The Carbon Price Paradox

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THE CARBON PRICE PARADOX

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Abstract

Should the carbon price be high to stimulate climate-friendly technologies or should it be low to realize inexpensive emission reductions? This 'carbon price paradox' is unraveled for the EU on the basis of legal, economic and political arguments. Legally, the primary aim of the EU ETS Directive is to promote cost-effective emission reductions. Economically, the rate of emission reduction in the EU ETS and to an increasing extent also its indirect impact on technological innovation are not so much determined by the level of the allowance price, but rather by the rate at which the emission ceiling falls. Politically, a lower carbon price creates room to lower the emission ceiling more quickly. In sum, society should welcome a low carbon price.

1 Introduction

Professor Martha Roggenkamp and I jointly established the Groningen Centre of Energy Law and Sustainability (GCELS) in 2007. I was studying the economics of climate regulation, and Martha covered the entire field of energy law. Martha was the leading lady, not only because she was professor while I was associate professor at the time, but also because climate law was still in its infancy. Much has happened since then. Climate change has accelerated for the worst, and climate law established itself as a mature discipline alongside

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energy law.[2] Supported by Martha, I became a full professor in 2018, and as the influence of economics on climate policy grew, issues of carbon pricing migrated from economic theory to legal practice.

Both among economists and lawyers, a much-debated question is: should the carbon price be low or high? Or to put it differently: should society welcome a continuously rising carbon price or not? And more specifically: should national governments set a carbon price floor in the emissions trading scheme by implementing an extra carbon levy for industry, as the Netherlands recently did? The answers to these questions lead to an apparent contradiction: the 'carbon price paradox'.

Some scholars and commentators welcome higher carbon prices. An example is the recent price increase of tradable emission allowances in the European Union Emissions Trading System (EU ETS).[3] "Prices have risen from 5€ per ton in 2017 to 40€ in early 2021. This is a great achievement", Grischa Perino said.[4] Reuters even concluded: "Analysts say [the carbon] price needs to be much higher to speed change".[5] Nicholas Stern, for instance, argues in favor of a "strong and rising carbon price".[6] A rising price would strengthen the innovation incentive for emitters of greenhouse gases, including power companies, industries and airlines, to develop and adopt climate-friendly production technologies. An upward price trend would also bring the allowance price more in line with the damage costs of human-induced climate change.

Paradoxically, there are other voices that are either indifferent to the carbon price level or even welcome lower prices. "The market for allowances generates a carbon price in response to supply and demand, (…) focusing on emissions reductions (as opposed to setting a specific carbon price (…))", so that "there is no need for regulators to dictate specific abatement actions or to try to prescribe an optimum carbon price", Alexander Eden and others argue.[7] Jeroen van den Bergh and others conclude: "the cap (…) will

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2 Woerdman, E., M.M. Roggenkamp & M. Holwerda (eds.) (2021), Essential EU Climate Law, second revised edition, Cheltenham: Edward Elgar.

3 Since 2005, the EU ETS caps emissions from carbon dioxide (CO2). Since 2013 it also regulates emissions from nitrous oxide (N2O) and perfluorocarbons (PFCs). These greenhouse gases are recalculated in carbon dioxide equivalents. This is why some still refer to the 'carbon' price of the EU ETS.

4 <https://lifedicetproject.eui.eu/2021/03/19/the-eu-ets-needs-a-new-autopilot-a-proposed-reform-for-the-msr/>

5 <https://www.reuters.com/business/energy/eu-carbon-price-tops-50-euros-first-time-2021-05-04/>

6 Stern, N. & A. Valero (2021), 'Innovation, Growth and the Transition to Net-zero Emissions', Research Policy 50(9): 1-12.

7 Eden, A., et al. (2018), *Benefits of Emissions Trading: Taking Stock of the Impacts of Emissions Trading Systems Worldwide*, Berlin: ICAP.

determine the adequate price level."[8] A downward price trend would therefore imply a successful realization of cost-effective emission reductions.

This brings us back to the original controversy: should society welcome a low or high carbon price? It is important to answer this basic question, not least as the European Commission proposes to expand the EU ETS to the maritime sector and aims to create a separate trading scheme for producers of fuel used in road transport and buildings.[9] This chapter argues that the 'carbon price paradox' can only be entangled by considering the institutional context of market-based climate instruments, which requires an appreciation of their economic rationale, legal objectives and political dynamics.

2 The polluter should pay

Environmental damage reduces welfare and must therefore be priced. Economists want external effects to be internalized. For reasons of effectiveness and fairness, lawyers want polluters to be accountable for the environmental damage they cause: that is why the so-called "polluter-pays" principle has been included in Article 191 of the Treaty on the Functioning of the European Union (TFEU). It is also better to be safe than sorry. Lawyers invoke the principle of preventive action, also enshrined in Article 191, while economists emphasize the *ex ante* incentive that pricing creates to reduce pollution.[10]

Pricing pollution ensures that the polluter pays and that those who cause it are encouraged to reduce or even cease their pollution. Such choices depend on the price level and on the design of the legislative instrument. This is where it gets exciting. Which instrument is the most efficient one for pricing pollution and how high should the price be that the polluter should pay?

Let's answer this economic question from the perspective of one of the greatest environmental problems and risks of our time: climate change.[11] Burning fossil fuels releases greenhouse gases, especially CO2, which contributes to global warming and leads to all kinds of damage, ranging from more forest fires and heavier rainfall to fiercer storms and major crop failures.[12]

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8 Baranzini, A., et al. (2017), 'Carbon Pricing in Climate Policy: Seven Reasons, Complementary Instruments, and Political Economy Considerations', WIREs Climate Change 8(4): 1-17.

9 The European Green Deal, COM(2019) 640 final, Brussels: European Commission.

10 Hanley, N., J.F. Shogren J.F. & B. White (1997), 'Economic Incentives for Environmental Protection: An Overview'. In: Environmental Economics in Theory and Practice, Londen: Palgrave.

11 World Economic Forum (2021), The Global Risks Report 2021, 16th edition, Genève: Zwitserland.

12 IPCC (2018), Global Warming of 1.5°C: Special Report.

3 The costs of auctioned versus free emission allowances

In order to price harmful CO2 emissions, a carbon tax or a carbon trading scheme must be introduced. With a carbon tax there is certainty about the CO2 price in the form of the tax rate, but there is uncertainty about its environmental effect: after all, how high must the tax be in order to achieve a certain emission reduction target? With carbon trading it is the other way around: there is certainty about the environmental effect, because emissions must remain below the emission ceiling, while there is uncertainty about the market price of CO2. There is no consensus among economists as to which of these two instruments is better,[13] reinforcing the political nature of instrument choice. The EU opted for a carbon trading scheme, mainly because a carbon tax required unanimity and therefore stranded in the legislative process. The energy-intensive industry also preferred emissions trading to an additional tax, because emission allowances could be obtained free of charge.[14]

The latter does not mean that free allowances have no cost. Free allowances have opportunity costs – the revenues foregone by not selling the allowances – when they are used to cover emissions. The price of the emission allowances must therefore be passed on to consumers via the product price. This pushes up the price of the polluting product, such as the price of electricity, steel or cement, exactly as intended by the polluter-pays principle.[15]

However, the financial advantage that free allowances imply for companies can be turned into a financial advantage for the government by auctioning the allowances.[16] Since 2013 electricity companies have to buy all of their allowances at auction, but the energy-intensive industry – exposed to international competition – enjoys allowances for free. This makes no difference to the effectiveness and efficiency of the EU ETS: these European companies must operate under absolute, decreasing emission ceilings and can trade the auctioned or free emission allowances on the carbon market.[17] If their emis-

13 Hsu, S.-L. (2020), 'Prices versus quantities', in: K.R. Richards & J. van Zeben (eds.), Policy Instruments in Environmental Law, Cheltenham: Edward Elgar, pp. 183-198.

14 Woerdman, E. (2004), The Institutional Economics of Market-Based Climate Policy, Amsterdam: Elsevier.

15 Woerdman, E., A. Arcuri & S. Clò (2008), 'Emissions Trading and the Polluter-Pays Principle: Do Polluters Pay under Grandfathering?', Review of Law and Economics 4(2): 565-590.

16 Woerdman, E., O. Couwenberg & A. Nentjes (2009), 'Energy Prices and Emissions Trading: Windfall Profits from Grandfathering?', European Journal of Law and Economics 28: 185-202.

17 Hahn, R.W. & R.N. Stavins (2011), 'The Effect of Allowance Allocations on Cap-and-Trade System Performance', Journal of Law and Economics 54(4): 267–94.

sions would exceed their emission allowances, an inflation-adjusted penalty of 100 euros (now rising to about 120 euros) per tonne of CO2 is imposed.

4 The impact of regulatory changes on the carbon price

In principle, the size of the aforementioned fine determines the maximum price level of emission allowances in the EU. Non-compliant companies also have a reparation obligation: if they emit too much in one year this must be compensated by extra emission reductions in the next year (Article 16 ETS Directive.)[18]

The allowance price is determined by supply and demand. The legislation determines the supply of emission allowances, which is capped and reduced annually. This means that the carbon price does not only react to increasing and decreasing demand, but also to legal changes of the carbon trading system. For example, the allowance price started at 10 euros in 2005 and rose to 30 euros in 2006, before falling back to almost zero euros in 2007 given that more emission allowances had been issued than there were emissions. On the one hand, the emission ceiling had become too high due to, *inter alia,* the import of emission reductions from climate projects from outside Europe. On the other hand, the allowance price fell as the legislation prohibited allowances from the first trading phase 2005-2007 to be transferred to the second trading phase 2008-2012.[19]

As of 2008, banking emission allowances has been made legally possible, which helps to avoid price collapses. More than ten years ago a carbon price in the EU was predicted of around 25 to 35 euros in 2010 and 35 to 50 euros in 2020.[20] The allowance price started at around 25 euros in 2008, but after a drop in demand due to the financial crisis, the price fell to around 5 euros at the start of the third trading phase 2013-2020. As a result, there were now two billion more emission allowances on the market than there were emissions. Nevertheless, the price did not fall to zero, because emission allowances were carried over to subsequent trading phases while a growing scarcity of allowances was anticipated in the long run.

The expected scarcity of emission allowances due to stricter climate rules has proven justified. The EU aims to be carbon neutral by 2050 and recently tightened the emission reduction target for 2030 from 40 to 55 percent. Importantly, the EU has introduced a kind of allowance 'vacuum cleaner' since 2019, the Market Stability Reserve (MSR),

18 Directive 2003/87/EC, OJ 2009 L.275/32–46.

19 Woerdman, E. (2021), 'EU Emissions Trading System', in: Woerdman, E., M.M. Roggenkamp & M. Holwerda (eds.), Essential EU Climate Law, Cheltenham: Edward Elgar, pp. 44-73.

20 Point Carbon (2008), Carbon 2008: Post-2012 is Now, Oslo: Point Carbon, p.31.

which automatically reduces the auction volume of emission allowances and even cancels part of the allowances in case of an allowance surplus.[21] Allowance supply is therefore limited by means of legal intervention. The surplus of emission allowances at the end of the third trading phase 2013-2020 had fallen by a third and the allowance price had risen from 5 euros in 2013 to more than 30 euros in 2020. Since the start of the fourth trading phase in 2021, the allowance price has increased to around 75 euros.

5 Regulatory intervention in the carbon price

According to Article 1 of the ETS Directive, this trading system is established "(...) in order to promote reductions of greenhouse gas emissions in a cost-effective and economically efficient manner."[22] A secondary goal, as stated in its preamble, is to stimulate climate-friendly technologies, such as combined heat and power in the electricity sector, but also hydrogen in the transport sector or CO2 storage by industry. Emissions trading is technology neutral: the market determines which technology can achieve the emission reductions at the lowest possible cost. The higher the allowance price, the more attractive it becomes for companies to develop and use relatively expensive abatement technology. But it also works the other way around: technological innovations, such as larger wind turbines at sea or solar panels with higher cell efficiency, can lead to cost savings in reducing carbon emissions, lowering the carbon price and thus making compliance cheaper.[23] This in turn gives more political room to tighten the emission ceilings further.

Empirical research shows that the EU ETS succeeds in reducing emissions and promoting climate-friendly technology, even at a low carbon price.[24] Nevertheless, during the third trading phase 2013-2020, when the allowance price was still around 5 euros, the United Kingdom (then still an EU Member State) and later also the Netherlands decided

21 Woerdman, E. (2021), 'Hoe emissiehandel werkt: als stofzuiger-met-wegwerpzak', Klimaatweb 12 april 2021.

22 Directive 2003/87/EC, OJ 2009 L.275/32–46.

23 Woerdman, E. (2019), 'Klimaatrecht tussen marktwerking en overregulering', Nederlands Tijdschrift voor Energierecht 18(2): 50-57.

24 Bayer, P. & M. Aklin (2020), 'The European Union Emissions Trading System Reduced CO2 Emissions Despite Low Prices' 117(16) PNAS: 8804-8812; Van den Bergh, J. & I. Savin (2021), 'Impact of Carbon Pricing on Low-Carbon Innovation and Deep Decarbonisation: Controversies and Path Forward', Environmental and Resource Economics 80: 705–715; Prest, B., D. Burtraw & K. Palmer (2021), Waiting for Clarity: How a Price on Carbon Can Inspire Investment, Report 21-08, Washington: Resources for the Future.

to introduce a carbon price floor for electricity companies. If the allowance price is lower than the floor price, these companies pay the difference in the form of a levy.

The floor price in the United Kingdom was set at 16 pounds in 2013 to gradually increase to 30 pounds in 2020. It is telling that the rising floor price was quickly capped permanently at 18 pounds. A carbon price of 30 pounds was, with hindsight, seen as to make climate policy too expensive, especially in a period of economic recovery after the financial crisis of a few years earlier.[25] These political interventions introduce rigidity into the market. After all, emissions trading acts as an automatic stabilizer: in economic good times the carbon price rises, in economic bad times the carbon price falls.[26]

The Netherlands also decided to intervene in the carbon price. The legislative proposal of a minimum CO2 price for electricity generation, which aims at a floor price of 12 euros in 2020 and 32 euros in 2030, has only been adopted early 2022. A CO2 floor price for the Dutch industry, however, is already longer in force: it will rise from 30 euros in 2020 to 127 euros in 2030, although initially a large part of the emissions will be exempted from this carbon levy.[27] France also tried to introduce a carbon tax, but it was met with massive, violent protests from the so-called 'yellow vest' movement.

The examples above demonstrate that it is complex but not impossible to increase the carbon price through administrative intervention. An added national carbon levy does indeed stimulate the development of climate-friendly technology, a derived goal of emissions trading, but it hinders a carbon price reduction because the extra levy acts as a floor price. This can make climate policy more expensive than necessary and potentially interferes with the primary goal of the ETS Directive: a cost-effective reduction of greenhouse gas emissions.

Crucially, raising the allowance price through administrative intervention ignores the rapidly falling costs of carbon-free energy technology and of CO2 reduction techniques. For example, the costs of wind energy, solar energy and battery storage have fallen spectacularly, actually more than expected, in recent years.[28] These cost reductions will ultimately be reflected in a falling carbon price. A low carbon price in an emission allowance market is therefore a signal that technological progress is effective in curbing emission reduction costs, despite increasingly stringent climate targets. In fact, these ever-tighter

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25 <https://commonslibrary.parliament.uk/research-briefings/sno5927/>

26 Woerdman, E. & A. Nentjes (2016), 'Misconceptions about Emissions Trading in Europe', in: A. Marciano & G.B. Ramello (eds.), Law and Economics in Europe and the U.S., London: Springer, pp. 211-227.

27 <https://wetten.overheid.nl/BWBR0044578/2021-01-01>

28 IRENA (2018), Renewable Power Generation Costs in 2017, Abu Dhabi: International Renewable Energy Agency (IRENA), p. 21; Glenk, G., et al. (2021), Clean Energy Technologies: Dynamics of Cost and Price, Working Paper, University of Mannheim.

reduction targets create business opportunities for entrepreneurs, for instance for those who become market leader by inventing or using carbon-free energy technologies that are cheaper than producing energy by burning fossil fuels.[29] Over time, therefore, the prospect of generating innovation profits could even become a stronger incentive for climate-friendly innovation than the carbon price itself.

The market price for CO2 is therefore a completely different story than the administrative price of a CO2 tax. In principle, the following applies in case of a tax: the higher the tax rate, the more sustainable the producer and, ultimately, the consumer. Due to inelastic demand for energy and consumer habits, a price increase may have a limited effect on emissions, but in principle higher taxes on dirty products lead to more sustainable consumer behavior.[30] In an emissions trading system, however, the rate of emission reduction is not so much determined by the level of the allowance price, but rather by the rate at which the emission ceiling falls. The lower the ceiling, the more sustainable the producer and, finally, the consumer.

6 The damage costs of carbon emissions

But should the price of emission allowances in the EU not be much higher than it is now, looking at the damage costs of carbon emissions, called the Social Cost of Carbon (SCC)? That may be a slippery slope. This slope slips from a few tens to many hundreds of euros per tonne of CO2. The problem is that the cost estimates of climate damage vary enormously, not only per country or region, but also depending on the model used and the assumptions chosen. Which economist do we want to listen to?

According to the American economist Matthew Kotchen, the damage costs for the EU are about 50 euros.[31] If that is the case, then we can be more than satisfied with the current emission allowance price of approximately 75 euros in Europe. But industrial parties that would like to earn money from, for example, the capture and storage of CO2, would rather see even higher prices: Carbon Capture and Storage (CCS) is usually only profit-

29 Grubb et al. (2021), 'Induced Innovation in Energy Technologies and Systems: A Review of Evidence and Potential Implications for CO2 Mitigation', Environmental Research Letters 16(4): 1-48.

30 Mulder, M. (2021), Regulation of Energy Markets: Economic Mechanisms and Policy Evaluation, Cham: Springer; Bolderdijk, J.W., L. Steg, E. Woerdman, R. Frieswijk & J.I.M. de Groot (2017), 'Understanding Effectiveness Skepticism', Journal of Public Policy & Marketing 36(2): 348-361.

31 Kotchen, M.J. (2018), 'Which Social Cost of Carbon? A Theoretical Perspective', Journal of the Association of Environmental and Resource Economists 5(3): 673-694.

able from around 60 euros per tonne of CO2 and often the costs are double as high.[32] Also financial service providers would in principle like to see further rising carbon prices, so that they can earn money from trading emission allowances as intermediaries.

According to a well-known *Nature* study by Katharine Ricke and others, global climate damage should be monetized between 154 and 700 euros per tonne of CO2, with a median of 363 euros.[33] Also according to various authoritative Dutch economists, including Jeroen van den Bergh and former State Secretary Rick van der Ploeg, climate damage is grossly underestimated.[34] They argue that if we weigh future climate damage more heavily and take less risk of irreparable damage to forests and biodiversity, while recognizing that oceans can absorb less and less carbon in the future, then CO2 prices should be at least 105 euros and should probably go towards 250 to 500 euros.

This sounds like a theoretical economic debate, irrelevant to lawyers. Which EU Member State now charges CO2 damage costs of 500 euros, or even more, while the market price for CO2 allowances is around 75 euros? The answer is: Sweden. In 2020, the Swedish Transport Administration increased the CO2 costs in cost-benefit analyses to assess investments in transport infrastructure from 100 euros to 682 euros.[35] This is approaching the upper range of 700 euros per tonne of carbon in the above-mentioned *Nature* study. That is not surprising, because the Swedish government body derived this price directly from this study and from other economic studies on climate damage.

The Swedish use of carbon damage studies is all the more interesting when one considers that the European Commission wants to extend the EU ETS to shipping and aims to set up a separate emissions trading system for producers of fuels used in road transport and buildings. Does this mean that the European allowance price, or the Dutch national carbon levy for the industry, must also be increased towards 700 euros in order to curb catastrophic climate change?

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32 Koelemeijer, R., et al. (2018), Kosten energie- en klimaattransitie in 2030 – update 2018, Planbureau voor de Leefomgeving Publicatienummer 3241; Beck, L. & L. Temple-Smith (2020), 'Is CCS Expensive? Decarbonisation Costs in the Net-Zero Context', Global CCS Institute Brief.

33 Ricke, K., et al. (2018), 'Country-level Social Cost of Carbon', Nature Climate Change 8: 895–900.

34 Bergh, J. van den & W. Botzen (2014), 'A Lower Bound to the Social Cost of CO2 Emissions', Nature Climate Change 4: 253–258; Dietz, S., F. van der Ploeg, A. Rezai & F. Venmans (forthcoming), 'Are Economists Getting Climate Dynamics Right and Does It Matter?', Journal of the Association of Environmental and Resource Economists.

35 Trafikverket (2020), Analysmetod och Samhällsekonomiska Kalkylvärden för Transportsektorn: ASEK 7.0; Vierth, I. & A. Merkel (2020), 'Internalization of External and Infrastructure Costs Related to Maritime Transport in Sweden', Research in Transportation Business & Management (in press).

The answer is: no. In principle, the level of the allowance price has no effect on the ever-decreasing size of the number of emission allowances. This falling emission ceiling is crucial: it ensures that the permitted emissions decrease every year, ultimately ending at net zero carbon emissions by 2050, as the EU aims for. Meanwhile, emissions trading ensures that companies can choose the cheapest way to meet their emission reduction obligations. If technology did not change, an ever-tighter emission ceiling would lead to an ever-higher emission price. But if renewable energy and CO2 reduction techniques are becoming cheaper, the carbon price should rise less rapidly – or even fall. The costs of climate damage should therefore not be confused with the price of emission allowances: the CO2 price reflects (not the damage costs but) the reduction costs per unit of CO2 below the emission ceiling.[36]

One economic nuance concerns the cancellation mechanism in the Market Stability Reserve (MSR).[37] From 2023, allowances in the MSR that exceed the auction volume of the previous year will be canceled. This means that an additional national carbon levy could lead to slightly more emission reductions in the EU if its rate is higher than the (fluctuating) price of emission allowances. Such an effective floor price leads to more emission reductions, so that more allowances come onto the market which increases the MSR, of which a portion is automatically deleted.[38] This extra reduction could be nullified later, however, because the MSR in its current legal design is allowed to release allowances if scarcity increases.[39]

7 Conclusion

Should the carbon price be high to stimulate climate-friendly technologies or should it be low to realize inexpensive emission reductions? This 'carbon price paradox' is unraveled, within the institutional context of the EU, on the basis of legal, economic and political considerations.

First, the primary legal aim of the EU ETS Directive is to promote cost-effective emission reductions. Second, from an economic point of view, the rate of emission reduction

36 Aldy, J.E. et al. (2021), 'Keep climate policy focused on the social cost of carbon', Science 373 (6557): 850-852.

37 Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve and amending Directive 2003/87/EC, OJ 2015 L.264/1-5.

38 Gerlagh, R. & R.J.R.K. Heijmans (2019), 'Climate-conscious consumers and the buy, bank, burn program', Nature Climate Change 9: 428-433.

39 If the surplus of allowances is less than 400 million allowances, 100 million allowances from the reserve are released automatically.

in the EU ETS and to an increasing extent also its indirect impact on technological innovation are not so much determined by the level of the allowance price, but rather by the rate at which the emission ceiling falls. The allowance price then ensures an optimal distribution of emission reduction options: the market price reveals the lowest cost at which emissions can be reduced and prevents unnecessary investments in relatively expensive reduction technology. Administratively increasing the allowance price, for example with a floor price, thus ignores the rapidly falling costs of carbon-free energy technology. In fact, a low allowance price is a signal that technological progress is effective in keeping emission reduction costs low, despite increasingly stringent climate targets. Third, and finally, a lower carbon price creates political room to lower the emission ceilings more quickly. It is telling that the EU recently decided to significantly tighten its 2030 reduction target, from 40 to 55 percent, after a decade in which both the cost of abatement technology and the price of emission allowances were far below initial forecasts.

INTERNATIONAL CHALLENGES