

## Extended Abstract

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<b>Paper/Poster Title</b>	<b>Can diet change meet climate targets? A trade story told with the UK Agricultural Market Model</b>
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<b>Abstract</b>	<i>200 words max</i>
<p>Ruminant livestock produce more than half of the UK's agricultural greenhouse gas emissions, leading the Climate Change Committee to call for diets to move away from meat and dairy. We run simulations in Defra's partial equilibrium model of the UK's agricultural economy to evaluate how diet change might affect UK herd sizes and associated greenhouse gas emissions. We also simulate carbon tax and tariff policy scenarios to compare how diet shifts would interact with a widely advocated policy measure. We find unilateral diet change in the UK alone more likely to provoke a decrease in imports (and potentially an increase in exports) than bring about a significant reduction in UK ruminant herds and associated UK territorial greenhouse gas emissions. Conversely, our simulations find a large carbon tax imposed on domestic farmers alone reducing territorial emissions significantly, but only by leading to higher imports (and associated emissions) from overseas as UK consumption remains inelastic. Our modelling indicates that meeting the UK's agricultural greenhouse gas mitigation goals requires holistic action on the consumption and production side of the economy, with the UK facing unintended consequences in its agri-food trade balance if its climate ambition is not in harmony with its trade policy.</p>	
<b>Keywords</b>	Diet, climate change, greenhouse gas
<b>JEL Code</b>	Agriculture Q1, Environmental economics Q5, Trade and Environment F18 see: <a href="http://www.aeaweb.org/jel/guide/jel.php?class=Q">www.aeaweb.org/jel/guide/jel.php?class=Q</a> )
<b>Introduction</b>	<i>100 – 250 words</i>
<p>As other sectors in the UK make strides to reduce greenhouse gas emissions, agriculture occupies a small but persistent proportion of the UK's carbon budget and will become one of the UK's biggest emitters if trends continue. Ruminant livestock makes up more than half of the UK's greenhouse gas emissions from agriculture giving rise to Climate Change Committee's call for consumer diets to move away from meat and dairy in order that agriculture in the UK contributes to Net Zero. We have sought to evaluate how much diets would have to move away from meat and dairy to have a significant impact on UK herd sizes and thus greenhouse gas emissions over the next decade, in the presence of the UK's continued trading relationship with its major partners.</p>	

<b>Methodology</b>	<i>100 – 250 words</i>
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We simulated a series of hypothetical policy scenarios in Defra’s partial equilibrium model of the UK’s agricultural market – the UK Agricultural Market Model (UKAMM) – to evaluate how cultural diet change might reduce greenhouse gas emissions from UK agriculture. We also simulated carbon tax and tariff policy scenarios to compare the combined effects of cultural shifts with a policy measure advocated by many economists.

UKAMM is a dynamic recursive partial equilibrium model, that simulates the aggregate UK market for most of the major agricultural commodities produced and consumed in the UK. The model includes detailed representations of the livestock and arable sectors, including their interrelationships. UKAMM also includes an endogenous modelling of import demand and export supply, given global conditions provided by the OECD-FAO’s Agricultural Outlook. We used UKAMM to simulate the market in yearly increments to 2030.

We simulated the impact of hypothetical 10%, 20%, 25% and 50% reductions in per capita meat and cheese consumption, implemented gradually between 2021 and 2030. To consider policy interaction, we levied a range of carbon taxes on UK producers in the model, followed by equivalent carbon tariffs on imports. Both taxes and tariffs were based on carbon intensities implied by the UK’s greenhouse gas inventory and BEIS carbon price guidelines. We also considered interactions between these scenarios, evaluating the combined and separate effects on UK market conditions.

<b>Results</b>	<i>100 – 250 words</i>
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We find that unilateral diet change in the UK alone is more likely to provoke an adjustment in the trade balance than bring about a significant reduction in UK ruminant herd sizes and associated UK territorial greenhouse gas emissions. UK beef and sheepmeat supply is relatively inelastic to changes in prices, in contrast to beef and sheepmeat import volumes and export demand which are relatively elastic. This means that these significant sources of emissions would be slow to fall in response to lower demand without changes in farming practices and industry reform. Our modelling finds adjustment more likely to happen in the UK’s trade balance, with more imports from overseas and more UK products exported. Further analysis is required to determine the exact greenhouse gas implications of this. Conversely, we demonstrate that a large carbon tax imposed on domestic farmers would reduce territorial emissions significantly, at the cost of much higher imports leading to carbon leakage and almost no reduction in the UK’s offshore greenhouse gas footprint associated with animal product consumption. We found that imposing a carbon tariff on imports may mitigate carbon leakage but at the cost of increasing consumer prices. Were diet change to occur in tandem with carbon taxes, our modelling suggests the combined measures could lead to unambiguous reductions in territorial ruminant herd sizes and greenhouse gas emissions without significant increases in

consumer prices, and without increases in demand for high-carbon imports from overseas.

**Discussion and Conclusion**

*100 – 250 words*

Our modelling demonstrates that significant reductions in UK agriculture’s greenhouse gas footprint require holistic action on both the consumer and producer side of the economy. The UK, as an open economy and one of the world’s biggest food importers, may face unintended consequences in its agri-food trade balance if its policy approach to reducing emissions from agriculture does not act in full consideration of its trade regime. Recent modelling by the OECD has demonstrated that a reduction in global meat consumption would be effective at reducing greenhouse gas emissions from global agriculture. Our modelling contributes to this conclusion by demonstrating the importance of global cooperation and trade policy in this transmission mechanism.

Our modelling also highlights moral hazard issues. Significant territorial emissions savings could be achieved by offshoring emissions through domestic-only carbon taxes, meeting targets enshrined in the UK’s Climate Change Act without making an unambiguous contribution to reducing global emissions. This approach may allow high-importing states to appear to take strong action while relying on other high-exporting states, who do not maintain similar climate commitments, for cheaper high-polluting production. Carbon offshoring in this manner can be prevented by trade policy, but governments may not be willing to sustain trade measures if consumer prices increase and territorial emissions do not fall by as much as a full offshoring policy would deliver. Shifts in consumer diets would help to ensure domestic mitigation measures deliver both territorial and global emissions savings without the same moral hazard challenges.