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## Article

# The Flexcap – An Innovative CO<sub>2</sub> Pricing Method for Germany

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## The Flexcap – An Innovative CO<sub>2</sub> Pricing Method for Germany



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### THE CURRENT DEBATE ABOUT A CO<sub>2</sub> PRICE

The past year has been marked by an extensive public debate about the introduction of a uniform CO<sub>2</sub> price in Germany.<sup>1</sup> On September 20, 2019, the federal government decided to introduce a national CO<sub>2</sub> price. It opted for a price regulation, which will be replaced by quantity regulations from 2026 onward. This article proposes an alternative approach that combines price and quantity targets from the outset, thus creating planning security without losing sight of the quantity target.

The German government's decision consists of a combination of two mechanisms which, as discussed below, lie at opposite ends of the possible spectrum: direct price control through a CO<sub>2</sub> tax on the one hand and direct quantity control through an emissions trading scheme on the other. Formally, a national emissions trading system for the heating and transport sectors is to be set up in 2021, with an annually increasing, predetermined price for certificates for first five years.<sup>2</sup> Companies subject to the scheme may purchase an unlimited number of certificates at this fixed price. This will give Germany a pure price control for the first five years, which will have the same effect as a CO<sub>2</sub> tax. From 2026 onward, the quantity of available certificates is to be limited in accordance with the German climate targets.<sup>3</sup> A CO<sub>2</sub> tax will therefore be replaced by emissions trading in 2026. According to the federal government, this switch between instruments is intended to guarantee companies and consumers price security initially, while at the same time ensuring compliance with the climate targets in 2030.<sup>4</sup> In this article we present the “Flexcap,” a mechanism that combines the advan-

tages of a tax and an emissions trading system in a single system.

A part of the greenhouse gas emissions (GHG) in Germany is already regulated by an emissions trading system: the European Emissions Trading System (EU ETS).<sup>5</sup> The EU ETS covers around 45 percent of total emissions across the EU; in Germany, the energy, industry, and construction sectors covered by the EU ETS accounted for as much as 57 percent of total emissions in 2017 (SVR 2019). The current debate therefore focuses on GHG emissions that are not covered by the EU ETS, particularly in the transport and heating sectors. In the transport sector, emissions have hardly decreased since 1990. This is also problematic because there are binding reduction targets for the non-ETS sectors under the “EU Effort Sharing Regulation.” By 2030, Germany must therefore reduce its GHG emissions in these sectors by 38 percent compared to 2005 levels. If this is not achieved, substantial compensation payments to other EU countries may be required.

For this and other reasons, policymakers, scientists, and the public seem to agree that a CO<sub>2</sub> price should be introduced as well for the non-ETS sectors (e.g., Blum et al. 2019). Concerning implementation, the federal government had obtained several expert opinions prior to September's decision (BMW 2019; SVR 2019; DIW 2019). These agreed that, at least in the longer term, efforts should be made to extend the EU ETS to all sectors in all EU Member States, an objective that will be politically difficult to achieve and implement in the short to medium term. In a transitional period, pricing CO<sub>2</sub> requires a solution at the national level (or in a “coalition of the willing”). This article presents a solution that combines the advantages of pure price and quantity regulation and is therefore more efficient: the so-called Flexcap. In the longer term, such a solution could also be established for the EU ETS or other emissions trading schemes. In order to place this proposal in the context of the current debate, it is helpful to recall the alternatives discussed prior to the government's decision: a CO<sub>2</sub> tax and an emissions trading scheme.

### CO<sub>2</sub> TAX

A CO<sub>2</sub> tax is levied on every ton of CO<sub>2</sub> emitted. If a company can reduce its CO<sub>2</sub> emissions by using certain technologies, it will save money by avoiding emissions for which the costs of these technologies – the so-called “abatement costs” – are lower than the tax. The remaining emissions are subjected to the tax. The same applies in an emissions trading scheme if the quantity of allowances is not limited but can be purchased at a fixed price, as decided by the federal government. The price of the certificates

<sup>1</sup> A component of this debate is the distributional effect of such CO<sub>2</sub> pricing. This question is orthogonal to our proposal and not part of this article. For a discussion in the German context, see for example DIW (2019).

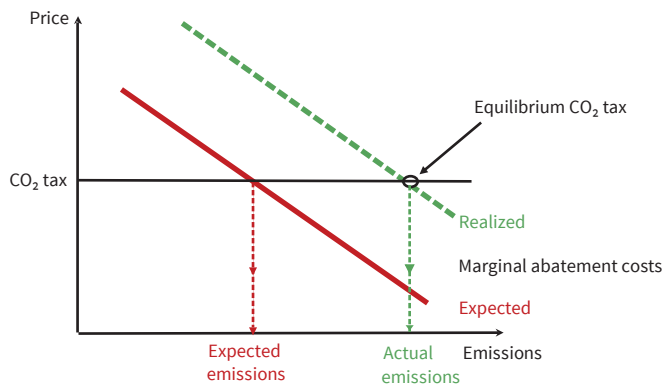
<sup>2</sup> The price in 2021 will be EUR 25/tCO<sub>2</sub>, and will increase to EUR 55/tCO<sub>2</sub> in 2025.

<sup>3</sup> In 2026, a price corridor of EUR 55-65/tCO<sub>2</sub> will be introduced, which allows the targeted emission quantity to be exceeded if the price is too high.

<sup>4</sup> However, this is not guaranteed due to the the upper price limit: when it is reached, additional certificates and thus emissions are generated until their price is EUR 65 again. In this case, Germany would not comply with its obligations to the EU and would have to compensate the other states for this with considerable financial sums.

<sup>5</sup> For more information on the EU ETS, see Schmitt et al. (2017) and Weimann (2017).

Figure 1  
CO<sub>2</sub> Taxes



Source: Authors' illustration.

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corresponds to the tax rate. The amount of emissions realized thus depends on the level of the tax and the (marginal) abatement costs. However, the actual level of abatement costs is subject to considerable uncertainty. If the abatement costs realized by companies and households are higher than anticipated by the regulator, a given tax leads to more emissions than expected (see Figure 1). Under such a price regulation, there is uncertainty about the amount of emissions generated, which may lead to considerable deviations from a reduction target (BMW 2019). Under the planned national emissions trading scheme, the federal government therefore has no control over the total emissions of the heating and transport sectors in the first five years (2021–2025). In order to meet the climate targets for 2030, a system change to actual emission trading (with a price corridor) is planned for the end of 2025.

## EMISSIONS TRADING

In an emissions trading scheme, also known as “cap and trade”, the regulator issues a limited quantity of emission certificates. Companies subject to the scheme must hold such a certificate for emitting one tonne of CO<sub>2</sub> and submit it by the end of the year. The total quantity of certificates – also known as the cap – determines the total emissions within a year. Certificates are distributed either by auction or free of charge on the basis of historically determined benchmarks (“grandfathering”). Companies can trade certificates

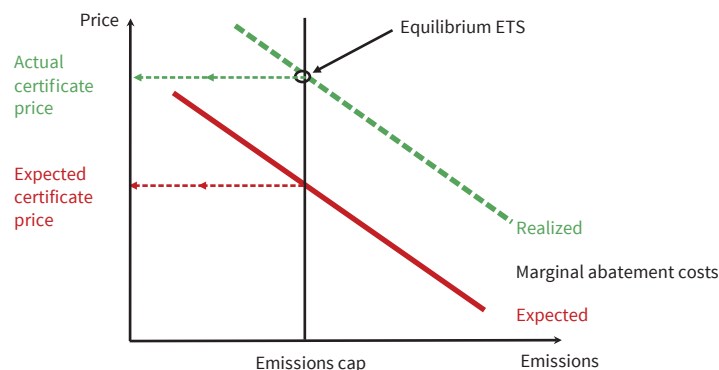
among themselves; the market price is formed by supply and demand. How many certificates a company wants to buy or sell depends on its marginal abatement costs. If these costs are below the market price for some of its emissions, it is worth saving these emissions and selling surplus certificates at the market price.

Uncertainty about abatement costs implies uncertainty about the demand for emission certificates. In emissions trading, the supply of certificates is fixed. Thus, supply and demand can clear only

through a price adjustment (see Figure 2).

If the abatement costs are higher than expected, this can lead to a considerable increase in the certificate price and impose a higher burden on companies and consumers. Conversely, a lower demand for certificates reflects in a lower market price. If companies and households expect that the certificate price will be low in the medium and long term, this may lead to less investment in new technologies and to higher abatement costs in the future. In addition, an emission cap renders additional policy futile. For example, a replacement premium for oil-fired heating systems will no longer have a direct climate impact. They merely cause emissions to occur elsewhere or at a different time as the quantity of allowances remains constant. The same applies to voluntary energy saving by private households (Perino 2015). In summary, pure quantity regulation guarantees compliance with given reduction targets, but can lead to considerable price fluctuations. Consequently, it limits planning secu-

Figure 2  
Functionality of Emissions Trading Scheme (ETS)



Source: Authors' illustration.

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rity for companies and consumers (BMW 2019) and renders additional measures ineffective.

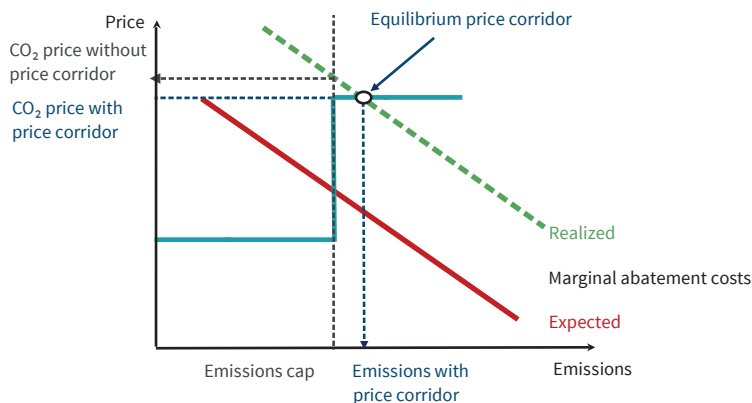
### HYBRID PRICING APPROACHES

The government's decision, at least for 2026, does not stipulate a “pure” emissions trading system, but a so-called “hybrid” system of price and quantity control. Traditional emissions trading is supplemented by a lower and/or upper limit for the market price.<sup>6</sup> The intention is to reduce the extent of possible price fluctuations in an emissions trading system and thus provide greater planning security. If both a minimum and a maximum price are introduced, this is referred to as a “price corridor” (see Figure 3). Such a corridor is stipulated for national emissions trading in Germany starting in 2026, whereby the minimum price will be EUR 55 and the maximum price EUR 65/tCO<sub>2</sub>. In 2025, it will be decided whether such a price corridor will be maintained after 2026 or whether the system will be converted into a classic emissions trading scheme. A minimum price in an emissions trading system can be implemented in various ways (Edenhofer et al. 2019):

- Reservation price at auctions of certificates: certificates will be retained as soon as the bids are below the minimum price.
- Purchase of already circulating certificates on the secondary market.
- Introduction of a CO<sub>2</sub> price support (carbon price support): this is an adaptive tax that compensates for the difference between the targeted minimum price and the current market price. Such an instrument exists in the United Kingdom in the electricity sector.

<sup>6</sup> See, among others, Roberts and Spence (1976), Pizer (2002), Wood and Jotzo (2011) as well as BMW (2019), Edenhofer et al. (2019) and SVR (2019) in the context of the German debate.

Figure 3  
Price Corridor (Upper and Lower Price Limit)



Source: Authors' illustration.

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How a minimum price is to be implemented in the German emissions trading system is still unclear. In order to implement a maximum price, additional certificates must be issued on the market when this price level is reached (BMW 2019). Similar to a price regulation, an emissions trading system with an upper price limit does not guarantee compliance with quantity targets. Given the high degree of uncertainty about the abatement costs in the non-ETS sectors in Germany, such a price ceiling can be reasonable (SVR 2019). If prices fall again below the maximum price after the additional certificates have been issued, a decision must be made as to whether and how the additional certificates will be withdrawn from the market. The corresponding course of action in the German system remains unclear.

### THE FLEXCAP: A BETTER WAY OF DEALING WITH UNCERTAINTY

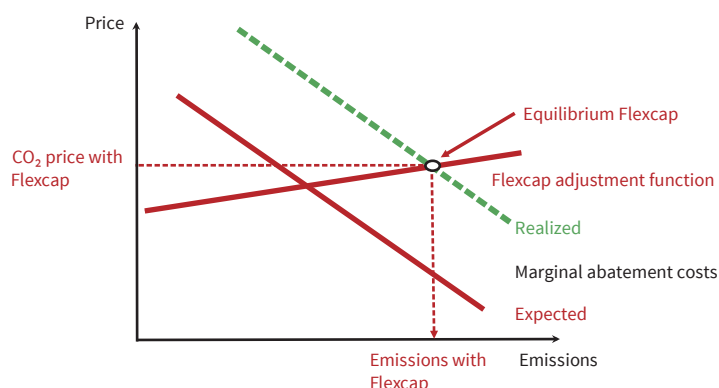
The simple emissions trading scheme passes all uncertainty to companies and consumers in the form of price fluctuations. A tax shifts all uncertainty onto the emission quantity and puts reduction targets in jeopardy. A price corridor passes the uncertainty to companies and consumers as long as the price fluctuations remain within the corridor, and to the emission quantity otherwise. The most efficient way, however, is to divide uncertainty continuously between price and quantity. Karp and Traeger (2020) propose an intelligent emissions trading scheme for this purpose, the so-called “smart cap”.<sup>7</sup> We present here a somewhat simplified version as the Flexcap and adapt it to the German debate and objective. As stressed before, it could also be an alternative for a reform of the EU ETS or other (inter-)national ETS.

### Mechanism and Mode of Action

When implementing a Flexcap, the price and quantity are determined along a special supply curve for certificates. This so-called “adjustment function” determines the quantity of allowances to be auctioned as a function

<sup>7</sup> Certificates whose CO<sub>2</sub> equivalent is a function of the market price are traded in the “smart cap”. In this way, certificates that have already been issued are adjusted to the market price in real time. In the applied version, certificates continue to be issued in tonnes of CO<sub>2</sub>, and the auctioned quantity of certificates adjusts to the market price with a slight delay. Unold and Requate (2001) have already proposed the implementation of a related system by issuing options. Perino and Willner (2017) also argue for a certificate supply function with a positive slope. Also, Rickels et al. (2019) discuss proposals on CO<sub>2</sub> pricing and note the advantages of a flexible certificate supply.

Figure 4  
Flexcap



Source: Authors' illustration.

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of the price (see Figure 4). If the price is high, more allowances are auctioned and the cap expands. If the price is low, fewer certificates are auctioned and the cap decreases. Both adjustments stabilize the price compared to an emissions trading system with a fixed cap. The slope of the adjustment function determines how much emphasis is placed on price stabilization (more emphasis the flatter the slope) and how much emphasis is placed on the quantity target (more emphasis the steeper the slope). A CO<sub>2</sub> tax and emissions trading with a fixed cap are extreme variants of this mechanism.

There are various possibilities for the practical implementation of this quantity adjustment. We propose a very simple version: the new amount of certificates to be auctioned should depend directly on the price of the previous auction.<sup>8</sup> In the EU ETS, auctions usually take place on a weekly basis. In a smaller German system, auctions are expected to take place only every two or four weeks.<sup>9</sup> For example, a high price in

<sup>8</sup> An average value of the prices of previous auctions could also be used to determine the new quantity to be auctioned. In this case, it makes most sense to weight the last auction most heavily in order to achieve the closest possible approximation. It is also conceivable to consider the stock market values of the secondary market. In an auction in which the companies specify demand functions as in the auctions of the EU ETS, the resulting auction price itself can also be taken into account.

<sup>9</sup> If there are about twelve auctions per year, then we suggest that each of these twelve auctions in a calendar year follows the same adjustment function, and thus one-twelfth of an annual adjustment function.

May would lead to more certificates being auctioned in June. Since certificates have to be submitted only at the end of the year and the adjustment function is known to all market participants, the adjustment in June is already anticipated at the auction in May, which dampens the price increase without delay. If, on the other hand, the price is very low in May, the amount of certificates auctioned in June will be reduced according to the adjustment function.

Table 1 contains a comparative example of the effect of the Flexcap and the classical

systems discussed previously. Our example contains both a flat and a steep choice of the adjustment function. We will return to the choice of this slope in the next section.

The example refers to the EU ETS in 2020. We assume that the adjustment function is given, the expected abatement costs are EUR 25/tCO<sub>2</sub> and the expected emission quantity is 1.60 GtCO<sub>2</sub>.<sup>10</sup> However, the actual abatement costs are higher.<sup>11</sup> Under a price regulation, a CO<sub>2</sub> tax of EUR 25/tCO<sub>2</sub> would be introduced. The realized emissions would then be approx. 10 percent above the expected level.

In an emissions trading system, certificates with a total volume of 1.60 GtCO<sub>2</sub> are issued. With such a rigid emissions cap, the price of a certificate rises to over EUR 37/tCO<sub>2</sub>, an increase of 50 percent above the expected price. The example illustrates how pure emissions trading passes all uncertainty to the certificate price and thus to companies and consumers.

<sup>10</sup> The actual cap in the EU ETS for 2020 is approx. 1.81 GtCO<sub>2</sub> (see [https://ec.europa.eu/clima/policies/ets/cap\\_de](https://ec.europa.eu/clima/policies/ets/cap_de)). However, the observed GHG emissions have been lower since 2016 (see <https://www.eea.europa.eu/data-and-maps/dashboards/emission-stradingviewer1>). We therefore adjust the cap downward in the example. The price here roughly corresponds to the current market price (beginning of September 2019).

<sup>11</sup> The increase in the expected marginal abatement costs is based on the parameterization of Landis (2015; see Table 4). However, the position of the marginal abatement cost curve was adjusted upward for this example. Otherwise, the cap used would result in a certificate price of less than EUR 20/tCO<sub>2</sub>, which seems too low given the pre-Corona market prices in the EU ETS. The actual abatement costs realized in the example were freely chosen as a possible scenario.

Table 1  
Flexcap and Classic System: Comparison of Effects

	Expected price in euros	Realized price in euros	Expected amount in GtCO <sub>2</sub>	Realized amount in GtCO <sub>2</sub>
CO <sub>2</sub> tax EUR 25/tCO <sub>2</sub>	25.00	25.00	1.60	1.75
Emissions trading with Cap 1.60 GtCO <sub>2</sub>	25.00	37.19	1.60	1.60
Price corridor EUR 20–35/tCO <sub>2</sub>	25.00	35.00	1.60	1.63
Flexcap with flat adjustment function	25.00	26.00	1.60	1.74
Flexcap with steep adjustment function	25.00	35.00	1.60	1.63

Source: Authors' calculations.

A tax, on the other hand, passes all uncertainty to the emissions and puts the quantity target in jeopardy.

The third row in Table 1 refers to a price corridor with a minimum price of EUR 20/tCO<sub>2</sub> and a maximum price of EUR 35/tCO<sub>2</sub>. In this case, the price is stabilized at the price ceiling of EUR 35/tCO<sub>2</sub>; the resulting emissions exceed the targeted emission ceiling.

Rows 4 and 5 illustrate the Flexcap. With a flat slope, it allows the price to rise only slightly, but allows a stronger expansion of the certificate quantity. With a steeper adjustment function, it allows a stronger price increase, but forces emissions that hardly deviate from the target quantity.

### Choice of Adjustment Function and Efficient Achievement of Objectives

The economic literature largely agrees that uncertainty about marginal abatement costs leads to particularly high costs when fully passed on to consumers and businesses, as in a pure emissions trading scheme.<sup>12</sup> This uncertainty is particularly severe when a new emissions trading system is introduced, not least because it covers sectors that have not been exposed to a direct CO<sub>2</sub> price before. We therefore propose an initially relatively flat adjustment function. This flat adjustment function should, of course, go through the price/quantity combination targeted for the year in question. Similar to the German government's decision, households and companies can gradually get used to pricing emissions without being exposed to large price fluctuations. Very low prices, which reduce the incentives to invest in emission abatement technologies, would be avoided, as would very high prices, which put an excessive burden on households and companies, for example because they cannot react quickly enough to CO<sub>2</sub> prices, due to a lack of short-term available and affordable alternatives.

The initial costs for consumers and companies have to be weighed against the long-term achievement of climate targets. The adjustment function should therefore become steeper over time (see Figure 5). A steep adjustment function leaves less scope for extending (or reducing) the Flex-

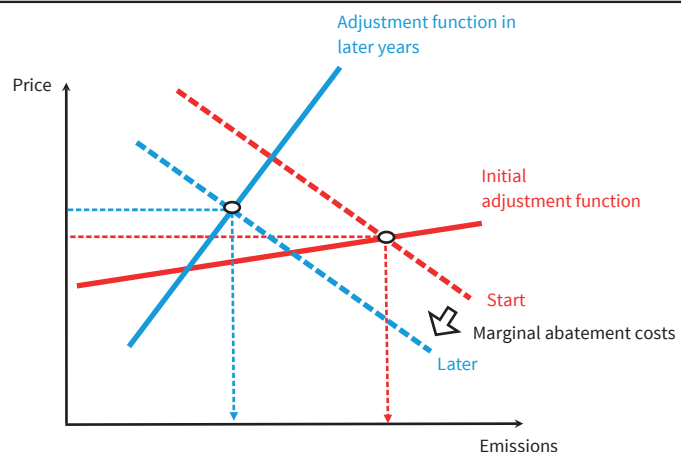
<sup>12</sup> See Newell and Pizer (2003) and Hoel and Karp (2002) for this result on CO<sub>2</sub> regulation. Karp and Traeger (2018) show that when technical progress is made, price stabilization should be somewhat less important than traditionally assumed, but even then, a full shift of uncertainty to consumers and companies is not efficient.

cap in order to avoid excessively large deviations from the targets set for 2030 or 2050.<sup>13</sup> The gradual decline in flexibility in adjusting emissions gives households and companies time to get used to and deal with higher prices and price fluctuations.

The definition of the form of the adjustment function within each year and its evolution over time is ultimately a political decision. However, the decision-making process could be supported by economic simulation models. The adjustment function could be calculated both for a specific period and over time in a way that the overall costs of achieving the long-term emissions target would be as low as possible. In this way, the adjustment function would be determined according to the best knowledge about current and future abatement technologies and costs. It can also take into account the extent to which other countries implement a comparable CO<sub>2</sub> price in the relevant sectors. This is important if German companies are in competition with foreign ones. The more countries price CO<sub>2</sub>, the less susceptible are companies based in Germany to these concerns about higher prices. If further relief is required for individual companies competing internationally, this could be implemented under the Flexcap in the same way as it is currently done in the EU ETS, with allowances allocated free of charge. In the transport and heating sector, however, the number of companies whose competitiveness is endangered by a CO<sub>2</sub> price may be much smaller than in the manufacturing sector, since mobility and heating are inherently site-specific services. The adjustment functions should already be set today for a foreseeable period, for example up to the target years 2030 or 2050. In this way, regulatory uncertainty can be significantly reduced.

<sup>13</sup> For the year 2030 or 2050, the Flexcap should run through a point that combines the quantity target set by Germany with a price acceptable to society. The slope could be based on the compensation payments due if the quantity target is not reached. Of course, the adjustment function does not have to be linear or symmetrical around the target.

Figure 5  
Increase in Slope of the Flexcap



Source: Authors' illustration.

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## DISCUSSION

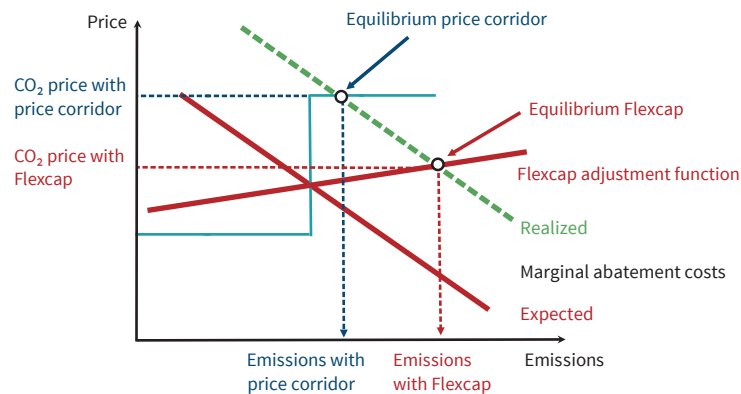
As outlined above, the Flexcap has clear advantages when dealing with uncertainty, compared to a CO<sub>2</sub> tax and a conventional emissions trading scheme. Among the proposals in the public discussion, emissions trading with a price corridor comes closest to the Flexcap. In comparison to a price corridor, a Flexcap reduces the price uncertainty for companies and consumers at all times, and thus irrespective of the level of price fluctuations (see Figure 6). The adjustment

function automatically determines how many certificates are made available to the market. In this way, a surplus of certificates does not remain in the system after a short-term price increase, but is gradually withdrawn from the market by automatically auctioning fewer certificates in future auctions. In an emissions trading system with a price corridor, this is usually the case only if allowances are bought back by the state. The German government's decision leaves open whether this would be the case in the planned German emissions trading system.

A Flexcap does not require active management and therefore incurs only low implementation cost. Since companies are aware of the current and future shape of the adjustment function, regulatory uncertainty is low. The danger that a Flexcap system develops in a way that is undesirable and thus creates political pressure for a change of rules is less than in case of a CO<sub>2</sub> tax or an emissions trading scheme with a fixed cap. The tax has to be re-adjusted if the climate targets are missed by too much, and a simple emissions trading system runs the risk that prices will not meet expectations. For this reason, significant corrections have been made to the EU ETS several times in recent years. The Flexcap draws on these experiences and reduces the risk of subsequent adjustments to the rules, thus increasing planning security for companies. Consequently, such a flexible system means a clear location advantage over countries with a pure CO<sub>2</sub> tax system or a pure emissions trading system.

We refer to Karp and Traeger (2020) for the discussion of the effects and neutralization of potential market power in Flexcap as well as the discussion of “banking,” i.e., the storage of certificates. A German Flexcap for the non-ETS sectors would already include a sufficient number of market participants, so market power should not be expected. Since the adjustment function dampens the extent of uncertainty, for example from economic fluctuations, this

Figure 6  
Flexcap



Source: Authors' illustration.

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takes care of a key argument for the transferability of certificates to future years (banking). For this reason, our proposal is to issue certificates valid for a specific calendar year and not to allow banking.<sup>14</sup> The German government's decision does not address the question of whether certificates can be transferred to future years.

Compared to this system to be implemented, the Flexcap would offer a more efficient solution that simultaneously tracks price and quantity targets and could avoid the already planned system changes and readjustments. It remains to be seen in which system and at what price the federal government will achieve its 2030 quantity target. This creates uncertainty for planning which, combined with low initial prices, can have a negative impact on investment and innovation. With the introduction of the Flexcap, Germany could establish itself as an innovative model for a better system of emission pricing, and thus for a more cost-effective achievement of long-term climate policy goals.

For an expansion at the EU level, it is important to note that the Flexcap is not a tax. Therefore, it would not fall under the unanimity requirement of the Lisbon Treaty. Even in Germany, the legal basis for the introduction of a de facto tax, as planned for the years 2021–2025, has not yet been definitively clarified.<sup>15</sup> Should the Flexcap be applied at the EU level in the medium term, the implementation hurdles would correspond to those of a modification to

<sup>14</sup> In emissions trading with a fixed cap, banking means that the expected price development over the entire banking horizon is based on the market interest rate (Silbye and Sørensen 2019). This is generally not optimal and can lead to considerable regulatory uncertainty if the details of subsequent phases are not known.

<sup>15</sup> Germany's Basic Law does not provide for direct taxation of CO<sub>2</sub> emissions (Article 106 GG). An emissions trading scheme that limits the quantity of allowances and thus forms the price on the market has already been classified as constitutional (e.g., 1 BvR 2864/13). However, this is not the case in the federal government's 2021–2025 proposal (and, strictly speaking, not in the subsequent emissions trading with price corridors). In our Flexcap proposal, the price of the previous period fixes the quantity of allowances to be auctioned and the price forms on the market.

the existing emissions trading system. It would be considerably more transparent and effective than the market stability reserve (Perino 2018), whose first review is scheduled for 2021, with others to follow every five years. If the currently planned German system does not pass potential judicial contests, the introduction of a Flexcap in Germany and its subsequent transfer to EU emission trading would be a realistic option.

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