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UNIVERSITÄT ZU KÖLN

POLICY BRIEF 2/3

WHICH PRICE SHOULD CARBON EMISSIONS HAVE?

KEY TAKEAWAYS

- *Carbon pricing is a policy option to compensate for the external costs from carbon emissions, hold polluters accountable and mobilize resources against climate change.*
- *The Social Cost of Carbon (SCC) method monetizes carbon cost externalities and societal losses associated with firms' economic activities, while the estimated Abatement Cost (AC) method reflects near-term transition costs.*
- *Survey evidence indicates preferred carbons price levels of 120 and 250€ per tonne of CO_2, depending on the materiality perspective adopted by stakeholders.*

WHAT IS THE JUST-PROFIT PROJECT?

The objective of the "Just Profit" research project is to assess policy options on how to integrate the costs of greenhouse gas emissions into existing financial accounting and disclosure rules. Current approaches to align financial resources with the Paris-objective of limiting global warming to 1.5°C focus on charging some polluters for their emissions (carbon pricing) and/or promoting transparency about corporate carbon footprints (carbon disclosure). Our project evaluates monetization approaches that combine carbon disclosure and pricing elements. Such approaches translate corporate "carbon footprints" into "monetary footprints" and can be used to merge financial and sustainability reporting by calculating CO_2-adjusted[1] key financial performance indicators (e.g., a CO_2-adjusted EBIT). As illustrated, such an adjustment has two main components: the scope of the emissions and the price per tonne of emission.

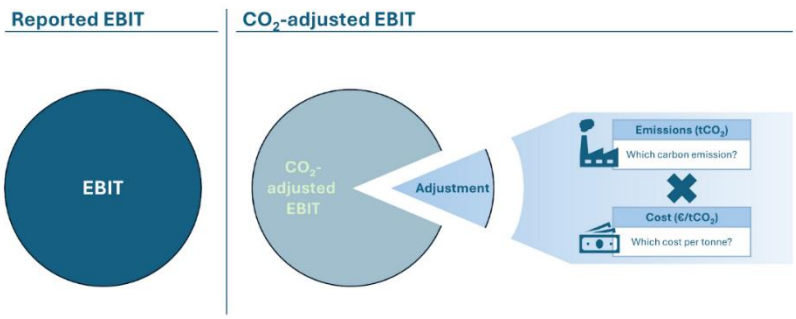

Figure 1 - Basic Adjustment Framework for a CO_2-adjusted EBIT

[1] For simplicity, the name of the KPI is referring to CO_2 emissions only. However, from a conceptual perspective, it is intended to include all types of GHG emissions, not only CO_2 emissions.

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THE CHALLENGE OF PRICING CARBON EMISSIONS

Putting a price on carbon emissions through actual or fictional payments is a key instrument to address climate-related financial implications. Yet, making polluting firms pay requires an adequate pricing of emissions. Whether 10, 50 or 200€ per tonne of CO_2 is appropriate depends on what decisionmakers want to achieve (conceptually) and whether the chosen approach is feasible (in practice). The IPCC emphasizes the importance of these pricing mechanisms in aligning corporate and governmental policies with the Paris Agreement temperature targets. To be effective, carbon pricing must reflect the true external costs of greenhouse gas (GHG) emissions, including their impact on ecosystems, human health, and economic stability. Thus, achieving net-zero emissions requires a combination of cost-effective abatement strategies and robust pricing mechanisms that incentivize low-carbon investments.

Current pricing methods fall into two categories: The Social Cost of Carbon (SCC) measures the climate change contribution of a firm. It represents a monetary equivalent of environmental and societal welfare losses. To estimate the SCC, researchers must possess a deep understanding of the multiple climate impact channels of carbon emissions. The Abatement Cost (AC) method measures relative market cost differences between the use of carbon-intensive and carbon-neutral technologies. The AC method reflects expected near-term costs associated with local emission reductions in the transition to a greener economy. Yet, the AC approach tends to overlook systems interactions, non-market barriers to change and long-term implications of net-zero trajectories. In this brief, we compare science-based reference prices, the conceptual underpinnings, the compatibility with GAAP as well as stakeholder preferences of SCC or AC methods to price corporate carbon emissions. The following table indicates science-based reference prices for SCC and AC estimated by policy and academic research:

Social Cost of Carbon (SCC)	
German Environment Agency (2024)	The German Environment Agency estimates climate-related SCC at 300€ per tonne of CO_2 for 2024 emissions and at 435€ per tonne of CO_2 for 2050 emissions using a 1% discount rate. Without time preference these figures are adjusted upwards to 880€ per tonne of CO_2 and 1080€ per tonne of CO_2 (German Environment Agency 2024).
Rennert et al. (2022)	Evidence for the sensitivity of SCC estimates to discounting assumptions, e.g., 170.2€ per tonne of CO_2 at 2% versus 73.6€ per tonne of CO_2 at 3%, are given by a widely cited Nature study by Rennert et al. (2022).
Environmental Protection Agency (2023)	Recommendations for lower discounting rates have been adopted by policy institutions such as the US EPA, which increased its SCC recommendation from 50€ per tonne of CO_2 to 174.8€ per tonne of CO_2 in line with a 2% discount rate (EPA 2023).
Abatement Cost (AC)	
IPCC (2022)	The IPCC recommends global carbon prices of 202.4€ per tonne of CO_2 by 2030 and 579.6€ per tonne of CO_2 by 2050 based on estimated AC to reduce emissions in line with the 1.5°C objective of the Paris Agreement (IPCC 2023).

IEA (2023) Rekker et al. (2023)	The International Energy Agency estimates that a rise in carbon prices from 128.8€ per tonne of CO_2 in 2030, to 188.6€ per tonne of CO_2, to 230€ per tonne of CO_2 is needed for net zero in advanced economies (IEA 2023). The availability of cost-effective abatement options is sector- and technology-specific. Estimates for the chemicals industry indicate a median affordable abatement cost level of 429€ per tonne of CO_2, although a carbon price of 50€ per tonne of CO_2 could already reduce emissions if process heating could be electrified (Rekker et al. 2023).

THE SOCIAL COST OF CARBON (SCC) METHOD

The objective of the SCC approach consists in estimating climate-related costs based on external damages and welfare losses induced by a tonne of CO_2. It represents a firm's climate change contribution as an estimate of future costs and global impact. A key strength of the SCC approach is its ability to monetize climate impacts, allowing stakeholders to understand the economic value of damages caused by carbon emissions, which facilitates a quantifiable assessment of trade-offs between economic activities and environmental repercussions (German Environment Agency 2021). By following the polluter-pays principle, the SCC reallocates external costs to emitters, ensuring compensation to affected third parties and future generations (European Commission 2021). It aims to correct aggregate costs to align individual behaviors with broader societal well-being, thus addressing the "tragedy of the commons" (Meadows et al. 2018). However, there are also limitations. For instance, its reliance on normative assumptions that can greatly affect the resulting estimates. These include assumptions related to discounting choices and the specification of non-linear cost functions (Rennert et al. 2022). While the SCC effectively evaluates the climate impacts of carbon-intensive goods and services, it also lacks the capacity to suggest alternative solutions for mitigation. In addition, tracing the causal pathways of climate impacts remains complex, complicating efforts to quantitatively assess the broader effects of carbon emissions on systems like agriculture and migration (EPA 2023).

THE ABATEMENT COST (AC) METHOD

The objective of the AC method consists in estimating the costs to reduce emissions by one additional tonne. It underpins carbon taxes and emission trading schemes, helping to balance price differences, to raise the competitiveness of clean technologies and to achieve climate targets. A key strength of the AC method is economic efficiency. By computing carbon prices just high enough to incentivize emission reductions, carbon pricing instruments based on the AC method ensure that CO_2 emissions are curtailed when the individual benefits exceed associated abatement costs. By leveraging marginal abatement cost curves, policymakers can forecast aggregate cost trajectories along the transition to a low-carbon economy, considering variations across countries, industries, and technologies. However, the AC approach is not without its critiques. Its emphasis on marginal costs can lead to a narrow focus on short-term solutions, often neglecting the need for radical and transformative innovations necessary for abatement

in high-emission sectors. Furthermore, the AC method tends to exhibit overestimation bias by overlooking intersectoral dependencies and non-monetary barriers to change, thus frequently exaggerating the potential for emission reductions at specific carbon prices. Finally, the AC approach's effectiveness hinges on comprehensive and detailed informational requirements regarding technological characteristics and context-specific information to accurately predict transition costs (German Environment Agency 2018, 2021).

SURVEY EVIDENCE

We asked investors and other stakeholders about their preferences regarding the methodological approach and level of evaluation for carbon prices. For our survey among overall 495 participants, we find that participants prefer market-related and regulatory prices to integrate carbon costs. Specifically, 32% of survey participants prefer a price of 45€ aligned with German legislation, and 43% favor a price of 66€ as exhibited under the EU ETS. In contrast, only one out of four participants prefer pricing schemes that reflect the social costs of carbon, such as the estimation by the FEA of 254€ per tonne of CO_2 (see figure 2).

Figure 2 - Should the CO_2-adjusted EBIT be based on the estimated social costs of a tonne of CO_2 or on CO_2 pricing instruments (e.g. emissions trading scheme, CO_2 tax) for monetization?

We also asked participants about what they consider an appropriate cost level for one tonne of CO_2 emitted. Consistent with prior stated preferences, stakeholders choosing the social cost prefer substantially higher prices (average: 279.35€; median: 250€) than those favoring market-related prices (average 124.6€; median: 120€). Similarly, respondents who tend to take an impact-oriented perspective tend to support higher prices near the social costs of carbon (average: 196.06€; median: 170€) than those who adopt a financial materiality perspective (average: 140.84€; median: 120€). Notably, the median market-related prices preferred by participants exceed current levels observed at the EU level or implemented in most member states. This observation confirms predictions that stakeholders anticipate increased market-based carbon prices amid a tightening of the policy environment in the near- to mid-term.

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