Carbon Taxes on Animal Products in the United States – *Emissions, Revenue, and Consumer Welfare*

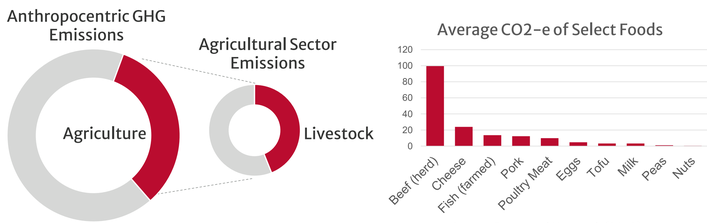
Beatrice Robson and Chen Zhen
Department of Agricultural & Applied Economics, The University of Georgia

Research Question

What is the mitigation and revenue potential of a Pigouvian emissions tax applied to animal-derived foods in the United States? How might this impact consumer welfare?

Animal Agriculture and GHG Emissions

- The FAO finds livestock produce 14.5% of global anthropocentric GHG emissions, about 65% of which comes from cattle.
- Rapid shifting toward plant-based diets is a key UN-backed strategy for limiting warming to 1.5°C .
- North Americans are among the highest in per capita meat consumption in the world.
- Implementation of an emissions tax on animal product emissions is one possible tool to reduce demand.



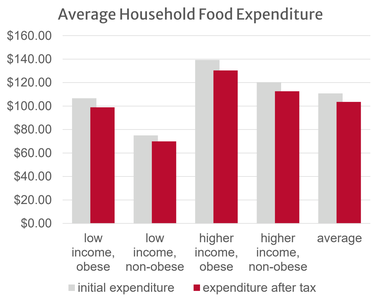
Source: UN FAO (2013) *Source: Poore and Nemecek (2018)*

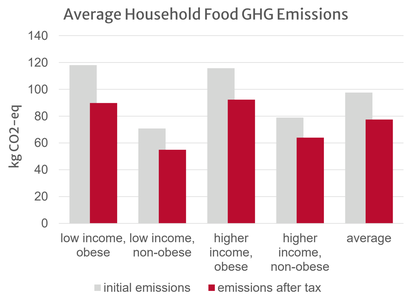
Data and Methodology

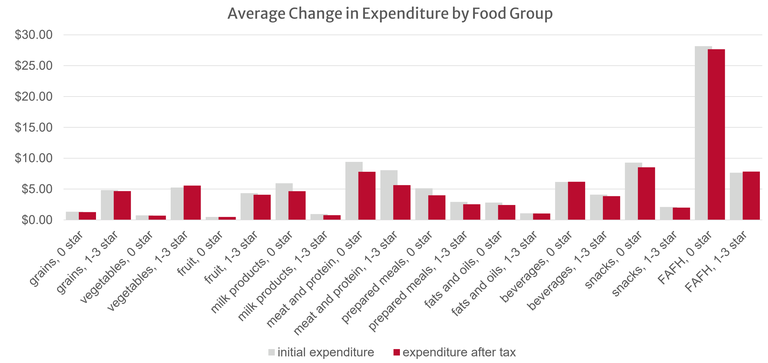
GHG footprints for animal foods from Poore & Nemecek (2018) were supplemented with other sources and combined with the US Social Cost of Carbon estimate of $51 to determine the tax rate for beef, dairy, pork, poultry, eggs, fish, and mutton.

Scanner data and nutritional content are sourced from the nationally representative USDA Food Acquisition and Purchase Survey (N=4724 households). Taxes are applied using embedded nutritional information to determine ingredients of each product.

Changes in demand after taxation are modeled using own- and cross-price elasticities estimated via the EASI demand system implemented by Zhen et al. (2023). Consumer welfare is studied with attention to overall expenditure and diet quality leveraging Guiding Stars nutrition ratings.







Guiding Stars Classification	Household Group: low income, obese	low income, non-obese	higher income, obese	higher income, non-obese
grains, 0 star	-11%	-1%	-9%	0%
grains, 1-3 star	-5%	0%	-6%	-1%
vegetables, 0 star	-4%	-12%	1%	-9%
vegetables, 1-3 star	10%	14%	0%	7%
fruit, 0 star	2%	9%	-6%	2%
fruit, 1-3 star	-6%	-5%	-7%	-5%
milk products, 0 star	-29%	-28%	-18%	-20%
milk products, 1-3 star	-35%	-13%	-27%	-10%
meat and protein, 0 star	-21%	-17%	-18%	-14%
meat and protein, 1-3 star	-30%	-27%	-32%	-29%
prepared meals, 0 star	-22%	-23%	-22%	-23%
prepared meals, 1-3 star	-14%	-17%	-10%	-14%
fats and oils, 0 star	-17%	-7%	-20%	-10%
fats and oils, 1-3 star	-3%	-2%	-3%	-3%
beverages, 0 star	-1%	8%	-6%	4%
beverages, 1-3 star	-9%	-3%	-9%	-4%
snacks, 0 star	-3%	-3%	-11%	-9%
snacks, 1-3 star	2%	-5%	-2%	-9%
FAFH, 0 star	-3%	-9%	3%	-4%
FAFH, 1-3 star	-3%	3%	0%	5%

Changes in quantity of goods purchased, stratified by household type and Guiding Stars nutritional rating.

Results

- The average increase in price for milk and meat products were 12% and 13%, respectively.
- Demand changes for food groups were heterogeneous between households.
  - Obese households showed greater overall price sensitivity.
  - Vegetables with positive Guiding Stars ratings saw the most consistent increase in demand and expenditure.
- Average predicted reduction in food purchase GHG emissions was 19%.
- Consumers spend more on unhealthy (0 stars) meat than healthier (1-3 stars) meats, but are more sensitive to price increases in healthier meats.
- Average tax payment per household-week was lowest for low-income non-obese households at $3.33, and highest for low-income obese households at $5.55.
- The tax shows potential to reduce American dietary GHG emissions by up to 24% while simultaneously increasing consumption of vegetables.

Discussion

- This study's novel contributions include use of US nationally representative food purchase data, and application of the Biden Administration's estimate for GHG emission damages.
- Food carbon taxes reducing GHGs while improving the healthfulness of diets is consistent with previous studies.
- Efficacy can be increased with synergistic measures like consumer education, green labeling, and targeted subsidies.
- Revenue distribution may help offset observed regressivity .
- The UNEP and UNDP found ~87% of agricultural subsidies distort the market or are environmentally harmful, revealing more direct avenues to address food system externalities.

Citations

Poore J, Nemecek T. Reducing food's environmental impacts through producers and consumers. *Science*. 2018 Jun 1;360(6392):987–992. doi: 10.1126/science.aaq0216. Erratum in: Science. 2019 Feb 22;363(6429): PMID: 29853680.

Zhen, C., Y. Chen, B-H. Lin, S. Karns, L. Mancino, and M. Ver Ploeg. 2023. Do Obese and Nonobese Consumers Respond Differently to Price Changes? Implications of Preference Heterogeneity for Obesity-Oriented Food Taxes and Subsidies. *American Journal of Agricultural Economics*, Forthcoming.

Gephart, J.A., Henriksson, P.J.G., Parker, R.W.R. et al. Environmental performance of blue foods. *Nature* 597, 360–365 (2021). https://doi.org/10.1038/s41586-021-03889-2

Contact: Beatrice Robson, University of Georgia. **email:** beatrice.robson@uga.edu

Carbon Taxes on Animal Products in the United States – Emissions, Revenue, and Consumer Welfare

Beatrice Robson, The University of Georgia, Beatrice.robson@uga.edu
Chen Zhen, The University of Georgia

Selected Paper prepared for presentation at the 2023 Agricultural & Applied Economics Association Annual Meeting, Washington DC; July 23-25, 2023