UNIO - *EU Law Journal*. Vol. 7, No. 2, December 2021, pp 106-123.

School of Law – University of Minho

The effects of introducing a carbon-meat tax in the EU: a literature review

Rafael Leite Pinto*

ABSTRACT: The food industry, especially meat production, is a major source of greenhouse gas emissions, contributing to climate change. Although the European Union has taken several measures to curb the effects from the agricultural sector, more recently launching the Farm to fork Strategy, livestock production seems to be left out of the proposed actions. Since 1985, the Commission has stated that the Polluter Pays principle should be applied to agriculture and in the most recent Strategy, this is also mentioned alluding to a possible carbon-tax on food products. In fact, one of the most popular measures discussed to internalise the environmental externalities of the sector and to encourage a reduction in animal products consumption is the introduction of a carbon tax, namely on meat products. Although several countries have applied climate taxes on fossil fuels and taxes on certain foods for health reasons, no country has applied a tax on food products for environmental reasons. In this article, we analyse the effects of implementing a carbon meat-tax in the EU by conducting a literature review of simulation studies. We discuss possible benefits and disadvantages with a practical, environmental, and socio-economic view.

KEYWORDS: Meat tax – carbon-tax – environmental impacts – Farm to Fork Strategy.

* Master's in European Union Law at the School of Law of the University of Minho.

1. Introduction

According to the Intergovernmental Panel on Climate Change (IPCC), agriculture is responsible for 23% of greenhouse gas emissions worldwide, of which livestock farming represents about 80%.[1] It is estimated that, with the projected reduction in the use of fossil fuels and the predicted increase in the consumption of animal products, by 2030 agriculture could represent 27% and, in 2050, 81% of the emissions allowed to reach the goal of the Paris Agreement, to keep the temperature increase below 1.5ºC.[2] These forecasts are in line with those of several authors who claim that emissions from food production could increase to 80-92% by 2050.[3] In the European Union ("EU"), agriculture occupies about 40% of total land, of which up to 71% is dedicated to the livestock sector.[4] According to official data from the Union, agriculture is responsible for 10% of emissions, a number that fell by about 20% between 1990 and 2005, but has remained stable, registering a slight increase in recent years.[5] However, several studies point to substantially higher values, just for livestock production, between 10% and 17%.[6/7/8/9] According to an analysis by *Greenpeace*, based on *the EAT-Lancet Commission*[10] for sustainable diets, for the Union to meet its environmental goals and for the global temperature to remain below a 2ºC increase, meat consumption should be reduced by 71% by 2030 and 81% by 2050. Although an increase in emissions from food production is expected, it is estimated that the adoption of a plant-based diet can reduce the

[1] IPCC, *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, eds. P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley (IPCC, 2019), https://www.ipcc.ch/site/assets/uploads/sites/4/2020/02/SRCCL-Complete-BOOK-LRES.pdf.

[2] GRAIN, "Emissions impossible: How big meat and dairy are heating up the planet", 2018, accessed July 02, 2020, https://www.grain.org/article/entries/5976-emissions-impossible-how-big-meat-and-dairy-are-heating-up-the-planet.

[3] Marco Springmann *et al.*, "Options for keeping the food system within environmental limits", *Nature*, v. 562, no. 7728 (2018): 519–25, doi:10.1038/s41586-018-0594-0.

[4] GreenPeace, "Feeding the Problem - the dangerous intensification of animal farming in the EU", 2019, accessed July 02, 2020, https://www.greenpeace.org/eu-unit/issues/nature-food/1803/feeding-problem-dangerous-intensification-animal-farming/.

[5] "Agri-environmental indicator - greenhouse gas emissions", 2017, accessed July 02, 2020, https://ec.europa.eu/eurostat/statistics-explained/pdfscache/16817.pdf.

[6] Jessica Bellarby *et al.*, "Livestock greenhouse gas emissions and mitigation potential in Europe", *Global Change Biology*, v. 19, no. 1 (2012): 3-18, doi:10.1111/j.1365-2486.2012.02786.x.

[7] Westohek *et al.*, "The protein Puzzle: The consumption and production of meat, dairy and fish in the European Union", The Hague: PBL Netherlands Environmental Assessment Agency, 2011, accessed July 02, 2020, https://www.researchgate.net/publication/239847417_The_protein_puzzle_The_consumption_and_production_of_meat_dairy_and_fish_in_the_European_Union.

[8] Leip *et al.*, "Impacts of European Livestock Production: Nitrogen, Sulphur, Phosphorus and Greenhouse Gas Emissions, Land-Use, Water Eutrophication and Biodiversity", *Environmental Research Letters*, v. 10, no. 11 (2015): 115004, Crossref, doi:10.1088/1748-9326/10/11/115004.

[9] Leip *et al.*, "Evaluation of the Livestock Sector's Contribution to the EU Greenhouse Gas Emissions (GGELS) – Final Report", 2010, accessed July 02, 2020, https://www.researchgate.net/publication/265250670_Evaluation_of_the_Livestock_Sector's_Contribution_to_the_EU_Greenhouse_Gas_Emissions_GGELS_-_Final_Report/stats.

[10] "EU Climate Diet: 71% Less Meat by 2030", Greenpeace, 2020, accessed July 02, 2020, https://www.greenpeace.org/eu-unit/issues/nature-food/2664/eu-climate-diet-71-less-meat-by-2030/.

sector's emissions by 55% in 2050, when compared to 2007, and reduce mortality from diet by 8.1 million deaths per year.[11]

With the "Farm to fork Strategy", the Union seems to be taking the first steps towards the transition from a Common Agricultural Policy to a Common Food Policy, which promotes the adoption of healthy and sustainable diets. Something that both scientists and NGO's have been advocating.[12/13] However, the proposal failed to address the impacts of animal farming. The recommendations for a healthy and sustainable diet are clear: a transition to plant-based diets is required to achieve environmental goals.[14/15] Technological improvements will not be sufficient to maintain the industry's impact within these targets.[16] The Commission acknowledges this in the communication of the strategy but fails to enforce concrete measures or targets to reduce the consumption of animal products. Despite this, it suggests a thorough review of any proposals in the National CAP Strategic Plans that intend to allocate coupled payments to animal agriculture. In addition, it advocates the ban on marketing campaigns for low-priced meat and stresses the need to introduce tax incentives that support the transition to a sustainable food system that promotes healthy diets, including the use of VAT and the introduction of new taxes that make food prices cover externalities on an environmental level. The aim here is to stimulate the increased availability of vegetable meats. Here, the Commission shyly demonstrates support for the introduction of a carbon tax on food but does not include it in the final proposals.

In fact, one of the most popular measures discussed to internalise externalities of the sector and to encourage a reduction in animal products consumption is the introduction of a carbon tax on these foods. Since 1985, the Commission has asserted that agriculture cannot be above the Polluter Pays principle.[17] At the end of the 5th Environmental Action Program, in 2000, the Commission outlined as one of the main measures to reduce the environmental impact of agriculture, an environmental tax on food products.[18]

---

[11] Springman *et al.*, "Analysis and Valuation of the Health and Climate Change Cobenefits of Dietary Change", *Proceedings of the National Academy of Sciences*, v. 113, no. 15 (2016): 4146-51, doi:10.1073/pnas.1523119113.

[12] Louise O. Fresco and Krijn J. Poppe, "Towards a Common Agricultural and Food Policy", Wageningen University & Research, 2016, accessed July 02, 2020, https://www.wur.nl/upload_mm/b/c/5/39e3f79f-5c4d-45a1-882b-b317e395e1af_Towards_CAFP_LR.pdf.

[13] IPES-FOOD, "Towards a common food policy for the European Union- The policy reform and realignment that is required to build sustainable food system in Europe", 2019, accessed July 02, 2020, http://www.ipes-food.org/_img/upload/files/CFP_FullReport.pdf.

[14] European Commission's Scientific Advice Mechanism, "A scoping review of major works relevant to scientific advice towards an EU sustainable food system", 2019, 10, accessed July 02, 2020, https://ec.europa.eu/info/publications/scoping-review-major-works-relevant-scientific-advice-towards-eu-sustainable-food-system_en.

[15] Walter Willett *et al.*, "Food in the Anthropocene: The EAT–Lancet Commission on Healthy Diets from Sustainable Food Systems", *The Lancet*, v. 393, no. 10170 (2019): 447–92, doi:10.1016/s0140-6736(18)31788-4.

[16] Van Doorslaer *et al.*, "An economic assessment of GHG mitigation policy options for EU agriculture", Joint Research Center, 2016, accessed July 02, 2020, https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/economic-assessment-ghg-mitigation-policy-options-eu-agriculture.

[17] Perspectives for the Common Agricultural Policy - Green Paper, COM (85)333, 15 July 1985.

[18] European Comission, "Global assessment Europe's environment: what directions for the future", 2000, 42, https://ec.europa.eu/environment/archives/action-programme/pdf/99543_en.pdf.

Taxing certain foods to limit consumption for health reasons is a generalised practice and it is recognised as one of the most effective policies, especially for high sugar and high saturated fat products.[19/20/21/22] In the same way, taxing carbon intensive industries and products, such as fossil fuels, is also recognised as an effective way to reduce emissions. However, an environmental tax on food products has never been tested, although it has been hypothesised in several studies.

In this article, we analyse the effects of implementing a carbon meat-tax in the EU by conducting a literature review of simulation studies. We discuss possible benefits and disadvantages with a practical, environmental, and socio-economic view.

2. A carbon meat-tax in practice

From the outset, it is discussed whether such a tax should be levied on producers or consumers, with the general consensus being that it should be levied on consumers.[23] This is because consumers have a greater choice of whether or not to pay this tax when they decide to buy a product or another. While producers do not have such an elastic option in the short term. Awareness component of the tax would not be achieved if consumers did not have direct contact with it. Although prices for producers are reflected in the final product, it is important that consumers understand why they are paying more for a particular purchase.[24] Furthermore, a producer-level tax would be more difficult to control as it would require correct records of all production that is unstable.

Then, it is important that the tax is exercised on a European level, to avoid the so-called "carbon leakage". That is, considering the proximity of European countries and the freedom of movement, if the tax was introduced in just one Member, inhabitants living in border areas can easily shop in neighboring countries, where prices are lower. In 2011, Denmark introduced an excise tax on high-fat food products, which focused particularly on animal products, after a year and under great pressure from the industry, the tax was removed on the grounds that the population was buying more abroad.[25] Despite this, a subsequent analysis concluded that consumption of taxed products reduced between 10-15% that year and the tax generated 226 million for the State.[26]

---

[19] O. Mytton *et al.*, "Could Targeted Food Taxes Improve Health?", *Journal of Epidemiology & Community Health*, v. 61, no. 8 (2007): 689–94, doi:10.1136/jech.2006.047746.

[20] Geir Wæhler Gustavsen and Kyrre Rickertsen, "Adjusting VAT rates to promote healthier diets in Norway: a censored quantile regression approach", *Food Policy*, v. 42 (2013): 88-95, doi:10.1016/j.foodpol.2013.07.001.

[21] Alexandra Wright *et al.*, "Policy lessons from health taxes: a systematic review of empirical studies", *BMC Public Health*, v. 17, no. 1 (2017), doi:10.1186/s12889-017-4497-z.

[22] Luc Louis Hagenaars *et al.*, "The taxation of unhealthy Energy-Dense Foods (EDFs) and Sugar-Sweetened Beverages (SSBs): an overview of patterns observed in the policy content and policy context of 13 case studies", *Health Policy*, v. 121, no. 8 (2017): 887-94, doi:10.1016/j.healthpol.2017.06.011.

[23] Lise Masselus, "A tax on meat as a climate policy measure", Universiteit Gent, 2016, accessed July 02, 2020, https://lib.ugent.be/fulltxt/RUG01/002/274/023/RUG01-002274023_2016_0001_AC.pdf.

[24] L. M. Abadie *et al.*, "Using food taxes and subsidies to achieve emission reduction targets in Norway", *Journal of Cleaner Production*, v. 134 (2016): 280-97, doi:10.1016/j.jclepro.2015.09.054.

[25] S. Vallgårda *et al.*, "The Danish Tax on saturated fat: why it did not survive", *European Journal of Clinical Nutrition*, v. 69, no. 2 (2014): 223-26, doi:10.1038/ejcn.2014.224.

[26] Jørgen Dejgård Jensen and Sinne Smed, "The Danish Tax on saturated fat – short run effects on

Another dimension of the carbon leakage problem is exports/imports for/from non-EU Members. If the tax is placed on the European consumer at the time of purchase, EU exports may not be covered, increasing the amount of animal products on the international market, which in turn reduces the price and encourages consumption. Thus, the reduction in European consumption could be offset by the increased intake in other countries. This is what a 2018 study concluded. According to it, up to 70% of the EU's emissions reduction would be offset by an increase in emissions from other countries. Thus, it would be necessary to create not one but two distinct taxes. Within the EU, a consumer-level tax that should cover imported meat. With regards to exports, a tax would have to be applied that accounts for externalities within the same level as the tax on the internal consumers, but at the time of exporting, that is, on the exporting company. Otherwise, domestic consumption would decline, but production would remain stable with increased exports.

Another important discussion is what foods should be taxed. Most studies focus on animal products, namely beef, pork, chicken, eggs, milk, and cheese due to their environmental impact and excessive consumption. Others consider creating a carbon tax on all foods. Those that do, conclude that the price increase on vegetable products would be small, except for vegetable oils. From a health standpoint, taxing fruits, vegetables, pulses and whole grains does not seem like the best option either.

It is also discussed whether the tax should be equal in percentage for all foods or variable according to the environmental impact of each one. Although this topic is raised in some studies, almost all evaluate the option of taxing foods according to their specific environmental impact, namely carbon emissions. This is the only way to guarantee that the price of each food reflects the externalities caused by its production. In most studies, the tax is calculated based on different carbon prices multiplied by the carbon emissions estimates of each food. This leads to different results in final tax levels and consumption, making it difficult to draw comparisons from one study to the other. However, the goal of this paper is not so much to compare the studies and methodologies but to assess the potential impact(s) of such a tax.

One issue that may arise from basing the tax on the environmental impact(s) of foods is that the same product may have a different impact depending on production methods. This means that the same product, for example, beef, could have several different tax levels depending on how it was produced. Taking this into account, to implement this proposal, we would need life-cycle assessments of every product involved. On one hand, this would incentivise producers within the same product to adopt more sustainable practices, so that the tax level on their product was lower. On the other hand, producers from more developed countries, even within the EU, could have a capital and technological advantage. All studies take into account the individual impacts of food but do not differentiate between production methods, meaning the more sustainable producers may not be rewarded with lower taxes.

Another problem usually raised is the taxation of compound foods, that is, when the consumer buys something that has only a percentage of the entire product covered by the tax. How should such a product be taxed? For example, buying a

consumption, substitution patterns and consumer prices of fats", *Food Policy*, v. 42 (2013): 18-31, doi:10.1016/j.foodpol.2013.06.004.

pre-frozen meal that has both animal products and vegetable products. Few studies have evaluated this hypothesis, but the answer may be simple. If the frozen meal contains a 100g portion of beef, this part of the meal will be taxed at the same price as 100g of beef purchased alone. This could also result in an incentive for companies to reduce the amount of meat in their products.

3. Literature review

Although the purpose of this article is to analyse the impact of introducing a carbon meat tax in the EU, some papers have studied this hypothesis on a global level.

A study by the University of Oxford, published in 2016, assessed the impacts of creating a global environmental tax on food products, based on the carbon externalities price of each product. They concluded that the fair carbon price should be about $52/t. With this price, a worldwide tax would increase the price of beef by 40%, goat meat by 14,9%, pork by 6,8%, poultry by 8,5 %, 21% for milk and 5,3% eggs. The only vegetable products that would register a significant increase in price would be vegetable oils, with an increase of 25%, rice with an increase of 8,2% and wheat with an increase of 7,7%. However, at the level of higher income countries, which include most EU countries, the price increase would be 26,6% for beef, 16,3% for goat meat, 8,3% for pork, 10,7% for poultry, 13,4% for milk, 6,6% for eggs. As for vegetable oils, the price increase would be 34,7%, for rice 10,1% and for wheat 9.6%.

Applying this tax, worldwide emissions from food production would fall by 9%. About 1/3 of the reduction in emissions is due to reduced consumption of beef and 1/4 due to reduced consumption of milk. In addition, this tax could prevent 146,000 deaths per year, from dietary causes. However, if the tax were introduced in order to maximize health at the level of each region, the reduction in mortality could reach 510,000 deaths per year. The study also assessed the impact(s) if the carbon price were set at 78$/t or 156$/t and the results were even more significant, reducing emissions from food production by 12% or 18.5% and mortality by 741,000 or 1.3 million a year.

Another Oxford study looked at the effects of creating a global health tax on red and processed meats and concluded that the health-related costs of consuming it are $285 billion a year. To cover these costs, the price of processed meat, in countries with higher incomes, must increase by 111%, while the price of red meat must increase by 21,3%. This tax could save 222,000 lives a year, 9% of deaths attributed to the consumption of these foods. In the 15 EU countries assessed, the tax represents savings of €8.94 billion a year in healthcare costs and an income of €26.6 billion.

From the global studies above, we conclude that implementing such tax would cause positive diet changes for the environment and health. But would this effect be strong enough to execute this measure in the EU?

To assess the impacts of creating a carbon meat tax in the EU, we carried out a review of the studies that have evaluated this hypothesis in Member-States (including theUK) and at the EU level. We identified 15 studies, which vary in methodology and geographic location. The results are shown in the table below. All studies take into account the elasticity of demand for products, some simulate various tax and subsidy scenarios and other even estimate what would happen if

VAT taxes were removed as the carbon tax was introduced, creating a "neutral tax revenue" effect, but shifting the purpose of the taxes from consumer taxes to carbon taxes.

Country and Study	Products	Tax level	Results
UK *Revoredo-Giha et al, 2018,* "Simulating the Impact of Carbon Taxes on Greenhouse Gas Emission and Nutrition in the UK"[27]	4 product scenarios tested 1) Beef; 2) All meats; 3) All animal products; 4) All animal and vegetable products with high environmental impacts;	Four different prices tested with carbon prices at 15€, 50€ and 200€ and one ad valorem tax setting taxes at 20%, 10% and 5% according to environmental impacts. With the first price: beef would increase 0,60€ per kilogram, 0,10€ for pork and 0,06€ for poultry. With the second price: beef would increase 2€ per kilogram, 0,35€ for pork and 0,21€ for poultry. With the third price: beef would increase 8€ per kilogram, 1,41€ for pork and 0,85€ for poultry.	For the ad valorem tax, sector emissions would drop approximately: 3% in scenario one, 5% in scenario 2, 7% in scenario 3 and 9% in scenario 4. For the first price, sector emissions would drop less than 2% on all scenarios For the second price, sector emissions would drop, at most, 5% in scenario 4 and less in others. For the third price, sector emissions would drop approximately: 14% in scenario 1, 15% in scenario 2, almost 18% in scenario 3 and 18,7% in scenario 4.

[27] Cesar Revoredo-Giha *et al.*, "Simulating the impact of carbon taxes on greenhouse gas emission and nutrition in the UK", *Sustainability*, v. 10, no. 2 (2018): 134, doi:10.3390/su10010134.

France Caillavet *et al,* 2016, "Taxing animal-based foods for sustainability: environmental, nutritional and social perspectives in France"[28]	Taxes all animal products	A flat 20% tax on all products	Results show emissions reduction between 6.6-13.2% of total emissions for the agriculture sector in France.
France Caillavet *et al,* 2008. "Distributional effects of emission-based carbon taxes on food: the case of France"[29]	Tested scenarios: 1) All foods 2) All animal products 3) Taxing all animal products whilst subsidizing vegetable products.	Using a carbon price of 140€/tonne Tax percentage would be around 0.93% for vegetable products and 19-23% for animal products in all scenarios. Subsidies for fruits and vegetables would reach 15% and 4.5% for pulses.	1) CO2 emissions would drop 15.2%, 16.9% for nitrous oxide emissions and 14,7% for nitrogen. 2) CO2 emissions would drop 5.2%, 9% for nitrous oxide and 6,4% for nitrogen. 3) CO2 emissions would drop 2.4%, 7.9% for nitrous oxide and 4.3% for nitrogen. All scenarios, especially number 3, would have positive health effects.

[28] France Caillavet *et al.*, "Taxing animal-based foods for sustainability: environmental, nutritional and social perspectives in France", *European Review of Agricultural Economics*, v. 43, no. 4 (2016): 537-60, doi:10.1093/erae/jbv041.

[29] F. Caillavet *et al.*, 'Distributional effects of emission-based carbon taxes on food: the case of France", 2018, accessed July 02, 2020, https://ideas.repec.org/p/ags/iaae18/277102.html.

France Sanna Dahlberg, 2017. "A French Meat Tax - An Effective Climate Mitigation Policy?"[30]	Tax on beef, pork and poultry meat	Based on a 43€/tonne of CO2 price: - Beef would increase 0.87€ per kilogram or 8.4% - Pork would increase 0.21€ per kilogram or 3.6% - Poultry would increase 0.15€ per kilogram or 3.6%	Emissions from the agriculture sector would drop about 7%. This would represent a total emissions reduction for France of about 1%.
Denmark *Edjabou and Smed, 2013*, "The effect of using consumption taxes on foods to promote climate friendly diets—The case of Denmark."[31]	Taxes on 23 food products of which 14 are animal products within 2 different scenarios. 1) A new carbon tax is imposed 2) A new carbon tax is imposed but VAT is reduced in the same level of revenue (compensated scenario)	Taxes according to environmental impacts based on two carbon prices per tonne, 30€ and 100€. For the first scenario with the lower price: beef would increase 11%, 2% for pork, 2.5% for poultry and 5.3% for milk. For the first scenario with the higher price: beef price would increase 32.4%, 5.8% for pork, 7.2% for poultry, and 15.4% for milk. For the second scenario with the lower price: beef price would increase 2.7%, pork would decrease 0.6%, poultry would also decrease 0.2% and milk would increase 2.6%. For the second scenario with the higher price: beef price would increase 25.3%, pork would decrease 1.4%, poultry would remain the same and milk would increase 8.2%.	For the first scenario with lower carbon price, sector emissions would drop 7.9%. For the first scenario with a higher carbon price, sector emissions would drop between 10.4-19.4%. For the second scenario with the lower carbon price, sector emissions would drop 3.4% For the second scenario with a higher carbon price, sector emissions would drop 8.8%.

[30] Sanna Dahlberg, "A French meat tax - an effective climate mitigation policy?", 2017, accessed July 02, 2020, https://core.ac.uk/download/pdf/85136821.pdf.
[31] Louise Dyhr Edjabou and Sinne Smed, "The effect of using consumption taxes on foods to promote climate friendly diets – the case of Denmark", *Food Policy*,

Spain *García-Muros et al, 2017,* "The distributional effects of carbon-based food taxes."[32]	Three scenarios: 1) Small tax on all foods (based on carbon price); 2) High tax on all foods (based on carbon price); 3) High tax on all foods besides cereals, fruits, and vegetables	The first scenario is based on a carbon price of 25€/tonne while the other two used a 50€/tonne price With the lower tax, beef prices would increase 0.62€ per kilogram, 0.25€ for pork, 0.10€ for poultry, 0.12€ for eggs, 0.04€ for milk and 0.34€ for cheese. With the higher tax, beef prices would increase 1.25€ per kilogram, 0.51€ for pork, 0.20€ for poultry, 0.24€ for eggs, 0.08€ for milk and 0.68€ for cheese.	The lower tax could reduce sector emissions by 3.8% whilst the higher tax could reach 7.6% with a small advantage for scenario number three that could also improve health outcomes.
Spain *Dogbe et al 2017* "Environmental, nutritional and welfare effects of introducing a Carbon Tax on food products in Spain"[33]	Taxing all foods or just animal products with scenarios based on EU emissions reduction targets of 20% for 2020 and 60% for 2050	Using a carbon price of 56€/tonne: beef price would increase 12.4%, 3.9% for pork, 6% for dairy and 9% for poultry Using a carbon price of 200€/tonne: beef would increase 44.4%, 13.9% for pork, 21.9% for dairy and 32.9% for poultry.	With the lower tax on all foods, sector emissions would drop 7.2%. If the tax was only for animal products emissions could drop 3.% With the higher tax on all foods, sector emissions could drop 25.7%. If the tax was only for animal products, emissions could drop 13%. Health would improve under all scenarios.

v. 39 (2013): 84-96, doi:10.1016/j.foodpol.2012.12.004.

[32] Xaquin García-Muros *et al.*, "The distributional effects of carbon-based food taxes", *Journal of Cleaner Production*, v. 140 (2017): 996-1006, doi:10.1016/j.jclepro.2016.05.171.

[33] W. Dogbe *et al.*, "Environmental, nutritional and welfare effects of introducing a carbon tax on food products in Spain", Annual Meeting Agricultural and Applied Economics Association, Chicago, Illinois, July 30-August 1, 2017, https://ideas.repec.org/p/ags/aaea17/258132.html.

UK Briggs *et al,* 2013, "Assessing the impact on chronic disease of incorporating the societal cost of greenhouse gases into the price of food: An econometric and comparative risk assessment modelling study."[34]	Two scenarios: 1) Taxing all foods with above average environmental impacts. 2) The same as scenario 1 but all revenue would be used to subsidize sustainable foods	A carbon price of 31€/tonne. Beef price would increase 2.06€ per kilogram, 0.12€ for pork, 0.04€ for poultry and 0.03€ for fish.	In the first scenario, sector emissions could decrease by 7.5%. The level would be slightly lower for the second scenario, but deaths related to diet could decrease by 1.4%.
EU 27 Wirsenius *et al*, 2011, "Greenhouse gas taxes on animal food products: Rationale, tax scheme and climate mitigation effects"[35]	All animal products, except fish	Using a carbon price of 60€/tonne Beef price would increase 1.4€ per kilogram, 0.3€ for pork, 0.15€ for poultry and about 0.10€ for milk and eggs.	Sector emissions could drop around 7% and land use about 21%.

[34] Adam D. M. Briggs *et al.*, "Assessing the impact on chronic disease of incorporating the societal cost of greenhouse gases into the price of food: an econometric and comparative risk assessment modelling study", *BMJ Open*, v. 3, no. 10 (2013): e003543, doi:10.1136/bmjopen-2013-003543.
[35] Stefan Wirsenius, Fredrik Hedenus *et al.*, "Greenhouse gas taxes on animal food products: rationale, tax scheme and climate mitigation effects", *Climatic Change*, v. 108, no. 1-2 (2010): 159-84, doi:10.1007/s10584-010-9971-x.

EU 27 Torbjorn Jansson and Sarah Sall, " Environmental Consumption Taxes on Animal Food Products To Mitigate Greenhouse Gas Emissions From the European Union"[36]	All animal products, except fish	Three scenarios with carbon prices of 16, 60 and 290€/tonne With the lowest price, beef would increase 0.36€ per kilogram, 0.12€ for pork, 0.08€ for poultry, 0.05€ for eggs and 0.13€ for cheese. With the middle price, beef would increase 1.35€ per kilogram, 0.45€ for pork, 0.30€ for poultry, 0.18€ for eggs and 0.48€ for cheese With the highest price, beef would increase 6.5€, 2.2€ for pork, 1.42€ for poultry, 0.87€ for eggs and 2.3€ for cheese.	All scenarios could reduce sector emissions in 0.5%, 1.47% and 4.9%, respectively
France Céline Bonnet *et al,* 2018, "An Environmental Tax Towards More Sustainable Food: Empirical Evidence of the Consumption of Animal Products in France"[37]	All animal products	Using carbon prices of 56 or 200€/tonne In the first scenario, prices would increase 2-5% for pork, 6-12% for beef, 4-8% for poultry, 2-5% for fish, and 7% for dairy In the second scenario, prices would increase 7-10% for pork, 21-41% for beef, 15-32% for poultry, 7-17% for fish, and 26% for dairy	With the lower tax scenario, sector emissions could drop 1.9%. With the higher tax scenario, the value rises to 6.1%

[36] Torbjörn Jansson and Sarah Säll, "Environmental consumption taxes on animal food products to mitigate greenhouse gas emissions from the European Union", *Climate Change Economics*, v. 09, no. 04 (2018), doi:10.1142/s2010007818500094.

[37] Céline Bonnet *et al.*, "An environmental tax towards more sustainable food: empirical evidence of the consumption of animal products in France", *Ecological Economics*, v. 147 (2018): 48-61, doi:10.1016/j.ecolecon.2017.12.032.

Sweden Säll, Sarah. Gren, Ing-Marie, 2015, "Effects of an environmental tax on meat and dairy consumption in Sweden"[38]	All animal products, except fish	Carbon price of about 90€. With this price, beef would increase 3.1€ per kilogram, 0.65€ for pork, 0.35€ for poultry, 0.17€ for milk and 1.30€ for cheese	Sector emissions could drop around 12%
Norway Abadie et al, 2016,"Using food taxes and subsidies to achieve emission reduction targets in Norway"[39]	All food products with the exception of poultry, fish, milk, eggs, vegetables, and fruits (calculations were performed in order to maintain the exact current nutritional profile of average diets and taking into account that the consumption of red meat would be replaced by other products of animal products) Subsidies for untaxed products were also included.	Tax and subsidies calculated as necessary to reach a target of -10% emissions. This would translate into a tax of approximately 40% for ruminant meat.	The calculations were made in order to achieve a 10% emissions reduction from the agricultural sector.

[38] Sarah Säll and Ing-Marie Gren, "Effects of an environmental tax on meat and dairy consumption in Sweden", *Food Policy*, v. 55 (2015): 41-53, doi:10.1016/j.foodpol.2015.05.008.

[39] L. M. Abadie *et al.*, "Using food taxes and subsidies to achieve emission reduction targets in Norway", *Journal of Cleaner Production*, v. 134 (2016): 280-97, doi:10.1016/j.jclepro.2015.09.054.

Belgium *Lise Masselus, 2016* "A Tax on Meat as a Climate Policy Measure"[40]	Tax on beef, pork and poultry	Using two scenarios for carbon prices of 50 and 69€/tonne. In the first scenario, beef price would increase 0.99€ por kilogram or 7.9%; pork would increase 0.36€ per kilogram or 4.4%; poultry would increase 0.21€ per kilogram or 5.2% In the second scenario, beef price would increase 1.36€ per kilogram or 10.7%; pork would increase 0.49€ per kilogram or 5.97%; poultry would increase 0.29€ per kilogram or 7.15	Sector emissions would drop around 7% in the first scenario and 10% in the second.
Scotland *Chalmers et al. 2016, "* Socioeconomic Effects of Reducing Household Carbon Footprints Through Meat Consumption Taxes"[41]	All meat products.	Based on the environmental impact of each product, the tax would be about 13% on beef, 6.3% on pork, 12% on sheep, 3% on poultry and 4.2% on turkey	Sector emissions would drop about 10%
EU-28 *True Animal Protein Price Coalition Report, 2020* "Aligning food pricing policies with the European Green Deal"[42]	Tax on beef, pork, and poultry	Carbon price of 90€/tonne. Beef price would increase 4.77€ per kilogram, pork 3.61€ and poultry 1.73€.	Total reduction of EU emissions (all sectors) by 3%.

[40] Lise Masselus, "A tax on meat as a climate policy measure", Universiteit Gent, 2016, accessed July 02, 2020, https://lib.ugent.be/fulltxt/RUG01/002/274/023/RUG01-002274023_2016_0001_AC.pdf.

[41] Neil G. Chalmers *et al.*, "Socioeconomic effects of reducing household carbon footprints through meat consumption taxes", *Journal of Food Products Marketing*, v. 22, no. 2 (2016): 258-77, doi:10.1080/10454446.2015.1048024.

[42] TAPPC, "Aligning food pricing policies with the European Green Deal", 2020, accessed July 02, 2020, https://www.tappcoalition.eu/nieuws/13130/eu-parliament-

4. Discussion

The carbon meat-tax is expected to reduce emissions in all cases, but its effectiveness is dependent on the carbon price used. Low carbon prices will not produce meaningful changes in product prices; therefore, consumption and emissions would remain unchanged. At the time of writing, carbon prices in the EU ETS is set at almost 80€/tonne.[43] Although this is the highest it has ever been, some studies and institutions suggest that it is still not enough to cover the true social costs of emissions. The German Federal Environmental Agency suggests a cost of about 180€/tonne,[44] while the IPCC, in a 2014 report, stated a price of 173€.[45] Still, the prices are expected to increase over time as the impacts of each additional tonne of emissions gets larger. Some authors indicate carbon prices could rise to 353€ by mid-century.[46] Obviously, like carbon taxes on fuel, a meat tax cannot be dependent on market carbon prices at a given time, otherwise the volatility would make it impossible to be in business. A carbon price needs to be agreed upon and the tax level could be updated on a given period.

Nevertheless, several studies have included carbon prices around 80€ or higher. The study from Denmark used a carbon price of 100€/tonne and concluded sector emissions would drop between 10.4-19.4%. The study from Sweden used a carbon price of 90€/tonne and concluded sector emissions could drop around 12%. The same price level was used by the True Animal Protein Price Coalition (TAPPC) for the EU-28 tax, and concluded it was able to reduce total emissions, including all sectors, by 3%.

On the higher end of carbon prices, the 2018 study from France based its estimates on a 200€ carbon price and concluded that sector emissions would drop by about 6.1%. Using the same carbon price, the Spanish study from *Dogbe et al.* concluded that sector emissions could drop by around 13%. The EU-28 study from Torbjorn Jansson and Sarah Sall concluded that sector emissions would drop by around 4.9%, using a carbon price of 290€/tonne. Lastly, the UK study, from 2018, used a carbon price of 170£ (199€) and concluded that sector emissions could drop by about 18%.

Another important conclusion from the review is that the effects differ vastly when the tax is applied to various products. In general, taxing beef seems to get the majority of results, but without surprise, taxing all meat products is even more effective, only being supplanted by a tax on all food products. However, a cost benefit analysis may not justify taxing vegetable products, especially fruits, vegetables, and pulses since it could affect healthy diets and go against what the tax is meant to eat (i.e. reduced meat consumption). For example, using a carbon price of 199€, the UK study concluded that taxing all food products with notable environmental impacts could reduce emissions by 18.7%. This would include some vegetable products. However, taxing only meat products could reduce emissions by almost as much, about 18%.

---

to-discuss-dutch-proposal-for-a-fair-meat-price-5th-of-feb.

[43] See https://ember-climate.org/data/carbon-price-viewer/, accessed December 05, 2021.

[44] E. Örtl, Method convention 3.0 for the determination of environmental costs - cost rates [Methodenkonvention 3.0 zur Ermittlung von Umweltkosten - Kostensätze] (Umweltbundesamt, 2019)

[45] IPCC, *Climate change 2014: impacts, adaptation, and vulnerability: Working Group II contribution to the fifth assessment report of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, 2014).

[46] J. Rockström *et al.*, "A roadmap for rapid decarbonization", *Science*, v. 355 (2017): 1269–1271.

Of the above studies, we highlight the most recent one, carried out by CE Delf[47] at the end of 2019, at the request of the organisation, TAPPC.[48] It is made up of farmers, health, environment, and food production organisations. The goal was to present the results to the European Parliament, so that the measure could be included in the Green Deal. The proposal intended to create a tax on animal products, which would reflect their externalised costs and assessedvalues for beef, pork and chicken. According to the report, the tax should be phased-in until 2030, reaching the values of:

- 47 cents for every 100g of beef or €4.77 per kg, which would lead to a 67% reduction in consumption.
- 36 cents for every 100g of pork or €3.61 per kg, which would lead to a 57% reduction in consumption.
- 17 cents for every 100g of chicken meat or €1.73 per kg, which would lead to a 30% reduction in consumption.

These values would reduce total EU emissions by 3% or 120 million tonnes of CO2eq. In addition, Members would collect €32.2 billion in tax revenue. About half the annual budget of the Common Agricultural policy and the according to Greenpeace, the amount attributed to the livestock industry in subsidies.[49]

How earnings from this tax are used is especially important and not evaluated in most studies included. TAPPC suggests that the funds be used to help farmers convert to more sustainable production methods; support and reduce VAT on the production of healthy plant foods, such as pulses, fruits, and vegetables; to support food schemes for low-income families; and to support nature conservation and restoration in the EU and third countries. According to the report, if 15 billion euros are used to encourage the conversion of 2,5 million specialised livestock farms, the income of each farm could increase by 6000€ per year.

A complementary measure that can exponentially increase the impact of the tax is the focus on increasing the elasticity of taxed products. The elasticity of animal products increases with the increase in available alternatives. If part of the tax proceeds are used to promote existing alternatives (legumes, soybeans, tofu, seitan and meat substitutes) or new alternatives (vegetable and cultivated meat), the effect on reducing intake and emissions will be greater.

The possibility of creating a tax on beef and use the income to subsidise other types of animal products has also been considered, in the hope that the substitution effect would reduce environmental impacts. However, according to a 2018 study, this would not result in a significant decrease in emissions and would have higher costs.[50] Studies such as the one carried out in Sweden and Denmark concluded that the overall, local impacts of pig production are greater than that

[47] CE Delf, "A sustainability charge on meat", 2020, accessed December 05, 2021, https://www.cedelft.eu/en/publications/2411/a-sustainability-charge-on-meat.

[48] TAPPC, "Aligning food pricing policies with the European Green Deal", 2020, accessed December 05, 2021, https://www.tappcoalition.eu/nieuws/13130/eu-parliament-to-discuss-dutch-proposal-for-a-fair-meat-price-5th-of-feb.

[49] Greenpeace, "Feeding the Problem", 2019, accessed December 05, 2021, https://www.greenpeace.org/static/planet4-eu-unit-stateless/2019/02/83254ee1-190212-feeding-the-problem-dangerous-intensification-of-animal-farming-in-europe.pdf.

[50] S. Grenholm *et al.*, "A study of the environmental and economic effects of subsidizing alternatives to red meat", 2018, accessed December 05, 2021, https://stud.epsilon.slu.se/13622/.

of cattle production. Finally, the health benefits would not be as relevant, as meat consumption continued to be encouraged.

One of the most used arguments against a meat tax is the issue of regressiveness. Critics claim it could affect lower income families more. However, according to a French study, this does not happen if the tax proceeds are used to subsidise healthy foods and support families in need.[51] According to the Lancet Commission on Obesity, arguments that taxes on unhealthy foods with excessive intake are regressive are countered by the progressive health effects on consumers.[52]

Finally, if the tax is not levied on fish products, the substitution effect can contribute to an increase in overfishing at the European level. In the Seventh Environmental Action Program, based on the Marine Strategy Framework Directive 2008/56/EC, the EU set the goal of maintaining healthy levels of marine stocks by 2020. According to the FAO, around 75% of fishing areas are overexploited.[53] At this rate, it is estimated that by 2048 we may have fish-free oceans.[54] In the EU, fish consumption is above the limit for maintaining sustainable stocks, especially in southern Europe,[55] where the Mediterranean is 80% overexploited.[56] Since 2007, the percentage of sustainable fishing has been increasing, rising from 34% to 60% in 2015, levels considered insufficient.[57] Resorting to aquaculture may not be an eco-friendly option, depending on the production method, species, practices and scale, aquaculture can have significant impacts on surrounding ecosystems such as pollution of water courses, eutrophication and methane emissions.[58/59/60] Overall, emissions are reduced compared to intensively producing other animals.[61]

Some studies presented evaluated the externalised cost and the respective real price of fish, such as the study carried out in France which concluded that the price would have to increase by 2-5% with a carbon value of 56€/tonne or 7-17% with a

[51] F. Caillavet *et al.*, "Distributional effects of emission-based carbon taxes on food: the case of France", 2018 Conference International Association of Agricultural Economists, Vancouver, British Columbia, July 28-August 2, 2018, https://ideas.repec.org/p/ags/iaae18/277102.html.

[52] Boyd A. Swinburn *et al.*, "The global syndemic of obesity, undernutrition, and climate change: the lancet commission report", *The Lancet*, v. 393, no. 10173 (2019): 791-846, doi:10.1016/s0140-6736(18)32822-8.

[53] FAO Newsroom, "General situation of world fish stocks", accessed a July 08, 2020, http://www.fao.org/newsroom/common/ecg/1000505/en/stocks.pdf.

[54] B. Worm *et al.*, "Impacts of Biodiversity Loss on Ocean Ecosystem Services", *Science*, v. 314, no. 5800 (2006): 787-90, doi:10.1126/science.1132294.

[55] EEA, "Status of marine fish and shellfish stocks in European seas", accessed May 22, 2019, https://www.eea.europa.eu/data-and-maps/indicators/status-of-marine-fish-stocks-3/assessment-1.

[56] European Commission, "Reflection Paper - Towards a Sustainable Europe by 2030", Brussels, COM (2019)22, 2019, 107.

[57] *Ibidem*.

[58] R. S. S. Wu, "The environmental impact of marine fish culture: towards a sustainable future", *Marine Pollution Bulletin*, v. 31, no. 4-12 (1995): 159-66, doi:10.1016/0025-326x(95)00100-2.

[59] Patrik John Gustav Henriksson *et al.*, "Measuring the potential for sustainable intensification of aquaculture in Bangladesh using life cycle assessment", *Proceedings of the National Academy of Sciences*, v. 115, no. 12 (2018): 2958-63, doi:10.1073/pnas.1716530115.

[60] Junji Yuan *et al.*, "Rapid growth in greenhouse gas emissions from the adoption of industrial-scale aquaculture", *Nature Climate Change*, v. 9, no. 4 (2019): 318-22, doi:10.1038/s41558-019-0425-9.

[61] FAO, "Greenhouse gas emissions from aquaculture A life cycle assessment of three Asian systems", accessed a July 08, 2020, http://www.fao.org/3/a-i7558e.pdf.

value of 200€/tonne.[62] Similar results were found in the remaining studies that evaluated the effect of a tax on fish.

5. Conclusion

After reviewing the existing literature on implementing a meat carbon-tax on EU Members, we conclude that the measure ensures the internalisation of environmental externalities caused by carbon emissions in the sector and is an effective way to reduce them, improve diet quality, reduce mortality and healthcare burdens. It could also finance the transition to sustainable food production, achieving revenues of about 32 billion euros per year. Although this measure gathers consensus in the scientific community, with all simulations showing positive results to some degree, no country has yet applied it. In the EU, if it were adopted, it would be the most effective action ever adopted to reduce the impacts of meat consumption up to 18% and total emissions by at least 3%, in a short period of time. These values could increase significantly with tax levels, investment in alternative foods, education, and awareness campaigns. The price of carbon linked to the tax is also a key factor in the performance of the measure. We learned that studies using a carbon price above 90€/tonne find significantly greater results in meat consumption and emissions reduction, while the effect is less visible, but still significant with lower prices. It was also possible to conclude that most of the positive effects arise from taxing beef. However, a substitution effect could lead to an increase in overall consumption of animal products, rendering the carbon benefits from lower beef intake useless. The results are the most significant when the tax is applied on all animal products, including dairy, cheese, and eggs, although some studies only evaluated the option of taxing beef, pork and poultry. Taxing vegetable products could be counterproductive if the tax was applied on healthy plant based foods. From an environmental perspective only, vegetable products typically have smaller carbon footprints, just so that the price increase with a carbon tax would be almost negligible in most cases. It should be noted that the tax would cause a significant reduction in food emissions at a time when they are expected to increase. However, several concerns arise from the practical implementation of the tax. Such as process of evaluating the carbon footprint of different types of production, carbon leakage and its possible socioeconomic impacts, leading us to conclude that this measure should be adopted as part of a wider package to transform the sector and dietary habits in the EU.

[62] Kuishuang Feng, "An environmental tax towards more sustainable food: empirical evidence of the consumption of animal products in France", *Ecological Economics*, v. 147 (2018): 48-61, doi:10.1016/j.ecolecon.2017.12.032.