The health co-benefits of a global greenhouse-gas tax on food

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Abstract

The food sector is responsible for about a quarter of all greenhouse-gas (GHG) emissions, and significant changes in food production and patterns of food consumption are required in order for the food sector to make its pro rata contribution to climate change mitigation. At the same time, imbalanced diets, such as diets high in red and processed meat and low in fruits and vegetables are responsible for the greatest health burden globally and in most regions.

Policy instruments that change the relative price of goods are among the most effective ways of influencing economic behaviour. Here we analyse the potential environmental and health impacts of a global GHG tax on foods levied at the point of purchase. For that purpose, we built a modelling framework consisting of agriculture, environmental, economic, and health aspects. In the framework, we used data from a global agriculture-economic model, the International Model for Policy Analysis of Agricultural Commodities and Trade, together with food-specific emissions data, and a global health model.

Using the model framework, we find that levying GHG taxes on food commodities in 2020 could reduce food-related GHG emissions by 6%, generate tax revenues of USD 482 billion per year, and lead to 189,000 avoided deaths globally. However, special policy attention is needed in low-income countries (and possibly for low-income segments in other countries) to avert potential health losses associated with increased levels of underweight (and reduced consumption of fruits and vegetables). Tax policies sparing health-critical food groups, and policies aimed at compensating income losses associated with tax-related price increases are potential policy options that could help to avert negative health impacts for exposed populations, whilst incentivising the food sector to make its pro rata contribution to climate change mitigation.

Introduction

The food sector is responsible for about a quarter of all greenhouse-gas (GHG) emissions, about 80% of which is associated with livestock production.[1–3] Significant changes in food production and patterns of food consumption are required in order for the food sector to make its pro rata contribution to climate change mitigation.[4] Policy instruments that change the relative price of goods are among the most effective ways of influencing economic behaviour.[5]

Here we analyse the potential impacts of levying GHG taxes on foods at the point of purchase. In addition to assessing the environmental impacts that a global GHG tax could have on food-related GHG emissions, we also investigate the health co-benefits that could be associated with changes in food consumption. Risk factors associated with dietary composition and excess consumption, such as high consumption of red and processed meat, low consumption of fruits and vegetables, and high body weight are among the greatest contributors to premature mortality.[6,7] Our study offers the first assessment of a global GHG tax on food commodities that integrates the environmental and health dimensions of dietary change.

Methods

We used a coupled modelling framework that represents agricultural, economic, environmental, and health aspects of the food system to analyse the environmental and health impacts of a global GHG tax on food commodities. In our agricultural analysis, we used the IMPACT global-agricultural model to project future food consumption for 62 agricultural commodities in 159 world regions.[8] Our model scenarios focus on the year 2020, the year in which a new global climate agreement is to be ratified.

In our economic analysis, we estimated the impacts that a GHG tax on food commodities could have on food consumption by using international data on commodity prices and regionally comparable estimates of demand elasticities. Both price and elasticity data were adopted from IMPACT. The IMPACT demand elasticities are originally based on elasticities estimated by the USDA,[9] and adjusted to represent a synthesis of average, aggregate elasticities for each region, given the income level and distribution of urban and rural population.[8] Own-price elasticities have been calibrated to a region-specific meta-analysis on the impacts of changes in food prices on food consumption.[10] Over time the elasticities are adjusted to accommodate the gradual shift in demand from staples to high value commodities like meat, especially in developing countries.

Price data were based on the OECD AMAD database of commodity prices,[11] adjusted for the effect of trade policy represented by taxes and tariffs, price policies expressed in terms of producer support estimates (PSE), consumer support estimates (CSE), and the cost of moving products from one market to another represented by marketing margins (MM). Export taxes and import tariffs are drawn from GTAP data (Global Trade Analysis Project at Purdue University) and reflect trade policies at the national level.[12–14] PSEs and CSEs represent public policies to support production and consumption by creating wedges between world and domestic prices. PSEs and CSEs are based on OECD estimates and are adjusted by expert judgment to reflect regional trade dynamics.[15] Marketing margins (MM) reflects other factors such as transport and marketing costs of getting goods to various markets and are based on expert opinion on the quality and availability of transportation, communication, and market infrastructure. We adopted the data on consumer prices for our consumption-based policy analysis.

For calculating levels of GHG taxes that would internalize the climate-change-related costs of food consumption we used commodity-specific emissions factors (to estimate food-related GHG emissions) and estimates of the social cost of carbon (to estimate the tax levels). We adopted the emissions factors from a meta-analysis of life-cycle analyses (LCAs) which estimated the ‘cradle to farm gate’ emissions of different food items.[16] The system boundaries of those LCAs included emissions from pre-farm activities, such as fertilizer and feed production, as well as infrastructure construction, but excluded emissions from land-use change and post-farm-gate activities, such as processing, packaging, and transportation to the household. We adopted the emissions factors for 17 food commodities (ruminant meat, pork, poultry, dairy, eggs, vegetable oils, oil crops, sugar, vegetables, temperature fruits, tropical fruits, wheat, maize, rice, other grains, legumes, roots). We did not account for GHG emissions related to the consumption of fish and seafood, because those food groups are not resolved in the projections of food demand used in this study.[8]

We adopted estimates of the social cost of carbon (SCC) from a comprehensive model comparison of integrated assessment models.[17,18] In our main scenarios, we adopted a SCC value for 2020 of 52 USD/tCO2-eq, and we investigated the impacts of using several alternative values (14, 78, and 156 USD/tCO2-eq) in a sensitivity analysis. All monetary data were converted to 2010-USD by using changes in the consumer price index by region with data adopted from the International Monetary Fund (IMF).

In our health analysis, we used a global comparative risk assessment framework with five disease states and six dietary and weight-related risk factors. The disease states included coronary heart disease (CHD), stroke, type 2 diabetes (T2DM), cancer (which is an aggregate of site-specific cancers), and an aggregate for all other causes. The dietary risk factors included fruit and vegetable consumption and red meat consumption which, together, accounted for more than half of all deaths that were attributable to diet-related risks in 2010.[6] The weight-related risk factors corresponded to the four weight classes of underweight (body mass index (BMI)<18·5), normal weight (18·5<BMI<25), overweight (25<BMI<30), and obesity (BMI>30). We used the scenario estimates of total energy intake to estimate changes in body weight based on historical relationships between those weight categories and caloric availability, and we adjusted the commodity-specific food availability used in the health analysis for waste at the consumption level using international estimates.[19]

We estimated the mortality and disease burden attributable to dietary and weight-related risk factors by calculating population attributable fractions (PAFs) which represent the proportions of disease cases that would be avoided when the risk exposure was changed from a baseline situation to a counterfactual situation.[6,7,20] The relative risk estimates used in those calculations were adopted from pooled analyses of prospective cohort studies,[21,22] and from meta-analysis of prospective cohort and case-control studies.[23–30] Mortality data were adopted from the Global Burden of Disease project,[31] and projected forward by using data from the UN Population Division.[32]

Results

According to our model simulations, GHG taxes on food commodities in 2020 (using a discount rate of 3% to discount future climate damages) were highest for animal-sourced foods (Table 1), such as ruminant meat (0.18 USD/100g), pork (0.09 USD/100g), and poultry (0.04 USD/100g), medium for products, such as vegetable oils (0.03 USD/100g), eggs (0.02 USD/100g), rice (0.01 USD/100g), and dairy (0.01 USD/100g); and low (< 0.01 USD/100g) for most other crops, such as fruits, vegetables, grains and legumes.

Levying those taxes on the associated food commodities resulted in price changes (Table 1) that were high (between 19-26%) for ruminant meat, vegetable oils, and pork; medium (between 5-10%) for poultry, dairy, rice, wheat, maize, and other grains; and low (below 5%) for other food commodities, such as eggs, vegetables, fruits, roots and legumes. Price changes were greater in high-income countries than in lower income countries, because food prices are generally lower in high-income countries. For example, the price of ruminant meat increased by 30% in high-income countries, and by 22% in low-income countries.

Tax revenues (Table 2) amounted to USD 482 billion per year globally in 2020, three quarters of which accrued to low and middle-income countries (upper middle-income countries: USD 75 billion, 16%; lower middle-income countries: USD 249 billion, 52%; low-income countries: USD 40 billion, 8%), and one quarter to high-income countries (USD 110 billion, 23%). Over 70% of tax revenue stemmed from taxes on animal-sourced foods (ruminant meat: 35%, pork: 20%, poultry, dairy: 8% each). Significant revenues from GHG taxes on non-animal-based foods included rice and vegetables (7% each).

Average food consumption (Table 3) decreased by 5-10% for ruminant meat, vegetable oils and pork, by 1.5-3% for rice, wheat, poultry, dairy, maize, other grains, and by less than 1.5% for vegetables, fruits, oil crops, sugar, legumes, and roots. Consumption changes in high-income countries were less than in lower income countries, because food consumption is less responsive to price changes in those countries (i.e., price elasticities are lower). For example, consumption of ruminant meat decreased by 7.5% in high-income countries, and by 10.5% in low-income countries.

Food-related GHG emissions decreased by 584 MtCO2-eq globally, which corresponds to a 6% reduction in food-related GHG emissions (Table 4). More than half of the emissions reductions were due to reduce consumption of ruminant meat (57%), a quarter due to reduced pork consumption (24%), 6% due to reduced consumption of vegetable oils, and about 3% each due to reduced consumption of poultry, dairy, and rice. About 80% of all emissions reductions were achieved in low and middle-income countries (low-income countries: 10%, lower middle-income countries: 50%, upper middle-income countries: 20%), and a fifth (20%) were achieved in high-income countries.

Total energy intake per person (Table 5) decreased by 78 kcal/d on average. The absolute changes in energy intake were greatest for high-income countries, because energy intake was high in those regions in absolute. The reductions in energy intake ranged from 96 kcal/d in high-income countries, over 76-79 kcal/d in middle-income countries, to 57 kcal/d in low-income countries.

Associated with changes in energy intake were changes in body weight (Table 6). The prevalence of underweight increased by 5.9% on average, and those of overweight and obesity decreased by 2.5% and 4.3%. The percentage increases in underweight were similar across income groups, but the percentage reductions in overweight and obesity were greater in lower income countries than in high-income countries, because of the relatively smaller absolute prevalence of overweight and obesity in those regions.

The tax-induced changes in dietary and weight-related risk factors (changes in red meat consumption, fruit and vegetable consumption, and the prevalence of underweight, overweight, and obesity) resulted in 2.8 million life-years saved globally, which corresponded to 189,000 avoided deaths, 50,000 of which were premature deaths (i.e, deaths before the age of 70) (Figure 1). Lower consumption of red meat resulted in 181,000 avoided deaths globally, whereas lower consumption of fruits and vegetables resulted in 38,000 additional deaths. More people being underweight led to 108,000 additional deaths globally, whereas less people being overweight and obese led to 19,000 and 136,000 avoided deaths, respectively.

The greatest number of deaths were avoided in lower middle-income countries (88,000), which corresponded to high absolute reductions in red meat consumption. About 53,000-55,000 deaths were avoided in upper middle-income countries and in high-income countries, respectively, and about 8,000 additional deaths occurred in low-income countries, in particular due to underweight-related deaths exceeding the deaths avoided due to reduced overweight and obesity in those regions.

Sensitivity analysis

In the sensitivity analysis, we explored alternative tax scenarios designed to reduce the negative health impacts on low-income countries, we analysed the impacts of tax-induced changes in income, and we explored the impacts of using different tax levels associated with different values for the social cost of carbon.

First, we explored two alternative tax scenarios with differing tax bases (Table 7). One scenario (TAXAdj) excluded health-critical food commodities, such as fruits and vegetables, as well as staple crops, such as grains, roots, and legumes, which have low emissions intensities and are important sources of energy (and protein), in particular in low-income countries. The other scenario (TAXAni) included only animal-based foods, which, in addition to fruits and vegetables and staples, also excluded vegetable oils and sugar from taxation, something that might ease the administrative burden of GHG taxation due to its more narrow focus on a limited set of food commodities (meats, dairy, and eggs). In the alternative tax scenarios, the health impacts on low-income countries changes from 7,800 additional deaths to 2,700 avoided deaths in the TAXAdj scenario, and to 4,600 avoided deaths in the TAXAni scenario. The global health benefits increased from 188,900 avoided deaths to 216,900 in the TAXAdj scenario, and to 217,200 in the TAXAni scenario. The environmental impacts were affected little in the alternative tax scenarios – emissions reductions changed from 5.8% to 5.5% – whilst tax revenues decreased from USD 482 billion to USD 380 billion and USD 360 billion, respectively.

Second, we analysed the impacts of tax-induced changes in income. In the main scenarios, we assumed that income changes are compensated by the tax policy, e.g., by recycling the revenues back to the consumer directly or by increasing public expenditure. In an alternative tax scenario (TAXinc), we investigated the impacts of that assumption by accounting for changes in income. As a proxy for income, we used GDP per capita adjusted for purchasing power parity, and we assumed that changes in income are equivalent to tax revenues. We modelled the changes in food demand as a result of changes in income by using region-specific income elasticities adapted from the IMPACT model.[8] Accounting for changes in income increased the percentage reduction in food availability from 2.88% to 2.92% on average, with larger reductions in low-income countries (from 2.47% to 2.84%) than in high-income countries (no changes). The global health benefits decreased from 188,900 avoided deaths to 171,800 avoided deaths, and the main scenario's health burden on low-income countries increased from 7,800 additional deaths to 24,900 additional deaths. In the alternative tax scenarios (TAXAdj, TAXAni), the impact on low-income countries was reduced to 14,400 additional deaths and 12,600 additional deaths, respectively.

Third, we analysed the impacts of using different tax levels (Table 8). In the main scenario, we adopted a social cost of carbon of 52 USD/tCO2 that was based on using a discount rate of 3% to calculate the net present value of future climate damages. In the a set of alternative tax scenarios (SCC14, SCC78, SCC156), we adopted values of the social cost of carbon of 14, 78, and 156 USD/tCO2-eq that are based on discount rates of 5%, 2.5%, and the 95th percentile of 3% which is intended to represent less likely but potentially more damaging impacts of climate change in the tails of the distribution. The impacts on prices, consumption, and health vary widely using this extended set of SCC values. For example, the GHG taxes on ruminant meat ranged from 0.05 USD/100g to 0.53 USD/100g, changes in food availability ranged from -0.9% to -7.3%, and health impacts ranged from 60,400 avoided deaths globally to 410,900 avoided deaths, with impacts on low-income countries ranging from 1,800 additional deaths to 30,000 additional deaths using the main scenario's tax base, and from 930-1,500 avoided deaths to 4,900-10,100 avoided deaths using adjusted tax bases (TAXAdj, TAXAni).

Conclusion

Levying GHG taxes on food commodities could be an attractive proposal for both high-income countries and low and middle-income countries. It could significantly reduce food-related GHG emissions, increase tax revenues, and result in health co-benefits associated with reductions in dietary and weight-related risk factors for chronic disease mortality. However, special policy attention is needed in low-income countries (and possibly for low-income segments in other countries) to avert potential health losses associated with increased levels of underweight (and reduced consumption of fruits and vegetables). Tax policies sparing health-critical food groups, and policies aimed at compensating income losses associated with tax-related price increases are potential policy options that could help to avert negative health impacts for exposed populations, whilst incentivising the food sector to make its pro rata contribution to climate change mitigation.

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Tables and Figures

Table 1: GHG taxes by food commodity, and price changes by food commodity and region.

Food commodity	GHG tax (USD/100g)	Price changes (%)				
		World	High-income countries	Upper middle-income countries	Lower middle-income countries	Low-income countries
Ruminant meat	0.184	25.876	30.399	27.732	25.395	21.712
Pork	0.085	18.976	17.079	18.080	20.942	15.032
Poultry	0.035	9.939	12.975	10.276	9.715	7.548
Vegetable oils	0.027	25.284	34.710	27.594	23.299	21.108
Eggs	0.016	4.137	5.627	4.085	4.000	3.193
Rice	0.010	8.265	10.473	9.345	7.912	6.615
Dairy	0.006	6.234	7.326	6.397	6.162	5.320
Vegetables	0.004	2.031	3.034	2.454	1.741	1.815
Wheat	0.003	7.696	8.944	7.419	7.885	6.113
Other grains	0.003	7.492	10.814	8.192	6.829	6.052
Oil crops	0.002	2.393	2.538	1.896	2.381	2.649
Maize	0.002	5.806	6.715	6.303	5.637	5.277
Sugar	0.001	1.729	2.278	2.282	1.421	1.910
Legumes	0.001	0.896	1.172	0.814	0.871	0.781
Tropical fruits	0.001	0.732	0.957	0.862	0.655	0.715
Temperate fruits	0.001	0.389	0.575	0.448	0.343	0.321
Roots	0.000	0.822	0.833	1.059	0.767	0.858

Table 2: Tax revenues by food commodity and region.

Food commodity	World	High-income countries	Upper middle-income countries	Lower middle-income countries	Low-income countries
Total	481,871.239	110,386.934	75,264.744	249,436.341	40,467.406
Ruminant meat	170,706.440	45,386.878	38,500.835	67,960.447	16,310.904
Pork	96,777.623	20,264.908	7,237.250	64,017.472	5,257.371
Diary	39,500.033	12,681.090	6,927.779	16,933.969	2,292.592
Poultry	37,503.554	12,231.319	8,608.997	14,607.547	1,470.506
Rice	35,752.719	1,809.246	1,839.829	25,590.241	6,448.438
Vegetables	35,370.313	5,010.343	2,720.827	24,698.290	2,152.957
Oils	21,024.801	5,156.136	3,011.587	10,574.964	1,778.958
Wheat	16,485.469	3,032.725	2,281.250	9,288.781	1,219.124
Eggs	10,653.808	2,319.237	1,432.631	6,426.328	304.459
Fruits (tropical)	5,392.079	733.081	825.196	2,913.956	859.583
Other grains	2,513.232	188.955	144.323	1,373.045	762.855
Roots	2,376.268	253.716	265.902	1,305.393	527.854
Sugar	2,357.376	511.686	506.426	1,134.909	148.213
Maize	2,301.422	183.745	616.756	863.642	594.323
Fruits (temperate)	1,440.145	454.064	164.866	656.302	100.952
Oil crops	1,041.097	115.368	75.948	740.347	91.475
Legumes	674.861	54.438	104.342	350.708	146.843

Table 3: Percentage change in food consumption (net of waste) by commodity and region.

Food commodity	World	High-income countries	Upper middle-income countries	Lower middle-income countries	Low-income countries
Ruminant meat	-9.013	-7.549	-9.745	-9.482	-10.503
Oils	-8.310	-11.268	-7.623	-7.380	-6.905
Pork	-6.617	-5.562	-7.515	-7.122	-5.672
Wheat	-2.756	-2.137	-1.975	-3.201	-2.965
Rice	-2.676	-1.833	-3.227	-2.681	-2.695
Poultry	-2.178	-1.436	-2.277	-2.967	-0.906
Diary	-1.971	-0.686	-1.349	-3.142	-2.204
Maize	-1.827	-1.363	-1.816	-1.742	-2.177
Other grains	-1.814	-1.997	-1.445	-1.754	-2.014
Vegetables	-0.703	-0.842	-0.856	-0.671	-0.770
Eggs	-0.703	-0.798	-0.242	-0.796	-0.651
Sugar	-0.520	-0.480	-0.623	-0.473	-0.666
Oil crops	-0.404	-0.919	-0.820	-0.217	-0.646
Fruits (temperate)	-0.188	-0.168	-0.125	-0.177	-0.342
Roots	-0.123	-0.014	-0.080	-0.100	-0.274
Legumes	-0.079	-0.102	0.049	-0.080	-0.168
Fruits (tropical)	-0.022	0.033	0.001	-0.054	-0.063

Table 4: Change in food-related GHG emissions (MtCO2-eq) by commodity and region.

Food commodity	World	High-income countries	Upper middle-income countries	Lower middle-income countries	Low-income countries
Total	-584.838	-119.238	-105.926	-294.636	-57.450
Ruminant meat	-335.255	-72.804	-79.843	-137.713	-40.738
Pork	-140.955	-25.283	-12.553	-95.002	-6.724
Oils	-37.448	-12.607	-4.792	-16.351	-2.815
Rice	-19.662	-0.660	-1.179	-14.068	-3.798
Poultry	-17.418	-3.452	-3.993	-9.343	-0.288
Diary	-15.844	-1.723	-1.812	-10.722	-1.104
Wheat	-9.305	-1.278	-0.866	-6.101	-0.789
Vegetables	-5.005	-0.827	-0.464	-3.249	-0.377
Eggs	-1.495	-0.355	-0.064	-1.009	-0.043
Other grains	-0.908	-0.075	-0.039	-0.472	-0.334
Maize	-0.825	-0.050	-0.219	-0.286	-0.279
Sugar	-0.241	-0.048	-0.061	-0.104	-0.021
Fruits (tropical)	-0.231	-0.028	-0.025	-0.110	-0.070
Oil crops	-0.171	-0.051	-0.014	-0.071	-0.031
Roots	-0.058	-0.001	-0.005	-0.022	-0.032
Legumes	-0.010	-0.001	0.001	-0.005	-0.005
Fruits (temperate)	-0.006	0.003	0.000	-0.007	-0.001

Table 5: Change in energy availability (kcal/d) by food commodity and region.

Food commodity	World	High-income countries	Upper middle-income countries	Lower middle-income countries	Low-income countries
Total	-78.05	-96.01	-76.04	-79.46	-57.05
Oils	-22.93	-51.05	-24.24	-18.04	-10.93
Wheat	-15.19	-13.80	-11.68	-17.95	-8.17
Rice	-13.76	-3.06	-6.82	-17.74	-16.86
Pork	-8.63	-10.24	-6.35	-10.48	-2.61
Ruminant meat	-5.87	-8.42	-11.54	-4.34	-4.52
Diary	-2.99	-2.15	-2.82	-3.64	-1.32
Maize	-2.69	-1.07	-5.91	-1.69	-5.78
Other grains	-1.78	-0.97	-0.63	-1.67	-4.15
Poultry	-1.31	-1.72	-2.49	-1.27	-0.14
Sugar	-1.18	-1.54	-2.48	-0.92	-0.66
Vegetables	-0.72	-0.79	-0.55	-0.84	-0.34
Oil crops	-0.34	-0.66	-0.23	-0.25	-0.39
Eggs	-0.25	-0.39	-0.09	-0.30	-0.05
Roots	-0.19	-0.01	-0.12	-0.13	-0.66
Fruits (tropical)	-0.16	-0.13	-0.14	-0.14	-0.31
Legumes	-0.05	-0.03	0.04	-0.05	-0.16
Fruits (temperate)	-0.01	0.02	0.00	-0.01	-0.01

Table 6: Change in weight by region.

Region	Weight class	Prevalence		
		absolute	change	%
World	underweight	0.118	0.007	5.921
	normal	0.501	0.006	1.122
	overweight	0.260	-0.007	-2.533
	obese	0.120	-0.005	-4.295
High-income countries	underweight	0.049	0.003	6.018
	normal	0.401	0.006	1.433
	overweight	0.320	-0.003	-0.981
	obese	0.230	-0.005	-2.233
Upper middle-income countries	underweight	0.049	0.003	6.044
	normal	0.387	0.009	2.265
	overweight	0.337	-0.003	-0.750
	obese	0.228	-0.009	-3.710
Lower middle-income countries	underweight	0.129	0.007	5.892
	normal	0.548	0.006	1.098
	overweight	0.244	-0.008	-3.257
	obese	0.080	-0.005	-5.802
Low-income countries	underweight	0.218	0.012	6.020
	normal	0.538	0.002	0.317
	overweight	0.187	-0.009	-4.684
	obese	0.057	-0.005	-7.952

Figure 1: Number of avoided deaths (thousands) by risk factor and region.

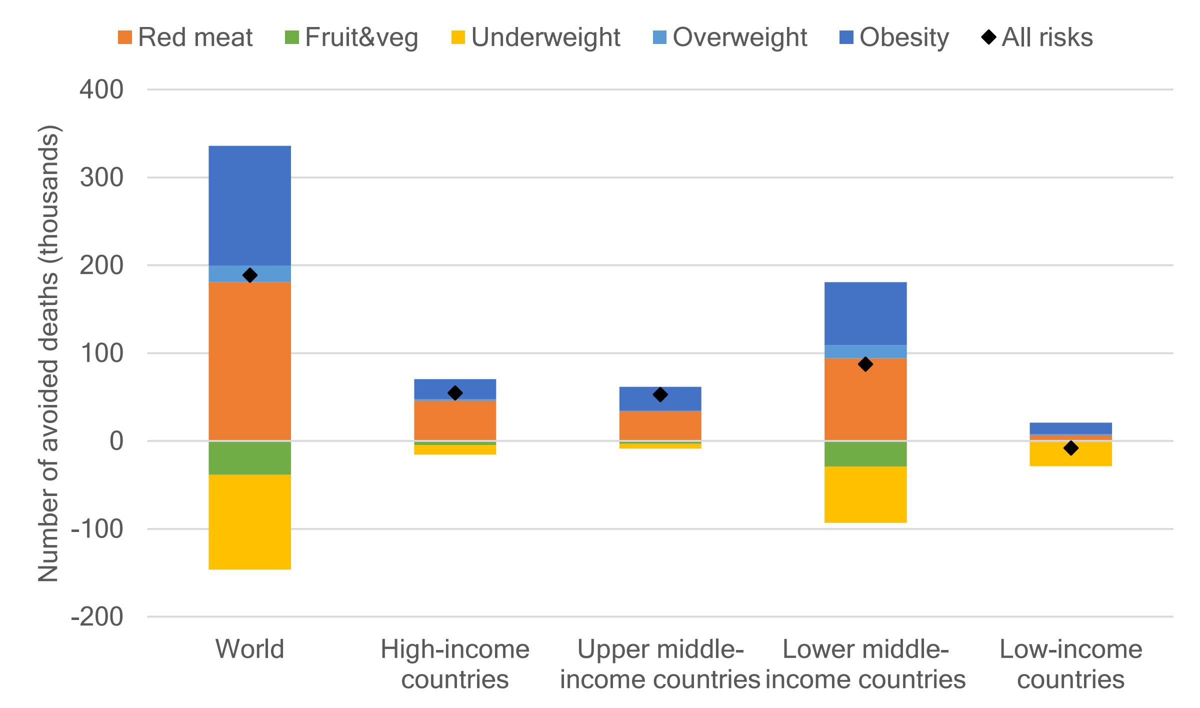

Table 7: Sensitivity analysis with respect to tax base. TAX includes all food groups, TAXadj excludes fruits, vegetables, and staple crops, and TAXani includes only animal-based foods.

Region	Avoided deaths (thousands)			Emissions reduction (%)			Tax revenue (million)		
	TAX	TAXadj	TAXani	TAX	TAXadj	TAXani	TAX	TAXadj	TAXani
World	188.864	216.857	217.221	-5.84	-5.48	-5.54	481,871	379,561	359,584
High-income countries	54.867	56.122	55.282	-5.30	-5.17	-5.27	110,387	98,666	94,655
Upper middle-income countries	52.887	48.208	45.787	-6.81	-6.63	-6.82	75,265	66,301	63,746
Lower middle-income countries	87.600	108.623	110.522	-5.77	-5.29	-5.32	249,436	182,394	171,300
Low-income countries	-7.799	2.700	4.565	-6.27	-5.65	-5.59	40,467	27,654	25,811

Table 8: GHG taxes on food commodities (USD/100g) for different values of the social cost of carbon (SCC).

SCC (USD/tCO2-eq)	14	52	78	156
Discount rate	5.00%	3.00%	2.50%	3.0%_95th
Ruminant meat	0.050	0.177	0.268	0.532
Pork	0.025	0.089	0.135	0.268
Poultry	0.010	0.036	0.054	0.107
Oils	0.007	0.027	0.040	0.080
Eggs	0.004	0.016	0.024	0.048
Rice	0.003	0.010	0.015	0.029
Diary	0.002	0.006	0.009	0.017
Wheat	0.001	0.003	0.005	0.010
Vegetables	0.001	0.003	0.005	0.010
Other grains	0.001	0.003	0.004	0.009
Oil crops	0.001	0.002	0.003	0.005
Maize	0.000	0.002	0.003	0.005
Fruits (tropical)	0.000	0.001	0.002	0.004
Legumes	0.000	0.001	0.002	0.004
Sugar	0.000	0.001	0.002	0.004
Fruits (temperate)	0.000	0.001	0.001	0.003
Roots	0.000	0.000	0.001	0.001