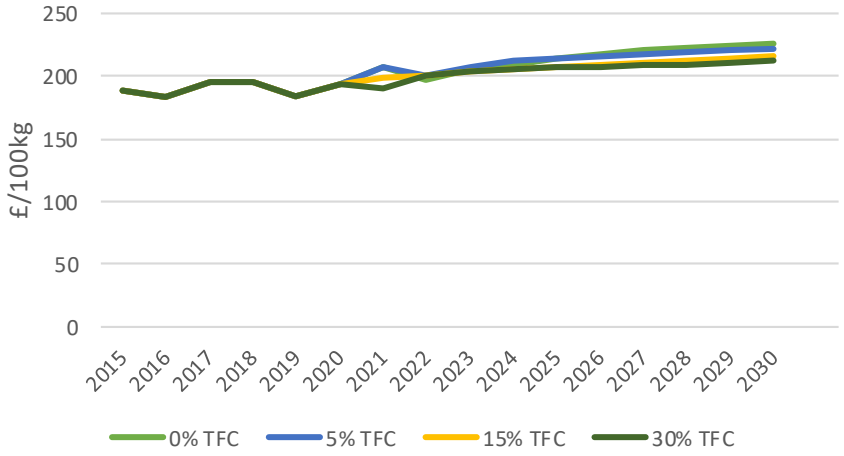
Table 2. Assumed non-tariff trading costs applied in Low, Moderate and High Trade Facilitation Cost (TFC) scenarios (£ per 100 kilograms)

	Low TFC		Moderate TFC		High TFC	
	UK-EU	EU-UK	UK-EU	EU -UK	UK-EU	EU-UK
Cheese	13.49	12.63	40.46	37.89	80.92	75.78
Butter	17.28	17.33	51.83	52.00	103.66	104.00
Beef	17.36	15.56	52.07	46.69	104.15	93.37
Sheepmeat	20.77	26.06	62.31	78.26	124.63	156.51
Poultrymeat	8.30	9.52	24.89	28.57	49.78	57.14
Pigmeat	7.13	6.05	21.38	18.14	42.77	36.28

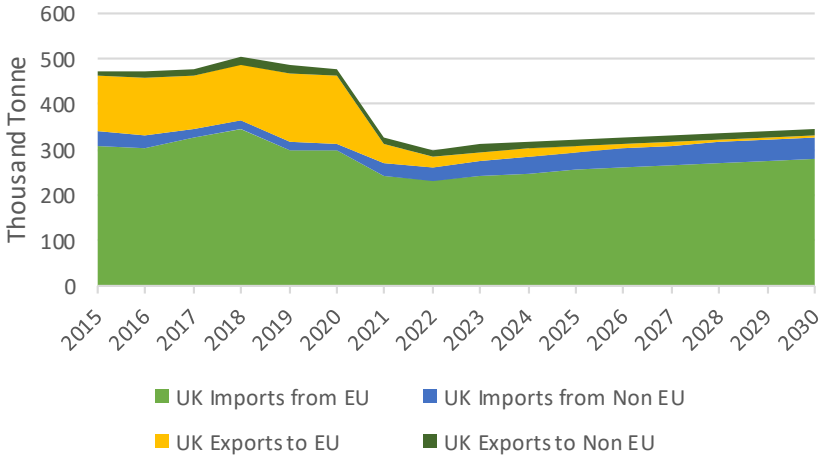
UK-EU: Exports to EU;

EU-UK: Imports from EU;

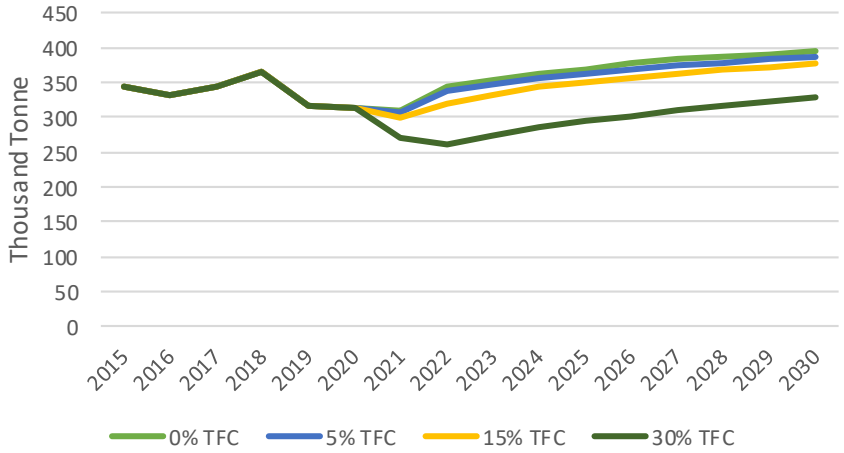
Figure 1. Beef price and trade changes under low, moderate and high Trade Facilitation Costs



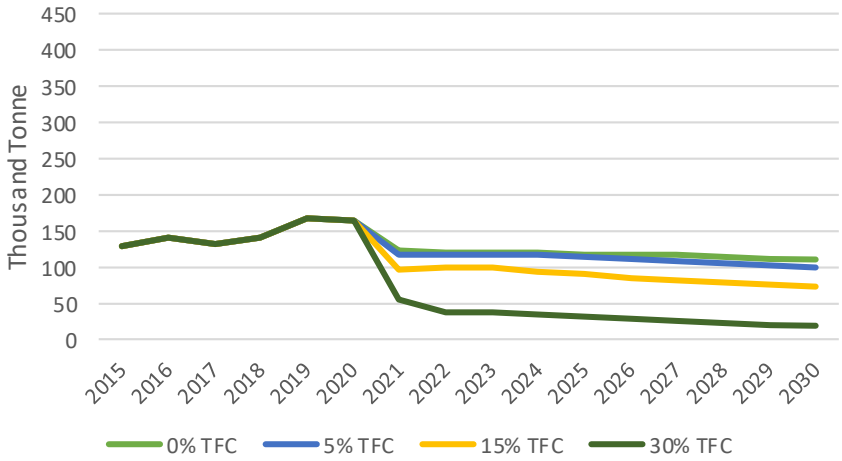
a. Beef price



b. Total UK trade flows by source and destination (High TFCs)

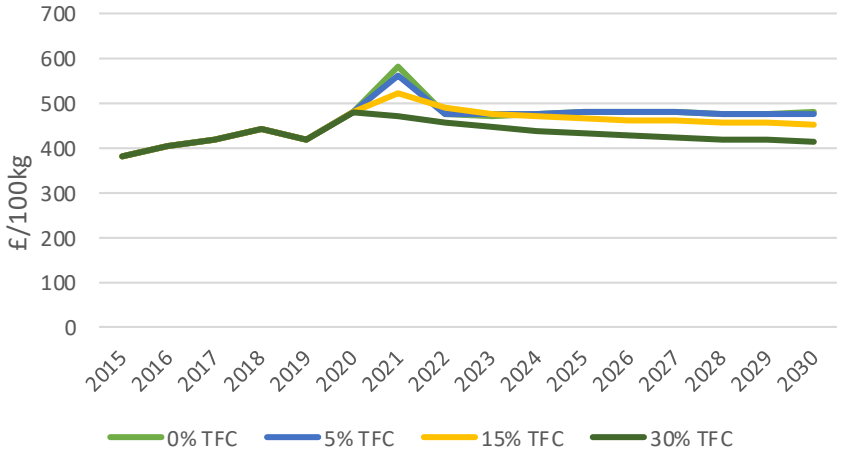


c. Total beef imports

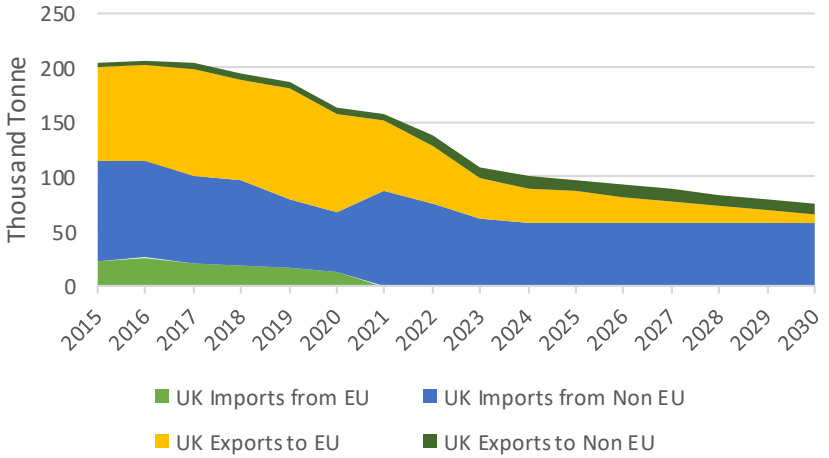


d. Total beef exports

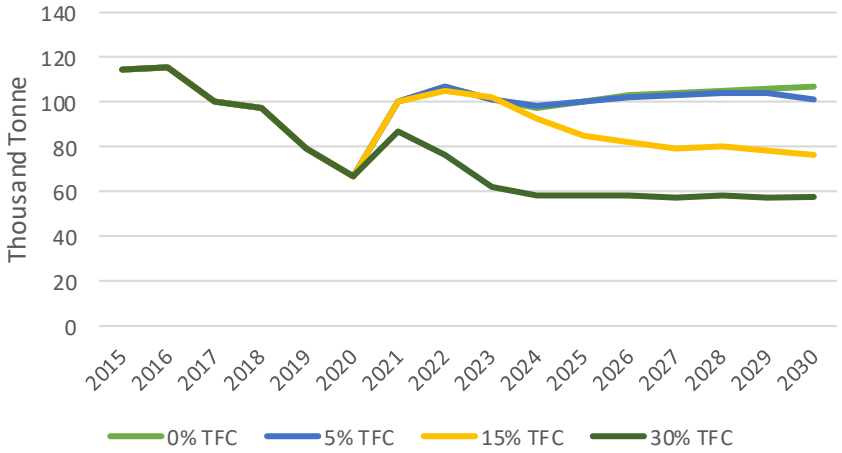
Figure 2 Sheepmeat price and trade changes under low, moderate and high Trade Facilitation Costs



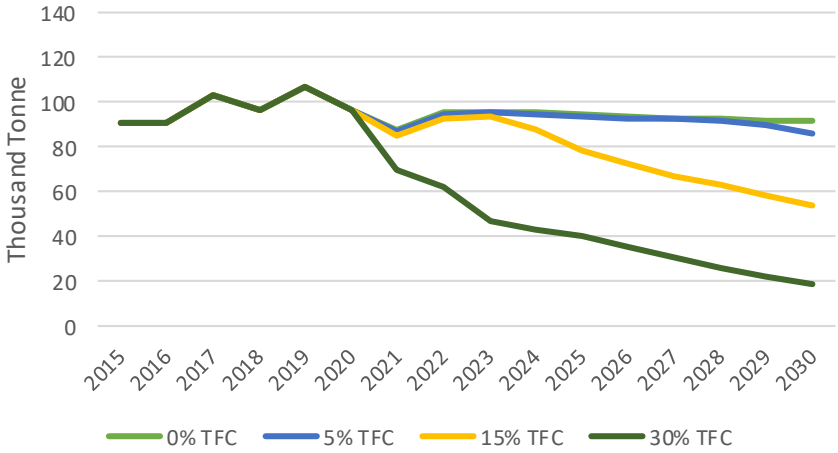
a. Sheepmeat price



b. Total UK trade flows by source and destination (High TFCs)

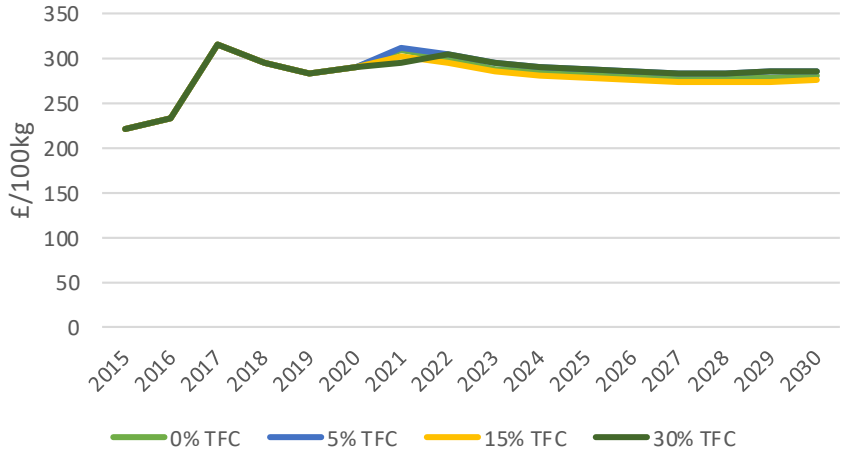


c. Total sheepmeat imports

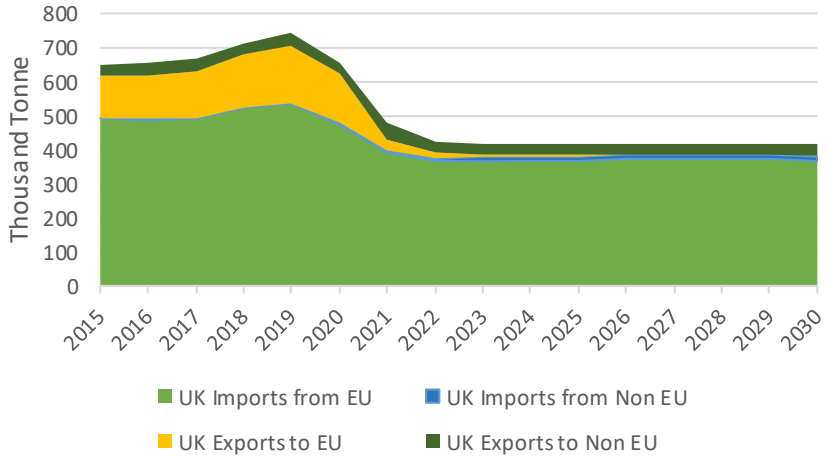


d. Total sheepmeat exports

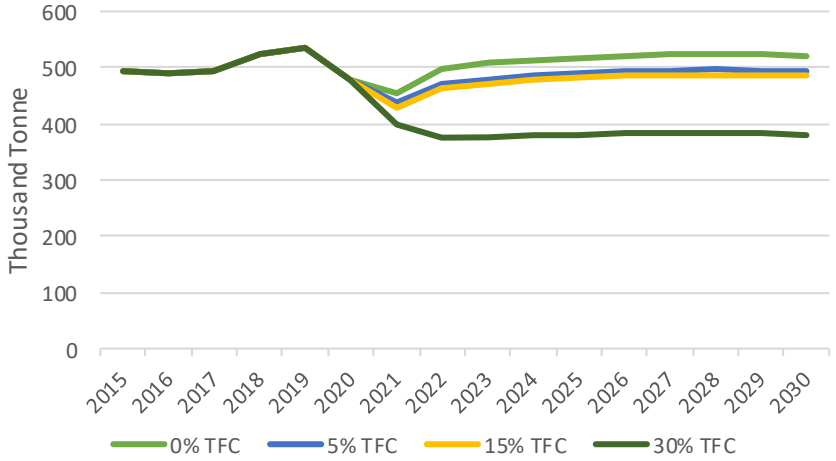
Figure 3 Cheese price and trade changes under low, moderate and high Trade Facilitation Costs



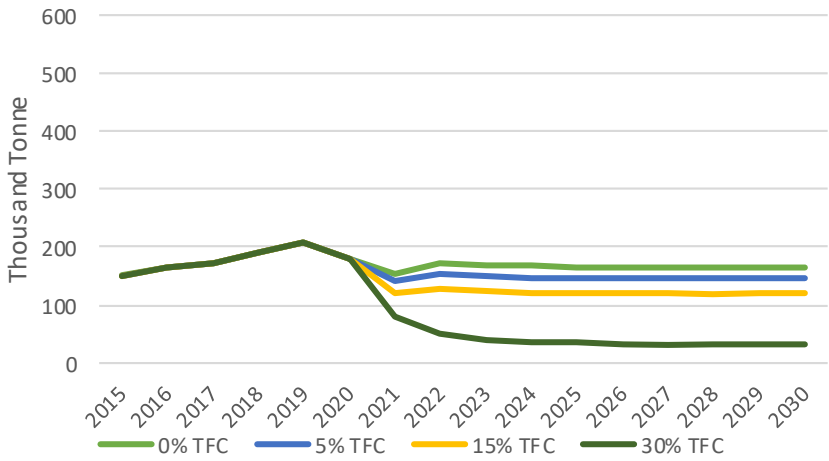
a. Cheese price



b. Total UK trade flows by source and destination (High TFCs)

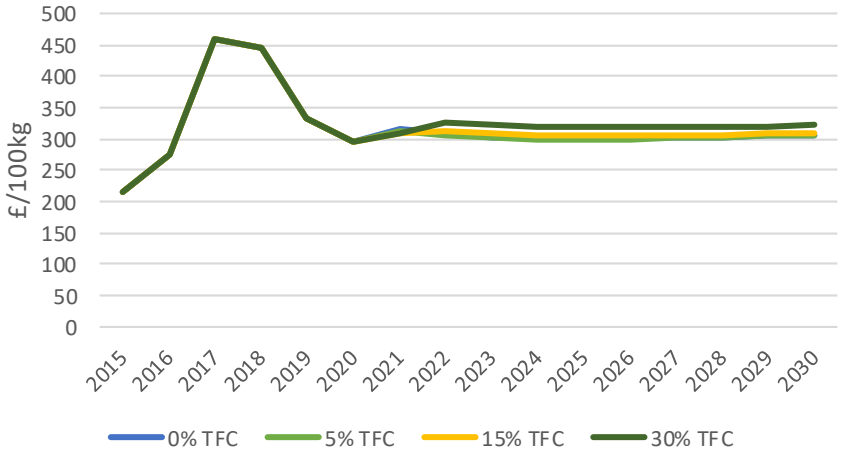


c. Total cheese imports

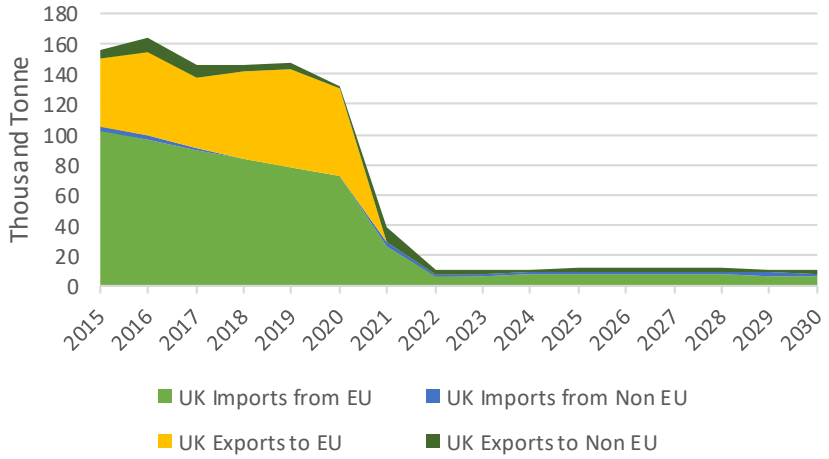


d. Total cheese exports

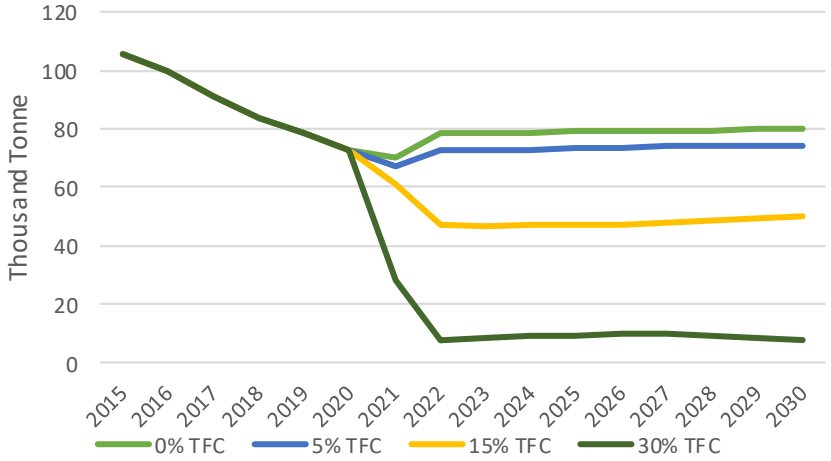
Figure 4 Butter price and trade changes under low, moderate and high Trade Facilitation Costs



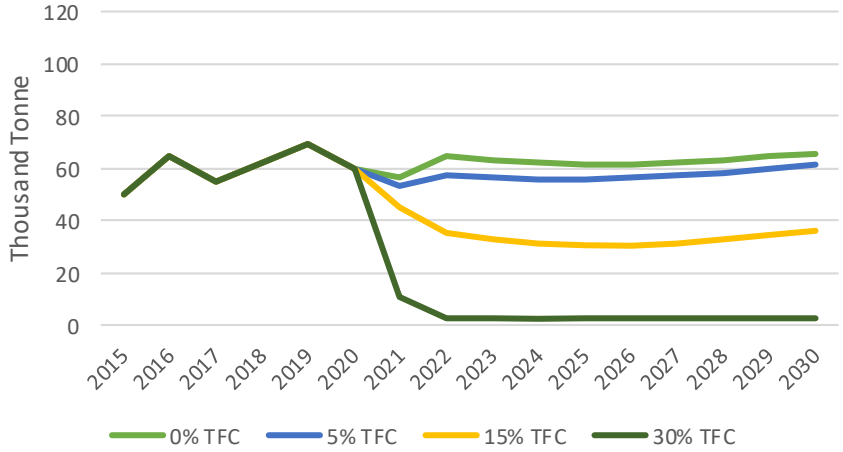
a. Butter price



b. Total UK trade flows by source and destination (High TFCs)



c. Total butter imports



d. Total butter exports

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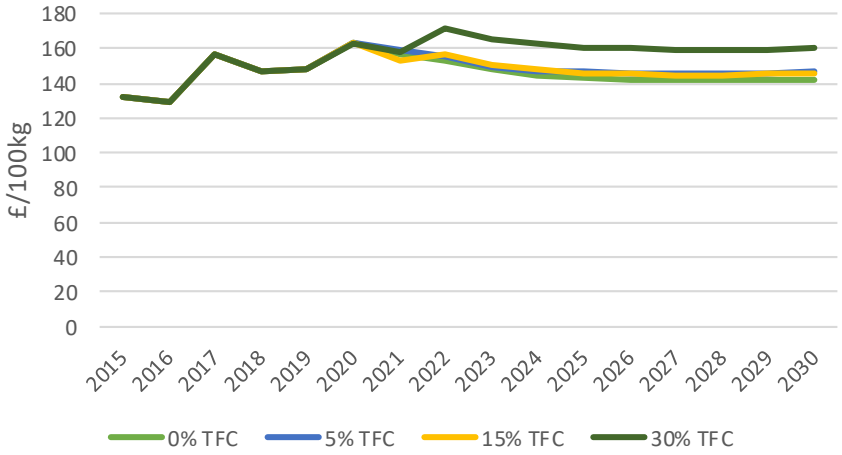
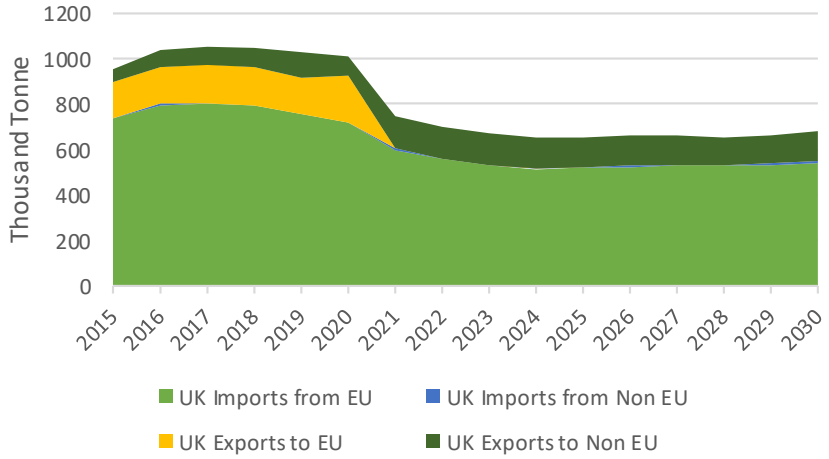
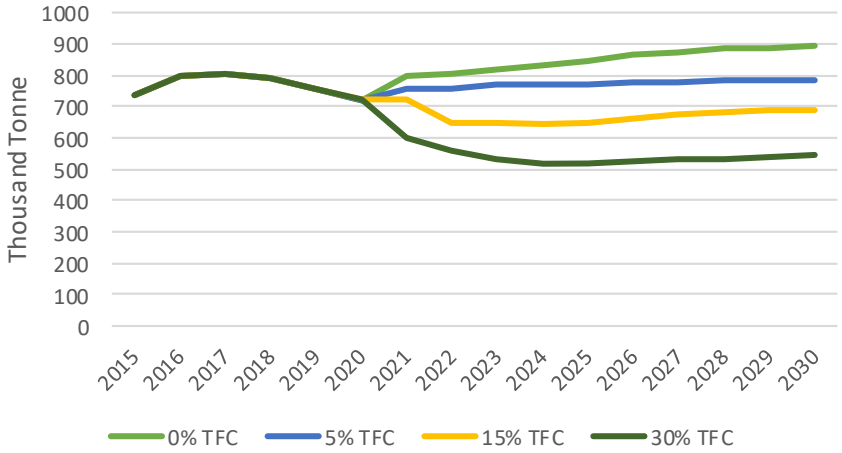
Figure 5 Pigmeat price and trade changes under low, moderate and high Trade Facilitation Costs



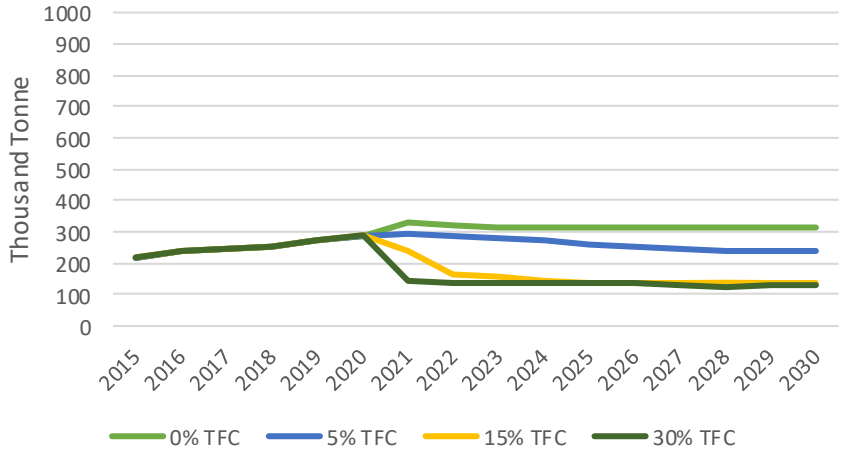
a. Pigmeat price



b. Total UK trade flows by source and destination (High TFCs)

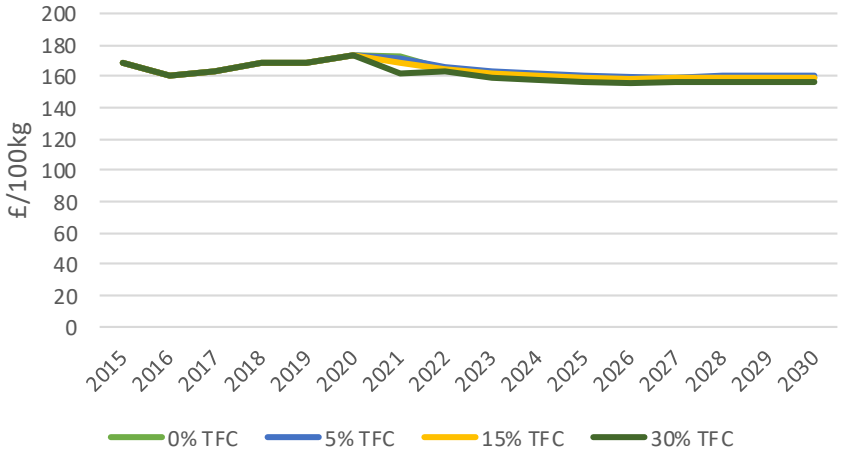


c. Total pigmeat imports

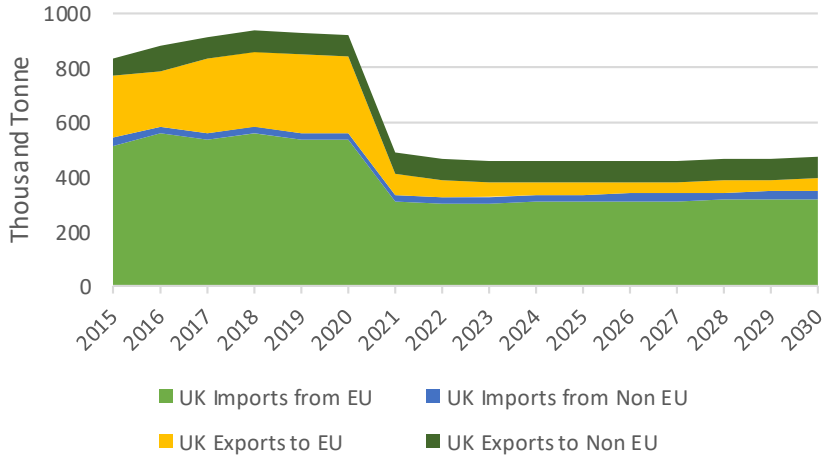


d. Total pigmeat exports

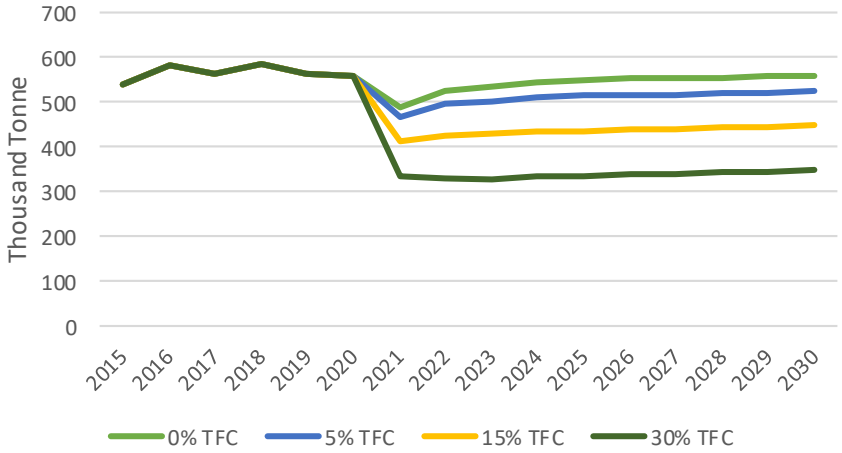
Figure 6 Poultrymeat price and trade changes under low, moderate and high Trade Facilitation Costs



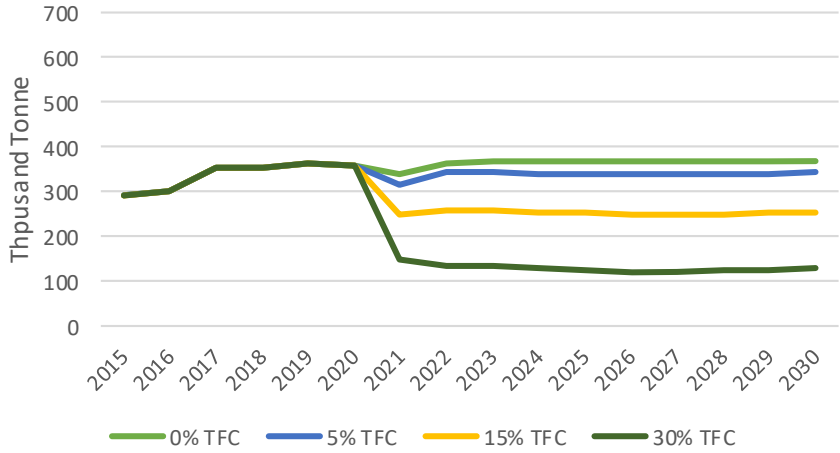
a. Poultrymeat price



b. Total UK trade flows by source and destination (High TFCs)



c. Total poultrymeat imports

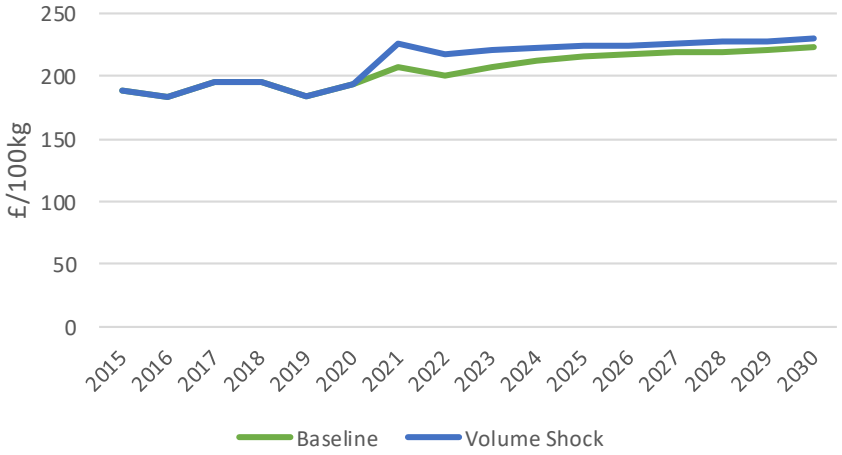


d. Total poultrymeat exports

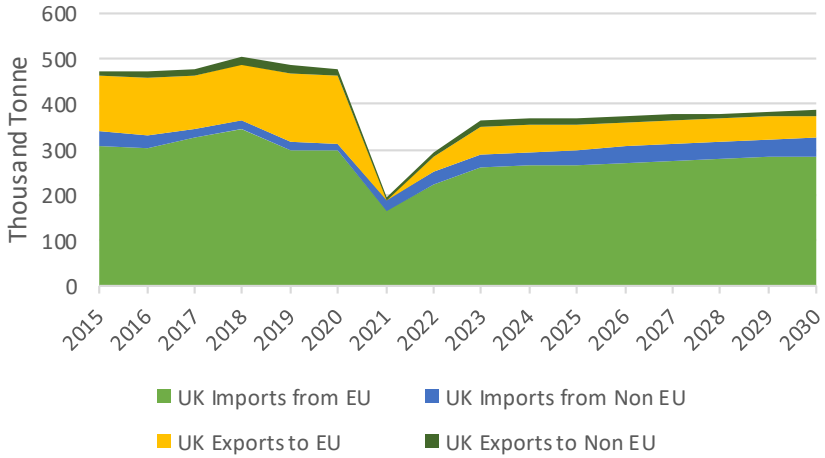
Table 3. Percent difference between No TFC and High TFC scenarios

Year	2021	2022	2023	2024-2030 (average)
Beef				
Total Suckler Cows	0.0%	0.1%	0.1%	-1.6%
Production	-0.3%	-0.1%	0.2%	0.2%
Domestic use	-0.1%	-0.3%	0.2%	1.5%
Net Exports	0.5%	-1.1%	0.3%	5.6%
Price	1.1%	1.3%	-0.7%	-4.9%
Sheep				
Total Sheep (1,000 head)	-0.7%	-1.5%	-2.2%	-5.1%
Production	0.9%	0.0%	-1.0%	-4.5%
Domestic use	1.3%	0.5%	0.8%	1.8%
Net Exports	10.0%	11.0%	108.9%	227.7%
Price	-9.0%	-3.8%	-5.5%	-11.2%
Butter				
Production	4.0%	3.6%	3.6%	3.4%
Domestic use	-1.9%	-1.6%	-1.7%	-1.6%
Net Exports	-86.8%	-71.9%	-66.4%	-60.7%
Farmgate price (En)	3.6%	2.6%	2.4%	2.5%
Price	6.2%	5.2%	5.7%	5.5%
Cheese				
Production	1.7%	0.9%	0.6%	0.7%
Domestic use	-0.8%	-0.3%	-0.3%	-0.3%
Net Exports	-4.9%	-2.0%	-1.5%	-1.7%
Price	4.9%	1.6%	1.7%	1.9%
Pigmeat				
Total Pigs	2.7%	7.5%	9.9%	12.1%
Production	1.2%	5.1%	8.5%	12.1%
Domestic use	-3.3%	-3.3%	-3.3%	-3.4%
Net Exports	-12.3%	-19.6%	-25.7%	-29.1%
Price	11.2%	11.2%	11.5%	12.2%
Poultry				
Production	0.9%	-0.2%	-0.8%	-1.2%
Domestic use	-0.4%	0.3%	0.3%	0.3%
Net Exports	-14.1%	1.1%	12.6%	16.4%
Price	3.1%	-2.2%	-1.9%	-1.9%

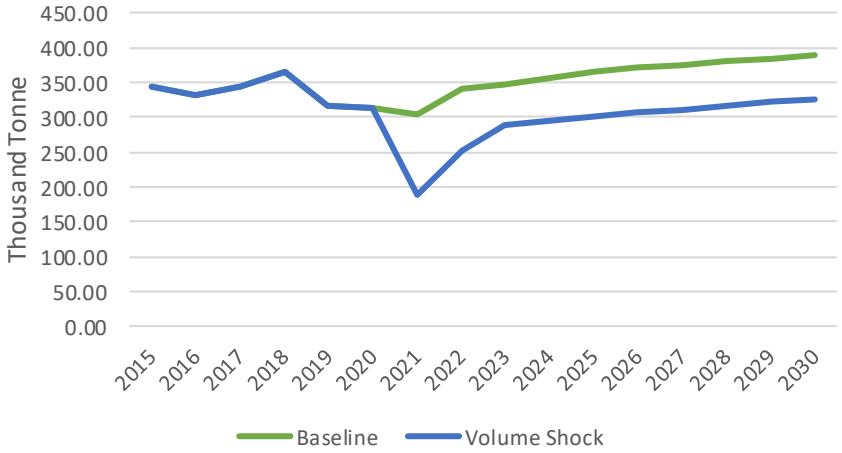
Figure 7 Impacts of a trade volume shock on beef price and trade



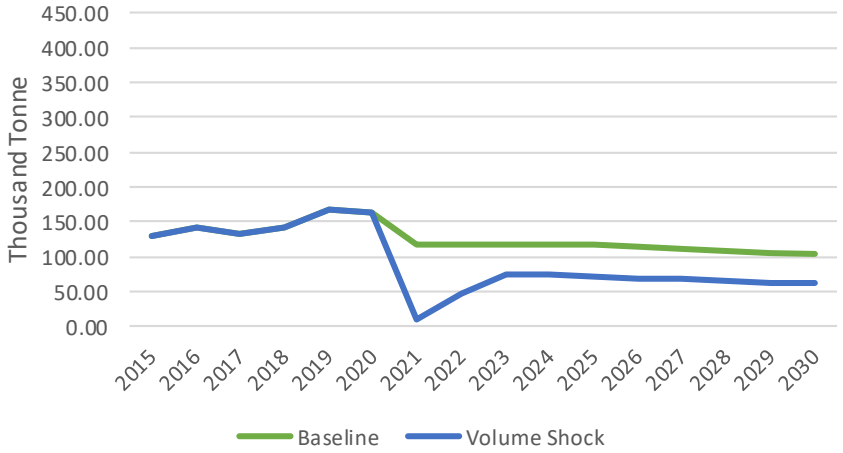
a. Beef price



b. UK beef trade flow by source and destination

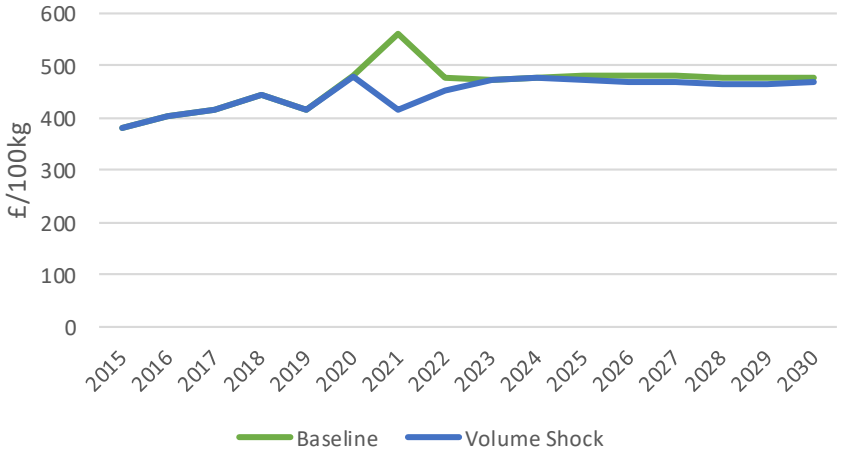


c. Total beef imports

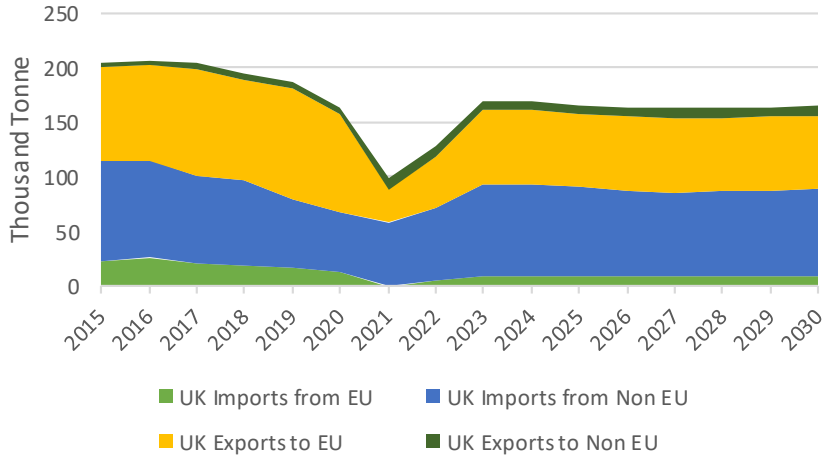


d. Total beef exports

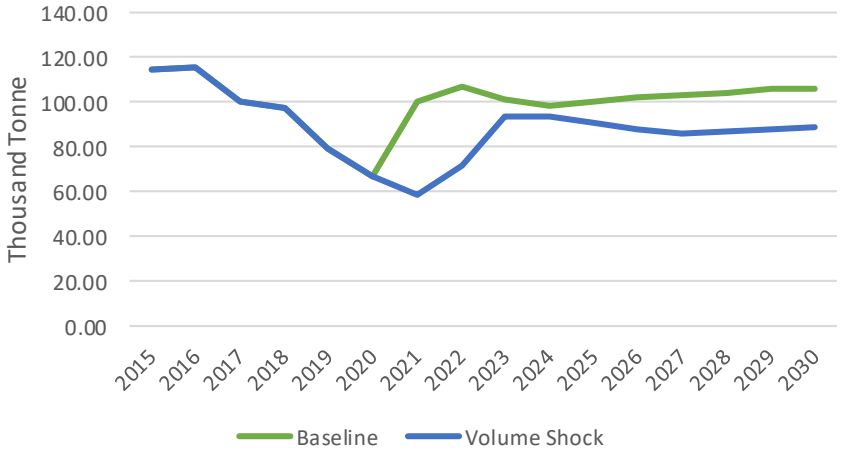
Figure 8 Impacts of a trade volume shock on sheepmeat price and trade



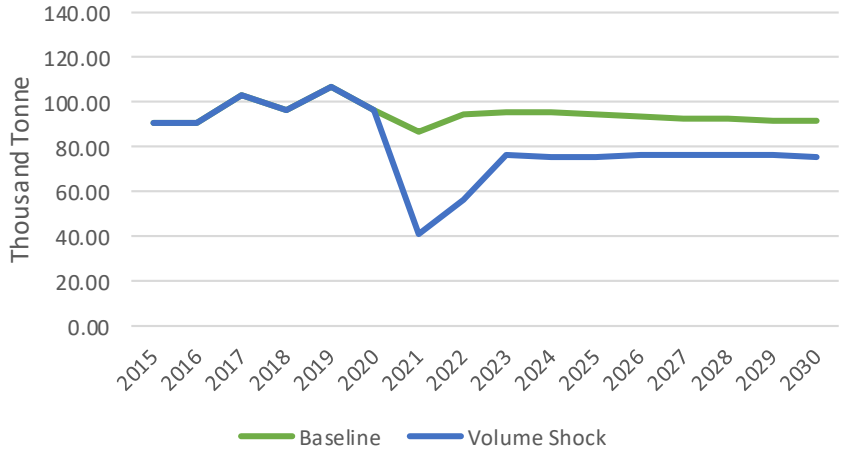
a. Sheepmeat price



b. UK sheepmeat trade flow by source and destination

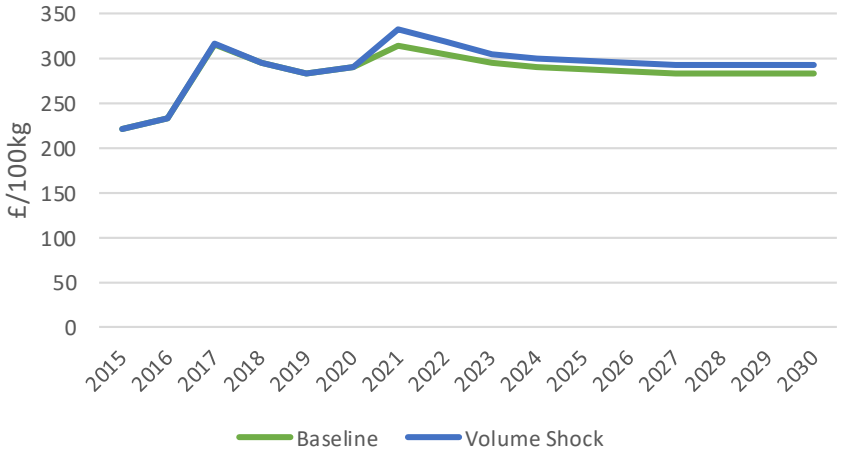


c. Total sheepmeat imports

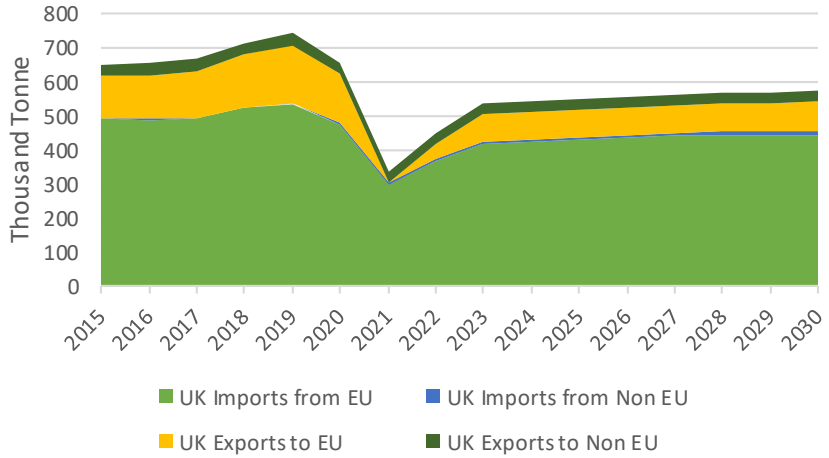


d. Total sheepmeat exports

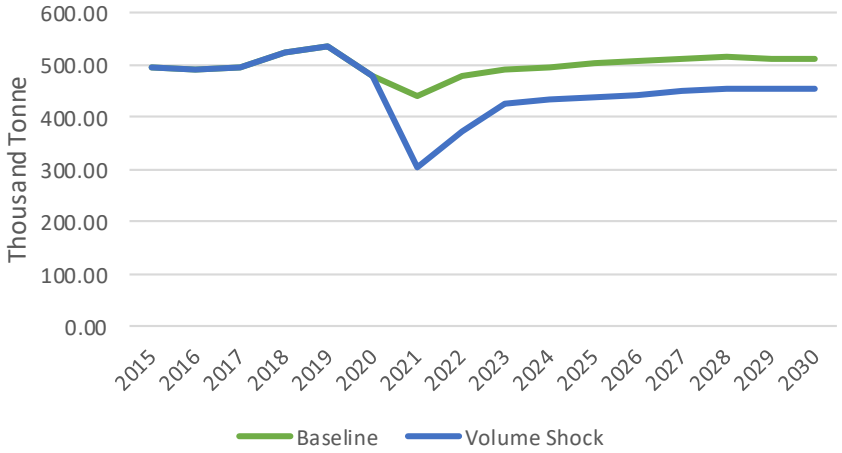
Figure 9 Impacts of a trade volume shock on cheese price and trade



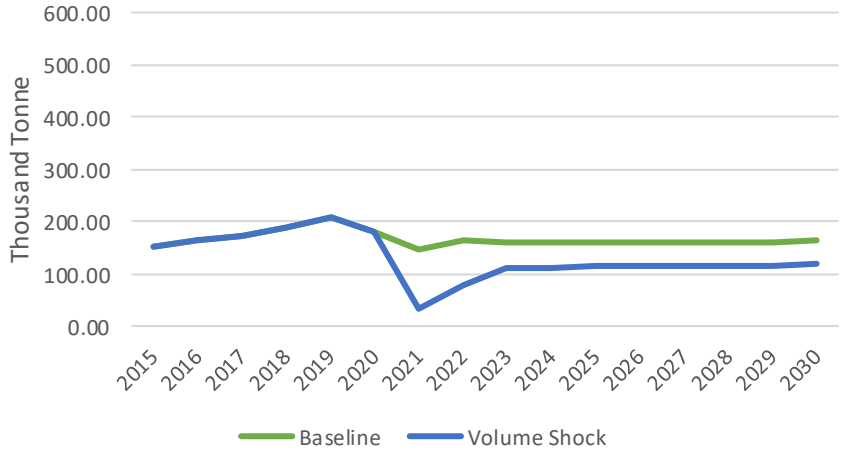
a. Cheese price



b. UK cheese trade flow by source and destination

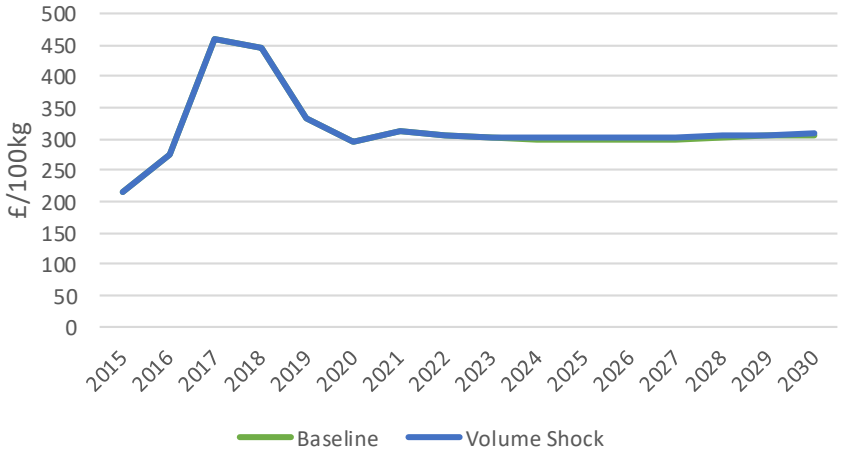


c. Total cheese imports

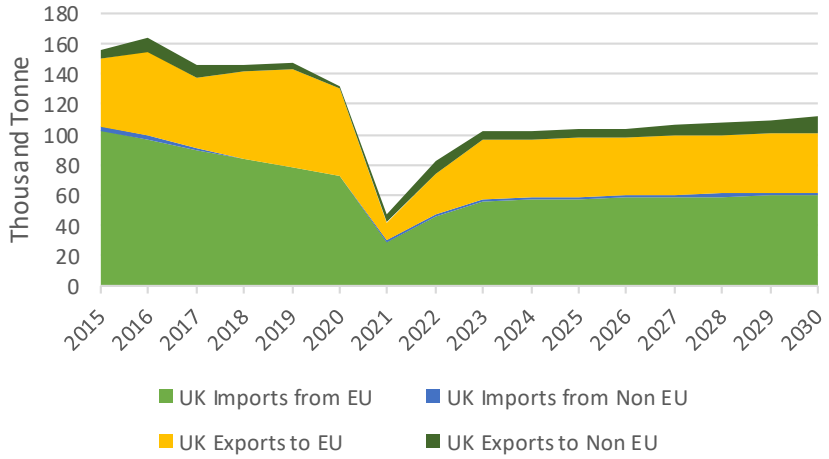


d. Total cheese exports

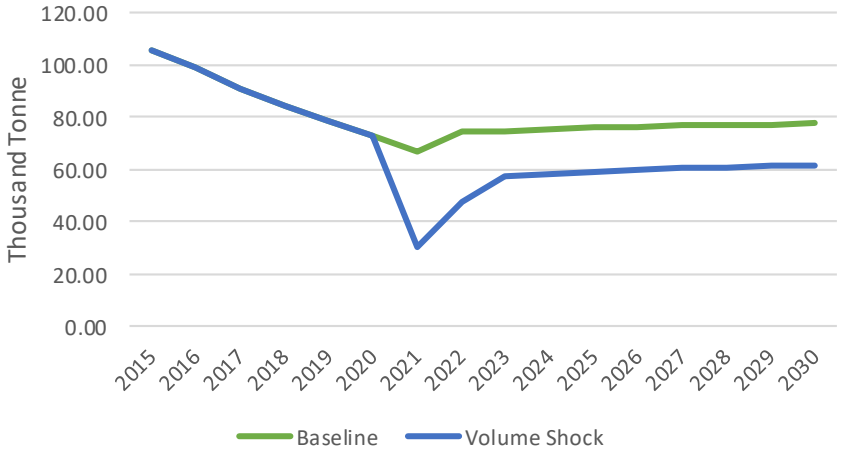
Figure 10 Impacts of a trade volume shock on butter price and trade



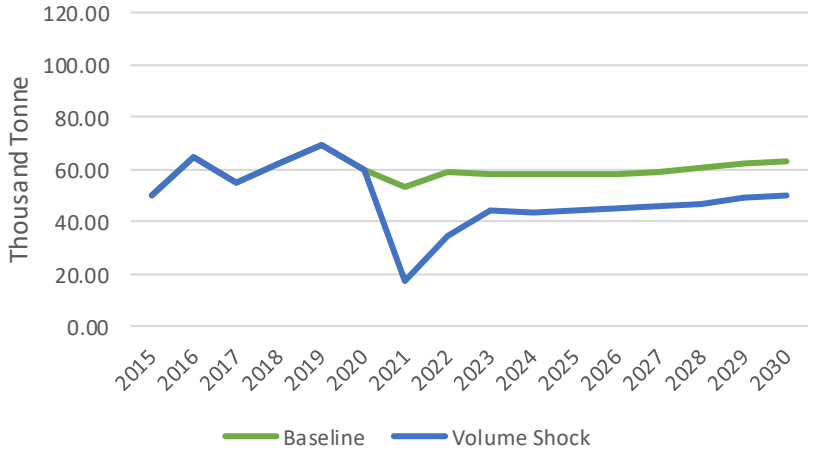
a. Butter price



b. UK butter trade flow by source and destination

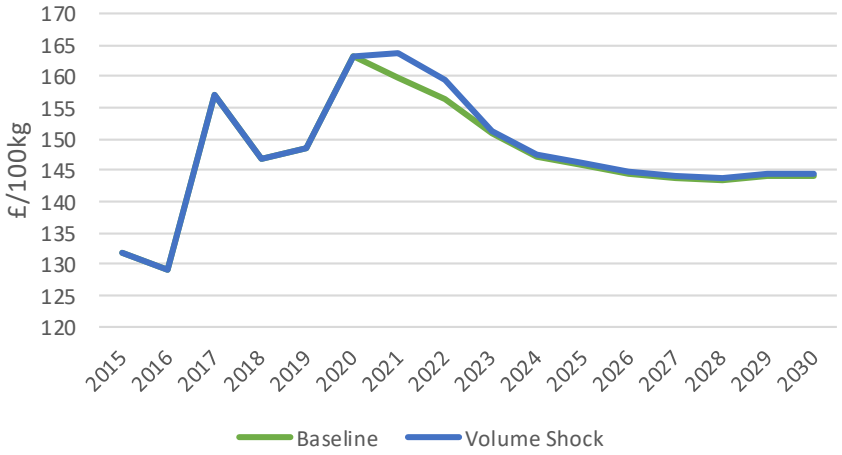


c. Total butter imports

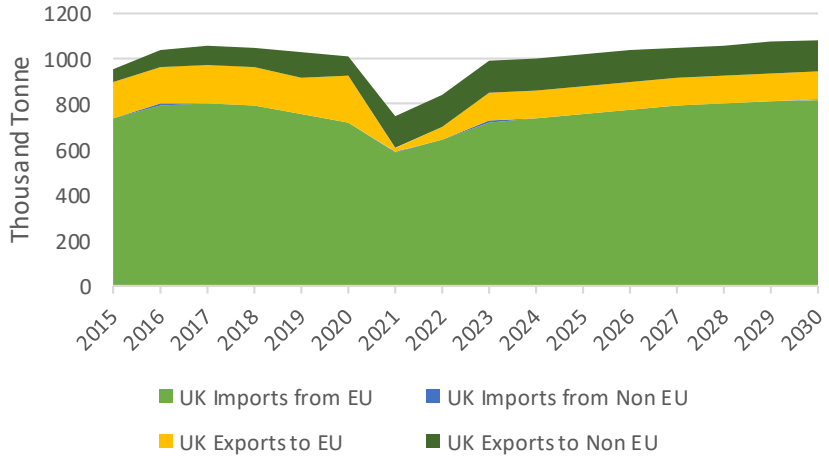


d. Total butter exports

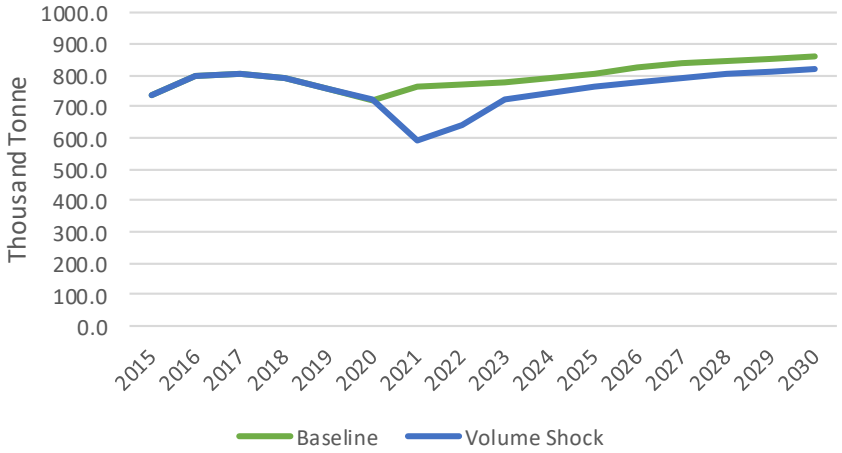
Figure 11 Impacts of a trade volume shock on pigmeat price and trade



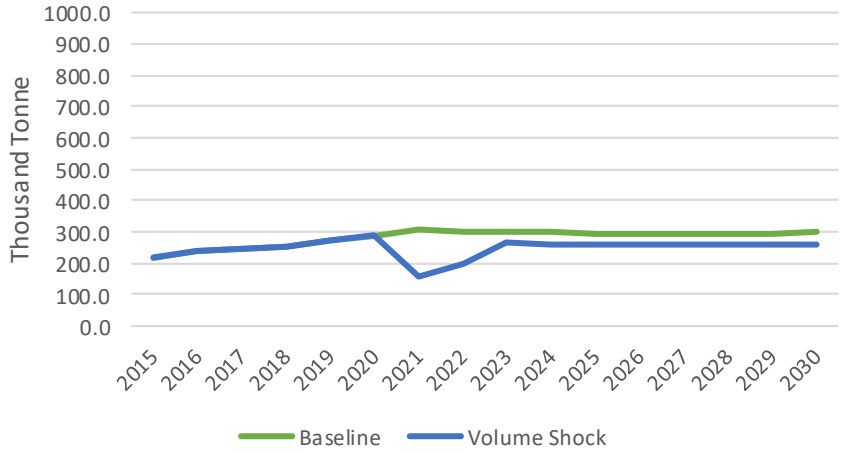
a. Pigmeat price



b. UK pigmeat trade flow by source and destination

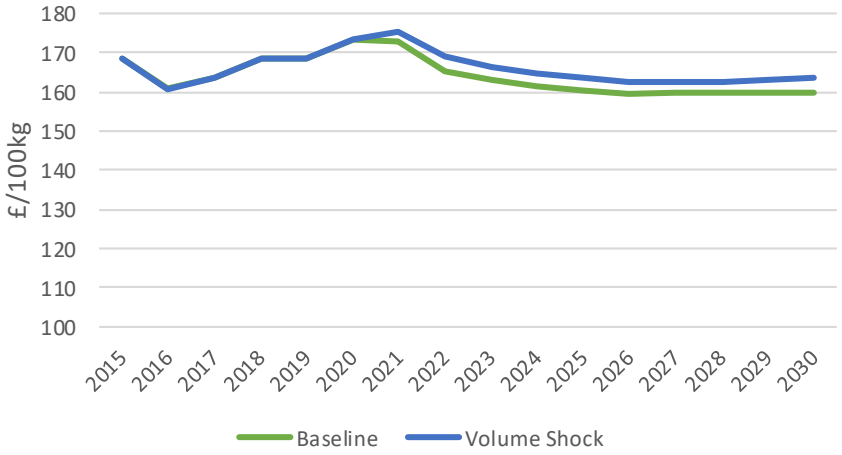


c. Total pigmeat imports

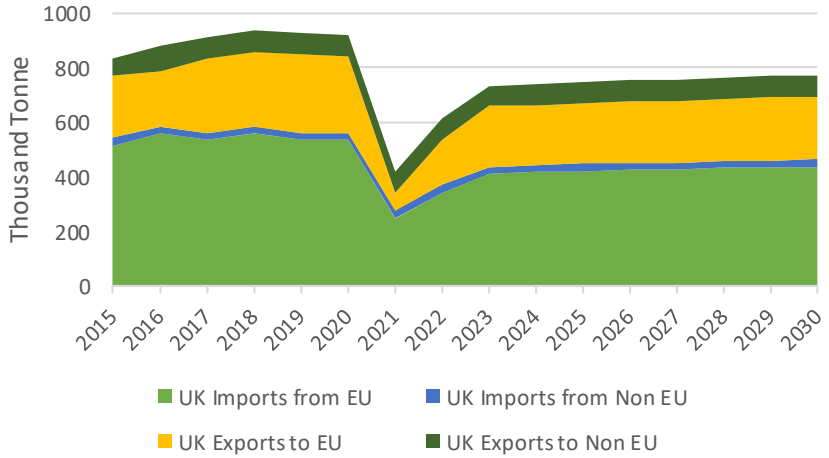


d. Total pigmeat exports

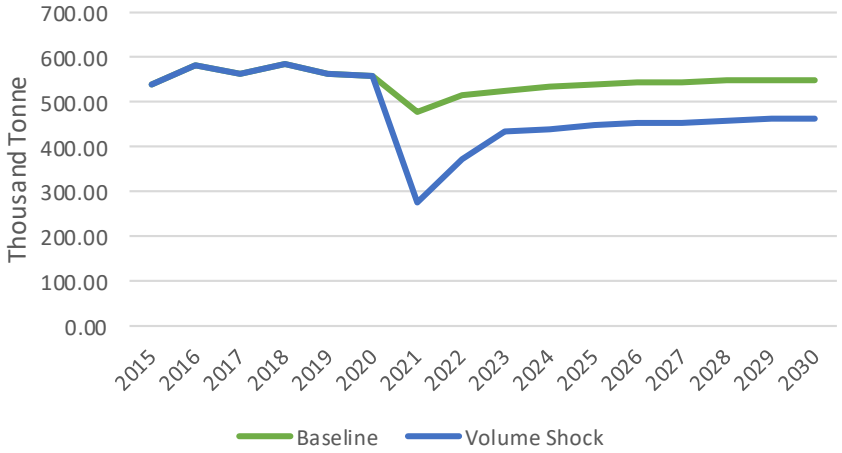
Figure 12 Impacts of a trade volume shock on poultrymeat price and trade



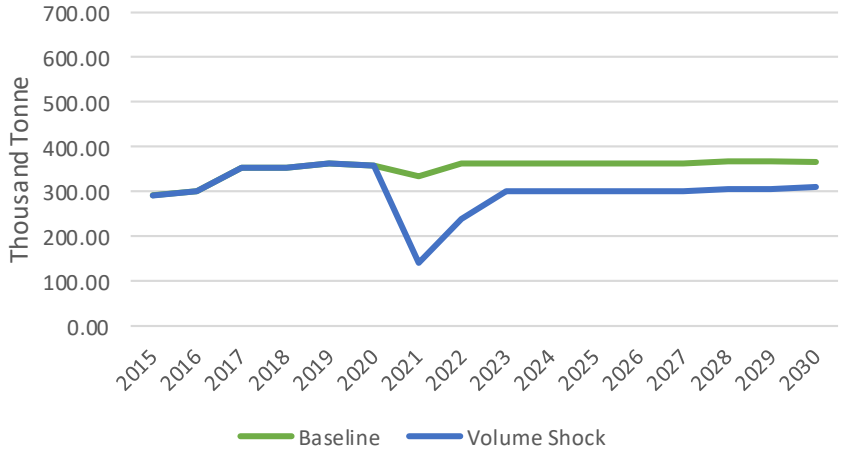
a. Poultrymeat price



b. UK poultrymeat trade flow by source and destination



c. Total poultrymeat imports



d. Total poultrymeat exports

Table 4. Percent difference between no trade volume shock and a volume shock

Year	2021	2022	2023	2024-2030 average
Beef				
Total Suckler Cows				
Production	-0.32%	-0.44%	-0.16%	1.20%
Domestic use	-1.12%	-1.84%	-1.58%	-0.81%
Net Exports	-4.98%	-7.44%	-7.03%	-7.37%
Price	8.87%	8.52%	6.78%	3.59%
Sheep				
Total Sheep (1,000 head)				
Production	2.35%	-0.77%	-4.16%	-0.76%
Domestic use	3.63%	0.34%	-0.21%	0.11%
Net Exports	30.12%	26.12%	182.39%	80.93%
Price	-25.75%	-4.87%	-0.36%	-1.80%
Butter				
Production	0.27%	0.99%	1.32%	1.23%
Domestic use	0.14%	-0.03%	-0.25%	-0.25%
Net Exports	-1.61%	-12.88%	-18.46%	-17.52%
Farmgate price (En)	-0.46%	0.08%	0.82%	0.80%
Price				
Cheese				
Production	-3.08%	-3.02%	-2.61%	-2.30%
Domestic use	0.92%	0.66%	0.57%	0.57%
Net Exports	-7.90%	-6.60%	-5.45%	-4.78%
Price	5.60%	4.06%	3.48%	3.46%
Pigmeat				
Total Pigs				
Production	0.26%	1.03%	1.40%	0.43%
Domestic use	-1.55%	-0.93%	-0.28%	-0.21%
Net Exports	-5.27%	-4.94%	-3.66%	-1.36%
Price	2.35%	1.97%	0.26%	0.28%
Poultry				
Production	0.37%	0.78%	0.98%	1.04%
Domestic use	-0.25%	-0.34%	-0.34%	-0.32%
Net Exports	-6.19%	-14.22%	-16.65%	-15.77%
Price	1.32%	2.19%	2.22%	2.05%