Foundation for
Family Businesses

SFU KOMPAKT: Brief study 1 | 2026

How can CBAM work?

Options for improving Europe's carbon border adjustment mechanism

Prof. Gabriel Felbermayr, PhD
Dr Hendrik Mahlkow
Isabel Pham, MSc
Dr Robin Sogalla
Prof. Joschka Wanner

Key findings

- The EU aims to reduce its CO_2 emissions by 55% by 2030 compared with 1990 levels, and by 90% by 2040 relative to 1990. To achieve these ambitious climate targets, the volume of available emission allowances will have to be drastically reduced in the coming years. This will lead to a sharp rise in the price of these emission allowances. According to our simulation model, the price would climb from the current rate of 80 euros per tonne of CO_2 to 125 euros in 2030 and, barring any technological advances, to as much as 520 euros in 2040.
- Despite the increasing electrification of the EU economy, energy prices will rise significantly. This is because, under the current electricity market design, electricity prices increase as long as fossil fuel power plants are still required to cover electricity demand.
- It is not to be expected that the EU's trading partners will face similarly high CO_2 prices and energy costs. This may lead to the relocation of energy-intensive companies, accelerated deindustrialisation, and a reduction in the effectiveness of European climate policy with regard to global emissions.
- A mechanism is therefore required to offset the negative effects of European CO_2 pricing on competitiveness. To this end, the EU has proposed a carbon border adjustment mechanism (EU CBAM).
- However, CBAM entails high information requirements and therefore considerable administrative costs, which force compromises. So far, it only covers a small number of particularly CO_2-intensive products such as steel, cement and fertilisers. As a result, industries that use these goods as inputs are burdened and forced to relocate. In addition, CBAM is applied only to imports, meaning that the competitiveness of exporters is not preserved. Trading partners have also threatened retaliatory tariffs.
- Until the information problem is solved, the EU should use alternative instruments that involve lower administrative costs. This brief study presents two options.
- Option 1: A uniform levy on imports combined with a subsidy for exports, thereby exactly offsetting the trade effects of CO_2 pricing. The calculation does not require information on the CO_2 intensity of foreign production. Its advantages lie in reduced information requirements, lower administrative burdens and the full inclusion of both imports and exports. The disadvantages include a lack of incentives for foreign producers to reduce emissions, still high information requirements and a substantial risk of retaliation by trading partners.
- Option 2: Continued allocation of free certificates to CO_2-intensive industries under the emissions trading scheme (ETS), combined with a levy on the final consumption of the affected goods, regardless of their origin. This approach would be unbureaucratic, WTO-compliant and effective from a climate policy perspective. It has the lowest probability of retaliation and would be well suited as a transitional solution. Based on simulation results, this approach is recommended because, compared to the other options, it minimises production losses resulting from higher CO_2 prices in the EU. The revenues generated should be used to promote climate-neutral production.
- **It is crucial that CBAM is able to fulfil its purpose. If it fails, the resulting deindustrialisation could discredit CO_2 pricing as such, causing it to be replaced by more costly and less effective regulation. A well-thought-out CBAM therefore also protects the market-based approach to climate policy in the EU.**

55%
CO_2 reduction within the EU by 2030 compared to 1990

90%
CO_2 reduction within the EU by 2040 compared to 1990

CBAM:
High information requirements and considerable bureaucratic costs make compromises unavoidable.

125 euros/t CO_2

in 2030 within the EU

520 euros/t CO_2

in 2040 within the EU

Introduction

The EU's climate policy relies primarily on CO_2 pricing. However, contrary to initial hopes, other major economies have so far imposed no or only very low CO_2 prices. This puts pressure on European industry – and the higher the prices in the EU climb, the greater this pressure becomes. There are fears that producers of energy-intensive goods could relocate to countries with low or no CO_2 pricing, which would lead to deindustrialisation in the EU and additionally weaken the positive impact on the global climate, as production outside the EU is more carbon-intensive than domestic production. To ensure that its unilateral climate policy does not adversely affect foreign trade, the EU has developed a carbon border adjustment mechanism (CBAM), which is being phased in gradually from January 2026 onwards. While the motivation behind this instrument is sound, the plans to date – as is often the case – are not yet convincing.

Ideally, a CBAM would level out international differences in CO_2 pricing in the same way as the tried-and-tested approach that is used for value added tax. Imports are subject to domestic tax, while exports are exempt. This creates a non-discriminatory, competition-neutral environment for foreign trade. The problem with CO_2 pricing, however, is that the basis for calculating this offset – that is, the CO_2 content of the traded goods – cannot be easily determined.

Europe's ambitious climate policy hinges on whether carbon border adjustment truly fulfils its purpose.

For the sake of operational feasibility and to ensure compliance with international trade law, the EU has made significant compromises in the design of CBAM compared to an ideal system. As a result, there is no relief for European companies on the export side. Meanwhile, on the import side, only the largest importers of certain basic materials are included, which increases costs for producers in downstream sectors without there being any offsetting.

Without effective border adjustment, the increasing burdens resulting from the EU's unilateral CO_2 pricing could lead to the deindustrialisation of Europe. This could weaken support for the market-based model of Europe's climate policy and lead either to the EU abandoning its climate targets or to the use of inefficient, non-market-based instruments. Both would be disastrous. It is therefore crucial that the border adjustment mechanism is designed in such a way that it is actually able to fulfil its purpose.

The EU's climate policy

CO_2 emissions in Europe and emission reduction plans

Europe has drawn up ambitious plans to phase out the combustion of fossil fuels. It aims to reduce emissions to 45% of the 1990 baseline level by 2030 and to 10% of that level by 2040.

The figure below presents historical CO_2 emissions in the EU and Germany from 1990 to 2023 (solid line) and the linear trend over this period extrapolated to 2030 (dotted line). As can be seen, both the EU and Germany have significantly reduced their emissions since 1990. In 1990, Germany accounted for 4.6% of global emissions and the EU27 for 17.0%; by 2024, these shares had fallen to 1.6% and 6.6% respectively, partly due to increased emissions in the rest of the world. However, if the EU is to achieve its "Fit for 55" target in 2030, CO_2 emissions must fall even further than the continuation of this linear trend suggests. This is illustrated by the second dotted line following the historical data, which assumes a linear reduction path towards the "Fit-for-55" target in 2030.

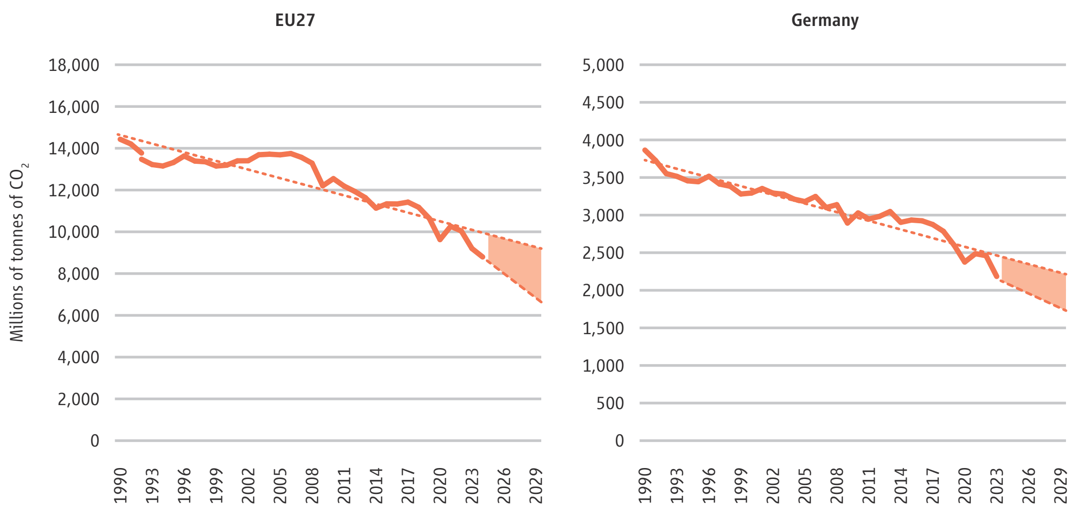


Figure:
CO_2 emissions in the EU are to be reduced to 55% of 1990 levels by 2030.

Source: Carbon Budget Project. Own calculations and illustration.

The figure presents historical CO_2 emissions in the EU and Germany in millions of tonnes of CO_2 from 1990 to 2023 (solid line) and the linear trend over the same period extrapolated to 2030 (dotted line).

The dotted line following the historical data (from 2023 onwards) represents a 55% reduction in emissions relative to 1990 by 2030.

Whether this unilateral policy by the EU and its member states is an appropriate means of addressing the global problem of climate change will be left open at this point. For the purposes of this study, the EU's target is taken as a given. Also taken as a given is the EU's approach of reducing emissions through price incentives.

The European Union Emissions Trading System

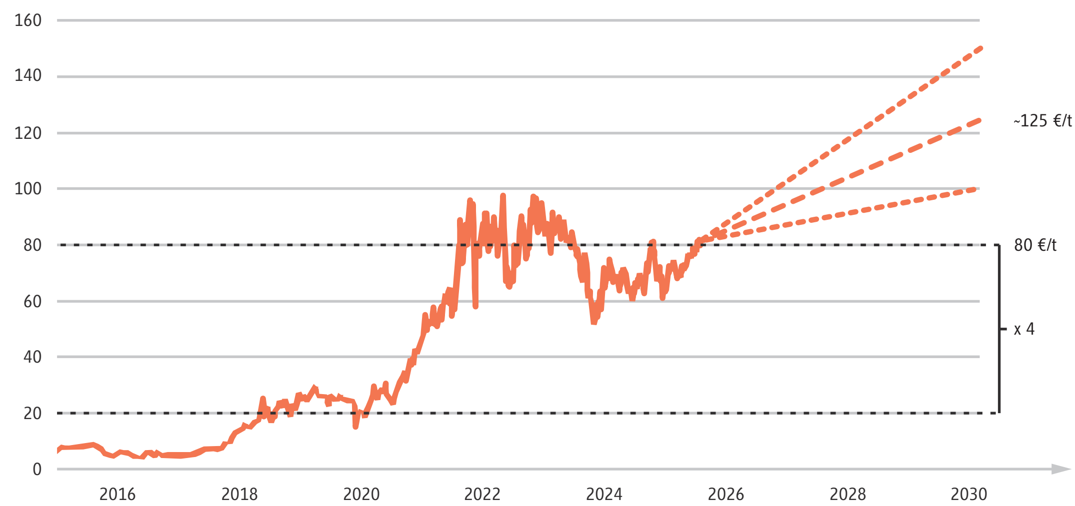
A central pillar of Europe's climate policy is to impose a price on climate-damaging emissions, thereby creating incentives for reduction efforts. This approach is implemented through a cap-and-trade system, in which a limited and annually decreasing number of emission allowances is auctioned off. For every emission of CO_2, corresponding allowances must be surrendered. Because the number of certificates is limited, they have a positive price. The tradability of the certificates means that decarbonisation is prioritised in those sectors and companies where it can be achieved at the lowest cost. Therefore, there is almost unanimous agreement among researchers that the European Union Emissions Trading System is a highly efficient instrument and should be expanded further.

In 2005, when the EU implemented its Emissions Trading System 1 (ETS1), which initially covered electricity production and industry, there was hope that other countries would also meet their climate policy commitments with the help of market-based pricing mechanisms. This hope remains unfulfilled. According to surveys by the World Bank, around 28% of global CO_2 emissions are currently subject to pricing, either via emissions trading or CO_2 taxes.[1] While the CO_2 price under the EU's ETS1 currently stands at around 80 euros per tonne, the price in other countries is significantly lower, for example around 10 euros per tonne in China. Furthermore, according to the World Bank, only 3.2% of global CO_2 emissions currently have a price attached to

The EU CO_2 price in ETS1 currently stands at **80 euros/t** and would increase to **125 euros/t** in 2030

1 The World Bank provides up-to-date information at carbonpricingdashboard.worldbank.org/.

Figure:
The EU CO_2 price in ETS1: historical and projected until 2030 (euros per tonne)



Source: Eurostat and model projection. The graph shows the average expected CO_2 price for 2025–2030 and trends based on extremely optimistic and pessimistic assumptions.

them; around three-quarters of these through the EU ETS1 and the rest mainly through CO_2 taxes in the European transport and housing sectors. Overall, the average CO_2 price in countries with CO_2 pricing is around 6 euros per tonne; the global average is around 1.7 euros.

In the early years of ETS1, the price of the certificates was very low; it was not until the third phase of the system (2013–2020) that emission allowances were auctioned off and their supply further reduced. Their price has risen gradually from around 5 euros per tonne in 2017 to an average of around 25 euros per tonne in 2019, peaking at 105 euros per tonne in March 2023, and currently standing at around 80 euros per tonne. In 2027, the current national CO_2 taxes in the housing and transport sectors will be transferred to an emissions trading scheme linked to ETS1.

To achieve the EU's climate targets – a 55% reduction in CO_2 emissions by 2030 and a 90% reduction by 2040, in each case relative to the 1990 baseline – by means of the CO_2 price under the emissions trading scheme, the price (assuming unchanged technology and with no other accompanying measures) would have to rise to 125 euros per tonne and 520 euros per tonne respectively.

The problem of leakage

CO_2 prices for industry and electricity generation in the EU are currently many times higher than those of the EU's trading partners. This discrepancy could become even more pronounced because the further reduction in emission allowances and the inclusion of the housing, transport and small business sectors in the EU will exert upward pressure on prices, while emission prices abroad are likely to remain lower. As a result, CO_2-intensive production – and thus also the associated emissions – could be relocated from the EU to third countries where CO_2 prices are low or non-existent, a phenomenon known as carbon leakage.[2]

The figure below shows the historical development of territorial emissions in the EU and Germany caused by domestic production of tradable and non-tradable goods (in orange). It also depicts the CO_2 emissions associated with domestic consumption (both private consumption and investment), regardless of whether these emissions were generated domestically or abroad (in green). Calculating this footprint is not straightforward, as it requires information on the international supply chains of all goods manufactured domestically or imported. As can be seen, the carbon footprint of domestic consumption is significantly larger than the territorial emissions from domestic production. This means that domestic consumption causes considerable emissions abroad. In other words, both the EU and Germany

2 See, for example, the overview in Felbermayr, G., Peterson, S. and Wanner, J. (2024), Trade and the environment: Trade policies and environmental policies – How do they interact? Journal of Economic Surveys 39(3): 1148–1184.

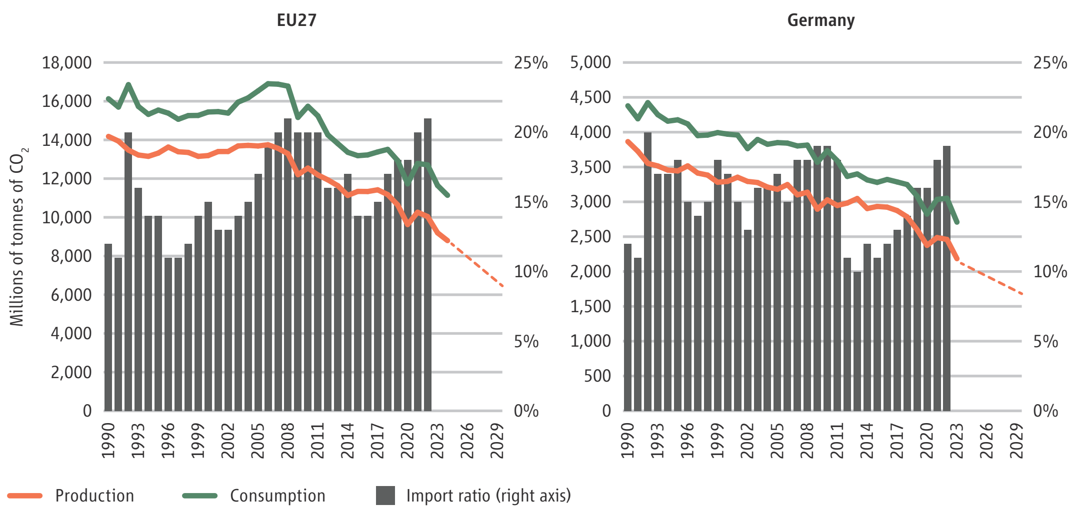


Figure:
Territorial CO_2 emissions (in million tonnes), carbon footprint (in million tonnes) and imported emissions (in %)

Source: Eurostat and model projection.

The figure shows the development of territorial emissions in millions of tonnes of CO_2 in the EU and Germany caused by domestic production (in orange) or included in domestic consumption (in green).

are clearly importers of CO_2-intensive goods. This fact is noteworthy because both Germany and the EU are net exporters of goods and services, and hence of resources such as labour and capital, but are apparently net importers of CO_2. The grey columns in the figure show that the share of imported emissions in the domestic carbon footprint has risen significantly in recent years, which indicates that net CO_2 imports have increased. This is consistent with the view that CO_2-intensive production is increasingly moving abroad, although strictly speaking it is not evidence of carbon leakage, because net imports of CO_2 can also have reasons other than CO_2 pricing.[3]

Rising CO_2 prices in Europe come up against a world without comparable pricing – a dangerous breeding ground for carbon leakage and deindustrialisation.

With a view to reducing relocation, the EU has supported domestic industry with freely allocated certificates ever since the inception of the ETS. When the number of emission allowances in circulation is sufficiently limited, the price of the certificates is positive. This means that even companies receiving free allowances have an incentive to reduce their emissions, whilst their cost base remains capped. However, as the number of certificates in the ETS is progressively reduced in line with the emission reduction pathways, the free allocation strategy is becoming increasingly difficult to implement. Therefore, another instrument is needed to maintain the international competitiveness of European producers. An EU border carbon adjustment mechanism is intended to fulfil this task.

Carbon border adjustment

An ideal border adjustment regime

Variations in excise duty rates between countries are common, even within the EU. To prevent such discrepancies from distorting cross-border competition, international trade law allows for border adjustment measures. The most important example of this is value added tax (VAT): exports are exempt from domestic VAT, while imports are subject to

3 For example, (intertemporal) leakage may also arise from the mere announcement of future climate policy measures: Today's CO_2 emissions are rising because fossil fuel producers are increasing production volumes to compensate for the expected decline in future revenues. This phenomenon is also known as the "green paradox" (Sinn, 2012).

domestic taxation. This means that, regardless of where a good originates, it is always subject to the same tax rate domestically. As a result, there is no incentive to produce goods in countries where the tax is lowest. Foreign producers are treated in the same way as domestic producers. Thus, the principle of national treatment, a central provision of the General Agreement on Tariffs and Trade (GATT), applies.[4]

In principle, a similar system is conceivable as a means of offsetting CO_2 prices: for imports, it is necessary to purchase emission allowances based on the amount of CO_2 contained in the goods; for exports, the CO_2 taxes paid during the production process are refunded. This means that all producers, whether domestic or foreign, pay the same CO_2 price in the country in question. Under this system, what was originally a production tax becomes a consumption tax. Decisions by manufacturing companies on where to locate their operations are no longer distorted. In addition, this allows the EU to create incentives for other countries to reduce their CO_2 emissions, so that they have to present fewer emission allowances when exporting to the EU.

An ideal carbon border adjustment creates fair competitive conditions – but its implementation is hampered both by the difficulty of measuring the CO_2 content of imports and by international rules.

However, in order to implement this adjustment mechanism, the CO_2 content of imported and exported goods must be known, as this forms the basis for pricing. In the case of value added tax, the value of the goods stated on the invoice is sufficient. For carbon border adjustment, on the other hand, it is necessary to know the CO_2 emissions generated throughout the entire production process. To ensure compliance with the GATT principle of national treatment, and thus conformity with international law, the basis for pricing must be determined objectively and with legal certainty. But this is not entirely feasible.

Even if these data-related challenges are overcome, border adjustment would lead to a loss of control over domestic territorial emissions. This is because the European cap-and-trade system would then limit emissions caused by domestic consumption, regardless of where they originate, rather than domestically generated emissions. Although this is the only appropriate approach – because in terms of global climate change it is irrelevant whether the emissions originate in Europe or elsewhere – international agreements have focused on territorial emissions ever since climate policy first emerged in the 1990s. If the EU is truly serious about border adjustment, it must advocate internationally for a departure from this practice. Doing so would mean admitting that the EU is responsible for significantly higher emissions than is evident from recording purely territorial emissions.

The EU model of carbon border adjustment: CBAM

To avoid breaking WTO law, the EU decided it would justify CBAM not on the basis of Article III GATT, but based on Article XX GATT, which allows for a departure from national treatment if this is *"necessary to protect human, animal or plant life or health"* and the measure is expedient and proportionate. However, this rules out refunds in export business, as these would lead to higher harmful CO_2 emissions domestically.

In addition, the EU is limiting the border adjustment to a small set of basic materials that are particularly CO_2-intensive and relatively uncomplicated to produce. The sectors affected are iron and steel, aluminium, cement, fertilisers, electricity and hydrogen. Furthermore, according to Omnibus Package I (COM(2025)87), only major companies that import large quantities (more than 50 tonnes per year) of these basic materials have to surrender emission allowances to offset the emissions associated with their imports.[5] This means that only the top 10% of importers are affected, while the remaining 90% of declarants currently subject to reporting requirements would no longer fall within the scope of CBAM. This is intended to reduce the administrative burden of border adjustment. Although this goal is achieved

4 National treatment in accordance with Art. III GATT (General Agreement on Tariffs and Trade). GATT is a central component of the World Trade Organisation's (WTO) legal framework.

5 See https://www.dehst.de/DE/Themen/CBAM/CBAM-Omnibus/cbam-omnibus_artikel.html for the threshold value.

by the restrictions, there is some question as to whether such significant departures from the ideal CBAM model in fact undermine the effectiveness of the entire system.

EU CBAM includes simplifications based on mass and size. Only major companies that import large quantities will continue to be affected.

Since October 2023, European importers have been required to submit quarterly reports on the goods they import and the embedded CO_2 emissions they contain. They are not required to make any payments; it is purely a reporting obligation. As of January 2026, CBAM certificates must be purchased and surrendered to cover the CO_2 emissions contained in imported goods. This obligation will be phased in, starting at 2.5% of the affected emission volumes and gradually increasing to 100% in 2034, mirroring the gradual phase-out of free allocations in the EU Emissions Trading System (EU ETS).

Alongside the major administrative hurdles involved in recording CO_2 emissions along supply chains, the proposed carbon border adjustment mechanism (CBAM) suffers from a number of other problems:

Problem 1: Non-inclusion of exports

Under the proposed CBAM, European exports will not be exempt from the CO_2 costs incurred in their production. If there are no corresponding CO_2 prices abroad, European manufacturers will fall behind and lose market share. Foreign producers, whose production is on average more CO_2-intensive, will fill the gap. As a result, emissions in the rest of the world will rise, despite domestic emissions falling. This can be prevented by including exports in CBAM; however, this will generally lead to an increase in domestic emissions, as export-oriented production will no longer be subject to CO_2 pricing.

Problem 2: Incomplete coverage of imports

If, as planned, only certain particularly CO_2-intensive products (basic materials such as steel, iron, aluminium, cement and fertiliser) are subject to the European CO_2 price when imported, the prices of these goods in the EU will rise. Industries that use these basic materials as inputs thus face higher costs and are at a disadvantage compared to producers abroad, where CO_2 prices are lower (or non-existent) and basic materials are therefore less expensive. This creates the risk of downstream goods production being relocated abroad and import volumes increasing. This kind of leakage (relocation of production) might prove more challenging for the economy than that of basic materials, because the depth of domestic value creation in downstream production is greater and the goods involved are more technologically advanced. Emissions in the rest of the world could rise, while domestic economic output could fall.

There are many examples of this problem: if urea were to become more expensive in the EU as a result of CBAM, synthetic resin and glue would also become more expensive. These inputs are central to the manufacture of chipboard, which could cause this industry to relocate abroad. Another example is steel: if CBAM were to make steel more expensive in the EU, this would put pressure on the steel processing industry, for example, the production of furniture fittings, in both the domestic and foreign markets. If steel used to manufacture forklift forks in the EU became more expensive due to CBAM, CO_2 pricing could drive not only steel production but also the manufacture of forklifts (and many other steel-using products) away from the EU. This would put EU industry in an even worse position.

Problem 3: Reshuffling in the countries of origin

The reshuffling problem occurs when foreign companies systematically use "clean" electricity (e.g. produced without CO_2 emissions) for exports to the EU and "dirty" energy for sales in other markets. This reshuffling does not actually reduce average CO_2 emissions abroad; at best, the energy mix remains constant. It can even get worse if overall production increases and the extra energy needed for this is not produced with zero CO_2 emissions. This ability to reshuffle takes away the incentive for foreign companies to decarbonise their production. One way to avoid reshuffling at a company level is to use country averages as the measurement basis for CBAM. However, this reduces the incentives at a country level to decarbonise foreign production. In addition, this also jeopardises WTO compatibility.

Problem 4: Retaliation by trading partners

The EU's unilateral supply chain regulation is meeting with resistance from some trading partners, mainly because they fear higher non-tariff trade barriers for their exports to the EU. For example, 17 countries in the Global South have lodged a formal protest against the EU's deforestation regulation.[6] Qatar is threatening to cut off liquefied gas supplies if the EU's supply chain due diligence legislation is enforced.[7] Furthermore, US President Trump has already announced that he would not accept climate tariffs on US exports.[8] So there is a risk of countermeasures that could make the application of CBAM more expensive for the EU. In addition, the EU is having to adopt simplifications in the implementation of CBAM that are not compatible with Art. XX GATT, thus increasing the likelihood that rulings will be made against it in WTO courts and giving trading partners legitimate grounds to consider retaliatory measures. However, there is also good news: some major emitters, such as Brazil and Turkey, are discussing the introduction of a CO_2 price, partly as a consequence of EU CBAM. To minimise the likelihood of retaliatory measures, the EU should therefore apply border adjustment methods which, as far as possible, do not lead to non-tariff trade barriers. This means that the administrative burden on foreign companies should be kept to a minimum.

Two better alternatives

EU CBAM thus suffers from a number of problems intrinsic to its design. While the simplifications afforded by the Omnibus packages – i.e. lowering the thresholds and limiting the scope of application – ease the administrative burden, they leave the fundamental challenges unresolved and reduce the effectiveness of CBAM. We therefore propose two alternatives.

Countervailing duties and subsidies

The first model is based on a proposal by the American trade economist Robert Staiger,[10] which has been taken up and modelled by Campolmi et al.[11] This model is based on the assumption that unilateral CO_2 pricing in the EU is equivalent to an unintended and unagreed subsidy of foreign production, which

6 The Deforestation Regulation is sharply criticised by many countries in the Global South; see, for example, https://www.euronews.com/my-europe/2023/09/20/why-the-global-south-is-against-the-eus-anti-deforestation-law .

7 For information on Qatar, see: https://www.bloomberg.com/news/articles/2025-11-06/eu-signals-flexibility-on-esg-rules-after-threats-from-qatar-us .

8 US Trade Representative Jamieson Greer considers CBAM an unfair trade practice that must be combated (https://x.com/USTradeRep/status/1909326878726365215). In the EU-US "deal" of 27 July 2025, the EU promised "additional flexibilities" for the US with regard to CBAM, although it is unclear what these will consist of.

9 See, for example, https://www.ieta.org/global-reactions-to-the-eu-cbam-2025-report. The EU's CBAM could be a step towards a global climate club; for more on this, see a study by the Scientific Advisory Board of the Federal Ministry for Economic Affairs and Energy (https://www.publikationen-bundesregierung.de/pp-de/publikationssuche/ein-co2-grenzausgleich-als-baustein-eines-klima-clubs-1880032).

can be neutralised by appropriate instruments. It requires significantly less information than an ideal CBAM, allowing the scope of the instrument to be extended to all imports and exports.

Because the instrument is limited to preventing leakage, Campolmi et al. (2025) refer to it as LBAM (**leakage border adjustment mechanism**). LBAM does not discriminate against foreign producers or put them at a competitive disadvantage through administrative burdens. Their position remains the same despite changes in the EU CO_2 price because the costs of European producers are simply offset on a one-to-one basis, regardless of the CO_2 intensity of foreign producers. The system is also compatible with the principles of national treatment (Art. III GATT) and non-discrimination (Art. I GATT). This prevents foreign producers that typically engage in more CO_2-intensive production than their EU competitors from losing market access to the EU as a result of the inclusion of all sectors in the CBAM regime. The idea behind this is as follows: based on its own data, the EU knows to what extent an increase in the CO_2 price will increase the production costs of *all* goods within the EU. Imports of a given good are then subject to an import duty set at a level that keeps import volumes constant despite the higher EU price. This means that importing the good becomes more expensive. To calculate this import duty, it is only necessary to know the domestic CO_2 intensity, not the foreign CO_2 intensity. Additionally, knowledge of domestic import demand elasticities is required. At the same time, EU exports are subsidised to ensure that export volumes remain unchanged despite the higher domestic production costs. This requires knowledge of the foreign demand elasticity for EU exports. Both import duties and export subsidies are unrelated to the specific CO_2 content of the goods concerned and are set at the same level for all partner countries. In effect, this completely neutralises the impact of the domestic CO_2 price on imports and exports. As it is no longer necessary to obtain information on foreign CO_2 intensity, this measure can be extended to many imported goods. Moreover, because the measure is not justified on the basis of Art. XX GATT, European exports can also be included.

Ultimately, this approach prevents unilateral CO_2 prices from leading to an increase in imports and a decrease in exports. This effectively counteracts leakage and reverses the unintended advantage afforded to foreign producers.

By including EU exports and providing broader coverage of EU imports, competitive neutrality can be achieved more effectively than with CBAM.

However, LBAM does not provide any strategic incentives – neither for clean production nor for CO_2 pricing abroad – and is therefore less ambitious in its objectives than EU CBAM.

Excise duty and free certificates

The second alternative to EU CBAM entails the continued allocation of free certificates to producers of CO_2-intensive goods within the EU Emissions Trading System, so that their competitiveness in the domestic and foreign markets is not undermined by rising CO_2 prices. At the same time, the incentives to reduce emissions remain in place because unused certificates can be sold and additionally required certificates must be purchased. This follows the logic of the EU ETS. While the allocation of free ETS certificates will ease the burden on domestic producers of CO_2-intensive goods, it does not necessarily guarantee that consumer prices for CO_2-intensive products will adjust sufficiently to bring about the desired changes in behaviour among domestic end consumers. To achieve the latter objective, Neuhoff et al. (2025a and 2025b) propose imposing a non-discriminatory climate levy (standardised per tonne of material based on the EU ETS) on domestic consumption of certain materials.

This would be a classic excise duty that could be offset at the border. The climate levy would be calibrated in such a way as to neutralise the allocation of free certificates. This mechanism would be non-discriminatory as the same levy would apply regardless of the goods' origin, thus avoiding any complications under WTO law. However, this measure would require careful legal construction to ensure that it does not constitute a classic tax and thus does

LBAM prevents leakage while having lower information requirements

A **climate levy** is the pragmatic middle ground

10 Staiger, R. (2022). A World Trading System for the Twenty-First Century. The MIT Press.

11 Campolmi, A., Fadinger, H., Forlati, C., Stillger, S. and Wagner, U. (2025), Designing Effective Carbon Border Adjustment with Minimal Information Requirements: Theory and Evidence, mimeo: University of Vienna.

+22.3 billion US dollars

of real income with the ideal CBAM by 2040 for Germany

-35.0 billion US dollars

of real income with "no BAM" by 2040 for Germany

+12.9 billion US dollars

of real income with the ideal CBAM by 2040 for the EU

-187.0 billion US dollars

of real income with "no BAM" by 2040 for EU

not interfere with the EU's division of powers. The approach involves minimal administrative burdens because there is no need to determine the CO_2 content of goods in detail for each production process. As with the first alternative, there would be no incentives for emission reductions abroad, and the mechanism would not address domestic emissions by producers but rather the CO_2 emissions generated by domestic consumption. The proposal envisions that the allocation of free certificates would initially be maintained for a longer period than previously planned; however, once free allocation ends, a full CBAM would have to be applied and the climate levy abolished.

Results of the simulations

To evaluate the existing EU CBAM and the two alternative border adjustment mechanisms, all scenarios were simulated using the extended KITE (Kiel Institute Trade Policy Evaluation) model. The following sections present the key findings for Germany and the European Union, as well as the global emissions impacts.

Results for Germany

The production effects in Germany show that the basic materials industries are the most sensitive to the different border adjustment mechanisms. In energy- and emission-intensive sectors such as chemicals and ferrous metals, the declines under an *ideal CBAM* and under *EU CBAM* are significantly lower than without border adjustment, while *LBAM* largely stabilises production but does not protect it completely. In downstream industries such as plastics and paper products, the differences between the scenarios are less pronounced, but here, too, *EU CBAM* and the *ideal CBAM* relieve the burden the most, while the climate levy stabilises production most consistently.

The macroeconomic results confirm this pattern. The different border adjustment designs have significant consequences for the German economy: while the existing EU CBAM reduces the burden only to a limited extent, both the ideal CBAM and LBAM achieve significantly stronger stabilisation effects.

In 2030, the ideal CBAM would increase Germany's nominal income by just under **28.8 billion euros**, while EU CBAM would increase it by **27.2 billion euros**. LBAM would lead to a slightly weaker improvement (**+26.9 billion euros**). Without any border adjustment at all, real income would be down by more than **35.0 billion euros** in 2040.

Real income development also follows this pattern: the ideal CBAM would bring about the strongest improvements, with an increase of **28.9 billion euros (2030)** and **22.3 billion euros (2040)**. EU CBAM also has a stabilising effect, but falls significantly short of the ideal design in 2040. LBAM prevents a deterioration, but remains slightly below the EU CBAM figures in both years.

Customs revenues from CO_2 pricing arise exclusively in scenarios with CBAM elements. Here, the ideal CBAM generates the highest revenues, followed by EU CBAM and LBAM. The differences are due to varying degrees of sectoral coverage and the extent to which exports are included.

Results for the European Union

The basic materials industries also show significant differences between the scenarios at the EU level. Under the ideal CBAM and EU CBAM, production declines for **chemicals, metals and mineral products** are noticeably lower than under LBAM or in the absence of border adjustment. At the same time, LBAM effectively prevents leakage in many of these sectors, albeit at the cost of slightly greater declines in domestic production. In processing industries such as **rubber/plastics and paper**, the differences between the instruments are less pronounced, but here, too, EU CBAM avoids the sharpest declines and keeps value chains more stable than the alternative approaches.

The macroeconomic results mirror this pattern. The ideal CBAM yields the greatest welfare gains for the EU, at **+128.5 billion euros in 2030** and **+201.0 billion euros in 2040**. Although EU CBAM generates lower welfare gains, it stabilises European incomes much more effectively than LBAM or the climate levy. As per its design, LBAM prevents trade diversion but generates lower income gains than a comprehensive CBAM. The climate levy improves the revenue situation but leads to lower real income in the long term. Without any border adjustment, the EU's economic situation deteriorates significantly: real income erosion would reach **-187 billion euros** by 2040, which represents a substantial weakening of overall economic performance.

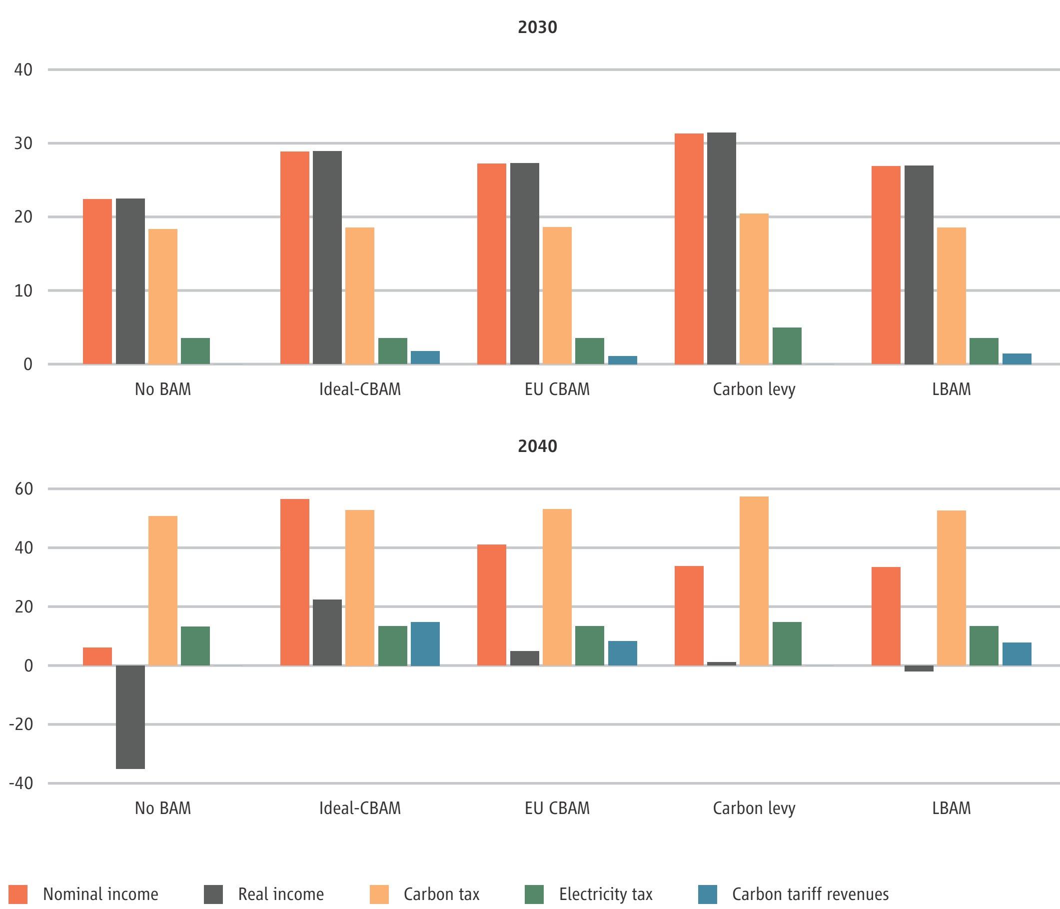
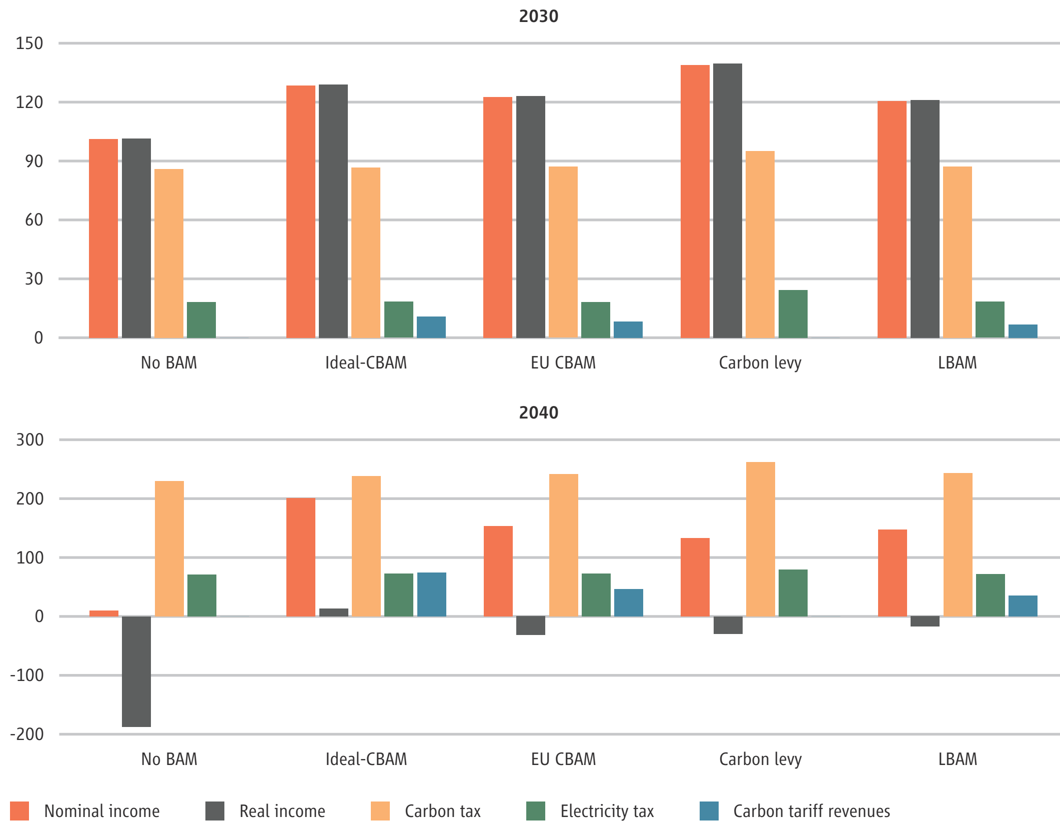


Figure:
Change in national income and taxes in Germany (in billions of euros)

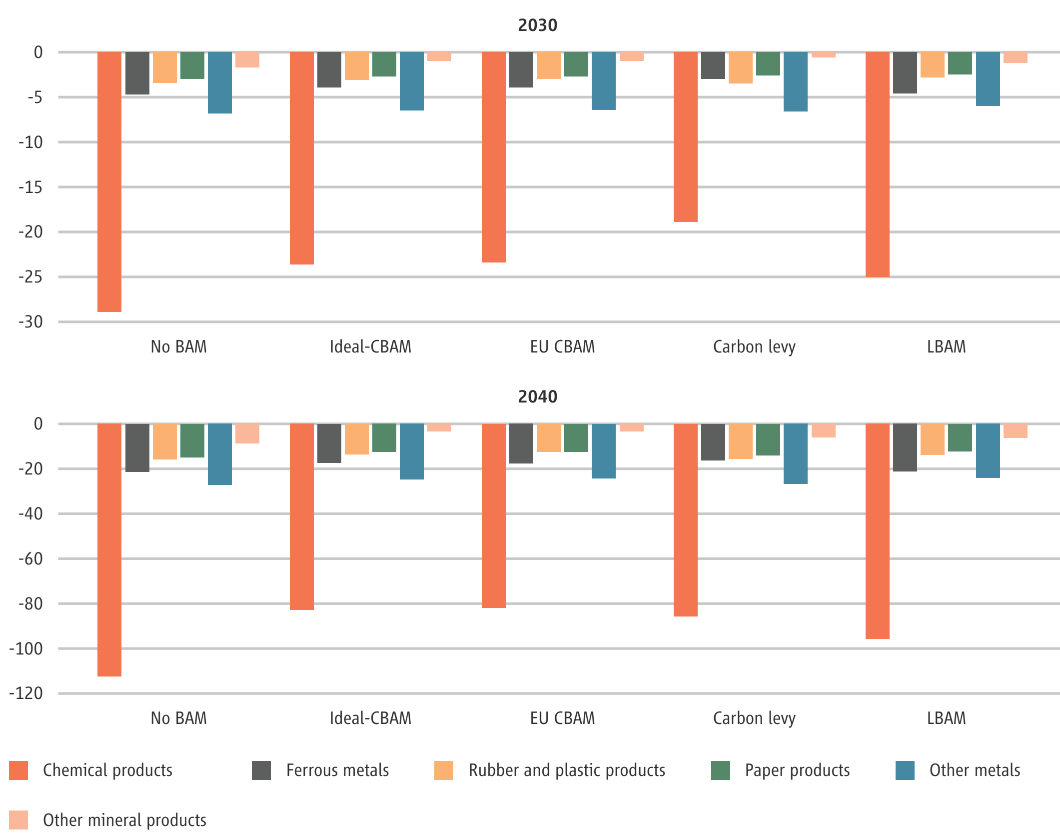
Source: Aguiar et al, 2022 and model projection/own calculations.

Figure:
Change in national income and taxes in the EU (in billions of euros)



Source: Aguiar et al, 2022 and model projection/own calculations.

Figure:
Change in production in Germany (in billions of euros)



Source: Aguiar et al, 2022 and model projection/own calculations.

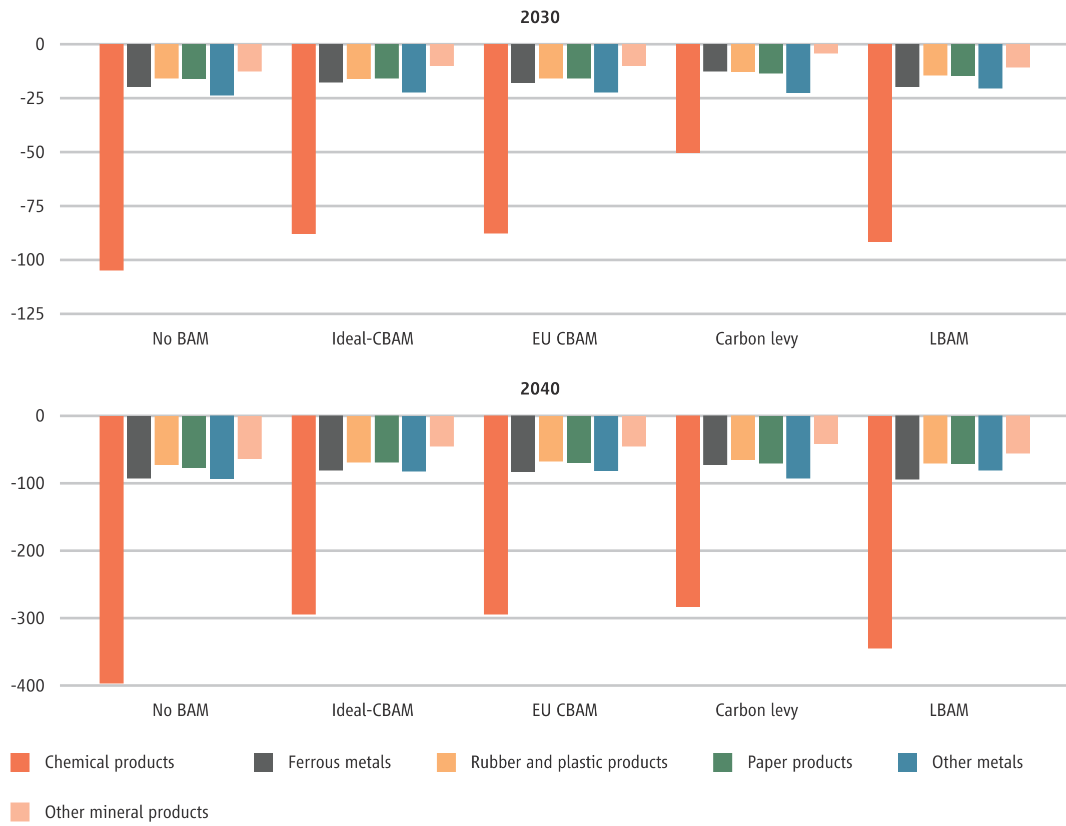


Figure:
Change in production in the EU (in billions of euros)

Source: Aguiar et al, 2022 and model projection/own calculations.

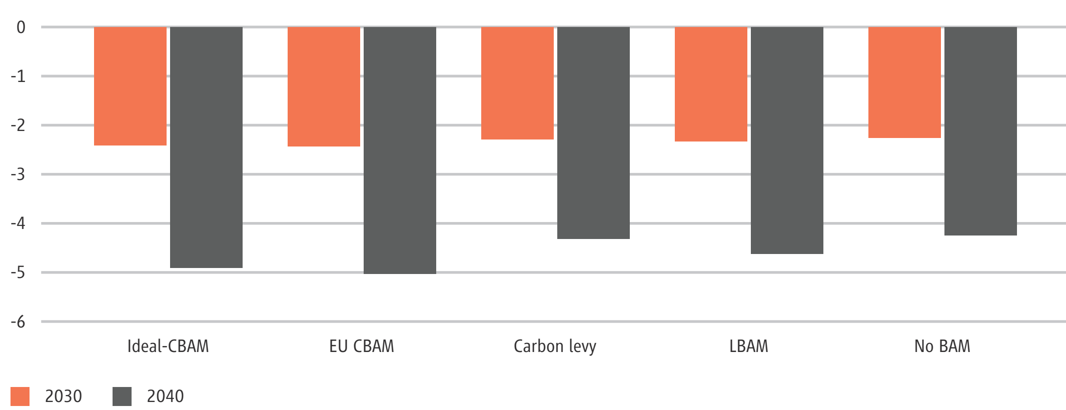


Figure:
Change in global emissions (in %)

Source: Aguiar et al, 2022 and model projection/own calculations.

Trade policy options for the EU

The current EU CBAM is a necessary attempt to shield high European CO_2 prices through trade policy and limit the exodus of industrial production. However, the envisaged design falls short of the ideal CBAM because the latter's high information requirements make implementation impossible. EU CBAM therefore entails major compromises that limit its effectiveness. Coverage is confined to a few basic materials, exports are not exempted for reasons of WTO compliance, the recording of CO_2 content data generates high administrative costs and the EU's trading partners are threatening retaliatory measures.

Yet, with rising CO_2 prices in the EU, EU CBAM offers clear advantages over a situation without border adjustment: it reduces the competitive disadvantages of energy-intensive industries and sends a signal that can encourage foreign producers to decarbonise their operations. The simulations show that these mechanisms cushion the impact of noticeable slumps in production, particularly in the basic materials industries. Globally, too, EU CBAM achieves greater emission reductions than alternative instruments because it not only prevents leakage but also creates pressure for reform abroad. In economic terms, it stabilises EU incomes to a lesser extent than an ideal border adjustment would, but significantly more than a scenario without any protective mechanism. However, downstream industries are disadvantaged due to its limited scope of application. Foreign governments, led by the US, consider EU CBAM to be a climate tariff and could take retaliatory measures that would reduce or even negate the net benefits of border adjustment.

The alternative of border adjustment in line with the LBAM model takes a completely different approach: rather than imposing a price on the CO_2 content of imports, it attempts to neutralise the trade effects of European CO_2 prices as completely as possible. Appropriately set import duties and export subsidies ensure that trade flows remain stable despite rising CO_2 prices in the EU – i.e. import volumes do not increase despite higher production costs, and exports do not collapse. In this way, LBAM effectively prevents carbon leakage and protects the competitiveness of industry more broadly and more strongly than EU CBAM, as reflected in more stable production levels, particularly for metals, chemicals and mineral products. It also involves significantly lower administrative burdens and is compatible with GATT. However, these advantages come at the expense of the ambition of climate policy: since foreign producers are not treated differently on the EU market based on their CO_2 intensity, there are hardly any incentives for decarbonisation, meaning that global emission reductions remain lower than with EU CBAM. However, this could also reduce the likelihood of penalties being imposed by other countries. From an economic perspective, LBAM performs well, reliably preventing income losses, but it does not reach the level of an ideal CBAM. Moreover, with market prices for CO_2 emissions constantly changing, it is difficult to keep up with the necessary adjustments of the offsetting measures.

The climate levy, which supplements the EU ETS with continued free allocation of certificates and an excise tax (Neuhoff et al., 2025a and 2025b), represents a pragmatic middle ground. Producers of CO_2-intensive goods are relieved through free ETS certificates, while a non-discriminatory excise duty ensures that CO_2-intensive products still become more expensive domestically. The model is the simplest in administrative terms, as standardised rates are sufficient and no measurement of supply chain emissions is required. It is WTO-compliant and treats imported and domestic products equally. Its concept is very different from the concept of climate tariffs, which means it should meet with the least resistance from the EU's trading partners. The climate levy offers industry a similar level of protection as LBAM, generates high fiscal revenues and stabilises individual downstream industries. However, it leads to lower real incomes in the long term because it places the burden primarily on consumers, and it does not have a global impact on emissions. It appears to be a good transitional solution, giving the EU time to establish the data basis for a truly comprehensive CBAM and to work towards international convergence of CO_2 prices.

Overall, the analysis shows that each option prioritises different objectives and has different advantages and disadvantages: none of the options comes close to the ideal type of border adjustment.

EU CBAM combines climate change mitigation and competitiveness but remains complex and incomplete. LBAM maximises competitive neutrality and minimises leakage but does not have an international climate impact.

The climate levy offers simple administration and fiscal stability but does little to incentivise global emissions reduction and has a weaker economic impact in the long term. Which option the EU chooses therefore depends on whether it wants to focus on global climate impact, industrial protection or political and administrative practicability.

Methodology

This analysis is based on the KITE (Kiel Institute Trade Policy Evaluation) model – a multi-country, multi-sector equilibrium model developed by Eaton & Kortum (2002). The model combines a global Ricardian trade framework with a detailed input-output structure in which goods can act as both consumer goods and intermediate goods. Policy interventions, such as tariffs or CO_2 prices, are represented by changes in trade and production costs (Hinz et al., 2025). Following a policy measure, the model simultaneously calculates all equilibrium variables (production, prices, income, trade flows and emissions), taking full account of intermediate input relationships.

Primary and secondary energy sources

To model carbon border adjustment, additional elements were added to the base model: following the approach of Mahlkow & Wanner (2023), a scarce, country-specific resource factor was introduced in the primary fossil fuel sectors (e.g. crude oil); this factor was assigned to countries based on GTAP data. Secondary energy products (e.g. petrol) are produced in a separate production block, which, via a Leontief component, requires a fixed quantity of the corresponding primary energy source. This structure ensures that, in order to produce one unit of secondary energy, a constant input of the raw material is always required and that the resulting CO_2 emissions are directly attributed to the country where the primary energy source is extracted.

The model gives rise to two types of leakage: direct leakage via product markets, whereby unilateral CO_2 pricing can lead to a relocation of production, and indirect (supply-side) leakage via global fossil fuel markets, whereby unilateral CO_2 pricing leads to a decline in global fossil fuel prices and thus to increased consumption.

Heterogeneous firms

In addition, the model was expanded to include heterogeneous firm structures based on the Melitz approach (Sogalla, 2025). Firms differ in their productivity and pay fixed export market access costs for foreign sales. In such a model, climate policy measures have an impact both through changes in emission intensity within established firms and through market entries and exits. This framework allows for a detailed analysis of how border adjustment mechanisms affect the production structure.

Data basis and calibration

The GTAP-11 Data Base (Aguiar et al., 2022) served as a calibrated data basis. It contains all the input-output coefficients, bilateral trade shares, wage and resource income, trade deficits and CO_2 emissions for each country required for the model. The country-specific endowments with fossil resources have also been taken from this database.

Literature:

About the authors

Gabriel Felbermayr studied economics and commercial sciences in Linz and earned his doctorate at the European University Institute in Florence. After working for McKinsey & Co. in Vienna and as an academic advisor in Tübingen, he took up professorships in international economics in Hohenheim and at the University of Munich, where he also headed the ifo Centre for International Economics. From 2019 to 2021, he was president of the Kiel Institute for the World Economy. Since October 2021, he has been director of the Austrian Institute of Economic Research (WIFO) and university professor at the Vienna University of Economics and Business.

"It is crucial that CBAM is able to fulfil its purpose. If it fails, the resulting deindustrialisation could discredit CO_2 pricing as such, causing it to be replaced by more costly and less effective regulation."

Hendrik Mahlkow is a quantitative trade economist specialising in climate and geopolitical issues. He develops large-scale general equilibrium models and uses these models along with microeconomic data to analyse the effects of international trade and climate policy. Mahlkow advises European and international institutions, and his research has been cited multiple times by leading media outlets.

"An ideal carbon border adjustment creates fair competitive conditions – but its implementation is hampered both by the difficulty of measuring the CO_2 content of imports and by international rules."

Isabel Pham is a doctoral candidate at the Austrian Institute of Economic Research and the Vienna University of Economics and Business. Her research focuses primarily on competition in the transport sector and international trade.

"To minimise the likelihood of retaliatory measures, the EU should therefore apply border adjustment methods which, as far as possible, do not lead to non-tariff trade barriers. This means that the administrative burden on foreign companies should be kept to a minimum."

Robin Sogalla is a postdoctoral researcher at the University of Mannheim. His research examines the interplay between international trade and climate policy, in particular the role of company-specific differences. He combines microeconometric analyses with quantitative trade models to analyse the macroeconomic effects of climate and trade policy.

"If the EU is serious about border adjustment, it must admit that it is responsible for significantly higher emissions than is evident from recording purely territorial emissions."

Joschka Wanner is a junior professor of quantitative international and environmental economics at the Julius Maximilian University of Würzburg and an external researcher at the Kiel Institute for the World Economy. He researches the effects of international climate policy. His work has been published in highly regarded academic journals such as the Journal of International Economics and the European Economic Review.

"Which option the EU chooses depends on whether it wants to focus on global climate impact, industrial protection or political and administrative practicability."

About the Foundation for Family Businesses

More than 90 percent of all companies in Germany are family-owned. The purpose of the Foundation for Family Businesses, a non-profit organisation, is to preserve the country's family-business landscape. The foundation is the most important sponsor of academic research in this field and a primary point of contact for politicians and the media in matters related to economic policy, legislation and taxation. The purpose of the foundation is to provide support, information, training and education as well as a platform for the sharing of ideas about family businesses in Europe.

Publication details:

Stiftung Familienunternehmen (ed.)

Prinzregentenstraße 50
80538 Munich
Germany

Phone: +49 (0) 89 / 12 76 400 02
E-mail: info@familienunternehmen.de

www.familienunternehmen.de

Price: €19.90
ISBN: 978-3-948850-77-7