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The Polluter-Pays Principle in Climate Change Law: an Economic Appraisal

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Abstract

There is a lively debate among scholars and policymakers on whether either consumers or producers should be seen as responsible for pollution caused in the production and consumption of traded goods. In this article, we argue that, in conformity with intuitive conceptions of causation, the economic incidence of a Pigouvian tax can be seen as a measure of the relative contribution to pollution of consumers and producers. Taking this perspective on the polluter-pays principle can help increase ambition in climate change action because it reduces the relevance of the question "Who is the polluter?" in climate change negotiations and enables a focus instead on the issue of "What can be done?" to reduce carbon emissions.

Keywords

polluter-pays principle – causation of environmental harm – carbon tax – Coasean bargaining – Pigouvian tax – economic incidence of tax

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1 Introduction

The polluter-pays principle (PPP) is widely seen as the backbone of environmental policy. It was already present in the European Community's first environment action program, and later in the Single European Act (1986). Lawyers have often argued that the idea that "the polluter should pay" is the most "economic" of the many environmental principles. However, how lawyers and economists describe the PPP often differs substantially. In legal documents (and legal doctrine), it is often held that the principle entails that the costs of pollution or other environmental damage, including the costs of restoring the environment following damage, are to be borne by the agent who undertakes the activity which releases the pollution. This is an ex-post approach to the PPP. Economists, on the other hand, often argue that the principle is just another version of the idea that so-called negative externalities (which are considered a market failure in economic terms) should be internalized. Internalization incentivizes polluters to take optimal *ex-ante* measures to prevent environmental harm. In this article, we focus on the ex-ante conception of the PPP.

Traditionally, environmental-policy documents and legal doctrine make clear who is to be considered the polluter: it is either the producer of a product, or the operator of a production process, or the person controlling the process that generates the pollution. It has been the foundation of Ronald Coase's work on social cost[1] that this cost is generally caused jointly by two or more parties. From this perspective, identifying a single entity (such as an operator or producer) as the polluter is problematic. To some extent, this is also recognized in legal literature, indicating that it is often unclear who should be considered the polluter. In the words of Langlet and Mahmoudi, "Is it, for example, the car driver, the car manufacturer, the producer or distributor of fuel, or perhaps all of them who are polluters in relation to car traffic environmental damage?".[2]

It is thus not enough to refer to the obligation of "the polluter" to pay. The causation requirement may make it necessary to identify who is the polluter in order to be able to apply the principle. Causation has already led to discussions in climate change policy on the relative contribution to carbon emissions of producers and consumers (in domestic trade), as well of exporters and importers (in international trade). For example, the contribution of a country to climate change depends on whether the greenhouse gases released in its

1 Ronald H. Coase, 'The Problem of Social Cost', 3 *Journal of Law and Economics* 1 (1960).

2 David Langlet and Said Mahmoudi, *EU Environmental Law and Policy* (Oxford: Oxford University Press, 2016), 56.

territory in the production of goods for export are ascribed to that country or to the importing countries.

Several attempts have been made to solve the problem of apportioning causation of emissions using economic theory—to little avail so far. The key problem is that there are no fixed methods or rules to determine the individual contributions to jointly caused damage (in this case, climate change). The question, therefore, remains whether economic theory can provide an answer to the problem of correctly allocating the consequences of climate change to the "true polluter".

In our view, the answer might be found in the work of the person against whom Coase directed his famous article on "The Problem of Social Cost"—Pigou.[3] We argue that, in the absence of transaction costs, the economic incidence of a Pigouvian tax can be seen as reflecting the relative causal contribution to pollution of the producer and the consumer, in accordance with intuitive notions of causation.[4] In a competitive market, Coasean bargaining will result in burden-sharing that is in line with the proportion in which each party contributed to the joint causation of the damage. A carefully designed carbon tax is thus able to avoid problems concerning the attribution of causation of environmental harm, in line with an economic interpretation of the PPP. Taking this perspective on the PPP may enable an increase in policy ambition in climate change mitigation because it shifts the focus of climate negotiations from the question "Who is the polluter?" to the question "What can be done to mitigate climate change?".

The remainder of the paper is structured as follows. Section 2 sketches the legal and economic perspectives on the PPP. Section 3 dissects conflicts that affect the implementation of the PPP today. We then argue that the introduction of a Pigouvian tax on greenhouse gas emissions can solve the problem of identifying the polluter, and that Coasean bargaining over the Pigouvian tax burden between transaction partners implements the PPP in line with intuitive conceptions of causation (Section 4). Section 5 discusses this proposal through the lenses of Pigou and Coase. Section 6 elaborates on the policy implication of the analysis, while Section 7 discusses some of its limits.

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3 Coase, supra n. 1.

4 In this article, we focus on taxes as an instrument of choice for implementing the PPP, but in many cases similar efficiency results can be obtained using emission-trading systems; see Ian W. H. Parry and William A. Pizer, *Emissions Trading versus CO_2 Taxes versus Standards* (Resources for the Future, Issue Brief 5, 2007). Our focus on carbon taxes is in line with the recent statement by 27 Nobel Prize winning economists; see George Akerlof et al., 'Economists' Statement on Carbon Dividends', *Wall Street Journal*, 17 January 2019, <http://econstatement.org>.

2 The Polluter-Pays Principle

In this section, we discuss the PPP in law and in economics. We then elaborate on differing views regarding how the PPP should be implemented.

2.1 *The PPP in Law*

The idea of the PPP is that a person causing environmental harm ought to bear the costs of his or her conduct.[5] According to Beyerlin, this principle "calls for ensuring that in every case where the environment has been, or runs the risk of being, polluted, the accountable person bears the costs resulting from the pollution or from the measures taken for the purpose of preventing pollution".[6]

As Luppi et al. observe, the PPP originally was an economic principle which later metamorphosed into "an established legal principle".[7] Bleeker goes so far to say that "the PPP is essentially an economic principle translated into law".[8] This reception has, at times, been criticized by legal scholars. De Sadeleer sees a conflict of justice. "The principle contains neo-liberal overtones that appear to countenance the idea that the right to pollute can be purchased for the monetary equivalent of the environmental cost sustained".[9] Similar critiques have been put forward by Sandel, who questions whether everything should be for sale.[10] Also, Dupuy and Viñuales indicate that cost internalization cannot necessarily imply that any costs "can be internalized or, in other words, that there are no limits to pollution as long as it is paid for".[11] Other legal scholars are more comfortable with the idea, pointing to its foundations in tort law.

5 Ibid.

6 Ulrich Beyerlin, 'Different Types of Norms in International Environmental Law: Policies, Principles and Rules', in *The Oxford Handbook of International Environmental Law*, edited by Daniel Bodansky, Jutta Brunnée, and Ellen Hey (Oxford: Oxford University Press, 2006), 441.

7 Barbara Luppi, Francesco Parisi, and Shruti Rajagopalan, 'The Rise and Fall of the Polluter Pays Principle in Developing Countries', 32(1) *International Review of Law and Economics* 135 (2012), 136.

8 Arne Bleeker, 'Does the Polluter Pay? The Polluter-Pays Principle in the Case Law of the European Court of Justice', 18 *European Energy and Environmental Law Review* 289 (2009), 292.

9 Nicolas de Sadeleer, 'The Polluter-pays Principle in EU Law: Bold Case Law and Poor Harmonisation', in *Pro Natura: Festskrift Til H.C. Bugge* (Oslo: Universitetsforlaget, 2012), 418.

10 Michael J. Sandel, *What Money Can't Buy: The Moral Limits of Markets* (London: Macmillan, 2012).

11 Pierre-Marie Dupuy and Jorge E. Viñuales, *International Environmental Law*, 2nd edn. (Cambridge: Cambridge University Press, 2018), 82.

In the words of Luppi et al., "The idea that a polluter should pay for the environmental harm it causes is well-rooted in Western legal history".[12]

Meanwhile, the legal adoption of the PPP has been gradual but sustained. We find the PPP in Principles 21 and 22 of the 1972 Stockholm Declaration.[13] European legislation followed, incorporating the PPP, as noted above, into the Single European Act, which was followed by the Maastricht Treaty (1992). Thus the PPP is now found in Article 191(2) of the TFEU, which states that Union policy is based on the principle "that the polluter should pay".[14] From here, the PPP found its way into many different places in EU legislation and the case law of the EU Court of Justice.[15] Perhaps the most critical policy area where this principle has been applied is carbon pricing. In 1990, Poland and Finland adopted the world's first carbon taxes, and by 2003 the policy of pricing carbon emissions had been established for all EU countries through the EU ETS.

Beyond Europe, support for the PPP became global in Principle 16 of the Rio Declaration. Principle 16 states that "National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment".[16] The PPP continued to expand its reach, covering additional areas of law[17] and regions.[18] According to the World Bank, in 2019 there were 57 carbon-pricing instruments implemented or scheduled for implementation around the world (Figure 1).[19] At the time

12 Luppi et al., supra note 7, at 135.

13 Siddhant Nanodkar, 'Polluter Pays Principle: Essential Element of Environmental Law and Policy, 1(5) *International Journal of Law, Management and Humanities* 1 (2018), 4.

14 See Marcin Stoczkiewicz, 'The Polluter Pays Principle and State Aid for Environmental Protection', 6(2) *Journal for European Environmental and Planning Law* 171 (2009), 175; Philippe Sands and Jacqueline Peel, *Principles of International Environmental Law*, 4th edn. (Cambridge: Cambridge University Press, 2018), 242–3 and Luppi et al., supra note 7, at 136.

15 See Langlet and Mahmoudi, supra note 2, at 55–7.

16 See, for example, Benoit Mayer, *The International Law on Climate Change* (Cambridge, UK: Cambridge University Press, 2018), 74; Sands and Peel, supra note 14, at 240; Luppi et al., supra note 7, at 136; and Priscilla Schwartz, 'The Polluter Pays Principle', in *Principles of Environmental Law*, edited by Ludwig Krämer and Emanuela Orlando (Cheltenham: Edward Elgar, 2018), 261.

17 So Stoczkiewicz, supra note 14, at 174–5.

18 See <https://carbonpricingdashboard.worldbank.org/>.

19 World Bank, *State and Trends of Carbon Pricing* (Washington, DC: World Bank Group, 2019).

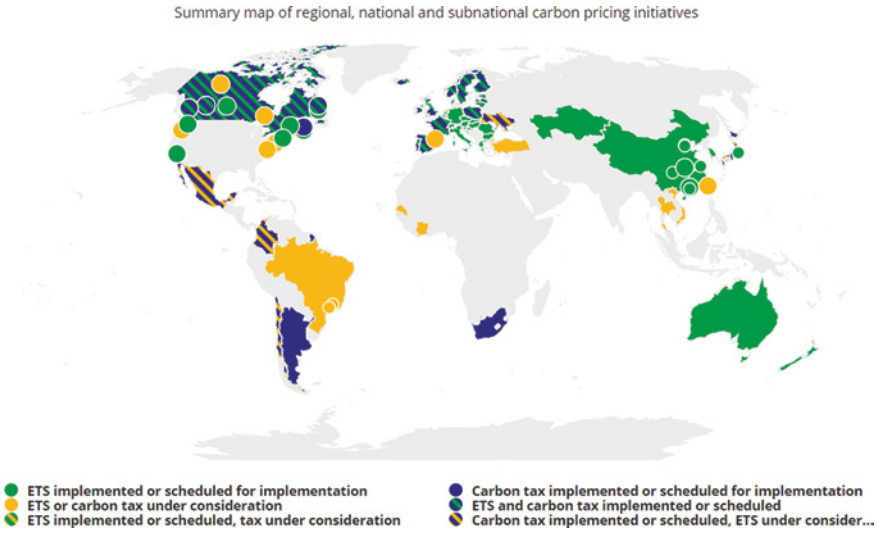

FIGURE 1 Global spread of initiatives to make polluters pay for greenhouse gas emissions through Pigou-inspired carbon taxes or emission-trading systems. Design: World Bank

of writing, China was launching its own ETS, which will make it a leader in carbon pricing due to its market size.[20]

Despite its reach, the PPP has not yet become a norm of customary international law.[21] Mayer holds that the PPP as an idea "ought to have some influence on the development of the international law on climate change",[22] but that currently it is "well-recognised as an aspirational principle within the OECD, but much less beyond".[23]

2.2 *PPP: the Economic Perspective*

By one reckoning, the idea underlying the PPP is as old as economics itself. Adam Smith himself pointed out the need to internalize external costs[24] and

20 Ibid.

21 Mayer, supra note 16, at 74, although Nanodkar, supra note 13, at 5, argues that the growing acceptance of the PPP at the international level is an "indication that it is not long when it definitely becomes a part of customary international law".

22 Mayer, supra note 16, at 74.

23 Ibid.

24 See Adam Smith, *The Wealth of Nations: An Inquiry into the Nature and Causes of the Wealth of Nations* (London: Strahan and Cadell, 1776), Section 1.4; and Adam Smith, *The Theory of Moral Sentiments* (London: Millar in the Strand, 1759), Section 2.2.2.

suggested tax policy as the instrument by which to achieve it.[25] Pigou later formalized this idea.[26] Tax policy has long been regarded as the standard tool by which to make polluters pay, although Dales has identified tradable discharge permits as an alternative.[27]

The jump from economic theory to economic policy came in 1972 with a formal recommendation by the OECD Council to make polluters pay as a "guiding principle concerning the international economic aspects of environmental policies".[28] It held:

> This principle means that the polluter should bear the expenses of carrying out the above-mentioned measures decided by public authorities to ensure that the environment is in an acceptable state. In other words, the costs of these measures should be reflected in the cost of goods and services, which cause pollution in production and/or consumption. Such measures should not be accompanied by subsidies that would create significant distortions in international trade and investment.

Almost fifty years later, in October 2019, fifty Finance Ministers agreed to collaborate on making polluters pay for carbon emissions, through taxes, trading schemes, and reduced fossil-fuel subsidies.[29]

2.3 *Differing Interpretations in Law and Ecological and Environmental Economics*

While the economic-policy application of "making the polluter pay" most likely originates in the economic-theory idea that external costs should be internalized, there have been calls to disassociate these two objectives. The question raised is whether the objective of the PPP is the reduction in physical pollution (a common position in environmental law and ecological economics) or cost-internalization per se, as an independent objective in the name of economic efficiency, irrespective of the impact on pollution (a position

25 See Smith, *Wealth of Nations*, supra note 24, Section 3.1 ("Of the public Works and Institutions for facilitating the Commerce of the Society"), which gives the example of taxing carriages in proportion to the damages they cause to roads and recommends this idea.

26 Arthur C. Pigou, *The Economics of Welfare* (London: Macmillan, 1932).

27 John H. Dales, *Pollution, Property and Prices* (Toronto: University of Toronto Press, 1968), 93–7; and Nanodkar, supra note 13, at 3.

28 OECD, *Recommendations*, C(72), 128(1972). See further Sands and Peel, supra note 14, at 241–2.

29 Coalition of Finance Ministers for Climate Action, *Helsinki Principles*, Principle 3 (Washington DC: World Bank Group, 2019).

underlying neoclassical environmental economics). The latter position can be based on the so-called First Fundamental Theorem of Welfare Economics, namely that for a free market to generate a Pareto-efficient competitive equilibrium, external costs must be internalized.[30] Under this interpretation, the PPP is justified irrespective of any impact of prices on pollution. If this is the perspective one adopts, the cost to be internalized is the social cost of carbon, meaning the economic cost of emitting an additional tonne of carbon.[31] Estimates of the social cost of carbon include, for instance, the economic cost of sea-level rise, droughts, and other extreme weather events. This cost is borne by society as a whole. Although estimates of the social cost of carbon differ, and although governments adopt different measures,[32] the underlying principle is the same: polluters should internalize the full cost of their activities.

Taking the position that the purpose of the PPP is to reduce pollution, not mere cost-internalization, Mayer argues that the PPP "does not necessarily require the polluter to pay *all the costs* in every circumstance, but it supports the view that polluters should be charged some fee that would dissuade them from polluting whenever this is likely to disincentivise pollution".[33] In debates on climate law and economics, Mayer's argument has been spun the other way round—asking whether polluters should pay for all the costs of their emissions (the "social cost of carbon" approach) or the cost required for disincentivizing emissions in order to reach an emission target (the "shadow price of carbon" approach), with the latter often considered to be a higher cost than the first.[34]

Different from Mayer's focus on the price that polluters need to pay to incentivize a reduction in pollution, Dupuy and Viñuales indicate that the PPP should lead to an internalization of a negative externality,[35] which does not

30 Abba P. Lerner, 'The Concept of Monopoly and the Measurement of Monopoly Power', 1(3) *Review of Economic Studies* 157 (1934), 157–75; Oskar Lange, 'The Foundations of Welfare Economics', 10(3/4) *Econometrica* 215 (1942), 215–28; Kenneth Arrow, 'An Extension of the Basic Theorems of Classical Welfare Economics', in *Second Berkeley Symposium on Mathematical Statistics and Probability*, edited by Jerzy Neyman (Berkeley: University of California Press, 1951), 507–32.

31 William D. Nordhaus, 'Revisiting the Social Cost of Carbon', 114(7) *Proceedings of the National Academy of Sciences* 1518 (2017), 1518–23.

32 Goran Dominioni and Dirk Heine, 'Behavioural Economics and Public Support for Carbon Pricing: A Revenue Recycling Scheme to Address the Political Economy of Carbon Taxation', 10(3) *European Journal of Risk Regulation* (2019), 554–570.

33 Mayer, supra note 16, at 74.

34 World Bank, *State and Trends of Carbon Pricing* (English) (Washington, D.C.: World Bank Group, 2016), at 22–3.

35 Dupuy and Viñuales, supra note 11, at 82.

necessarily yield reductions in pollution. Similarly, Stoczkiewicz argues that there are at least two meanings to the principle: in a broader sense the PPP implies that the polluter must pay for all the harm caused by the activity, whether the activity is legislatively compliant or not; a narrower version of the PPP focuses on making the polluter liable for meeting the environmental protection requirements of existing laws.[36]

These different interpretations of the PPP can also be seen in the 2019 agreement of Finance Ministers, which states that fiscal policymakers commit to "work towards measures that result in effective carbon pricing".[37] This is relevant for two reasons: it is the first time that no less than fifty Finance Ministries committed to fiscal-policy action related to the PPP; and the word "effective" (instead of "efficient") supports an interpretation of the PPP that its objective is the reduction of harm rather than mere cost-internalization. In an Explanatory Note, the Finance Ministers clarified that their commitment refers to the use of price-based instruments to reach the emission-reduction objectives of the Paris Agreement.[38] This suggests that in the eyes of policymakers in charge of instruments such as carbon taxes (e.g. the Finance Ministries of Mexico and Sweden),[39] making the polluter pay has the fiscal definition of applying the shadow price of carbon instead of the social cost of carbon. This observation does not resolve the debate over the correct definition of the PPP, as the answer to that question is normative in nature. Therefore, even though the theoretical debate over what the PPP means may continue, in applied policy discussions, there is more clarity: the way lawyers have tended to interpret the PPP is also the one endorsed by key fiscal policymakers.

Related to the debate on the PPP's objective is the debate on which types of prices count as making polluters pay. Jans and Vedder argue that the PPP is satisfied with traditional command-and-control regulations, such as standard-setting,[40] whereas Nanodkar limits the PPP strictly to the use of market-based instruments.[41] Jephcote et al. argue that the PPP is a way of ensuring economic efficiency and minimizing distortions in international trade by incorporating

36 Stoczkiewicz, supra note 14, at 173.

37 Coalition of Finance Ministers for Climate Action, supra note 29.

38 Explanatory Note to the Helsinki Principles, available at <www.cape4financeministry.org/coalition_of_finance_ministers>.

39 World Bank, *Using Carbon Revenues: Partnership for Market Readiness Technical Note; No. 16* (Washington, DC: World Bank, 2019), Annex.

40 Jan H. Jans and Hans H. B. Vedder, *European Environmental Law After Lisbon*, 4th edn (Groningen: Europa Law Publishing, 2012), 49–51; see also Edwin Woerdman, Alessandra Arcuri, and Stefano Clò, 'Emissions Trading and the Polluter-Pays Principle: Do Polluters Pay Under Grandfathering?', 4(2) *Review of Law and Economics*, 565 (2008), 574.

41 Nanodkar, supra note 13, at 5.

environmental costs in the decision-making process.[42] That outcome is achieved, according to them, by the trading of greenhouse-gas-emission allowances or the taxation charges on polluting substances.[43] However, if the objective is to reduce pollution irrespective of making polluters pay, they also hold that, notwithstanding the PPP, the government can follow a command-and-control approach with activity restrictions through abatement devices.[44] The Finance Ministers' statement informs this debate as well. Environmental taxes, permit trading, and reductions in subsidies for polluting activities all count toward the Finance Ministers' commitment to effective carbon pricing, but regulatory policies only count if they "result in an implicit marginal price on carbon, such as tradable performance standards".[45] This statement fits with the interpretation that making the polluter pay requires market-based policies, not the command-and-control regulations traditionally used in environmental law.

3 Who is the Polluter?

In this section we show that while legal systems traditionally have made producers legally liable for pollution, an argument exists to consider consumers as the polluters. Thus policymakers trying to implement the PPP may need a framework to apportion liability between consumers and producers.

As noted earlier, an implicit assumption in the legal reception of the PPP is that the person who pollutes, for example by emitting greenhouse gases, is also the one who causes the pollution and to whom responsibility for that pollution should be attributed. In many of the legal texts discussed in Section 2, the polluter is identified as the producer, the operator of the production process, or the person controlling the process that generates the pollution. The EU Environmental Liability Directive takes this approach.[46] It seeks to lay down rules based on the PPP.[47] It attributes liability for environmental damage to legal,

42 Calvin Jephcote, Haibo Chen, and Karl Ropkins, 'Implementation of the Polluter Pays Principle (PPP) in Local Transport Policy', 55 *Journal of Transport Geography* 58 (2016), 60.

43 Ibid.

44 See further on the implementation of the polluter-pays-principle, Schwartz, supra note 16, at 265–8.

45 Coalition of Finance Ministers for Climate Action, supra note 29.

46 Directive 2004/35/CE of 21 April 2004 on environmental liability concerning the prevention and remedying of environmental damage, OJ L143, 30 April 2004.

47 Recital 2 of the Environmental Liability Directive states: "The prevention and remedying of environmental damage should be implemented through the furtherance of the 'polluter-pays' principle, as indicated in the Treaty and in line with the principle of sustainable development".

private, or public persons operating or controlling a damaging occupational activity. The recital preceding the Environmental Liability Directive holds that the Directive's fundamental principle should be that an *operator* whose activity has caused the environmental damage or the imminent threat of such damage is to be held financially liable.[48] In the OECD, moreover, member states agree that the PPP "implies that the *operator* of a hazardous installation should bear the costs".[49] From an administrative standpoint, it is often argued that it is easier to monitor a few producers than many consumers.[50] As another example, the Oslo Principles on Global Climate Change Obligations (while they derive the obligations of states and enterprises from the precautionary principle rather than the PPP) refer to an obligation of enterprises to reduce their greenhouse gas emissions, insofar as they can do so without relevant additional costs.[51]

The literature on ecological footprinting, by contrast, tends to consider consumers as contributing equally to environmental harm. Proponents of this theory do not consider producers and consumers as sharing causation, but rather allocate full responsibility for emissions to both groups.[52] In the words of De Meza, "everyone involved is fully responsible for all the damage done".[53] From an economic perspective this is unsatisfactory, as it leads to double counting: the same unit of emissions is part of the footprint of the consumer and the producer. While problematic in this respect, the intuition behind footprinting—viz. that the producer is not the only one who causes pollution—is appealing. In the words of Lezen et al., "it is intuitively clear that the responsibility is somewhat shared between the supplier and the recipient of a commodity, because the supplier has caused the impacts directly, but the recipient

48 Recital 18 of the Directive reads: "According to the 'polluter-pays' principle, an operator causing environmental damage or creating an imminent threat of such damage should, in principle, bear the cost of the necessary preventive or remedial measures".

49 OECD Council, *Recommendation of the Council Concerning the Application of the Polluter-Pays Principle to Accidental Pollution,* 1989, para. 4.

50 Karl Lidgren and Göran Skogh, 'Extended Producer Responsibility Recycling, Liability, and Guarantee Funds', 21(79) *Geneva Papers on Risk and Insurance* 170 (1996), 178.

51 Expert Group on Global Climate Obligations, *Oslo Principles on Global Climate Obligations* (The Hague: Eleven Publishing, 2015), 4–5.

52 See, for example, William Rees, 'Ecological Footprints and Appropriated Carrying Capacity: What Urban Economics Leaves Out', 4(2) *Environment and Urbanization* 121 (1992); and Simone Bastianoni, Federico Pulselli, and Enzo Tiezzi, 'The Problem of Assigning Responsibility for Greenhouse Gas Emissions', 49(3) *Ecological Economics* 253 (2004), 255.

53 David de Meza, 'Coase Theorem', in *The New Palgrave Dictionary of Economics and the Law*, edited by Peter Newman (London: Macmillan, 1998), 273.

has demanded that the supplier do so".[54] Given this premise, in implementing the PPP, how should we determine the relative share of responsibility of the producer and the consumer?

We will argue that a solution for making consumers and producers pay for the relative share in the joint causation of environmental harm is to apply the PPP by allowing Coasean bargaining over price signals imposed via Pigouvian taxes. Pigou and Coase are often seen as mirror images in their treatment of social costs. Pigou argued that the appropriate response to externalities is an environmental tax set equal to the marginal cost that a polluting activity imposes on a third-party victim.[55] Coase instead argued that in situations where bargaining is possible between parties, no single side should be regarded as having caused all of the externality's cost.[56] For bilateral externalities, the harm is, therefore, not one-sided, but reciprocal and symmetrical.[57] When we put these two views together, the question arises whether it matters if the PPP is applied to either producers or consumers in apportioning the tax burden for an externality suffered by a third-party victim.

4 Causation and the Incidence of Pigouvian Taxes

In this section, we argue that in a world of zero transaction costs, the economic incidence of a Pigouvian tax between transaction partners (producer and consumer) can be seen as the degree in which each party has contributed to causing the greenhouse gas emissions. Carbon pricing can thus implement the PPP.

Consider the following scenario. There is a competitive market with a large number of producers, manufacturing an identical product at zero profit. All producers, apart from one, share the same technology, which produces no pollution. The remaining producer uses another technology that causes a fixed amount of pollution per unit of output. This pollution is harming a third party, which has no means to avoid it. The production technology used by the non-polluting producers operates at the same marginal and fixed costs as the technology used by the polluting producer, and there is no environmental tax, so the extra cost to society that comes from the pollution is fully externalized. The

54 Manfred Lenzen, Joy Murray, Fabian Sack, and Thomas Wiedmann, 'Shared Producer and Consumer Responsibility: Theory and Practice', 61(1) *Ecological Economics* 27 (2007), 32.

55 Pigou, supra note 26.

56 Coase, supra note 1, at 87–137.

57 Dupuy and Viñuales also refer to Pigou "who suggested a tax to correct this market failure and increase welfare" as well as to Coase "who suggested trading as a better policy response" (Dupuy and Viñuales, supra note 11, at 81).

producers all have the same production costs and prices, and all face the same residual demand by customers. Is it the polluting producer that causes the pollution or is it, instead, its customers?

In the economic analysis of tort law, the test for such a question is the "but-for" test.[58] The test attributes causation to an individual if harm would not have occurred but for the action undertaken by the individual.[59] Let us apply this test to our problem. The pollution would not have occurred if consumers had not demanded products from the polluting producer, given that the producer is only in business because consumers demand its products. It is equally arguable that the pollution would not have occurred had the producer not adopted the polluting technology. Both lines seem to work, so both consumers and producer may be said to have caused the damage.

Another version of the but-for test uses information that we have about the demand function. As the market is in perfect competition, all producers individually face a flat demand function. Hence, consumers of the polluting producer would be entirely willing to change their source of supply of the product away from the polluting producer to one of the non-polluting producers. Social welfare would be increased if such a shift in demand occurred, since social welfare here is the sum of consumer surplus, no producer surplus (as none exists under perfect competition), plus the loss to the pollution victim. There is another but-for condition: social welfare would be higher, but for the producer's unwillingness to use a non-polluting technology. However, again, social welfare would also be higher but for the consumer's insistence on using this source of supply. It thus appears again that producer and consumers are sharing causation equally.

Now imagine that a Pigouvian tax is introduced. The tax only affects the polluting producer's products; so its marginal costs rise. If the producer passes them on in prices, all consumers will shift away to other producers. Because in a competitive market with zero profit the producer cannot absorb the cost, it goes out of business. Neither the polluting producer nor its customers end up paying the tax. They share the (zero) tax burden equally. Hence, the amount of

58 In this analysis, we are skipping another test that judges apply in tort law prior to considering the causation of damages, namely the test relating to whether there has been any wrongful behaviour, which is a precondition for the existence of a tort. Since the consumer's purchase was legal, there was no such wrongful behaviour, so tort law would not apply any sanctions. However, there was an external cost and damage caused to a third party, which is why we apply the but-for test to determine how the causation—independently from the existence of any wrongful behavior—could be apportioned.

59 For the legal test concerning causation, see Michael Faure, 'Attribution of Liability: An Economic Analysis of Various Cases', 91(2) *Chicago-Kent Law Review* 602 (2016), 606–12.

tax borne by producers and consumers, and the related responsibility for the environmental harm, is even.

Consider now a slight modification. The polluting producer is not a perfectly competitive firm but makes a small profit margin. This might be because its technology is cheaper by a very small amount than the clean technology of the other producers. For some fixed cost of switching technology, the clean producers are not adopting the polluting technology. All the producers still sell their products at the same price, with the polluting producer being able to sell at a slight mark-up. The consumers still consider the goods of all producers perfectly substitutable and behave as if in a situation of perfect competition, with each producer facing a flat residual demand function. What does this different set-up entail for the but-for test?

The situation prior the introduction of the tax is identical to the previous example. Social welfare could be higher, but for the consumers' choice to buy from the polluting producer; and social welfare could be increased, but for the producer's choice to use the polluting technology. When the tax is introduced, the polluting producer may not immediately go out of business, since it can afford a slight rise in its marginal costs, but it would not be able to pass on the tax in prices. If it does increase the price, the consumers will shift to other producers and it will not be possible to say that "Social welfare could be higher, but for the consumers' maintained choice to buy from the polluting producer"; instead, the consumer's action of shifting away all their demand would cause social welfare to increase, as the consumers would no longer be causing the social welfare loss. The producer, if it wants to continue producing, must absorb the tax in its costs. It must continue paying the tax, which—if it is set at the Pigouvian tax rate that equals the damage to the third-party victim—will equalize the social loss from pollution. Therefore, after paying the tax, the producer is no longer causing a social welfare loss. It is the payment of the tax and its full absorption by the producer that equalizes the degree to which the producer and the consumers are causing changes in social welfare. As with the first thought experiment, the proportion of the tax paid by the polluting producer and the consumers equals the proportion by which the two sides cause the damage.

What do these thought experiments teach us intuitively? We considered a notion of causation that depends on conditions of supply and demand for a product that caused damage. The actor who insisted the most on continuing the pollution after the onset of taxation was regarded as having caused that pollution to a greater extent. In the boundary case we considered, the decision to continue the pollution was entirely due to the insistence of the polluting producer itself to continue its production, as consumers were perfectly willing

to give up this product and buy from others. This share of the causation matched the relative shares of the tax burden borne by the producer and the consumers. Intuitively, the degree to which an actor insists on an outcome raises that person's causal contribution to that outcome. The notion of causation we considered is thus in line with that intuition, and was how the tax burden ended up being divided.

The idea that relative causation is defined by the tax incidence is consistent with the intuition that relative causation is associated with the relative benefits of an action. In the second thought experiment, the producer was the only one benefiting from the pollution, because for the consumers there was no benefit in buying the product manufactured with the polluting technology compared to buying the one manufactured with the clean technology. The sharing of the tax incidence is proportionate to the sharing of the benefits of pollution. This notion of causation is in line with the intuition that the more one benefits from an outcome, the more one is responsible for it. Adam Smith himself had this intuition. He writes on the burden of taxation borne by the final consumer that "His payment is exactly in proportion to his gain"[60] from the activity that is causing the externality.

In economic terminology, the carbon price is distributed according to the relative price elasticity of demand and supply of transaction partners. When the price elasticity is low, the Pigouvian tax reduces pollution less than when the elasticity is high because, in the former case, the polluter insists on engaging in the polluting activity. Such a transaction partner at the same time receives a more significant incidence of the environmental taxation. (The extended working-paper version of this article provides the formal derivations.[61])

A similar framework also applies in situations outside of perfect competition; however, besides price elasticities of demand and supply, in monopoly the curvature of demand also matters.[62] Holding price elasticities of demand and supply the same, a monopolist will bear a more significant share of the incidence from an environmental tax than a competitive firm, as it needs to account for the reduction in demand from its own price increases. This means

60 Smith, supra note 24, Section 3.1.

61 See Dirk Heine, 'Does Pigou Make the True Polluter Pay? A Framework For Prospective Multilateral Causation of Emissions in High-Frequency Market Interactions', in *Challenges and Solutions to Environmental Tax Reform* (EDLE Dissertation Manuscript, 2020).

62 For a recent review of research on economic tax incidence under different market conditions, see Don Fullerton and Erich Muehlegger, 'Who Bears the Economic Costs of Environmental Regulations?', National Bureau of Economic Research Working Paper, No. 23677 (2017).

that a monopolist will pay a larger share of the environmental tax for the same pollution, which can be seen as compensation to society for the cost of market concentration, which the monopolist otherwise benefits from. What matters here is that in both perfect competition and monopoly, the distribution of environmental tax burdens happens in a way that corresponds to intuitive views of responsibility. The PPP is thus upheld by the splitting of the tax burden in different market circumstances.

This analysis shows that it is not necessary for a government to determine ex ante the relative share of the producer and consumer in causing climate change. Given a low transaction-cost setting between producers and consumers, bargaining will take place, resulting in an allocation of the tax incidence that corresponds to intuitive notions of causation. Notice that, under the proposed view of the PPP, the government does not need to determine ex-ante who is responsible for carbon emissions. However, the government is in a position to affect the proportion of economic incidence of the tax. For instance, competition law and policy can affect market structure. Since market structure is one of the factors that determine the distribution of the tax incidence, it also defines the attribution of responsibility for emissions. Similarly, governments can make the demand for certain products more elastic, and thus reduce the incidence of the tax on consumers. For instance, investment in public transportation reduces citizens' need to use private vehicles, potentially reducing the pass-through to consumers of carbon prices imposed on the road-transport sector. As the tax incidence on consumers decreases, their share of responsibility also decreases, while that of producers increases.

5 Bridging Coase and Pigou

The view that both the producer and the consumer are responsible for carbon emissions resembles Coase's idea concerning causation. Coase showed that, in the absence of transaction costs, and with price-taking agents, an efficient allocation of entitlements is reached regardless of the initial allocation of rights. In the previous section, we showed that if the producer and consumers jointly cause the emissions, they will share the effective liability for the emission tax according to the proportion by which each contributes to causing the emissions. The advantage of this model is that the outcome will be reached independently of how the state perceives and attributes relative causation and tax liabilities between the producer and the consumer. The result of Coasean bargaining is that the burden of the tax is split between the producer and the consumer through private bargaining instead of through state intervention.

How does this seemingly theoretical idea work in practice? If an environmental tax on emissions is introduced, producers and consumers do not need to set up a separate transaction to distribute the tax burden. The sharing of the tax will be determined as a by-product of the transaction. Producers and consumers only need to determine the after-tax market price. There is an (implicit) bargaining between producers and consumers concerning the determination of the tax incidence. Notice that consumers and producers do not need to know their relative contribution to emissions, nor do they need to be aware that the economic incidence of the Pigouvian tax determines their relative responsibility for emissions. Market conditions will determine the distribution of the tax incidence between them.

Pigouvian and Coasean solutions have to, and can be, reconciled. In the case of greenhouse gas emissions, the radiative forcing of a molecule released by any emitter in the world can have global ramifications with long time effects, and the consequences depend on the pre-existing stock of greenhouse gases. This is a complex situation, where bargaining alone between producer and consumer is impossible—simply considering the number of people involved. The fact that greenhouse gas emissions are stock pollutants that cause harm by remaining in the atmosphere for long periods implies that future generations are affected by today's emission decisions. Future generations cannot, of course, bargain with current generations, and they certainly cannot be seen to cause the emissions that will harm them. There exists, in other words, a proportion of the damage that the victim cannot reasonably be considered to have caused. This subset of social cost can be dealt with through the imposition of a Pigouvian tax; it cannot be solved through Coasean bargaining. It is the imposition of the Pigouvian tax that enables Coasean bargaining over the tax burden between producers and consumers, who jointly cause the damage to third parties.

6 Implications for Climate Change Policy

In Section 4, we showed that the economic incidence of a Pigouvian tax could be seen as a measure of the relative responsibility of consumers and producers for the pollution released in the production and consumption of a good. In this section, we argue that looking at the PPP through these lenses can contribute to progress in climate policy, as it reduces the need to engage in lengthy negotiations on which countries are responsible for greenhouse gas emissions released in the production of goods that are traded internationally.

Under the current climate regime, emissions released in the production of goods that are subsequently exported count towards the carbon budget of the exporting nation. This practice is contested. Some countries' policymakers and certain scholars have opposed this accounting practice, arguing that this class of emissions is caused by the countries to whom the goods are exported. Just as with the PPP, the question arises who the polluter is in the production of exported products. Wang and Watson write that "Whilst the nation-state is at the heart of most international negotiations and treaties, global trade means that a country's carbon footprint is international."[63] This problem affects about 23 per cent of global emissions[64] and 23–38 per cent of emissions from China.[65] It is thus not a trivial issue to determine who should be responsible for the costs of carbon emissions released in the production of exported goods.[66]

Similar to the sharing of causation between producers and consumers, the embodied emissions of internationally traded products are jointly caused by the entities selling and buying the goods. In this context, the exporter and the importer have the roles of the producers and the consumers, respectively.[67] The exporter causes the proportion of emissions that corresponds to its price elasticity of supply relative to the price elasticity of demand of the importer. In this way, the causation is shared and quantifiable. What would then be the way to implement the PPP for embodied emissions?

We would argue that it is the very same policy that China is presently rolling out: carbon pricing. It is right for China's national ETS to cover emissions released in the production of goods that are subsequently exported, as much as it is right for the EU to cover in its own ETS and carbon taxes the emissions released from goods produced in the EU and exported to China. The respective overseas consumers will bear a share of the incidence of these carbon prices, which is appropriate given the contribution of those consumers to causing the

63 Tao Wang and Jim Watson, *Who Owns China's Carbon Emissions* (Brighton: University of Sussex Tyndall Centre, 2007), 7.

64 Steven Davis, Glen Peters, and Ken Caldeira, 'The Supply Chain of CO_2 Emissions', 108(45) *Proceedings of the National Academy of Sciences* (2011), 18554–9.

65 Ibid.; and Ying Liu, Kankesu Jayanthakumaran, and Frank Neri, 'Who is Responsible for the CO_2 Emissions that China Produces?', 62 *Energy Policy* (2013), 1412–19.

66 Zhongxiang Zhang, 'Who Should Bear the Cost of China's Carbon Emissions Embodied in Goods for Exports?, 24(2–3) *Mineral Economics* (2011), 104.

67 Equating producers and exporters in this way appears to be the legally correct way of pursuing our analysis. In both domestic law and international law, causation and responsibility for emissions are typically assigned to the agent engaged in the activity that caused the emissions, e.g. at the point of combustion of fuels. So we can here use our results for producers from Section 5 to analyse exporters.

emissions of those traded goods. In a competitive and free market, the relative price elasticities of demand and supply will determine both the share by which producers and consumers in different countries contribute to causing the damage and the related distribution of the incidence of the carbon price between them. Furthermore, the distribution of the tax incidence between two transaction partners will be the same irrespective of who of the two bears the legal obligation to remit the tax payment.[68]

This sharing of causation and incidence is independent of how international climate law accounts for the emissions: causation and tax burdens would be the same irrespective of whether emission inventories account for greenhouse gases under the consumption principle or the production principle. This result is important because it means that policymakers should not engage in long-winded negotiations about accounting principles. Instead, they should focus on progressing with their carbon-pricing schemes, since the adoption of such policies would resolve the problem.

A key advantage of considering the distribution of the economic incidence of carbon pricing as the relative contribution of different economic actors to climate change is that it makes it more difficult to "blame" a party for its emissions, and thus it may facilitate cooperation. The economic tax incidence is less visible than the measures provided by standard accounting practices. Also, it varies across time, depending, for instance, on market conditions. This lower visibility, as well as the fact that the incidence varies across time, makes it more difficult for a country to blame others for their emissions. We thus believe that it is the right focus for the Coalition of Finance Ministers for Climate Action to each "work towards measures that result in effective carbon pricing", instead of focusing on accounting rules. With the implementation of its new ETS, China's national law has the opportunity to lead the world towards this objective. It is a breakthrough for the implementation of the PPP.

7 Limitations

We do realize, of course, that this proposal may, to some extent, sound theoretical, especially to lawyers. However, it should inform the debate in legal doctrine on the question of who should be considered the polluter under the PPP:

68 The invariance of the tax incidence follows from the classic result of Henry Jenkin, 'On the Principles which Regulate the Incidence of Taxes', *Proceedings of the Royal Society of Edinburgh* (1872), 618–30. See also Kyle Logue and Joel Slemrod, 'Of Coase, Calabresi, and Optimal Tax Liability', 63(4) *National Tax Review* (2010), 797–866.

producers or consumers. We have shown that, economically, both can be considered to cause climate change, but that this shared causation does not imply that the government will have to determine the relative degree of responsibility of producer and consumer. We rely on Coasean bargaining in a low-transaction-cost setting between producer and consumer to determine the final share of the relative tax incidence. An important assumption underlying our solution is that Coasean bargaining over a Pigouvian tax works, and that the condition of low transaction costs is met.

In some circumstances, the conditions necessary for the PPP to be implemented via carbon pricing may not be realized. For instance, to the extent that an entity is able to evade the price signal, the PPP may not be implemented.[69] However, governments can take action to limit the scope of these distortions. Implementing carbon pricing upstream, that is, at the point of extraction and on imports, greatly reduces opportunities for evasion, because it reduces the number of entities that need to be monitored, compared to a carbon price applied directly on consumption.[70] The literature reviewing such schemes finds that the carbon-price signal does normally get passed on efficiently, suggesting that there is an implicit bargaining between consumers and producers through the normal price-setting process. The transaction costs of this implicit bargaining can be assumed to be very low, because it occurs as a by-product of the normal price-setting mechanism that already occurs in the market for the taxed product.

The suggestion to implement the PPP through an environmental tax is obviously not new, but traditionally it has given rise to discussions on whether the tax should be imposed on either the producer or the consumer, given the possibility for producers to pass on the tax incidence. We show that in the zero-transaction-cost world of Coasean bargaining the state does not need to decide whether the producer or consumer caused the pollution and attribute the tax liability accordingly. Instead, the attribution of the tax liability can be based on administration and compliance considerations only. The pass-through of the price signal distributes the burden of the environmental tax between the producer and the consumer, and this distribution can be seen as proportional to their contribution to the pollution.

69 On the effect of tax evasion in the economic incidence of fuel taxes, see Wojciech Kopczuk, Justin Marion, Erich Muehlegger, and Joel Slemrod, 'Does Tax-Collection Invariance Hold? Evasion and the Pass-Through of State Diesel Taxes', 8(2) *American Economic Journal: Economic Policy* (2016), 251–86.

70 Miria A. Pigato, *Fiscal Policies for Development and Climate Action: International Development in Focus* (Washington, DC: World Bank, 2019).

Notice that our argument is not that carbon pricing alone is a viable instrument to meet the temperature aims of the Paris Agreement. It is widely recognized that the mitigation potential of carbon pricing increases if complemented with other measures,[71] such as R&D subsidies for clean technologies or mandates to label products according to their climate impact, so that consumers are better able to ascertain the climate implications of their consumption choices. Our argument is instead that when a country implements carbon pricing, the concern about which entities should be seen as the polluter becomes less relevant, because the economic incidence of the instrument can be seen as reflecting the relative responsibility of producers and consumers.

We are also aware of the political resistance that carbon pricing faces in various jurisdictions, which indicates that it is not necessarily a viable solution to implement the PPP in some countries. The Yellow Vest protests in France, as well as the ballot rejection of Washington Initiative 1631, are examples of these difficulties. However, scholars and policymakers are increasingly proposing solutions, which often focus on carbon-revenue uses.[72] A recent article proposes a revenue-recycling scheme whereby money is distributed to the public in frozen bank accounts (on the basis of forecast revenues), which are unfrozen only on the day of passage of the environmental tax reform.[73] This mechanism is likely to substantially reduce public opposition during the run-up to the reform, because citizens will be keen to receive the visible (and thus salient and more highly valued) cash transfers.[74] We also want to stress that despite the resistance to carbon pricing in many jurisdictions, in the last decade, the number of carbon pricing initiatives implemented or scheduled for implementation has tripled worldwide.[75] As solutions are put forward to overcome public opposition, more governments may be able to implement the PPP via carbon pricing.

8 Conclusion

In this article, we have argued that in a world with zero transaction costs, the economic incidence of a Pigouvian tax can be seen as reflecting the relative

71 World Bank, supra note 34.

72 World Bank Group, supra note 19; Stefano Carattini, Maria Carvalho, and Sam Fankhauser, 'Overcoming Public Resistance to Carbon Taxes', 9(5) *Wiley Interdisciplinary Reviews: Climate Change* (2018), 531; and Dominioni and Heine, supra note 32.

73 Dominioni and Heine, supra note 32.

74 Ibid.

75 World Bank Group, supra note 19.

responsibility of the producer and the consumer for the environmental harm. We have shown that this view corresponds to intuitive notions of causation, namely that the actor who benefits from the absence of Pigouvian taxation is also the actor that can be seen as causing the emissions; alternatively, the actor that continues to emit greenhouse gases after the Pigouvian tax is implemented can be seen as causing the pollution, as it insists on this activity.

We have also discussed how taking this view on the PPP can help increase ambition on climate change action, because the apportionment of emissions released in producing internationally traded goods becomes less relevant. The economic incidence of a Pigouvian tax is less visible than measures commonly considered for the apportionment of emissions in international law, and varies across time. Thus, if the view proposed in this article is adopted, it becomes more difficult for countries to attribute blame to others for the emissions released in international trade, potentially enabling more ambitious cooperation.[76]

76 We are grateful to Daisy Ivanova (Maastricht University) for useful research assistance in the preparation of this paper.