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The Price of Meat in International Climate Change Law

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ABSTRACT

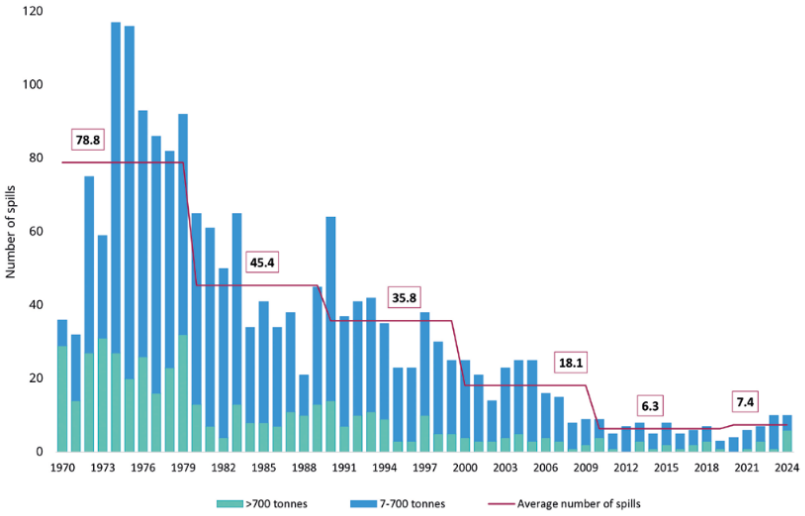
International climate change law has dramatically ignored the influence of food production, particularly the production of meat. This neglect is striking, as several reports indicate that livestock production creates 14.5% of all global greenhouse gas emissions and 25% if land use is included. This Article argues that the international climate change regime should include meat production and examines a variety of instruments that could be employed to do so. Available instruments examined in this Article include production changes, production regulation, and a possible extension of the emissions trading schemes. This Article argues that the most promising instrument, however, is the introduction of a meat tax. This Article examines how the optimal tax rate should be determined, the expected effects of the tax, and how support for a meat tax could be achieved. However, this Article equally argues that the meat tax should be one instrument implemented among a smart mix of various instruments, including behavioral policy. Given cross-border externalities, the meat tax should be mandated at least at a regional and preferably even international level. So far, the effects of meat production on climate change have been dramatically ignored, as none of the G20 countries have referred to the effects of food production on global warming in their nationally determined contributions. That omission is dramatic, as it is highly likely that the goals of the Paris Agreement cannot be reached without incorporating meat production into climate change policy. The only reason that meat production has not yet been incorporated into international climate change policy is effective lobbying by the meat industry. This Article, therefore, argues that the price of meat should take the negative external effects of meat production and consumption into account, more particularly on climate change.

INTRODUCTION

In the thirty-four years that I was a professor of comparative and environmental law, there have been many changes in the domain that I studied in my chair. Fortunately, many changes constitute improvements. For example, empirical studies in both the United States and Europe show that domestic water pollution has improved drastically over the past several decades. There have also been improvements in domains at the cross-border, international level. These improvements are largely due to regulatory efforts, such as effluent charges (environmental taxes) on emissions of wastewater.[1]

Similarly, at the international level, there have been improvements in the domain of marine oil pollution. The following graph clearly illustrates that the number of marine oil spills has decreased (see Figure 1). Whereas in the 1970s, incidents with major tankers leading to massive oil pollution were a regular phenomenon, today such incidents are hardly heard of. The data indicate that releases due to oil tanker incidents have indeed gone down over the past decades.

Figure 1. Number of medium (7–700 tons) and large (> 700 tons) tanker spills from 1970 to 2024.[2]

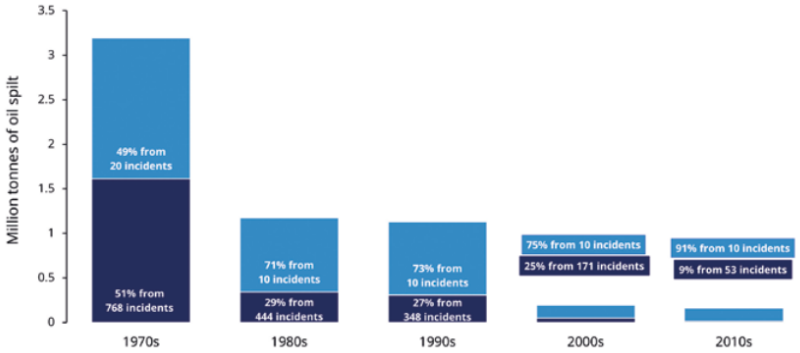


1 *See* DON DEWEES, DAVID DUFF & MICHAEL TREBILCOCK, EXPLORING THE DOMAIN OF ACCIDENT LAW: TAKING THE FACTS SERIOUSLY (1996) (discussing improvements in the empirics in the domain of accident law).

2 ITOPF, OIL TANKER SPILL STATISTICS: 2024, at 8 fig. 2 (2025), https://www.itopf.org/fileadmin/uploads/itopf/data/Documents/Company_Lit/Oil_Spill_Stats_brochure_2024.pdf [https://perma.cc/AX5T-GKA8].

This is also confirmed by a table indicating the global number of oil spills from tankers from 1990 to 2022 (see Figure 2).

Figure 2. Tanker spills of 7 tons or more per decade, showing how a relatively small number of comparatively large spills influence the overall total (2020s excluded; only four years of data).[3]



Notably, this reduction in oil pollution incidents from 1980 to 2020 occurred despite the world's oil tanker fleet increasing by more than 77% in the same time span.[4] Technological advancements, spurred by safety regulations,[5] played a key role in realizing those improvements, but so too, to some extent, did an improved liability regime.[6]

There are, however, many domains where there have been few or no improvements and where, to some extent, the situation has worsened, such as biodiversity. There are several main reasons for biodiversity loss: changes in land use (e.g., deforestation, intensive monoculture, and urbanization), direct exploitation (hunting and overfishing), climate change, pollution, and invasive species.[7] In all continents there

3 ITOPF, OIL TANKER SPILL STATISTICS: 2023, at 10 fig. 7 (2024), https://www.itopf.org/fileadmin/uploads/itopf/data/Documents/Company_Lit/Oil_Tanker_Spill_Statistics_2023 [https://perma.cc/4ZVW-J3YQ].

4 *10 Largest Oil Tanker Companies in the World*, MARINE DIGIT., https://marine-digital.com/article_10largestoiltankercompanies [https://perma.cc/6XST-RRCF] (last visited Nov. 5, 2025).

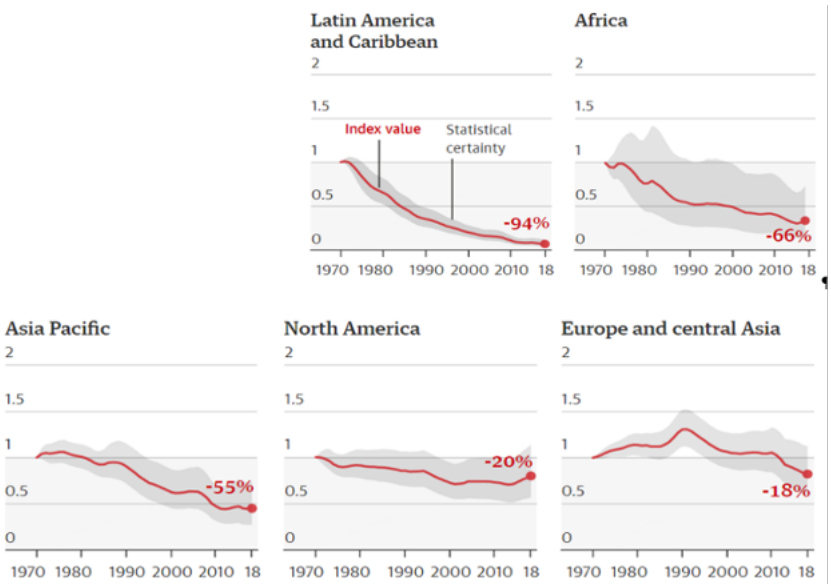
5 For example, the phasing out of so-called single-hull tankers and the introduction of segregated ballast tanks.

6 *See* Ruud Hendrickx, *Marine Oil Pollution: An Empirical Analysis*, *in* SHIFTS IN COMPENSATION FOR ENVIRONMENTAL DAMAGE 243, 243–60 (Michael Faure & Albert Verheij eds., 2007). Hendrickx claims that the stricter liability regime in the U.S. 1990 Oil Pollution Act has contributed to reduced oil spill quantities. *Id.* at 244.

7 Eur. Parliament, *Biodiversity Loss: What Is Causing It and Why Is It a Concern?* (Jan. 16, 2020), https://www.europarl.europa.eu/topics/en/article/20200109STO69929

has been a sharp decline in biodiversity, but it has been the sharpest in Latin America and Africa, as shown in Figure 3.

Figure 3. Decline in biodiversity from 1970 to 2018.[8]



Source: World Wildlife Fund and Zoological Society London

One of the reasons for this decline is the large absence of policy and regulation to protect biodiversity. For example, the Convention on Biological Diversity has not been able to provide adequate protection of biodiversity.[9]

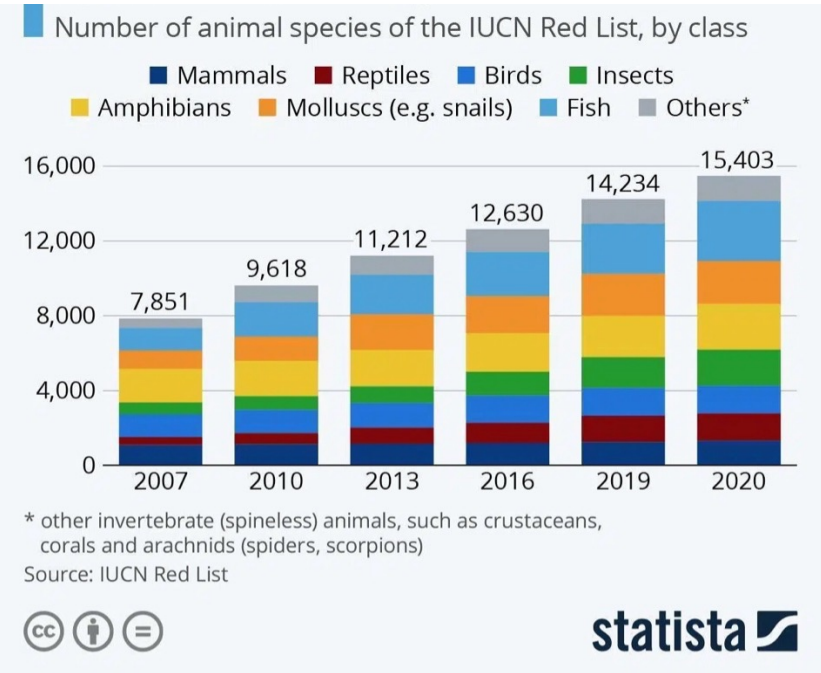
The number of endangered species on the International Union for the Conservation of Nature (IUCN) red list is also rising (see Figure 4).

/biodiversity-loss-what-is-causing-it-and-why-is-it-a-concern [https://perma.cc/F7K4-KQ3L].

8 Patrick Greenfield & Max Benato, *Animal Populations Experience Average Decline of Almost 70% Since 1970, Report Reveals*, GUARDIAN (Oct. 12, 2022, at 19:01 EDT), https://www.theguardian.com/environment/2022/oct/13/almost-70-of-animal-populations-wiped-out-since-1970-report-reveals-aoe [https://perma.cc/W8LS-N4VR].

9 A. Chandra & A. Idrisova, *Convention on Biological Diversity: A Review of National Challenges and Opportunities for Implementation*, 20 BIODIVERSITY & CONSERVATION 3295, 3295–316 (2011).

Figure 4. Increase in the number of endangered species 2007–2020.[10]



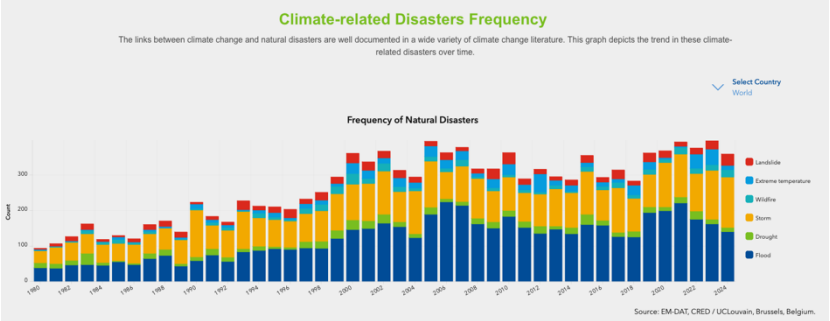
Again, this increase is largely because adequate regulations are either lacking or weakly implemented. One example is the Convention on International Trade in Endangered Species (CITES), which suffers from an enforcement deficit.[11]

Another domain that has seen few improvements and, in many contexts, has worsened is climate change. Research strongly points to an increase in the frequency of climate-related disasters (see Figure 5).

10 *See* Lei Nguyen, *What Animals Will Be Extinct By 2100?*, EARTH.ORG (Nov. 5, 2021), https://earth.org/what-animals-will-be-extinct-by-2100/ [https://perma.cc/C526-5MBN].

11 *See* Michael Faure, *Criminal Liability for Exploitation of Natural Resources*, *in* INTERNATIONAL NATURAL RESOURCES LAW, INVESTMENT AND SUSTAINABILITY 435, 435–52 (Shawkat Akam, Jahid Hossain Bhuiyan & Jona Razzaque eds., 2018).

Figure 5. Climate-related disaster frequency.[12]



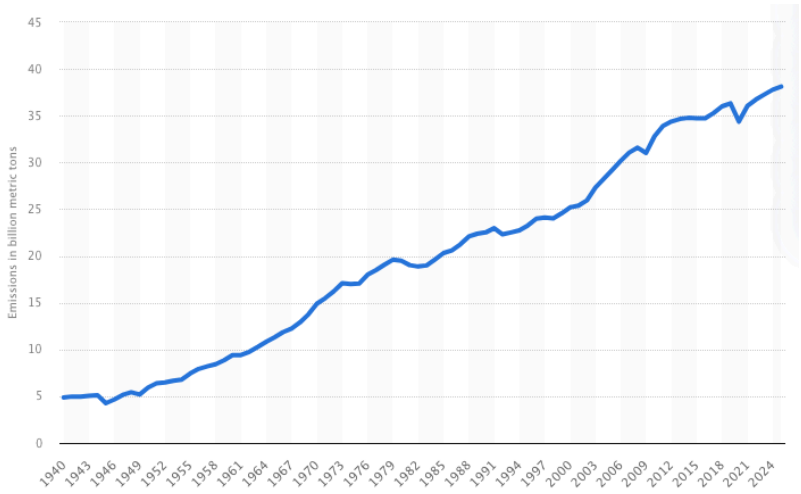
The greenhouse gas emissions causing climate change have not reduced. Notwithstanding many efforts, especially by some regions like the EU,[13] whose policies are largely shaped by scholarship,[14] global greenhouse gas emissions have been rising since 1990, but the growth rate is slightly slowing down. This trend is illustrated by the following graph showing the evolution of worldwide carbon dioxide (CO_2) emissions from 1940 to 2025 (see Figure 6).

12 Int'l Monetary Fund, *Climate Change Data*, IMF: CLIMATE CHANGE DASHBOARD, https://climatedata.imf.org/pages/climatechange-data [https://perma.cc/A9M7-EXLH] (last visited Nov. 5, 2025).

13 For an overview of all the legislative and policy actions in the domain of climate change in the EU, see RESEARCH HANDBOOK ON EU ENVIRONMENTAL LAW (Marjan Peeters & Mariolina Eliantonio eds., 2020).

14 MARJAN PEETERS, MARKT CONFORM MILIEURECHT? EEN RECHTSVERGELIJKENDE STUDIE NAAR DE VERHANDELBAARHEID VAN VERVUILINGSRECHTEN (1992); EU CLIMATE CHANGE POLICY: THE CHALLENGE OF NEW REGULATORY INITIATIVES (Marjan Peeters & Kurt Deketelaere eds., 2006); CLIMATE CHANGE AND EUROPEAN EMISSION TRADING: LESSONS FOR THEORY AND PRACTICE (Michael Faure & Marjan Peeters eds., 2008); Marjan Peeters, *EU Climate Law: Largely Uncharted Legal Territory*, 9 CLIMATE LAW 137, 137–47 (2019).

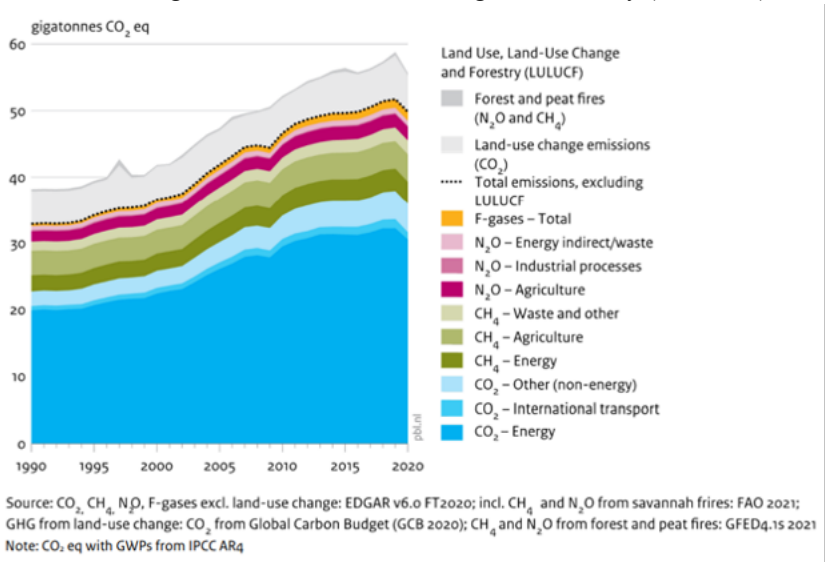
Figure 6. Annual carbon dioxide (CO_2) emissions worldwide from 1940 to 2025 (in billion metric tons).[15]



This is further shown in a graph representing global greenhouse gas emissions (not just CO_2) per type of gas and source (see Figure 7).

15 *Annual Carbon Dioxide (CO_2) Emissions Worldwide from 1940 to 2025*, STATISTA (Nov. 25, 2025), https://www.statista.com/statistics/276629/global-co2-emissions/ [https://perma.cc/5TCJ-V79Q].

Figure 7. Global greenhouse gas emissions, according to type of gas and source, including Land Use, Land-Use Change and Forestry (LULUCF).[16]



Source: CO_2, CH_4, N_2O, F-gases excl. land-use change: EDGAR v6.0 FT2020; incl. CH_4 and N_2O from savannah frires: FAO 2021; GHG from land-use change: CO_2 from Global Carbon Budget (GCB 2020); CH_4 and N_2O from forest and peat fires: GFED4.1s 2021
Note: CO_2 eq with GWPs from IPCC AR4

One crucial contributor to global greenhouse gas emissions has largely been ignored in international regulation: global food supply chains, which are responsible for approximately 26% of global emissions.[17] The production of meat is a particularly illustrative example of a major contributor to greenhouse gas emissions that has been ignored in international regulation. While food production is mentioned as one of the objectives of the United Nations Framework Convention on Climate Change (UNFCC),[18] the potentially negative effects of food, and particularly of meat production, on greenhouse gas emissions were largely ignored until COP28 (2023) in Dubai.[19] As

16 Jos G.J. Olivier, *Trends in Global CO_2 and Total Greenhouse Gas Emissions*, PBL NETH. ENV'T AGENCY 1, 5 fig. S.1 (2022), https://www.klimaatweb.nl/wp-content/uploads/po-assets/721477.pdf [https://perma.cc/7QA8-AQLB].

17 J. Poore & T. Nemecek, *Reducing Food's Environmental Impacts Through Producers and Consumers*, 360 SCI. 987–92 (2018), https://doi.org/10.1126/science.aaq0216; *see also* Walter Willett et al., *Food in the Anthropocene: The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems*, 393 LANCET 447, 447–92 (2019), https://doi.org/10.1016/so140-6736(18)31788-4 (referring to a contribution by food production to global greenhouse gas emissions of 30%).

18 "Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner." U.N. Framework Convention on Climate Change art. 2, May 9, 1992, 1771 U.N.T.S. 107.

19 *See* discussion *infra* Section IV.D.

Figure 7 clearly illustrates, agriculture constitutes an important part of global greenhouse gas emissions, not only of CO_2 but also of nitrous oxide (N_2O) and methane (CH_4).

Concerning the effects of meat production on climate change, there is a paradox: On the one hand, overwhelming literature in environmental economics supports the introduction of a meat tax,[20] and numerous studies examine which types of interventions can reduce meat consumption.[21] On the other hand, there is almost no attention given to this topic in environmental or climate law,[22] nor in the field of law and economics.[23] This absence of discussion is striking when compared to other sectors. For example, there is a lot of attention on the effects of aviation on climate change, but those are in fact minimal compared to the much larger influence of livestock production, which,

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20 *See, e.g.*, Marco Springmann et al., *Health-Motivated Taxes on Red and Processed Meat: A Modelling Study on Optimal Tax Levels and Associated Health Impacts*, PLOS ONE, Nov. 2018 at 1, 1–16, https://doi.org/10.1371/journal.pone.0204139.

21 *See* Tatjana Kwasny, Karin Dobernig & Petra Riefler, *Towards Reduced Meat Consumption: A Systematic Literature Review of Intervention Effectiveness, 2001–2019*, APPETITE, Jan. 2022, at 1, 1–17, https://doi.org/10.1016/j.appet.2021.105739.

22 An important exception constitutes the work of Jonathan Verschuuren, who has spent a lot of attention on the legal instruments needed to reduce greenhouse gas emissions from agriculture. *See* Jonathan Verschuuren, *Achieving Agricultural Greenhouse Gas Emission Reductions in the EU Post-2030: What Options Do We Have?*, 31 REV. EUR., COMPAR. & INT'L ENV'T L. 246, 246–57 (2022), https://doi.org/10.1111/reel.12448 [hereinafter Verschuuren, *Achieving Agricultural Greenhouse Gas Emission Reductions*]; *see also* Jonathan Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology in the Agricultural and Food Transition in the EU: What Role for Law?*, *in* CLIMATE TECHNOLOGY AND LAW IN THE ANTHROPOCENE 163 (Alexander Zahar & Leonie Reins eds., 2025) [hereinafter Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*]; *see also* Melina Moreira Campos Lima, *The Ignored Impact of the Livestock Sector on Climate Change: An Analysis from the Perspective of International Law*, 25 GERMAN L.J. 1149, 1149–65 (2024), https://doi:10.1017/glj.2024.28; *see also* Cordelia Christiane Bähr, *Greenhouse Gas Taxes on Meat Products: A Legal Perspective*, 4 TRANSNAT'L ENV'T L. 153, 153–79 (2015), https://doi.org/10.1017/S2047102515000011 (who equally pay attention to the impact of livestock on climate change, as well as to the possibility of introducing greenhouse gas taxes on meat products); *see also* André Nollkaemper, *The Other 'Transitioning Away' Imperative: Meat as the Next Frontier in Global Climate Change Policy*, EUR. J. OF INT'L L.: BLOG (2025), https://www.ejiltalk.org/the-other-transitioning-away-imperative-meat-as-the-next-frontier-in-global-climate-change-policy/[https://perma.cc/9PFE-LVF2] (calling meat "the next frontier in global climate change policy").

23 An important exception constitutes the work of Romain Espinosa & Nicolas Treich, *Animal Welfare as a Public Good*, ECOLOGIC ECON., Oct. 2023, at 1, 1–11, https://doi.org/10.1016/j.ecolecon.2023.108025; *see also* Nicolas Treich, *Veganomics: vers une approche économique du véganisme?*, 33 REVUE FRANÇAISE D'ECONOMIE 3, 3–48 (2018).

depending on the calculation, amounts to 14.5–25% of all greenhouse gases.[24]

This Article analyzes the effects of meat production on climate change and examines the possible legal instruments that could address this issue. Part I analyzes the impact of meat production on global greenhouse gas emissions based on an overview of the literature in that domain. Part II then discusses which legal instruments would be optimal to address the problem. Part III examines why a meat tax, which has been largely recognized in the literature as the most optimal instrument, has been omitted from the international climate change regime and discusses how such a tax could theoretically be implemented within the international climate change regime. Part IV discusses the limits of this research.

The central thesis of this Article is that livestock production creates substantial negative externalities that are not yet included in the international climate change regime. This Article argues that legal reform is necessary in order to internalize those externalities. Ultimately, this Article concludes that the most adequate instrument to reach this goal is a tax on meat, which should therefore be introduced.

I
ENVIRONMENTAL AND SOCIAL IMPACTS OF MEAT PRODUCTION

Various reports from renowned institutions provide estimates either on the general impact of food production on climate change[25] or specifically on the effects of livestock on the environment.[26] The impact of food production in general is outlined, inter alia, in the Eat-Lancet Commission's report. The report mentions that food production is responsible for up to 30% of global greenhouse gas emissions.[27] An analysis of the relationship between agriculture (more specifically,

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24 The range in the calculation of GHGs is related to whether land use change, as a result of livestock production, is included or not. *See* Marco Springmann et al., *Mitigation Potential and Global Health Impacts from Emissions Pricing of Food Commodities*, 7 NATURE CLIMATE CHANGE 69, 72 (2017), https://doi.org/10.1038/nclimate3155.

25 Willett et al., *supra* note 17.

26 *See* FOOD & AGRIC. ORG., LIVESTOCK'S LONG SHADOW: ENVIRONMENTAL ISSUES AND OPTIONS (2006) [hereinafter FAO]; *see also* Mario Herrero et al., *Greenhouse Gas Mitigation Potentials in the Livestock Sector*, 6 NATURE CLIMATE CHANGE 452, 452–61 (2016), https://doi.org/10.1038/nclimate2925.

27 Willett et al., *supra* note 17, at 3. Note that this refers to food production generally and not just meat. These data are based on the study by Sonja J. Vermeulen, Bruce M. Campbell & John S.I. Ingram, *Climate Change and Food Systems*, 37 ANN. REV. ENV'T & RES. 195, 195–222 (2012), https://doi.org/10.1146/annurev-environ-020411-130608.

livestock production) and greenhouse gas emissions is also established in the chapter on agriculture, forestry, and other land uses in the Intergovernmental Panel on Climate Change (IPCC) 2022 report.[28]

The various reports point to a wide variety of effects that food production, particularly meat production, has on climate change. First, it is necessary to provide an explanation of the scope and terminology used in this Article. Many reports refer generally to food production[29] or to agriculture. The Food and Agriculture Organization of the United Nations (FAO) and several studies mostly refer to livestock production.[30] The FAO defines livestock as "domesticated terrestrial animals that are raised to provide a diverse array of goods and services such as traction, meat, milk, eggs, hides, fibres and feathers."[31] Under this definition, therefore, food is broader than livestock, but livestock does not include all animals. For example, fish are excluded.[32] Within livestock production, I mostly focus on the effects of beef, which is not limited to meat. Livestock farming also leads to other products and environmental effects, such as cheese and yogurt, which are farmed and thus create greenhouse gas emissions. The reader should be aware that some studies that will be referred to discuss the effects of food production in general, while others will focus on livestock production, and others on meat. To the extent possible, I will indicate which issue is addressed in the various studies. Because livestock farming, particularly meat production, has the greatest impact on greenhouse gas emissions, this Article will focus primarily on the effects of meat production.

In this Part, I will first focus on the contribution of livestock production to greenhouse gas emissions (Section A). I then highlight the significant effects that livestock has on land use change, particularly deforestation (Section B), and that the consumption of meat creates

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28 GERT-JAN NABUURS ET AL., INT'L PANEL ON CLIMATE CHANGE, *Agriculture, Forestry and Other Land Uses (AFOLU)*, *in* CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE 747, 747–860 (Priyadarshi Shukla et al. eds., 2022), https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter07.pdf [https://perma.cc/676M-SKPH].

29 For example, the EAT-Lancet Report. *See* Willett et al., *supra* note 17.

30 *Livestock Systems*, FAO, https://www.fao.org/livestock-systems/en/ [https://perma.cc/86W8-DU72] (last visited Dec. 8, 2025).

31 *See id.*

32 Serious problems resulting from fisheries also emerge; for example, as far as biodiversity is concerned, but they do not directly relate to greenhouse gas emissions and will therefore not further be addressed in this study. *See* JING LIU, MICHAEL FAURE & PETER MASCINI, ENVIRONMENTAL GOVERNANCE OF COMMON-POOL RESOURCES: A COMPARISON OF FISHERY AND FORESTRY (2018) (discussing the regulation of fisheries).

substantial health risks (Section C). I conclude that livestock production has an important influence on greenhouse gas emissions and should therefore be included in international climate change policy (Section D). One way of doing that is through the true cost pricing method, which allows for the correct pricing of all kinds of products and services, including the production of meat (Section E). Section F provides a summary.

A. Greenhouse Gas Emissions

A good overview of the various ways in which livestock production affects climate change is provided in the FAO-LEAD (The Livestock, Environment and Development Initiative) Report of 2006.[33] The report explains that livestock produces three gases that all have the potential to contribute to global warming.[34] First, livestock produces direct emissions of carbon dioxide (CO_2) through the animals' respiratory processes. The carbon flux emitted from the respiration of organisms in the biosphere into the atmosphere amounts to fifty billion tons per year.[35] In addition, there are important carbon emissions from food production and from farm use of fossil fuels. Fossil fuel use in manufacturing fertilizer is estimated at forty-one million tons of CO_2 per year worldwide,[36] whereas on-farm fossil fuel use is estimated at ninety million tons of CO_2 per year worldwide.[37]

The second greenhouse gas that animals emit is methane. Methane (CH_4) has twenty-one times more global warming potential than carbon dioxide.[38] This means that CH_4 traps more heat in the atmosphere over a specific time period than CO_2. Animals produce significant amounts of methane as part of their digestive process (so-called enteric fermentation). This fermentation process produces methane as a by-product, which is exhaled by the animal.[39] The methane released in this way is estimated at eighty-six million tons per year worldwide.[40] In addition, animal manure releases methane through the growth of the

33 FAO, *supra* note 26.

34 *Id.* at 82.

35 *Id.* at 85.

36 *Id.* at 88.

37 *Id.*

38 Abdelmajid Moumen et al., *The Effects of Livestock Methane Emission on the Global Warming: A Review*, 9 INT'L J. GLOBAL WARMING 229, 229–53 (2016), https://doi.org/10.1504/IJGW.2016.074956.

39 FAO, *supra* note 26, at 95–96.

40 *Id.* at 95–97.

bacteria in the manure. Methane emissions from this process are estimated at eighteen million tons per year worldwide.[41]

The third greenhouse gas with direct warming potential is nitrous oxide (N_2O). It is 296 times more effective than carbon dioxide in trapping heat and has a very long atmospheric lifetime (114 years compared to methane at 9–15 years).[42] Livestock can emit nitrous oxide in various ways, the most predominant source being manure.[43] Animal manure provides a total N_2O loss of 1.7 million tons per year.[44]

Ammonia (NH_3) is also reported to be a prevailing source of air pollution.[45] Ammonia emissions relate to deposited and applied manure. Global anthropogenic atmospheric ammonia emissions are estimated at forty-seven million tons, of which 94% is produced by the livestock sector.[46]

There are still other ways that livestock can affect climate change, the most important one being land use change, which is discussed below. Land use change refers to the transformation of natural landscapes due to human activities (such as deforestation).[47] The FAO summarizes the impact of livestock production on climate change as follows:

- 9% of global anthropogenic emissions of CO_2;
- 35–40% of global anthropogenic emissions of methane;
- 65% of global anthropogenic emissions of nitrous oxide; and
- 64% of global anthropogenic emissions of ammonia.[48]

If all emissions are taken together, livestock is responsible for 14.5% of all global greenhouse gas emissions,[49] or 25% (if land use is included as well).[50] There has been criticism of this FAO report. The criticism mostly focused on the fact that the 14.5% estimate could be an underestimation, as other studies come to higher estimates of the

41 *Id.* at 97–99.

42 *Id.* at 82.

43 *Id.* at 110–11.

44 *Id.* at 111.

45 Annika Hedberg, *The Farm to Fork Strategy and the Inconvenient Truth*, SUSTAINABILITY (2020), https://www.epc.eu/publication/The-Farm-to-Fork-Strategy-and-the-inconvenient-truth-33ac84/ [https://perma.cc/ZH3E-UPXS].

46 FAO, *supra* note 26, at 114.

47 *Id.* at 90–91.

48 *Id.* at 112–14.

49 Treich, *supra* note 23, at 13.

50 Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 4.

contribution of livestock farming to global greenhouse gas emissions.[51] To put things in perspective: The climate change mitigation potential of dietary changes is higher than the current emissions of global aviation.[52] Focusing on the EU, agriculture accounts for 10.3% of Europe's greenhouse gas emissions, of which approximately 70% is produced by livestock farming.[53] Moreover, global average meat consumption per capita is growing, which can potentially have major negative effects on the environment.[54]

B. Land-Use Change

In addition to these direct effects of livestock production through greenhouse gas emissions, there are also considerable effects on global warming through land use change. The FAO reports that in various parts of the world land use is changing, often to convert forests into pastureland. As a forest contains more carbon than a field of crops or a pasture, large amounts of carbon are released.[55] Livestock plays an important role in deforestation and leads to emissions of approximately 2.4 billion tons of CO_2 per year.[56] In addition, there are also livestock-related releases from cultivated soils (losses due to, inter alia, decomposition and mineralization processes) that lead to twenty-eight million tons of CO_2 emissions per year.[57] Livestock also plays an important role in desertification, leading to changes in biomass and carbon losses, estimated at one hundred million tons of CO_2 emissions per year.[58] Often, land use change takes place by burning forests,[59] which not only increases CO_2 emissions but also creates biodiversity loss. This is especially problematic when primary tropical forests are converted for agriculture, thereby contributing to increased extinction rates and biodiversity loss.[60] As forests are highly complex ecosystems,

51 For a summary of those various studies, see Lima, *supra* note 22, at 1150–53.

52 Springmann et al., *supra* note 24, at 72; *see also Aviation and Shipping*, INT'L ENERGY AGENCY (Sep. 26, 2023), https://www.iea.org/reports/aviation-and-shipping [https://perma.cc/KK8G-J56R] (showing aviation accounted for 2.5% of global energy-related CO_2 emissions).

53 Verschuuren, *Achieving Agricultural Greenhouse Gas Emission Reductions*, *supra* note 22, at 247.

54 H. Charles J. Godfray et al., *Meat Consumption, Health, and the Environment*, 361 SCIENCE 243 (2018).

55 FAO, *supra* note 26, at 90.

56 *Id.* at 90–91.

57 *Id.* at 92.

58 *Id.* at 93–95.

59 *Id.* at 91.

60 Willett et al., *supra* note 17, at 474–75.

deforestation is particularly problematic because forests that have been removed cannot simply be restored on a short-term basis.

Agriculture occupies 40% of global land.[61] Three-fourths of all agricultural land is used for livestock and 40% of the total cereal production in the world is consumed by livestock.[62] Seventy percent of all freshwater is used for agriculture.[63] To produce one kilogram of beef, 15,415 liters of water are needed.[64] Compare this to the water footprint of potatoes: Producing 1 kilo of potatoes requires only 250 liters of water on average worldwide.[65]

C. Increased Health Risks

In addition to the environmental impacts caused by the production of meat, the consumption of meat is also connected to increased health risks.[66] The EAT-Lancet Report mentions that the consumption of red meat in particular creates high risks of cardiovascular disease. Several studies indicate that meat consumption is associated with higher mortality rates.[67] In a meta-analysis, Wolk established that the consumption of fifty grams per day of processed meat significantly increases chronic diseases (18% for colorectal cancer, 19% for pancreatic cancer, 24% for cardiovascular mortality, and 32% for diabetes).[68] Studies equally comparing cohorts of vegetarians and non-vegetarians established that the vegetarians had a significantly lower mortality rate.[69] Also, the impact that livestock-related air pollution has on people's health is often overlooked. The ammonia emissions from livestock waste are a particularly significant source of air pollution. Air

61 *Id.* at 449.

62 Treich, *supra* note 23, at 8.

63 Willett et al., *supra* note 17, at 449, 464–65.

64 Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 4. Beef requires substantially more water than what is needed to produce vegetables. *See id.*

65 Arjen Y. Hoekstra, *The Water Footprint of Food*, *in* WATER FOR FOOD 49, 53 (Jonas Förare ed., Lewis Gruber trans., 2008).

66 *See* David Tilman & Michael Clark, *Global Diets Link Environmental Sustainability and Human Health*, 515 NATURE 518, 518 (2014), https://doi.org/10.1038/nature13959 ("Global diets link environmental sustainability and human health"); *see also* Godfray et al., *supra* note 54.

67 Willett et al., *supra* note 17, at 455–56.

68 Alicja Wolk, *Potential Health Hazards of Eating Red Meat*, 281 J. INTERNAL MED. 106, 106–22 (2017), https://doi.org/10.1111/joim.12543.

69 Vesanto Melina, Winston Craig & Susan Levin, *Position of the Academy of Nutrition and Dietetics: Vegetarian Diets*, 116 J. ACAD. NUTRITION & DIETETICS 1970, 1970–80 (2016), https://doi:10.1016/j.jand.2016.09.025.

pollution, greatly driven by agricultural emissions, causes 400,000 to 790,000 premature deaths and leads to significant economic costs.[70] As a result, the EAT-Lancet Report comes to the remarkable conclusion that the optimal intake of red meat might be null grams per day.[71]

D. Results

Livestock's massive environmental and social costs have major policy implications. Despite the alarming figures associated with livestock's environmental impacts, greenhouse gas emissions related to livestock and meat consumption are largely ignored in global climate change law, which, according to Moreira, "remains a glaring blind spot in the global response."[72] If one agrees that these greenhouse gas emissions should, to some extent, be taken into account, the obvious question arises: how? The answer relates to the issue of whether it is possible to determine "optimal" standards for meat production and consumption. The EAT-Lancet Report indicates that, whereas the Intergovernmental Panel on Climate Change (IPCC) has provided relatively precise emission targets for greenhouse gas emissions from CO_2, which formed the basis for the Paris Agreement, that has not been the case for the global food system. There is uncertainty, and clear scientific targets do not exist.[73]

There are several aspects to be considered when assessing "the price of meat," which is essential to addressing the question of which policy action should be taken to deal with those costs. The economic perspective with respect to the external costs created by meat production and consumption is one of the externalities. In simple terms, meat production and consumption cause significant external costs (some of which were summarized in Sections I.A and I.B) that are not sufficiently incorporated into the price of meat. Because of this lack of internalization, meat is currently seriously underpriced. This raises another issue: whether the costs (in this case related to livestock production) are internal (i.e., affecting only the consumers of meat) or whether there are external costs affecting third parties.

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70 Hedberg, *supra* note 45.

71 Willett et al., *supra* note 17, at 455 ("Because intake of red meat is not essential and appears to be linearly related to total mortality and risks of other health outcomes in populations that have consumed it for many years, optimal intake might be 0 gr/d, especially if replaced by plant sources of protein").

72 Lima, *supra* note 22, at 1.

73 Willett et al., *supra* note 17, at 451.

Some environmental economists argue that the effects of unhealthy diets on the individual are not an externality, as they are a form of self-inflicted harm. They would argue that costs related to increased health risks are usually imposed only upon the consumers of unhealthy food products and are therefore largely internal. Economists refer to these costs as "internalities" for which no justification for government intervention would exist. It is uncertain, however, whether that would be an argument against regulatory intervention. Health impacts can indeed also affect economic outcomes, as health consequences of meat consumption can indirectly lead to productivity losses.[74] That would therefore be an argument to still take those costs into account in calculating the correct costs of meat, even when they are "internalities." Moreover, others argue that those health costs are not merely internal, as they are (especially in the European context) often covered by public health insurance systems, and should therefore be treated as external health costs that should be internalized into actual food prices.[75] That seems to be the correct approach, as unhealthy food habits undoubtedly also create costs for people other than the consumer, which is obviously one of the reasons behind the sugar taxes and fat taxes that have been introduced in some countries (to be discussed in Part II). Ultimately, unhealthy eating habits lead to more pressure on public budgets.[76]

The next question that arises is which policy action with respect to food should be considered; or, in other words, how can one determine which type and quantity of food can be considered sustainable? The answer to that question will depend on the goals determined for policy action and, inter alia, whether one includes health and environmental objectives and, if so, how the latter are precisely determined. The approach used by the EAT-Lancet Report is to rely on the so-called planetary boundaries. Those are "the safe operating space for humanity with respect to the Earth system."[77] These spaces are defined by scientific targets and include the total global amount of cropland use, biodiversity loss, water use, greenhouse gas emissions, and nitrogen and phosphorus pollution that can be associated with food production.[78]

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74 *Id.*

75 Felix Seidel et al., *The True Price of External Health Effects from Food Consumption*, 15 NUTRIENTS, July 30, 2023, at 16–29 (showing that in Germany 601.50 euro per capita and 50.38 billion euro per capita in total are incurred as external health costs on a yearly basis due to bad nutrition and 32.56% of these costs are related to excessive meat consumption).

76 *Id.*

77 Willett et al., *supra* note 17, at 451.

78 *Id.* at 452.

Verschuuren also uses the planetary boundaries approach to identify the impact of agriculture on those boundaries and to determine the policy objectives to be achieved.[79]

The EAT-Lancet report translates the planetary boundaries into concrete standards, as follows (see Figure 8):

Figure 8. Scientific targets for six key Earth system processes and the control variables used to quantify the boundaries.[80]

Earth System Process	**Control Variable**	**Boundary** (uncertainty range)
Climate change	Greenhouse-gas (CH_4 and N_2O)	5 Gt of carbon dioxide equivalent per year (47–54)
Nitrogen cycling	Nitrogen application	90 Tg of nitrogen per year (65–90; *90–130†)
Phosphorus cycling	Phosphorus application	8 Tg of phosphorus per year (6–12: *8–16†)
Freshwater use	Consumptive water use	2500 km^3 per year (1000–4000)
Biodiversity loss	Extinction rate	Ten extinctions per million specie-years (1–80)
Land-system change	Cropland use	13 million km^2 (11–15)

* Lower boundary range if improved production practiced and redistribution are not adopted.
† Upper boundary range if improved production practices and redistribution are adopted and 50% of applied phosphorus is recycled.

The major policy issue is how the planetary boundaries can subsequently be translated into criteria for optimal meat consumption. Several initiatives have been developed to better calculate the costs of meat production and consumption. That is a crucial first step in determining which policy instruments can be employed to achieve more efficient (in economic terms) pricing of meat production and consumption.

79 Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 4–5.

80 Willett et al., *supra* note 17, at 453 tbl. 2.

E. True Cost Pricing

If meat production and consumption do indeed cause such large externalities,[81] there needs to be a method by which those costs can be accurately assessed.[82] One initiative is the True Cost Accounting. The basis of True Cost Accounting can be found in life-cycle assessment (LCA), which uses monetary valuation to aggregate environmental impacts. There is a wide variety of monetary valuation approaches available in LCA, leading to significant variability depending on the environmental impacts that are taken into account.[83] Practical guidelines on how to apply True Cost Accounting for the food and farming sector can be found in True Cost's March 2022 handbook.[84] The handbook provides theoretical and practical principles of the true cost accounting methodology, as well as true cost accounting indicators for agrifood supply chains. True cost accounting can also be found in a 2023 FAO Working Paper on true cost accounting applications for agrifood systems policymakers.[85] This paper also provides a literature review of True Cost Accounting and guidance on how a true cost accounting study can be undertaken, more particularly for the agrifood sector. Generally, the idea of True Cost Accounting is that by reflecting the environmental impact of food, true pricing can promote more sustainable means of production, encouraging consumers to make more sustainable food choices.[86]

The European Commission's Farm-to-Fork Strategy now details a vision of a European Union (EU) tax system that should adequately reflect the "real cost" of environmental damage associated with food

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81 Recall that this can also include health effects even though these are by some (debatably) described as "internalities." But given that those health effects also create external (public health services) costs, they may equally require internalization.

82 Many of the studies refer to externalities created by food production generally. However, for the purposes of this study, I will mostly focus on meat production, but the reader should be aware that the production of other food may equally create externalities that have to be internalized.

83 *See* Andrea M. Amadei, Valeria De Laurentiis & Serenella Sala, *A Review of Monetary Valuation in Life Cycle Assessment: State of the Art and Future Needs*, 329 J. CLEANER PROD., Nov. 2021, at 1, 1–11, https://doi.org/10.1016/j.jclepro.2021.129668 (providing an excellent overview of monetary valuation studies in life-cycle assessment).

84 TRUE COST, TRUE COST ACCOUNTING AGRIFOOD HANDBOOK (2022), https://tca2f.org/wp-content/uploads/2022/03/TCA_Agrifood_Handbook.pdf [https://perma.cc/B3BM-WXY2].

85 Reinier de Adelhart Toorop et al., *True Cost Accounting Applications for Agrifood Systems Policymakers* (Food & Agri. Org., Working Paper No. 23-11, 2023).

86 *See* Editorial, *The True Cost of Food*, 1 NATURE FOOD 185, 185 (2020).

items.[87] Note that the Farm-to-Fork Strategy was criticized in the literature as too strongly relying on empowering consumers via information provisions.[88] As many empirical studies have shown, consumers often do not understand the information provided (or the nudges), as a result of which their effectiveness may be limited.[89] The Farm-to-Fork Strategy largely relies on providing consumers with information on, for example, health risks related to the consumption of meat, with the assumption that the information provision will change consumption behavior.

From an environmental economics perspective, the correct pricing of meat (i.e., that reflects the true social costs) should be at the core of any regulation.[90] That is exactly where True Cost Accounting can help to inform the policymaker about the accurate social costs of meat, thus allowing a correct pricing of meat. The correct pricing of meat has two effects: The higher prices can solve an information problem (ignorance concerning the harmful effects of meat), but the higher prices (resulting from true cost pricing) also have an immediate effect—meat might simply become unaffordable for many, thus generating positive health and environmental effects.

Meat is currently significantly underpriced. The approach followed is, as mentioned, to start with a life cycle analysis in order to analyze the pressure of a certain production process on the environment. For example, the Dutch National Institute for Public Health and the Environment has developed a score list with different environmental effects, such as climate change, water use, land use, and soil

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87 EUR. COMM'N, FARM-TO-FORK STRATEGY – FOR A FAIR, HEALTHY AND ENVIRONMENTALLY FRIENDLY FOOD SYSTEM 15 (2020), https://food.ec.europa.eu/document/download/472acca8-7f7b-4171-98b0-ed76720d68d3_en?filename=f2f_action-plan_2020_strategy-info_en.pdf [https://perma.cc/ED9W-2FW5] ("Tax incentives should also drive the transition to a sustainable food system and encourage consumers to choose sustainable and healthy diets. . . . EU tax systems should also aim to ensure that the price of different foods reflects their real costs in terms of use of finite natural resources, pollution, GHG emissions and other environmental externalities"); *see also* David Klenert, Franziska Funke & Mattia Cai, *Meat Taxes in Europe Can Be Designed to Avoid Overburdening Low-Income Consumers*, 4 NATURE FOOD 894, 894–901 (2023), https://doi.org/10.1038/s43016-023-00849-z.

88 *See* Nikhil Gokani, *Healthier Food Choices: From Consumer Information to Consumer Empowerment in EU Law*, 47 J. CONSUMER POL'Y 271, 271–96 (2024).

89 *See* discussion *infra* Section III.E.

90 Franziska Funke et al., *Toward Optimal Meat Pricing: Is It Time to Tax Meat Consumption?*, 16 REV. ENV'T ECON. & POL'Y 219, 220 (2022).

acidification.[91] These insights subsequently allow for a monetary calculation of the true costs by multiplying their environmental impacts in different emission categories to determine the environmental costs of various protein sources.[92] This led the Dutch Institute for Public Health and the Environment to a calculation of the environmental impacts of particular food products, distinguishing, inter alia, between effects on global warming, acidification, eutrophication, land use, and water consumption.[93] If the external costs of beef, due to the impacts on climate change and nutritional pollution, were incorporated, this would add up to an average of USD $5.75–9.17 per kilogram.[94] Accounting for biodiversity loss and diet-related health impacts would further increase those costs,[95] which would certainly be the case when animal welfare is equally taken into account.[96]

These numbers indicate high social costs of meat production and consumption that are currently not internalized (as they are not incorporated in the price of meat).[97] According to a report by the financial services provider Trucost,[98] none of the large economic activities (such as coal power generation in Eastern Asia, cattle ranching and farming in South America, or rice farming in Southern Asia) would be profitable if the environmental costs were fully

91 Mark A. J. Huijbregts et al., *ReCiPe 2016: A Harmonised Life Cycle Impact Assessment Method at Midpoint and Endpoint Level*, 22 INT'L J. LIFE CYCLE ASSESSMENT 138, 138–47 (2017).

92 Sahar Azarkamand et al., *Calculating the True Costs of Protein Sources by Integrating Environmental Costs and Market Prices*, 49 SUSTAINABLE PROD. & CONSUMPTION 28, 28–41 (2024).

93 *See* NATIONAL INSTITUTE FOR PUBLIC HEALTH AND THE ENVIRONMENT, DATABASE MILIEUBELASTING VOEDINGSMIDDELEN (2019) (providing a detailed account of the environmental impact of a variety of products, measured in Kg CO_2 equivalent, showing, not surprisingly, that the impact on global warming of meat production (for example 20,345 kg CO_2 eq. for hamburgers) is substantially higher than potatoes (0.339 kg CO_2 eq.) or beer (0.414 kg CO_2 eq.)).

94 Funke et al., *supra* note 90, at 221.

95 *Id.*

96 *See id.* at 225; Mark Budolfson et al., *Monetizing Animal Welfare Impacts for Benefit-Cost Analysis*, J. BENEFIT-COST ANALYSIS 206, 207–23 (2024), https://doi.org/10.1017/bca.2024.19 (explaining an attempt to monetize animal welfare impacts).

97 Even though, as indicated above, there is a large variety of different environmental effects of meat production, the most important social costs of meat are often defined as carbon emissions, biodiversity loss, and increased health risks.

98 Trucost is a part of Standard and Poor (S&P). According to its website, it is a leader in carbon and environmental data and risk analysis. *Trucost Environmental*, S&P GLOBAL: MARKETPLACE, https://www.marketplace.spglobal.com/en/datasets/trucost-environmental-(46) [https://perma.cc/W7TE-8F27] (last visited Nov. 5, 2025).

integrated for the simple reason that the natural capital costs would be higher than the total revenues (see Figure 9).[99]

Figure 9. Ranking of the five region-sectors with the greatest overall natural capital impact[100]

RANK	SECTOR	REGION	NATURAL CAPITAL COST, $BN	REVENUE, $BN	IMPACT RATIO
1	COAL POWER GENERATION	EASTERN ASIA	452.8	443.1	1.0
2	CATTLE RANCHING AND FARMING	SOUTH AMERICA	353.8	16.6	18.8
3	COAL POWER GENERATION	NORTHERN AMERICA	316.8	246.7	1.3
4	WHEAT FARMING	SOUTHERN ASIA	266.6	31.8	8.4
5	RICE FARMING	SOUTHERN ASIA	235.6	65.8	3.6

Assuming that these findings are accurate, this would imply that many companies in the above-mentioned sectors would no longer be profitable if they fully incorporated social costs. This also implies that polluters are not incorporating social costs and that the polluter-pays principle is not respected.[101] In fact, the contrary is true: Instead of a polluter-pays principle, in the EU, in effect, a polluter-receives principle is applied,[102] as the core of the Common Agricultural Policy (CAP) is that substantial subsidies are provided to the agricultural sector in general, including to the livestock industry. Hedberg criticizes the Common Agricultural Policy for spending over EUR $348 billion on agriculture to support, in his words, "unhealthy and unsustainable meat and dairy production."[103] Similar criticism also comes from the World Bank, which argues that fossil fuel and farming subsidies are "toxic" and cause "environmental havoc."[104]

F. Summary

This overview showed that food production and consumption, particularly of meat, have substantial environmental and health

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99 TRUCOST, NATURAL CAPITAL AT RISK: THE TOP 100 EXTERNALITIES OF BUSINESS 7–9 (2013), https://www.naturalcapitalcoalition.org/wp-content/uploads/2016/07/Trucost-Nat-Cap-at-Risk-Final-Report-web.pdf [https://perma.cc/6LEU-HT9J].

100 *Id.* at 9 tbl. 2.

101 *See* Treich, *supra* note 23, at 14.

102 *Id.*

103 Hedberg, *supra* note 45.

104 Damian Carrington, *Vast Fossil Fuel and Farming Subsidies Causing 'Environmental Havoc*,*'* THE GUARDIAN (June 15, 2023, at 21:00 ET), https://www.theguardian.com/environment/2023/jun/15/vast-fossil-fuel-and-farming-subsidies-causing-environmental-havoc-world-bank [https://perma.cc/7RRH-GG35]; FOOD & LAND USE COAL., GROWING BETTER: TEN CRITICAL TRANSITIONS TO TRANSFORM FOOD AND LAND USE (2019), https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf [https://perma.cc/J375-KWQZ].

impacts, and that there is, via various channels, a substantial impact (directly and indirectly) on climate change. Costs of meat production and consumption, particularly externalities (but also internalities via increased health risks), are substantial and can be calculated based on true cost accounting. That, however, indicates that many industries, including farming, would no longer be profitable if there were a full internalization of social costs. However, the policy is currently not geared toward internalizing the costs related to livestock production and consumption; to the contrary, these activities are largely subsidized. That obviously leads to the question of which possible regulatory (and other) tools could be employed in order to achieve an internalization of livestock's social costs.

II
POSSIBLE REGULATORY (AND OTHER) TOOLS

The goal of a regulatory intervention can be clearly distilled from the true cost analysis at the end of the previous Part: Food production in general, but meat production and consumption specifically, currently lead to substantial social costs that are not incorporated in the prices. The policy goal of regulatory intervention can therefore be described as closing the gap between the current prices of meat and the true social cost.[105] As discussed in the previous Part, several studies indicate that consumers would benefit from dietary changes, particularly moving to a plant-based diet,[106] which would be both in their own interest (by reducing health risks) and in the planet's interest (by reducing greenhouse gas emissions). In that sense, a dietary change provides co-benefits.[107] However, given a large number of behavioural biases, dietary changes are not likely to occur automatically (i.e., without any regulatory or other intervention).[108] The classic paradigm of the

105 Maximilian Pieper, Amelie Michalke & Tobias Gaugler, *Calculation of External Climate Costs for Food Highlights Inadequate Pricing of Animal Products*, 11 NATURE COMMC'NS, 2020, at 1, 1–13 (emphasizing that policy measures should close the gap between current market prices and their true costs of food).

106 Willett et al., *supra* note 17, at 472.

107 Marco Springmann et al., *Analysis and Valuation of the Health and Climate Change Cobenefits of Dietary Change*, 113 PNAS 4146, 4146–51 (2016), https://www.pnas.org/doi/10.1073/pnas.1523119113.

108 Funke et al., *supra* note 90.

economic approach to law (i.e., the Coase theorem)[109] cannot help out here either, as transaction costs might be prohibitive.

This Part discusses available tools that can take livestock production and consumption into account when crafting policy approaches that aim to close the gap between the current market price of meat and its true social costs. Section A focuses on production transformation, which is, however, difficult to achieve for a variety of reasons. Section B deals with the possibility of regulating livestock production, which is, given the large variety of producers, equally problematic. Section C examines market-based instruments as a logical alternative, such as the emission trading scheme. Section D advances the option that is strongly advocated for in the literature: the introduction of a meat tax. Section E contemplates using behavioral policy as a strategy to change consumption patterns. Lastly, Section F concludes that while there is a strong argument in favor of the introduction of a meat tax, its introduction should not be done in isolation, but rather as part of a smart mix of different instruments.

A. Production Changes

The literature mentions that a Great Food Transformation,[110] which would require immediate action, is needed to avoid serious, even disastrous, consequences.[111] The Lancet Commission suggests five strategies for a Great Food Transformation: seeking international and national commitment to shift consumers toward healthy diets, shifting agricultural practices to prioritize producing healthy food, generating high-quality sustainable food, and reducing food loss and waste.[112] The Lancet Commission also offers several tools to realize the transformation, such as building an alliance of forces to operationalize the Lancet Commission's broad recommendations.[113]

This production transformation is equally suggested in the EU's Farm to Fork Strategy, which also has a strong focus on improving

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109 R.H. Coase, *The Problem of Social Cost*, J.L. & ECON. 1, 1–44 (1960) (holding that when transaction costs are zero or at least low, an optimal (efficient) solution could be reached without a need for the law to intervene).

110 Willett et al., *supra* note 17, at 477 (introducing the concept by the EAT-Lancet Commission that is also used by the FAO in its 2018 report, Transforming Food and Agriculture to Achieve the SDG's).

111 *Id.* at 476 (discussing a variety of consequences from hunger and negative health effects to climate change, land use change, and biodiversity loss).

112 *Id.* at 478–85.

113 *Id.* at 484–85. *See also* FOOD & LAND USE COAL., *supra* note 104 (providing an analysis of the way to implement a transformation of food and land use).

methods of production by, inter alia, suggesting a code of conduct for responsible business and marketing practices accompanied by a monitoring framework.[114] Also in the FAO 2006 Report, there is a strong focus on technical options to improve the efficiency of meat production toward sustainability. For example, the 2006 Report suggests reducing the methane (CH_4) emissions from enteric fermentation through improved efficiency and diets,[115] mitigating CH_4 emissions through improved manure management and biogas,[116] and seeking technical options for N_2O emissions and ammonia (NH_3) volatilization.[117] More recent FAO studies also examine nutritional, manure, and animal husbandry practices for mitigating CH_4 and nitrous oxide (N_2O) emissions from livestock production.[118] These FAO studies also suggest a wide variety of measures that could be taken at the production level to reduce emissions (including improved rice management, manure management, and crop nutrient management).[119]

The easiest, healthiest, and cheapest option currently available to implement the Great Food Transformation is to move to vegetarian meat substitutes.[120] However, some propose even more radical alternatives for meat production. One option receiving increasing attention is the production and consumption of insects, at least as feed in livestock production.[121] Another alternative is to replace animal protein with plant protein. For example, the Farm-to-Fork Strategy suggests marine feed stocks, such as algae, as feed for animals (e.g., to replace soya grown on deforested land).[122] Yet another alternative is either "mock meat" (transformed plant proteins) or muscle tissues

114 EUR. COMM'N, *supra* note 87.

115 FAO, *supra* note 26, at 119.

116 *Id.* at 121.

117 *Id.* at 122.

118 FOOD & AGRIC. ORG. OF THE UNITED NATIONS (FAO), CLIMATE CHANGE MITIGATION OPTIONS IN AGRIFOOD SYSTEMS, SUMMARY OF THE WORKING GROUP III CONTRIBUTION TO THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 6TH ASSESSMENT REPORT 8–12 (2023).

119 *See* Alexander N. Hristov et al., *Mitigation of Greenhouse Gas Emissions in Livestock Production – A Review of Technical Options for Non-CO_2 Emissions* (Pierre J. Gerber, Benjamin Henderson & Harinder P.S. Makkar eds., FAO Animal Prod. & Health, Paper No. 177, 2013).

120 Willett et al., *supra* note 17, at 471–85.

121 *See* Arnold van Huis & Laura Gasco, *Insects as Feed for Livestock Production: Insect Farming for a Livestock Feed as the Potential to Replace Conventional Feed*, 379 SCIENCE 138, 138–39 (2023), https://doi.org/10.1126/science.adc9165.

122 EUR. COMM'N, *supra* note 87.

cultured in bioreactors.[123] The latter is also referred to as lab-grown meat or cultured meat.[124] However, that does not yet seem to be a viable alternative as almost 23% of the global energy production would be needed for cultured meat production, the water use associated with conventional meat and cultured meat would be comparable, and the costs involved in large-scale cultured meat production would, at this stage, still be very high.[125] Verschuuren refers to a cost of USD $63 per kilogram.[126] He therefore argues that cultured meat will likely remain a niche product for consumers in developed countries. Others also argue that these alternatives are, at this moment, of marginal help.[127]

The question then becomes how to achieve the (realistic) production changes, such as those proposed by the EAT-Lancet Commission and by the FAO. One possibility is to use the clean development mechanism (CDM) under the Kyoto Protocol.[128] Still, in addition to these financial incentives, more drastic legal and policy measures will be necessary to close the gap between current market prices and the true costs of food.[129]

B. Regulation of Production

One available legal option for closing the gap between current market prices and the true cost of food is to make use of liability rules. Within Shavell's framework for the choice between liability rules and regulation, the policymaker should first analyze if the internalization of negative externalities can be reached via liability

123 Harry Aiking & Joop de Boer, *The Next Protein Transition*, 105 TRENDS FOOD SCI. & TECH. 515, 520 (2020).

124 *See* Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 174 (explaining the details of the technology).

125 *Id.* at 174–76.

126 *Id.* at 176.

127 Aiking & de Boer, *supra* note 123, at 520.

128 As suggested by the FAO, *supra* note 26, at 238–39. The CDM, as defined in Article 12 of the Kyoto Protocol, allows developed countries to invest in emission reduction or removal projects in developing countries. The CDM has been replaced by a successor provided for in Article 6 of the Paris Agreement, which outlines mechanisms for international cooperation on carbon markets and nonmarket approaches. It is referred to as the "Sustainable Development Mechanism" (SDM) and is designed to eventually replace the CDM. The CDM will, however, continue for a transitional period and can thus be employed for projects aimed at sustainable food transfer within the livestock sector. *See A Practitioner's Guide: Aligning the Voluntary Carbon Market with the Paris Agreement Test*, GOLD STANDARD (July 3, 2024), https://www.goldstandard.org/publications/a-practitioners-guide-aligning-the-voluntary-carbon (on file with the Journal of Environmental Law and Policy).

129 Pieper, Michalke & Gaugler, *supra* note 105, at 1.

rules, as their costs are relatively lower;[130] only when that would not work should regulation come into the picture. A liability rule can have an ex ante incentivizing effect by holding an injurer ex post liable for the harm caused by their actions.[131] The use of liability rules to deal with the externalities created by livestock production would imply holding producers liable for the external costs resulting from livestock production. However, as the damage is typically widespread, it is very unlikely that the liability rules would be used against meat producers.[132] Liability rules are therefore not a viable option to realize the Great Food Transformation that is needed, according to the EAT-Lancet Commission.[133] Liability rules would assume that potential victims (particularly of climate change) would bring a lawsuit against farmers, arguing that their livestock contributed to climate change through their emissions. Many issues may arise, including the standard of care (under negligence), uncertainty over causation, and access to justice. Therefore, it cannot be expected that liability rules would play a major role in internalizing the negative externalities related to livestock production.

One other option is to have standards set ex ante via government regulation.[134] Regulation is also suggested in some literature as a policy

130 Steven Shavell, *Liability for Harm Versus Regulation of Safety*, 13 J. LEGAL STUD. 357, 357–74 (1984).

131 The incentivizing effects of liability rules have been explored in detail in the economic analysis of law. *See* STEVEN SHAVELL, *Economic Analysis of Accident Law*, *in* FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW (1987).

132 Although in the United States lawsuits have started against the animal industry. *See* Daina Bray & Thomas M. Poston, *The Methane Majors: Climate Change and Animal Agriculture in U.S. Courts*, 49 COLUM. J. ENV'T L. 145, 145–248 (2024).

133 With this I do not deny the importance of climate change litigation, which is especially important as an instrument to force policymakers to set appropriate standards. It cannot be expected that the food production changes needed in the Great Food Transformation will be realized via standard-setting by the judiciary. At best liability rules could play a supplementary role, as a backup for other instruments (like a meat tax). *See* Michael Faure & Marjan Peeters, *Liability and Climate Change*, *in* OXFORD RESEARCH ENCYCLOPEDIA OF CLIMATE CHANGE 1–30 (2019) (talking about climate change liability and litigation); *see also* MIRIAM HARITZ, AN INCONVENIENT DELIBERATION – THE PRECAUTIONARY PRINCIPLE'S CONTRIBUTION TO THE UNCERTAINTIES SURROUNDING CLIMATE CHANGE LIABILITY (Dec. 17, 2010) (dissertation, Maastricht University); GIEDRE KAMINSKAITE-SALTERS, CLIMATE CHANGE LITIGATION UNDER ENGLISH LAW (Feb. 11, 2010) (dissertation, Maastricht University); JANA NYSTEN, PRIVATE CLIMATE LITIGATION ACTIONS VS. NATIONAL REGULATORY APPROACHES: A LEGAL ASSESSMENT OF THEIR INTERRELATION AND POTENTIAL BASED ON THE EXAMPLE OF GREENHOUSE GAS EMISSION REDUCTIONS (Nov. 26, 2024) (dissertation, Maastricht University).

134 Shavell, *supra* note 130, at 357–74 (presenting the classic criteria for safety regulation). *But see* Niels J. Philipsen, *Regulation of Liberal Professions and Competition*

instrument to control meat production.[135] This could take the form of a direct regulation of farming practices by controlling the greenhouse gas emissions from meat production (for example, through permits), banning particular unsustainable production practices via regulation (backed up with public sanctions), or prescribing the use of sustainable practices. Direct regulation of producers could ensure minimum standards for rearing conditions and environmentally sustainable farming practices.[136]

It is, however, considered more complicated to regulate food externalities on the production side.[137] As such, most instruments focus on reducing the consumption of animal products.[138]

There are different EU Directives that deal with specific aspects of meat production. For example, methane emissions are regulated through the Effort Sharing Regulation,[139] as well as through the Industrial Emissions Directive.[140] However, the regulation of greenhouse gas emissions from meat production at the EU level is qualified as haphazard[141] and certainly does not cover all emissions in such a way as to sufficiently close the gap between market prices and

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Policy: Developments in the EU and China, 6 J. COMPETITION L. & ECON. 203–31 (2010); Niels J. Philipsen, *Limiting Auditors' Liability: The Case for (and Against) EU Intervention*, 39 GENEVA PAPERS ON RISK & INS. 585, 585–97 (2014); Niels J. Philipsen, *The Role of Private Actors in Preventing Work-Related Risks: A Law and Economics Perspective*, 24 EUR. PUB. L. 539–54 (2018).

135 Jonathan A. Foley et al., *Solutions for a Cultivated Planet*, 478 NATURE 337, 337–42 (2011) (arguing that food security can increase while at the same time reducing agriculture's environmental footprint by "closing 'yield gaps' on underperforming lands, increasing cropping efficiency, shifting diets and reducing waste").

136 Funke et al., *supra* note 90, at 234.

137 *See* Stefan Wirsenius, Fredrik Hedenus & Kristina Mohlin, *Greenhouse Gas Taxes on Animal Food Products: Rationale, Tax Scheme and Climate Mitigation Effects*, 108 CLIMATE CHANGE 159, 159–84 (2011).

138 Marco Springmann et al., *Options for Keeping the Food System Within Environmental Limits*, 562 NATURE 519, 519–25 (2018).

139 Commission Regulation 2018/248 of May 30, 2018 on Binding Annual Greenhouse Gas Emission Reductions by Member States from 2021 to 2030 Contributing to Climate Action to Meet Commitments Under the Paris Agreement, 2018 O.J. (L 156) 26; *see also* Marjan Peeters & Natassa Athanasiadou, *The Continued Effort Sharing Approach in EU Climate Law: Binding Targets, Challenging Enforcement?*, 29 REV. EUR., COMPAR. & INT'L ENV'T L. 201, 201–11 (2020).

140 *See* Directive 2024/1785 of April 24, 2024 on Industrial Emissions (Integrated Pollution Prevention and Control), 2024 O.J. (L 1785); *see also* Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 170; *see also* Verschuuren, *Achieving Agricultural Greenhouse Gas Emission Reductions*, *supra* note 22, at 253–55.

141 Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 164.

the true costs of food. There is, incidentally, a recent EU Regulation on the reduction of methane emissions, promulgated on June 13, 2024, but the scope is limited to methane emissions related to oil and gas production[142] and does not relate to methane emissions from agriculture at all.[143]

That, of course, raises the question of whether market-based instruments would be more effective than government regulation via standards. In theory, market-based instruments could provide incentives for an efficient internalization of externalities in a dynamic manner—that is, providing dynamic incentives to keep investing in research and development to further abate pollution at low marginal costs.[144] Regulatory standards have the disadvantage that they are not dynamic, can become quickly outdated, provide no incentives to go beyond the regulatory standards, are often insufficiently differentiated (according to the specific situation of different operators), and require high monitoring and enforcement costs in order to be effective.[145]

C. Extending the ETS

In the context of market-based instruments, one option for closing the gap between current market prices and the true cost of food is to extend the EU Emissions Trading System (ETS), which may be the most important system in controlling greenhouse gas emissions, to the agricultural sector.[146] Verschuuren mentions that the expansion of the ETS to cover major meat and dairy processing installations is a serious option. The same sources of emissions related to livestock could be monitored (such as emissions from fertilizer production, land use change, and on-farm sources) and could therefore theoretically be subject to an ETS. However, there are disadvantages for other sources

142 *See* Commission Regulation 2024/1787 of June 13, 2024 on the Reduction of Methane Emissions in the Energy Sector, 2024 O.J (L 1787) art. 1(2)(a).

143 Commission Regulation 2024/1787 of July 15, 2024 on the Reduction of Methane Emissions in the Energy Sector, 2024 O.J (L 1787) art. 1(2) (explaining the regulation applies to methane emission from the energy sector, such as oil and gas exploration, not methane emission from the livestock sector).

144 *See* MOVING TO MARKETS IN ENVIRONMENTAL REGULATION: LESSONS FROM TWENTY YEARS OF EXPERIENCE (Jody Freeman & Charles D. Kolstad eds., 2007) (explaining the advantages of market-based instruments).

145 Shavell, *supra* note 130, at 363–64.

146 *See* Marjan Peeters, *Greenhouse Gas Emissions Trading in the EU*, *in* CLIMATE CHANGE LAW, ELGAR ENCYCLOPEDIA OF ENVIRONMENTAL LAW 377–87 (Daniel A. Farber & Marjan Peeters eds., 2016).

if included in an ETS.[147] This would specifically be the case when considering the incorporation of, for example, emissions from manure or enteric fermentation into an ETS. One problem is that the ETS would also focus on controlling production, which may lead to substantial monitoring costs.[148] Moreover, controlling greenhouse gas emissions from fixed installations in industry is one thing; monitoring greenhouse gas emissions such as methane from manure or enteric fermentation is quite another.[149] Monitoring production would, in effect, entail a measurement of all living and moving beings on separate farms and thus potentially pose very high monitoring costs. However, especially for larger farms, including them in an ETS should not be totally discarded. This could be done by calculating the number of cows on a farm and the methane emissions per cow. Verschuuren states, "For a small number of farming activities, however, direct inclusion in the ETS seems possible, especially for large-scale intensive livestock keeping within closed buildings. Methane emissions can easily be monitored here."[150]

There is, however, doubt that production-focused measures would be able to satisfy growing food demands in a sustainable manner; demand-side mitigation options are often considered more promising.[151] That is why the instrument most often cited in the literature is the use of taxation, not on production, but rather on consumption—in other words, a meat tax.

D. Meat Tax

1. Meat Tax and Carbon Pricing

Recall that the policy goal defined at the end of the previous Part is to seek a policy measure that is able to close the gap between the current market prices and the true cost of food.[152] From that perspective, it seems obvious to focus on the instruments that may be most suited to

147 Verschuuren, *Achieving Agricultural Greenhouse Gas Emission Reductions*, *supra* note 22, at 254.

148 Funke et al., *supra* note 90, at 221.

149 Springmann et al., *supra* note 24, at 69.

150 Verschuuren, *Achieving Agricultural Greenhouse Gas Emission Reductions*, *supra* note 22, at 254 (mentioning that many non-European regions (e.g., Alberta and California) have included agricultural emissions in their ETS as offsets).

151 Bojana Bajželj et al., *Importance of Food-Demand Management for Climate Mitigation*, 4 NATURE CLIMATE CHANGE 924, 924–29 (2014), https://doi.org/10.1038/nclimate2353; *see also* Herrero et al., *supra* note 26.

152 Pieper, Michalke & Gaugler, *supra* note 105.

reach this policy goal (i.e., a Pigouvian tax).[153] The question then arises: What should be taxed? The classic answer in economics would be to impose the tax on the source of the emission—in other words, on the method of production. However, that may be a complicated strategy. It is costly and technically difficult to control all the various sources of greenhouse gas emissions from agriculture, given the heterogeneity of agricultural practices and the problem of diffuse pollution.[154] Even if the meat production sector were able to substantially improve its practices (along the suggestions discussed in Section II.A), reducing meat consumption on a large scale would surely have a more substantial impact on both the environment and health.[155] This was argued in a Science article,[156] and to consider the consumer in this case as a polluter is also in line with economic principles, particularly the Coase theorem, as producers and consumers are bound to each other via the price mechanism.[157]

Funke et al. explain that a meat tax is not the same as carbon pricing. Carbon pricing would suppose that appropriate prices on carbon and other externalities are in place. That would be the so-called first-best option. If that is not available, the strategy of targeting meat is the second-best solution.[158] They equally mention another advantage of consumption taxes (on meat) compared to taxes on production: The latter might create negative impacts on competitiveness for the country that would introduce such a tax.[159]

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153 As propagated in the classic work of ARTHUR C. PIGOU, A STUDY IN PUBLIC FINANCE (1951).

154 Treich, *supra* note 23, at 14–15; Springmann et al., *supra* note 24, at 69.

155 Treich, *supra* note 23, at 14–15; Springmann et al., *supra* note 24, at 69.

156 Poore & Nemecek, *supra* note 17 ("Today, and probably into the future, dietary change can deliver environmental benefits on a scale not achievable by producers").

157 Dirk Heine, Michael Faure & Goran Dominioni, *The Polluter-Pays Principle in Climate Change Law: An Economic Appraisal*, 10 CLIMATE L. 94, 94–115 (2020).

158 Funke et al., *supra* note 90, at 220–21.

159 *Id.* at 221. Of course, a tax on the consumption of meat can also indirectly affect producers (although probably less than a direct production tax). That is a reason why countervailing measures to deal with the consequences of a meat tax for farmers should be considered as well, as will be argued in Sections II.D.4 and IV.A. Even though, in line with the literature, I will mostly focus on the effects of a meat tax. One should be aware that only taxing meat would not completely internalize the externalities related to livestock farming, as it would exclude other products such as milk, cheese, and yogurt, the production of which equally leads to emissions of greenhouse gases.

2. Determining the Optimal Meat Tax

With this in mind, the issue becomes achieving the optimal meat tax—in other words, how to set the correct tax level?[160] The True Cost Analysis, discussed at the end of Part I, can be helpful in determining the amount of the externality and thus the optimal price of the tax. Several elements determine the design and optimal tax rate.

First, in the case of multiple market failures and inefficiencies (as is the case in meat production and consumption), the optimal tax rate does not always equal the total sum of all externalities.[161] If an optimal tax to reduce greenhouse gas emissions from livestock is set and fully controls the externality, it will have the co-benefit of reducing local nutrient pollution—for example, through the use of fertilizers. If a tax (e.g., on fuel) were set at the level of the sum of the external costs for both pollution and greenhouse gas emissions, the tax would be suboptimally high.[162]

Second, meat production also has indirect effects of deforestation and biodiversity loss. A tax should take into account the potential interaction effects with those aspects as well.[163]

Third, crucial to the tax design are the so-called cross-price elasticities of demand. Price elasticity refers to how the demand for a particular good (in this case, meat) changes in response to the price. Ideally, the meat tax would give rise to a substantial reduction in the demand for meat. But whether that is really the case depends not only on the size of the tax but also on the price of alternatives. Meat taxes should be carefully designed to avoid encouraging consumers to substitute other unhealthy products for red and processed meat.[164]

Finally, the literature raises the discussion of whether animal welfare concerns should also be incorporated when setting the meat tax. Although consumers might care about animal welfare and would be willing to pay a premium for better conditions for animals, there is often an unwillingness to pay such a price premium if there is free-riding by others.[165] Moreover, there is often a gap between consumers'

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160 Funke et al., *supra* note 90.

161 *Id.* at 226.

162 Ian W.H. Parry & Kenneth A. Small, *Does Britain or the United States Have the Right Gasoline Tax?*, 95 AM. ECON. REV. 1276, 1276–89 (2005). A counterargument is that other elements should be taken into account like local emissions, peak-period congestion, and the accident risk. *Id.* at 1276.

163 Budolfson et al., *supra* note 96; Funke et al., *supra* note 90, at 227.

164 Funke et al., *supra* note 90, at 229.

165 *Id.* at 229–30.

stated preferences (concerning animal welfare) and their actual purchase decision (i.e., buying cheap meat).[166] As far as the meat tax is concerned, part of the fiscal revenue could be used to help farmers improve animal welfare. Moreover, higher meat prices can help correct consumers' cognitive dissonance when buying meat.[167]

Springmann et al. calculated optimal tax levels on red and processed meat.[168] They estimate increased meat prices by 4% on average, ranging from less than 1% in low-income countries to 21% in high-income countries (for red meat).[169] For processed meat, the price would, on average, increase by 25%, ranging from 1% in low-income countries to 111% in high-income countries.[170] In their additional analysis, they indicate that optimal taxation could also reduce food-related greenhouse gas emissions by 109 metric tons CO_2-eq, resulting from reduced beef consumption.[171] Others argue that a correct pricing of meat (for example, via an environmental tax that covers GHG emissions and nutrient pollution)[172] would lead to an estimated increase in current retail prices of meat in high-income countries by roughly 20–60%.[173] There are, in other words, several studies that provide estimates, with ranges of uncertainties, on the optimal tax rate.

3. Effects of a Meat Tax

Several studies have also estimated the expected effects of incorporating these optimal tax levels, both on health risks and on greenhouse gas emissions. As (almost) no country today has a meat tax, none of these studies provides empirical evidence on the effects of the introduction of a meat tax. Most studies either relate to taxes on other (food) products or to carbon taxes, or they theoretically analyze the expected effects of a meat tax, based on modelling. Notwithstanding these limitations, these studies provide interesting insights into the potential effects of the introduction of a meat tax.

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166 *Id.* at 230.

167 *Id.*

168 Whereby they only took into account the negative health effects of meat consumption, not GHG emissions. Springmann et al., *supra* note 24. However, they indicate that even if a meat tax was introduced to reduce health risks, it would have the co-benefit of reducing GHG emissions. *See id.*

169 Springmann et al., *supra* note 20, at 6.

170 *Id.* at 6.

171 *Id.* at 10.

172 As will be further discussed in the next section.

173 Funke et al., *supra* note 90, at 236.

Several studies hold that an optimal meat tax can reduce mortality by 6–10% and emissions by 29–70%.[174] Taxes are therefore, based on these modelling exercises, predicted to have substantially beneficial effects, both as far as reduced health risks (decrease in the number of deaths attributed to red and processed meat consumption) and climate change are concerned.[175] In a randomized controlled experiment that evaluated the potential effects of carbon and/or health taxes, it was shown that a combined carbon and health tax policy maximizes benefits in terms of both environmental and health outcomes.[176] Evidence on the effectiveness of health-related food taxes comes from natural experiments, controlled trials, and modelling studies. They all unequivocally come to one conclusion: health-related food taxes could improve health.

Experiments equally showed that even though information on the carbon and/or health characteristics of food may also have an impact, the imposition of taxes has a far larger effect on food purchasing decisions.[177] The tax would, however, have to be at least 20% to have a significant effect on health.[178] Designing a tax that achieves both a reduction of greenhouse gas emissions and positive health effects is complex but possible (for example, by using the revenue of the tax to subsidize healthy products).[179] Ayden and Esen come to a similar conclusion as far as CO_2 emissions in the EU Member States are concerned. They conclude that taxes could be effective in controlling the market failure that results from carbon emissions, but an effective design is crucial—if there were extensive tax exemptions (for particular emitters), the taxes would have only limited effects.[180] Assuming an effective design, environmental taxes could reduce CO_2 emissions

174 Springmann et al., *supra* note 107, at 4149; Springmann et al., *supra* note 24, at 69–72; Treich, *supra* note 23, at 15.

175 Springmann et al., *supra* note 20.

176 Michela Faccioli et al., *Combined Carbon and Health Taxes Outperform Single-Purpose Information or Fiscal Measures in Designing Sustainable Food Policies*, 3 NATURE FOOD 331, 331–40 (2022).

177 *Id.*

178 *See* Oliver T. Mytton, Dushy Clarke & Mike Rayner, *Taxing Unhealthy Food and Drinks to Improve Health*, BMJ (2012), https://doi. 10.1136/bmj.e2931.

179 Erica Doro & Vincent Réquillart, *Review of Sustainable Diets: Are Nutritional Objectives and Low-Carbon-Emission Objectives Compatible?*, 101 REV. AGRIC., FOOD & ENV'T STUD. 117, 117–46 (2020), https://doi.org/10.1007/s41130-020-00110-2.

180 Celil Ayden & Ömer Esen, *Reducing CO_2 Emissions in the EU Member States: Do Environmental Taxes Work?*, 61 J. ENV'T PLAN. & MGMT. 2396, 2398 (2018), https://doi.10.1080/09640568.2017.1395731.

effectively.[181] One experiment showed that a combined carbon/health tax could contribute to approximately one-third of the reductions in residual emissions required to achieve the United Kingdom's 2050 net-zero commitment, while also discouraging the purchase of unhealthy snacks.[182]

Several countries already have some experience with food taxes. One example is the use of sugar taxes in Chile, which were introduced as a tool to limit the consumption of unhealthy foods. A tax of up to 18% led to a 21.6% reduction in consumption after Chile's introduction of the policy.[183] Denmark introduced a saturated fat tax in 2011. Several other European Member States might consider the introduction of a meat tax, and several countries already have some experience with food taxes.[184] Denmark's tax on saturated fat applied to food products containing more than 2.3% saturated fat. The tax resulted in a decrease in consumption of oil, butter, and other fats by 10–15%. Vegetable consumption also increased by 7.9%.[185] However, there were also side effects, such as an increase in salt consumption and cross-border purchases—many Danes were travelling to Germany and Sweden to buy butter and other fat products at lower prices. The fat tax was therefore ultimately abolished in 2013.[186] The Danish example shows the problem of carbon leakage that may occur when price policies are applied only nationally, as the Danes apparently purchased their products at lower prices in neighboring countries.[187] Recently, Denmark introduced a carbon tax on livestock.[188] This tax focuses

181 *Id.* at 2413–15. Note that this study examines environmental taxes for CO_2 emissions in EU Member States generally but does not focus specifically on meat taxes.

182 Faccioli et al., *supra* note 176.

183 FOOD & LAND USE COAL., *supra* note 104, at 69.

184 Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 172.

185 *See* Sinne Smed et al., *The Effects of the Danish Saturated Fat Tax on Food and Nutrient Intake and Modelled Health Outcomes: An Econometric and Comparative Risk Assessment Evaluation*, 70 EUR. J. CLINICAL NUTRITION 681, 681–86 (2016), https://doi: 10.1038/ejcn.2016.6.

186 *Id.*

187 *See* Marlin J. Broeks et al., *A Social-Cost Benefit Analysis of Meat Taxation and a Fruit and Vegetables Subsidy for a Healthy and Sustainable Food Consumption in the Netherlands*, 20 BMC PUB. HEALTH 9 (2020), https://doi.org/10.1186/s12889-020-08590-z (explaining the danger of carbon leakage in the case of national price policies); *see also* Verschuuren, *Cultivated Meat and Dairy as a Game Changing Technology*, *supra* note 22, at 172–73.

188 *See* Hanna Ziady, *World's First Carbon Tax on Livestock Will Cost Farmers $100 per Cow*, CNN (Jun. 27, 2024, 7:40 PM EDT), https://edition.cnn.com/2024/06/26 /business/denmark-cows-carbon-tax [https://perma.cc/BH4Q-GSNQ] (explaining that the

directly on agricultural emissions, setting a levy of USD $43 per ton of methane produced by livestock such as cows and pigs. On average, Danish dairy cows emit 5.6 tons of CO_2 eq. per year, which would result in a tax per cow of approximately USD $96 per year.[189]

4. Support for a Meat Tax?

In the literature, there is also specific attention toward how support for particular taxes can be obtained from the population and from the livestock sector. In this respect, a distinction must be made between gaining support from producers and from consumers. The latter is particularly important, as this Article argues for a tax on consumption. A meat tax could have financial consequences for both groups, which could make the introduction of the tax more difficult if this issue is not adequately addressed.

Public opposition played a role in France after the yellow vests crisis stopped the planned increase of the carbon tax. Douenne and Fabre examined opinions relative to carbon taxation and support for climate policies.[190] They found limited knowledge, but high concern for climate change. The subjects largely rejected the carbon tax but did support stricter norms and green investments. They therefore recommend information campaigns on climate change, as climate awareness would increase support for climate policies.[191]

Funke et al. also discuss policies to get "meat producers on board." Farmers may obviously fear negative distributional consequences from the introduction of a meat tax. After all, the purpose of the tax is to reduce demand for meat, which may, if successful, directly affect the income of farmers. Funk et al. also argue that one advantage of a consumption tax on meat is that it applies to both domestic and imported products.[192] Taxes also have the advantage (especially when compared to regulation) that they will create additional revenue that can be used to compensate producers and finance the transition to more sustainable farming practices.[193] There are examples of similar

new Danish tax applies to carbon emissions from agriculture and would amount to 300 Danish Krones per ton of CO_2 equivalent from 2030 raising to 750 Danish Krones in 2035 and that a 60% tax exemption would, however, apply as a result of which farmers would effectively pay 120 Danish Krones per ton from 2030 raising to 300 Danish Krones in 2035).

189 *Id.* (explaining that Denmark plans to impose a livestock carbon tax).

190 Thomas Douenne & Adrien Fabre, *French Attitudes on Climate Change, Carbon Taxation and Other Climate Policies*, 169 ECOLOGICAL ECON., March 2020, at 1, 1–19.

191 *Id.*

192 Funke et al., *supra* note 90, at 234.

193 *Id.*; *see also* Treich, *supra* note 23, at 14 n.20.

structures. For example, in the framework of the revisions in the ETS Directive of 2023, a social climate fund was created. The idea is to provide EU Member States with dedicated funding so that the most affected vulnerable groups, such as households in energy or transport poverty, are directly supported and not left behind during the green transition.[194]

Meat taxation may lead not only to distributional concerns on the side of producers (which can be alleviated with targeted subsidies to finance the transition to sustainable practices). There is also the problem that meat taxes can be regressive in the sense that they might particularly affect low-income populations. Low-income individuals may spend a proportionally higher amount of their budget on food and may consume less healthy food.[195] However, since the lower class might be more sensitive to price changes, they would equally experience greater dietary improvements from the tax.[196] Low-income groups might also eat less fruit, vegetables, and fish[197] than higher-income groups. However, as low-income groups are more responsive to price changes, a meat tax, combined with a subsidy on fruit and vegetables, could be a desirable policy intervention to deal with this distributional issue.[198] It is, in other words, crucial to take these environmental justice concerns into account in the design of the tax—for example, by using the revenues of the tax to subsidize low-income groups. Ignoring these distributional concerns could potentially jeopardize the likelihood that the meat tax could get political support.

These distributional issues and the potential remedies to address them have been examined in the literature. Some studies identified various scenarios of the design of a meat tax, arguing that the effect on inequality (overburdening low-income consumers) can be avoided through revenue recycling via uniform lump sum transfers, as lowering value-added taxes on fruit and vegetables does not fully offset the

194 *Social Climate Fund*, EUR. COMM'N, https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/social-climate-fund_en [https://perma.cc/L4PX-BDBX] (last visited Nov. 5, 2025).

195 Mytton, Clarke & Rayner, *supra* note 178, at 2.

196 *Id.*

197 From a purely environmental perspective, fish would also need to be taxed, even though it is healthy. This shows that it may, in that particular case, be difficult to have environmental and health co-benefits (which is easier in the case of a meat tax, as meat, more particularly beef, has both negative health effects as well as negative effects on greenhouse gas emissions).

198 *See* Broeks et al., *supra* note 187, at 9.

regressive effect.[199] Economists generally prefer correcting the distributional impact through a transfer system to low-income households rather than correcting the taxes for distributional impact (as that could reduce the effectiveness of the tax). However, some argue that when income taxes cannot be optimally adjusted in response to the introduction of meat taxes, it may be justified to differentiate the meat tax to achieve distributional goals.[200] That could be an argument for a differentiation according to income levels, although the enforcement of such a differentiated tax might be problematic. In that respect, the introduction of the meat tax might draw lessons from the taxation of cigarettes, where there is also some evidence of regressive effects (the tobacco tax especially hurting low-income groups)[201] and avoidance behavior.[202]

E. Behavioral Policy

The idea of a meat tax still very much relies on the classic economic paradigm—that is, the price mechanism. It assumes that utility-maximizing individuals will reduce their demand for a product that (as a result of the meat tax) becomes more expensive. However, behavioral insights have, on the one hand, shown that particular biases can distort the way in which the (financial and other) instruments are supposed to function; on the other hand, behavioral insights could also be used to "nudge" consumers into healthier and sustainable choices.[203] Behavioral economics suggests that consumers do not adequately account for the health risks of eating unhealthy food.[204] This includes the consumption of large quantities of meat, which can result in internalities from diet-related diseases.[205] Consumer choices are often time-inconsistent: They prefer the immediate pleasure (of consumption) and ignore (or discount) the long-run health effects.[206]

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199 *See* Klenert, Funke & Cai, *supra* note 87.

200 *See* Funke et al., *supra* note 90, at 231–32.

201 Alan Fuchs Tarlovsky et al., *Is Tobacco Taxation Regressive? Evidence on Public Health, Domestic Resource Mobilization, and Equity Improvements*, WORLD BANK GRP. (Apr. 8, 2019), http://documents.worldbank.org/curated/en/893811554737147697 [https://perma.cc/V8U9-58YS].

202 Ara Cho et al., *The Effect of Tobacco Tax Increase on Price-Minimizing Tobacco Purchasing Behaviors: A Systematic Review and Meta-Analysis*, 119 ADDICTION 1923, 1923–36 (2024).

203 FOOD & LAND USE COAL., *supra* note 104, at 73.

204 Funke et al., *supra* note 90, at 228.

205 *Id.* at 228–29.

206 *Id.* at 229.

This is a behavioral failure that would, according to Funke et al., justify governmental correction.[207] Status quo bias also makes it difficult to change behavior (meat consumption), especially when the behavior is contained in a social norm.[208] Consumers are also exposed to the so-called meat paradox.[209] This refers to the fact that consumers want to consume meat but are opposed to animal suffering. Consumers deal with this paradox by manipulating beliefs (e.g., refusing to obtain information on animal suffering or searching for justifications).

Many have advocated for the use of insights from cognitive psychology to nudge consumers toward more sustainable and healthier food choices. Meanwhile, there is a large amount of research sketching the effects of those interventions, either in a laboratory setting or in natural experiments.[210] There is skepticism in the literature as to whether just providing information to consumers (which is the basis for the EU Farm-to-Fork Strategy) will be effective. This skepticism especially applies to the effectiveness of information regulation—for example, through labelling. In the EU, this is addressed through the so-called food claims regulation.[211] This concerns information through labelling, presentation, or advertising, which suggests that food has particular characteristics. The effectiveness of this type of regulation is seriously doubted in the literature.[212] For example, a packaging should indicate the weight content of fat per 100 grams, but consumers are not advised whether the fat content is healthy or unhealthy.[213]

The literature indicates that information that is appealing to the emotions of consumers (e.g., by showing pictures of suffering animals) may be relatively effective. Generally, health appeals seem to have a stronger effect on intentions to reduce meat consumptions than environmental appeals.[214]

The lessons drawn from a literature review (reviewing more than ninety-nine papers on the topic) lead, inter alia, to the following

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207 *Id.*

208 Treich, *supra* note 23, at 26.

209 *Id.* at 24–25.

210 *See* Kwasny, Dobernig & Riefler, *supra* note 21; *see also* Linda Ferrari et al., *Can Nudging Improve the Environmental Impact of Food Supply Chain? A Systematic Review*, 91 TRENDS FOOD SCI. & TECH. 184, 184–92 (2019).

211 Nutrition claims are only permitted in the EU if they are listed in the Annex of Regulation No. 1925/2006. *See* Commission Regulation 1047/2012 of Nov. 8, 2012, 2012 O.J. (L310) 36 (amending Regulation No. 1924/2006 regarding the list of nutrition claims).

212 Gokani, *supra* note 88, at 279.

213 *Id.*

214 Kwasny, Dobernig & Riefler, *supra* note 21, at 6.

suggestions: (1) inform consumers about negative side effects with a focus on health (rather than environmental issues such as greenhouse gas emissions);[215] (2) try to trigger emotions (e.g., messages about animal suffering or pictures of cute baby animals that might foster empathy);[216] and (3) increase the visibility of vegetarian food (e.g., by framing them as "dish of the day").[217]

Whereas most of the studies reviewed refer to either information provision or nudging to bring consumers to healthier food choices, there is also an increasing number of (relatively recent) papers specifically addressing how carbon footprint information affects consumer choice. One paper reports a 9.2% effect (consumers choosing less carbon-intensive dishes) when carbon footprint information is visualized in food labels (via color codes) in an experimental setting.[218] Similar results were obtained by an experiment with carbon labels (reflecting greenhouse gas emission information) for dishes at a university restaurant. Compared to the control, green-labeled (low-emission) meat dishes increased in sales by 11.5%, whereas the sales of red-labeled (high-emission) dishes reduced by 4.8%.[219] A similar result was obtained in a large-scale experiment (with 80,000 individuals) at five university cafeterias: The introduction of carbon footprint labels was associated with a 4.3% reduction in average carbon emissions per meal.[220] The authors suggest that carbon footprint labels can be a viable and low-cost policy to address information failure and to encourage more sustainable food choices.[221]

Some studies have also addressed how true cost pricing and accounting can be accepted by the public at large. A study on Dutch

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215 *Id.* at 11.

216 *Id.*

217 *Id.* at 12.

218 Bianca Beyer et al., *How Does Carbon Footprint Information Affect Consumer Choice? A Field Experiment*, 62 J. ACCT. RSCH. 101, 122–36 (2024), https://doi: 10.1111/1475-679X.12505.

219 Florentine Brunner et al., *Carbon Label at a University Restaurant – Label Implementation and Evaluation*, 146 ECOLOGICAL ECON. 658, 658–67 (2018), https://doi.org/10.1016/jpcolecon.2017.12.012.

220 Paul M. Lohmann et al., *Do Carbon Footprint Labels Promote Climatarian Diets? Evidence from a Large-Scale Field Experiment*, 114 J. ENV'T ECON. & MGMT., July 2022, at 1, 1–21, https://www.sciencedirect.com/science/article/pii/S0095069622000596 [https://perma.cc/XU9G-ZSJQ].

221 Of course, there may always be the question whether results obtained from experiments in University restaurants with students have external validity and are representative for the larger community of consumers as the academic community may be more sensitive to environmental issues than the public at large.

supermarkets showed that particular elements (such as social status and positive environmental impact) could increase the consumers' trust in true pricing characteristics; that could in turn increase the consumers' intention to purchase true-priced food products.[222] Another study showed that consumers are generally interested in the topic of true food pricing and would, to a certain extent, be willing to pay true prices for food.[223] The implementation of True Cost Accounting could, however, suffer in the case of insufficient transparency and an unjust distribution of wealth.[224]

This brief account provides a balanced view of the behavioral literature concerning the relationship between consumption patterns and food choices: Behavioral problems and biases may seriously limit consumer awareness and willingness to engage in more healthy and sustainable food choices. Merely providing information (such as food labels on packaging), in line with the information paradigm inherent in the EU Farm-to-Fork Strategy,[225] is not likely to lead to improved decision-making. However, there is overwhelming evidence that, depending on the specific design and implementation, particular nudges may work, especially when they use images that appeal to emotions.[226] Nudges can thus be effective in encouraging healthier food choices and promoting sustainability (including a lower carbon footprint).

F. Toward a Smart Instrument Mix

The previous Sections presented a wide range of policy instruments that could help achieve the policy goal of closing the gap between the market price and the true costs of food.[227] Yet, there is not one single instrument that could reach that goal on its own. That is not surprising, as particular instruments often have strengths and weaknesses or function optimally only if particular conditions are met. For that reason,

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222 Danny Taufik, Mariët A. van Haaster-De Winter & Machiel J. Reinders, *Creating Trust and Consumer Value for True Price Food Products*, 390 J. CLEANER PROD., no. 136145, 2023, at 1, 1–8, https://doi.org/10.1016/j.jclebro.2023.136145.

223 *See* Amelie Michalke et al., *True Cost Accounting in Agri-Food Networks: A German Case Study on Informational Campaigning and Responsible Implementation*, 17 SUSTAINABILITY SCI. 2269, 2269 (2022), https://doi.org/10.1007/s11625-022-01105-2.

224 *Id.*

225 EUR. COMM'N, *supra* note 87.

226 Treich, *supra* note 23, at 27.

227 Pieper, Michalke & Gaugler, *supra* note 105. Recall that most of the literature on true cost pricing refers to food in general, whereas I mostly focus on meat, given the importance of meat production in the emission of greenhouse gases.

as is often the case in environmental policy, the optimal approach likely consists of identifying a smart mix of different policy instruments.[228]

This is already the case as far as the goals to be achieved are concerned. Some would propose a particular instrument (such as a meat tax) to achieve particular health benefits for consumers,[229] whereas others would propose the instrument to reduce the greenhouse gas emissions related to meat production.[230] The literature indicates that it is possible to use one instrument (meat tax) and achieve both health and climate change co-benefits of dietary change.[231]

The same is likely the case for the choice between regulating producers or consumers. Even though there can be convincing arguments in favor of regulating consumers (via a meat tax) rather than taxing meat production, this again does not imply that the introduction of a meat tax should be done in the absence of any regulation of producers.[232] For that reason, it is not surprising that the literature advocates a combination of (some) regulation of production technology at the level of livestock producers in combination with a meat tax.[233]

The same is also true as far as nudging is concerned. The way in which the nudges are presented in the literature is not as the sole instrument that would lead to healthy and sustainable meat consumption, but rather as a useful, low-cost, and easy-to-implement instrument that can be applied in addition to other regulatory and market-based instruments.[234]

As a result, the question is not which is the one and only instrument that could optimally internalize the social costs of meat production and consumption; rather, the question is which combination of regulatory and other instruments might be employed to reach this goal. Therefore, it is crucially important to pay attention to an optimal interaction

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228 SMART MIXES FOR TRANSBOUNDARY ENVIRONMENTAL HARM (Judith van Erp et al. eds., 2019) (advocating for a smart instrument mix for transboundary environmental pollution).

229 Mytton, Clarke & Rayner, *supra* note 178.

230 Treich, *supra* note 23.

231 Springmann et al., *supra* note 107; Springmann et al., *supra* note 24.

232 *See* Wirsenius, Hedenus & Mohlin, *supra* note 137 (discussing the choice between output or consumption taxes).

233 Funke et al., *supra* note 90, at 234; *see also* Verschuuren, *Achieving Agricultural Greenhouse Gas Emission Reductions*, *supra* note 22, at 250 (advocating a smart instrument mix).

234 *See* Ferrari et al., *supra* note 210, at 184 ("[W]e propose that green nudges should not be meant to replace stricter environmental and food policies, but rather they should be regarded as potential complements to be implemented with the aim of gradually moving society in a direction that might benefit all").

between the different instruments to guarantee that one has, in the words of Peeters, an instrument mix and not an instrument mess.[235]

It is, however, striking that the literature unanimously agrees that current meat prices do not reflect social costs, that the current regulation is also not achieving that aim, and that the best way (in addition to other instruments) to achieve this goal is the introduction of a meat tax.[236] Within a smart instrument mix, there can be a role for production regulation in addition to the meat tax; to the extent possible, there can also be a role for including some emissions (e.g., methane) in an ETS.[237] Further, behavioral tools like nudging could be employed to guide consumers to optimal choices concerning the consumption of meat. Finally, in certain circumstances, such as when policymakers would hesitate to introduce the necessary meat tax, there may be a role for liability rules. Like in the case of climate change litigation, liability rules could play a modest but important supplementary role, especially in forcing policymakers to take necessary measures to control emissions from livestock production. As meat production and consumption are important contributors to climate change, the question is how these insights can be incorporated in the climate change regime and why that has apparently not been done until now.

III
IMPLEMENTATION OF MEAT PRODUCTION AND CONSUMPTION IN THE CLIMATE CHANGE REGIME

Having sketched the various options to regulate meat production and consumption, this Part will analyze how this could be implemented in the international climate change regime. First, I stress that it is important to include producers (Section A) and to face specific challenges in implementing a meat tax (Section B). The obvious question that arises is at which level of governance should such a tax be advocated; whereby I strongly argue in favor of an introduction at least at a regional (for example, European) level, but preferably at the international level (Section C). The problem is, however, that until recently (2023), the effects of meat on climate change were not discussed at the COPs (Section D). This was, not surprisingly, the result of effective lobbying by the meat industry (Section E).

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235 Marjan Peeters, *Instrument Mix or Instrument Mess? The Administrative Complexity of the EU Legislative Package for Climate Change*, *in* EU ENVIRONMENTAL LEGISLATION 173–92 (Marjan Peeters & Rosa Uylenburg eds., 2014).

236 *See infra* Section II.D.

237 *See* Springmann et al., *supra* note 20; *see also* Treich, *supra* note 23.

A. Likelihood of a Meat Tax

One thing should be clear from the analysis so far: Meat production and consumption cause substantial externalities and significantly contribute to climate change. Today, the social costs of meat production are largely unaddressed. That is striking if one compares it to, for example, greenhouse gas emissions resulting from electricity production and transport, which have been subject to detailed discussions and incorporation in the climate change regime.[238] As a result, no matter which of the many instruments presented in Part II one would choose, it is clear that, one way or another, the greenhouse gas emissions related to meat production should be accounted for.

As mentioned earlier,[239] it is important to get both the meat producers on board[240] and to get support from the general public, in other words from consumers.[241] Without the support of both the producers and consumers, the political price for introducing instruments to regulate meat production and consumption, specifically a meat tax, may simply be too high. Producers might be convinced because a consumption tax on meat applies both to domestic and imported products (and thus does not cause competitive distortions).[242] Taxes also create additional revenue that can be used to finance the transition of farmers to healthier and more sustainable food production practices.[243] The literature equally mentions ways of increasing acceptability among the public at large, a simple example being to call it a levy, rather than a tax.[244] Policy packaging may also increase support for meat taxation—for example, by combining meat taxes with animal welfare standards, discounts on vegetarian meals, and information campaigns.[245]

B. Challenges in Implementation

Traditionally, public choice scholars have indicated that industry will be heavily opposed to taxation (particularly emission taxes to abate

238 Funke et al., *supra* note 90, at 233.

239 *See supra* Section II.D.4.

240 Funke et al., *supra* note 90, at 234.

241 *Id.* at 234–35.

242 *Id.* at 234.

243 *Id.*

244 David Klenert et al., *Making Carbon Prices Work for Citizens*, 8 NATURE CLIMATE CHANGE 669, 669–77 (2018).

245 Lukas Fesenfeld et al., *Policy Packaging Can Make Food System Transformation Feasible*, 1 NATURE FOOD 173, 173–82 (2020).

pollution). Polluters prefer standards, which can be introduced with grandfather clauses,[246] thus raising profits for incumbents by creating barriers to market entry. From industries' perspective, taxes (for example, on emissions) have the disadvantage of raising costs for all without any distinction (thus not allowing the creation of barriers to market entry). That is the reason why Nobel Prize Winners James Buchanan and Gordon Tullock argued that emission taxes have never been introduced in textbook form in the US: effective lobbying and opposition by industry is the main reason.[247] That problem should, however, not necessarily affect the meat tax. Even though a meat tax (on consumption) may also affect producers (as a result of reduced demand), the opposition should not necessarily be as high if the facilitating measures mentioned above could be implemented. Of course, as will also be explained below, there is already strong lobbying opposing any attempt to regulate meat production. Precisely for that reason, it is important to design measures that incorporate the introduction of a meat tax to alleviate the negative distributional consequences for producers. One possibility is to design accompanying (financial) measures to be financed by the proceeds of the meat tax in order to compensate farmers. Indeed, it is important to address these distributional issues to facilitate implementation. However, that does not mean that the meat tax "in the textbook form" should not be implemented. It simply implies that the revenues should be used in a smart way, such as by compensating small farmers who would be disproportionately disadvantaged through the imposition of the tax or financing countervailing measures for vulnerable consumer groups who may be disproportionately affected by the tax.

A difficulty in the implementation of the meat tax, mentioned in the EAT-Lancet Report, is that clear scientific targets do not exist for the global food system (as is the case for emission targets for CO_2 from industry).[248] Still, they propose the planetary boundaries framework as providing scientific targets that could be viewed as guides for decision-makers on acceptable levels of risk for human health and

246 A grandfather clause implies that new (and often more stringent) regulation will only be applied to newcomers on the market and not to incumbent firms (the grandfathers). *See* Michael T. Maloney & Robert E. McCormick, *A Positive Theory of Environmental Quality Regulation*, 25 J.L. & ECON. 99, 99–123 (1982) (examining the application of the grandfather clause in the environmental area).

247 James Buchanan & Gordon Tullock, *Polluters' Profits and Political Response: Direct Controls Versus Taxes*, 65 AM. ECON. REV. 139, 139–47 (1975).

248 Willett et al., *supra* note 17, at 451.

environmentally sustainable food production.[249] These scientific targets could subsequently be reached by applying the true cost pricing method (discussed in Section I.E) and through the meat tax (discussed in Section II.D).

C. Multilevel Governance

One central issue is at what level of governance the meat tax should be implemented. First, I will discuss possible implementation at the national level. Then, I turn to the regional level before lastly addressing the international level.

The example of Denmark shows that if just one country were to introduce a meat tax, there is always a risk of substitution if consumers could relatively easily buy the same products cheaper (without the tax) in neighboring countries. That is exactly what happened in the case of Denmark. It reduces the effectiveness (and even usefulness) of the tax if consumers can simply avoid the tax by purchasing in neighboring countries. This leads to the phenomenon of carbon leakage, as a result of which the reduced emissions in Denmark would lead to more emissions in the countries where the Danes would subsequently purchase their meat (in this case, Sweden and Germany).

These types of negative trading effects might always emerge when pricing policies are applied only nationally.[250] There is also a danger of a distortion of competition, as producers in the country where the meat tax applies would see a reduction in their sales. This corresponds with a classic argument in the economics of federalism: When cross-border externalities occur, it makes sense to move decision-making to a higher level of governance, in this case, the EU.[251]

As indicated by Verschuuren, today, at the EU level, a variety of instruments are focused on farmers. Some are command and control instruments (such as standards in permits prescribing the use of a particular technology) or subsidies provided to farmers who transfer to a sustainable production technology.[252] The EU has no specific competence to introduce forms of indirect taxation; it is therefore

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249 *Id.* at 451–52.

250 Broeks et al., *supra* note 187, at 9.

251 Roger Van den Bergh, *Subsidiarity as an Economic Demarcation Principle and the Emergence of European Private Law*, 5 MAASTRICHT J. EUR. & COMPAR. L. 129, 129–52 (1998).

252 Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 169–70.

doubtful that the EU could introduce a meat tax.[253] However, an analysis by Bähr showed that the introduction of a meat tax would be compatible with both international and EU law.[254] Ignoring the climate change effects of livestock production could even be considered a violation of the polluter-pays principle.[255]

Verschuuren suggests that even where the EU might not have the competence to mandate Member States to introduce a meat tax, there may be reasons for the EU to regulate some cooperation, precisely to avoid the type of cross-border purchases that happened in the case of Denmark.[256] Moreover, one could even argue that climate change is a typical example of a cross-border externality that clearly goes beyond the borders of the EU, which would be a strong argument in favor of action at the international level.[257]

Climate change policy is also implemented at the level of the Member States. According to the Paris Agreement, Member States have the obligation to determine nationally determined contributions (NDCs). In the case of the EU, the determination of the NDCs is done by the EU together with the Member States, as a result of which there are no separate NDCs per Member State. Contained in the so-called Fit for 55 package is a set of proposals to revise and update EU legislation to reduce the net greenhouse gas emissions by at least 55% by 2030.[258] Food system emissions have been integrated into the nationally determined contributions of the various parties to the Paris Agreement.[259] However, a recent analysis by the FAO showed that the current NDCs address only about 40% of the greenhouse gas emissions

253 *Id.* at 180.

254 Bähr, *supra* note 22, at 153–79.

255 *See* Amtul Chowdhury & Mohammad B. Hossain, *Role of Environmental Law and International Conventions in Mitigating Climate Change Effects on Food System and Livestock Production*, 8 LEX PUBLICA 14, 24–26 (2021), https://doi.org/10.58829/lp.8.2.2021.14-28.

256 Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 180.

257 Transboundary externalities have always been a major justification for centralization or rulemaking. *See* Richard L. Revesz, *Rehabilitating Interstate Competition: Rethinking the "Race-for-the-Bottom" Rationale for Federal Environmental Regulation*, 67 N.Y.U. L. REV. 1210, 1210–54 (1992).

258 The Fit for 55 package is a set of EU laws aiming to reduce EU greenhouse gas emissions by at least 55% by 2030. It, inter alia, contains a revision of the EU ETS.

259 Sultan Ahmed Al Jaber, *Letter to Parties I*, COP28 UAE, https://www.cop28.com/en/letter-to-parties [https://perma.cc/4E28-MTQC] (last visited Nov. 5, 2025).

related to agrifood systems.[260] In particular, emissions by livestock are largely neglected, with 66% of emissions being unaddressed. The FAO argues that without closing these gaps, achieving global temperature targets will be nearly impossible.[261] In fact, the NDCs of most countries largely ignore the effects of animal-source food production and consumption on global warming. According to Moreira, no NDC from the G20 countries had addressed the issue.[262] Moreira argues that ignoring the livestock sector from the NDCs leads to a real probability that the main goal of the Paris Agreement will not be achieved.[263] This is supported by a Science article published by Clark et al., who also argue that ignoring global food emissions could preclude achieving the targets of the Paris Agreement.[264]

This shows the significant difficulty of adequately addressing this issue: At the international level, agreements can be formed (in this case, the Paris Agreement), but the implementation necessarily requires action at the level of the Parties to the agreement. If it then appears that the Parties do not take sufficient measures (particularly by not including the emissions related to food production in the NDCs), reaching the goals set by the international agreement becomes difficult or even impossible.

The idea that at the international level a meat tax would be mandated might be illusory,[265] but the least one could argue is that at the international level the effects of greenhouse gas emissions resulting from meat production should equally be on the agenda.[266] Moreover, if

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260 KRYSTAL CRUMPLER ET AL., AGRIFOOD SYSTEMS IN NATIONALLY DETERMINED CONTRIBUTIONS: GLOBAL ANALYSIS – KEY FINDINGS (2024), https://openknowledge.fao.org/server/api/core/bitstreams/4e039efc-1a8e-47f1-b40d-b7773e8fbadb/content [https://perma.cc/T9FC-3V73].

261 *Id.*

262 Lima, *supra* note 22, at 5.

263 Which equally leads to the question of whether this can lead to responsibility of the countries concerned under international law. *See* Lima, *supra* note 22, at 6–14.

264 Michael A. Clark et al., *Global Food System Emissions Could Preclude Achieving the 1.5° and 2°C Climate Change Targets*, 370 SCIENCE 705, 705–08 (2020); *see also* Verschuuren, *Achieving Agricultural Greenhouse Gas Emission Reductions*, *supra* note 22, at 246 (arguing that in order to achieve the Paris Agreement goals, a sharp reduction of agricultural emissions is necessary).

265 *See* Alice Pirlot, *International Taxation and Environmental Protection*, *in* RESEARCH HANDBOOK ON INTERNATIONAL TAXATION 258–77 (Yariv Brauner ed., 2020).

266 The introduction of an environmental tax in an international legal instrument is also not completely illusory. For example, within the framework of the negotiations on a global plastics treaty, a so-called polymer premium was proposed, which in fact is a fee on plastic pollution. *See* LUISA CORTAT, HOW TO INCORPORATE THE POLYMER PREMIUM INTO THE GLOBAL PLASTICS TREATY (2024).

the EU Member States were to introduce a meat tax, Verschuuren rightly argues that the EU might also have to introduce a carbon border adjustment measure (i.e., imposing a tax on meat coming from outside the EU that does not reflect through prices). Such a mechanism would be needed to avoid the import within the EU of cheap meat products that would reduce the effectiveness of a meat tax.[267] This shows that the precise implementation of a pricing mechanism for meat within the multilevel governance framework of the international level, the EU, and the Member States, is still a point of attention that definitely merits further research.[268]

D. Meat at the COPs

Furthermore, the topic of emissions related to meat has not been on the agenda in the various COP meetings.[269] In fact, food production and consumption had not been a major topic at any of the COPs until COP28 (2023) in Dubai. Agriculture was mentioned at COP3 in 1997 (via the Kyoto Protocol), which recognized sources of emissions from agriculture, including enteric fermentation, manure management, rice cultivation, and agricultural residues, but not much else. Food security was introduced as a potential area of risk under climate change at COP5 in Bonn (1999), and agriculture was mentioned as a source of climate change in 2006 at COP12 in Nairobi, but again without further action.[270] At COP21 (where the Paris Agreement emerged), there were discussions on the environmental impact of agriculture, but these topics were largely overshadowed by the importance of emissions from the energy and industrial sectors. Agriculture was also mentioned at COP23 in Bonn, at COP26 (2021) in Glasgow (where the importance of meat production in climate discussions was acknowledged), and at COP27 in Sharm El Sheikh (2022) (where livestock management and its relation to emissions were explicitly mentioned).[271]

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267 Verschuuren, *Cultivated Meat and Dairy as a Game-Changing Technology*, *supra* note 22, at 179–80.

268 *See* Hervé Guyomard et al., *Review: Why and How to Regulate Animal Production and Consumption: The Case of the European Union*, ANIMAL, 2021 at 1.

269 The Conference of the Parties (COP) is the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNNFCCC). The mandate of the COP, which represents all States that are Parties to the Convention, is provided in Article 7 of the UNFCCC.

270 Danush Dinesh et al., *Has Process Hijacked Purpose? Outlook on Food Systems Transformation in the Global Climate Change Processes*, 53 OUTLOOK ON AGRIC. 98, 98–105 (2024).

271 *Id.*

The first COP where food production was expressly discussed with a plan of action was COP28 in Dubai (2023). It was even called "the first food COP."[272] In Dubai, a declaration was accepted on sustainable agriculture, resilient food systems, and climate action, signed by 159 countries.[273] The declaration urges measures to adapt food systems in response to climate change, aims to tackle various topics relating to agriculture and food production, and outlines concrete strategies and commitments. In addition to several other concrete strategies, the declaration suggests reducing greenhouse gas emissions, restoring land and natural ecosystems, enhancing soil health and biodiversity, and shifting toward more sustainable production and consumption practices.[274] Nations are expected to integrate agriculture and food systems into their climate action plans and strategies, particularly into their nationally determined contributions (NDCs) within the framework of the Paris Agreement, but also in other long-term strategies like national biodiversity strategies and action plans.[275]

E. Effective Lobbying

It is striking that such an important sector (as far as greenhouse gas emissions are concerned) has been able to remain largely out of the picture until COP28. The glaring reason is that lobby groups and several states representing meat interests have successfully managed to delay the inclusion of meat production in the COP agendas throughout the years. The relative success of the meat sector should not come as a surprise. In general, the agricultural sector has been very successful in obtaining subsidies in the EU via the common agricultural policy.[276] Political economy, and particularly the work of Mancur Olson, has indicated that lobbying by interest groups will be especially successful

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272 Benjamin Ferrer, *World's First "Food COP": Agri-Food Systems Finally Tabled as "the Climate Solution," but Can Pledges Be Implemented?*, FOOD INGREDIENTS FIRST (Dec. 15, 2023), https://www.foodingredientsfirst.com/news/worlds-first-food-cop-agri-food-systems-finally-tabled-as-the-climate-solution-but-can-pledges-be-implemented.html [https://perma.cc/MHN2-DX9G].

273 Al Jaber, *supra* note 259.

274 *COP28 UAE Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action*, COP28 UAE (2023), https://www.cop28.com/en/food-and-agriculture [https://perma.cc/7LLN-2Q52].

275 *Id.*

276 Empirical research indicates that the direct payment distributions under the Common Agricultural Policy are badly targeted in the sense that they benefit less to the most environmentally friendly farms. *See* Alessandra Kirsch, Jean-Christophe Kroll & Aurélie Trouvé, *Aides Directes et Environnement: La Politique Agricole Commune en Question*, 359 ÉCONOMIE RURALE 121, 121–39 (2017).

when the information costs for the public at large are high and when the transaction costs for the lobby group concerned are relatively low.[277] The effects of meat production and consumption are undoubtedly a topic of high information costs for the public at large. The behavioral research (discussed in Section II.E) indicates that for consumers, it is, as a result of a variety of behavioral biases, often difficult to assess the negative consequences of bad eating habits for one's own health, let alone for the planet. In that respect, it is clear that the information costs for the public at large (to realize the consequences of greenhouse gas emissions by meat production) are high. Transaction costs for the lobby group will be low when they are single-issue-oriented and well-organized.

At the global level, there are groups representing "big meat" that indeed meet those conditions, specifically the North American Meat Institute (NAMI) and the Global Meat Alliance (GMA). They have played an important role (via meat-producing countries such as the US, Australia, and Brazil) in opposing the inclusion of measures addressing the environmental effects of meat production in the COPs.[278] Even during COP28, lobby groups sent a large number of participants to actively spread positive messages about meat, framing meat as essential for global nutrition.[279] The absence of explicit mentions of meat production until COP28 in 2023 provides evidence of the success of the well-organized meat industry.[280] However, one could question what changed in 2023 so that the countries participating in COP28 agreed to sign the declaration on sustainable agriculture, resilient food systems, and climate action. Several significant changes involve the work of NGOs and scientific bodies, which have increasingly provided evidence of the effects of meat production and consumption on climate change. Framed in terms of the conditions of Olson: These reports and NGO actions lowered the information costs for the public at large and thus increased the lobbying costs for special interest groups.

The efforts of NGOs and intergovernmental panels (like the IPCC) could also fit into an alternative framework concerning the emergence of regulation presented by Gary Becker. According to Becker, there

277 MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION (1971).

278 Rachel Sherrington, *Big Meat Unveils Battle Plans for COP28*, DESMOG (Nov. 29, 2023), https://www.desmog.com/2023/11/29/big-meat-unveils-battle-plans-for-cop28/ [https://perma.cc/LAX2-62R8].

279 *Id.*

280 *Id.*

will often be various groups competing for political power.[281] In his view, the creation of regulation is rather the outcome of a competitive process whereby NGOs and experts may provide a countervailing power against lobbying by special interest groups representing industry. To the extent that this framework is applicable, the outcome of the lobbying would (as a result of the competition between various interest groups) be closer to the optimum.

Before COP28, public awareness of the environmental impact of meat production was indeed increased by reports from advocacy organizations. Several environmental activists boasted a large social media influence, arguing that mass animal extinction must be prevented. Moreover, reports from well-recognized bodies such as the IPCC (but also other scientific bodies such as the EAT-Lancet Commission and the FAO) all highlighted that there is a growing scientific consensus concerning the role of meat production in greenhouse gas emissions, particularly via methane.[282] For example, the director of the Institute for Climate, Energy and Disaster Solutions of the Australian National University, Mark Howden, argued publicly that it is of utmost importance to reduce methane emissions by 30% by 2030 and by half or more in the longer term.[283] Moreover, reports from investigative journalists, both from the Guardian and DeSmog, showed how the "big meat" industry engaged in public relations campaigns to change the narrative around meat production and its impact on climate change. In other words, the change that occurred in Dubai in 2023 might well be explained by the public choice framework as well. Indeed, in line with Becker, it could be argued that the increased attention on the effects of livestock on greenhouse gas emissions and the increasing pressure from NGOs could have provided a counterweight in the struggle for political power that might explain the decision at COP28 in Dubai in 2023.

Some observers, however, warn that—notwithstanding the declaration that was accepted at COP28 in Dubai—there is no reason to be overly optimistic concerning its concrete implementation, as several months after the declaration, there was no clear indication of

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281 Gary Becker, *A Theory of Competition Among Pressure Groups for Political Influence*, Q.J. ECON. 371, 371–400 (1983).

282 Sherrington, *supra* note 278.

283 Andrew Green, *The Debate over Meat at COP 28, Explained*, DEVEX (Dec. 6, 2023), https://www.devex.com/news/the-debate-over-meat-at-cop-28-explained-106690 [https://perma.cc/9RDQ-JE39].

any substantial outcomes.[284] COP29 (in Baku) in 2024 did not further address the inclusion of concrete measures to address meat production and consumption, even though there were suggestions to implement an emission pricing mechanism in agrifood systems from NGOs.[285]

Industry lobbying can undoubtedly continue to play a role—for example, in preventing the concrete implementation of the declaration on sustainable agriculture accepted at COP28 in Dubai—but more generally, in opposing the introduction of any of the instruments presented in Part II, particularly the meat tax. At the international level, the influence of the large meat industry has been well-documented.[286] Large companies such as JBS and Tyson Foods focus on preventing steps toward including meat production in climate change discussions. These major companies also relied on a public relations firm, Red Flag, in an attempt to provide a good image and reputation of the industry.[287] One of the efforts of these lobbying activities is to demonstrate how meat production can be a solution for "healthy people and a healthy planet."[288] The lobbying continued at COP29, with lobbyists taking part in official national delegations,[289] successfully advocating against stricter environmental regulations.[290]

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284 Dhanush Dinesh, *The Great COP Food Systems Illusion: UN Climate Talks Deliver No Real-World Action*, CLIMATE HOME NEWS (June 3, 2024), https://www.climatechangenews.com/2024/06/03/the-great-cop-food-systems-illusion-un-climate-talks-deliver-no-real-world-action/ [https://perma.cc/WQS3-FYSF].

285 *100+ NGOs Join Forces with Equatorial Guinea, Nigeria, the DRC, and Uganda and Urge Global Action on Meat Consumption Ahead of COP29*, TRUE ANIMAL PROTEIN PRICE COAL. (October 15, 2024), https://www.tappcoalition.eu/nieuws/22741/50%2B-ngos-urge-global-action-on-meat-consumption-and-climate-change-ahead-of-cop29 [https://perma.cc/4JEN-LU6Q].

286 The political power of the livestock sector has been qualified as "enormous," as a result of which the meat industry has been successful in blocking green alternatives. *See* Lima, *supra* note 22, at 4; Simona Vallone & Eric F. Lambin, *Public Policies and Vested Interests Preserve the Animal Farming Status Quo at the Expense of Animal Product Analogs*, 6 ONE EARTH 1213, 1213–26 (2023).

287 Sherrington, *supra* note 278.

288 Anay Mridul, *'Music to Our Ears': Meat Lobby Celebrates 'Positive Outcomes' for Industry at COP28*, GREEN QUEEN (Apr. 22, 2024), https://www.greenqueen.com.hk/meat-dairy-lobby-cop28-livestock-food-agriculture/ [https://perma.cc/4F2S-AK93].

289 Andrew N. Rowan, *COP29 Selected Dynamics and Context in Baku, Azerbaijan*, 6 WELLBEING NEWS (Dec. 4, 2024), https://www.wellbeingintlstudiesrepository.org/wbn/vol6/iss10/3 [https://perma.cc/UY4L-EDQ7].

290 Rachel Sherrington, *Hundreds of Lobbyists for Industrial Farming Attend COP29 Climate Summit*, THE GUARDIAN (Nov. 19, 2024), https://www.theguardian.com/environment/2024/nov/19/hundreds-of-lobbyists-for-industrial-farming-attend-cop29-climate-summit [https://perma.cc/LPG7-H7AP].

These lobbying efforts all fit into the theoretical frameworks presented by Olson and Becker but also make clear that it may be challenging to achieve the Great Food Transformation, which is, according to the EAT-Lancet Commission, urgently needed. Other literature also points to the importance of lobbying by the meat industry, which will undoubtedly always focus on achieving low production costs and favorable regulation.[291] It has been well-documented that, in part for historical reasons, farmers' interests have always had a higher political weight than, for example, the interests of urban residents.[292] As far as the introduction of a meat tax is concerned, some stress that introducing new instruments will undoubtedly face strong resistance from livestock farmers.[293] It is for that reason that, as explained above (Section II.D), it is important to introduce countervailing measures to keep the meat producers on board. The ideal scenario would obviously be that the producers would be part of the Great Food Transformation—for example, by being (financially) incentivized (via the proceeds of the meat tax) to transform toward plant-based production methods.

Still, this case is yet another one where one can observe why, in environmental policy, efficient instruments and solutions are often not adopted, and inefficient practices persist.[294] Given the weight of the meat industry and the success of their lobbying efforts, there is no reason for great optimism concerning a rapid introduction of instruments implementing the Great Food Transformation, particularly the inclusion of meat production in the climate change regime. Yet, it is equally important to remember the positive lessons from the public choice literature: Lobbying efforts can be made less effective by increased transparency (reducing information costs for the public at large) and by organizing an effective counterweight against industry lobbying by NGOs (to provide competition in the lobbying process).[295]

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291 Treich, *supra* note 23, at 30.

292 *Id.* at 24.

293 Funke et al., *supra* note 90, at 234.

294 This is the case in many other domains of environmental policy as well. A notable example is the nuclear sector. Already before my coming to Maastricht (in 1990) I showed that nuclear liability is arranged in a totally inefficient manner which only serves the interests of the nuclear industry. Michael Faure & Roger Van den Bergh, *Liability for Nuclear Accidents in Belgium from an Interest Group Perspective*, 10 INT'L REV. L. & ECON. 241, 241–54 (1990). That has, after 35 years, unfortunately not changed.

295 There is evidence that environmental NGOs exert a statistically significant impact on air pollution levels measured by concentrations of sulfur dioxide, smoke, and heavy particulates. Seth Binder & Eric Neumayer, *Environmental Pressure Group Strength and Air Pollution: An Empirical Analysis*, 55 ECOLOGICAL ECON. 527, 527–38 (2005).

Indeed, even though the strong lobbying efforts by the meat industry cast a shadow on the likelihood of livestock production being discussed at subsequent COPs, providing a countervailing power—for example, via lobbying by climate NGOs and other groups representing civil society—can change the tide. It fits into the theory of Nobel Prize winner Gary Becker that a competition between different lobby groups can lead to an outcome that is closer to the optimum.[296] That may well explain why the Food Declaration appeared at COP28 in Dubai. The important policy conclusion is therefore that activism from civil society and particularly from climate advocacy groups is crucial to get the effects of food production on the agenda of the COPs.

IV
LIMITS

The overview of the consequences of meat production presented in Part I made clear that livestock production leads to a wide variety of different types of externalities. My main focus was on the effects of livestock production on the climate change regime. But if one takes the goal of closing the gap between market prices and true costs of food[297] seriously, one should address all the other elements as well, even though they may be more difficult to calculate. The FAO indicates that livestock production causes not only greenhouse gas emissions but also pollution.[298] Moreover, the land use change related to livestock production also creates an important impact on biodiversity.[299]

The calculations of the optimal meat tax usually take the first elements (greenhouse gas emissions and pollution) into account, but not always the second (biodiversity loss).[300] In addition, Part I equally referred to air pollution by ammonia, water scarcity,[301] and health effects. So far, animal welfare is also hardly considered as an element of the externalities caused by meat production. There is, however, increasing interest, also from economists, in how animal welfare can

296 Gary Becker, *A Theory of Competition Among Pressure Groups for Political Influence*, 98 Q.J. ECON. 371, 371–400 (1983).

297 Pieper, Michalke & Gaugler, *supra* note 105.

298 FAO, *supra* note 30 (making a distinction between livestock's role in climate change, air pollution, water depletion, and pollution and its impact on biodiversity).

299 *Id.* at 180–214.

300 Springmann et al., *supra* note 107, at 41–50.

301 *See* Hedberg, *supra* note 45.

be assessed in economic terms and thereby incorporated in decision-making.[302]

In addition, it should be recalled that the central economic argument—that prices should reflect true costs—should obviously apply not only to meat but also to other elements of food that have equally strong impacts on greenhouse gas emissions. Moreover, as this text one-sidedly focuses only on the agricultural sector (as that was the one that was so far largely left out of the climate change regime), one could wrongly infer that there is no other sector where the problem of lacking internalization emerges. The contrary is, of course, true. The different reports on true cost accounting and the website of True Cost make perfectly clear that there is a wide variety of sectors where true costs are not correctly incorporated into prices. Recall the report discussed in Part I, indicating that none of the world's top industries would be profitable if they paid for the natural capital they use.[303] That text mentions that there is not only a problem with cattle ranching, wheat, and rice farming, but with coal power generation as well. In that respect, I can also refer to the World Bank Report declaring that farming subsidies cause "environmental havoc," which also mentioned the same about the fossil fuel industry.[304]

The report by True Cost, with a ranking of the twenty region-sectors with the greatest GHG costs, lists eight other sectors (mostly related to coal power generation, petroleum, and natural gas extraction, as well as cement factoring) before coming to cattle farming.[305] And one should not necessarily stay within the environmental, energy, or agricultural area to look for uninternalized externalities. There is increasing evidence that the digitalization process also leads to huge social costs that are not always correctly internalized. A recent paper delved into the social costs created by blockchain, where it was argued that externalities through blockchain are not inherently eliminated

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302 Treich, *supra* note 23; Budolfson et al., *supra* note 96; *see* Carl-Johan Largerkvist & Sebastian Hess, *A Meta-Analysis of Consumer Willingness to Pay for Farm Animal Welfare*, 38 EUR. REV. AGRIC. ECON. 55, 55–78 (2011). *See generally* CASS R. SUNSTEIN ET AL., ANIMAL RIGHTS: CURRENT DEBATES AND NEW DIRECTIONS (2004).

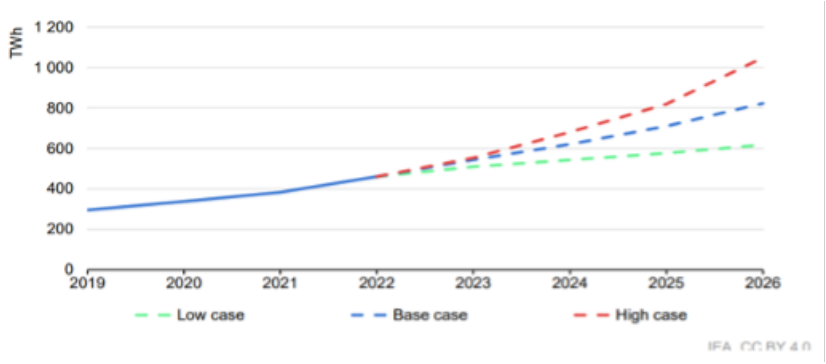
303 David Roberts, *None of the World's Top Industries Would Be Profitable if They Paid for the Natural Capital They Use*, GRIST (Apr. 17, 2013), https://grist.org/business-technology/none-of-the-worlds-top-industries-would-be-profitable-if-they-paid-for-the-natural-capital-they-use/ [https://perma.cc/DJ3Y-VS5R].

304 Damian Carrington, *Vast Fossil Fuel and Farming Subsidies Causing 'Environmental Havoc*,*'* THE GUARDIAN (Jun. 15, 2023), https://amp-theguardian-com.cdn.ampproject.org/c/s/amp.theguardian.com/environment/2023/jun/15/vast-fossil-fuel-and-farming-subsidies-causing-environmental-havoc-world-bank [https://perma.cc/N849-Z72C].

305 TRUCOST, *supra* note 99, at 38.

and create a variety of complex social costs.[306] There is equally a problem with the electricity consumption from data centers, artificial intelligence (AI), and cryptocurrency. Together, those will use almost 2% of global electricity demand. The expectations are that this will only increase, as Figure 10 shows.

Figure 10. Global electricity demand from data centers, AI, and cryptocurrencies, 2019–2026.[307]



It is estimated that the data centers on which artificial intelligence (AI) relies are already responsible for 1% of total CO_2 emissions, according to the International Energy Agency. Moreover, AI uses enormous quantities of drinking water for cooling. For Microsoft, carbon emissions went up 30% compared to 2020 to support AI services, and Google mentioned an increase of 48%.[308] It is therefore crucial that policy focuses not only on agriculture, but on an internalization of externalities from all sources, including AI, cryptocurrency, and many others.

There are, in other words, other industries responsible for enormous quantities of greenhouse gas emissions, and where the true social costs are not incorporated in the price of the product or service. As such, further research into the internalization of these costs may prove useful

306 Edoardo D. Martino & Wolf-Georg Ringe, *The Social Cost on Blockchain: Externalities, Allocation of Property Rights, and the Role of the Law* (Hamburg Univ. Working Papers No. 80, 2024), https://ssrn.com/abstract=4821063.

307 INT'L ELEC. AGENCY, ELECTRICITY 2024: ANALYSIS AND FORECAST TO 2026 at 31 (2024), https://iea.blob.core.windows.net/assets/6b2fd954-2017-408e-bf08-952fdd62118a/Electricity2024-Analysisandforecastto2026.pdf [https://perma.cc/E7K2-PD5S].

308 Shirin Ghaffary, *Big Tech's Climate Goals at Risk from Massive AI Energy Demands*, BLOOMBERG (Jul. 11, 2024, at 14:05 PDT), https://www.bloomberg.com/news/newsletters/2024-07-11/big-tech-s-climate-goals-at-risk-from-massive-ai-energy-demands [https://perma.cc/2BUH-RXQQ].

in determining how the costs of livestock production can be successfully internalized.

In addition to changing diets, there are other methods to reduce emissions; all of which provide more benefits than even completely moving to a plant-based diet.[309] Moreover, I mostly focused on classic economic instruments, such as regulation and taxation—in other words, on the "sticks" to reduce meat consumption. But the elephant in the room materializes, as today no sticks are employed but rather carrots to subsidize food production. The problem, thereby, is that the subsidies are not structured in such a way that they primarily focus on the most ecological production facilities. An ecological redesign of the subsidy system could therefore also generate substantive benefits, which is a point that undoubtedly merits further research. This is also the case for other areas on which this Article could not focus and where further research could prove to be informative. These areas include, for example, the issue of consumer reaction to labelling, as well as the ways in which the revenues from a meat tax could be distributed to alleviate environmental and social justice concerns. Another interesting topic that warrants further research would be a comparison with other industries that put forth massive lobbying efforts (e.g., tobacco, fossil fuels) and how these efforts were, or were not, defeated. This comparison could prove useful in examining how the current lobbying efforts of the meat industry could be countered.

CONCLUSION

In sum, this Article argues that the price of meat should increase to achieve a true cost pricing, thereby closing the gap between the current market price of meat and the externalities caused by meat production, especially for climate change. The bottom line is that the consequences of meat production and consumption should be taken into account at the policy level, most importantly in the international climate change regime. The policy goal to be achieved is a correct pricing of meat (closing the gap between the market price and the true costs of meat). A variety of instruments could reach that goal. Ideally, they could equally reach the co-benefit of reducing greenhouse gas emissions and health costs related to meat consumption.

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309 Seth Wynes & Kimberly A. Nicholas, *The Climate Mitigation Gap: Education and Government Recommendations Miss the Most Effective Individual Actions*, 12 ENV'T RSCH. LETTERS, July 12, 2017, at 1, https://doi.org/10.1088/1748-9326/aa7541.

Although a variety of instruments were reviewed that could be employed to reach those goals, the most effective one from an economic perspective is the introduction of a tax on meat consumption. However, this could be part of a smart mix of different instruments, as the meat tax could be combined with other instruments, such as behavioral policy tools, as well as instruments aiming at the regulation of production.

Fortunately, at the COP28 in Dubai (2023), important steps were taken to include meat production in climate change policy, but effective lobbying prevented further implementation of the declaration on sustainable agriculture, resilient food systems, and climate action. Given the important contribution of food systems, particularly meat production, to greenhouse gas emissions, the incorporation of instruments that aim to reduce those emissions within the international climate change regime seems unavoidable. To state the issue more clearly: it is very likely that if the effects of food systems and particularly meat production are not incorporated in the NDCs of the various states, the goals of the Paris Agreement will likely not be reached. It is therefore of the utmost importance that agreements to that extent are reached at the next COPs, and that the effects of food, meat production in particular, are adequately incorporated by the state parties, especially within their NDCs.