WORLD BANK GROUP

The impact of the implementation of EU's Carbon Border Adjustment Mechanism on North Macedonia

Policy Note

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Contents

Acknowledgments

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Executive Summary

This note specifically focuses on explaining the impact of the application of the EU's Carbon Border Adjustment Mechanism (CBAM) on the economy of the Republic of North Macedonia as requested by the authorities in March 2024. It builds on the detailed work delivered under the North Macedonia Climate Public Finance Review that simulates the results of the carbon tax introduction.

The EU's CBAM is designed to address the risk of carbon leakage, which occurs when emissions reductions in one jurisdiction are offset by increased emissions abroad. The CBAM aims to level the playing field between domestic firms and their competitors in other jurisdictions by imposing a carbon price on imports of certain goods from countries without comparable carbon pricing policies. It will be fully effective from 2026 and initially limited to few products. But this is only the first phase with further extension expected thereafter.

In this first phase, the CBAM is expected to increase product prices in North Macedonia's cement, aluminum, iron, and steel industries. This is primarily because these sectors have higher Scope 1 emissions (direct emissions from production processes) than the EU average, and having in mind that the CBAM scope is limited to direct emissions for iron/steel, aluminum and hydrogen when it starts to apply in 2026. The higher emissions intensity necessitates the payment of CBAM fees on North Macedonia's export products in these sectors to the EU. These are payments into the EU budget.

The World Bank's MINDSET model, a demand-driven global macroeconomic model, was used to simulate the impacts of CBAM on North Macedonia. The model projects that the CBAM will lead to a decline in exports to the EU, particularly in the sectors mentioned above. However, the model also suggests that the overall impact on the economy will be relatively small, with a decline in economic output of less than 0.3 percent. This impact is primarily driven by reduced exports to EU in sectors like cement, iron and steel, aluminum, fertilizers, and electricity, due to the lack of carbon pricing in these sectors in North Macedonia.

While the overall impact on the economy is relatively small, certain sectors are more vulnerable than others. The aluminum and steel sectors are projected to experience losses close to 2 percent of their total output, while most other sectors see losses of around 0.5 percent or less. This is due to the higher Scope 1 emissions in these sectors compared to their EU counterparts, leading to higher CBAM fees for North Macedonia's exports. The output loss could result in job losses in North Macedonia's manufacturing sector, particularly in the aluminum and steel industries. The model estimates that the CBAM could lead to approximately 1,500 job losses in North Macedonia, with most of these losses occurring in service sectors due to indirect effects along the value chain.

The government of North Macedonia should consider implementing policies to mitigate the potential negative impacts of the CBAM on jobs and competitiveness, as well as future anticipated expansion of the CBAM's scope. Some of the immediate policies to implement are:

- Introducing Monitoring, Reporting, Verification, and Accreditation (MRVA) to protect the participation in the EU value chain;
- Introducing carbon pricing in key sectors covered by CBAM to avoid paying to the EU budget;
- Investing in energy efficiency and renewable energy;
- Integrating the electricity market with the EU single electricity market and
- Implementing the Just Transition Action Plan.

1. Policy Context

International climate change commitments to limit global warming to 1.5 degrees continue to strengthen and increase in ambition. 196 parties have adopted the Paris Agreement with the overarching goal to limit the increase in global average temperatures to well below 2°C above pre-industrial levels.[1] Under the Paris Agreement, countries define their own ambitions considering their respective national circumstances. As a result, the emissions reduction levels and trajectories vary across jurisdictions. This variation across jurisdictions presents a range of transition risks, where changes to social and economic policy result in a shift in technologies, fuel availability, and changes in trade dynamics (e.g. due to changes in consumer preferences or tariffs on emissions-intensive goods). In addition, with the adoption of the Green Deal for the EU and its citizens, the EU set climate neutrality as its objective for 2050 and such objective requires rethinking and reforming the energy sectors. Decarbonization of all sectors of the economy and increased targets for energy efficiency, renewables, and greenhouse gas (hereinafter, GHG) emissions reductions for 2030 have been set.

The EU's legally binding goal to cut GHG emissions by 55 percent by 2030 includes key reforms like the Carbon Border Adjustment Mechanism (CBAM) and the expansion of the Emissions Trading System (ETS). The commitment to climate neutrality and reducing EU economy-wide GHG emissions, as set out in the submission to the UNFCCC on behalf of the EU and its Member States became a legally binding obligation with the adoption of the European Climate Law.[2] Rapid decarbonization of the electricity system will be critical to achieving these emissions reductions, by reducing emissions from the production of electricity itself, but also through the clean electrification of energy services currently provided by fossil fuels. The Regulation (EU) 2023/956: the CBAM Regulation[3] is one of several tax and carbon price reforms proposed as part of the European Green Deal. Other key reform measures include extension of the scope of the EU's ETS to include emissions from fuel combustion in buildings, road transport and additional sectors, phasing out of free allowances[4] and reform of the Energy Taxation Directive (hereinafter, ETD).[5]

Despite the absence of a global carbon price, the EU leads with its EU ETS system, a cornerstone of its climate policy and commitment to climate change adaptation. According to the World Bank's Carbon Pricing Dashboard,[6] 50 national and 39 subnational jurisdictions have implemented compliance instruments, in the form of either an ETS or a carbon tax, which covers 24 percent of the global GHG emissions. Even though carbon pricing has been recognised as the most comprehensive and cost-effective way to reduce global carbon emmissions and large number of jurisdictions are implementing carbon pricing through establishing a carbon market or carbon taxes, there is no global carbon price in place.[7] The EU has established the first system for GHG allowance trading through legally binding legislation—the EU ETS Directive as the cornerstone of the EU's climate policy. The EU ETS establishes harmonised pricing of GHG

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[1] https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en

[2] Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999 [2021] OJ L 243.

[3] Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism

[4] Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system

[5] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity

[6] https://carbonpricingdashboard.worldbank.org/

[7] IMF, Proposal for an International Carbon Price Floor Among Large Emitters, Vol 2021: Issue 001, 18.06.2021 and the World Economic Forum, Increasing Climate Ambition: Analysis of an International Carbon Price Floor, November 2021.

emissions at EU level for energy-intensive sectors.[8] The commitment to adaptation to climate change by the EU Member States has been reflected in their integrated national energy and climate plans (hereinafter, NECPs), reviewed, and monitored by the European Commission in accordance with the Governance Regulation.[9]

With raised ambition, prices on carbon are expected to increase and free allowances to be phased out. This would increase the risk of carbon leakage, i.e. that emissions reductions achieved in a certain jurisdiction are to some extent offset by an increase of emissions abroad. Such leakage could occur if, for reasons of differing ambitions related to climate policies, businesses in certain industry sectors or subsectors were to transfer production to other countries with less strict emission constraints or imports from these countries would replace equivalent but less GHG emissions intensive products due to the difference in climate policy. The risk for leakage has been identified also in the EU from the start of the EU ETS implementation and so far has been addressed through two mechanisms: (i) the free allocation of ETS allowances to sectors at highest risk of carbon leakage and (ii) the possibility for Member States to give state aid to electricity-intensive undertakings active in sectors exposed to international trade, compensating the higher electricity costs resulting from the ETS.[10] Free allocation of allowances under the EU ETS is seen to weaken the price signal that the system provides for the installations receiving it compared to full auctioning and thus might affect the incentives for investment into further abatement of emissions. Another anti-leakage measure, which might complement an ETS, aiming at levelling the playing field between domestic firms and their competitors in other jurisdictions through carbon border adjustments, is the EU's CBAM introduced through the CBAM Regulation.

The introduction of the EU CBAM presents a tangible example of a transition risk. The purposes of the EU CBAM are to address the risk carbon leakage (Box 1),[11] contribute to the EU decarbonization objectives and reinforce the EU ETS, and to encourage greater mitigation ambition and improve emissions intensity by producers in third countries.[12] The EU CBAM will gradually replace the existing approach for managing the risk of carbon leakage under the EU ETS, which is primarily the provision of free allowances to emissions-intensive, trade-exposed sectors.[13] The EU CBAM will impact countries exporting to the EU, including North Macedonia, as highlighted in the World Bank's "North Macedonia Climate Public Finance Review". Manufacturing sectors are particularly vulnerable due to their high emissions intensity and trade exposure. The Climate Public Finance Review estimates the total compliance to be around USD 120 million

[8] Two more EU legislation related to GHG emissions consist of Regulation (EU) 2018/842 on binding annual GHG reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement [2018] OJ L 156, which introduces national targets for reduction of GHG emissions by 2030, and Regulation (EU) 2018/841 on the inclusion of GHG emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework [2018] OJ L 156 which requires Member States to compensate GHG emissions from land use with removals of emissions from the atmosphere.

[9] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council [2018] OJ L 328

[10] Guidelines on certain State aid measures in the context of the system for greenhouse gas emission allowance trading post-2021 [2021] OJ L 130.

[11] Partnership for Market Readiness. 2015. Carbon Leakage: Theory, Evidence and Policy Design. Partnership for Market Readiness Technical Papers. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/22785

[12] EU Commission's proposal for CBAM Regulation of 2021, recital 12: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52021PC0564

[13] Ditto, paragraph 11.

annually. To manage these climate risks effectively, fiscal policies should focus on reducing asset vulnerability, supporting resilient infrastructure and guiding the economy through the transition. Strategic fiscal planning, including the establishment of a domestic carbon price, is crucial in this regard and therefore are highly recommended.

This paper further clarifies the critical interplay between CBAM and decarbonization and provides insights from the MINDSET model used to assess a detailed impact of the CBAM on North Macedonia. By comparing scenarios with and without the CBAM, it emphasizes the need for coupling CBAM with robust carbon pricing policies and investments in decarbonization. The paper provides a comprehensive overview of the policy landscape, CBAM Regulation, modeling approach, data sources, simulation outcomes, and key recommendations aimed at policymakers.

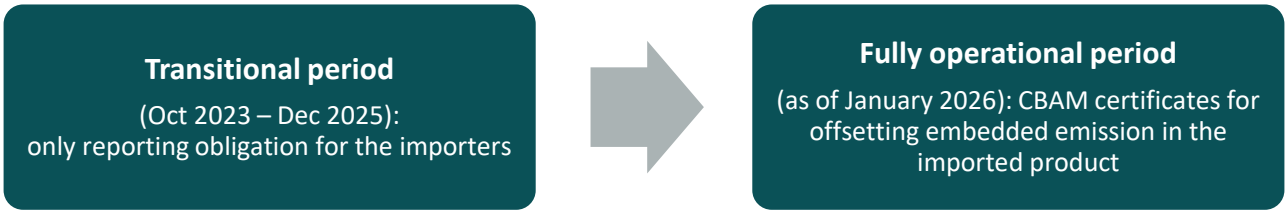
Box 1. Carbon leakage

Carbon leakage refers to the risk of production being relocated to another jurisdiction with laxer emission constraints (e.g. a jurisdiction with a lower, or no, carbon price). Carbon leakage is an economic, political, and environmental concern: it translates into loss of GDP, jobs, and tax revenue in the most ambitious countries, creating a disincentive to act, and also reduces the efficiency of climate policies by shifting emissions to laxer countries, which can lead to an increase in global carbon emissions. There is little empirical evidence of carbon leakage to date. This is likely, in part, due to historically low carbon prices and that most existing climate policies have included measures (such as free allocations of allowances) to reduce carbon leakage in high-risk sectors.

2. Summary of the CBAM Regulation

The CBAM will initially cover imports of carbon-intensive goods at highest risk of carbon leakage: cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen. Unlike the EU ETS, which limits emissions through a cap-and-trade system, the CBAM does not impose quantitative import restrictions to avoid direct impacts on trade flows. Instead, it operates on a declarative basis where EU importers must report verified GHG emissions associated with imported goods annually. This administrative responsibility falls on EU importers, not exporters like those from third countries such as North Macedonia, who must be authorized CBAM declarants[14]. For electricity imports, the designated recipient of allocated transmission capacity becomes the authorized CBAM declarant upon declaring import in the customs documentation[15]. The CBAM registry, established by the European Commission under Article 14 of the CBAM Regulation, maintains data on CBAM certificates, operator information, and third-country installations eligible for registration under Article 10(2), subject to periodic verification and reporting requirements[16].

The CBAM regulation would be implemented in phases:



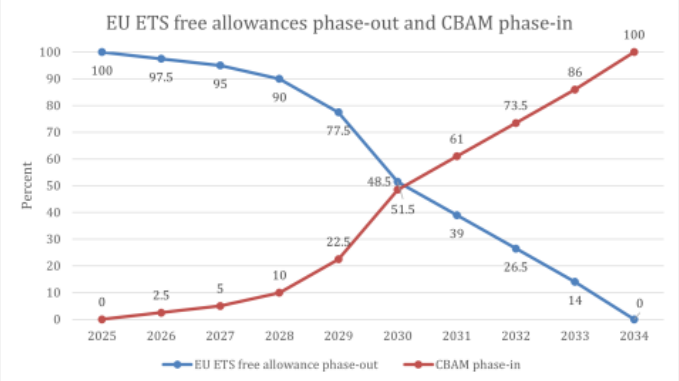
[14] Article 17 CBAM Regulation.
[15] Article 5(4) CBAM Regulation.
[16] Registered operators and installations, shall determine the embedded emissions, ensure verification of the embedded emissions by accredited verifier and keep a copy of the verification report for a period of four years (Article 10(5) CBAM Regulation.
* Article 20 CBAM Regulation
** Article 21 CBAM Regulation

Important deadlines: By 31 May each year, the authorized declarants would need to:

- declare the amount of GHG emissions and
- surrender CBAM certificates (purchased on a comon central platform by the Member States at a price calculated as the average of the closing prices of the EU ETS allowances each calendar week) in an amount equal to these emissions.

To maintain its efficiency in preventing carbon leakage, CBAM should closely mirror the costs applied through the EU ETS. The cost of the CBAM on importers is determined by the number of CBAM certificates to be surrendered multiplied by the price of those certificates (€ per ton of CO_2e). The number of CBAM certificates importers must surrender is determined by the "embedded emissions"[17] of the covered products. The regulations set out how embedded emissions must be measured, with different approaches for non-electricity and electricity goods (Box 2). There is no cap or limit on the number of available CBAM certificates. The number of CBAM certificates is adjusted to reflect the amount of free allowances allocated under the EU ETS (Figure 1 as indicative) and any carbon price already paid in the country of production.[18] The price of CBAM certificates would be calculated by taking the weekly average auction price of EU ETS allowances expressed in € / ton of CO_2 emitted. [19] Importers must submit quarterly CBAM reports[20], including carbon pricing details from the country of origin.

Figure 1. ETS free allowances phase-out and CBAM phase-in



Source: ICAP illustration based on EU Commission information

Box 2. Provisions of the CBAM regulation related to imported electricity

According to Article 7(3) of the CBAM Regulation, "Embedded emissions in imported electricity shall be determined by reference to default values in accordance with the method set out in point 4.2 of Annex IV, unless the authorised CBAM declarant demonstrates that the criteria to determine the embedded emissions based on the actual emissions listed in point 5 of Annex IV are met." Annex IV of the CBAM Regulation stipulates that the default values shall be determined for a third country or group of third countries or region within a third country where the electricity was produced. The default values are weighted average of the CO2 intensity of electricity produced from fossil fuels within a geographic area based on data from the International Energy Agency (IEA).[21]

Point 5 of Annex IV stipulates that an authorised CBAM declarant may apply actual embedded emissions instead of default values under certain conditions:

[17] Embedded emissions represent the carbon content of a product and is an essential element of the EU CBAM. It relates to the GHG emissions released during the production of the good (not the carbon physically contained in a product). The Commission proposal outlines different approaches to determine the relevant embedded emissions for each product depending on what data is available on the emissions associated with production in the relevant country or installation. There are also different approaches for electricity and all other (non-electricity) products.

[18] Article 9, Commission Proposal

[19] Article 21, Commission Proposal

[20] Article 35 CBAM Regulation.

[21] Section D of Annex III of Commission Implementing Regulation (EU) 2023/1773 of 17 August 2023 laying down the rules for the application of Regulation (EU) 2023/956 of the European Parliament and of the Council as regards reporting obligations for the purposes of the carbon border adjustment mechanism during the transitional period [2023] OJ L 228.

(a) the amount of electricity for which the use of actual embedded emissions is claimed is covered by a power purchase agreement between the authorised CBAM declarant and a producer of electricity located in a third country;

(b) the installation producing electricity is either directly connected to the Union transmission system or it can be demonstrated that at the time of export there was no physical network congestion at any point in the network between the installation and the Union transmission system;

(c) the installation producing electricity does not emit more than 550 grammes of CO_2 of fossil fuel origin per kilowatt-hour of electricity;

(d) the amount of electricity for which the use of actual embedded emissions is claimed has been firmly nominated to the allocated interconnection capacity by all responsible transmission system operators in the country of origin, the country of destination and, if relevant, each country of transit, and the nominated capacity and the production of electricity by the installation refer to the same period of time, which shall not be longer than one hour;

(e) the fulfilment of the above criteria is certified by an accredited verifier, who shall receive at least monthly interim reports demonstrating how those criteria are fulfilled.

3. The implications of the CBAM Regulation in North Macedonia

The economic implications for North Macedonia as a result of the application of the EU CBAM vary across products and sectors. The expected effects are detailed in **Error! Reference source not found.** and depend on factors such as the production process in the covered industries, the diversity of trade partners and traded goods as well as the country's climate policy.

Table 1. Expected impacts under two scenarios

Scenario	Potential impacts EU Member States	Potential impacts Non-members	Resulting potential impacts globally
EU ends free ETS allowances	Cost increases in ETS sectors	Competitive advantage	
		Exports to EU increase	
		Investment increases	
		Production increases	
		GDP increases	
	Lower emissions	Higher emissions	Carbon leakage: Net higher emission
EU ends free ETS allowances and introduces CBAM	Import prices increase	Exports to EU decrease	
	Imports decrease	Lower production in CBAM	
	Investment increases		
	Production increases		
	GDP increases		
	Higher emissions	Lower emissions	Lower net GHG emissions

The World Bank's MINDSET[22] model was used to simulate the impacts of CBAM on North Macedonia in 2034 under various EU's CBAM policy scenarios. MINDSET simulated results for the year 2034, the first year after CBAM comes into full force, under two distinct scenarios. The reference scenario assumes a gradual phase-out of free allowances in the EU by 2034, allowing for carbon leakage and without implementing carbon border adjustments. In contrast, the CBAM scenario imposes a uniform price on imports of fertilizers, iron and steel, aluminum, cement, and electricity when these goods cross into an EU Member State. Under this scenario and its counterfactual counterpart, any declines in output and employment for

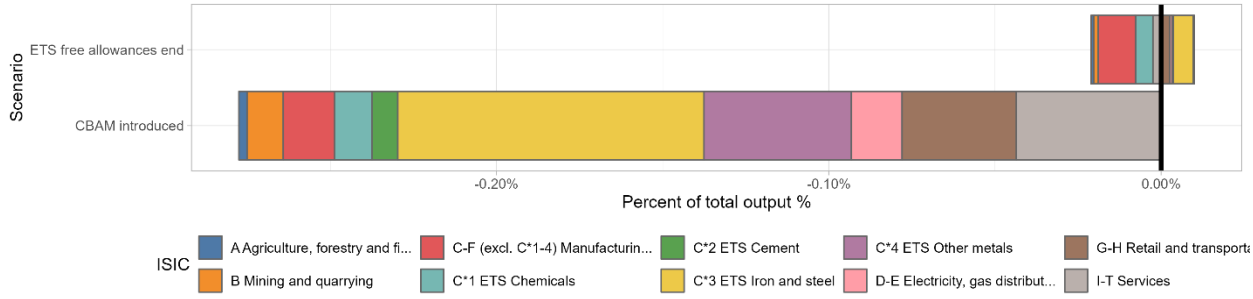
[22] A demand-driven, global macroeconomic Model of Innovation in Dynamic Low-Carbon Structural Economic and Employment Transformations. See Appendix 2 for more details on the model and the methodology.

North Macedonia's economy can be attributed to the introduction of CBAM, assuming all other factors remain unchanged (*ceteris paribus*). Notably, the EU-ETS carbon price trajectory is consistent across both scenarios, increasing from EUR 36 in 2020 to EUR 187 by 2034.

North Macedonia's greatest potential exposure is in the metal-producing sectors. More than 60 percent of the country's iron and steel exports go to the EU and almost half of its aluminum exports (Figure 2). Next to this, the country's planned participation in the EU's single electricity market (provided that the North Macedonia's electricity market couples with the EU's single electricity market) will be put at risk by CBAM, if the current electricity production structure is maintained and if no carbon pricing at levels equal to the EU ETS price is introduced. The indirect effects along the value chain expose intermediate goods and services supplying to these sectors to the largest risks.

Overall, the aggregate economic impact of the CBAM on North Macedonia is relatively minor in both scenarios. Measured against total economic output, the net economy-wide effects are slightly negative, with economic output declining around -0.3 percent under CBAM and close to neutral under the scenario ending ETS free allowances.

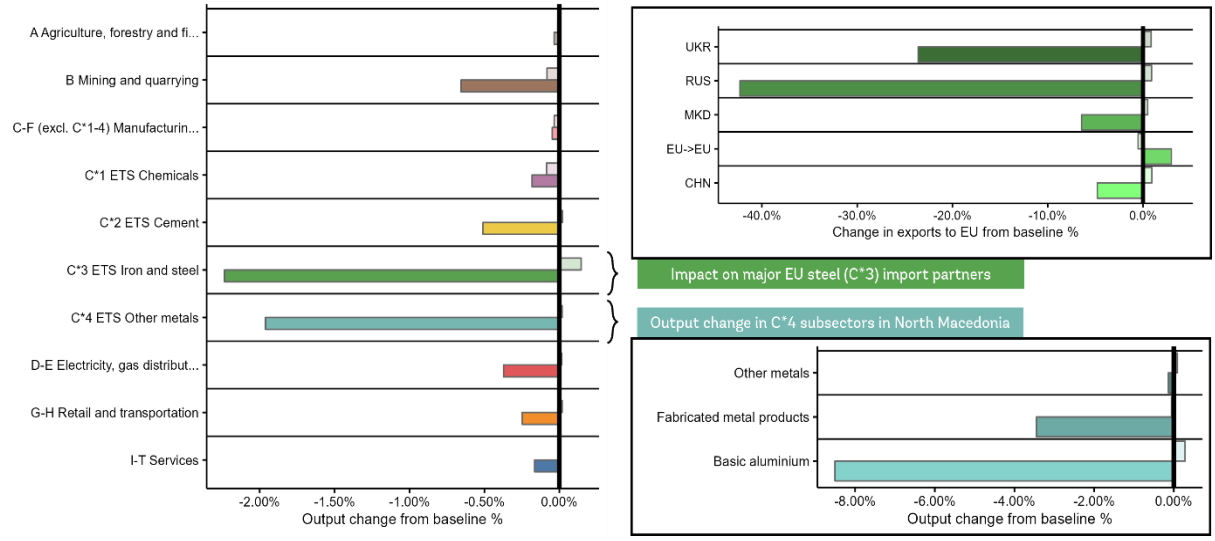
Figure 2. Economic output impact on North Macedonia when EU ends free allowances (counterfactual) vs EU ends free allowances and introduces CBAM



In the CBAM scenario, North Macedonia faces reduced exports to EU Member States across key sectors such as cement, iron and steel, aluminum, fertilizers, and electricity, due to lack of carbon pricing in these sectors, resulting in full CBAM fees for exports of those products to the EU, all of which contribute to the EU's budget. In this case, North Macedonia continues business as usual and has no carbon pricing applied to the CBAM sectors, i.e. full CBAM fee is paid for importing Macedonian products to the EU (Figure 3). Overall losses are small, dominated by losses in iron and steel, aluminum, cement, and mining. Value chain effects also mean that there are some losses in electricity, retail, and other services. This presupposes that the North Macedonia's electricity market is not coupled with the EU's single electricity market and explicit allocation continues, thus paying the full carbon fee for export of electricity directly into the EU's budget (more details provided in the Appendix 1).

While the overall effect on the North Macedonia's economy in terms of output is below 0.3 percent, sector-specific results for output and employment tell a more warning story. At a more detailed level, the impacts are more evident: aluminum and steel experience losses close to 2 percent of their total output, while most other sectors see losses of around 0.5 percent or less. The left panel of Figure 3 provides additional detail on these effects. Losses in "Other metals" (C4) primarily stem from reduced production in the aluminum sector (over 8 percent). Meanwhile, losses in iron and steel (C3) are notable at about 2 percent but are comparatively lower than in other EU trade partners due to North Macedonia's sector having lower carbon intensity (Figure 3 right panel).

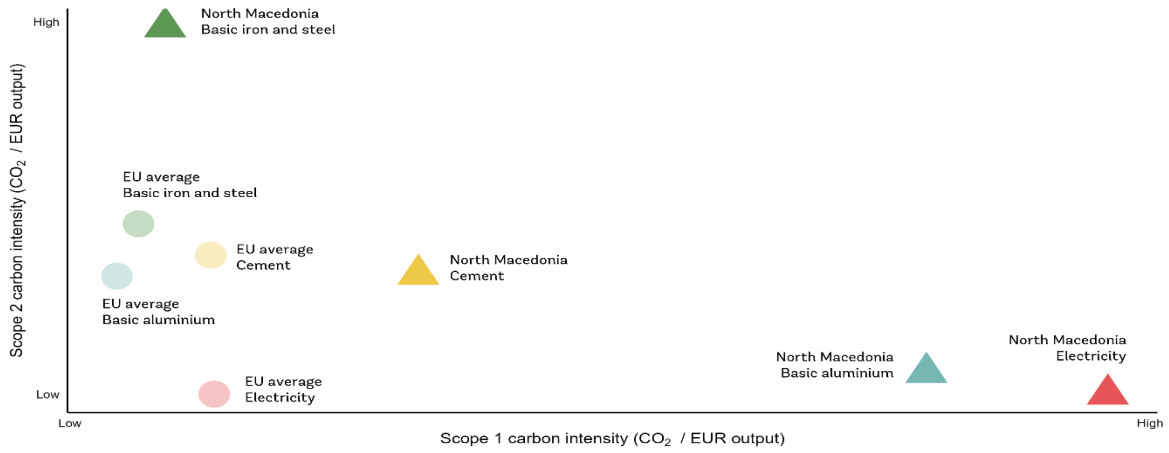
Figure 3. Disaggregated impacts, relative differences in output.
(Top bar is EU ends free allowances (counterfactual), bottom is EU ends free allowances and introduces CBAM (CBAM) scenario.)



In North Macedonia, industries like cement, aluminum, and iron and steel face potential increases in product prices under the CBAM due to higher Scope 1 emissions compared to their EU counterparts. Scope 1 emissions refer to direct emissions from production processes, where North Macedonia shows higher intensity in sectors like cement and aluminum than the EU average. This disparity necessitates the payment of CBAM fees for Macedonian exports in these sectors to the EU. For iron, while Scope 1 emissions are relatively low in carbon content, the industry is affected by high Scope 2 emissions (although the CBAM currently excludes scope 2 emissions from iron and steel and aluminum).[23] Scope 2 emissions result from electricity use, and North Macedonia's electricity production emits more carbon than the EU average, increasing the CBAM fees for iron exports despite their lower direct emissions. However, the overall impact on North Macedonia's iron sector is moderate compared to other Western Balkan countries due to its lower Scope 1 carbon intensity (Figure 4).

[23] During the transitional phase, for monitoring purposes, importers are required to report both direct and indirect emissions for all goods falling under the scope of CBAM. During the definite phase starting on 1 January 2026, the CBAM scope is limited to direct emissions for iron/steel, aluminium and hydrogen, while importers of cement and fertilisers will have to declare both direct and indirect emissions.

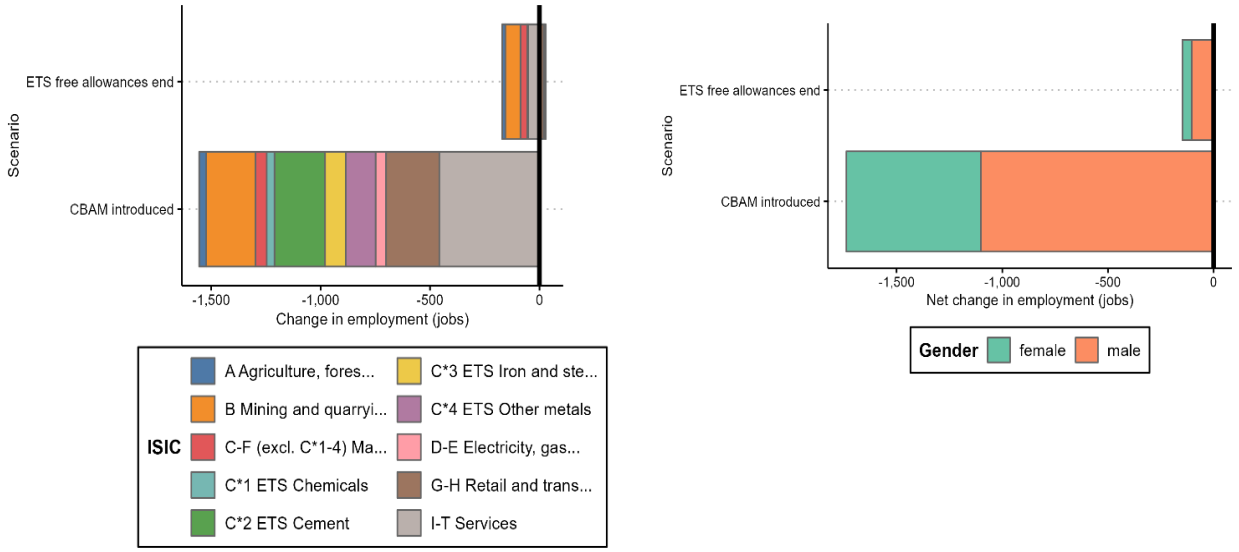
Figure 4. Calculated Scope 1 and Scope 2 carbon intensity of different industrial sectors in North Macedonia compared to the EU average



When considering employment impacts, the hierarchy of sectoral losses shifts, primarily affecting heavy industries directly involved in trade. Indirectly, supply chain linkages, as depicted in Figure 2, account for nearly 40 percent of the overall impact, driven by services and transportation. In the first scenario, gains are limited, largely benefiting sectors with low labor intensity or high productivity. The significance of value chain losses becomes more apparent from an employment perspective, especially affecting labor-intensive sectors like services. Job reductions also trigger negative spillover effects: reduced incomes constrain household budgets, leading to decreased consumption that further impacts retail and certain service sectors, potentially exacerbating job losses, albeit on a relatively modest scale.

The CBAM scenario projects approximately 1,500 job losses across various sectors in North Macedonia, majority held by male workers. In absolute terms, service sectors, known for their high labor intensity, are expected to see the largest reductions. However, the relative impact is most significant in directly affected sectors such as cement, iron and steel, and metals, with estimated job losses of around -3, -2, and -2 percent respectively (**Figure *5*. Employment impact on North Macedonia when EU ends free allowances (counterfactual) vs EU ends free allowances and introduces CBAM**Figure 5). From a gender perspective, the majority of jobs at risk are currently held by male workers, particularly in industries traditionally dominated by men. For instance, the mining sector in North Macedonia, where over 90 percent of employees are male, faces significant losses, contributing to more than 20 percent of the total male job reductions due to CBAM-induced effects.

Figure 5. Employment impact on North Macedonia when EU ends free allowances (counterfactual) vs EU ends free allowances and introduces CBAM.



Overall, North Macedonia could face pronounced and negative impacts if the EU CBAM is implemented without significant changes to the current economic and energy structure (Table 2)**.** Heavy industries, particularly those with high Scope 1 carbon intensities like aluminum and cement, risk substantial trade disadvantages in EU markets unless they decarbonize. Even industries with lower Scope 1 emissions must address their Scope 2 emissions, influenced by North Macedonia's relatively carbon-intensive power generation. Job losses stem from both direct export declines and induced effects, affecting intermediate demand and consumption due to reduced wages. While overall employment losses at an economy-wide level are modest (around 0.2 percent), specific sectors, notably cement, iron and steel, and metals, could experience more pronounced losses of 2-3 percent. These effects are more likely to impact male employment due to their prevalence in directly affected and male-dominated industries like mining.

Table 2. Resulting impacts under two scenarios for North Macedonia

Scenario	Potential impacts Non-members	Simulation result for North Macedonia	
EU ends free ETS allowances	Competitive advantage		
	Exports to EU increase	▲	• Minor increase in ETS sectors
	Production increases	▼	• Minor increase in ETS sector exports • Offset by minor decrease in manuf. sectors due to import linkages from EU (higher import prices) • Slight net negative impact
	GDP increases	–	• Net neutral impact, although both positive and negative sector effects
	Higher emissions	▲	• Higher emissions due to higher exports of ETS sectors
	Exports to EU decrease	▼	• Exports to EU in CBAM covered sectors decrease

EU ends free ETS allowances and introduces CBAM	Lower production	▼	• Production of covered goods decrease, lower economic activity in these industries causes less demand for domestic intermediate goods, production of sectors linked through value-chain decrease
	Lower employment	▼	• Employment losses due to direct and indirect effects
	GDP decreases	▼	• Net negative GDP impact, due to trade losses and induced effects (employment, intermediate sectors)
	Lower emissions	▲	• Over 5% lower economy wide emissions due to lower domestic production of CBAM covered industries

Appendix 1: Linkages and value-/supply-chain effects

This Appendix demonstrates the value-/supply-chain effects captured by the model and simulated in the CBAM scenario. A clear advantage of the MRIO core of the MINDSET model is the possibility to capture and trace these channels of impact and to highlight how an effect on one part of the economy can have long-reaching impacts in other sectors. This Appendix presents sankey impact channel figures for two of the sectors most impacted in the CBAM scenario (iron and steel and other metals) and a separate chart on the composition of the total impacts.

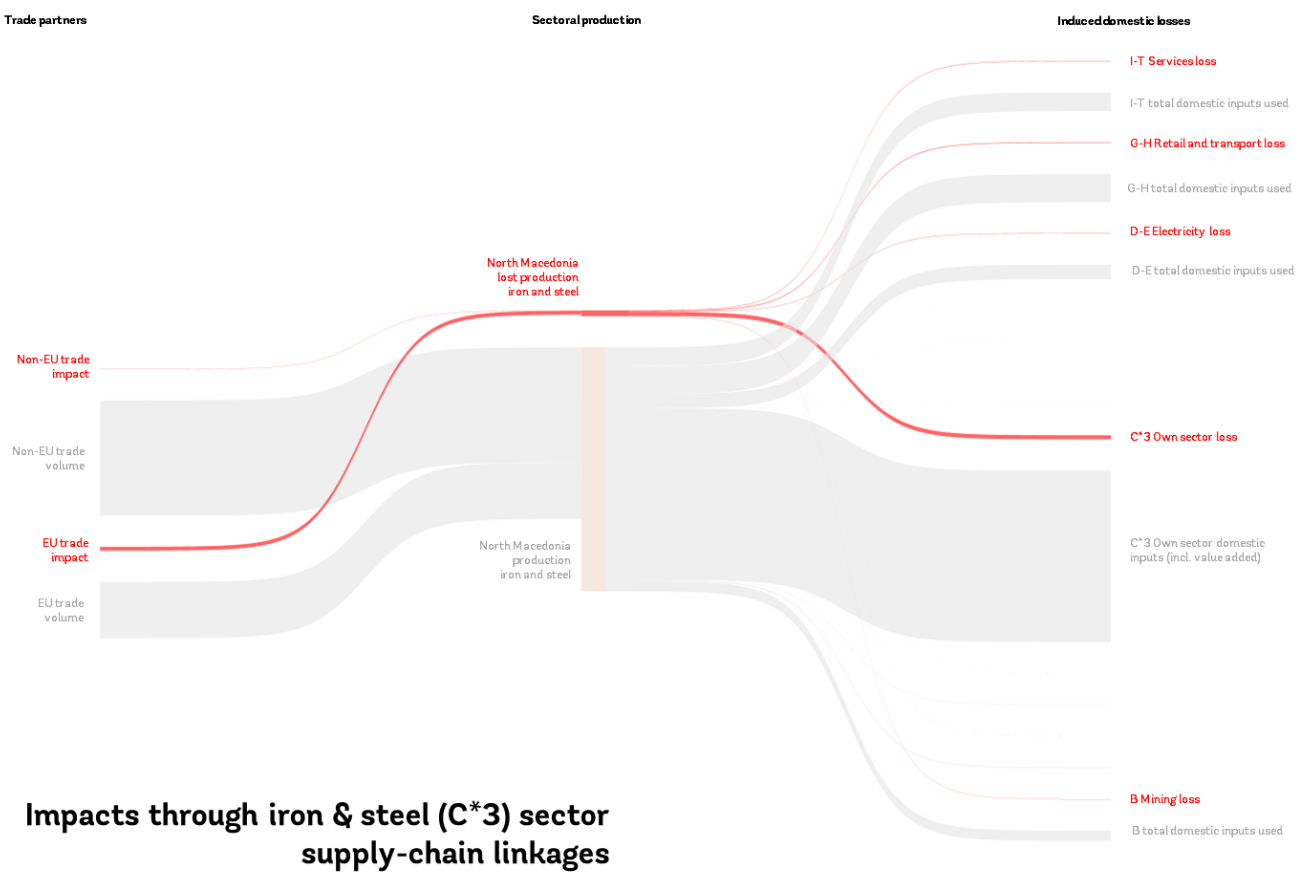


Figure A1. Impacts through iron & steel (C*3) sector supply-chain linkages

Impacts in the iron and steel sector originate from both EU trade and non-EU trade impacts. The latter is rather small and a result of minor trade structure changes. These impacts together decrease production of the sector (center), which subsequently leads to lower demand for various domestic inputs. These include services, transport, as well as electricity and mining. While the impact to intermediate goods is relatively small, it can be a more serious concern if the exporting sector (e.g. steel) is a major buyer of the intermediate good.

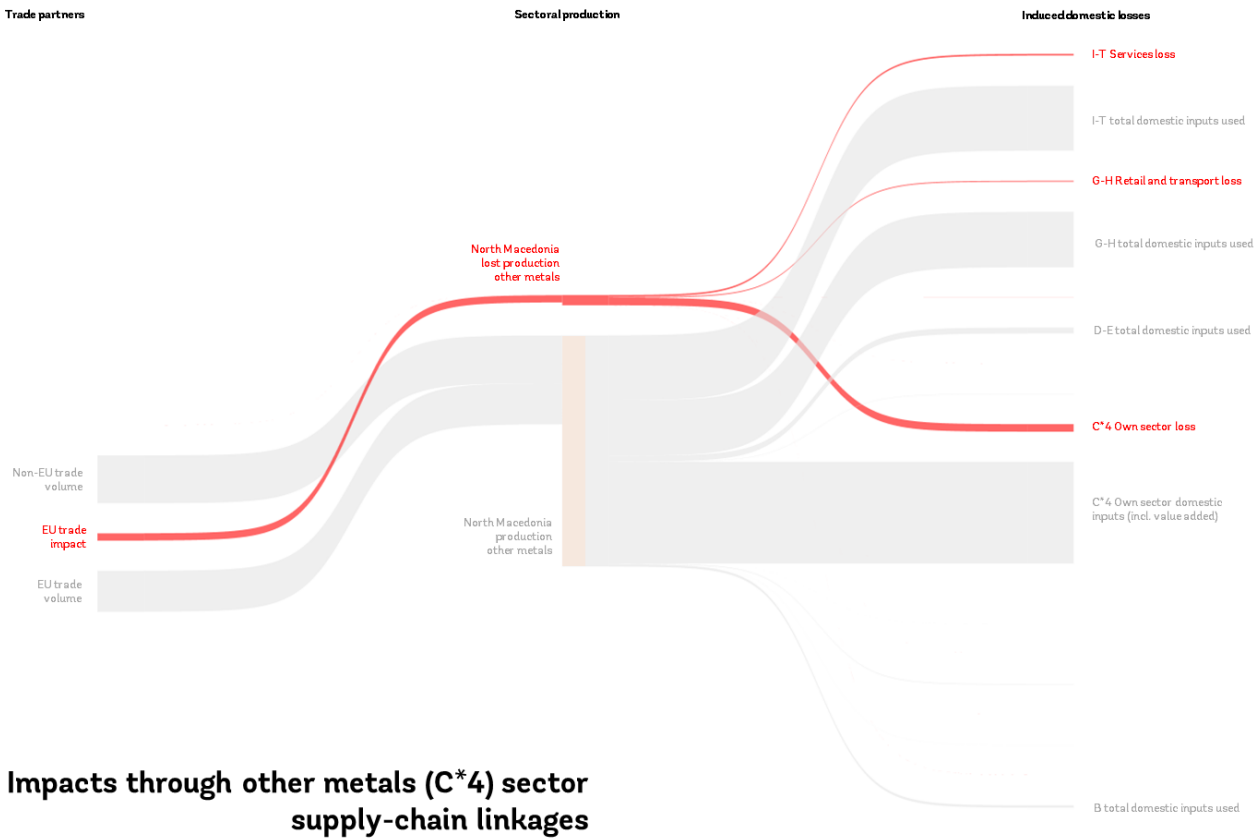


Figure A2. Impacts through other metals (C*4) sector supply-chain linkages

Similarly to the iron and steel sector impacts in the other metals (incl. aluminium) sector mostly originate from a loss of EU exports. This decreases domestic production (center), which in turn decreases demand for intermediate goods. While an impact on services, such as transport, are present for both iron and steel, and other metals other intermediate goods are industry specific. Hence, mining is not impacted in the case of other metals. Nevertheless, impact on own industry inputs (i.e., value added) are higher in the case of other metals. Which means, that due to its higher value added ratio export losses in other metals result in higher wage and other value added component loss.

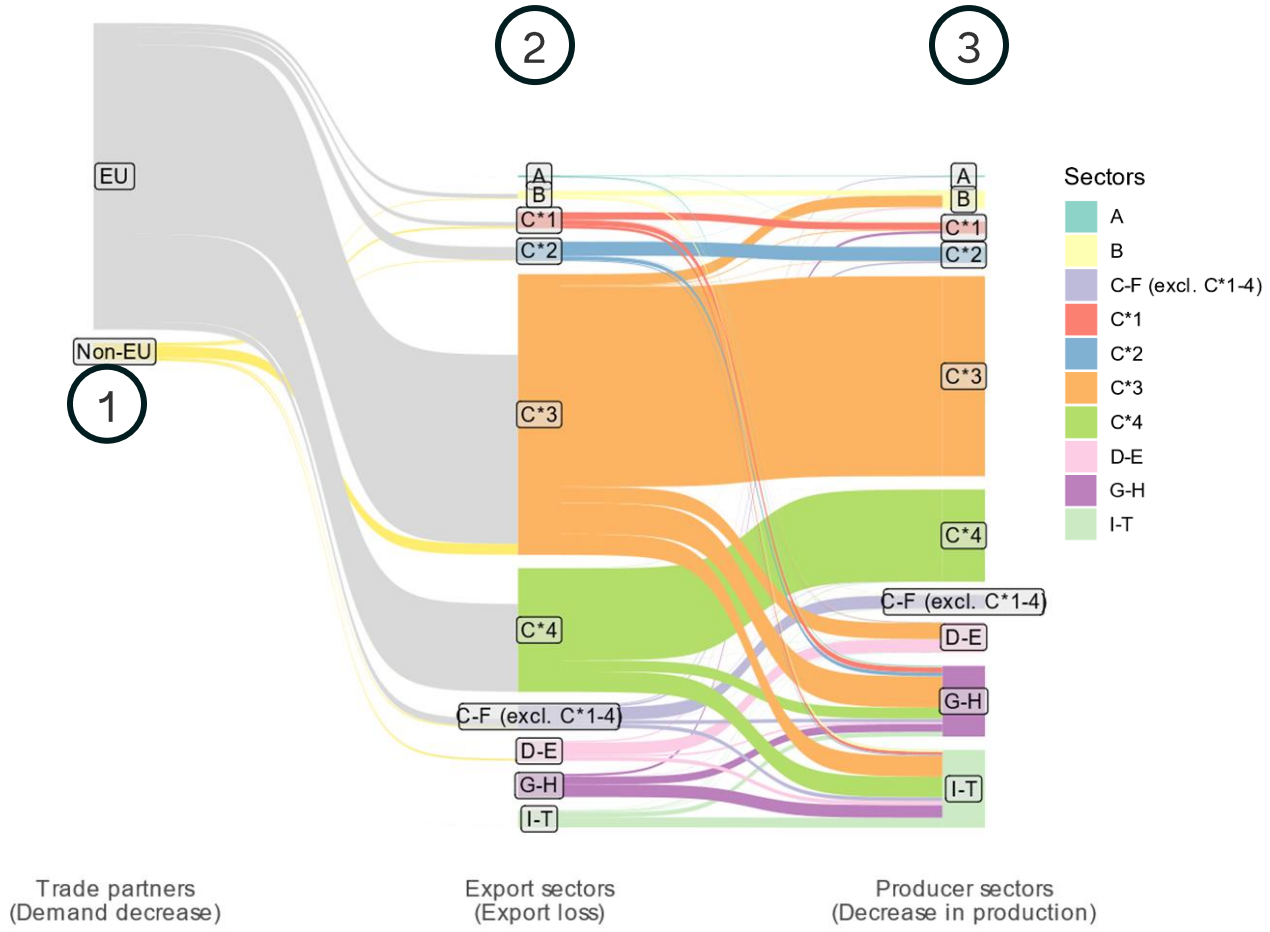


Figure A3. All trade impacts and induced impacts (losses)

This figure paints a comprehensive effect of the trade impacts and the indirect effects that they cause through supply-chain linkages in the economy. From left-to-right one can follow through how reduced EU trade demand [1] (due to prices inflated by CBAM) leads to lower domestic production in exporting sectors [2], esp. in heavy industry (C*3, C*4). Which in turn shrinks demand for intermediate goods and services, resulting in lower production even in sectors supplying the domestic economy [3]. Eventually, these production losses, might result in lower production in other sectors too. For example, one can follow how decreased production of other metals (C*4) induces lower demand for transport (G-H) services, which in turn results in a decreased demand from transport to other services (I-T).

Appendix 2: The Methodology behind the MINDSET model

The World Bank's MINDSET model was used to estimate the impacts on jobs and economic outcomes from CBAM in North Macedonia. The Model of Innovation in Dynamic Low-Carbon Structural Economic and Employment Transformations, MINDSET, is a demand-driven global macroeconomic model. The current version of MINDSET is designed to rapidly analyze short- and medium-term sectoral output, labor demand, and carbon-related cross-border competitiveness effects of climate and development policy mixes. MINDSET covers the whole economy in 164 countries, breaking it down into 120 sectors. The sectoral analysis is linked to detailed labor-market impacts using microdata. Based on the global GLORIA Multi-Regional Input-Output (MRIO) database (Lenzen et al., 2017, 2021)[24], the model supports multi- or single-country policy scenario analyses, including impact analyses from third-party policies.

MINDSET combines the strengths of Input-Output (IO) analysis – namely, short- to medium-term economic responses to exogenous demand changes, accounting for all multiplier effects from intermediate demand along the value chains in a consistent framework – with responses to exogenous price changes. It connects all 164 countries in the dataset to each other through bilateral trade flows, thereby capturing trade effects from intermediate and final demand changes in one country on its trading partners. It estimates indirect and supply-chain impacts, as well as price-induced changes in international trade. The core elements of the model are the interindustry relations given by intermediate use at basic prices by economic sector and final demand vectors by country connected by respective bilateral trade. The model does not capture labor flows into or out of the labor force or unemployment. The model has been used in several climate-informed country analytics, such as the Bosnia and Herzegovina Country Economic Memorandum, CCDRs in the Philippines, Peru, and Bangladesh, as well as country operations, such as a Morocco Climate Operation PforR.

The main transmission mechanism translates climate policies into price and demand changes and simulates the response of the economy to different climate policy scenarios. The results then are typically given as scenario differences, such as percentage difference of employment, output, or other economic indicators. The approach needs assumptions regarding the responses of industries and households to the scenario's price level and labor tax level. These responses are determined by the respective elasticities, with own- and cross-price elasticities for energy carriers as intermediate inputs to production and price elasticities of final demand from households and Governments. The same holds true for labor taxes.

Introducing endogenous adjustments of production, consumption, and trade into the input-output framework, the model projects policy-induced shifts across all sectors and across all countries or regions. The model estimates indirect and supply-chain impacts, as well as price-induced changes in international trade. Coverage is disaggregated into 120 sectors, including 10 energy sectors, across 164 countries and regions. The model is parametrized with the various sector-country-(fuel)-specific elasticities, including energy efficiency and fuel switching, household income and demand, trade, and output-induced investment (and converters), and output-employment. Augmentation with national labor force microdata allows for distributional labor demand analyses across income strata, skill levels, occupation types, and subnational provinces, providing relevant information for active labor market and reskilling interventions, as well as sectoral or regional government support funds.

[24] Release 057 of the GLORIA global environmentally-extended multi-region input-output (MRIO) database has been used (Lenzen et al., 2021), constructed in the Global MRIO Lab (Lenzen et al., 2017).

MINDSET uses a harmonized database. The data used in this report were compared to the latest publication of Supply and Use tables by the statistical office of North Macedonia and only very small differences were found. They do not affect the results reported below.

The model includes a detailed representation of fuel use and energy-related emission flows between countries and industries. Carbon content of individual input-output flows is calculated based on IEA Energy Balances[25] complemented with UNSD Energy Balances[26] and emission factors based on IIASA's GAINS model. This enables the system not just to model monetary impacts on an industry level based on flow-level energy use and CO_2 emissions, but also to be able to pick-up the environmental impacts of endogenous changes in the economy (e.g., price induced substitution, energy efficiency, etc.).

[25] IEA Energy Balances 2023 edition; data reported for 2019 were used.
[26] United Nations Energy Statistics, Energy Balances.