

How Do Governments Set the Carbon Tax Rate?

A Comparative Analysis

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Abstract

Over 30 national jurisdictions around the world have adopted a carbon tax. The tax rate is one of the key aspects of the design of carbon taxes, determining environmental effectiveness, competitiveness, carbon leakage risks and revenue raised. This article sheds new light on the criteria countries use to set the tax rate in their domestic instruments. To do so, we first outline a taxonomy of criteria that governments can use in setting the tax rate and then provide a comparative analysis of the criteria actually used by 13 jurisdictions to set this rate.

We find that empirically driven criteria, such as marginal abatement cost curves (MACCs) and the social cost of carbon (SCC), are rarely used to determine the tax rate. Few countries use MACCs to set their carbon tax rate and such use is always combined with other criteria. Overall, carbon tax rates are mostly set based on evaluations that transcend purely empirical estimates. In addition, the Nobel Prize-winning idea of the SCC is not used in any documents published by the countries analysed, despite the fact that it can be adapted to suit political preferences.

The common description of carbon taxes as instruments that primarily aim to internalise externalities does not reflect their implementation in practice. A corollary of this finding is that scholarship that criticises carbon taxes for embedding a cost-benefit analysis approach to climate policy simply condemns these instruments for being something they are not.

Our analysis also indicates that emulation and competition play an important role in setting the tax rate, as governments copy price levels implemented in other jurisdictions or supranational carbon pricing instruments. This has implications for the design of carbon taxes in the current geopolitical situation, as changes in the tax rate in one jurisdiction may spill over into others.

Keywords

Carbon tax; legal diffusion; social cost of carbon; tax rate

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Abbreviations

CDM	Clean Development Mechanism
EU ETS	European Union Emissions Trading Scheme
GHG	greenhouse gas
IAM	integrated assessment model
IMF	International Monetary Fund
MACC	marginal abatement cost curve
NDC	nationally determined contribution
SCC	social cost of carbon

1 Introduction

The tax rate is one of the most important aspects of the design of a carbon tax. It is a key determinant of the greenhouse gas (GHG) abatements that may be achieved, the revenues that a carbon tax can raise, the incidence of the tax, and potential carbon leakage risks. Scholars have elaborated criteria for setting the carbon tax rate, which are regularly used in both academic (Boyce, 2018; Parry et al., 2022) and grey literature (IMF [International Monetary Fund], 2019; Metcalf, 2021; Stiglitz et al., 2017; World Bank, 2024a) to assess progress in climate change mitigation policy. These analyses are also often reported in media outlets and can influence public perception of the need for more stringent climate action (Mooney & Friedman, 2019; Storrow, 2018). International policy actors, such as the World Bank (2021) and IMF (2019), utilise the same criteria to explain why carbon taxes should be implemented and why policy-makers implement these instruments (World Bank, 2024b).¹ Yet what criteria do governments actually use to set the rate of their domestic carbon taxes?

Academic research has analysed what factors influence government decisions to implement a carbon tax (Lilliestam et al., 2025; Rabbia, 2023; Skovgaard & Ferrari, 2023). We complement this research by studying for the first time how governments have chosen their tax rate in practice.

In particular, we provide a comparative analysis of the criteria used in 13 national jurisdictions to set the rate of domestic carbon taxes since they were first implemented up until the present. Our analysis focuses on whether governments base their decisions on criteria identified in academic and grey literature on how to set carbon tax rates, namely: i) the social cost of carbon (SCC), ii) marginal abatement cost curves (MACCs), iii) the price level implemented in other jurisdictions, iv) the price level needed to achieve a climate target (with no reference to MACCs) and v) revenue raised.

In addition to shedding new light on how carbon taxes are implemented in practice, this analysis allows us to contribute to three related strands of research. Firstly, there is a lively academic debate on the best approach to climate policy, with some authors supporting a cost-benefit analysis approach based on the SCC and others advocating for a focus on cost-effective policies to achieve climate targets (Aldy et al., 2021; Stern & Stiglitz, 2021). Analysing how governments set the carbon tax rate can help us to understand which of these approaches has prevailed so far in practice and the reasons for this. Moreover, it is a testbed for the real-life impact of one of the most influential ideas in climate change mitigation policy, namely the SCC.

Secondly, an equally dynamic discussion exists on the pros and cons of carbon pricing as a climate change mitigation instrument (Döbbeling-Hildebrandt et al., 2024; Green, 2021; Lilliestam et al., 2021; Van Den Bergh & Savin, 2021). Some of the scholarship that criticises carbon pricing does so on the premise that governments supposedly set carbon pricing levels based on ethically problematic criteria, such as mere efficiency (Bryant & Webber, 2024; Huwe & Frick, 2022); however, it provides no evidence that policy-makers actually use these criteria to set carbon price levels. Such criticism would be of little practical relevance unless governments adopted these criteria to set carbon price levels. Our article sheds light on this matter.

Thirdly, our study contributes to the literature on legal and policy diffusion (Engel & Weinshall, 2022; Goldbach, 2019), particularly regarding the choices related to the tax rate. We add to the literature on factors that determine the diffusion of carbon taxes and draw lessons for the

1 The underlying idea is that if certain criteria are used to set the tax rate, targeted policy aims will be more easily achieved (World Bank, 2024a).

implementation of carbon pricing policy at a time when there is a backlash in various jurisdictions around the world (Linsenmeier et al., 2023; Muth, 2023; Thisted & Thisted, 2020).

The remainder of this article is structured as follows. Section 2 provides a taxonomy of criteria that can be used to set the carbon tax rate and describes how political economy factors can influence this choice. Section 3 explains the methodology for the comparative analysis, while Section 4 presents the results and Section 5 offers conclusions.

2 Setting the tax rate: a framework

Carbon taxes are taxes applied on an amount of GHG emitted or on the carbon content of fuels. Currently, there are 47 carbon taxes (including 34 national and 13 sub-national ones) implemented around the world, covering around 5 per cent of global GHG emissions (World Bank, 2026).

These instruments can be implemented to achieve a variety of policy aims, such as mitigating GHG emissions, reducing emissions cost-effectively, raising revenues, and balancing the costs and benefits of climate change mitigation (Baranzini et al., 2017). The achievement of these aims is not necessarily mutually exclusive, but carbon taxes are best designed in a particular way depending on which aim(s) are prioritised. For instance, if the aim is to maximise revenues, implementing a very high carbon tax rate may not be the best approach if it results in a quick erosion of the tax base. A very high GHG price may lead to a quick decrease in emissions and therefore reduce the overall revenues collected over time (Dominioni & Englert, 2022; Mazzarano & Borghesi, 2024), as shown by the Laffer curve (Budolfson et al., 2021).

It is common in academic scholarship to describe carbon taxes as instruments whose primary rationale is to internalise externalities (Huwe & Rehm, 2022; Wainwright & Mann, 2018) and thereby balance the cost and benefit of climate action. A similar idea of Pigouvian taxation is often included and widely used in manuals on microeconomics (Taylor & Mankiw, 2023); it is often proposed by key international policy actors, such as the World Bank (2021) and the IMF (2019), as a key reason to implement carbon taxes – or even as a key motivation that explains why policy-makers implement carbon pricing (World Bank, 2024b).

Table 1: Criteria for setting the carbon tax rate and their key rationale(s)

Criteria	Rationale(s)
SCC	Cost-benefit analysis; focus on a particular model
MACC	Cost-effectiveness in reducing emissions
Climate target	Aligning instrument with climate goal
Price level in another jurisdiction	Competitiveness, carbon leakage, emulation and learning, joining intergovernmental organisations
Revenues	Fiscal needs

Source: Authors

This section starts by discussing criteria that can be used to set the carbon tax rate and identifies potential rationales for using (or not using) each criterion (Table 1). This taxonomy is drawn from academic and grey literature that discusses common options for setting the tax rate (Boyce, 2018; IMF, 2019; Metcalf, 2021; Parry et al., 2022). While we do not claim that the taxonomy is exhaustive, we aim to cover key criteria as identified in the existing literature. This taxonomy is applied in Section 4 as a framework to analyse the criteria and rationales used to set the tax rate in the 13 jurisdictions analysed in this article. Subsequently, Section 2 discusses political

economy considerations that may explain why governments deviate from these criteria in setting the tax rate of domestic carbon taxes.

2.1 The social cost of carbon

Academic and grey literature often mentions the SCC as the key criterion that can be used to set the carbon tax rate (Boyce, 2018; IMF, 2019; Metcalf, 2021; Parry et al., 2022). This section discusses the SCC and its pros and cons as a criterion for setting the tax rate.

The SCC is the cost to society of emitting an additional tonne of GHGs. This can be estimated using integrated assessment models (IAMs) (Nordhaus, 2019). Since the SCC is a measure of the climate externality of emitting an additional tonne of GHGs, the key rationale for setting the tax rate equal to the SCC is to internalise the climate externality – and therefore to increase (or at least not decrease) social welfare (Metcalf, 2021). The advantage of the SCC is that, in theory, it allows policy-makers to directly weigh the hidden costs of climate change and pollution against the benefits of environmental policies; this would allow the most efficient emission reduction strategies to be implemented.

Some of the main criticisms of the SCC relate to the methodology employed in estimating the cost and certain assumptions that can significantly alter these estimates. IAMs are mathematical and simplified representations of complex physical and social systems and their interactions (Barrage & Nordhaus, 2024; IAMC [Integrated Assessment Modeling Consortium], 2026; Keppo et al., 2021; Rennert et al., 2025). They use scenarios to estimate different long-term outcomes (climate change, economic output, etc.) under different courses of action, such as different climate mitigation policies. In most cases, they aim to find the policy combination that maximises intertemporal welfare, thereby extending neoclassical growth models (Doukas & Nikas, 2020). Given the long timespan of such models and the many variables considered, they are often criticised for their uncertainty. In particular, two of the most troublesome parameters are the long-term costs of climate change and the discount rate that translates these future costs into present ones.

Regarding the first parameter, it is very difficult to estimate the occurrence and the socio-economic impacts of catastrophic climate events, such as climate tipping points (Asefi-Najafabady et al., 2021). In fact, such events are highly non-linear, while cost-benefit IAMs rely on linear and incremental damage functions in their mathematical formulations.

The discount rate is not a scientific concept but a political one; it has an important effect on how the model compares present and future climate events. It refers to the importance that we give to future welfare and climate damages compared with present ones (Drupp et al., 2018; Polasky & Dampha, 2021). A low discount rate means that we give high importance to the future. There is no scientific consensus on discount rates as such parameters are normative, but different choices can have very significant effects on the estimated SCC and can be driven by political choices.

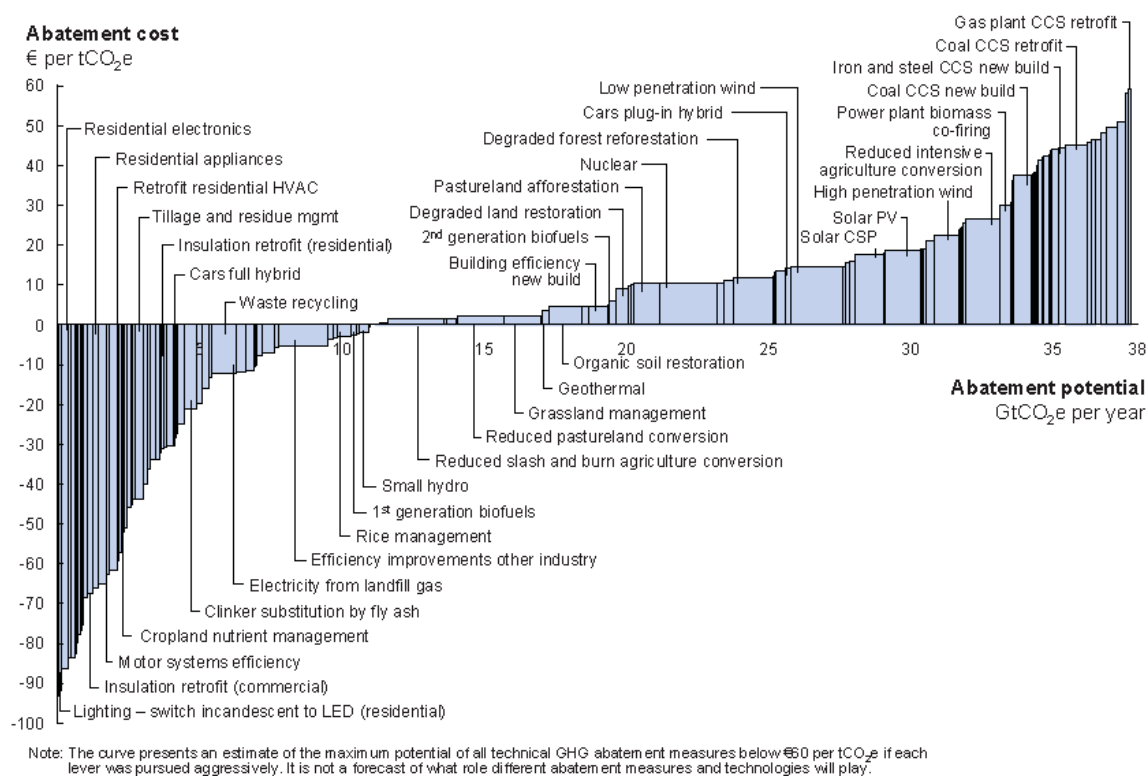
Another problem with the SCC is whether or not to use a global or national estimate of the SCC (Tol, 2019), which can differ significantly. A national SCC captures the amount of marginal damage (or, if negative, the benefit) expected to occur in the individual country due to additional GHG emissions, without accounting for harm (or benefit) caused to other countries. If countries were to price their own carbon emissions at their national SCC, only approximately 5 per cent of the global climate externality would be internalised (Ricke et al., 2018). This is because large emitting countries are often not the ones that would suffer higher damages. As a result, the use of a national SCC by these countries rather than a global one significantly reduces the SCC estimates. During the first Trump administration, agencies were directed to use a domestic-only SCC, producing values roughly seven times lower (Janik, 2023).

2.2 Marginal abatement cost curves

A second criterion often mentioned in the literature for setting the carbon tax rate involves MACCs (Boyce, 2018; IMF, 2019; Metcalf, 2021; Parry et al., 2022). These are estimates of the marginal cost of reducing GHG emissions cost-effectively by one tonne if a set of technologies are deployed within a particular period (World Bank, 2015). Together with the SCC, these two criteria can be defined as economic approaches as they use economic methods and models to derive the rate.

MACCs are usually presented with a figure showing the cost per tonne on the vertical axis for the different options and technologies, and the total emission reduction that can be achieved with each technology on the horizontal axis (see Figure 1, which shows one of the most commonly used examples). Technologies are ordered by their cost, from the cheapest to the most expensive option; some options can also have a negative cost as they save money while reducing emissions. Due to the explicit computation of emission reductions, MACCs can be linked to a particular climate goal, such as the temperature targets of the Paris Agreement (IPCC [Intergovernmental Panel on Climate Change], 2023), national targets or a determined emission reduction goal, such as those specified in the 2023 International Maritime Organization's GHG Strategy for the decarbonisation of international maritime transport (Longva et al., 2024). In principle, emission reductions can be expected to occur when their marginal cost is lower than the price applied to those emissions.

Figure 1: Example of an MACC



Source: Nauclér & Enkvist (2009)

When using MACCs, the aim is not to maximise social welfare by balancing the costs and benefits of climate action (as for the SCC) but instead to find the least expensive approach to meet a chosen environmental target (cost-effectiveness). For example, if a country has a target of reducing emissions by 50 per cent by a certain date, it will select a carbon tax rate higher than the marginal cost of the technology that will achieve such emission reductions. As

discussed above, the idea here is that regulated entities will prefer to adopt the technology than to pay the tax (as the latter is more expensive). To the extent that the environmental target is set to support human life on the planet in the long term, a tax rate equal to MACCs may also be seen as closer to a planetary boundary approach to carbon taxation.

One of the main criticisms of the traditional MACCs² is their focus on delivering marginal improvements. This criticism can be traced back to the origin of MACCs in the 2000s, when the discussion around climate policies concentrated on marginal changes (Kesicki & Ekins, 2012; Kesicki & Strachan, 2011). MACCs prioritise cheap, short-term abatement over long-term transformational change and net zero targets that may require investment in technologies with lock-ins; this is crucial as many now argue that very costly technologies (such as hydrogen) are needed (Kouchaki-Penchah et al., 2024; Parra et al., 2019) to achieve deep decarbonisation, going beyond incremental improvements and addressing hard-to-abate sectors. Another issue outlined regarding the use of MACCs is that such curves do not look at the interaction between measures, but instead show the average cost of reduction by technology. Compared to IAMs, MACCs are a static approach (Ward, 2014), meaning that they assume that mitigation measures can all be implemented simultaneously; they do not consider how the implementation of one measure can change the cost of others or can lead to behavioural changes, for example. In addition, they struggle to incorporate changing technologies for the different options.

2.3 Climate targets

A third approach discussed in the literature to set the carbon tax rate is to use the price level needed to achieve a particular climate target (Metcalf, 2021; Stiglitz et al., 2017). This approach is similar to using MACCs to set the carbon tax rate, and indeed estimates of the carbon price level needed to deliver a climate target are often informed by MACC studies (Stiglitz et al., 2017). However, in the presence of other policies that reduce GHG emissions, the tax rate needed to achieve a chosen climate target does not need to equal the MACC, as some of these other policies will drive some of the emission reductions. For example, renewable energy subsidies, energy efficiency standards, vehicle emissions regulations and methane performance standards all reduce emissions independently of a carbon tax. As a result, the carbon tax only needs to incentivise the remaining abatement required to meet the target, thus entailing a lower optimal tax rate than would be required if the carbon tax were the sole climate policy instrument.

This way of determining the tax rate aligns with the approach many countries have taken to climate change mitigation under the Paris Agreement, namely to pledge a climate change mitigation goal framed as an absolute emission reduction target in their nationally determined contributions (NDCs) (UNFCCC [United Nations Framework Convention on Climate Change], n.d.). Many countries have also embedded these targets in national legislation. Of the 13 countries analysed in this article, nine (Canada, Chile, Colombia, France, Ireland, Mexico, Spain, Switzerland and the United Kingdom) have adopted a national net zero climate target in domestic legislation.³

Studies suggest that implementing climate policies to meet an already established climate target can help to increase public support (Lin, 2024; Schaffer & Umit, 2023; Tingley & Tomz, 2020), although more recent research indicates that this may not be the case (Dominioni et al. 2026).

2 New approaches to MACCs use other top-down approaches as computable general equilibrium (CGE) models.

3 Net Zero Tracker: <https://zerotracker.net/> (last accessed on 21 May 2026).

This may also apply in the context of carbon taxation and may therefore provide a rationale for following this approach.

On a more theoretical level, the adoption of carbon tax rates estimated to be necessary to achieve climate goals may also be driven by the significant and increasing research on optimal carbon pricing, which is often considered from an economic perspective as the first-best policy given its efficiency (Bhardwaj et al., 2021).

2.4 Price level in another jurisdiction

Another approach is to set the carbon tax rate at a level that applies in other countries (Lilliestam et al., 2025; Linsenmeier et al., 2023). In principle, this approach can be used as a metric to reduce competitiveness risks, such as that of policy-induced carbon leakage – that is, the risk that differences in the price applied across countries might lead to a shift in GHG emissions towards jurisdictions with less stringent GHG policies (Grubb et al., 2022).

Other advantages of setting the tax rate equal to the one in another jurisdiction are its potential simplicity and learning opportunities. Regarding simplicity, once the target country is identified, there is no need for complex estimates. In addition, copying others may allow lessons to be learnt from ex-post evidence on the effects of that policy.

There are various issues with the competitiveness/carbon leakage argument in setting domestic tax rates. Firstly, while simulations of climate change policies indicate the existence of carbon leakage risks, these vary across sectors and jurisdictions, and their existence is less well supported by ex-post empirical analyses (Böhringer et al., 2022; Verde, 2020). For instance, smaller jurisdictions tend to be at greater risk of carbon leakage than larger ones (Caron, 2022; Saussay & Sato, 2024; Verde, 2020). Secondly, in practice, since all countries rely on multiple policies to mitigate GHG emissions, equalising GHG prices across jurisdictions may not address competitiveness concerns or prevent GHG leakage risks, as it is the combination of the costs of the multiple policies that determines this risk (Dominioni & Esty, 2022). Thirdly, while it is in principle simple to set the tax rate equal to that of another jurisdiction, current carbon tax rates vary significantly in practice (World Bank, 2026). Thus, the choice of which tax rate to mimic may require complex analytical considerations. Lastly, the option of learning from the experience of other countries only exists if two jurisdictions are sufficiently similar.

2.5 Revenues

Another criterion for setting carbon tax rates discussed in academic and grey literature involves applying a level of carbon tax based on revenue goals, as revenues are the product of GHG emissions covered and the price applied to these emissions (Metcalf, 2021; Parry et al., 2022). From this perspective, a carbon tax is primarily an instrument to generate fiscal space, and its role in generating climate change mitigation improvements exists as a co-benefit. The World Bank has recently underlined this fiscal potential of carbon taxes (World Bank, 2026).

2.6 Political economy considerations on criteria for the tax rate

The previous section discussed the criteria that countries may use to set the rate of their domestic carbon tax. In practice, countries may choose a different price level because of political economy dynamics. For example, they may initially use the SCC as the criterion for setting the tax level but then resort to a lower price because of political pressure (Muth, 2023).

Several political economy factors can severely constrain the implementation of ambitious carbon taxes, especially the negative distributional effects of the policies combined with the strain they may impose on firms (Baranzini et al., 2017; Carattini et al., 2019) or segments of the population (Carattini et al., 2018). Such factors also include opposition by sectors of the economy with a concentration of assets that would lose value under such policies, the collective action nature of climate mitigation efforts, principal–agent failures, a reduced willingness to pay for climate mitigation by citizens and low trust in governments (Jenkins, 2014).

In this regard, it is important to stress that some of the criteria discussed in the previous section do not account for political economy factors, at least not significantly. Although the use of MACCs has political dimensions (e.g. choice of climate target), for instance, it still remains a relatively technical exercise. Conversely, mirroring price levels applied in another jurisdiction or setting tax rates based on the revenue-raising potential of a carbon tax are ways of thinking about carbon taxes that are more likely to surface explicitly in political processes. Thus, overall, some criteria for carbon prices may be more permeable to political economy considerations than others. We will come back to this point in Section 4 when we analyse the findings on the 13 jurisdictions considered.

3 Methodology

To understand what criteria (if any) are employed to set carbon tax rates in the 13 countries considered in this analysis, we reviewed the legislation, accompanying policy documents, government websites, parliamentary debates, related policy documents, grey literature and academic scholarship in each of these countries. In particular, for each of these jurisdictions, we began by analysing the main legislative text(s) that introduced or modified the carbon tax and (if publicly available) related official explanatory notes on this legislation. If this analysis did not produce clear results regarding the criterion or criteria used to select the tax rate, we looked for government responses in consultation phases and parliamentary debates/documents related to the implementation of this legislation. If this search did not produce clear results either, we expanded our search to academic and grey literature on the implementation of the carbon taxes analysed in this article.

To complement this search, we also corroborated our findings through email communication with relevant experts. These experts included government officials from these jurisdictions, members of international governmental organisations working on these topics in the countries concerned, and academics with expertise on the topic. If the experts we contacted in relation to a particular jurisdiction were not able to confirm or correct our results, we continued our search for other experts with the relevant knowledge.

Similarly to Lilliestam et al. (2025), we do not analyse the internal political negotiations around the choice of tax rate within a government. This would require process tracing and interviews and goes beyond the scope of the current work.

Our analysis focuses on all 13 English-, French- and Spanish-speaking countries that have implemented a carbon tax at the national level as of August 2024. This facilitated the search for documents and made it possible to explore regional dynamics in legal diffusion (as most of the Spanish-speaking countries are part of the Latin American region, for example). The 13 countries are Argentina, Canada, Chile, Colombia, France, Ireland, Mexico, Singapore, South Africa, Spain, Switzerland, the UK and Uruguay. We limited the scope of our analysis to these jurisdictions to ensure the correct interpretation of primary data. The sample therefore excludes Nordic countries such as Norway and Sweden, which are usually mentioned as pioneers of carbon taxes. These countries are not particularly relevant in terms of global emissions coverage. With regard to sample bias, they implemented their carbon taxes for environmental

reasons and due to emulation across the different countries (Harrison, 2010; Linsenmeier et al., 2023; Thisted & Thisted, 2020). We therefore do not expect them to have used the SCC. Other countries not included in our analysis, such as Ukraine and Poland, were also excluded by Lilliestam et al. (2025) as information is difficult to obtain.

In terms of global representation, the 13 initiatives account for almost 50 per cent of the total (34) national carbon taxes worldwide (see Table 2). In terms of emissions coverage, they also represent 40 per cent of total emissions covered by national carbon taxes. Our sample therefore covers a considerable share of the existing national carbon taxes worldwide. The only other country missing from the list that has significant (global) emissions is Japan.

Table 2: Characteristics (price and coverage) of carbon taxes considered in the analysis

Scheme	Status	% of jurisdiction (and global) emissions covered	Current price
Argentina carbon tax	Implemented in 2018	38% of jurisdiction (0.2674% of global)	USD 4 (ARS 5,716)
Canada federal OBPS	Implemented in 2019 (abolished in 2025)	3% of jurisdiction (0.0433% of global)	USD 68 (CAD 95)
Chile carbon tax	Implemented in 2017	22% of jurisdiction (0.0497% of global)	USD 5 (CLP 4,800)
Colombia carbon tax	Implemented in 2017	20% of jurisdiction (0.0818% of global)	USD 8 (COP 29,070)
France carbon tax	Implemented in 2014	41% of jurisdiction (0.2914% of global)	USD 52 (EUR 45)
Ireland carbon tax	Implemented in 2010	34% of jurisdiction (0.0386% of global)	USD 74 (EUR 64)
Mexico carbon tax	Implemented in 2014	42% of jurisdiction (0.5370% of global)	USD 4 (MXN 68)
Singapore carbon tax	Implemented in 2019	70% of jurisdiction (0.1001% of global)	USD 35 (SGD 45)
South Africa carbon tax	Implemented in 2008	82% of jurisdiction (0.8782% of global)	USD 18 (ZAR 308)
Spain carbon tax	Implemented in 2014	2% of jurisdiction (0.0102% of global)	USD 17 (EUR 15)
Switzerland carbon tax	Implemented in 2014	38% of jurisdiction (0.0307% of global)	USD 150 (CHF 120)
UK CPS	Implemented in 2013	10% of jurisdiction (0.0727% of global)	USD 24 (GBP 18)
Uruguay CO ₂ tax	Implemented in 2022	5% of jurisdiction (0.0042% of global)	USD 166 (YUY 6,704)

Notes: CPS, Carbon Price Support; OBPS, Output-Based Pricing System.

Source: Authors based on World Bank data

Section 4 distinguishes between criteria for setting the carbon tax rate that were “mentioned as a rationale” and those that were “used to set the tax rate”. The conceptual difference between these two categories is the following: the latter identifies criteria that are directly employed to set the tax rate (e.g. if a jurisdiction decides to mimic the price level in another jurisdiction). In contrast, a criterion that is only mentioned as a rationale is one that is discussed as a potential method for setting the carbon tax rate but is not directly used. In some cases, the rationale mentioned is explicitly disregarded in the documents analysed (e.g. because it is considered inferior to other potential criteria) or is simply not used in practice (without being explicitly excluded).

4 Setting the tax rate: which criteria are used in practice?

The results of the analysis are organised following the taxonomy discussed in Section 2; we thus identify whether the countries analysed rely on one or more of the criteria discussed in Section 2 to set the rate of their domestic carbon tax.

4.1 Carbon tax rates and the social cost of carbon

Our findings cast doubt on the view that the primary rationale of carbon taxes is to internalise externalities: none of the 13 countries analysed uses the SCC as the starting point to set the tax rate. If the primary aim of carbon taxes was to internalise externalities, we would expect the tax rate to be equal to the estimated social cost of GHG emissions.

Preparatory documents in some jurisdictions mention the SCC estimates as a *potential* criterion for setting the carbon tax rate, for example in Argentina (National Executive Power of Argentina, 2017, pp. 17-18), Chile (Ministry of Social Development, 2014), France (Centre for Strategic Analysis, 2009, p. 14) and South Africa (National Treasury, 2013, p. 58). However, the SCC was ultimately not employed to set the tax rate. In particular, in the French case, the decision to rely on MACCs instead of the SCC was based on two rationales (Centre for Strategic Analysis, 2009): i) the possibility of estimating MACCs designed to deliver the political objective of reducing GHG emissions by 20 per cent by 2020, and ii) the ease with which this approach can be integrated into existing modelling frameworks. Similarly, in Chile, the use of the SCC to set the tax rate was explicitly rejected when the tax was first adopted in 2014 on the basis that there is no consensus on how to estimate the SCC (Ministry of Social Development, 2014, p. 20). The use of the SCC was once again ruled out in the 2017 revision of the tax rate because the SCC also depends on actions by other countries, over which Chile has limited influence, and IAMs provide estimates that are too uncertain to be used (Ministry of Social Development, 2017, p. 7). Others mention the need to internalise externalities as one of the rationales for the carbon tax, but then do not rely on SCC estimates to set it. For instance, in South Africa, documents submitted by the National Treasury and the South Africa Revenue Service (SARS) to the Standing Committee on Finance (National Treasury & SARS, 2019, p. 6) state that the main aims of the carbon tax are to price environmental and economic externalities, but they also recognise that the tax rate chosen does not fully internalise these externalities, including climate ones. As such, the low tax rate aims to provide flexibility to industries to adapt to the transition (National Treasury & SARS, 2019, p. 6). In a similar vein, the Mexican legislature (Rodríguez Aguirre, 2016, p. 2) indicates that the tax is a Pigouvian tax aimed at internalising externalities. However, the Mexican tax rate is in fact not based on estimates of climate damage.

It is common in academic scholarship and grey literature to state that tax rates in many countries are too low compared with SCC estimates identified in academic literature (Dominioni & Heine,

2019; Lilliestam et al., 2025; Merkle, 2024). Our analysis reveals something different, namely that countries are not using estimates of the SCC to set the carbon tax rate. This suggests that the SCC is not considered an adequate criterion to design carbon taxes, regardless of the value obtained through SCC estimates. As mentioned in Section 2, estimates of the SCC can vary significantly depending on methodological choices (e.g. the discount rate applied to harm to future generations). Thus, in principle, a government could make methodological choices in estimating the SCC that lead to a lower value and then use it as the starting point to set their carbon tax rate. No government in our sample has followed this path. A good example of this approach in the context of setting the shadow price of carbon (not the tax rate) is offered by the first Trump administration. The SCC used for a cost-benefit analysis in the United States was reduced from USD 50 to between USD 1 and 7 during the Obama administration and the first Trump administration due to a higher discount rate (Janik, 2023) and the use of national rather than international damages (Farber, 2018, p. 101). The fact that no country has decided to estimate a low SCC and then use it as a criterion to set the tax rate indicates that this criterion is simply rejected. Indeed, as discussed above, preparatory documents in various jurisdictions provide explicit reasons why the SCC has been discarded in favour of other criteria.

While carbon taxes implemented to achieve other aims can, *de facto*, internalise a share of the climate externalities, this seems to be primarily a byproduct of the pursuit of other aims that can be achieved through carbon taxes designed in a particular way (e.g. incentivising GHG emission reductions, minimising competitiveness losses or raising revenues). This finding has relevance for three related strands of research.

Firstly, it contributes to the debate on the use of cost-benefit analyses in climate law and policy (Aldy et al., 2017; Masur & Posner, 2011, 2015; Molocchi & Mela, 2024) rather than politically derived cost-effective climate targets (Kaufman et al., 2020; Stern & Stiglitz, 2021). Our article does not take a position on this point but highlights the fact that the cost-benefit approach to carbon taxation has not made its way into the design of carbon taxes – despite being malleable to political preferences. In his 2018 Nobel Prize lecture, Robert Nordhaus described the SCC as “a critical ingredient in climate-change policy [...] that provides [...] policy makers a target to aim for if they are seeking an economically efficient policy for carbon pricing” (Nordhaus, 2019, p. 454). Our analysis suggests that the Nobel Prize-winning analytical approach has remained largely theoretical, at least concerning the design of carbon taxes. A possible explanation for this is that the idea of maximising social welfare through Pigouvian taxation is too abstract to have strong political appeal.

Secondly, for many years, legal, economic and policy research on instrument choice has debated the pros and cons of carbon pricing versus other policy instruments (Goulder & Parry, 2008; Mehling & Tvinnereim, 2018; Van Den Bergh & Botzen, 2024). This lively debate focuses on various aspects of carbon pricing (and alternative instruments), such as its effectiveness in reducing GHG emissions, inducing deep transformations and its distributive impacts (Huwe & Frick, 2022; Lilliestam et al., 2025; Magnetti et al., 2025; Mehling & Tvinnereim, 2018; Van Den Bergh & Botzen, 2024). Within this scholarship, some authors criticise carbon pricing based on intrinsic problems of cost-benefit analyses in climate change mitigation, such as its blindness to ensuring minimum social justice standards or the achievement of a biophysical state (Bryant & Webber, 2024; Huwe & Frick, 2022). The logic presented in this scholarship is largely based on the following line of argument: the SCC – and the underlying cost-benefit analysis logic – is problematic from a political and ethical perspective, as carbon pricing aims to internalise the SCC and carbon pricing is therefore problematic. Our research indicates that this scholarship is criticising carbon taxes for something they are not doing (namely using the SCC) and is therefore missing the mark.

Thirdly, the finding contributes to the academic literature on why carbon taxes are implemented. A few studies have found discrepancies between the supposed aims of carbon taxation and their practical implementation (Lilliestam et al., 2025; Rabbia, 2023; Skovgaard & Ferrari, 2023).

Lilliestam et al. (2025), for example, indicate that countries implementing relatively low carbon taxes may do so to raise revenues. Our study complements these findings by looking closely at a core design feature of carbon taxes, namely the criteria used to select the tax rate. Despite the fact that the key rationale of carbon taxation is often described in the literature and in policy reports as that of internalising externalities, this approach does not seem to correctly describe the way carbon taxes are implemented in reality.

4.2 The diffusion of carbon tax rates

Comparative legal and policy scholarship has long been analysing drivers of diffusion of new legislation and has identified three main ones (Engel & Weinshall, 2022; Twining, 2004): i) emulation, whereby countries follow the example of other countries for conformity-seeking reasons; ii) learning, whereby evidence on the effects of a type of legislation becomes increasingly available as more countries adopt it, allowing others to evaluate whether to follow a similar path; iii) competition, whereby countries copy others with the aim of retaining resources or attracting new ones (including by adopting legislation that helps them join an intergovernmental organisation).

Previous scholarship focusing on the diffusion of carbon taxes analysed mechanisms of diffusion of carbon taxes as an instrument type, in other words why a country decides to adopt a carbon tax instead of a different climate mitigation instrument (Harrison, 2010; Linsenmeier et al., 2023; Thisted & Thisted, 2020). Our analysis adds to this scholarship by specifically analysing the diffusion of carbon price levels.

Our analysis indicates that in seven countries studied (Chile, Colombia, France, Ireland, Mexico, Singapore and Spain), the carbon tax rate is/has been based on, or at least heavily influenced by, carbon price levels established in non-domestic carbon pricing instruments such as the EU Emissions Trading Scheme (EU ETS) and the Clean Development Mechanism (CDM) or pricing mechanisms implemented in other jurisdictions. In Mexico, for instance, the stated aim of the tax is both to reduce emissions and to internalise externalities (Rodríguez Aguirre, 2016). However, the actual tax rate is primarily based on prices set elsewhere. In Singapore, the initial tax rate for 2019 was set to balance the need to achieve emission reductions, address competitiveness concerns and allow for a transition period for affected businesses (Parliament of Singapore, 2018). A similar approach was taken when the tax rate was revised in 2022 (Chee Huan, 2022). On both occasions, the carbon price levels implemented in “competing jurisdictions” – such as China, South Korea and the EU – were taken into account in the choice of the tax rate. Likewise, while in several EU countries such as France, Ireland and Spain, the domestic carbon tax rate was initially based on the average price of EU ETS allowances in the years prior to the implementation of the carbon tax, this approach has been abandoned with subsequent reforms in France and Ireland, but persists in Spain.

Previous scholarship on the diffusion of carbon taxes has also identified various World Bank-led initiatives, such as the Partnership for Market Readiness (now Partnership for Market Implementation) and the Carbon Pricing Leadership Coalition, as some of the key drivers (Biedenkopf et al., 2017; Linsenmeier et al., 2023; Muth et al., 2025). The key recommendation from these initiatives regarding the tax rate level, presented in the High-Level Commission on Carbon Prices (Stiglitz et al., 2017), was to set the carbon tax rate at USD 40-80 per tonne of GHG emissions in 2020, potentially adjusting it depending on the policy environment and income levels (World Bank, 2023). However, with the exception of Ireland, we have not found any evidence of the recommendations included in this report having significantly influenced government choices. For instance, with some minor exceptions, these recommendations are not widely mentioned in preparatory documents despite six of the 13 countries surveyed implementing or reforming their carbon tax rate after the publication of the report. This suggests

that the influence of these World Bank-led initiatives on the diffusion of carbon pricing policies may be more effective regarding the decision to implement a tax than on the choice of the tax rate itself. An alternative explanation is that these benchmark prices are not used by the World Bank-led initiatives as reference prices in their country engagement.

As discussed above, another driver of the adoption of rules from other countries is emulation, and existing literature suggests that this is also a driver in the context of the adoption of carbon taxes (Harrison, 2010; Linsenmeier et al., 2023). For instance, Harrison (2010) finds that the adoption of carbon taxes in some Scandinavian countries was a driver for adoption in other countries in the region. Our research supports the emulation hypothesis and suggests that this may hold not only with regard to the decision to implement a carbon tax, but also to the actual carbon tax rate itself. Indeed, seven out of 13 countries explicitly account, or have accounted, for carbon prices implemented in non-domestic GHG pricing mechanisms when setting their own tax rate. Thus, there seem to be spillover effects from one jurisdiction to others when tax rates are set. In addition, four of these countries are Spanish speaking, of which three are in Latin America. This hints to the existence of an imitation pattern among countries at the regional level or even among countries that share a common language.

Existing research on the diffusion of carbon taxes indicates that emulation is one of the drivers of the adoption of carbon taxes in Nordic countries (Harrison, 2010; Linsenmeier et al., 2023; Thisted & Thisted, 2020). Future research may investigate whether emulation is also linked to the actual carbon tax rate chosen.

4.3 Carbon tax rates: MACCs, climate targets and revenues

MACC estimates are often mentioned in academic and grey literature as a criterion for setting the carbon tax rate in order to achieve cost-effective mitigation. Of the 13 countries analysed, we have not found any evidence of widespread use of domestic MACC estimates to set the carbon tax rate. France uses MACC estimates as the starting point for setting the *trajectory* of its carbon tax rate (French Republic, 2015). However, this trajectory is not the actual tax rate implemented, as this is determined in the yearly Financial Act (Rocamora, 2017). Another country where MACC estimates have influenced the choice of tax rate is Ireland. Since 2019, Ireland's approach has been informed by MACC estimates, even though the benchmark level is derived from the 2017 report of the High-Level Commission on Carbon Prices (Joint Committee on Climate Action, 2019)⁴ and is not based on an MACC estimate tailored to Ireland's country-specific circumstances.

In addition, neither in France nor in Ireland are MACCs the sole criterion for setting the domestic carbon tax rate. In both jurisdictions, the tax rate is increased over time based on a pre-determined trajectory, and in both countries, this trajectory has been adjusted to account for considerations that are not derived from MACC calculations. In France, the tax rate trajectory set since 2015 has been based on MACC estimates adjusted downward with the aim of not affecting economic growth and facilitating the management of the energy transition (Centre for Strategic Analysis, 2009, p. 14). Non-climate-related concerns, such as "Yellow Vests" protests, were also the key motivation to stop the increase of the carbon tax rate in 2018 (Dominioni & Heine, 2019). In Ireland, the gradual increase of the tax rate from EUR 20 per tonne of GHGs to EUR 100 per tonne of GHGs in 2030 was informed by a study by the Economic and Social Research Institute aimed at identifying pathways to minimise fuel poverty risks (O'Malley et al.,

4 In particular, the 2017 High-Level Commission on Carbon Prices report identifies benchmark carbon prices needed to meet the temperature targets of the Paris Agreement, relying, among other things, on MACC estimates (see Stiglitz et al., 2017).

2020). Thus, no country in our sample uses MACCs as the sole criterion for setting the domestic carbon tax rate (see Table 3).

Table 3: Criteria used to set the tax rate in each country

	SCC	MACC	Climate target	Third jurisdiction	Revenues	Other
Argentina			X			X
Canada			X			X
Chile				X		
Colombia				X		
France		X	X			X
Ireland		X	X		X	
Mexico				X		X
Singapore			X	X		X
South Africa						X
Spain				X		X
Switzerland			X			X
UK			X			X
Uruguay						X

Notes: Where multiple criteria are given, this indicates either that: i) multiple criteria were used to set the tax rate or ii) the criteria used to set the tax rate changed over time.

This finding, together with those on the SCC discussed in Section 4.1, indicates that empirically driven approaches to setting the carbon tax rate, such as the use of MACC and SCC estimates, are rarely used in practice. Instead, carbon tax rates tend to be determined based on less technical considerations that allow political commitments and political economy factors to be more easily accounted for, including economic growth, competitiveness and limiting the increase in energy prices.

Indeed, we find that achieving a climate target is mentioned in many countries as the criterion for setting the carbon tax rate (Argentina, Canada, Switzerland, the UK and Uruguay). However, this is not linked to specific MACC estimates and seems to be more the result of a political process where various interests are weighted. The federal government of Canada introduced a federal carbon pricing benchmark in 2018. The price level of this carbon pricing instrument was set to increase by CAD 15 per year up to CAD 170 per tonne of GHG in 2030 (Government of Canada, 2021). This trajectory was set on the basis of various considerations, including Canada's GHG emission reduction targets (Government of Canada, 2023). According to one carbon tax expert, the trajectory was determined based on the need to increase the stringency of climate policies in Canada, but it results from a political process of "give and take" (expert communication with the authors by email). Similarly, the UK government (HM Treasury & HM Revenue and Customs, 2011, p. 15) presented three scenarios that could set the trajectory for the carbon price floor and indicated a preference for an intermediate tax rate trajectory because it balanced the need to set incentives to achieve the government environmental and energy security goals and the need to limit the increase in energy prices and impacts on competitiveness.

We also have not found any evidence that revenue raised is a key criterion for setting the carbon tax rate in the 13 countries analysed. This is the case even in Ireland, which introduced the Irish carbon tax in 2010 in an attempt to increase tax revenues. Even in this case, the tax rate was set looking at the price of EU ETS allowances at the time.

5 Conclusions

Carbon taxes can be an important component of the policy mix to address climate change. A key aspect of the design of these carbon taxes is the tax rate. This article has thus provided a taxonomy of the criteria that governments use to set the rate of their domestic carbon taxes and has analysed the criteria used by 13 jurisdictions to set their national carbon tax rates since their implementation.

We find that no governments base the tax rate on SCC estimates in the published documents outlining their rationales for determining the tax rate. While a few countries mention the need to internalise externalities as one of the rationales for carbon taxation, this aim does not drive the choice of a tax rate equal to the SCC. This is surprising because, at least in principle, SCC estimates can be adapted to suit political preferences (e.g. with the choice of the discount rate). This finding suggests that the Nobel Prize-winning idea of the SCC has remained largely theoretical and has not translated into carbon tax policy implementation. A corollary of this finding is that scholarship that criticises carbon taxes because they supposedly incorporate the SCC logic into climate policy is in fact criticising these taxes for being something they are not.

Similarly to the SCC, MACCs are rarely used to set the tax rate, and if they are used, this is done in conjunction with other criteria. Overall, along with the finding on the SCC, this indicates that the more economic and technical approaches to setting the tax rate are rarely used in practice.

We also find that the choice of tax rate is often influenced by price levels in non-domestic GHG pricing mechanisms, such as GHG prices in countries perceived as competitors, or supra-national instruments (e.g. EU ETS and CDM). This suggests that emulation and competition, the two factors identified in academic literature as explaining the diffusion of carbon pricing mechanisms, may explain not only the decision to adopt a carbon tax but also one of its key design features, namely the tax rate itself. At a time when carbon pricing is experiencing significant backlash in the EU and beyond,⁵ this finding indicates that governments' decisions to reduce carbon tax rates (or postpone scheduled increases) may reduce ambition in carbon tax policy in other jurisdictions too. In this context, intergovernmental initiatives to coordinate and support the implementation of foreign carbon pricing mechanisms⁶ become even more important to prevent a government's decision to adopt a less climate-ambitious domestic carbon tax rate from having negative spillover effects in other jurisdictions.

5 For instance, EU institutions postponed the entry into force of the ETS2, Ireland has postponed the increase of the carbon tax rate scheduled for May 2026, and various governments and industry stakeholders are calling for a less ambitious EU ETS and carbon taxation in the UK: https://climate.ec.europa.eu/news-other-reads/news/commission-proposes-targeted-adjustments-market-stability-reserve-decision-support-smoother-start-2025-11-27_en, <https://www.citizensinformation.ie/en/money-and-tax/tax/motor-carbon-other-taxes/carbon-tax/>, <https://www.ft.com/content/875644ab-ab13-4d24-b2ca-fe33eeaec270?syn-25a6b1a6=1>

6 Mechanisms include the recently launched Open Coalition on Compliance Carbon Markets between the EU, China and Brazil: https://climate.ec.europa.eu/news-other-reads/news/eu-brazil-and-china-launch-open-coalition-boost-integrity-and-effectiveness-carbon-markets-2026-05-07_en

References

- Aldy, J. E., Pizer, W. A., & Akimoto, K. (2017). Comparing emissions mitigation efforts across countries. *Climate Policy*, 17(4), 501-515. <https://doi.org/10.1080/14693062.2015.1119098>
- Aldy, J. E., Kotchen, M. J., Stavins, R. N., & Stock, J. H. (2021). Keep climate policy focused on the social cost of carbon. *Science*, 373(6557), 850-852. <https://doi.org/10.1126/science.abi7813>
- Asefi-Najafabady, S., Villegas-Ortiz, L., & Morgan, J. (2021). The failure of Integrated Assessment Models as a response to 'climate emergency' and ecological breakdown: The Emperor has no clothes. *Globalizations*, 18(7), 1178-1188. <https://doi.org/10.1080/14747731.2020.1853958>
- Baranzini, A., Van Den Bergh, J. C. J. M., Carattini, S., Howarth, R. B., Padilla, E., & Roca, J. (2017). Carbon pricing in climate policy: Seven reasons, complementary instruments, and political economy considerations. *WIREs Climate Change*, 8(4), e462. <https://doi.org/10.1002/wcc.462>
- Barrage, L., & Nordhaus, W. (2024). Policies, projections, and the social cost of carbon: Results from the DICE-2023 model. *Proceedings of the National Academy of Sciences*, 121(13), e2312030121. <https://doi.org/10.1073/pnas.2312030121>
- Bhardwaj, C., Axsen, J., & McCollum, D. (2021). Simulating automakers' response to zero emissions vehicle regulation. *Transportation Research Part D: Transport and Environment*, 94, 102789. <https://doi.org/10.1016/j.trd.2021.102789>
- Biedenkopf, K., Müller, P., Slominski, P., & Wettestad, J. (2017). A global turn to greenhouse gas emissions trading? Experiments, actors, and diffusion. *Global Environmental Politics*, 17(3), 1-11. https://doi.org/10.1162/GLEP_e_00412
- Böhringer, C., Fischer, C., Rosendahl, K. E., & Rutherford, T. F. (2022). Potential impacts and challenges of border carbon adjustments. *Nature Climate Change*, 12(1), 22-29. <https://doi.org/10.1038/s41558-021-01250-z>
- Boyce, J. K. (2018). Carbon pricing: Effectiveness and equity. *Ecological Economics*, 150, 52-61. <https://doi.org/10.1016/j.ecolecon.2018.03.030>
- Bryant, G., & Webber, S. (2024). *Climate finance: Taking a position on climate futures*. Agenda Publishing.
- Budolfson, M., Dennig, F., Errickson, F., Feindt, S., Ferranna, M., Fleurbaey, M., Klenert, D., Kornek, U., Kuruc, K., Méjean, A., Peng, W., Scovronick, N., Spears, D., Wagner, F., & Zuber, S. (2021). Climate action with revenue recycling has benefits for poverty, inequality and well-being. *Nature Climate Change*, 11(12), 1111-1116. <https://doi.org/10.1038/s41558-021-01217-0>
- Carattini, S., Carvalho, M., & Fankhauser, S. (2018). Overcoming public resistance to carbon taxes. *WIREs Climate Change*, 9(5), e531. <https://doi.org/10.1002/wcc.531>
- Carattini, S., Kallbekken, S., & Orlov, A. (2019). How to win public support for a global carbon tax. *Nature*, 565(7739), 289-291. <https://doi.org/10.1038/d41586-019-00124-x>
- Caron, J. (Ed.). (2022). *Handbook on trade policy and climate change*. Edward Elgar Publishing. <https://doi.org/10.4337/9781839103247>
- Centre for Strategic Analysis. (2009). *La valeur tutélaire du carbone*. Report by the Commission chaired by Alain Quinet. La Documentation Française, no. 16-2009. <https://www.vie-publique.fr/files/rapport/pdf/094000195.pdf>
- Chee Hean, T. (2022). *A decisive move to net zero*. Speech by Senior Minister Teo Chee Hean at the Committee of Supply 2022. Prime Minister's Office Singapore. <https://www.pmo.gov.sg/newsroom/sm-teo-chee-hean-at-the-committee-of-supply-2022>
- Döbbeling-Hildebrandt, N., Miersch, K., Khanna, T., Bachelet, M., Bruns, S. B., Callaghan, M., Edenhofer, O., Flachsland, C., Forster, P., Kalkuhl, M., Koch, N., Lamb, W., Ohlendorf, N., Steckel, J., & Minx, J. (2024). Systematic review and meta-analysis of ex-post evaluations on the effectiveness of carbon pricing. *Nature Communications*, 15, 4147. <https://doi.org/10.1038/s41467-024-48512-w>

- Dominioni, G., & Englert, D. (2022). *Carbon revenues from international shipping: Use, recipients and management*. World Bank. <https://openknowledge.worldbank.org/entities/publication/2c6a3435-b005-52a5-89d4-f66e1fe862d2>
- Dominioni, G., & Esty, D. (2022). Designing effective border carbon adjustment mechanisms: Aligning the global trade and climate change regimes. *Arizona Law Review*, 65(1), 10686-10692.
- Dominioni, G., & Heine, D. (2019). Behavioural economics and public support for carbon pricing: A revenue recycling scheme to address the political economy of carbon taxation. *European Journal of Risk Regulation*, 10(3), 554-570. <https://doi.org/10.1017/err.2019.44>
- Dominioni, G., Kantorowicz, J., & Quintavalla, A. (2026). Do net-zero targets embedded in (EU) legislation increase public support for climate policies? *Swiss Political Science Review*. Advance online publication. <https://doi.org/10.1111/spsr.70047>
- Doukas, H., & Nikas, A. (2020). Decision support models in climate policy. *European Journal of Operational Research*, 280(1), 1-24. <https://doi.org/10.1016/j.ejor.2019.01.017>
- Drupp, M. A., Freeman, M. C., Groom, B., & Nesje, F. (2018). Discounting disentangled. *American Economic Journal: Economic Policy*, 10(4), 109-134. <https://doi.org/10.1257/pol.20160240>
- Engel, C., & Weinshall, K. (2022). Diffusion of legal innovations. *Annual Review of Law and Social Science*, 18(1), 139-153. <https://doi.org/10.1146/annurev-lawsocsci-050420-012835>
- Farber, D. (2018). A política climática dos EUA: Obama, Trump e o futuro. *Revista de Estudos Constitucionais, Hermenêutica e Teoria Do Direito*, 10(2), 95-108. <https://doi.org/10.4013/rechtd.2018.102.01>
- French Republic. (2015). *LOI n° 2015-1786 du 29 décembre 2015 de finances rectificative pour 2015 (1)*. Légifrance. <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000031733082>
- Goldbach, T. S. (2019). Why legal transplants? *Annual Review of Law and Social Science*, 15(1), 583-601. <https://doi.org/10.1146/annurev-lawsocsci-101518-042617>
- Goulder, L. H., & Parry, I. W. H. (2008). Instrument choice in environmental policy. *Review of Environmental Economics and Policy*, 2(2), 152-174. <https://doi.org/10.1093/reenp/ren005>
- Government of Canada. (2021). *Canada's climate actions for a healthy environment and a healthy economy*. <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/actions-healthy-environment-economy.html>
- Government of Canada. (2023). *Social cost of greenhouse gas emissions*. <https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data/social-cost-ghg.html>
- Green, J. F. (2021). Does carbon pricing reduce emissions? A review of ex-post analyses. *Environmental Research Letters*, 16(4), 043004. <https://doi.org/10.1088/1748-9326/abdae9>
- Grubb, M., Jordan, N. D., Hertwich, E., Neuhoﬀ, K., Das, K., Bandyopadhyay, K. R., Van Asselt, H., Sato, M., Wang, R., Pizer, W. A., & Oh, H. (2022). Carbon leakage, consumption, and trade. *Annual Review of Environment and Resources*, 47(1), 753-795. <https://doi.org/10.1146/annurev-environ-120820-053625>
- Harrison, K. (2010). The comparative politics of carbon taxation. *Annual Review of Law and Social Science*, 6(1), 507-529. <https://doi.org/10.1146/annurev.lawsocsci.093008.131545>
- HM Treasury & HM Revenue and Customs. (2011). *Carbon price floor consultation: The Government response*. https://assets.publishing.service.gov.uk/media/5a74fd5de5274a3cb2868cbf/carbon_price_floor_consultation_govt_response.pdf
- Huwe, V., & Frick, M. (2022). Far from optimal? Exploring the normative premises and politics of carbon pricing. *Energy Research & Social Science*, 86, 102458. <https://doi.org/10.1016/j.erss.2021.102458>
- Huwe, V., & Rehm, M. (2022). The ecological crisis and post-Keynesian economics – bridging the gap? (2022). *European Journal of Economics and Economic Policies: Intervention*, 19(3), 397-414. <https://doi.org/10.4337/ejeep.2022.03.08>

- IAMC (Integrated Assessment Modeling Consortium). (2026). *What are IAMs?* <https://www.iamconsortium.org/what-are-iams/>
- IMF (International Monetary Fund). (2019). Fiscal policies for Paris climate strategies – from principle to practice. *Policy Papers*, 19(10), 1. <https://doi.org/10.5089/9781498311717.007>
- IPCC (Intergovernmental Panel on Climate Change). (2023). Mitigation pathways compatible with long-term goals. In IPCC (Ed.), *Climate change 2022: Mitigation of climate change* (1st edition, pp. 295-408). Cambridge University Press. <https://doi.org/10.1017/9781009157926.005>
- Janik, A. G. (2023). The social cost of carbon: A tool for environmental planning and climate progress. *Syracuse Law Review*, 73, 303-330.
- Jenkins, J. D. (2014). Political economy constraints on carbon pricing policies: What are the implications for economic efficiency, environmental efficacy, and climate policy design? *Energy Policy*, 69, 467-477. <https://doi.org/10.1016/j.enpol.2014.02.003>
- Joint Committee on Climate Action. (2019). *Climate change: A cross-party consensus for action*. Houses of the Oireachtas. https://data.oireachtas.ie/ie/oireachtas/committee/dail/32/joint_committee_on_climate_action/reports/2019/2019-03-28_report-climate-change-a-cross-party-consensus-for-action_en.pdf
- Kaufman, N., Barron, A. R., Krawczyk, W., Marsters, P., & McJeon, H. (2020). A near-term to net zero alternative to the social cost of carbon for setting carbon prices. *Nature Climate Change*, 10(11), 1010-1014. <https://doi.org/10.1038/s41558-020-0880-3>
- Keppo, I., Butnar, I., Bauer, N., Caspani, M., Edelenbosch, O., Emmerling, J., Fragkos, P., Guivarch, C., Harmsen, M., Lefèvre, J., Le Gallic, T., Leimbach, M., McDowall, W., Mercure, J.-F., Schaeffer, R., Trutnevyte, E., & Wagner, F. (2021). Exploring the possibility space: Taking stock of the diverse capabilities and gaps in integrated assessment models. *Environmental Research Letters*, 16(5), 053006. <https://doi.org/10.1088/1748-9326/abe5d8>
- Kesicki, F., & Ekins, P. (2012). Marginal abatement cost curves: A call for caution. *Climate Policy*, 12(2), 219-236. <https://doi.org/10.1080/14693062.2011.582347>
- Kesicki, F., & Strachan, N. (2011). Marginal abatement cost (MAC) curves: Confronting theory and practice. *Environmental Science & Policy*, 14(8), 1195-1204. <https://doi.org/10.1016/j.envsci.2011.08.004>
- Kouchaki-Penchah, H., Bahn, O., Bashiri, H., Bedard, S., Bernier, E., Elliot, T., Hammache, A., Vaillancourt, K., & Levasseur, A. (2024). The role of hydrogen in a net-zero emission economy under alternative policy scenarios. *International Journal of Hydrogen Energy*, 49, 173-187. <https://doi.org/10.1016/j.ijhydene.2023.07.196>
- Lilliestam, J., Patt, A., & Bersalli, G. (2021). The effect of carbon pricing on technological change for full energy decarbonization: A review of empirical ex-post evidence. *WIREs Climate Change*, 12(1), e681. <https://doi.org/10.1002/wcc.681>
- Lilliestam, J., Eckardt, J., & Bersalli, G. (2025). Sequencing, spending, and symbolism: Low carbon taxes primarily serve purposes other than emissions reduction. *One Earth*, 8(10), 101390. <https://doi.org/10.1016/j.oneear.2025.101390>
- Lin, A. (2024). In defense of 2.0°C: The value of aspirational environmental goals. *Texas A&M Law Review*, 11(2), 405-429. <https://doi.org/10.37419/LR.V11.I2.4>
- Linsenmeier, M., Mohommad, A., & Schwerhoff, G. (2023). Global benefits of the international diffusion of carbon pricing policies. *Nature Climate Change*, 13(7), 679-684. <https://doi.org/10.1038/s41558-023-01710-8>
- Longva, T., Eide, M. S., Endresen, Ø., Sekkesæter, Ø., Helgesen, H., & Rivedal, N. H. (2024). Marginal abatement cost curves for CO₂ emission reduction from shipping to 2050. *Maritime Transport Research*, 6, 100112. <https://doi.org/10.1016/j.martra.2024.100112>
- Magnetti, J., Dominioni, G., & Gordijn, B. (2025). Ethics of carbon pricing – a review of the literature. *Climate Policy*, 25(5), 772-791. <https://doi.org/10.1080/14693062.2024.2416493>
- Masur, J. S., & Posner, E. A. (2011). Climate regulation and the limits of cost-benefit analysis. *California Law Review*, 99, 1557-1600.

- Masur, J. S., & Posner, E. A. (2015). Toward a Pigouvian state. *University of Pennsylvania Law Review*, 164(1), 93-147.
- Mazzarano, M., & Borghesi, S. (2024). Searching for a carbon Laffer curve: Estimates from the European Union Emissions Trading System. *Metroeconomica*, 75(4), 398-418. <https://doi.org/10.1111/meca.12458>
- Mehling, M., & Tvinnereim, E. (2018). Carbon pricing and the 1.5°C target: Near-term decarbonisation and the importance of an instrument mix. *Carbon & Climate Law Review*, 12(1), 50-61. <https://doi.org/10.21552/cclr/2018/1/9>
- Merkle, M. (2024). Distributional impacts of heterogenous carbon prices in the EU. *IMF Working Papers*, 2024(149), 1. <https://doi.org/10.5089/9798400280825.001>
- Metcalf, G. E. (2021). Carbon taxes in theory and practice. *Annual Review of Resource Economics*, 13(1), 245-265. <https://doi.org/10.1146/annurev-resource-102519-113630>
- Ministry of Social Development. (2014). *Precios sociales vigentes 2014*. Government of Chile. https://sni.gob.cl/storage/docs/Precios_Sociales_Vigentes_2014.pdf
- Ministry of Social Development. (2017). *Estimación del precio social del CO₂*. Government of Chile. <https://sni.gob.cl/wp-content/uploads/Precio-Social-del-CO2.pdf>
- Molocchi, A., & Mela, G. (2024). Social cost of carbon as an international benchmark to drive countries' carbon pricing during the transition. *Sustainability*, 16(19), 8573. <https://doi.org/10.3390/su16198573>
- Mooney, C., & Friedman, A. (2019, October 10). The world needs a massive carbon tax in just 10 years to limit climate change, IMF says. *Washington Post*. <https://www.washingtonpost.com/climate-environment/2019/10/10/world-needs-massive-carbon-tax-just-years-limit-climate-change-imf-says>
- Muth, D. (2023). Pathways to stringent carbon pricing: Configurations of political economy conditions and revenue recycling strategies. A comparison of thirty national level policies. *Ecological Economics*, 214, 107995. <https://doi.org/10.1016/j.ecolecon.2023.107995>
- Muth, D., Blondeel, M., & Pattberg, P. (2025). The architecture of global carbon pricing governance: Institutions, functions and policy pathways. *Global Policy*, 16(5), 811-828. <https://doi.org/10.1111/1758-5899.70078>
- National Executive Power of Argentina. (2017). *Mensaje MEN-2017-126-APN-PTE*. <https://zuletasintecho.com/wp-content/uploads/2017/11/mensaje-nc2b0-126-2017.pdf>
- National Treasury of the Republic of South Africa. (2013). *Carbon tax policy paper: Reducing greenhouse gas emissions and facilitating the transition to a green economy. Policy paper for public comment*.
- National Treasury of the Republic of South Africa & SARS (South African Revenue Service). (2019). *Carbon tax bill 2018: Response document*.
- Naucr, T., & Enkvist, P. A. (2009). *Pathways to a low-carbon economy – version 2 of the global greenhouse gas abatement cost curve*. McKinsey & Company.
- Nordhaus, W. (2019). Climate change: The ultimate challenge for economics. *American Economic Review*, 109(6), 1991-2014. <https://doi.org/10.1257/aer.109.6.1991>
- O'Malley, S., Roantree, B., & Curtis, J. (2020). *Carbon taxes, poverty and compensation options*. Economic and Social Research Institute (ESRI). <https://esri.ie/publications/carbon-taxes-poverty-and-compensation-options>
- Parliament of Singapore. (2018, 20 March). *Carbon Pricing Bill debate*. <https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=bill-248>
- Parra, D., Valverde, L., Pino, F. J., & Patel, M. K. (2019). A review on the role, cost and value of hydrogen energy systems for deep decarbonisation. *Renewable and Sustainable Energy Reviews*, 101, 279-294. <https://doi.org/10.1016/j.rser.2018.11.010>
- Parry, I., Heine, D., Kizzier, K., & Smith, T. (2022). A carbon levy for international maritime fuels. *Review of Environmental Economics and Policy*, 16(1), 25-41. <https://doi.org/10.1086/717961>

- Polasky, S., & Dampha, N. K. (2021). Discounting and global environmental change. *Annual Review of Environment and Resources*, 46(1), 691-717. <https://doi.org/10.1146/annurev-environ-020420-042100>
- Rabbia, M. (2023). Why did Argentina and Uruguay decide to pursue a carbon tax? Fiscal reforms and explicit carbon prices. *Review of Policy Research*, 40(2), 230-259.
- Rennert, K., Kingdon, C., & Prest, B. C. (2025). *Social cost of carbon 101*. Resources for the Future. <https://www.rff.org/publications/explainers/social-cost-carbon-101/>
- Ricke, K., Drouet, L., Caldeira, K., & Tavoni, M. (2018). Country-level social cost of carbon. *Nature Climate Change*, 8(10), 895-900. <https://doi.org/10.1038/s41558-018-0282-y>
- Rocamora, A. (2017). *The rise of carbon taxation in France: From environmental protection to low-carbon transition* (IGES Working Paper). Institute for Global Environmental Strategies. <https://doi.org/10.57405/iges-5983>
- Rodríguez Aguirre, M. de la A. (2016). *Iniciativa que adiciona el artículo 20. de la Ley del Impuesto Especial Sobre Producción y Servicios*. Sistema de Información Legislativa. http://sil.gobernacion.gob.mx/Archivos/Documentos/2016/10/asun_3430629_20161020_1477034515.pdf
- Saussay, A., & Sato, M. (2024). The impact of energy prices on industrial investment location: Evidence from global firm level data. *Journal of Environmental Economics and Management*, 127, 102992. <https://doi.org/10.1016/j.jeem.2024.102992>
- Schaffer, L. M., & Umit, R. (2023). Public support for national vs. international climate change obligations. *Journal of European Public Policy*, 30(3), 537-573. <https://doi.org/10.1080/13501763.2022.2099957>
- Skovgaard, J., & Ferrari, S. S. (2023). The unlikely Mexican carbon tax – a question of economic-environmental synergies? *Journal of Environmental Planning and Management*, 66(13), 2623-2639.
- Stern, N., & Stiglitz, J. E. (2021). *The social cost of carbon, risk, distribution, market failures: An alternative approach* (Working Paper 28472). <https://www.ssrn.com/abstract=3785806>
- Stiglitz, J. E., Stern, N., Duan, M., Edenhofer, O., Giraud, G., Heal, G. M., La Rovere, E. L., Morris, A., Moyer, E., Pangestu, M., Shukla, P. R., Sokona, Y., & Winkler, H. (2017). *Report of the High-Level Commission on Carbon Prices*. <https://doi.org/10.7916/D8-W2NC-4103>
- Storow, B. (2018, September 20). Carbon prices are too low to reduce emissions. *Scientific American*. <https://www.scientificamerican.com/article/carbon-prices-are-too-low-to-reduce-emissions/>
- Taylor, M., & Mankiw, G. (2023). *Microeconomics* (6th edition). Cengage.
- Thisted, E. V., & Thisted, R. V. (2020). The diffusion of carbon taxes and emission trading schemes: The emerging norm of carbon pricing. *Environmental Politics*, 29(5), 804-824. <https://doi.org/10.1080/09644016.2019.1661155>
- Tingley, D., & Tomz, M. (2020). International commitments and domestic opinion: The effect of the Paris Agreement on public support for policies to address climate change. *Environmental Politics*, 29(7), 1135-1156. <https://doi.org/10.1080/09644016.2019.1705056>
- Tol, R. S. J. (2019). A social cost of carbon for (almost) every country. *Energy Economics*, 83, 555-566. <https://doi.org/10.1016/j.eneco.2019.07.006>
- Twining, W. (2004). Diffusion of law: A global perspective. *Journal of Legal Pluralism and Unofficial Law*, 36(49), 1-45. <https://doi.org/10.1080/07329113.2004.10756300>
- UNFCCC (United Nations Framework Convention on Climate Change). (n.d.). *Nationally determined contributions (NDCs)*. <https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs>
- Van Den Bergh, J., & Botzen, W. (2024). Assessing criticisms of carbon pricing. *International Review of Environmental and Resource Economics*, 18(3), 315-384. <https://doi.org/10.1561/101.00000172>
- Van Den Bergh, J., & Savin, I. (2021). Impact of carbon pricing on low-carbon innovation and deep decarbonisation: Controversies and path forward. *Environmental and Resource Economics*, 80(4), 705-715. <https://doi.org/10.1007/s10640-021-00594-6>

- Verde, S. F. (2020). The impact of the EU Emissions Trading System on competitiveness and carbon leakage: The econometric evidence. *Journal of Economic Surveys*, 34(2), 320-343. <https://doi.org/10.1111/joes.12356>
- Wainwright, J., & Mann, G. (2018). *Climate leviathan: A political theory of our planetary future*. Verso.
- Ward, D. J. (2014). The failure of marginal abatement cost curves in optimising a transition to a low carbon energy supply. *Energy Policy*, 73, 820-822. <https://doi.org/10.1016/j.enpol.2014.03.008>
- World Bank. (2015). *Romania toward a low carbon and climate resilient economy: Transport sector analysis*. <https://doi.org/10.1596/24059>
- World Bank. (2021). *Carbon pricing for climate action*. <https://doi.org/10.1596/36080>
- World Bank. (2023). *Carbon pricing leadership report 2022/23*. https://www.pmiclimate.org/sites/default/files/downloads/publication/CPLC%20report%202023_Final%20v2.pdf
- World Bank. (2024a). *State and trends of carbon pricing 2024*. <http://hdl.handle.net/10986/41544>
- World Bank. (2024b). *Balancing act: Political economy and the pursuit of ambitious carbon pricing in developing countries*. <https://doi.org/10.1596/42093>
- World Bank. (2026). *State and trends of carbon pricing 2025*. <https://www.worldbank.org/en/publication/state-and-trends-of-carbon-pricing>