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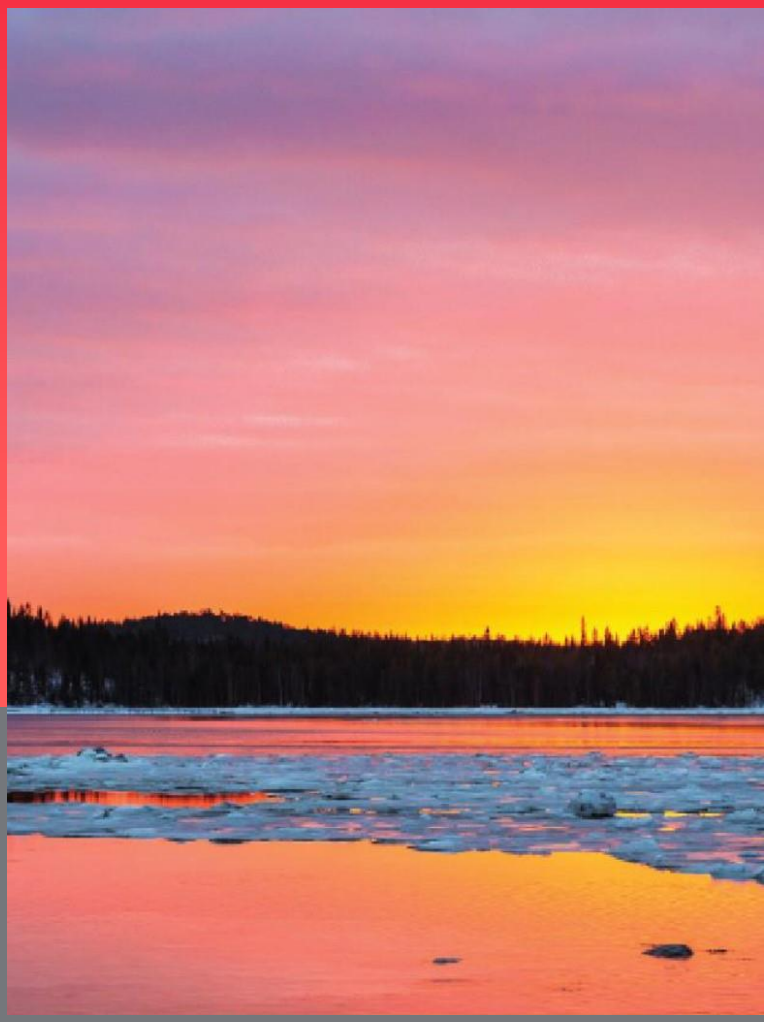

Russian Economic Transformation: Navigating Climate Policy and Trade Restrictions

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Abstract

We are considering the introduction of climate policy in Russia under conditions of quantitative export restrictions. We have enhanced the model employed in the article (Burova et al., 2023) by incorporating a mechanism for quantitative trade restrictions.

We demonstrate that in the case of deterioration in external economic conditions, such as a decline in the prices of Russian exports, the significance of quantitative export restrictions becomes secondary. The reason is that at low export prices the optimal physical volume of exports only marginally exceeds or may even be less than the quantitative restrictions.

Without unrestricted access to global green technologies, ambitious climate policy goals may become excessively costly in terms of economic impact. In the presented model, attempting to achieve a 70% reduction in CO2-equivalent emissions from the 2016 level, coupled with decreasing prices for Russian exports and quantitative trade restrictions, could result in a deviation of GDP in 2040 by 11% from the baseline scenario, which implies maintaining the current status quo in climate policy both in Russia and globally.

A more economically viable approach seems to be a moderate climate policy: achieving a 36% reduction in emissions from combustion compared to the 2016 level results in a 4.7% downward deviation of real GDP in 2040 from the baseline scenario. Only 0.3% of this decrease is attributed to the impact of domestic climate policy through an emissions trading system. The remaining 4.4% is explained by the deterioration of external economic conditions, stemming from the climate policies of other countries and quantitative restrictions on Russian exports.

In the absence of a proactive climate policy, the carbon intensity of Russian GDP rises, amplifying transitional and physical risks of addressing the consequences of climate change. Essential measures to mitigate these risks involve the promotion and development of green industries, particularly those oriented towards exports.

Keywords: Russia, climate policy, NGFS scenarios, export restrictions, CGE, emissions trading, ETS

JEL classification: C68, F13, Q52, Q54, Q58

1. Introduction

An active climate policy aimed at reducing greenhouse gas emissions, including 'transitioning away from fossil fuels' (UN FCCC 2023), was named among the priority tasks for all participants in the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (Dubai, December 2023).

A gradual 'transitioning away from fossil fuels' in conjunction with active climate policies can lead to significant changes in global trade, including a reduction in demand for traditional Russian exports. The main Russian exports reflect the current comparative advantage of the Russian economy in accessing cheap sources of fossil fuels and, as a result, have a significant carbon footprint. To find a new place for the Russian economy in the global economic system, it is necessary to carefully study various scenarios of possible energy transition.

Amidst worrying trends of deglobalisation, the global economy is increasingly polarising into self-sufficient regional trade blocs and economic spheres of influence. Collaboration is becoming more confined to smaller clusters of 'friendly' and 'similar' nations, as noted by (Aiyar et al. 2023), (WTO 2023). Notably, there is a rising endorsement of state industrial policies, non-tariff trade measures, and restrictions on exports and investments worldwide, especially within the realm of climate policy initiatives (WTO 2023), (Kowalski and Legendre 2023). Given this context, it is essential to delve into the nuanced dynamics of quantitative trade restrictions and their implications within the framework of evaluating climate scenarios up to 2040.

This article presents economic impact assessments stemming from emissions reduction across six scenarios: three scenarios marked by the absence of active Russian domestic climate policies and three scenarios integrating an emissions trading system (ETS) for emissions in Russia. Within each category, we delve into the BAU (Business as Usual), CBAM Moderate (Moderate Carbon Border Adjustment Mechanism), and CBAM Extreme (Extreme Carbon Border Adjustment Mechanism) scenarios,[1] aligning them with NGFS scenarios (Phase III, (Menon, Holthausen, and Breeden 2022)). Specifically, the BAU scenario corresponds to the NDC (Nationally Determined Contributions) scenario, CBAM Moderate aligns with the NGFS Below 2C scenario, and CBAM Extreme corresponds to the Net Zero 2050 scenario. NGFS scenarios serve as a benchmark for assessing potential climate change consequences and are widely adopted by numerous central banks (Grippa and Mann 2021), (Financial Stability Board 2022).

We enhanced the CGE model (Computable General Equilibrium model) used in the articles (Burova et al. 2023) and (Böhringer et al. 2015) by incorporating a mechanism for quantitative trade restrictions. To the best of our knowledge, this is the

[1] A detailed discussion of the scenarios is given in Section 4.

first study that examines the introduction of an emissions quota trading system in Russia in the context of existing quantitative export constraints.

We demonstrate that as the external economic conditions steadily deteriorates, which is manifested in declining prices for Russian exports, the significance of quantitative export constraints diminishes. This is due to the fact that, at lower export prices, the export supply is only marginally higher or may even be lower than the quantitative export constraints. The same principle applies to climate policy. In scenarios with lenient greenhouse gas emission reduction targets, amidst unfavourable external economic conditions, the introduction of an emissions quota trading system does not result in additional economic effects compared to a scenario without domestic climate policy.

Changes in industrial output indicate a significant influence of scenario conditions on the sectoral structure of industrial production. Overall, our scenario calculations reveal a decline in the output of oil products, oil extraction, and pipeline transportation. Industries driven to increase production include those serving consumer demand (food production), mechanical engineering sectors (vehicle manufacturing, machinery and equipment production, and electrical equipment manufacturing), as well as industries that use oil products as raw materials (chemical production) and do not encounter significant restrictions in accessing the global market.

It is important to emphasise that our scenarios are built upon the current structure of goods and services production in Russia, without assuming the emergence of new green industries. Therefore, the presented estimates regarding the consequences of an active domestic climate policy are rather conservative. The implementation of policies aimed at fostering new industries could significantly enhance efforts to combat climate change and its consequences.

The structure of the remainder of the paper is as follows: the second section offers a concise overview of our computable general equilibrium model. In the third section, we briefly address the calibration of model parameters and initial data. The fourth section provides a comprehensive description of the scenario conditions. Subsequently, the fifth section delves into a discussion of the modelling results, and the sixth section serves as the conclusion.

2. Model description

We have refined the model that was used in the articles (Burova et al. 2023) and (Böhringer et al. 2015). It is a static Computable General Equilibrium (CGE) model where Russia is represented as a small open economy. As most models of this class, the model is based on solutions to consumer and producer optimisation problems, as well as supply and demand balances across all markets. Climate policy is incorporated into the model through the establishment of an emissions quota trading system (An et al. 2023).

Our contribution lies in the introduction of the quantitative trade restriction mechanism, a topic that will be further explored in Section 2.3.

2.1. Economic agents, production, consumption, and emissions

2.1.1. Economic agents

In alignment with the approach taken by (Burova et al. 2023), our model comprises a representative economic agent (REA), producers, the government, and the investment sector. The REA optimises utility within budget constraints, owning all factors of production in the economy, receiving wages, capital rents, and payments for the use of specific capital in the extractive sectors. In our model, the REA additionally derives income from access to export markets in the event of trade restrictions (see Section 2.3 below).

Adhering to the framework established by (Burova et al. 2023), our model attributes tax collection and revenue from CO2 emission quotas to the government in the respective scenarios. Across all scenarios, government consumption remains fixed at the base year (2016) level in real terms. The resulting budget surplus, calculated as budget's revenue minus expenditures on government purchases, is directed to the representative agent's budget. Conversely, in the case of a budget deficit, financing is sourced from the REA's budget.

Diverging from the model proposed by (Burova et al. 2023), we refrain from fixing the level of investment spending in the economy in real terms. Instead, we assume that the myopic representative agent makes decisions on savings period-by-period, based on the level of disposable income and the price ratio between the consumer basket and the set of investment goods, considering only the current period and not the impact on future periods. In essence, our model posits a time-separable utility function for the representative consumer, where the upper-level choice is determined by a Cobb-Douglas function between the composite good for final consumption and the composite investment good.

The savings and investment bank purchases goods in the final product market. The structure of investment demand remains fixed at the base year (2016) level in real terms and is funded from the representative agent's budget allocated for savings. In

other words, the model assumes that investments are savings-driven (Lofgren et al. 2002).

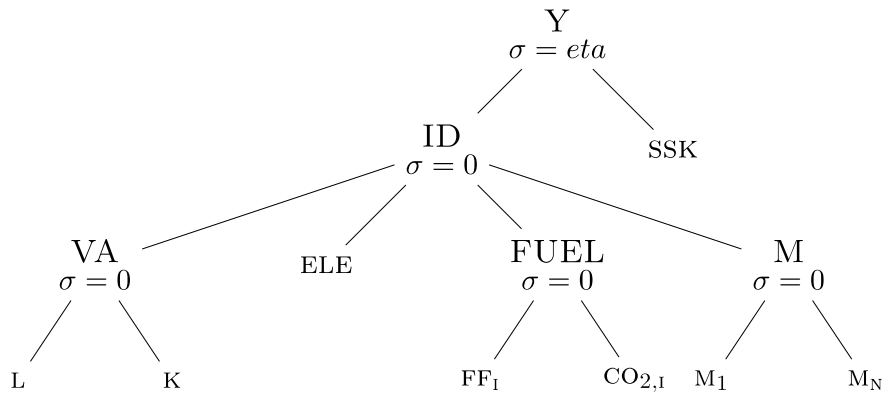
2.1.2. Producers

In alignment with (Burova et al. 2023) our model encompasses 42 distinct industrial sectors (refer to Table 4), each characterised by a constant-returns-to-scale-production function. All enterprises minimise costs, and all markets allow free entry, resulting in zero economic profit. This implies that the marginal revenues for an individual firm precisely coincide with its marginal costs.

The literature on climate policy focuses on the choice of the nested structure of production functions (Zha and Zhou 2014), (Lagomarsino 2021), (Mardones and Ortega 2021), (Balistreri and Brown 2023). It is important to note that the question of the form and structure of production functions goes hand in hand with issues related to the parameterisation of the selected functions. Currently, computable general equilibrium models predominantly employ functions with constant elasticity of transformation and substitution, with parameterisation involving the estimation and selection of suitable values for substitution and transformation elasticities. We will revisit the discussion of the elasticities' values in our model in Section 3.

In line with (Burova et al. 2023) and (Böhringer et al. 2015), three distinct types of production processes are identified: the extraction of natural resources (Figure 1), electricity generation (Figure 2), and the production of all other goods and services (Figure 3). Each process uses labour and capital, along with fuel and intermediate goods for production. The extractive industries also employ specific capital.

Figure 1. Production structure in the extractive industries

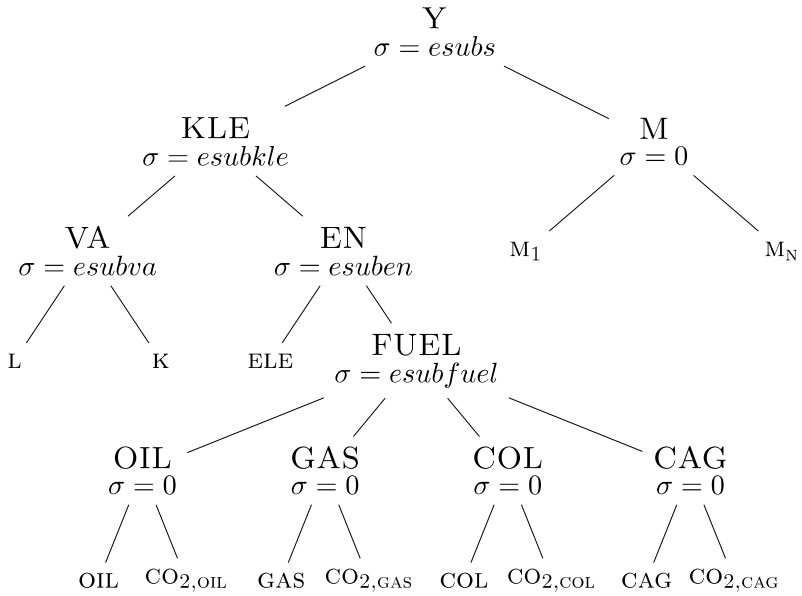


Notations: Y is the total output of the industry, described using a Constant Elasticity of Substitution (CES) function, where the substitution elasticity (σ) at the upper nesting level is equal to *eta* (Table 1); ID is a composite good for intermediate consumption, described using a Leontief function, i.e. the substitution elasticity between all components (σ) is equal to 0; SSK is specific capital, i.e. capital that can only be used in a particular industry, and its remuneration is determined by the residual principle; VA is value added, described using a Leontief function, i.e. the substitution elasticity between labour (L) and capital (K) is equal to

0; ELE is electricity used in the production of this industry; FUEL is a composite energy good, described using a Leontief function, i.e. zero substitution elasticity between all types of fuel (oil products (OIL), natural gas from a pipeline (GAS), distribution network gas (CAG), coal (COL)) and CO2 emission quotas; and M is a composite intermediate good, described using a Leontief function, i.e. the substitution elasticity (σ) between all components M_i is equal to 0.

Source: author, based on (Böhringer et al. 2015).

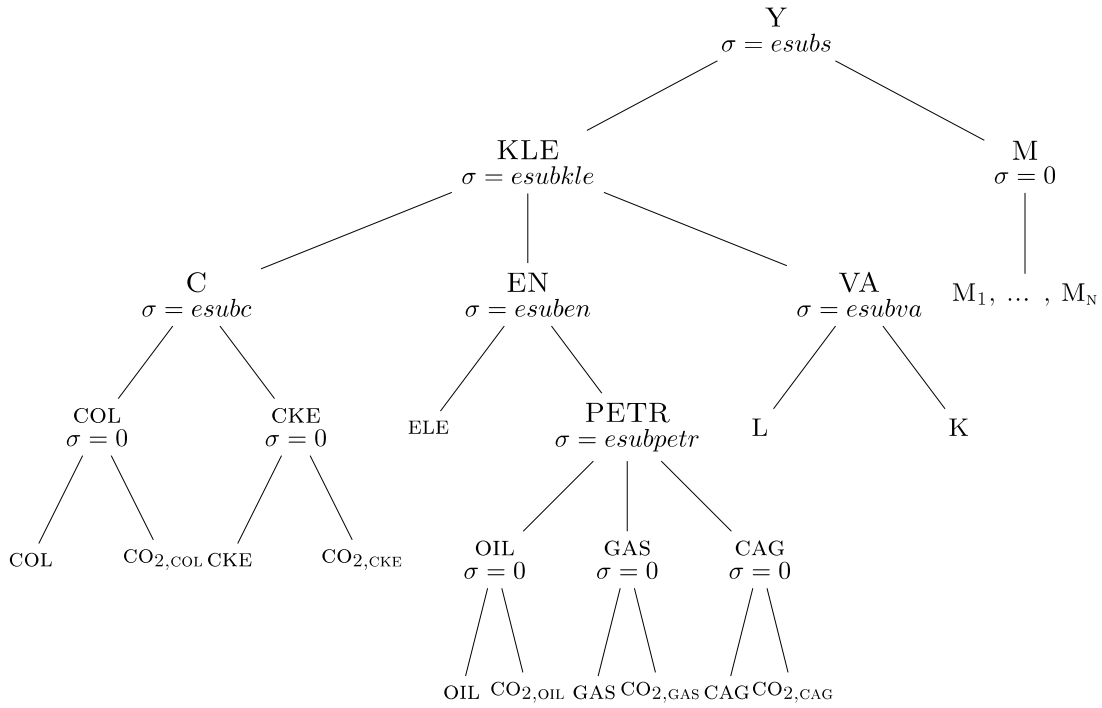
Figure 2. Production structure in the electricity generation



<u>*Notations*</u>: Y is the aggregate electricity output, modelled using a Constant Elasticity of Substitution (CES) function, with the elasticity of substitution (σ) set at the upper nesting level as *esubs* (Table 1); KLE is a composite of value-added and energy inputs, explicated through a CES function with a substitution elasticity (σ) denoted as *esubkle* (Table 1); VA is the value-added component, delineated using a CES function featuring a substitution elasticity (σ) between labour (L) and capital (K), designated as *esubsva* (Table 1); EN is a composite energy input, characterised by a CES function with a substitution elasticity (σ) of *esubn* (Table 1); ELE is the electricity utilised within the electricity production process; FUEL is a composite energy input, modelled using a CES function, with the substitution elasticity (σ) among various fuel types, accounting for CO2 quota expenses, expressed as *esubsfuel* (Table 1); the carbon-containing fuel mixtures (such as oil (OIL), pipeline natural gas (GAS), distributed gas (CAG), and coal (COL)), along with emission quotas, are delineated using a Leontief function, wherein the substitution elasticity (σ) between fuel and emission quotas is stipulated as 0; and M is a composite intermediate input, articulated through a Leontief function, signifying a substitution elasticity (σ) of 0 among all constituent components M_i.

Source: author, based on (Böhringer et al. 2015).

Figure 3. Production structure in all other industries except electricity generation and extraction



<u>*Notations*</u>: Y is the aggregate industry output, excluding electricity production and extractive sectors, described using a Constant Elasticity of Substitution (CES) function, where the elasticity of substitution (σ) at the upper nesting level is *esubs* (Table 1); KLE is a composite of value-added and energy goods, described through a CES function with a substitution elasticity (σ) denoted as *esubkle* (Table 1); C is a composite energy good, consisting of coal (COL) and coke (CKE), accounting for CO2 quota costs, described using a CES function with a substitution elasticity (σ) of *esubc* (Table 1); VA is the value-added component, described using a CES function with a substitution elasticity (σ) between labour (L) and capital (K) designated as *esubsva* (Table 1); EN is a composite energy good, described using a CES function with a substitution elasticity (σ) of *esubn* (Table 1); ELE is the electricity utilised within the electricity production process; PETR is a composite energy good, described using a CES function with a substitution elasticity (σ) among all types of carbon-containing fuels (oil (OIL), pipeline natural gas (GAS), distributed gas (CAG))) accounting for CO2 quota expenses, equal to *esubpetrl* (Table 1); carbon-containing mixtures of various fuel types and emission quotas are described using a Leontief function, wherein the substitution elasticity (σ) between fuel and emission quotas is stipulated as 0; and M is a composite intermediate good, articulated through a Leontief function, signifying a substitution elasticity (σ) of 0 among all constituent components M_i.

Source: author, based on (Böhringer et al. 2015).

2.1.3. Factors of production

Building on the model of (Burova et al. 2023), we define three types of factors: labour, mobile capital, and specific capital. Labour and mobile capital are fully mobile between sectors, indicating a unified market for each factor within the entire country. Consequently, this leads to a unified wage and a unified mobile capital rent across all

sectors. Specific capital is exclusive to the extractive sectors and remains fixed at the base year (2016) level for each of these sectors. We assume a constant volume of specific capital at this base year level, implying that the growth of proven reserves matches the rate of depletion of deposits for all fossil fuels. Hence, within each extractive sector, a specific capital rent is established, determined residually after covering all other production costs.

2.1.4. Emissions

In our model, mirroring the approach of (Burova et al. 2023) and (Böhringer et al. 2015), we distinguish between two primary energy sources: electricity and fossil fuels. The use of fossil fuels (including coal, oil products, and gas) leads to the emission of greenhouse gases according to fixed sector-specific emission coefficients. It is worth noting that crude oil is not treated as a direct fuel source in our model; instead, it is utilised in the production of oil products without direct combustion.

Detailed information regarding sectoral CO2-equivalent (CO2-eq) emissions and fuel expenditures in the base year (2016), along with sector-specific emission coefficients for different fuel types, can be found in the appendix (Table 6).

2.2. Domestic climate policy: CO2 emissions cap

Following the studies of (Burova et al. 2023) and (Böhringer et al. 2015), we model domestic climate policy through the introduction of a carbon emissions trading system. Under this framework, a maximum aggregate level of CO2-eq emissions is set for all sources of emissions within the economy. The carbon tax rate will correspond to the price of one tonne of CO2-eq emission allowance, established within the system to ensure that the resulting total emissions meet the predetermined target.

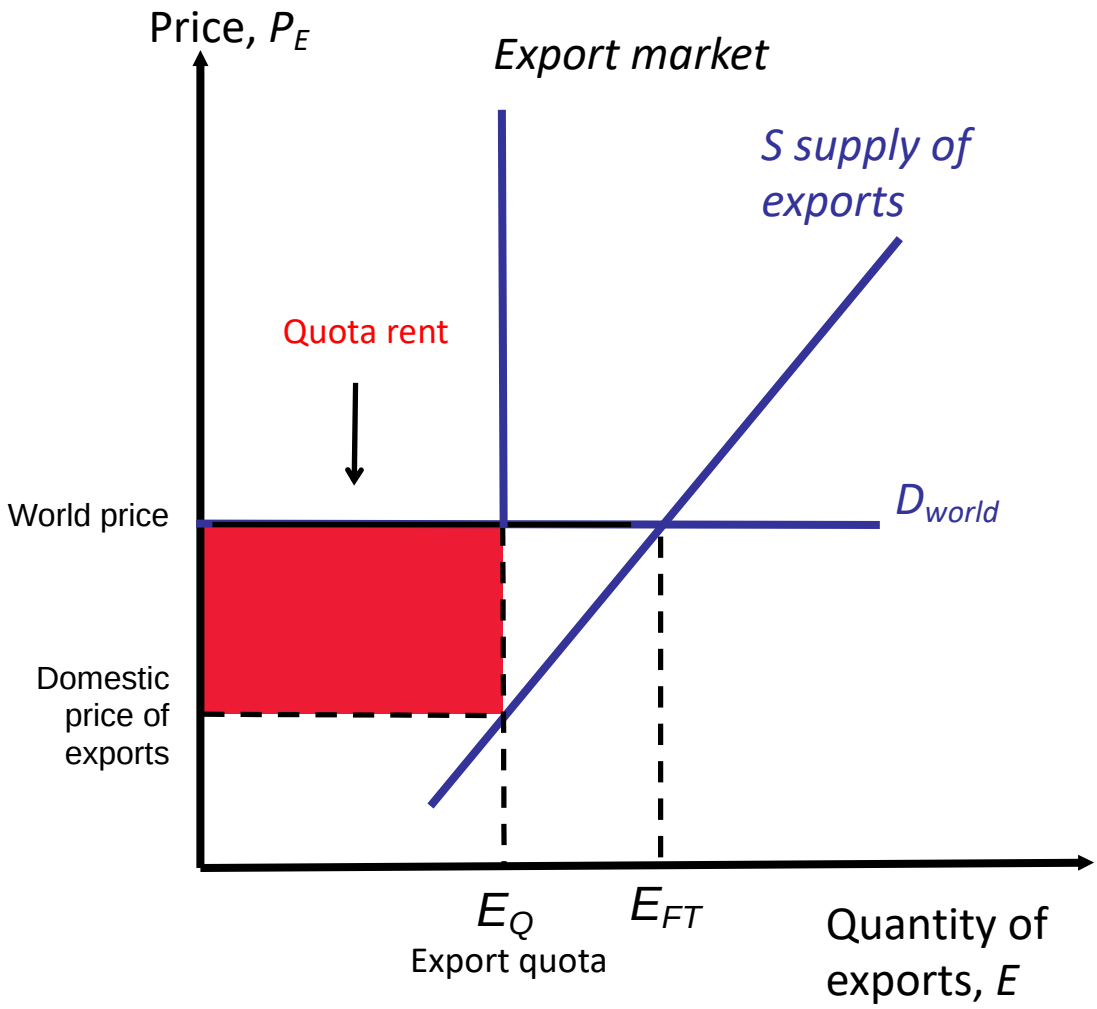
2.3. Quantitative export restrictions

The theory of international trade has developed approaches to assess the consequences of implementing quantitative export or import restrictions quite effectively (Vousden 1990). In this regard, the quantitative export restrictions encountered by the Russian economy in 2022 align well with the analytical approaches proposed by the theory of international trade.

In our model, the Russian economy is depicted as a small open economy. In other words, global prices do not change based on the volume of Russian exports and imports. Under the assumption of a small open economy, the world demand curve for Russian exports transforms into a horizontal line at the world price level (D_{world}, Figure 4).

Under free trade conditions (O_{FT}), meaning no external export restrictions, the equilibrium in the domestic market is determined by the domestic export supply curve (S) and the global demand for Russian exports (D_{world}). At this equilibrium, the export volume (E_{FT}) is traded at the price P_W.

Figure 4. Domestic market after implementation of quantitative export restrictions



Source: author.

The introduction of quantitative restrictions on exports (E_Q) leads to a shift in market equilibrium (O_Q) (see Figure 4). This results in a reduction in the domestic price of exported goods (PD), while the global price remains unchanged (P_W), thus reducing the marginal costs for exporters to achieve maximum export volume (E_Q).

In the economic landscape, a discrepancy arises between domestic and global export prices. Notably, not all exporters willing to transact at global prices can do so due to the imposition of quantitative restrictions. The mechanism governing export allocation, particularly the selection criteria for entities to supply export goods within the allotted quota, significantly shapes the macroeconomic consequences of quantitative export restrictions.

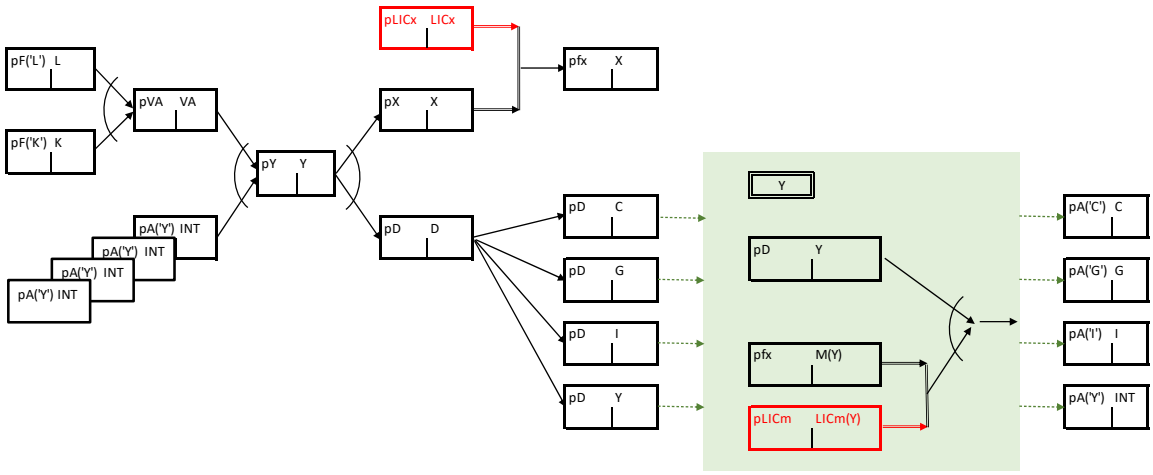
We assume an optimal mechanism: the allocation of export quotas through auction. Under this framework, the price of an export quota aligns with the surplus derived from supplying E_Q to the global market, denoted as the difference between P_W and P_D. As quantitative export restrictions expand while global prices remain constant,

the volume of quotas offered at auction increases, leading to a decrease in the unit price of quotas. With a fixed volume of quantitative export restrictions and a decrease in global prices, the cost of export permits similarly decreases. Through this quota allocation mechanism, the most efficient companies, whose marginal costs are equal to or lower than P_D, are included among the exporters.

The question of ownership rights to export and the distribution of quota revenues plays a significant role in assessing the consequences of quantitative export restrictions. We assume that the quota revenue is returned to the domestic representative household. An alternative assumption would be the transfer of the quota revenue to a foreign economic agent, which could be perceived as a discount on Russian export deliveries within the quota framework or increased costs for logistic services provided by foreign companies.

In our analysis, we simulated the decrease in export volumes through the introduction of extra costs in foreign trade. These costs refer to expenses associated with obtaining the permit to export within the export quota system. These additional costs are integrated into the cost structure of exporters (as illustrated in Figure 5, where the extra costs incurred by exporters are highlighted in red: LICx represents the number of export licences, and pLICx stands for the price of one licence).

Figure 5. Cost structure of a representative firm and distribution of goods to markets



<u>*Notations*</u>: Labour (quantity L, price pF(L)) and capital (K, pF(K)) contribute to value added (pVA, VA), which is utilised in the production of goods and services (pY, Y) alongside intermediate goods (pA, INT). All produced goods are divided between export (pX, X) and the domestic market (pD, D). Exporting goods (X) requires acquiring a licence (pLIC, LICx) at world prices in foreign currency units (pfx). Deliveries to the domestic market (pD, D) are combined with imports according to the preferences of economic agents (C - consumers, G - government, I - investment bank) and technological capabilities (INT - composite goods for intermediate consumption), forming supply in retail markets. Variations in economic agents' preferences affect the substitution elasticities between domestic and imported goods. Each retail market (C, G, I, INT) has its price for composite goods, blending domestic consumption and imports (pA(C), pA(G), pA(I), pA(INT)). Import rationing (M) using import licences (LICm)

is feasible within our model, although no import restrictions were implemented in the scenarios we consider.

Source: author.

3. Calibration

Expanding upon the equilibrium dataset outlined in (Burova et al., 2023), we refined the granularity of commodity groups. Our dataset for the model consists of two primary components: economic indicators depicting the Russian economy in the base year (2016) and emissions data.

The main sources of economic data for model calibration include Russian input-output tables for 2016 and national accounts data for the same year. Sectoral input-output data were aggregated at the level of 42 sectors (Table 4) and 59 commodity groups (Table 5). The methodology for constructing an equilibrium dataset for CGE modelling based on input-output tables is visually elucidated in Rutherford and Paltsev (1999).

Following a methodology akin to that in (Burova et al., 2023), we integrated CO2, CH4, and N2O emissions into the model. These emissions are caused by the combustion of various fuels during the production of goods and services. Burova et al. (2023) extensively delve into the process of creating a greenhouse gas emissions database consistent with economic data on the production of goods and services from input-output tables.

3.1. Elasticities of substitution and transformation

Numerous studies have delved into estimating substitution elasticities in computable general equilibrium models with climate policies. The elasticities that wield the most significant impact on assessing climate policy outcomes are those of substitution between different types of fuels, as well as the elasticity of substitution between capital (or value added) and energy (Antimiani, Costantini, and Paglialunga 2015).

Various approaches exist for determining elasticities, each influencing the results obtained: panel regressions, cross-sectional analyses, and time-series estimations. On average, elasticity estimates using panel data tend to be higher than those estimated using time-series data. This is partly because panel data reflect long-term elasticity, whereas time-series data estimate short-term elasticity (Apostolakis 1990). According to a meta-analysis of publications (Stern 2012), the majority of studies (71%) used time-series data.

Recently, more researchers have converged on the notion that long-term substitution elasticities should be used to assess the impacts of climate policies (Ma and Stern 2016). This has led them to use panel regressions to estimate the substitution elasticities of various fuels, as well as capital, labour, and energy (Costantini and Paglialunga 2014), (Okagawa and Ban 2008), (Steinbuks and Narayanan 2015), (Lagomarsino 2020).

An alternative approach to estimating substitution elasticities in climate policy models is based on calibrating the parameters of cost functions using marginal

abatement cost curves (MACCs) (Balistreri and Brown 2023). The magnitudes of capital and energy substitution under this approach exceed the values from econometric studies by several times (Kim and Heo 2013), (Mardones and Ortega 2021).

This study used elasticity values similar to those in (Burova et al. 2023), (Böhringer et al. 2015), and (Böhringer, Carbone, and Rutherford 2018) (see Table 1).

Table 1. Values of elasticities of substitution in the model

№	Name	Nesting level	Value
1	esubs	Elasticity of substitution between intermediate goods (M) and aggregated energy and value added bundle (KLE)	0.1
2	esubkle	Elasticity of substitution between value added (KL) and composite energy bundle (E)	0.5
3	esubva	Elasticity of substitution between labour (L) and capital (K) in value added	1
4	esuben	Elasticity of substitution between fuel mix (FUEL) and electricity (ELE)	1
5	esubpetr	Elasticity of substitution between different type of fuels (except coal) in electricity generation (OIL, GAS, CAG)	3
6	esubc	Elasticity of substitution between brown coal (COL) and coke (CKE) in production (except electricity generation and extraction industries)	3
7	esubfuel	Elasticity of substitution between different types of fuel (OIL, GAS, COL, CAG) in electricity generation	0.5

Source: author.

It is worth noting that the elasticity values we employed are within the conventional ranges for climate policy models (Stern 2012), (Lagomarsino 2020). Alternative methods for estimating elasticities (Balistreri and Brown 2023) could potentially change the modelling outcomes significantly, necessitating further exploration (refer to Section 5.9).

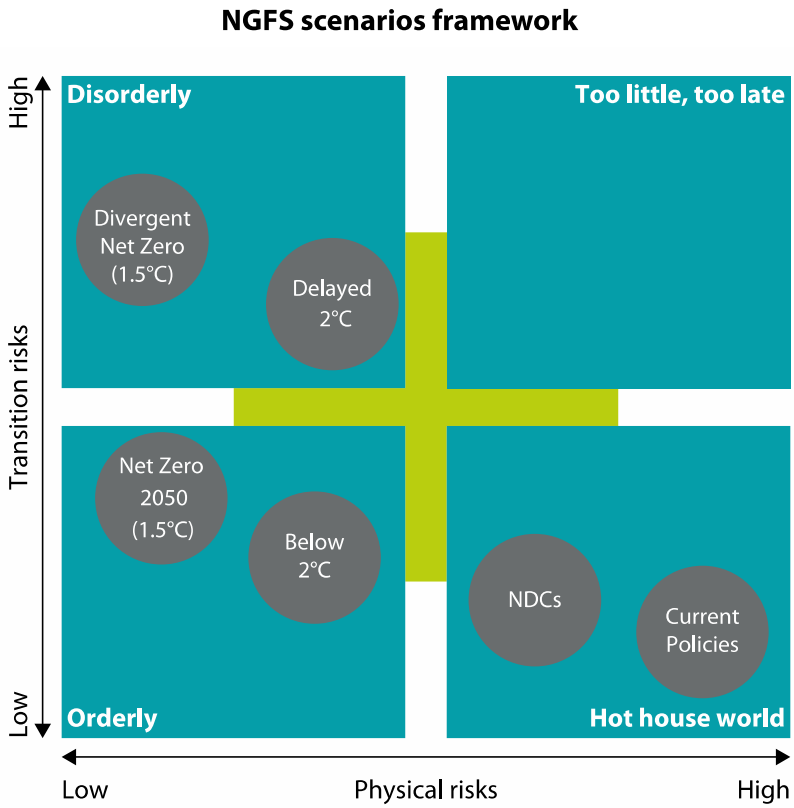
4. Scenarios

We examine two primary groups of scenarios: three scenarios lacking domestic climate policies and three scenarios incorporating the implementation of an emissions trading system (ETS), recognised in the event of global carbon border adjustment mechanism (CBAM). Within each scenario group, we analyse three variations of external economic conditions: BAU, CBAM Moderate, and CBAM Extreme. Our scenario construction is based on the NGFS (Phase III) scenarios (Menon, Holthausen, and Breeden 2022):

- The baseline scenario in our model aligns with the NDC (Nationally Determined Contributions) scenario from the hot house world scenario group (Figure 6). 'Hot house world scenarios assume that some climate policies are implemented in some jurisdictions, but globally efforts are insufficient to halt significant global warming. The scenarios result in severe physical risk including irreversible impacts like sea-level rise.' (Menon, Holthausen, and Breeden 2022). This scenario encompasses commitments made by all countries worldwide under the Paris Agreement, including commitments that have yet to commence or are highly uncertain (UN FCCC 2022).

- The CBAM Moderate and CBAM Extreme scenarios correspond to the Below 2C and Net Zero 2050 scenarios within the orderly energy transition scenario group. These scenarios presuppose coordinated early action by all countries globally, facilitating a reduction in the Earth's surface average temperature increase to 1.6°C by 2100 in the Below 2C scenario and to 1.4°C in the Net Zero 2050 scenario (Menon, Holthausen, and Breeden 2022).

Figure 6. NGFS scenarios framework



Source: (Menon, Holthausen, and Breeden 2022).

For each scenario – BAU, CBAM Moderate, and CBAM Extreme – forecasts of export prices (see Section 4.1.1) and export volumes (see Section 4.2.1) were employed. These forecasts were developed by experts from the Economic Forecasting Department and International Department of the Central Bank of Russia. Scenario projections were generated using data from the NiGEM macroeconomic model (UNEP FI 2022) and the MESSAGEix-GLOBIOM model (Krey et al. 2020), along with the World Bank's April 2023 commodity market price forecasts (World Bank Group 2023).

Table 2. Scenarios overview

NGFS Scenarios (Phase III, 2022)	Scenario name	Global CBAM, no domestic limate policy				Scenario name	Domestic ETS, recognised by the trading partners				
		Index of change of export		Average real GDP rate of change	Change in emissions (2040 to 2016), %		Index of change of export		average real GDP rate of change	Emissons limit (2040 level to 2016), %	Price tCO2-eq in 2040, thousand RUB/tCO2-eq
		prices	volumes				prices	volumes			
NDC (2.6C)	BAU	-1,79	0,07	-0,58	-4,90	ETS BAU	-1,79	0,07	-0,58	42,97	0,00
Below 2C (1.6C)	CBAM Moderate	-2,72	-0,49	-0,73	-8,25	ETS+CBAM Moderate	-2,50	-0,49	-0,75	-35,26	1,95
Net Zero 2050 (1.4C)	CBAM Extreme	-3,65	-1,42	-0,90	-8,12	ETS+CBAM Extreme	-3,20	-1,42	-1,18	-68,43	18,43

Source: author.

In general, conditions in the scenarios without domestic climate policies can be characterised by the average values of export price and export supply indices (see Table 2). For scenarios involving an emissions trading system, we will introduce another characteristic - the price of a CO2-eq emission permit (carbon price), which is determined within the emissions trading system.

The export price change index for a given year and a given scenario represents the weighted average change in the export price of goods from year to year. We use the shares of each export commodity in the total exports of the base year as weights. The export supply change index is calculated in a similar way.

4.1. International climate policy

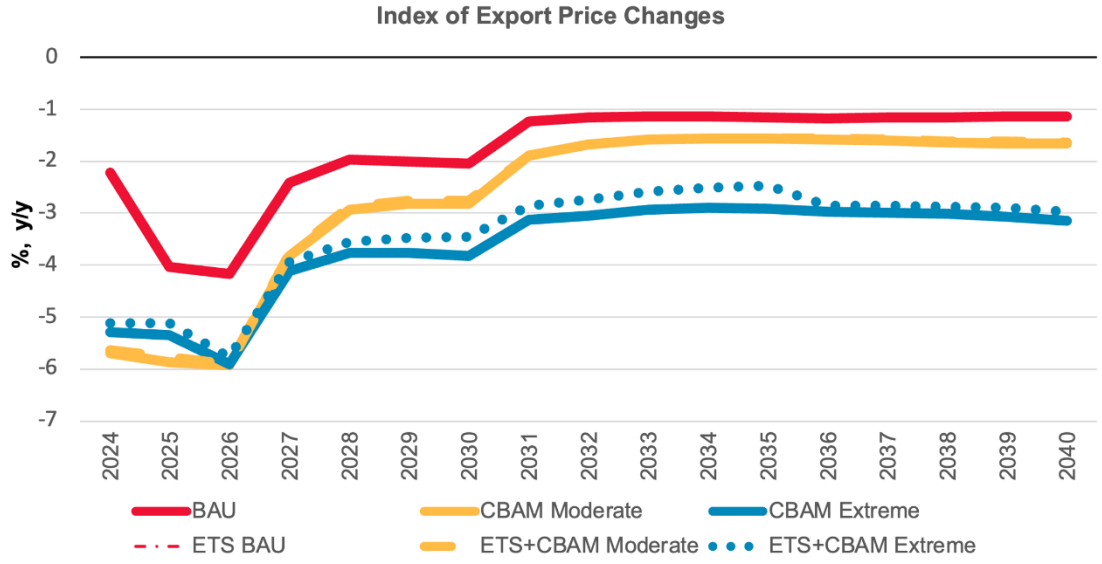
International climate policy will affect Russian exports in two main ways: by reducing global demand for carbon-intensive energy sources and by lowering the price of Russian exports in international markets (Grippa and Mann 2021), (Bashmakov 2023).

Forecasts of export prices and volumes reflect the level of intensity of climate policies: ranging from mild in the BAU and ETS Basic scenarios to highly ambitious in the CBAM Extreme and ETS+CBAM Extreme scenarios.

4.1.1. Export price change index

Fluctuations in the export price change index in our scenarios reflect a progression from lenient climate policies (BAU and ETS Basic) globally, which minimally affect the global prices of Russian exports, to more rigorous ones (CBAM Extreme and ETS+CBAM Extreme) (refer to Figure 7).

Figure 7. Export price change index year-on-year

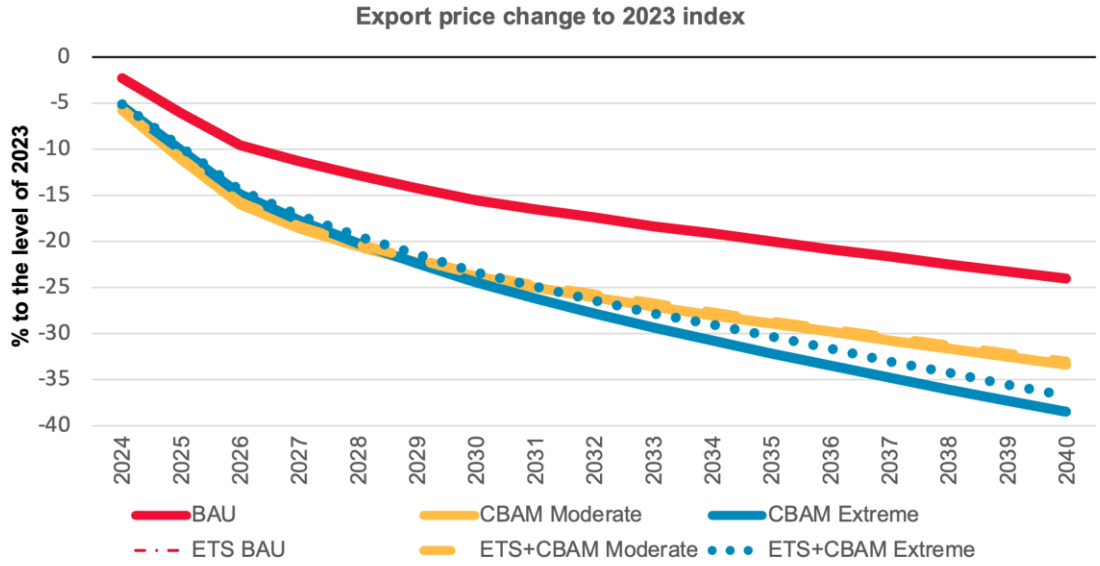


Source: author.

The rationale behind the decline in Russian export prices (refer to Figure 8) lies in the composition of Russia's primary export commodities. These include carbon-intensive fuels like oil, petroleum products, natural gas, and coal, as well as energy-intensive goods such as products from black metallurgy, steel, and chemicals, all of which entail significant CO2 emissions during their production processes.

Consequently, in the rest of the world under climate regulations, consumers of these goods will face a carbon levy, which escalates as nations approach their carbon neutrality objectives. As restrictions on CO2-eq emissions tighten, the prices of emission quotas will soar, thereby increasing the carbon levy. This widening gap between the buyer's price (inclusive of the carbon levy) and the producer's prices, notably those of Russian exporters, will ensue. The surge in buyer prices will dampen demand for carbon-intensive goods, prompting global prices to adjust accordingly to accommodate the carbon levy. These are the prices observed by Russian exporters in our model, aligning with the logic underpinning NGFS scenarios (Menon, Holthausen, and Breeden 2022).

Figure 8. Export price change to 2023 level index



Source: author.

4.1.2. Russian export commodity prices

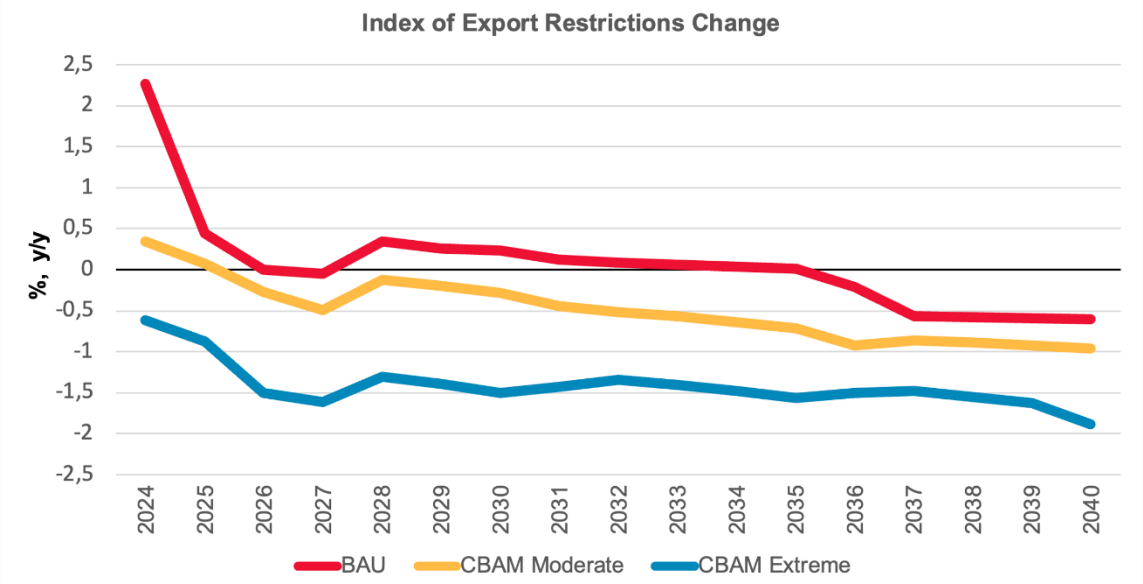
Changes in export prices across the BAU, CBAM Moderate, and CBAM Extreme scenarios are outlined in the Appendix (refer to Tables 7–9). In total, modifications are applied to 25 groups of goods and services, encompassing 68% of the total base year exports.

As we progress towards the CBAM Extreme scenario, alterations in export prices become more pronounced. The most notable fluctuations in global prices for Russian exports by 2040 are observed in the CBAM Extreme scenario, particularly for brown (energy) coal and coke, where the decline exceeds 70% compared to the base year (2016). An upsurge in Russian export prices by 2040 is anticipated solely in the non-ferrous metals group (including precious metals, aluminium, and other non-ferrous metal products). This concurs with the NGFS Net Zero 2050 scenario and is driven by the assumption of heightened demand for non-ferrous metals due to the accelerated electrification of economies worldwide.

4.2. Index of changes in quantitative restrictions of Russian exports

The scenarios we have modelled do not differentiate between the origins of quantitative restrictions. Our focus lies solely on the resulting level of quantitative limitations for each type of export product and its impact on the Russian economy. Consequently, our model operates two mechanisms of foreign trade restrictions: changes in Russian export prices and the imposition of quantitative export limitations.

Figure 9. Index of export restrictions change



Source: author.

4.2.1. Export volumes for key commodities

Table 3 below outlines the export commodities subject to quantitative restrictions in the model until 2040. The restrictions set predetermined upper limits on exports for these specific commodities. However, in each scenario, the actual equilibrium export volume may be lower. In such cases, the prices for export licences required to access global markets will be zero.

Table 3. Average values of quantitative export restrictions

№	code	Commodities	BAU	CBAM Moderate	CBAM Extreme
1	col	coal	-2,93	-11,86	-11,89
2	cru	crude oil	-0,32	-1,16	-2,32
3	gas	natural gas	3,35	2,32	-2,91
4	ore	metal ores	0,78	-0,94	-3,44
5	cke	coke	0,15	-5,93	-9,25
6	oil	petroleum products	-1,13	-1,16	-2,32
7	stl	steel and ferroalloys	0,78	0,02	-0,89
8	pmt	precious metals	2,62	2,80	3,60
9	alu	aluminium	0,91	1,05	1,32
10	cop	copper products	1,54	1,90	2,27
11	nfe	other non-ferrous metals	1,20	1,40	1,68

Source: author.

Quantitative export restrictions for each scenario are presented in the Appendix (see Tables 10–12).

4.3. Domestic climate policy

There are numerous types of climate policies aimed at reducing greenhouse gas emissions. One such policy we model is the implementation of an emissions trading system (ETS).

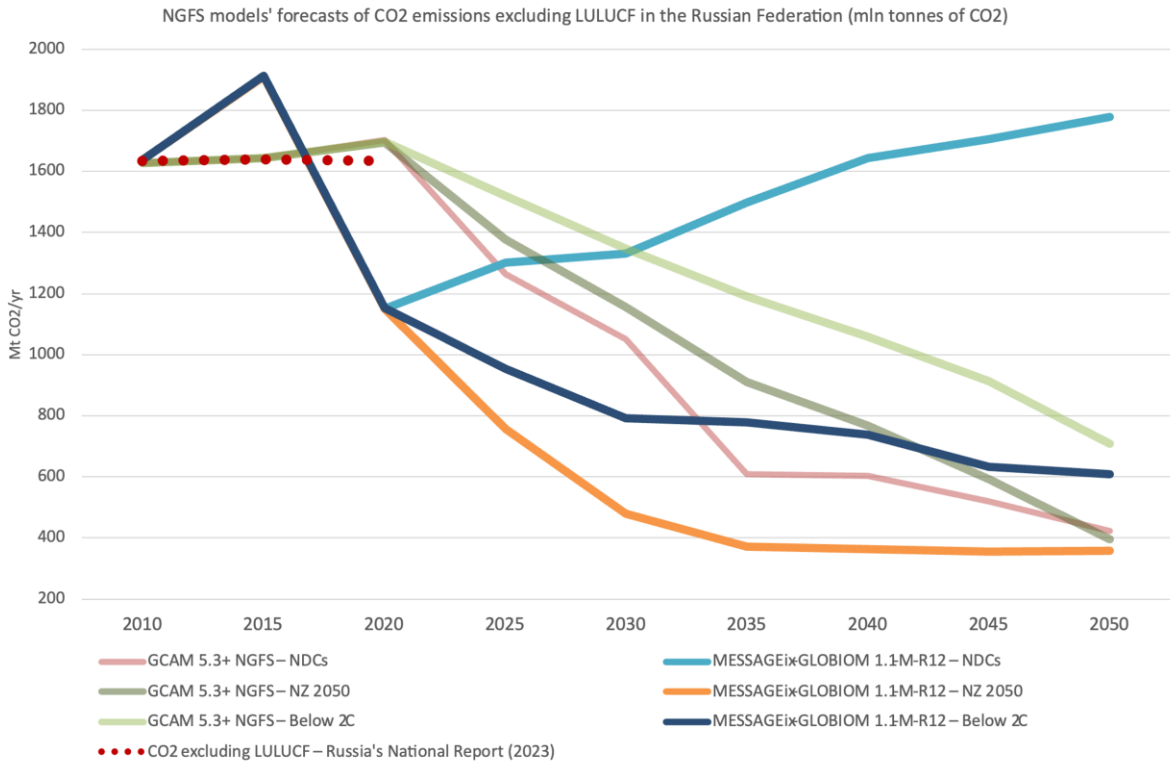
The ETS is «a market-based instrument aiming at meeting a mitigation objective in an efficient way. A cap on GHG emissions is divided in tradeable emission permits that are allocated by a combination of auctioning and handing out free allowances to entities within the jurisdiction of the trading scheme. … Entities need to surrender emission permits equal to the amount of their emissions (e.g., tonnes of CO2). An entity may sell excess permits to entities that can avoid the same amount of emissions in a cheaper way. Trading schemes may occur at the intra-company, domestic, or international level (e.g., the flexibility mechanisms under the Kyoto Protocol and the EU-ETS) and may apply to carbon dioxide (CO2), other greenhouse gases (GHGs), or other substances» (IPCC 2022).

4.3.1. Emissions trading system: emission constraints and permit prices

We referenced emission levels from NGFS models (Menon, Holthausen, and Breeden 2022), (Richters et al. 2022), (NGFS 2022) to develop scenario-specific emission limits within the greenhouse gas emissions trading system.

However, NGFS models lack a unified approach to estimating emission trajectories for scenarios with identical names. Consequently, we observed significant variations in emission limits. Figure 10 below illustrates CO2 emissions values in the Nationally Determined Contributions (NDC), Below 2C, and Net Zero 2050 scenarios for two NGFS model variants: MESSAGEix-GLOBIOM (Krey et al. 2020) and GCAM (Calvin et al. 2019). Additionally, for comparison, CO2-eq emissions excluding LULUCF are provided based on data from the National Inventory Report (Romanovskaya et al. 2023).

Figure 10. NGFS models' forecasts of CO2 emissions excluding LULUCF[2] in the Russian Federation, million tonnes of CO2

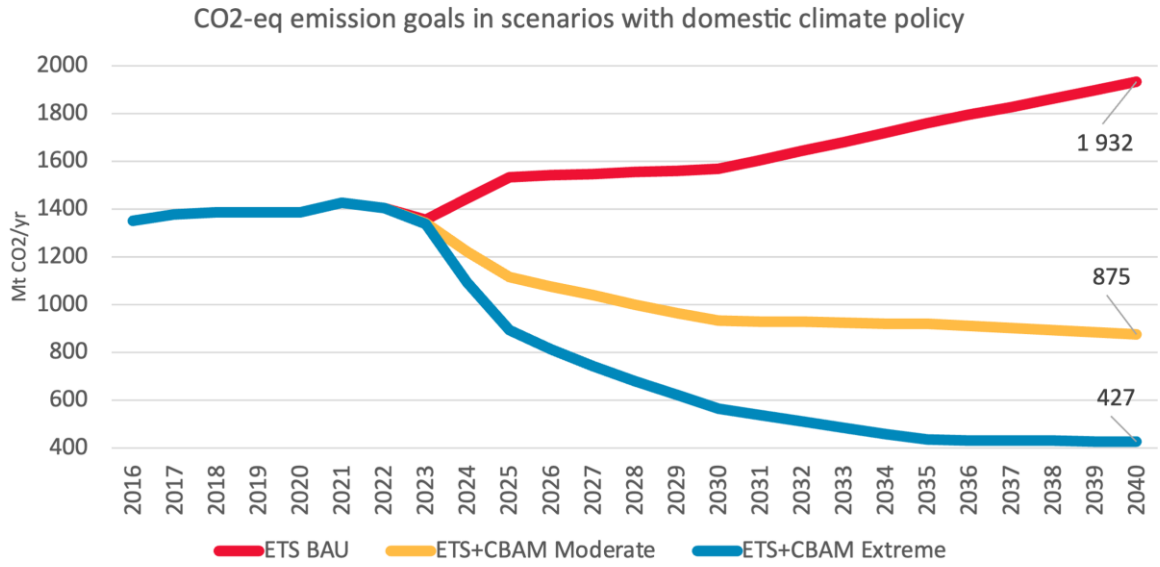


Source: (Richters et al. 2022), (Romanovskaya et al. 2023).

To ensure coherent emission limits in our scenarios, we adopted a synthetic approach based on the MESSAGEix-GLOBIOM scenarios (Krey et al. 2020). We incorporated the emission dynamics from three pertinent scenarios, using the emission volume from combustion in the CGE model as the baseline for the year 2023 (see Figure 11).

[2] LULUCF is land use, land-use change, and forestry.

Figure 11. CO2-eq emission goals in scenarios with domestic climate policy



Source: author.

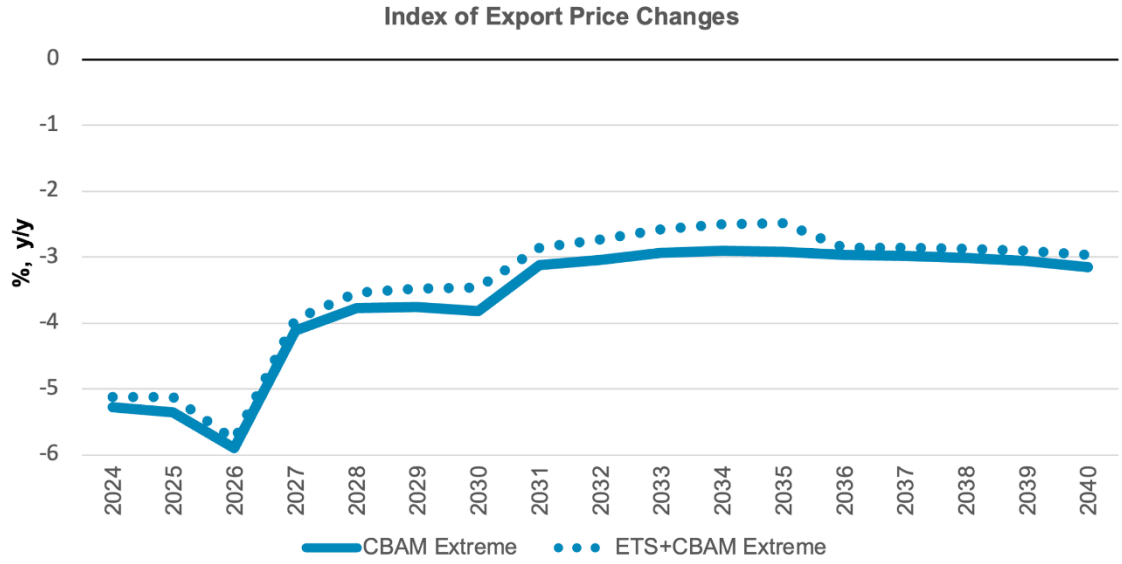
4.3.2. Prices for Russian exports subject to domestic carbon pricing

If a domestic emissions trading system for CO2-eq is implemented, industrial carbon pricing will be applied at the production stage of goods. Consequently, exported goods will enter the international market only after the payment of domestic carbon price. Under the scenario conditions, we assume that all countries worldwide have implemented CO2-eq emissions trading systems and carbon border adjustment mechanism (CBAM).

If Russia's emissions trading system is recognised internationally, foreign importing companies of Russian export goods are exempt from paying carbon prices in their jurisdictions. This exemption may lead to an adjustment in the price of Russian exports by the amount of the domestic carbon price paid.

The adjustment amount for each export product will depend on the carbon intensity of that product and the reference rate of carbon pricing in a given year. Figure 12 below illustrates the dynamics of export price indices in the scenario without domestic climate policy (CBAM Extreme) and with a domestic emissions trading system recognised internationally (ETS+CBAM Extreme). The difference between the solid and dashed curves indicates the degree of change in the export price index due to the adjustment of export prices by the amount of domestic carbon price paid within the emissions trading system.

Figure 12. Changes in the export price index with recognition of domestic climate policy (ETS+CBAM Extreme scenario)



Source: author.

4.3.3. Carbon charge in the cost of exported goods

Let us define the emissions coefficient for a specific product as the ratio of all direct CO2-eq emissions during production (Scope 1 emissions) to the total output of the industry. In our model, emissions are measured in million tonnes of CO2-eq while output in real terms is expressed in million rubles of the base year. Thus, the emissions coefficient is measured in tCO2-eq per ruble of the 2016 year.

With the emissions coefficient for a given industry and the output volume, we can estimate the emissions volume for exported goods manufactured in that industry. To adjust the export price, we need to calculate the share of the carbon charge in the production cost per unit of the product.

In our model, identical export goods may be produced in various industries. Hence, the final share of the carbon charge in the production cost per unit of export is equal to the weighted average of the carbon charge shares for all industries producing that specific product. The weight of each industry share equals the reference share value of the production of this industry in the export volume of the product in a given year.

To compare the results of introducing the ETS in scenarios where domestically paid carbon charges are not recognised internationally, we conducted several additional experiments where the introduction of the ETS does not affect the prices of Russian exports as outlined in the BAU, CBAM Moderate, and CBAM Extreme scenarios (for more details, see Section 5.7).

5. Results and discussion

5.1. Marcoeconomic impacts

The results of scenario calculations, including changes in GDP, household consumption, production volumes by sector (Figures 15–20, 23–26), as well as the breakdown of real GDP by expenditure are presented in the Appendix (see Tables 13 and 15).

5.2. Effects of export volume constraints

The imposition of quantitative restrictions on Russian exports results in price differences between identical goods in domestic and export markets. We term this variance the ‘shadow price of constraints’. Tables 16–18 in the Appendix show the proportions of the shadow price in the prices of export goods. As can be seen, in the BAU scenario, only half of the quantitative restrictions exhibit a non-zero shadow price, effectively restraining exports by 2040. However, limitations on export categories such as natural gas, metallic ores, and non-ferrous metal products cease to restrain exports by 2040 compared to the outset of the study in 2024. This shift is attributed to declining export prices for these commodity groups. As export prices decrease, the supply of exports falls below the assumed quantitative constraint, resulting in the shadow price of quantitative restriction being zero. Conversely, in the CBAM Extreme scenario, nearly all quantitative restrictions limit Russian exports.

Furthermore, the reduction in export prices for critical Russian export categories leads to an additional decrease in energy resource prices in the domestic market. Consequently, both the energy and carbon intensity of the Russian GDP experience an increase (see Figures 27 and 28).

5.3. Decomposition of the impact of export price changes and quantitative restrictions on real GDP

To study the effect of declining export prices independently of the consequences of quantitative restrictions, we conducted additional experiments. They replicated scenarios from BAU to CBAM Extreme, altering only export price changes while excluding quantitative restrictions (refer to Table 14).

As adverse external economic conditions worsen, reflected in the reduction of Russian export prices, the influence of export constraints diminishes. The reason is that at such low export prices the supply will be marginally higher or even lower than the quantitative restrictions.

The same trend applies to climate policy. In the BAU scenario, where the limit on CO2-eq emissions from combustion exceeds the actual emissions, the introduction of an emissions trading system does not lead to an additional economic impact. In this scenario, the price of emission permits is zero.

In the most adverse scenario conditions in 2040, depicted in the ETS+CBAM Extreme scenario, the deviation of real GDP compared to the BAU scenario is -11.3%. The main contribution stems from unfavourable external economic conditions, accounting for -7%. The impact of internal climate policy contributes -4.3% to the deviation from the real GDP level in the BAU scenario (see Table 13).

5.4. Changes in sectoral output due to trade restrictions

Changes in industrial output indicate a significant influence of scenario conditions on the structure of industrial production. Overall, our scenario calculations reveal a decline in the output of oil products, oil extraction, and pipeline transportation. Industries driven to increase production include those serving consumer demand (food production), mechanical engineering sectors (vehicle manufacturing, machinery and equipment production, and electrical equipment manufacturing), as well as industries that use oil products as raw materials (chemical production) and do not encounter significant restrictions in accessing the global market (refer to Figures 30 and 31).

Detailed changes in sectoral output can be found in the Appendix (refer to Table 23), along with variations in accounting profits across sectors (refer to Table 26).

5.5. Structural changes under climate policy

In the ETS BAU scenario, the target level of emission constraints exceeds the economy's total emissions each year. With global energy prices falling and quantitative export restrictions in place, emissions quotas are not sought after in the economy. The rationale is that reduced production leads to lower emissions through decreased use of carbon-intensive energy sources. Essentially, the production drop due to external constraints results in greater emission reductions than those targeted in the ETS BAU scenario (see Figure 29).

The most significant impact of climate policy is evident in the ETS+CBAM Extreme scenario, where CO2-eq emissions from combustion are projected to drop by 70% compared to the model base year (2016).

Major changes at the sectoral level are observed in key emitting sectors, particularly in electricity and heat generation.

In this scenario, the emission price reaches 18,000 rubles per tonne of CO2-eq (in 2016 prices). It is noteworthy that this figure is substantially lower than the price per tonne of CO2-eq in NGFS models. In essence, even substantial emission reductions are relatively more cost-effective for the Russian economy compared to other countries globally.

5.6. Changes in tax revenues

Carbon levy revenues could become a significant part of total indirect tax revenues by 2040. In the CBAM Extreme scenario, carbon levies make up 40% of all

indirect tax revenues. In this scenario, the government's redistributive role grows notably (refer to Figures 21 and 22).

5.7. Recognition of Russian climate policy

To gauge the impact of recognising domestic climate policy, we conducted additional scenarios: BAU, ETS+CBAM Moderate, and ETS+CBAM Extreme with no recognition (see Table 15). In terms of scenario conditions, no recognition means that export prices remain the same as in the corresponding scenarios without domestic climate policy.

Recognition of Russian climate policy within the ETS+CBAM Extreme global cross-border regulation scenario results in a 0.5% reduction in the deviation of real GDP from the BAU scenario by 2040. This occurs because domestic carbon levy payments are included in export shipments. Offsetting the costs of domestic carbon levies leads to a relative increase in export prices, providing support to export sectors (see Table 15).

5.8. Quantitative export restrictions and rent from export market access

In the presence of quantitative export restrictions, exporters' access to global markets becomes tied to increased revenues for specific companies or industrial groups involved in export activities. As highlighted earlier (see Section 5.2), the rent associated with the shadow price of export constraints can make up a significant portion of the export price (see Table 18). This scenario may deepen economic inequality and foster a stronger inclination among potential exporters to seek rent.

5.9. Sensitivity of main results to substitution elasticity between value added and energy

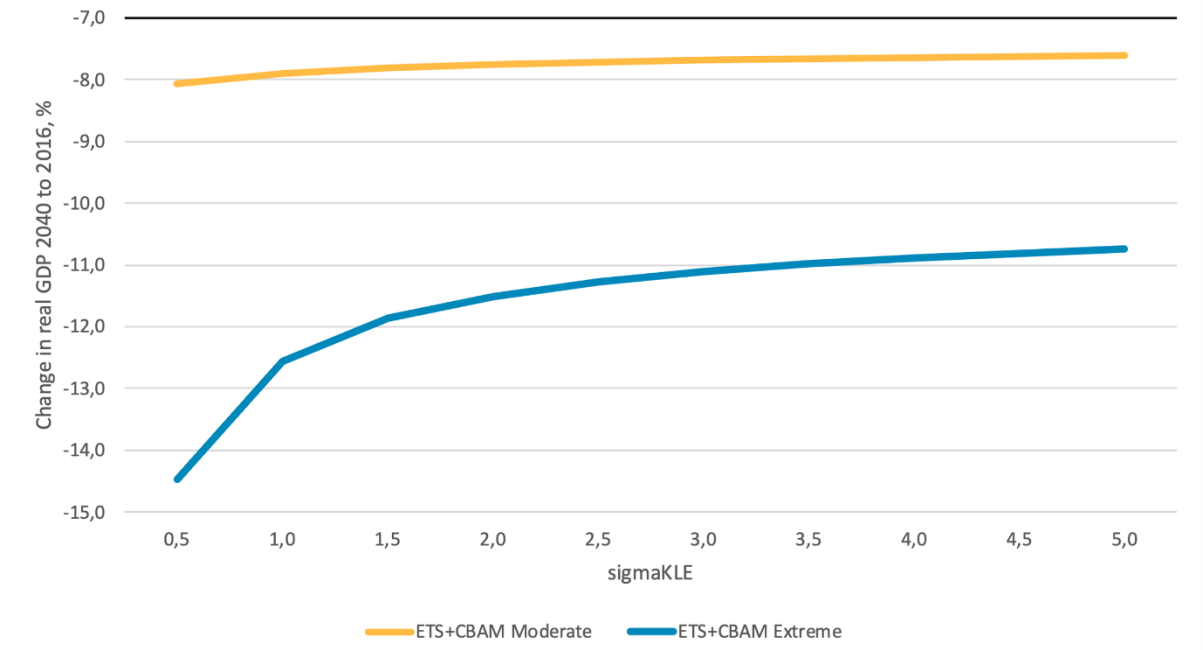
The question of substitutability between capital and labour, on the one hand, and energy, on the other, is crucial for understanding the quantitative effects of climate policies (Jorgenson et al. 2000). In computable general equilibrium models, the degree of substitution is determined by the elasticity of substitution between value added and energy in production functions. As mentioned earlier (see Section 3.1), there are various approaches to estimating this parameter (Stern 2012), (Lagomarsino 2020), (Balistreri and Brown 2023), resulting in significant variation in estimates.

We assessed the robustness of our model's scenario outcomes by varying esubkle, the elasticity of substitution between value added and energy in electricity generation and the production of other goods (see Table 1). In this series of experiments, we simulated the year 2040 in the ETS+CBAM Moderate and ETS+CBAM Extreme scenarios, with the esubkle parameter varying in the range [0.5; 5] (Figure 13). The lower bound of this range corresponds to the base value of esubkle

elasticity in all scenarios of our study, while the upper bound aligns with the estimates in (Balistreri and Brown 2023), where the elasticities of capital and energy substitution were estimated using a bottom-up approach with the possibility of using available technologies assuming their break-even deployment. In the framework of (Balistreri and Brown 2023), the high significance of this parameter can be considered as a broad access to the latest green and energy-saving technologies.

In the studies focusing on the Russian economy, the estimates of substitution elasticity between labour, capital, and energy generally typically fall below the lower bound of the range we consider. For instance, in (Polbin 2013), the elasticity of substitution between 'capital in use and energy in the production function' of the DSGE model is 0.1, while (Zubarev and Polbin 2016) note 'a reasonably low elasticity of substitution between capital and energy, approximately 0.14 in both conventional and energy-efficient technologies'.

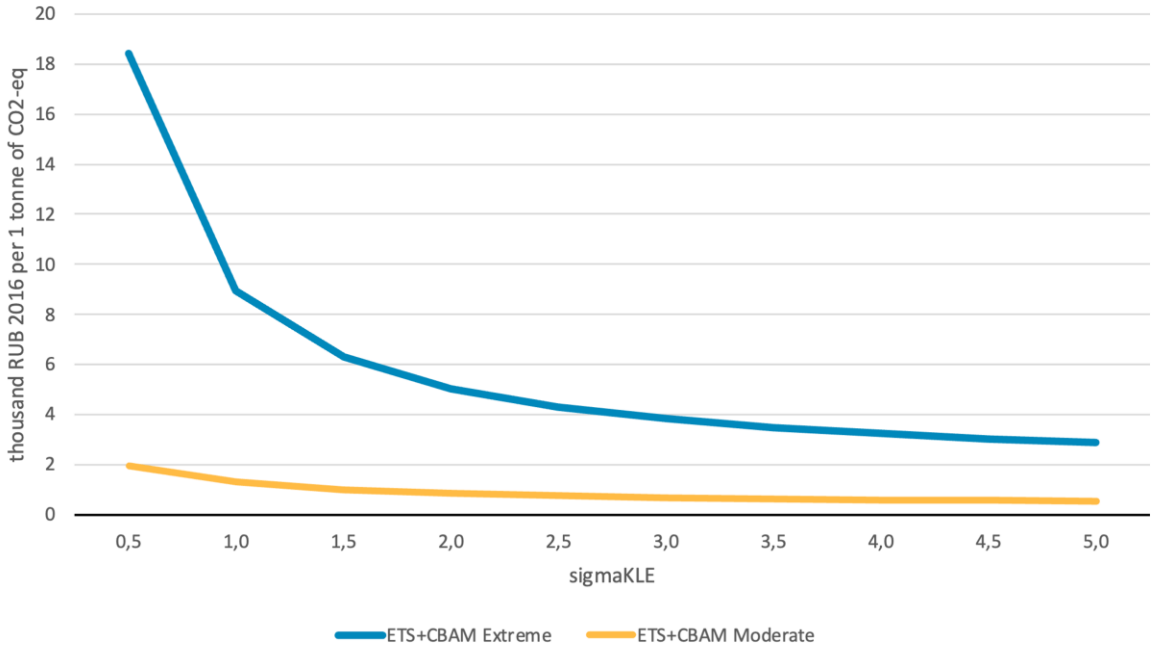
Figure 13. Change in real GDP in 2040 for different values of elasticity of substitution between value added and energy (σ_{KLE}), %



As shown in Figure 13, the outcomes of the ETS+CBAM Extreme scenario are significantly more influenced by the value of the elasticity of substitution between value added and energy than the assessment of the change in real GDP in the ETS+CBAM Moderate scenario. This sensitivity arises due to the impact of domestic climate policy. The higher the elasticity of substitution of energy for labour and capital, the lower the pressure of emission constraints on producer costs.

This trend is also evident in the changes in the price of a tonne of CO2-eq emission quota at different values of this elasticity (Figure 14). In the ETS+CBAM Extreme scenario, we observe a substantial decrease in the price of CO2 by 84%, from 18,400 to 2,900 rubles. Meanwhile, the reduction in the price of CO2 in the ETS+CBAM Moderate scenario amounts to 72%, from 1,950 to 500 rubles.

Figure 14. Price of 1 t CO2-eq emission quota in 2040 under various values of substitution elasticity between value added and energy (σ_{KLE}), thousand rubles 2016 per 1 tonne of CO2-eq



As a result, we observe that when the elasticity of substitution between value added and energy is high, the introduction of climate policy has a lesser impact on the economy. Instead, the negative effects of unfavourable external economic conditions become more prominent.

6. Conclusions

This paper introduces a computable general equilibrium (CGE) model incorporating climate policy and a quantitative trade restriction mechanism. We enhanced the CGE model used in the articles (Burova et al. 2023) and (Böhringer et al. 2015) by incorporating the mechanism for quantitative trade restrictions. To the best of our knowledge, this is the first study that examines the introduction of an emissions quota trading system in Russia in the context of existing quantitative export constraints.

We demonstrate that as the external economic conditions steadily deteriorates, which is manifested in declining prices for Russian exports, the significance of quantitative export constraints diminishes. This is due to the fact that, at lower export prices, the export supply is only marginally higher or may even be lower than the quantitative export constraints. The same trend applies to climate policy. In scenarios with lenient greenhouse gas emission reduction targets, amidst unfavourable external economic conditions, the introduction of an emissions quota trading system does not result in additional economic effects compared to a scenario without domestic climate policy.

Without unrestricted access to global green technologies, ambitious climate policy goals may become excessively costly in terms of economic impact. In the presented model, attempting to achieve a 70% reduction in CO2-eq emissions from the 2016 level, coupled with decreasing prices for Russian exports and quantitative trade restrictions, could result in a deviation of GDP in 2040 by 11% from the baseline scenario, which implies maintaining the current status quo in climate policy both in Russia and globally.

A more economically viable approach seems to be a moderate climate policy: achieving a 36% reduction in emissions from combustion compared to the 2016 level results in a 4.7% downward deviation of real GDP in 2040 from the baseline scenario. Only 0.3% of this decrease is attributed to the impact of domestic climate policy through an emissions trading system. The remaining 4.4% is explained by the deterioration of external economic conditions, resulting from the climate policies of other countries and quantitative restrictions on Russian exports.

In the absence of a proactive climate policy, the carbon intensity of Russian GDP rises, amplifying transitional and physical risks of addressing the consequences of climate change. Essential measures to mitigate these risks involve the promotion and development of green industries, particularly those oriented towards exports.

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8. Appendix. Tables and figures

8.1. Model data and parameters

Table 4. List of industries

No.	Code	Industry/activity name
1	s01	agriculture
2	s02	forestry
3	sB	fishing
4	s10	coal and peat mining
5	scru	crude oil extraction
6	sgas	gas extraction
7	s112	oil and gas extraction services
8	s13	metal ore mining
9	s14	other minerals mining
10	sDA	food production
11	sDB	textile and clothing production
12	sDC	manufacture of leather products
13	sDD	wood processing
14	sDE	pulp and paper production
15	s231	production of coke
16	s232	production of petroleum products
17	sDG	chemical production
18	sDH	production of plastic products
19	sDI	manufacturing of other non-metallic mineral products
20	sDJ	metallurgy
21	sDK	manufacturing of machinery and equipment
22	sDL	manufacturing of electrical equipment
23	sDM	manufacturing of vehicles
24	sDN	manufacturing of other products
25	s40	electricity generation
26	s41	distribution of water
27	sF	construction
28	sG	wholesale and retail trade
29	sH	hotels and restaurants
30	s601	railway
31	s602	other land transport
32	s603	pipelines
33	s61	water transport
34	s62	air transport
35	s63	additional transport activities
36	s64	post and telecommunications
37	sJ	financial services
38	sK	real estate
39	sL	public administration
40	sM	education
41	sN	health and social service

No.	Code	Industry/activity name
42	sO	other public services

Source: (Burova et al. 2023).

Table 5. List of goods

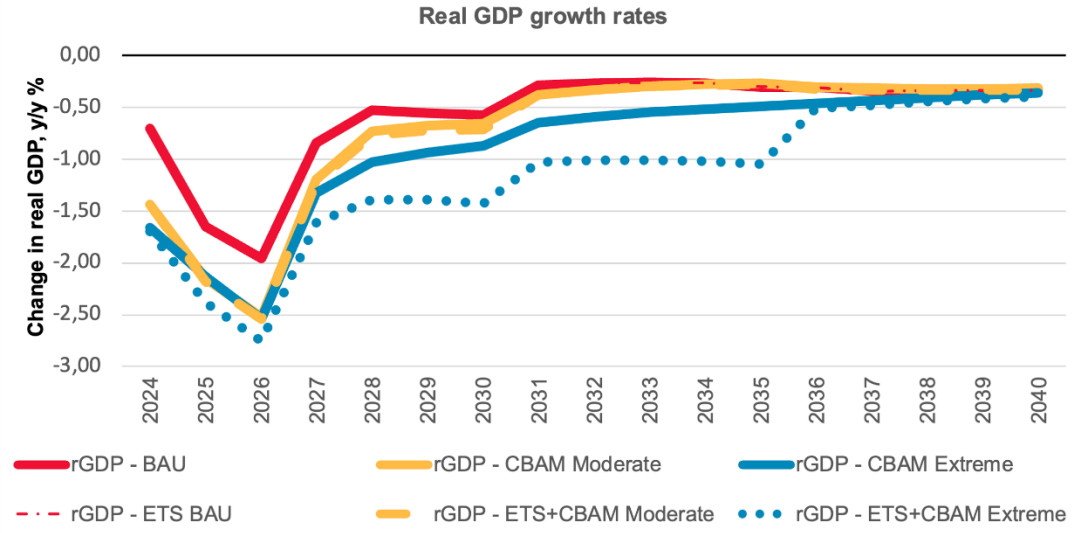
No.	Code	Goods
1	g01	agriculture products
2	g02	forestry products
3	woo	wood
4	gB	fish
5	col	coal
6	cru	crude oil
7	gas	natural gas
8	g112	oil and gas extraction services
9	g12	uranium and thorium ores
10	ore	metal ores
11	g14	other minerals
12	gDA	food, beverages and tobacco
13	gDB	textile and clothing
14	gDC	leather goods and shoes
15	gDD	processed wood
16	pap	paper
17	gDE	pulp and paper products
18	cke	coke
19	oil	petroleum products
20	gDG	chemicals
21	ior	inorganic chemicals
22	org	organic chemicals
23	frt	fertilizers and nitrogen compounds
24	gDH	rubber and plastic products
25	gDI	other non-metallic mineral products
26	cmn	cement, lime and gypsum
27	stl	steel and ferroalloys
28	pps	pipes and pipeline connecting elements
29	fmp	other ferrous metals
30	pmt	precious metals
31	alu	aluminium
32	lzt	lead, zinc, tin and products thereof
33	cop	copper products
34	nfe	other non-ferrous metals
35	gDJ	finished metal products
36	gDK	machinery and equipment
37	gDL	electrical, electronic and optical equipment
38	gDM	vehicles and equipment
39	gDN	other products
40	ele	electricity

No.	Code	Goods
41	cag	combustible artificial gases
42	g40	electricity, gas, steam and hot water
43	g41	collection, cleaning and distribution of water
44	gF	construction
45	gG	wholesale and retail trade
46	gH	hotels and restaurants
47	g601	railway transport
48	g602	other land transport
49	g603	transportation through pipelines
50	g61	water transport
51	g62	air transport
52	g63	additional transport activities
53	g64	telecommunication services
54	gJ	financial services
55	gK	real estate
56	gL	state administration
57	gM	education
58	gN	health services
59	gO	public, social and personal services

Source: author.

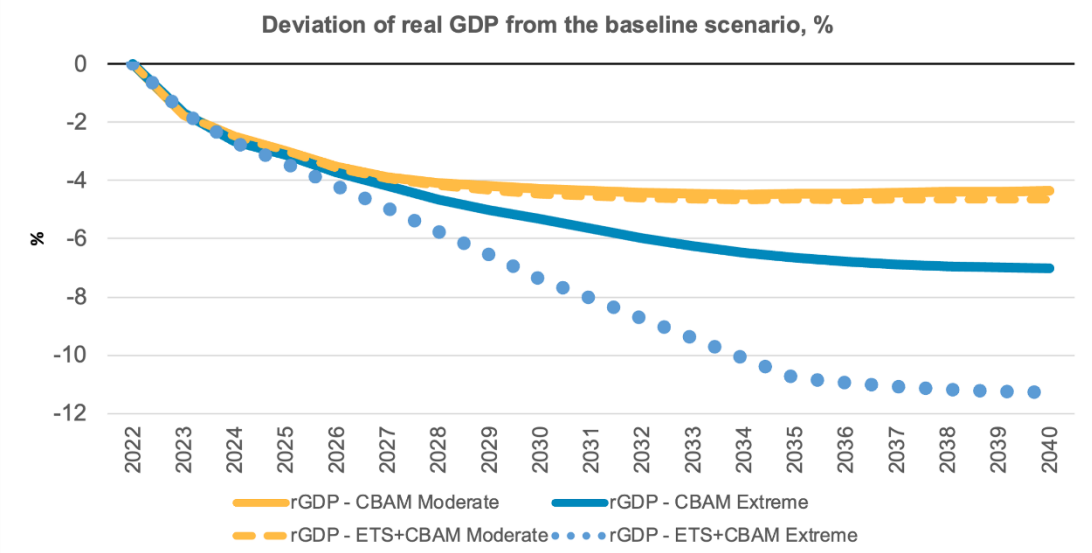
8.2. Scenario results

Figure 15. Real GDP growth rates



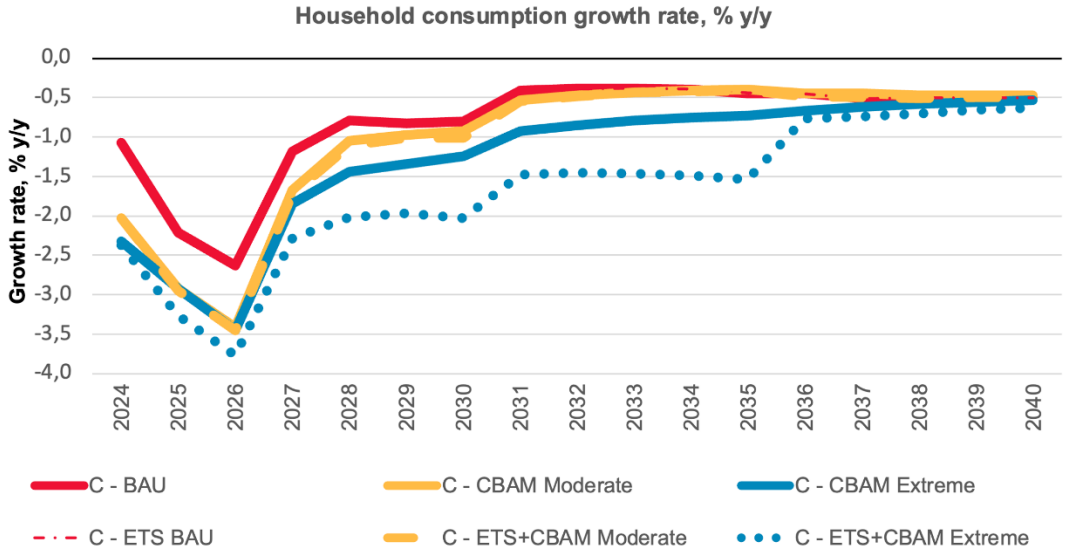
Source: author.

Figure 16. Deviation of real GDP from the BAU scenario, %



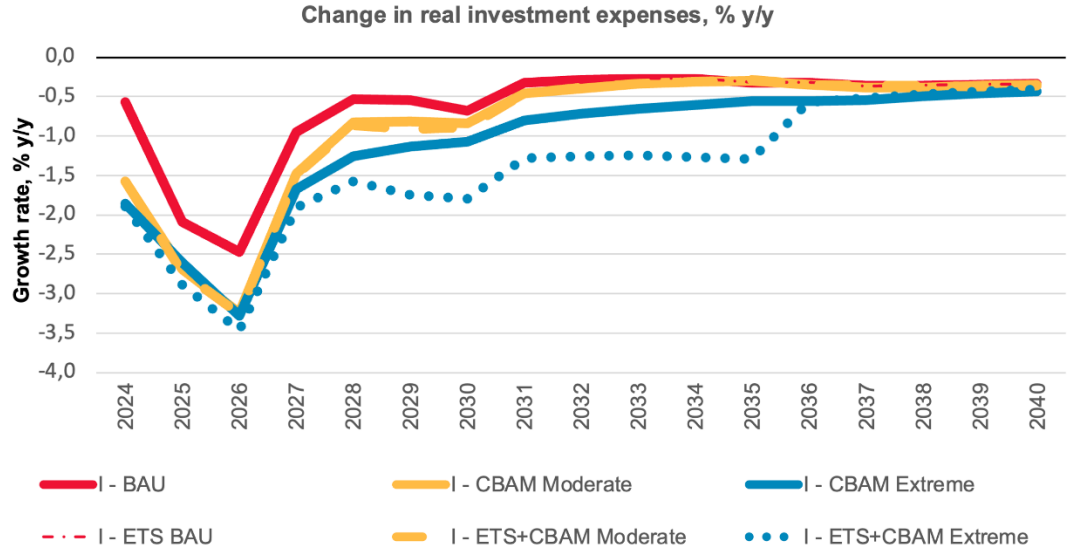
Source: author.

Figure 17. Household consumption growth rate, % y/y



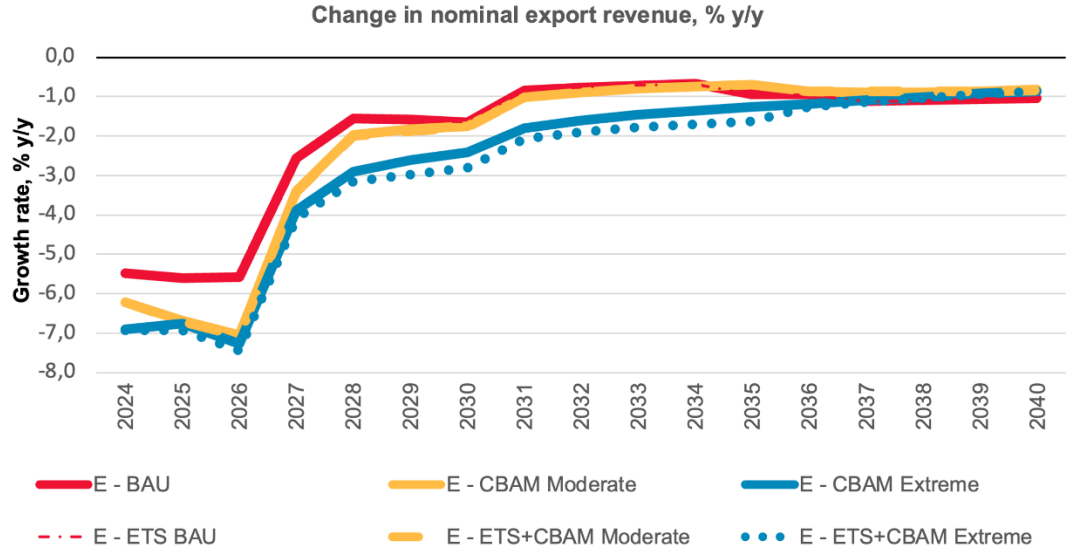
Source: author.

Figure 18. Change in real investment expenses, % y/y



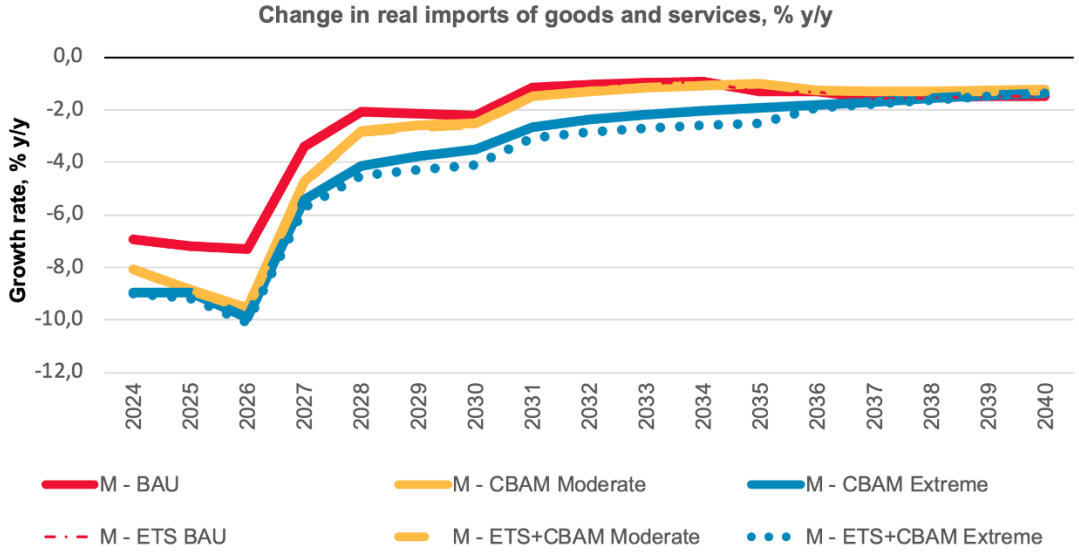
Source: author.

Figure 19. Change in nominal export revenue, % y/y



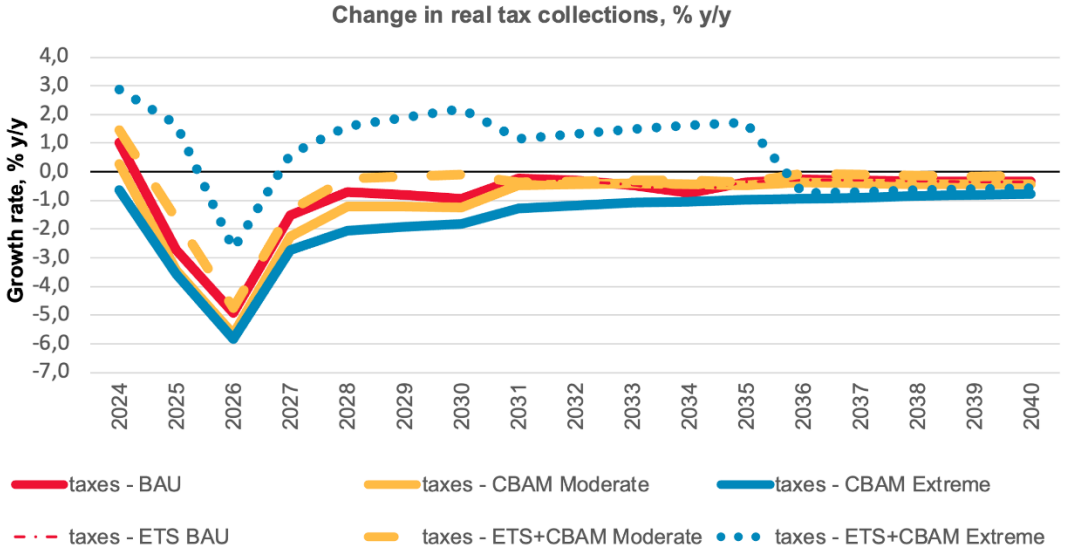
Source: author.

Figure 20. Change in real imports of goods and services, % y/y



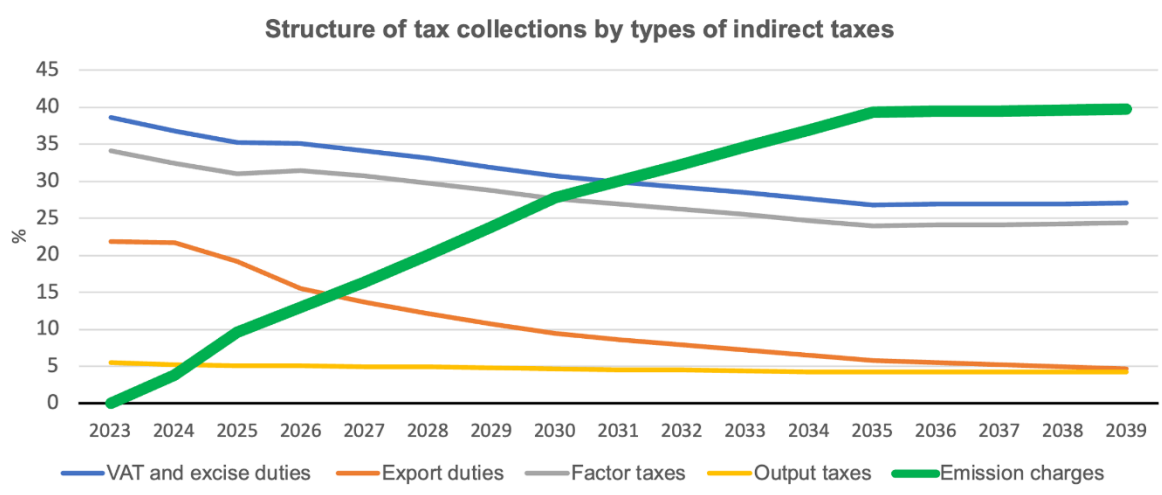
Source: author.

Figure 21. Change in real tax collections, % y/y



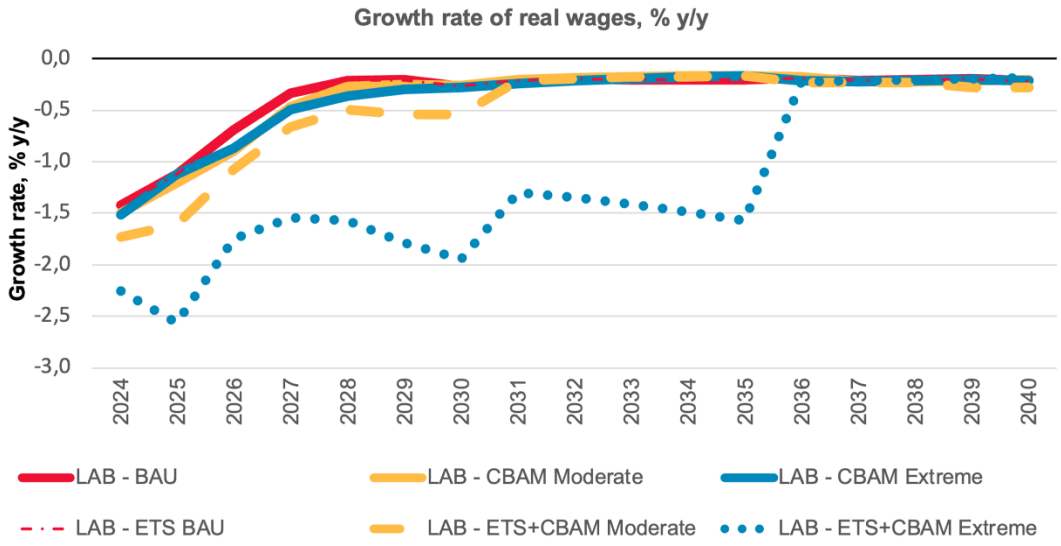
Source: author.

Figure 22. Structure of tax collections by types of indirect taxes in ETS+CBAM Extreme scenario



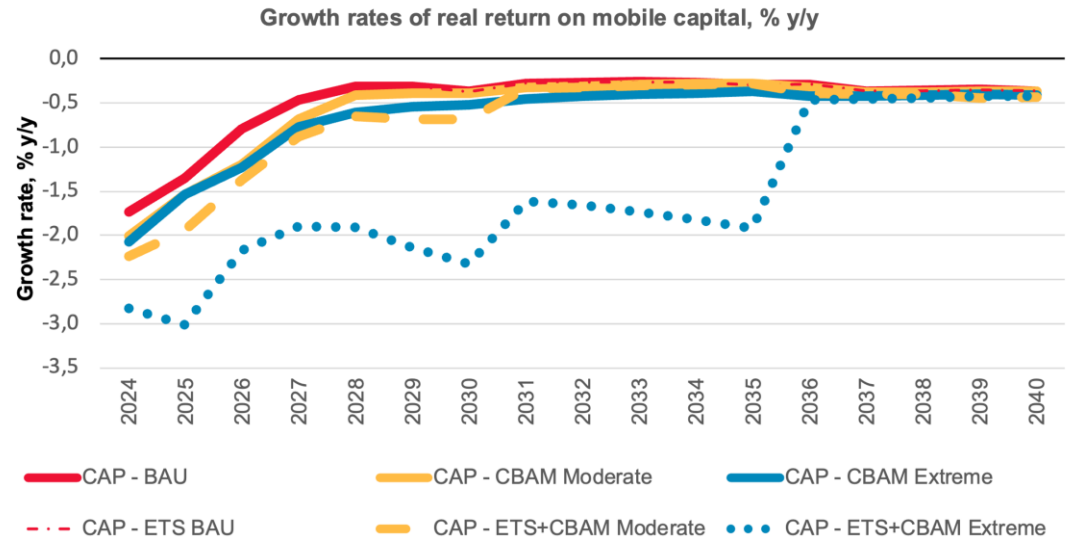
Source: author.

Figure 23. Growth rate of real wages



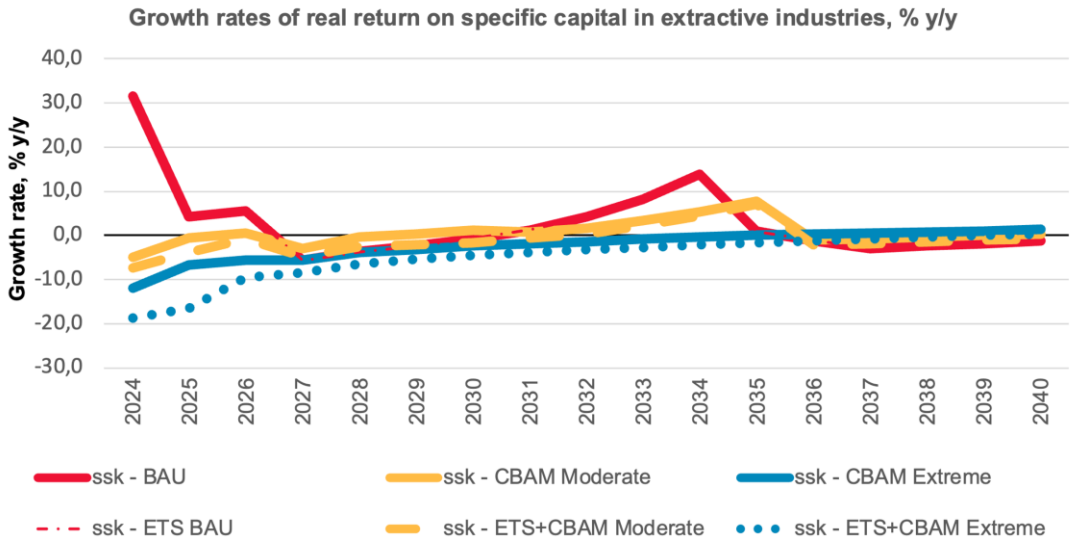
Source: author.

Figure 24. Growth rates of real return on mobile capital, % y/y



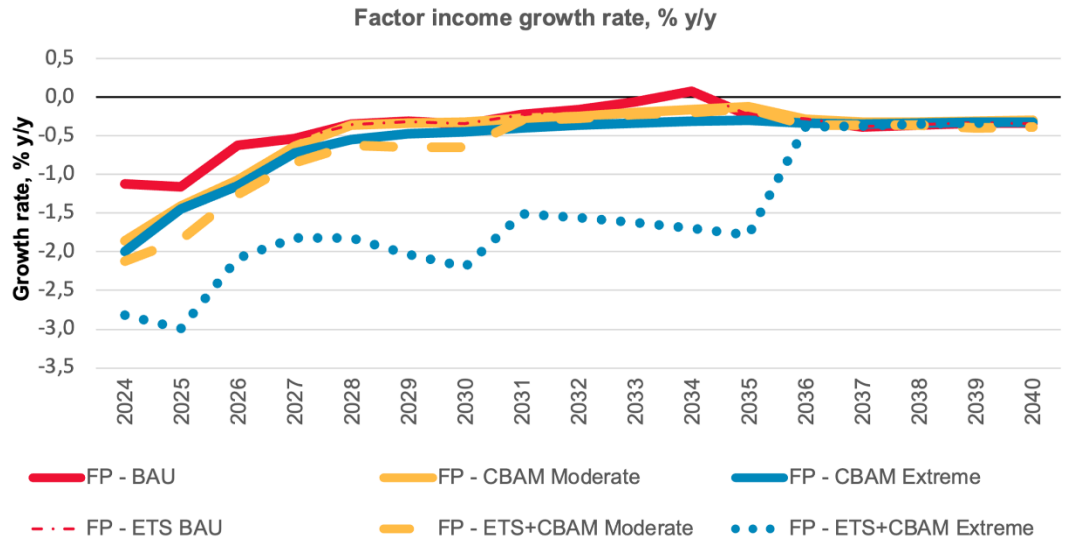
Source: author.

Figure 25. Growth rates of real return on specific capital in extractive industries, % y/y



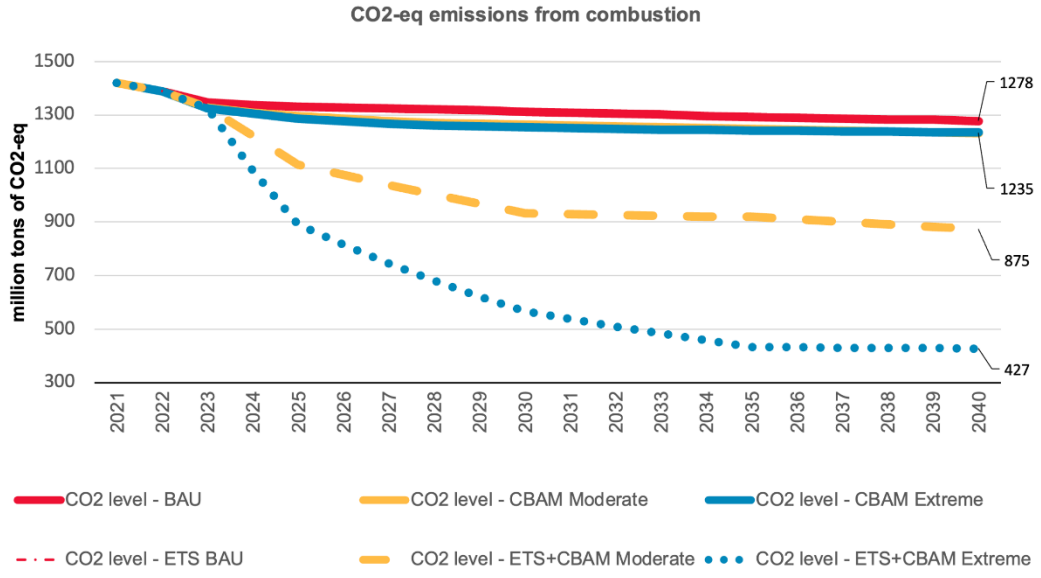
Source: author.

Figure 26. Factor income growth rate, % y/y



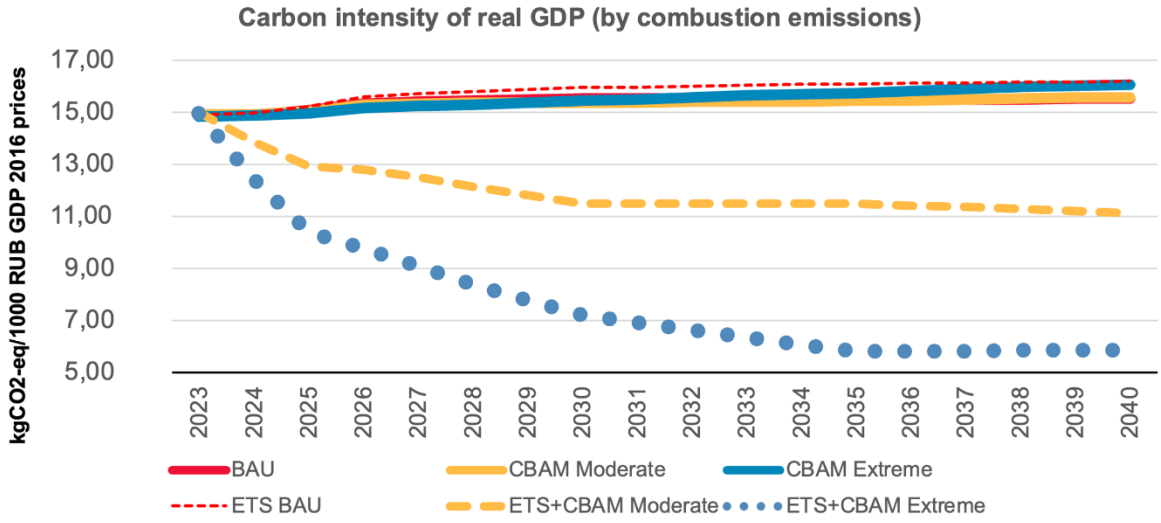
Source: author.

Figure 27. CO2-eq emissions from combustion



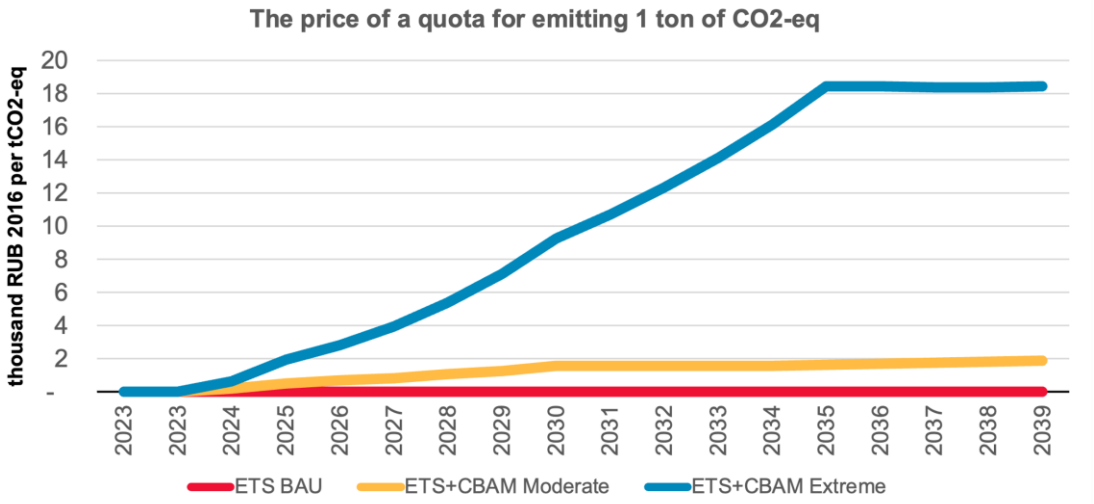
Source: author.

Figure 28. Carbon intensity of real GDP by emission from combustion



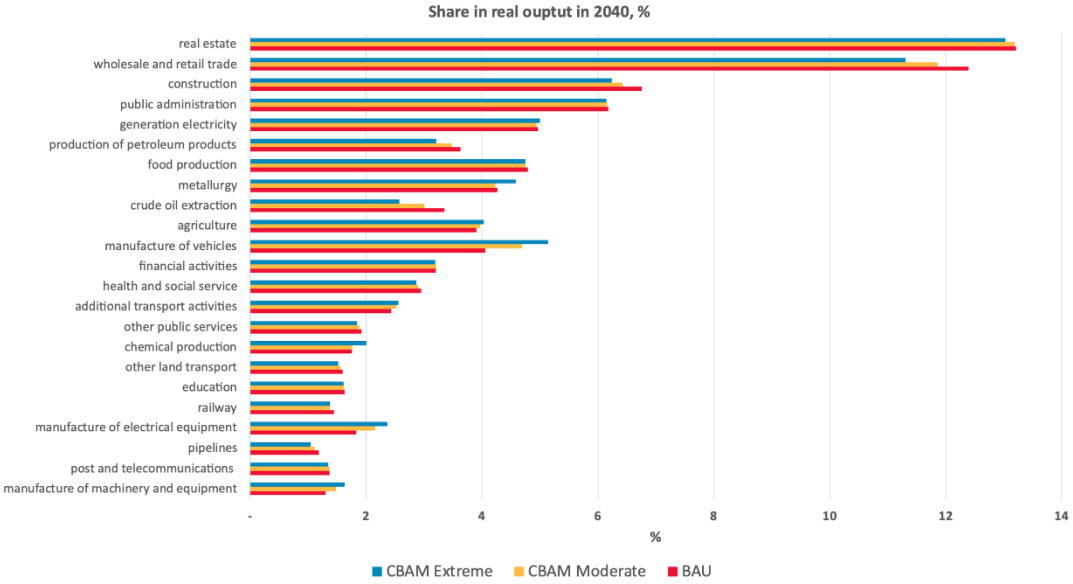
Source: author.

Figure 29. Price of a quota for emitting 1 tonne of CO2-eq, thousand RUB 2016/tCO2-eq



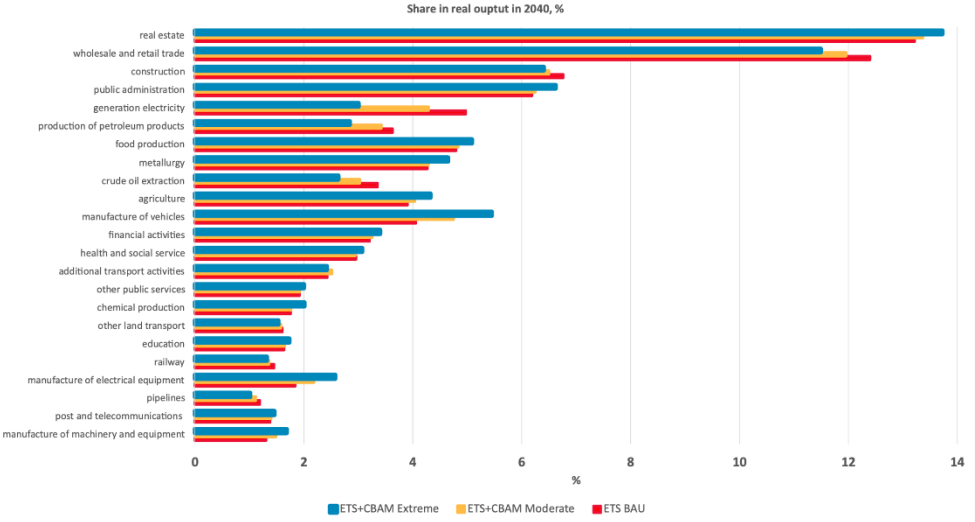
Source: author.

Figure 30. Share in real output in scenarios without domestic climate policy in 2040, %



Source: author.

Figure 31. Share in real output in scenarios with domestic climate policy in 2040, %



Source: author.

Table 6. Carbon coefficients by industry and fuel type, tCO2-eq/thousand RUB 2016

			CO2-eq emissoins, benchmark (2016), thousand tCO2-eq					Fuel costs, benchmark (2016), mln RUB					Emission coefficient CO2-eq, tCO2-eq/thousand RUB				
No.	code	Activity name	coal (col)	oil products (oil)	natural gas (gas)	coke (cke)	distributed gas (cag)	coal (col)	oil products (oil)	natural gas (gas)	coke (cke)	distributed gas (cag)	coal (col)	oil products (oil)	natural gas (gas)	coke (cke)	distributed gas (cag)
1	s01	agriculture	862.54	14,671.69	-	-	5,222.07	2,843.27	137,263.67	-	1.00	36,037.59	0.30	0.11		-	0.14
2	s02	forestry	437.92	1,751.93	-	-	37.83	18.00	27,979.19	-	-	22.00	24.33	0.06			1.72
3	sB	fishing	15.43	3,331.91	-	-	4.08	63.00	45,226.31	-	-	89.00	0.24	0.07			0.05
4	s10	coal and peat mining	2,818.30	4,934.34	-	-	95.62	159,999.11	41,851.13	-	1.00	-	0.02	0.12		-	
5	scru	crude oil extraction	0.12	3,425.92	10,641.33	-	7,284.69	30.01	67,486.96	2,183.99	-	802.00	0.00	0.05	4.87		9.08
6	sgas	gas extraction	-	285.24	5,812.21	-	7,448.80	-	6,082.97	773.00	-	169.00		0.05	7.52		44.08
7	s112	oil and gas extraction services	-	3,168.16	144.72	-	4,335.53	-	39,476.83	132.00	206.00	3,643.98		0.08	1.10	-	1.19
8	s13	metal ore mining	1,534.12	5,877.42	-	795.28	3,260.89	244.00	23,844.84	-	176.01	7,478.21	6.29	0.25		4.52	0.44
9	s14	other minerals mining	-	2,479.20	-	-	285.64	149.01	26,836.22	-	-	75.01	-	0.09			3.81
10	sDA	food production	2,003.26	3,365.07	-	20.66	9,105.54	1,747.96	33,761.39	-	2.00	32,165.26	1.15	0.10		10.33	0.28
11	sDB	textile and clothing production	18.59	63.97	-	-	413.34	8.00	1,571.00	-	-	2,210.98	2.32	0.04			0.19
12	sDC	manufacture of leather products	1.56	13.40	-	-	69.78	1.00	255.99	-	-	418.99	1.56	0.05			0.17
13	sDD	wood processing	5,643.30	739.93	-	-	1,193.84	27.00	11,472.04	-	29.00	4,651.03	209.01	0.06		-	0.26
14	sDE	pulp and paper production	18,000.26	1,879.02	-	-	6,718.70	2,374.03	13,028.13	-	-	17,882.14	7.58	0.14			0.38
15	s231	production of coke	-	12.88	-	-	1,230.97	44,998.85	309.02	-	36.00	258.01	-	0.04		-	4.77
16	s232	production of petroleum products	2,467.12	28,934.82	5,304.96	42.69	2,309.38	-	887,675.25	91,362.57	-	37,967.88		0.03	0.06		0.06
17	sDG	chemical production	587.53	1,440.12	-	8.46	22,392.10	2,016.05	282,278.26	-	4,008.08	61,533.91	0.29	0.01		0.00	0.36
18	sDH	production of plastic products	2.10	138.56	-	-	709.57	8.00	8,075.24	-	159.00	1,413.07	0.26	0.02		-	0.50
19	sDI	manufacturing of other non-metallic mineral products	3,599.92	2,747.56	-	-	15,181.56	6,100.27	24,362.49	-	1,643.05	50,355.87	0.59	0.11		-	0.30
20	sDJ	metallurgy	11,053.41	2,390.16	-	75,503.42	70,671.47	152,396.58	78,372.61	-	87,473.78	88,603.80	0.07	0.03		0.86	0.80
21	sDK	manufacturing of machinery and equipment	5,066.36	996.77	-	0.79	5,979.85	588.00	11,160.02	-	426.01	5,410.99	8.62	0.09		0.00	1.11
22	sDL	manufacturing of electrical equipment	52.35	345.63	-	0.01	1,518.99	44.00	7,237.11	-	1,239.03	7,313.02	1.19	0.05		0.00	0.21
23	sDM	manufacturing of vehicles	1,122.73	1,258.09	-	5.40	3,622.97	853.01	28,871.09	-	994.02	22,089.01	1.32	0.04		0.01	0.16
24	sDN	manufacturing of other products	240.76	251.66	-	0.09	117.90	12.00	5,980.00	-	-	1,073.99	20.06	0.04			0.11
25	s40	electricity generation	213,804.92	20,003.76	221,554.35	-	143,814.28	118,767.34	98,937.22	703,260.60	38.00	662,301.59	**1.80**	0.20	0.32	-	0.22
26	s41	distribution of water	386.05	996.62	-	-	994.15	269.00	5,738.98	-	2.00	2,147.98	1.44	0.17		-	0.46
27	sF	construction	431.46	26,994.55	-	-	859.87	708.01	289,200.50	-	1.00	10,607.98	0.61	0.09		-	0.08
28	sG	wholesale and retail trade	83.04	4,287.94	118.61	-	95.47	740.00	187,189.93	23,044.93	-	13,032.98	0.11	0.02	0.01		0.01
29	sH	hotels and restaurants	139.26	675.27	-	-	109.15	93.00	3,942.94	-	-	1,448.99	1.50	0.17			0.08
30	s601	railway	305.35	8,227.98	-	-	292.04	419.00	74,690.31	-	-	266.00	0.73	0.11			1.10
31	s602	other land transport	205.57	15,425.23	-	-	583.81	100.00	365,881.07	-	-	2,964.97	2.06	0.04			0.20
32	s603	pipelines	-	1,062.81	14,129.95	-	69,779.22	1.00	7,734.99	23,469.93	-	71,792.89	-	0.14	0.60		0.97
33	s61	water transport	23.59	2,498.92	-	-	18.25	62.00	31,334.62	-	-	50.00	0.38	0.08			0.37
34	s62	air transport	11.85	17,299.26	-	-	62.99	26.00	186,071.75	-	-	40.00	0.46	0.09			1.57
35	s63	additional transport activities	481.56	6,842.10	33.86	0.39	896.63	753.02	159,324.87	265.00	6.00	5,755.00	0.64	0.04	0.13	0.07	0.16
36	s64	post and telecommunications	98.76	581.68	-	-	76.66	194.00	11,965.02	-	31.00	469.00	0.51	0.05		-	0.16
37	sJ	financial services	-	682.97	-	-	1.87	-	10,621.90	-	-	16.00		0.06			0.12
38	sK	real estate	354.44	4,276.65	-	0.15	3,238.40	644.01	66,512.45	-	41.00	27,650.02	0.55	0.06		0.00	0.12
39	sL	public administration	2,306.63	5,827.90	-	0.63	2,131.36	4,191.01	90,638.22	-	173.00	18,197.91	0.55	0.06		0.00	0.12
40	sM	education	412.81	999.79	-	-	480.16	399.00	7,928.94	-	-	5,499.96	1.03	0.13			0.09
41	sN	health and social service	486.53	1,723.00	-	-	860.74	2,487.99	28,903.67	-	-	12,236.85	0.20	0.06			0.07
42	sO	other public services	504.75	1,480.69	-	-	363.07	670.02	27,016.38	-	2.00	4,727.16	0.75	0.05		-	0.08
		Industry total	275,564.22	204,390.57	257,739.99	76,377.98	393,869.22	505,045.55	3,464,091.53	844,492.01	96,688.00	1,220,870.00					
			Total CO2-eq emission from combustion, thousand tons				*1,207,941.97*	Total fuel costs (2016), mln RUB				*6,131,187.09*	Average industry emission coefficient, tCO2-eq/thousand RUB				*0.20*

Source: author's calculations based on 4-TER database 'Information on the use of fuel and energy resources' for 2016, base «Input-Output Tables» for 2016 (Federal State Statistics Service 2020).

Table 7. Changes in export prices to base year (2016) in BAU scenario, %

No.	Code	Goods	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	g01	agriculture products	2.40	0.36	-1.60	-3.53	-5.43	-7.28	-9.09	-10.87	-12.60	-14.29	-15.96	-17.59	-19.19	-20.75	-22.29	-23.80	-25.28
2	g02	forestry products	-26.61	-28.07	-29.48	-30.86	-32.22	-33.55	-34.85	-36.11	-37.36	-38.57	-39.76	-40.93	-42.08	-43.20	-44.30	-45.38	-46.44
3	woo	wood	-26.61	-28.07	-29.48	-30.86	-32.22	-33.55	-34.85	-36.11	-37.36	-38.57	-39.76	-40.93	-42.08	-43.20	-44.30	-45.38	-46.44
5	col	coal	108.46	95.37	82.78	70.60	58.82	47.45	36.46	27.30	19.23	11.99	5.15	-1.46	-7.81	-13.19	-17.68	-21.55	-25.00
6	cru	crude oil	6.16	4.05	2.45	0.87	-0.69	-2.23	-3.73	-5.21	-6.67	-8.10	-9.51	-10.89	-12.26	-13.61	-14.94	-16.26	-17.55
7	gas	natural gas	265.34	194.90	95.84	70.18	56.86	44.00	31.59	31.24	31.06	30.97	30.90	30.82	30.64	30.25	29.78	29.29	28.81
10	ore	metal ores	23.60	7.68	2.93	-1.67	-6.14	-10.47	-14.66	-16.32	-17.12	-17.92	-18.71	-19.49	-20.26	-21.02	-21.78	-22.53	-23.28
12	gDA	food, beverages and tobacco	15.22	12.93	10.71	8.54	6.41	4.33	2.29	0.29	-1.65	-3.56	-5.43	-7.27	-9.07	-10.83	-12.56	-14.26	-15.92
13	gDB	textile and clothing	10.34	8.15	6.03	3.95	1.91	-0.09	-2.04	-3.95	-5.82	-7.64	-9.44	-11.19	-12.92	-14.61	-16.26	-17.89	-19.48
15	gDD	processed wood	-26.61	-28.07	-29.48	-30.86	-32.22	-33.55	-34.85	-36.11	-37.36	-38.57	-39.76	-40.93	-42.08	-43.20	-44.30	-45.38	-46.44
16	pap	paper	-26.61	-28.07	-29.48	-30.86	-32.22	-33.55	-34.85	-36.11	-37.36	-38.57	-39.76	-40.93	-42.08	-43.20	-44.30	-45.38	-46.44
17	gDE	pulp and paper products	-26.61	-28.07	-29.48	-30.86	-32.22	-33.55	-34.85	-36.11	-37.36	-38.57	-39.76	-40.93	-42.08	-43.20	-44.30	-45.38	-46.44
18	cke	coke	62.14	52.81	43.83	35.13	26.72	18.58	10.73	10.74	10.76	10.79	10.81	10.83	10.86	10.88	10.90	10.93	10.95
19	oil	petroleum products	6.16	4.05	2.45	0.87	-0.69	-2.23	-3.73	-5.21	-6.67	-8.10	-9.51	-10.89	-12.26	-13.61	-14.94	-16.26	-17.55
20	gDG	chemicals	34.23	9.87	7.01	4.22	1.49	-1.17	-3.75	-6.27	-8.72	-11.11	-13.44	-15.71	-17.93	-20.09	-22.20	-24.26	-26.27
21	ior	inorganic chemicals	34.23	9.87	7.01	4.22	1.49	-1.17	-3.75	-6.27	-8.72	-11.11	-13.44	-15.71	-17.93	-20.09	-22.20	-24.26	-26.27
22	org	organic chemicals	34.23	9.87	7.01	4.22	1.49	-1.17	-3.75	-6.27	-8.72	-11.11	-13.44	-15.71	-17.93	-20.09	-22.20	-24.26	-26.27
23	frt	fertilizers and nitrogen compounds	34.23	9.87	7.01	4.22	1.49	-1.17	-3.75	-6.27	-8.72	-11.11	-13.44	-15.71	-17.93	-20.09	-22.20	-24.26	-26.27
25	gDI	other non-metallic mineral products	-16.97	-18.62	-20.21	-21.77	-23.31	-24.82	-26.28	-27.72	-29.13	-30.50	-31.85	-33.17	-34.47	-35.74	-36.99	-38.21	-39.41
27	stl	steel and ferroalloys	7.06	4.08	1.20	-1.61	-4.35	-7.01	-9.60	-11.37	-12.22	-13.06	-13.90	-14.72	-15.54	-16.35	-17.15	-17.95	-18.73
28	pps	pipes and pipeline connecting elements	7.06	4.08	1.20	-1.61	-4.35	-7.01	-9.60	-11.37	-12.22	-13.06	-13.90	-14.72	-15.54	-16.35	-17.15	-17.95	-18.73
29	fmp	other ferrous metals	7.06	4.08	1.20	-1.61	-4.35	-7.01	-9.60	-11.37	-12.22	-13.06	-13.90	-14.72	-15.54	-16.35	-17.15	-17.95	-18.73
30	pmt	precious metals	112.00	104.68	100.59	96.34	92.71	89.88	85.84	81.70	77.64	73.67	69.79	65.99	61.90	57.76	53.60	49.44	45.31
31	alu	aluminium	19.65	19.28	19.21	19.45	20.01	20.87	22.06	23.02	23.74	24.22	24.47	24.47	24.47	24.47	24.47	24.47	24.47
32	lzt	lead, zinc, tin and products thereof	3.65	1.60	-0.39	-2.35	-4.26	-6.14	-7.98	-9.77	-11.52	-13.24	-14.92	-16.57	-18.19	-19.78	-21.34	-22.86	-24.36
33	cop	copper products	30.25	27.24	28.85	29.83	29.00	28.16	27.30	26.62	26.11	25.77	25.60	25.60	25.60	25.60	25.60	25.60	25.60
34	nfe	other non-ferrous metals	36.00	33.38	34.09	34.38	34.10	33.96	34.11	34.25	34.34	34.40	34.42	34.39	34.37	34.35	34.32	34.30	34.28
35	gDJ	finished metal products	7.06	4.08	1.20	-1.61	-4.35	-7.01	-9.60	-11.37	-12.22	-13.06	-13.90	-14.72	-15.54	-16.35	-17.15	-17.95	-18.73
45	gG	wholesale and retail trade	15.22	12.93	10.71	8.54	6.41	4.33	2.29	0.29	-1.65	-3.56	-5.43	-7.27	-9.07	-10.83	-12.56	-14.26	-15.92
46	gH	hotels and restaurants	15.22	12.93	10.71	8.54	6.41	4.33	2.29	0.29	-1.65	-3.56	-5.43	-7.27	-9.07	-10.83	-12.56	-14.26	-15.92

Source: author.

Table 8. Changes in export prices to base year (2016) in scenario CBAM Moderate, %

No.	Code	Goods	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	g01	agriculture products	-2.32	-5.82	-9.05	-11.69	-13.71	-15.48	-17.13	-18.69	-20.16	-21.56	-22.94	-24.30	-25.67	-27.04	-28.44	-29.82	-31.18
2	g02	forestry products	-29.99	-32.50	-34.82	-36.71	-38.15	-39.42	-40.61	-41.72	-42.78	-43.78	-44.77	-45.74	-46.72	-47.71	-48.71	-49.70	-50.67
3	woo	wood	-29.99	-32.50	-34.82	-36.71	-38.15	-39.42	-40.61	-41.72	-42.78	-43.78	-44.77	-45.74	-46.72	-47.71	-48.71	-49.70	-50.67
5	col	coal	65.06	43.55	18.90	0.48	-13.51	-25.41	-36.22	-43.50	-48.07	-52.01	-55.61	-59.02	-62.16	-64.62	-66.57	-68.23	-69.72
6	cru	crude oil	-8.12	-12.66	-16.23	-19.22	-21.60	-23.75	-25.76	-27.66	-29.48	-31.21	-32.90	-34.57	-36.22	-37.86	-39.50	-41.11	-42.68
7	gas	natural gas	248.23	175.70	79.35	52.52	38.01	24.52	11.95	10.09	9.13	8.81	8.79	8.93	9.05	8.90	8.50	8.03	7.52
10	ore	metal ores	11.36	-5.27	-11.44	-16.86	-21.53	-25.86	-29.98	-31.71	-33.22	-34.72	-36.25	-37.82	-39.44	-41.13	-42.88	-44.69	-46.54
12	gDA	food, beverages and tobacco	9.91	5.97	2.33	-0.64	-2.90	-4.90	-6.76	-8.51	-10.16	-11.74	-13.29	-14.82	-16.36	-17.91	-19.48	-21.03	-22.56
13	gDB	textile and clothing	5.26	1.49	-2.00	-4.84	-7.01	-8.92	-10.70	-12.38	-13.96	-15.47	-16.96	-18.43	-19.90	-21.38	-22.89	-24.38	-25.84
15	gDD	processed wood	-29.99	-32.50	-34.82	-36.71	-38.15	-39.42	-40.61	-41.72	-42.78	-43.78	-44.77	-45.74	-46.72	-47.71	-48.71	-49.70	-50.67
16	pap	paper	-29.99	-32.50	-34.82	-36.71	-38.15	-39.42	-40.61	-41.72	-42.78	-43.78	-44.77	-45.74	-46.72	-47.71	-48.71	-49.70	-50.67
17	gDE	pulp and paper products	-29.99	-32.50	-34.82	-36.71	-38.15	-39.42	-40.61	-41.72	-42.78	-43.78	-44.77	-45.74	-46.72	-47.71	-48.71	-49.70	-50.67
18	cke	coke	42.78	20.45	9.67	0.04	-8.55	-16.61	-24.29	-32.94	-38.37	-43.04	-47.32	-51.36	-55.09	-58.00	-60.32	-62.29	-64.07
19	oil	petroleum products	-8.12	-12.66	-16.23	-19.22	-21.60	-23.75	-25.76	-27.66	-29.48	-31.21	-32.90	-34.57	-36.22	-37.86	-39.50	-41.11	-42.68
20	gDG	chemicals	8.82	-12.37	-16.17	-19.38	-21.97	-24.31	-26.52	-28.60	-30.59	-32.50	-34.36	-36.18	-37.98	-39.76	-41.54	-43.28	-44.98
21	ior	inorganic chemicals	8.82	-12.37	-16.17	-19.38	-21.97	-24.31	-26.52	-28.60	-30.59	-32.50	-34.36	-36.18	-37.98	-39.76	-41.54	-43.28	-44.98
22	org	organic chemicals	8.82	-12.37	-16.17	-19.38	-21.97	-24.31	-26.52	-28.60	-30.59	-32.50	-34.36	-36.18	-37.98	-39.76	-41.54	-43.28	-44.98
23	frt	fertilizers and nitrogen compounds	8.82	-12.37	-16.17	-19.38	-21.97	-24.31	-26.52	-28.60	-30.59	-32.50	-34.36	-36.18	-37.98	-39.76	-41.54	-43.28	-44.98
25	gDI	other non-metallic mineral products	-20.79	-23.63	-26.25	-28.39	-30.02	-31.46	-32.80	-34.06	-35.26	-36.39	-37.51	-38.62	-39.72	-40.84	-41.97	-43.09	-44.19
27	stl	steel and ferroalloys	0.12	-5.56	-9.97	-13.71	-16.78	-19.58	-22.21	-24.16	-25.90	-27.63	-29.39	-31.20	-33.07	-35.02	-37.05	-39.13	-41.26
28	pps	pipes and pipeline connecting elements	0.12	-5.56	-9.97	-13.71	-16.78	-19.58	-22.21	-24.16	-25.90	-27.63	-29.39	-31.20	-33.07	-35.02	-37.05	-39.13	-41.26
29	fmp	other ferrous metals	0.12	-5.56	-9.97	-13.71	-16.78	-19.58	-22.21	-24.16	-25.90	-27.63	-29.39	-31.20	-33.07	-35.02	-37.05	-39.13	-41.26
30	pmt	precious metals	104.78	96.10	90.78	85.93	82.36	79.70	75.76	72.04	68.31	64.75	61.15	57.62	56.89	56.25	55.58	54.93	54.25
31	alu	aluminium	21.61	20.48	19.69	19.81	20.68	21.80	23.00	24.29	25.95	27.89	29.89	31.99	34.14	36.33	38.54	40.82	43.21
32	lzt	lead, zinc, tin and products thereof	-1.12	-4.66	-7.94	-10.61	-12.65	-14.44	-16.11	-17.69	-19.18	-20.60	-21.99	-23.37	-24.75	-26.15	-27.56	-28.96	-30.33
33	cop	copper products	29.00	25.57	23.70	23.00	23.11	23.45	23.95	24.65	25.62	26.79	28.12	29.62	31.25	33.08	34.96	36.96	38.97
34	nfe	other non-ferrous metals	39.48	35.94	34.20	33.77	34.17	34.85	35.66	36.65	37.98	39.56	41.28	43.14	45.12	47.24	49.40	51.67	54.01
35	gDJ	finished metal products	0.12	-5.56	-9.97	-13.71	-16.78	-19.58	-22.21	-24.16	-25.90	-27.63	-29.39	-31.20	-33.07	-35.02	-37.05	-39.13	-41.26
45	gG	wholesale and retail trade	9.91	5.97	2.33	-0.64	-2.90	-4.90	-6.76	-8.51	-10.16	-11.74	-13.29	-14.82	-16.36	-17.91	-19.48	-21.03	-22.56
46	gH	hotels and restaurants	9.91	5.97	2.33	-0.64	-2.90	-4.90	-6.76	-8.51	-10.16	-11.74	-13.29	-14.82	-16.36	-17.91	-19.48	-21.03	-22.56

Source: author.

Table 9. Changes in export prices to base year (2016) in CBAM Extreme scenario, %

No.	Code	Goods	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	g01	agriculture products	1.15	-1.27	-3.70	-5.96	-7.92	-9.75	-11.53	-13.23	-14.83	-16.37	-17.88	-19.36	-20.86	-22.38	-23.88	-25.35	-26.80
2	g02	forestry products	-27.50	-29.24	-30.98	-32.60	-34.00	-35.32	-36.59	-37.81	-38.95	-40.06	-41.14	-42.21	-43.28	-44.37	-45.44	-46.50	-47.53
3	woo	wood	-27.50	-29.24	-30.98	-32.60	-34.00	-35.32	-36.59	-37.81	-38.95	-40.06	-41.14	-42.21	-43.28	-44.37	-45.44	-46.50	-47.53
5	col	coal	64.20	45.96	15.89	-4.19	-16.95	-26.26	-33.82	-41.60	-48.19	-52.67	-56.16	-59.14	-61.92	-64.80	-67.73	-70.65	-73.53
6	cru	crude oil	-7.15	-11.29	-15.34	-19.15	-22.62	-25.91	-29.09	-32.13	-35.03	-37.83	-40.54	-43.18	-45.77	-48.31	-50.79	-53.18	-55.51
7	gas	natural gas	238.58	167.95	74.24	46.74	25.31	5.95	-11.15	-18.74	-24.97	-30.21	-34.86	-39.12	-42.97	-46.04	-48.53	-50.72	-52.75
10	ore	metal ores	8.53	-7.31	-13.21	-18.78	-23.92	-28.83	-33.56	-35.72	-38.29	-40.90	-43.56	-46.30	-49.14	-52.08	-55.11	-58.23	-61.43
12	gDA	food, beverages and tobacco	13.81	11.08	8.35	5.81	3.61	1.54	-0.46	-2.37	-4.16	-5.90	-7.60	-9.27	-10.95	-12.66	-14.35	-16.01	-17.63
13	gDB	textile and clothing	9.00	6.38	3.77	1.33	-0.77	-2.75	-4.67	-6.50	-8.22	-9.88	-11.51	-13.11	-14.72	-16.36	-17.97	-19.56	-21.12
15	gDD	processed wood	-27.50	-29.24	-30.98	-32.60	-34.00	-35.32	-36.59	-37.81	-38.95	-40.06	-41.14	-42.21	-43.28	-44.37	-45.44	-46.50	-47.53
16	pap	paper	-27.50	-29.24	-30.98	-32.60	-34.00	-35.32	-36.59	-37.81	-38.95	-40.06	-41.14	-42.21	-43.28	-44.37	-45.44	-46.50	-47.53
17	gDE	pulp and paper products	-27.50	-29.24	-30.98	-32.60	-34.00	-35.32	-36.59	-37.81	-38.95	-40.06	-41.14	-42.21	-43.28	-44.37	-45.44	-46.50	-47.53
18	cke	coke	41.69	20.25	9.09	-1.49	-11.39	-20.85	-29.96	-38.20	-45.17	-49.91	-53.60	-56.75	-59.70	-62.74	-65.84	-68.93	-71.98
19	oil	petroleum products	-7.15	-11.29	-15.34	-19.15	-22.62	-25.91	-29.09	-32.13	-35.03	-37.83	-40.54	-43.18	-45.77	-48.31	-50.79	-53.18	-55.51
20	gDG	chemicals	9.65	-10.62	-13.53	-16.26	-18.69	-20.98	-23.20	-25.32	-27.32	-29.26	-31.15	-32.99	-34.83	-36.65	-38.45	-40.19	-41.89
21	ior	inorganic chemicals	9.65	-10.62	-13.53	-16.26	-18.69	-20.98	-23.20	-25.32	-27.32	-29.26	-31.15	-32.99	-34.83	-36.65	-38.45	-40.19	-41.89
22	org	organic chemicals	9.65	-10.62	-13.53	-16.26	-18.69	-20.98	-23.20	-25.32	-27.32	-29.26	-31.15	-32.99	-34.83	-36.65	-38.45	-40.19	-41.89
23	frt	fertilizers and nitrogen compounds	9.65	-10.62	-13.53	-16.26	-18.69	-20.98	-23.20	-25.32	-27.32	-29.26	-31.15	-32.99	-34.83	-36.65	-38.45	-40.19	-41.89
25	gDI	other non-metallic mineral products	-17.98	-19.94	-21.91	-23.75	-25.33	-26.82	-28.26	-29.64	-30.93	-32.19	-33.41	-34.61	-35.83	-37.06	-38.27	-39.47	-40.64
27	stl	steel and ferroalloys	1.59	-4.38	-8.38	-12.14	-15.54	-18.77	-21.88	-24.43	-27.45	-30.51	-33.65	-36.86	-40.20	-43.66	-47.23	-50.89	-54.66
28	pps	pipes and pipeline connecting elements	1.59	-4.38	-8.38	-12.14	-15.54	-18.77	-21.88	-24.43	-27.45	-30.51	-33.65	-36.86	-40.20	-43.66	-47.23	-50.89	-54.66
29	fmp	other ferrous metals	1.59	-4.38	-8.38	-12.14	-15.54	-18.77	-21.88	-24.43	-27.45	-30.51	-33.65	-36.86	-40.20	-43.66	-47.23	-50.89	-54.66
30	pmt	precious metals	118.98	114.75	112.72	109.30	106.02	103.08	98.39	97.50	96.73	95.87	95.20	94.60	95.48	96.45	97.77	99.35	101.17
31	alu	aluminium	34.87	38.11	41.39	45.18	49.34	53.63	58.01	62.54	67.61	73.06	78.84	84.95	91.32	97.88	104.72	111.90	119.44
32	lzt	lead, zinc, tin and products thereof	2.39	-0.06	-2.52	-4.81	-6.79	-8.65	-10.45	-12.17	-13.78	-15.34	-16.87	-18.37	-19.89	-21.43	-22.94	-24.44	-25.90
33	cop	copper products	38.64	39.67	42.44	44.78	46.79	48.75	50.76	52.91	55.57	58.38	61.42	64.84	68.64	72.82	77.53	82.74	88.11
34	nfe	other non-ferrous metals	52.83	54.26	57.58	60.88	64.11	67.37	70.70	74.20	78.19	82.46	87.05	92.05	97.41	103.11	109.29	115.96	123.04
35	gDJ	finished metal products	1.59	-4.38	-8.38	-12.14	-15.54	-18.77	-21.88	-24.43	-27.45	-30.51	-33.65	-36.86	-40.20	-43.66	-47.23	-50.89	-54.66
45	gG	wholesale and retail trade	13.81	11.08	8.35	5.81	3.61	1.54	-0.46	-2.37	-4.16	-5.90	-7.60	-9.27	-10.95	-12.66	-14.35	-16.01	-17.63
46	gH	hotels and restaurants	13.81	11.08	8.35	5.81	3.61	1.54	-0.46	-2.37	-4.16	-5.90	-7.60	-9.27	-10.95	-12.66	-14.35	-16.01	-17.63

Source: author.

Table 10. Quantitative export restrictions changes to base year (2016) in BAU scenario, %

No.	Code	Goods	2024	2025	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	6.3	3.7	-1.5	-4.0	-6.6	-9.2	-12.2	-15.4	-18.5	-21.7	-24.9	-27.2	-29.0	-30.8	-32.6	-34.3
6	cru	crude oil	-2.1	-2.1	-3.3	-4.0	-4.6	-5.3	-6.0	-6.7	-7.4	-8.1	-8.8	-9.5	-11.2	-12.8	-14.4	-16.1
7	gas	natural gas	-27.9	-24.4	-20.9	-16.9	-12.8	-8.7	-4.6	-0.5	3.6	7.7	11.8	12.8	13.9	14.9	16.0	17.0
10	ore	metal ores	-7.8	-12.2	-10.6	-7.5	-5.1	-2.8	-1.3	0.2	1.7	3.2	4.7	6.3	7.9	9.5	11.2	12.8
18	cke	coke	121.0	127.6	139.1	145.1	151.2	157.5	153.3	148.7	144.1	139.3	134.4	130.8	128.0	125.1	122.2	119.3
19	oil	petroleum products	-36.2	-36.2	-37.0	-37.5	-37.9	-38.3	-38.8	-39.2	-39.7	-40.1	-40.6	-41.1	-42.1	-43.2	-44.3	-45.3
27	stl	steel and ferroalloys	-26.8	-30.3	-29.1	-26.6	-24.7	-22.9	-21.7	-20.5	-19.3	-18.1	-16.9	-15.7	-14.4	-13.1	-11.8	-10.5
30	pmt	precious metals	-8.6	13.4	13.3	13.2	13.0	12.9	12.8	12.6	12.5	12.3	12.1	11.5	10.8	10.1	9.3	8.4
31	alu	aluminium	-16.8	-15.4	-13.6	-12.7	-11.8	-10.9	-10.4	-9.9	-9.4	-8.8	-8.2	-7.5	-6.7	-5.9	-5.0	-4.0
33	cop	copper products	67.2	70.8	76.0	78.6	81.2	83.8	85.1	86.4	87.7	89.1	90.5	92.0	93.7	95.6	97.6	99.7
34	nfe	other non-ferrous metals	-8.7	-6.8	-3.8	-2.1	-0.4	0.8	1.4	2.0	2.6	3.2	3.9	4.7	5.5	6.5	7.5	8.5

Source: author.

Table 11. Quantitative export restrictions changes to base year (2016) in CBAM Moderate scenario, %

No.	Code	Goods	2024	2025	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	-17.8	-29.1	-43.9	-50.5	-57.0	-63.6	-68.3	-71.9	-75.4	-79.0	-82.6	-84.6	-85.8	-86.9	-88.0	-89.1
6	cru	crude oil	-9.9	-10.0	-10.8	-11.4	-12.0	-12.6	-13.6	-14.8	-16.0	-17.2	-18.5	-19.9	-21.5	-23.0	-24.6	-26.1
7	gas	natural gas	-27.9	-24.4	-23.6	-20.8	-18.0	-15.2	-12.4	-9.7	-6.9	-4.1	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3
10	ore	metal ores	-10.0	-14.3	-15.6	-15.1	-15.0	-14.8	-15.1	-15.4	-15.7	-16.0	-16.3	-16.5	-16.8	-17.0	-17.2	-17.4
18	cke	coke	85.2	72.5	53.9	44.9	35.3	25.0	16.9	10.3	3.3	-4.2	-12.4	-17.5	-20.5	-23.7	-27.0	-30.4
19	oil	petroleum products	-37.8	-37.9	-38.4	-38.8	-39.2	-39.6	-40.3	-41.2	-42.0	-42.9	-43.7	-44.7	-45.8	-46.8	-47.9	-49.0
27	stl	steel and ferroalloys	-28.6	-32.0	-32.2	-31.0	-30.1	-29.1	-28.6	-28.0	-27.4	-26.8	-26.2	-25.5	-24.9	-24.3	-23.6	-23.0
30	pmt	precious metals	-9.0	12.6	13.1	13.6	14.1	14.6	14.2	13.9	13.5	13.1	12.8	12.6	12.4	12.2	12.0	11.9
31	alu	aluminium	-16.8	-15.4	-13.3	-12.3	-11.3	-10.3	-9.6	-9.0	-8.2	-7.5	-6.7	-5.8	-4.9	-3.9	-2.9	-1.8
33	cop	copper products	67.2	71.3	77.5	80.7	83.9	87.0	89.1	91.2	93.4	95.6	98.0	100.5	103.1	105.9	108.9	112.0
34	nfe	other non-ferrous metals	-8.7	-6.8	-3.5	-1.7	0.4	1.8	2.5	3.4	4.3	5.2	6.2	7.2	8.3	9.5	10.7	12.1

Source: author.

Table 12. Quantitative export restrictions changes to base year (2016) in CBAM Extreme scenario, %

No.	Code	Goods	2024	2025	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	-21.9	-35.2	-51.0	-57.7	-64.3	-71.0	-75.0	-77.4	-79.7	-82.1	-84.5	-85.9	-86.8	-87.7	-88.6	-89.5
6	cru	crude oil	-12.3	-13.8	-16.8	-18.3	-19.9	-21.5	-23.2	-24.8	-26.6	-28.3	-30.1	-32.0	-33.9	-35.8	-37.8	-40.2
7	gas	natural gas	-31.0	-29.9	-38.4	-40.5	-42.4	-44.4	-46.2	-48.0	-49.7	-51.3	-52.9	-54.5	-56.0	-57.5	-58.9	-60.2
10	ore	metal ores	-12.2	-16.5	-20.7	-22.8	-24.8	-26.9	-29.0	-31.0	-33.1	-35.2	-37.3	-39.3	-41.4	-43.5	-45.6	-47.6
18	cke	coke	80.9	65.4	44.6	34.7	24.1	12.5	-2.9	-12.1	-21.3	-30.5	-40.3	-47.3	-51.1	-55.0	-58.9	-62.7
19	oil	petroleum products	-38.8	-39.8	-41.9	-43.0	-44.1	-45.2	-46.4	-47.5	-48.7	-50.0	-51.2	-52.5	-53.8	-55.2	-56.6	-58.3
27	stl	steel and ferroalloys	-30.3	-33.8	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4	-35.4
30	pmt	precious metals	-9.1	12.4	16.0	17.9	19.9	21.9	22.4	23.0	23.5	24.1	24.6	25.3	26.0	26.6	27.4	28.2
31	alu	aluminium	-16.8	-15.3	-13.0	-11.8	-10.6	-9.4	-8.5	-7.5	-6.5	-5.3	-4.1	-2.9	-1.6	-0.2	1.3	2.8
33	cop	copper products	67.2	71.8	79.1	82.8	86.6	90.3	93.3	96.3	99.4	102.7	106.0	109.5	113.2	117.1	121.2	125.6
34	nfe	other non-ferrous metals	-8.7	-6.7	-3.2	-1.1	1.1	2.9	4.0	5.2	6.5	7.9	9.3	10.8	12.4	14.0	15.8	17.6

Source: author.

Table 13. Scenario results: real GDP at 2016 prices (billion rubles), deviation from BAU scenario, and year-on-year change (%)

Scenario/Parameter	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Real GDP at 2016 prices (main set of scenarios), billion rubles.																	
BAU	90,503.93	89,007.26	87,266.51	86,534.70	86,074.84	85,599.11	85,111.32	84,865.89	84,640.55	84,419.98	84,197.19	83,942.03	83,685.91	83,398.14	83,114.72	82,835.86	82,560.67
CBAM Moderate	88,249.26	86,351.89	84,175.86	83,166.39	82,560.52	81,999.73	81,460.12	81,154.14	80,886.17	80,647.31	80,421.64	80,204.71	79,961.59	79,711.90	79,456.26	79,202.94	78,953.33
CBAM Extreme	88,099.90	86,221.64	84,027.09	82,909.73	82,060.96	81,290.61	80,579.32	80,056.18	79,582.99	79,147.02	78,739.17	78,354.74	77,994.94	77,657.55	77,344.36	77,053.01	76,772.55
ETS BAU	90,503.93	89,007.26	87,266.51	86,534.70	86,074.84	85,599.11	85,111.32	84,865.89	84,640.55	84,419.98	84,197.19	83,942.03	83,685.91	83,398.14	83,114.72	82,835.86	82,560.67
ETS+CBAM Moderate	88,252.13	86,332.86	84,141.07	83,109.36	82,474.41	81,878.52	81,294.88	80,987.25	80,717.32	80,476.43	80,248.84	80,030.31	79,774.70	79,513.18	79,246.27	78,980.93	78,718.84
ETS+CBAM Extreme	88,066.97	85,969.94	83,603.71	82,256.00	81,112.63	79,982.38	78,838.68	78,030.63	77,245.49	76,469.08	75,691.01	74,902.00	74,524.26	74,168.74	73,837.99	73,530.41	73,239.11
Change in real GDP compared to the "BAU" scenario (main set of scenarios), %.																	
BAU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBAM Moderate	-2.49	-2.98	-3.54	-3.89	-4.08	-4.20	-4.29	-4.37	-4.44	-4.47	-4.48	-4.45	-4.45	-4.42	-4.40	-4.39	-4.37
CBAM Extreme	-2.66	-3.13	-3.71	-4.19	-4.66	-5.03	-5.32	-5.67	-5.98	-6.25	-6.48	-6.66	-6.80	-6.88	-6.94	-6.98	-7.01
ETS BAU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETS+CBAM Moderate	-2.49	-3.00	-3.58	-3.96	-4.18	-4.35	-4.48	-4.57	-4.64	-4.67	-4.69	-4.66	-4.67	-4.66	-4.65	-4.65	-4.65
ETS+CBAM Extreme	-2.69	-3.41	-4.20	-4.94	-5.76	-6.56	-7.37	-8.05	-8.74	-9.42	-10.10	-10.77	-10.95	-11.07	-11.16	-11.23	-11.29
Year-on-year change in real GDP (main set of scenarios), %.																	
BAU	-0.70	-1.65	-1.96	-0.84	-0.53	-0.55	-0.57	-0.29	-0.27	-0.26	-0.26	-0.30	-0.31	-0.34	-0.34	-0.34	-0.33
CBAM Moderate	-1.44	-2.15	-2.52	-1.20	-0.73	-0.68	-0.66	-0.38	-0.33	-0.30	-0.28	-0.27	-0.30	-0.31	-0.32	-0.32	-0.32
CBAM Extreme	-1.66	-2.13	-2.55	-1.33	-1.02	-0.94	-0.87	-0.65	-0.59	-0.55	-0.52	-0.49	-0.46	-0.43	-0.40	-0.38	-0.36
ETS BAU	-0.70	-1.65	-1.96	-0.84	-0.53	-0.55	-0.57	-0.29	-0.27	-0.26	-0.26	-0.30	-0.31	-0.34	-0.34	-0.34	-0.33
ETS+CBAM Moderate	-1.43	-2.17	-2.54	-1.23	-0.76	-0.72	-0.71	-0.38	-0.33	-0.30	-0.28	-0.27	-0.32	-0.33	-0.34	-0.33	-0.33
ETS+CBAM Extreme	-1.69	-2.38	-2.75	-1.61	-1.39	-1.39	-1.43	-1.02	-1.01	-1.01	-1.02	-1.04	-0.50	-0.48	-0.45	-0.42	-0.40

Source: author.

Table 14. Results of the additional set of scenarios without export restrictions: real GDP at 2016 prices (billion rubles), deviation from BAU scenario, and year-on-year change (%)

Scenario/Parameter	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Real GDP at 2016 prices (modified scenarios without export restrictions), billion rubles.																	
BAU w/o export restrictions	93,638.49	91,558.76	89,046.63	88,134.44	87,495.32	86,871.17	86,258.05	85,953.14	85,675.19	85,407.91	85,146.83	84,889.79	84,634.05	84,382.50	84,137.47	83,898.46	83,664.99
CBAM Moderate w/o export restrictions	91,480.47	88,957.98	86,007.55	84,792.37	83,991.63	83,265.11	82,581.17	82,216.13	81,906.68	81,630.57	81,368.65	81,115.91	80,875.56	80,631.98	80,382.03	80,134.48	79,890.95
CBAM Extreme w/o export restrictions	91,543.51	89,200.92	86,343.01	85,091.21	84,067.39	83,130.33	82,262.09	81,665.95	81,124.39	80,630.92	80,168.94	79,730.57	79,315.70	78,926.19	78,564.38	78,225.60	77,905.34
ETS BAU w/o export restrictions and recognition	93,638.49	91,558.76	89,046.63	88,134.44	87,495.32	86,871.17	86,258.05	85,953.14	85,675.19	85,407.91	85,146.83	84,892.28	84,634.05	84,382.50	84,137.47	83,898.46	83,664.99
ETS+CBAM Moderate w/o export restrictions and recogni	91,461.47	88,883.91	85,895.20	84,637.80	83,788.18	83,004.39	82,254.29	81,888.62	81,576.88	81,298.13	81,033.51	80,777.86	80,519.23	80,256.17	79,985.74	79,716.85	79,451.24
ETS+CBAM Extreme w/o export restrictions and recogniti	91,444.64	88,760.62	85,619.93	84,011.49	82,541.50	81,059.05	79,529.17	78,521.97	77,565.74	76,641.83	75,727.80	74,813.96	74,432.18	74,071.54	73,735.90	73,423.50	73,132.01
ETS BAU w/o export restrictions and recognition	93,638.49	91,558.76	89,046.63	88,134.44	87,495.32	86,871.17	86,258.05	85,953.14	85,675.19	85,407.91	85,146.83	84,889.79	84,634.05	84,382.50	84,137.47	83,898.46	83,664.99
ETS+CBAM Moderate w/o export restrictions	91,483.57	88,929.33	85,951.92	84,704.61	83,865.31	83,092.41	82,353.74	81,987.98	81,676.42	81,397.88	81,133.47	80,878.02	80,622.05	80,361.70	80,093.99	79,827.83	79,564.92
ETS+CBAM Extreme w/o export restrictions	91,498.57	88,885.10	85,792.28	84,236.91	82,825.22	81,404.12	79,930.87	78,949.50	78,021.20	77,128.41	76,246.72	75,364.93	74,973.68	74,603.62	74,258.59	73,936.76	73,635.51
Change in real GDP compared to the "Base" scenario (modified scenarios without export restrictions), %.																	
BAU w/o export restrictions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBAM Moderate w/o export restrictions	-2.30	-2.84	-3.41	-3.79	-4.00	-4.15	-4.26	-4.35	-4.40	-4.42	-4.44	-4.45	-4.44	-4.44	-4.46	-4.49	-4.51
CBAM Extreme w/o export restrictions	-2.24	-2.58	-3.04	-3.45	-3.92	-4.31	-4.63	-4.99	-5.31	-5.59	-5.85	-6.08	-6.28	-6.47	-6.62	-6.76	-6.88
ETS BAU w/o export restrictions and recognition	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETS+CBAM Moderate w/o export restrictions and recogni	-2.32	-2.92	-3.54	-3.97	-4.24	-4.45	-4.64	-4.73	-4.78	-4.81	-4.83	-4.84	-4.86	-4.89	-4.93	-4.98	-5.04
ETS+CBAM Extreme w/o export restrictions and recogniti	-2.34	-3.06	-3.85	-4.68	-5.66	-6.69	-7.80	-8.65	-9.47	-10.26	-11.06	-11.87	-12.05	-12.22	-12.36	-12.49	-12.59
ETS BAU w/o export restrictions and recognition	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETS+CBAM Moderate w/o export restrictions	-2.30	-2.87	-3.48	-3.89	-4.15	-4.35	-4.53	-4.61	-4.67	-4.70	-4.71	-4.73	-4.74	-4.76	-4.81	-4.85	-4.90
ETS+CBAM Extreme w/o export restrictions	-2.29	-2.92	-3.65	-4.42	-5.34	-6.29	-7.34	-8.15	-8.93	-9.69	-10.45	-11.22	-11.41	-11.59	-11.74	-11.87	-11.99
Year-on-year change in real GDP (modified scenarios without export restrictions), %.																	
BAU w/o export restrictions	-0.63	-2.22	-2.74	-1.02	-0.73	-0.71	-0.71	-0.35	-0.32	-0.31	-0.31	-0.30	-0.30	-0.30	-0.29	-0.28	-0.28
CBAM Moderate w/o export restrictions	-1.49	-2.76	-3.32	-1.41	-0.94	-0.86	-0.82	-0.44	-0.38	-0.34	-0.32	-0.31	-0.30	-0.30	-0.31	-0.31	-0.30
CBAM Extreme w/o export restrictions	-1.64	-2.56	-3.20	-1.45	-1.20	-1.11	-1.04	-0.72	-0.66	-0.61	-0.57	-0.55	-0.52	-0.49	-0.46	-0.43	-0.41
ETS BAU w/o export restrictions and recognition	-0.63	-2.22	-2.74	-1.02	-0.73	-0.71	-0.71	-0.35	-0.32	-0.31	-0.31	-0.30	-0.30	-0.30	-0.29	-0.28	-0.28
ETS+CBAM Moderate w/o export restrictions and recogni	-1.51	-2.82	-3.36	-1.46	-1.00	-0.94	-0.90	-0.44	-0.38	-0.34	-0.33	-0.32	-0.32	-0.33	-0.34	-0.34	-0.33
ETS+CBAM Extreme w/o export restrictions and recogniti	-1.74	-2.94	-3.54	-1.88	-1.75	-1.80	-1.89	-1.27	-1.22	-1.19	-1.19	-1.21	-0.51	-0.48	-0.45	-0.42	-0.40
ETS BAU w/o export restrictions and recognition	-0.63	-2.22	-2.74	-1.02	-0.73	-0.71	-0.71	-0.35	-0.32	-0.31	-0.31	-0.30	-0.30	-0.30	-0.29	-0.28	-0.28
ETS+CBAM Moderate w/o export restrictions	-1.49	-2.79	-3.35	-1.45	-0.99	-0.92	-0.89	-0.44	-0.38	-0.34	-0.32	-0.31	-0.32	-0.32	-0.33	-0.33	-0.33
ETS+CBAM Extreme w/o export restrictions	-1.69	-2.86	-3.48	-1.81	-1.68	-1.72	-1.81	-1.23	-1.18	-1.14	-1.14	-1.16	-0.52	-0.49	-0.46	-0.43	-0.41

Source: author.

Table 15. Scenario results: decomposition of real GDP at 2016 prices, billion rubles (2016)

Scenario/Parameter	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
GDP Decomposition - BAU																	
Real GDP at 2016 prices	90,503.93	89,007.26	87,266.51	86,534.70	86,074.84	85,599.11	85,111.32	84,865.89	84,640.55	84,419.98	84,197.19	83,942.03	83,685.91	83,398.14	83,114.72	82,835.86	82,560.67
Household consumption	48,035.51	46,972.86	45,735.65	45,193.62	44,838.31	44,468.95	44,113.00	43,930.96	43,760.79	43,592.73	43,421.63	43,228.15	43,032.78	42,814.08	42,597.98	42,384.71	42,173.16
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,795.56	20,361.53	19,857.98	19,668.21	19,563.66	19,457.28	19,325.44	19,262.05	19,206.88	19,154.37	19,102.70	19,041.00	18,980.25	18,911.18	18,843.87	18,778.28	18,714.63
Export	24,866.99	23,472.78	22,164.49	21,597.55	21,260.84	20,923.24	20,578.87	20,402.75	20,247.01	20,101.98	19,964.45	19,776.10	19,588.22	19,367.57	19,155.52	18,951.96	18,753.83
Import	19,348.12	17,953.91	16,645.62	16,078.68	15,741.97	15,404.37	15,060.00	14,883.88	14,728.14	14,583.11	14,445.58	14,257.23	14,069.35	13,848.70	13,636.65	13,433.09	13,234.96
GDP Decomposition - CBAM Moderate																	
Real GDP at 2016 prices	88,249.26	86,351.89	84,175.86	83,166.39	82,560.52	81,999.73	81,460.12	81,154.14	80,886.17	80,647.31	80,421.64	80,204.71	79,961.59	79,711.90	79,456.26	79,202.94	78,953.33
Household consumption	46,469.01	45,112.31	43,570.35	42,840.13	42,389.56	41,978.63	41,592.36	41,370.48	41,173.64	40,996.29	40,827.71	40,664.93	40,484.16	40,302.03	40,114.02	39,925.35	39,736.40
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,107.38	19,566.71	18,932.63	18,653.39	18,498.08	18,348.22	18,194.89	18,110.79	18,039.65	17,978.14	17,921.06	17,866.91	17,804.56	17,736.99	17,669.36	17,604.71	17,544.06
Export	22,597.05	21,085.25	19,596.70	18,928.62	18,553.27	18,215.43	17,897.46	17,713.48	17,553.47	17,414.18	17,286.04	17,166.39	17,017.98	16,866.94	16,717.45	16,573.97	16,437.25
Import	17,078.18	15,566.38	14,077.83	13,409.75	13,034.40	12,696.56	12,378.59	12,194.61	12,034.60	11,895.31	11,767.17	11,647.52	11,499.11	11,348.07	11,198.58	11,055.10	10,918.38
GDP Decomposition - CBAM Extreme																	
Real GDP at 2016 prices	88,099.90	86,221.64	84,027.09	82,909.73	82,060.96	81,290.61	80,579.32	80,056.18	79,582.99	79,147.02	78,739.17	78,354.74	77,994.94	77,657.55	77,344.36	77,053.01	76,772.55
Household consumption	46,376.04	45,021.37	43,467.79	42,667.33	42,052.88	41,489.82	40,974.04	40,595.70	40,250.91	39,930.96	39,629.32	39,342.79	39,080.32	38,837.49	38,610.26	38,397.12	38,191.00
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,050.99	19,527.40	18,886.43	18,569.53	18,335.21	18,127.92	17,932.41	17,787.60	17,659.21	17,543.19	17,436.98	17,339.08	17,241.75	17,147.19	17,061.22	16,983.01	16,908.68
Export	22,410.77	20,895.03	19,372.59	18,619.53	18,076.65	17,603.84	17,180.51	16,871.34	16,600.09	16,356.38	16,134.37	15,930.75	15,742.29	15,568.89	15,412.11	15,270.15	15,135.72
Import	16,891.90	15,376.16	13,853.72	13,100.66	12,557.78	12,084.97	11,661.64	11,352.47	11,081.21	10,837.51	10,615.50	10,411.88	10,223.42	10,050.02	9,893.24	9,751.28	9,616.85
GDP Decomposition - ETS BAU (w/o recognition)																	
Real GDP at 2016 prices	90,503.93	89,007.26	87,266.51	86,534.70	86,074.84	85,599.11	85,111.32	84,865.89	84,640.55	84,419.98	84,197.19	83,942.03	83,685.91	83,398.14	83,114.72	82,835.86	82,560.67
Household consumption	48,035.51	46,972.86	45,735.65	45,193.62	44,838.31	44,468.95	44,113.00	43,930.96	43,760.79	43,592.73	43,421.63	43,228.15	43,032.78	42,814.08	42,597.98	42,384.71	42,173.16
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,795.56	20,361.53	19,857.98	19,668.21	19,563.66	19,457.28	19,325.44	19,262.05	19,206.88	19,154.37	19,102.70	19,041.00	18,980.25	18,911.18	18,843.87	18,778.28	18,714.63
Export	24,866.99	23,472.78	22,164.49	21,597.55	21,260.84	20,923.24	20,578.87	20,402.75	20,247.01	20,101.98	19,964.45	19,776.10	19,588.22	19,367.57	19,155.52	18,951.96	18,753.83
Import	19,348.12	17,953.91	16,645.62	16,078.68	15,741.97	15,404.37	15,060.00	14,883.88	14,728.14	14,583.11	14,445.58	14,257.23	14,069.35	13,848.70	13,636.65	13,433.09	13,234.96
GDP Decomposition - ETS+CBAM Moderate (w/o recognition)																	
Real GDP at 2016 prices	88,237.57	86,299.53	84,100.01	83,060.28	82,416.98	81,812.49	81,219.98	80,912.12	80,641.95	80,400.84	80,173.06	79,954.38	79,696.99	79,433.65	79,164.91	78,897.98	78,634.33
Household consumption	46,460.85	45,077.34	43,516.06	42,759.70	42,281.10	41,846.96	41,419.34	41,194.65	40,994.69	40,814.08	40,642.14	40,475.79	40,281.00	40,081.41	39,877.56	39,677.90	39,477.83
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,103.85	19,549.31	18,911.08	18,627.71	18,463.01	18,292.65	18,127.77	18,044.60	17,974.40	17,913.89	17,858.05	17,805.72	17,743.11	17,679.37	17,614.48	17,547.21	17,483.62
Export	22,584.36	21,054.09	19,559.10	18,883.90	18,499.00	18,147.94	17,819.10	17,636.52	17,477.49	17,339.03	17,211.81	17,093.40	16,943.91	16,794.36	16,645.94	16,500.36	16,361.33
Import	17,065.49	15,535.22	14,040.23	13,365.03	12,980.13	12,629.07	12,300.23	12,117.65	11,958.62	11,820.16	11,692.94	11,574.53	11,425.04	11,275.49	11,127.07	10,981.49	10,842.46
GDP Decomposition - ETS+CBAM Extreme (w/o recognition)																	
Real GDP at 2016 prices	88,027.54	85,884.45	83,493.42	82,117.44	80,939.97	79,769.87	78,580.11	77,744.58	76,929.33	76,120.64	75,307.92	74,471.98	74,101.23	73,752.81	73,430.28	73,130.55	72,847.69
Household consumption	46,322.64	44,773.24	43,063.16	42,053.81	41,179.67	40,338.70	39,484.67	38,881.38	38,291.94	37,706.92	37,118.41	36,513.79	36,234.83	35,970.20	35,722.81	35,491.39	35,272.66
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,032.02	19,438.34	18,757.39	18,390.75	18,087.43	17,758.30	17,422.57	17,190.33	16,964.52	16,740.84	16,516.63	16,285.31	16,193.52	16,109.74	16,034.59	15,966.28	15,902.15
Export	22,371.04	20,787.90	19,226.17	18,426.58	17,826.14	17,275.30	16,765.93	16,405.97	16,079.86	15,777.94	15,494.81	15,205.79	15,021.24	14,855.02	14,708.16	14,577.43	14,458.32
Import	16,852.17	15,269.03	13,707.30	12,907.71	12,307.27	11,756.43	11,247.06	10,887.10	10,560.99	10,259.07	9,975.94	9,686.92	9,502.37	9,336.15	9,189.29	9,058.56	8,939.45
GDP Decomposition - ETS BAU																	
Real GDP at 2016 prices	90,503.93	89,007.26	87,266.51	86,534.70	86,074.84	85,599.11	85,111.32	84,865.89	84,640.55	84,419.98	84,197.19	83,942.03	83,685.91	83,398.14	83,114.72	82,835.86	82,560.67
Household consumption	48,035.51	46,972.86	45,735.65	45,193.62	44,838.31	44,468.95	44,113.00	43,930.96	43,760.79	43,592.73	43,421.63	43,228.15	43,032.78	42,814.08	42,597.98	42,384.71	42,173.16
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,795.56	20,361.53	19,857.98	19,668.21	19,563.66	19,457.28	19,325.44	19,262.05	19,206.88	19,154.37	19,102.70	19,041.00	18,980.25	18,911.18	18,843.87	18,778.28	18,714.63
Export	24,866.99	23,472.78	22,164.49	21,597.55	21,260.84	20,923.24	20,578.87	20,402.75	20,247.01	20,101.98	19,964.45	19,776.10	19,588.22	19,367.57	19,155.52	18,951.96	18,753.83
Import	19,348.12	17,953.91	16,645.62	16,078.68	15,741.97	15,404.37	15,060.00	14,883.88	14,728.14	14,583.11	14,445.58	14,257.23	14,069.35	13,848.70	13,636.65	13,433.09	13,234.96
GDP Decomposition - ETS+CBAM Moderate																	
Real GDP at 2016 prices	88,252.13	86,332.86	84,141.07	83,109.36	82,474.41	81,878.52	81,294.88	80,987.25	80,717.32	80,476.43	80,248.84	80,030.31	79,774.70	79,513.18	79,246.27	78,980.93	78,718.84
Household consumption	46,470.47	45,099.37	43,543.63	42,793.01	42,318.60	41,890.46	41,469.07	41,244.59	41,044.82	40,864.40	40,692.62	40,526.40	40,332.84	40,134.50	39,931.90	39,733.34	39,534.43
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,108.79	19,560.62	18,924.56	18,643.48	18,482.94	18,315.18	18,152.94	18,069.79	17,999.62	17,939.15	17,883.35	17,831.04	17,768.98	17,705.81	17,641.50	17,574.72	17,511.54
Export	22,596.71	21,079.97	19,588.06	18,916.69	18,536.65	18,189.73	17,864.90	17,681.56	17,521.86	17,382.82	17,255.03	17,136.06	16,986.76	16,837.39	16,689.12	16,543.43	16,404.21
Import	17,077.84	15,561.10	14,069.19	13,397.82	13,017.78	12,670.86	12,346.03	12,162.69	12,002.99	11,863.95	11,736.16	11,617.19	11,467.89	11,318.52	11,170.25	11,024.56	10,885.34
GDP Decomposition - ETS+CBAM Extreme																	
Real GDP at 2016 prices	88,066.97	85,969.94	83,603.71	82,256.00	81,112.63	79,982.38	78,838.68	78,030.63	77,245.49	76,469.08	75,691.01	74,902.00	74,524.26	74,168.74	73,837.99	73,530.41	73,239.11
Household consumption	46,348.98	44,831.41	43,139.17	42,149.89	41,296.94	40,483.45	39,661.04	39,076.45	38,507.44	37,944.30	37,379.26	36,805.59	36,521.62	36,251.82	35,998.26	35,760.60	35,535.11
Government consumption	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00	16,154.00
Investments	20,045.11	19,465.65	18,791.66	18,433.25	18,142.82	17,826.06	17,504.76	17,281.31	17,065.17	16,851.91	16,638.88	16,423.54	16,329.77	16,244.04	16,166.86	16,096.93	16,031.12
Export	22,404.36	20,852.54	19,301.12	18,514.70	17,931.42	17,398.93	16,910.02	16,560.34	16,245.45	15,955.30	15,684.46	15,427.97	15,235.03	15,060.39	14,904.15	14,764.98	14,637.55
Import	16,885.49	15,333.67	13,782.25	12,995.83	12,412.55	11,880.06	11,391.15	11,041.47	10,726.58	10,436.43	10,165.59	9,909.10	9,716.16	9,541.52	9,385.28	9,246.11	9,118.68

Source: author.

Table 16. Share of shadow price of quantitative restrictions in export price in BAU scenario, %

No.	code	Commodities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	40.4	42.5	43.5	43.1	42.0	40.6	39.0	37.7	36.7	35.9	35.0	34.3	32.8	31.4	30.5	30.1	29.8
6	cru	crude oil	0.0	0.0	0.0	2.3	4.0	5.6	7.3	8.5	9.7	11.0	12.5	13.5	14.4	16.6	18.6	20.4	22.0
7	gas	natural gas	56.1	53.1	44.6	41.2	37.4	32.6	26.5	22.8	18.0	11.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0
10	ore	metal ores	16.3	22.2	27.3	19.9	10.8	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	cke	coke	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	oil	petroleum products	58.4	59.3	60.9	61.3	61.5	61.8	62.1	62.2	62.4	62.5	62.7	62.9	63.1	63.6	64.1	64.5	65.0
27	stl	steel and ferroalloys	77.6	79.7	79.9	77.8	75.2	73.1	70.1	67.8	65.7	63.4	60.9	58.3	55.5	52.6	49.6	46.4	41.6
30	pmt	precious metals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2
31	alu	aluminium	74.0	71.3	68.9	67.4	66.2	65.3	63.5	62.4	61.4	60.1	58.6	57.2	55.6	54.0	52.3	50.5	46.7
33	cop	copper products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	nfe	other non-ferrous metals	68.4	57.2	45.1	33.8	19.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: author.

Table 17. Share of shadow price of quantitative restrictions in export price in CBAM Moderate scenario, %

No.	code	Commodities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	51.1	54.8	55.1	54.6	54.8	54.7	52.9	49.8	47.2	44.1	40.6	36.4	31.9	28.0	24.7	21.6	18.6
6	cru	crude oil	7.3	8.4	10.4	11.0	11.3	11.6	12.0	12.5	13.3	14.0	14.8	15.5	16.3	17.2	18.1	19.1	20.0
7	gas	natural gas	56.5	53.4	45.4	42.2	38.8	34.6	29.5	27.3	24.9	22.4	19.4	15.7	16.0	16.3	16.4	16.4	16.5
10	ore	metal ores	22.5	29.8	36.2	35.2	33.1	31.9	30.1	30.8	31.5	32.1	32.6	33.0	33.6	33.0	32.2	31.3	30.1
18	cke	coke	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	20.2	29.9	34.2	39.5	45.4	51.5
19	oil	petroleum products	56.6	56.9	57.8	58.1	58.2	58.3	58.4	58.5	58.7	58.9	59.1	59.3	59.6	60.0	60.3	60.7	61.1
27	stl	steel and ferroalloys	77.0	79.1	79.4	77.9	76.5	75.3	73.9	72.8	71.7	70.6	69.5	68.2	66.9	64.7	62.2	59.3	56.1
30	pmt	precious metals	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	12.4	23.5	35.6	48.9
31	alu	aluminium	72.9	70.8	68.2	66.6	65.6	64.5	62.8	62.0	61.1	60.3	59.3	58.2	57.2	53.8	49.6	44.5	38.1
33	cop	copper products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	nfe	other non-ferrous metals	61.8	52.1	37.7	24.6	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: author.

Table 18. Share of shadow price of quantitative restrictions in export price in CBAM Extreme scenario, %

No.	code	Commodities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	53.5	59.9	60.0	59.3	59.9	60.0	58.8	54.9	50.2	46.5	43.2	39.9	36.4	32.1	26.9	20.5	12.9
6	cru	crude oil	12.2	15.3	18.3	19.6	20.4	21.2	21.9	22.3	22.7	23.1	23.5	24.0	24.6	25.3	26.2	27.2	28.9
7	gas	natural gas	56.6	53.9	47.3	44.9	41.7	37.6	32.5	30.0	27.7	25.4	23.1	20.7	18.2	16.2	14.4	12.8	11.1
10	ore	metal ores	25.8	35.1	42.8	47.7	51.8	55.8	59.1	63.1	66.3	68.9	71.1	72.7	73.7	74.3	74.6	74.5	74.0
18	cke	coke	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.8	38.1	54.7	68.6	78.5	82.4	83.3	83.6	83.3	82.6
19	oil	petroleum products	57.3	58.3	59.6	60.2	60.6	60.9	61.2	61.4	61.6	61.8	61.9	62.1	62.3	62.5	62.7	62.8	63.2
27	stl	steel and ferroalloys	78.7	80.9	81.6	81.3	81.0	80.9	80.8	80.6	80.4	80.0	79.7	79.2	78.4	77.3	76.1	74.6	72.9
30	pmt	precious metals	20.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.2	16.6	24.3	32.2	40.4
31	alu	aluminium	75.4	75.6	74.6	74.2	74.1	74.4	74.6	75.1	75.6	76.1	76.6	77.1	76.4	75.4	74.2	72.9	71.5
33	cop	copper products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	nfe	other non-ferrous metals	64.6	61.0	52.8	45.0	35.5	24.2	16.5	14.3	12.2	9.9	7.6	5.3	0.0	0.0	0.0	0.0	0.0

Source: author.

Table 19. Share of shadow price of quantitative restrictions in export price in ETS BAU scenario, %

No.	code	Commodities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	40.4	42.5	43.5	43.1	42.0	40.6	39.0	37.7	36.7	35.9	35.0	34.3	32.8	31.4	30.5	30.1	29.8
6	cru	crude oil	0.0	0.0	0.0	2.3	4.0	5.6	7.3	8.5	9.7	11.0	12.5	13.5	14.4	16.6	18.6	20.4	22.0
7	gas	natural gas	56.1	53.1	44.6	41.2	37.4	32.6	26.5	22.8	18.0	11.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0
10	ore	metal ores	16.3	22.2	27.3	19.9	10.8	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	cke	coke	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	oil	petroleum products	58.4	59.3	60.9	61.3	61.5	61.8	62.1	62.2	62.4	62.5	62.7	62.9	63.1	63.6	64.1	64.5	65.0
27	stl	steel and ferroalloys	77.6	79.7	79.9	77.8	75.2	73.1	70.1	67.8	65.7	63.4	60.9	58.3	55.5	52.6	49.6	46.4	41.6
30	pmt	precious metals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2
31	alu	aluminium	74.0	71.3	68.9	67.4	66.2	65.3	63.5	62.4	61.4	60.1	58.6	57.2	55.6	54.0	52.3	50.5	46.7
33	cop	copper products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	nfe	other non-ferrous metals	68.4	57.2	45.1	33.8	19.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: author.

Table 20. Share of shadow price of quantitative restrictions in export price in ETS+CBAM Moderate scenario, %

No.	code	Commodities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	50.2	52.7	52.4	51.3	51.4	51.7	50.9	48.8	46.7	44.1	40.9	37.0	32.6	28.8	25.6	22.7	19.9
6	cru	crude oil	6.9	7.5	9.2	9.6	9.5	9.5	9.4	9.8	10.5	11.1	11.7	12.2	12.8	13.5	14.1	14.8	15.4
7	gas	natural gas	56.5	53.3	45.2	41.9	38.3	33.9	28.7	26.6	24.6	22.4	19.8	16.8	17.1	17.3	17.4	17.6	17.7
10	ore	metal ores	21.9	27.9	33.9	32.2	29.3	26.7	23.7	24.3	25.1	25.7	26.3	26.6	27.4	28.1	28.7	27.7	26.5
18	cke	coke	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	oil	petroleum products	56.4	56.4	57.2	57.3	57.2	57.1	57.0	57.1	57.3	57.5	57.7	57.9	58.1	58.4	58.7	59.1	59.4
27	stl	steel and ferroalloys	77.1	79.1	79.3	77.7	76.2	74.6	72.8	71.6	70.4	69.2	67.9	66.6	65.3	64.0	62.7	59.9	56.8
30	pmt	precious metals	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	23.7
31	alu	aluminium	72.8	70.2	67.2	65.3	63.7	61.1	58.3	57.1	56.0	54.8	53.5	52.1	51.3	50.4	49.3	44.3	37.8
33	cop	copper products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	nfe	other non-ferrous metals	61.7	50.0	33.5	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: author.

Table 21. Share of shadow price of quantitative restrictions in export price in ETS+CBAM Extreme scenario, %

No.	code	Commodities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
5	col	coal	51.5	55.7	54.5	52.9	53.8	55.6	57.0	55.0	51.9	49.9	48.4	47.2	44.9	41.9	38.4	34.2	29.2
6	cru	crude oil	11.1	12.4	14.4	14.3	13.5	12.2	10.3	8.9	7.2	5.1	2.7	0.0	0.0	0.0	0.0	0.0	0.0
7	gas	natural gas	56.5	53.2	45.9	42.7	38.0	31.8	23.6	19.5	15.3	11.1	6.7	1.9	0.6	0.0	0.0	0.0	0.2
10	ore	metal ores	23.8	27.7	33.0	34.9	35.7	34.8	32.9	35.5	37.3	38.7	39.7	40.4	47.3	53.5	58.8	63.4	67.2
18	cke	coke	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	oil	petroleum products	56.6	56.5	57.2	56.9	56.1	55.1	53.6	52.7	51.6	50.3	48.7	46.9	47.4	47.9	48.5	49.2	50.4
27	stl	steel and ferroalloys	78.7	80.6	81.0	80.5	80.2	79.4	78.6	78.1	77.4	76.7	76.0	75.2	74.8	74.3	73.6	72.8	71.9
30	pmt	precious metals	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	alu	aluminium	75.2	73.6	71.4	69.7	68.2	64.8	60.5	58.2	55.6	52.5	48.9	44.6	44.9	45.2	45.7	46.5	47.6
33	cop	copper products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	nfe	other non-ferrous metals	64.0	54.4	39.8	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: author.

Table 22. Change in sectoral output in ETS BAU scenario, % YoY

№	code	Activities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	s01	agriculture	2.1	1.1	1.1	0.3	0.0	-0.1	0.0	-0.1	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.0	0.0	0.0
2	s02	forestry	2.9	1.2	0.6	0.2	0.0	0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.0	0.0	0.0
3	sB	fishing	8.0	4.3	2.1	1.0	0.6	0.6	0.7	0.4	0.4	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5
4	s10	coal and peat mining	-1.5	-1.7	-1.7	-1.7	-1.8	-1.8	-1.8	-2.2	-2.4	-2.5	-2.5	-2.5	-1.8	-1.3	-1.3	-1.3	-1.3
5	scru	crude oil extraction	6.1	0.8	0.7	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.8	-0.7	-0.7	-1.7	-1.7	-1.7	-1.7
6	sgas	gas extraction	-0.5	0.5	0.8	0.2	1.2	1.4	1.5	1.6	1.6	1.7	1.7	0.3	0.1	0.1	0.1	0.1	0.1
7	s112	oil and gas extraction services	3.5	1.2	0.7	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	-0.5	-0.5	-0.5	-0.5
2	s13	metal ore mining	-0.4	-1.1	0.2	2.0	2.0	1.6	0.6	0.1	0.3	0.3	0.2	0.5	0.5	0.7	0.7	0.7	0.4
3	s14	other minerals mining	-3.9	2.1	4.0	1.9	1.1	1.2	1.2	0.6	0.6	0.5	0.5	0.7	0.8	0.9	0.9	0.9	0.9
10	sDA	food production	1.7	0.3	-0.4	-0.3	-0.3	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
11	sDB	textile and clothing production	8.5	7.5	6.5	2.5	1.0	1.0	1.3	0.3	0.1	0.1	0.0	0.5	0.5	0.9	0.8	0.8	0.9
12	sDC	manufacture of leather products	19.5	17.0	14.4	7.1	4.5	4.5	5.0	3.0	2.7	2.6	2.5	3.4	3.5	4.2	4.2	4.1	4.4
13	sDD	wood processing	6.8	3.9	2.7	0.9	0.2	0.3	0.3	-0.2	-0.2	-0.3	-0.3	0.0	0.0	0.1	0.1	0.1	0.2
14	sDE	pulp and paper production	2.4	2.0	1.5	0.6	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.2
15	s231	production of coke	-4.5	-0.5	-0.2	-1.7	-2.1	-1.7	-1.8	1.4	1.4	1.4	1.4	1.7	1.5	1.6	1.6	1.6	1.3
16	s232	production of petroleum products	-0.7	0.2	0.5	-0.1	-0.3	-0.2	-0.2	-0.3	-0.3	-0.2	-0.2	-0.3	-0.3	-0.8	-0.8	-0.8	-0.8
17	sDG	chemical production	-41.2	-14.9	5.9	1.1	-0.5	-0.4	-0.2	-1.3	-1.4	-1.4	-1.4	-0.9	-0.8	-0.5	-0.5	-0.5	-0.4
18	sDH	production of plastic products	-5.4	0.8	3.4	1.5	0.7	0.7	0.8	0.3	0.2	0.2	0.1	0.4	0.4	0.6	0.6	0.6	0.6
19	sDI	manufacturing of other non-metallic mineral products	3.1	1.2	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2
20	sDJ	metallurgy	4.2	0.0	-0.3	0.3	0.4	0.5	0.1	0.0	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.1
21	sDK	manufacturing of machinery and equipment	10.0	6.4	4.9	2.4	1.5	1.6	1.5	0.8	0.8	0.7	0.7	1.0	1.0	1.2	1.2	1.2	1.1
22	sDL	manufacturing of electrical equipment	12.6	8.6	6.3	3.2	2.1	2.1	2.1	1.3	1.2	1.1	1.1	1.4	1.5	1.7	1.7	1.6	1.6
23	sDM	manufacturing of vehicles	11.2	6.5	4.4	2.2	1.4	1.5	1.5	0.9	0.8	0.8	0.7	1.1	1.1	1.3	1.3	1.3	1.2
24	sDN	manufacturing of other products	8.3	4.2	3.3	2.0	1.5	1.6	1.1	0.6	0.6	0.6	0.6	0.8	0.9	1.0	1.0	1.0	0.9
25	s40	electricity generation	-1.9	-0.8	-0.3	-0.2	-0.1	-0.1	-0.2	-0.1	-0.2	-0.3	-0.4	-0.1	-0.1	-0.1	0.0	0.0	-0.1
26	s41	distribution of water	-1.0	-1.1	-1.2	-0.6	-0.3	-0.4	-0.4	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
27	sF	construction	0.2	-1.3	-1.8	-0.7	-0.4	-0.4	-0.5	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
28	sG	wholesale and retail trade	-1.6	-1.7	-1.6	-0.7	-0.3	-0.4	-0.4	-0.2	-0.1	-0.2	-0.2	-0.3	-0.3	-0.4	-0.3	-0.3	-0.3
29	sH	hotels and restaurants	-0.2	-1.4	-1.9	-0.8	-0.6	-0.6	-0.6	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
30	s601	railway	-1.6	-0.4	0.1	-0.1	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2
31	s602	other land transport	0.2	-0.5	-0.8	-0.4	-0.2	-0.3	-0.3	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
32	s603	pipelines	-0.1	-0.6	-0.4	-0.5	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.7	-0.7	-0.7	-0.7
33	s61	water transport	13.0	11.0	9.1	4.4	2.8	2.9	3.1	1.8	1.7	1.6	1.5	2.0	2.1	2.2	2.2	2.1	2.3
34	s62	air transport	17.3	11.0	7.5	3.6	2.3	2.3	2.5	1.6	1.4	1.4	1.3	1.7	1.7	1.7	1.6	1.6	1.7
35	s63	additional transport activities	0.7	1.3	1.3	0.6	0.3	0.3	0.4	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
36	s64	post and telecommunications	1.8	0.3	-0.7	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
37	sJ	financial services	1.0	0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1
38	sK	real estate	1.9	0.6	-0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
39	sL	public administration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	sM	education	0.3	0.0	-0.2	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	sN	health and social service	-0.3	-0.5	-0.6	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
42	sO	other public services	0.8	-0.3	-0.9	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Source: author.

Table 23. Change in sectoral output in ETS+CBAM Moderate scenario, % YoY

No.	code	Activities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	s01	agriculture	0.8	1.0	1.1	0.3	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	-0.1	-0.2	-0.1	-0.1
2	s02	forestry	1.9	0.8	0.5	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1
3	sB	fishing	6.3	4.2	2.8	1.4	0.8	0.8	0.7	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.5	0.5
4	s10	coal and peat mining	-8.7	-9.6	-7.1	-5.4	-4.9	-4.1	-2.8	-0.8	-0.2	0.1	0.2	0.3	0.4	0.4	0.4	0.0	-0.1
5	scru	crude oil extraction	-0.2	-0.2	-0.2	-0.6	-0.7	-0.7	-0.7	-1.1	-1.4	-1.4	-1.4	-1.4	-1.6	-1.7	-1.8	-1.8	-1.8
6	sgas	gas extraction	-0.6	-0.9	-0.1	-1.0	0.2	0.4	0.5	1.6	1.6	1.6	1.6	1.6	0.1	0.1	0.1	0.1	0.1
7	s112	oil and gas extraction services	1.3	0.6	0.3	-0.1	-0.2	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.5	-0.6	-0.6	-0.6	-0.6
2	s13	metal ore mining	-1.4	-0.6	0.5	1.0	0.7	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.0	0.0
3	s14	other minerals mining	0.9	4.9	5.1	2.5	1.4	1.3	1.2	0.8	0.7	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8
10	sDA	food production	0.4	0.0	-0.6	-0.5	-0.4	-0.3	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2
11	sDB	textile and clothing production	9.2	8.4	8.4	3.4	1.6	1.6	1.5	0.6	0.5	0.4	0.3	0.2	0.5	0.5	0.5	0.8	0.7
12	sDC	manufacture of leather products	23.2	23.3	23.6	12.2	7.5	7.3	7.2	4.4	4.0	3.6	3.4	3.2	4.2	4.3	4.3	5.2	5.2
13	sDD	wood processing	5.3	3.5	2.8	0.9	0.3	0.2	0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	0.0	0.0
14	sDE	pulp and paper production	2.1	1.7	1.6	0.5	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
15	s231	production of coke	-23.3	-29.2	-7.5	-10.1	-11.1	-11.7	-12.2	-1.8	-1.3	-1.3	-1.3	-1.2	-3.4	-3.1	-2.9	-2.8	-2.7
16	s232	production of petroleum products	-0.8	-0.3	0.4	-0.2	-0.4	-0.5	-0.5	-0.5	-0.7	-0.7	-0.7	-0.7	-0.9	-1.0	-1.0	-1.0	-1.0
17	sDG	chemical production	-30.4	-9.9	6.7	1.6	0.0	0.1	0.1	-0.7	-0.8	-0.8	-0.9	-0.9	-0.7	-0.7	-0.7	-0.4	-0.4
18	sDH	production of plastic products	-1.8	2.0	4.2	1.8	0.9	0.8	0.8	0.5	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5
19	sDI	manufacturing of other non-metallic mineral products	2.2	0.9	0.3	0.1	0.0	-0.1	-0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0
20	sDJ	metallurgy	3.1	0.4	-0.2	0.3	0.4	0.0	0.0	0.2	0.2	0.3	0.3	0.3	0.5	0.6	0.6	-0.1	-0.2
21	sDK	manufacturing of machinery and equipment	9.3	7.1	6.3	3.1	1.8	1.6	1.6	1.1	1.0	0.9	0.9	0.8	1.1	1.1	1.1	0.9	0.9
22	sDL	manufacturing of electrical equipment	12.3	9.7	8.5	4.3	2.6	2.3	2.2	1.5	1.3	1.2	1.1	1.1	1.3	1.4	1.4	1.3	1.3
23	sDM	manufacturing of vehicles	9.9	6.7	6.4	3.3	2.0	1.8	1.7	1.2	1.1	1.0	0.9	0.9	1.2	1.2	1.2	1.2	1.2
24	sDN	manufacturing of other products	7.4	4.9	4.1	2.3	1.5	0.9	0.9	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.6	0.6
25	s40	electricity generation	-3.3	-3.9	-1.8	-1.7	-1.8	-1.8	-1.9	-0.1	-0.1	-0.1	-0.1	-0.1	-0.4	-0.4	-0.4	-0.4	-0.5
26	s41	distribution of water	-1.6	-2.2	-1.9	-1.2	-0.9	-0.9	-0.9	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3
27	sF	construction	-0.7	-1.9	-2.4	-1.1	-0.6	-0.7	-0.7	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3
28	sG	wholesale and retail trade	-1.9	-2.1	-2.1	-1.1	-0.6	-0.6	-0.5	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3
29	sH	hotels and restaurants	-1.0	-1.8	-2.4	-1.2	-0.7	-0.6	-0.6	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
30	s601	railway	-2.5	-1.9	-0.5	-0.6	-0.8	-0.8	-0.7	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2
31	s602	other land transport	-0.4	-0.9	-1.1	-0.6	-0.4	-0.4	-0.4	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
32	s603	pipelines	-1.7	-1.5	-1.0	-0.8	-0.7	-0.7	-0.7	-0.5	-0.6	-0.6	-0.6	-0.6	-0.7	-0.7	-0.8	-0.8	-0.8
33	s61	water transport	14.2	13.9	14.1	7.0	4.0	3.8	3.6	2.4	2.1	1.8	1.7	1.6	1.8	1.8	1.8	2.2	2.1
34	s62	air transport	15.2	11.7	10.4	5.0	2.7	2.5	2.3	1.8	1.6	1.4	1.3	1.2	1.2	1.2	1.2	1.5	1.5
35	s63	additional transport activities	1.0	1.3	1.7	0.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
36	s64	post and telecommunications	1.3	0.1	-0.7	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
37	sJ	financial services	0.8	0.2	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	sK	real estate	1.4	0.4	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	sL	public administration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	sM	education	0.1	-0.1	-0.3	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	sN	health and social service	-0.5	-0.7	-0.8	-0.4	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
42	sO	other public services	0.3	-0.5	-1.1	-0.5	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Source: author.

Table 24. Change in sectoral output in ETS+CBAM Extreme scenario, % YoY

No.	code	Activities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	s01	agriculture	1.5	1.5	1.5	0.5	0.2	0.1	0.0	-0.2	-0.2	-0.3	-0.4	-0.5	-0.2	-0.3	-0.3	-0.4	-0.4
2	s02	forestry	2.3	0.9	0.6	0.0	-0.2	-0.3	-0.5	-0.4	-0.4	-0.5	-0.5	-0.6	-0.1	-0.1	-0.2	-0.2	-0.2
3	sB	fishing	6.4	4.0	2.7	1.2	0.6	0.4	0.1	0.1	-0.1	-0.3	-0.4	-0.6	0.5	0.4	0.3	0.2	0.2
4	s10	coal and peat mining	-11.2	-12.1	-8.4	-6.3	-6.1	-5.9	-5.5	-2.7	-2.5	-2.6	-2.7	-2.8	1.1	1.1	1.2	1.2	1.3
5	scru	crude oil extraction	-1.7	-1.6	-1.5	-1.6	-1.7	-1.9	-2.0	-2.0	-2.1	-2.2	-2.4	-2.6	-2.7	-2.7	-2.7	-2.8	-2.8
6	sgas	gas extraction	-3.3	-6.8	-5.8	-8.2	-7.7	-7.9	-7.9	-5.1	-5.1	-5.1	-5.0	-4.9	-1.6	-1.4	-1.3	-1.0	-0.8
7	s112	oil and gas extraction services	0.3	-0.7	-0.7	-1.0	-1.3	-1.6	-1.8	-1.4	-1.5	-1.6	-1.7	-1.9	-0.8	-0.8	-0.8	-0.8	-0.9
2	s13	metal ore mining	-1.5	-1.3	-0.2	-0.8	-1.2	-1.9	-2.4	-1.5	-1.7	-1.9	-2.1	-2.4	0.6	0.7	0.9	1.1	1.2
3	s14	other minerals mining	1.6	4.5	5.0	2.5	1.6	1.3	1.0	0.9	0.6	0.5	0.3	0.2	1.2	1.1	1.0	0.9	0.9
10	sDA	food production	0.9	0.3	-0.3	-0.4	-0.5	-0.4	-0.5	-0.5	-0.5	-0.6	-0.6	-0.7	-0.4	-0.4	-0.5	-0.5	-0.5
11	sDB	textile and clothing production	11.5	9.5	9.7	4.6	3.2	3.1	2.9	1.9	1.7	1.6	1.5	1.4	1.0	0.9	0.7	0.5	0.4
12	sDC	manufacture of leather products	26.1	25.6	26.6	16.1	13.2	13.7	14.0	10.7	10.4	10.4	10.5	10.7	7.6	7.2	6.7	6.1	5.7
13	sDD	wood processing	6.3	3.8	3.2	1.1	0.5	0.2	0.0	-0.1	-0.2	-0.3	-0.4	-0.4	0.0	0.0	-0.1	-0.1	-0.2
14	sDE	pulp and paper production	2.2	1.2	1.4	0.2	-0.2	-0.3	-0.4	-0.3	-0.4	-0.4	-0.5	-0.6	0.1	0.0	0.0	0.0	-0.1
15	s231	production of coke	-50.4	-52.3	-14.6	-11.7	-6.8	-2.2	0.8	0.7	1.3	1.8	1.8	1.6	-0.2	-0.3	-0.5	-0.6	-0.7
16	s232	production of petroleum products	-2.1	-2.2	-1.1	-1.6	-2.2	-2.5	-2.9	-2.3	-2.5	-2.7	-2.9	-3.2	-1.1	-1.2	-1.2	-1.3	-1.4
17	sDG	chemical production	-28.0	-10.1	7.4	2.2	0.9	0.9	0.6	0.0	-0.2	-0.3	-0.5	-0.6	-0.4	-0.6	-0.7	-0.9	-1.0
18	sDH	production of plastic products	-1.2	1.6	4.3	1.9	1.2	1.0	0.8	0.6	0.5	0.4	0.3	0.2	0.7	0.6	0.5	0.4	0.4
19	sDI	manufacturing of other non-metallic mineral products	2.0	0.1	-0.1	-0.4	-0.7	-0.9	-1.1	-0.6	-0.7	-0.8	-0.9	-0.9	0.2	0.2	0.2	0.2	0.1
20	sDJ	metallurgy	2.9	0.4	-0.2	0.1	0.2	-0.4	-0.5	0.0	0.0	0.1	0.1	0.1	1.0	1.1	1.2	1.3	1.4
21	sDK	manufacturing of machinery and equipment	9.4	6.9	6.4	3.4	2.5	2.1	1.8	1.6	1.4	1.3	1.2	1.1	1.7	1.6	1.6	1.5	1.4
22	sDL	manufacturing of electrical equipment	12.8	9.7	8.7	4.9	3.7	3.3	3.1	2.5	2.3	2.1	2.0	1.9	1.9	1.8	1.7	1.5	1.5
23	sDM	manufacturing of vehicles	10.2	6.7	6.5	3.7	2.7	2.4	2.2	1.9	1.7	1.6	1.5	1.4	1.8	1.7	1.6	1.5	1.5
24	sDN	manufacturing of other products	7.4	4.7	4.2	2.4	1.9	0.9	0.8	0.8	0.7	0.6	0.5	0.5	1.0	0.9	0.9	0.9	0.9
25	s40	electricity generation	-7.2	-9.9	-5.4	-5.5	-5.5	-5.4	-5.2	-3.0	-2.9	-2.9	-2.9	-2.9	-0.1	-0.1	-0.1	-0.1	-0.1
26	s41	distribution of water	-2.7	-4.0	-3.1	-2.6	-2.6	-2.6	-2.7	-1.7	-1.7	-1.8	-1.8	-1.8	-0.3	-0.3	-0.3	-0.3	-0.2
27	sF	construction	-1.0	-2.1	-2.6	-1.4	-1.2	-1.4	-1.5	-1.0	-1.0	-1.0	-1.0	-1.1	-0.4	-0.4	-0.3	-0.3	-0.3
28	sG	wholesale and retail trade	-2.2	-2.5	-2.6	-1.8	-1.5	-1.5	-1.5	-1.1	-1.1	-1.1	-1.1	-1.1	-0.5	-0.5	-0.5	-0.4	-0.4
29	sH	hotels and restaurants	-1.0	-1.7	-2.4	-1.3	-1.1	-1.1	-1.1	-0.9	-0.9	-0.9	-0.9	-0.9	-0.5	-0.5	-0.5	-0.4	-0.4
30	s601	railway	-3.7	-2.9	-1.1	-1.2	-1.3	-1.4	-1.6	-1.0	-0.9	-1.0	-1.1	-1.1	-0.1	-0.1	-0.1	-0.1	-0.1
31	s602	other land transport	-0.7	-1.3	-1.5	-1.1	-1.1	-1.1	-1.3	-0.9	-0.9	-1.0	-1.0	-1.1	-0.3	-0.3	-0.3	-0.3	-0.3
32	s603	pipelines	-2.7	-2.6	-2.0	-1.8	-1.8	-1.9	-2.1	-1.6	-1.6	-1.7	-1.8	-1.9	-1.0	-1.0	-1.0	-1.0	-1.1
33	s61	water transport	13.7	11.6	12.8	6.0	3.6	2.9	1.9	1.8	1.2	0.7	0.2	-0.2	2.8	2.5	2.3	1.9	1.7
34	s62	air transport	13.7	8.0	7.8	2.4	0.2	-0.7	-1.9	-0.9	-1.5	-2.1	-2.7	-3.2	1.9	1.7	1.5	1.2	1.0
35	s63	additional transport activities	0.7	0.5	1.1	0.1	-0.3	-0.6	-0.8	-0.5	-0.6	-0.7	-0.9	-1.0	0.3	0.2	0.2	0.2	0.1
36	s64	post and telecommunications	1.3	0.3	-0.7	-0.2	-0.2	-0.1	-0.2	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1
37	sJ	financial services	0.8	0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	-0.2	-0.2	-0.2	0.0	0.0	0.0	0.0	0.0
38	sK	real estate	1.4	0.4	-0.3	-0.2	-0.2	-0.3	-0.4	-0.3	-0.3	-0.3	-0.4	-0.4	-0.1	-0.1	-0.1	-0.1	-0.1
39	sL	public administration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	sM	education	0.1	-0.1	-0.3	-0.2	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	0.0	0.0	0.0
41	sN	health and social service	-0.5	-0.7	-0.8	-0.5	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1
42	sO	other public services	0.4	-0.3	-1.0	-0.5	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.4	-0.4	-0.2	-0.2	-0.2	-0.2	-0.2

Source: author

Table 25. Change in sectoral accounting profit in ETS BAU scenario, % YoY

No.	code	Activities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	s01	agriculture	0.6	0.0	0.5	-0.1	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3	-0.2	-0.3	-0.3	-0.2
2	s02	forestry	0.7	-0.1	-0.1	-0.2	-0.3	-0.2	-0.3	-0.3	-0.3	-0.3	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2
3	sB	fishing	5.9	3.1	1.5	0.7	0.3	0.3	0.4	0.2	0.2	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.3
4	s10	coal and peat mining	-12.2	-12.3	-11.1	-10.2	-9.5	-8.8	-8.3	-8.9	-8.7	-7.9	-7.1	-6.4	-4.2	-3.1	-2.9	-2.7	-2.7
5	scru	crude oil extraction	21.8	2.8	3.0	-3.4	-3.4	-3.3	-3.3	-3.1	-3.0	-2.9	-2.8	-2.7	-2.6	-5.1	-4.7	-4.3	-4.1
6	sgas	gas extraction	-3.9	0.8	2.8	0.4	5.8	7.4	9.1	11.3	14.1	17.7	22.7	3.9	0.9	1.1	1.0	1.0	1.1
7	s112	oil and gas extraction services	1.8	0.2	0.2	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3	-0.2	-0.2	-0.3	-0.3	-0.7	-0.7	-0.7	-0.7
2	s13	metal ore mining	-1.7	-2.1	-0.2	2.0	2.0	1.6	0.4	-0.1	0.1	0.1	0.1	0.4	0.4	0.6	0.6	0.7	0.3
3	s14	other minerals mining	-6.7	1.7	4.8	2.2	1.2	1.3	1.3	0.6	0.5	0.4	0.4	0.8	0.8	1.0	0.9	0.9	0.9
10	sDA	food production	0.2	-0.7	-0.9	-0.6	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
11	sDB	textile and clothing production	7.1	6.5	6.0	2.2	0.8	0.8	1.0	0.1	0.0	-0.1	-0.2	0.3	0.3	0.6	0.6	0.6	0.7
12	sDC	manufacture of leather products	17.8	15.8	13.7	6.7	4.2	4.3	4.7	2.8	2.5	2.4	2.2	3.2	3.3	4.0	3.9	3.9	4.2
13	sDD	wood processing	5.2	2.9	2.1	0.6	0.0	0.0	0.0	-0.4	-0.4	-0.4	-0.5	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1
14	sDE	pulp and paper production	0.9	1.0	1.0	0.2	0.0	0.0	0.0	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
15	s231	production of coke	-5.4	-1.2	-0.3	-1.6	-1.9	-1.4	-1.6	1.7	1.8	1.9	1.9	2.3	1.9	1.9	1.9	1.9	1.5
16	s232	production of petroleum products	-3.2	-1.0	-0.1	-0.4	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.3	-0.4	-0.4	-0.8	-0.8	-0.8	-0.8
17	sDG	chemical production	-42.2	-15.7	5.4	0.9	-0.7	-0.6	-0.4	-1.4	-1.5	-1.6	-1.6	-1.0	-0.9	-0.6	-0.6	-0.6	-0.5
18	sDH	production of plastic products	-6.0	0.2	3.0	1.2	0.6	0.6	0.6	0.1	0.1	0.0	0.0	0.3	0.3	0.4	0.4	0.4	0.4
19	sDI	manufacturing of other non-metallic mineral products	1.4	0.2	-0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
20	sDJ	metallurgy	2.8	-0.8	-0.6	0.1	0.3	0.4	0.0	-0.1	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.3	0.0
21	sDK	manufacturing of machinery and equipment	8.5	5.5	4.5	2.1	1.3	1.4	1.3	0.7	0.6	0.5	0.5	0.8	0.9	1.1	1.1	1.0	0.9
22	sDL	manufacturing of electrical equipment	11.1	7.6	5.8	2.9	1.9	1.9	1.9	1.1	1.0	0.9	0.9	1.2	1.3	1.5	1.5	1.4	1.4
23	sDM	manufacturing of vehicles	9.7	5.6	3.9	2.0	1.2	1.3	1.3	0.7	0.6	0.6	0.5	0.9	0.9	1.1	1.1	1.1	1.1
24	sDN	manufacturing of other products	6.6	3.1	2.7	1.7	1.2	1.3	0.8	0.4	0.4	0.4	0.3	0.6	0.6	0.8	0.7	0.7	0.7
25	s40	electricity generation	-3.9	-1.9	-0.8	-0.4	-0.3	-0.3	-0.4	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2
26	s41	distribution of water	-2.6	-2.1	-1.7	-0.8	-0.6	-0.6	-0.6	-0.4	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
27	sF	construction	-1.4	-2.4	-2.3	-1.0	-0.6	-0.6	-0.7	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5
28	sG	wholesale and retail trade	-3.2	-2.8	-2.2	-1.1	-0.6	-0.6	-0.7	-0.4	-0.4	-0.4	-0.4	-0.5	-0.6	-0.6	-0.6	-0.6	-0.6
29	sH	hotels and restaurants	-1.8	-2.4	-2.5	-1.2	-0.8	-0.8	-0.8	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6
30	s601	railway	-3.3	-1.6	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.5	-0.4	-0.4	-0.4	-0.4	-0.5
31	s602	other land transport	-1.7	-1.6	-1.3	-0.7	-0.5	-0.5	-0.5	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.3	-0.4
32	s603	pipelines	-1.9	-1.8	-1.0	-0.9	-0.7	-0.7	-0.7	-0.6	-0.6	-0.5	-0.5	-0.6	-0.6	-1.0	-1.0	-1.0	-1.0
33	s61	water transport	10.8	9.8	8.5	4.1	2.6	2.7	2.9	1.6	1.5	1.4	1.3	1.9	1.9	2.1	2.0	2.0	2.1
34	s62	air transport	14.8	9.8	6.9	3.3	2.1	2.1	2.3	1.4	1.3	1.2	1.1	1.5	1.5	1.6	1.6	1.5	1.6
35	s63	additional transport activities	-1.1	0.1	0.7	0.2	0.1	0.1	0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
36	s64	post and telecommunications	0.2	-0.8	-1.3	-0.5	-0.4	-0.4	-0.4	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
37	sJ	financial services	-0.6	-0.8	-0.8	-0.4	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
38	sK	real estate	0.2	-0.6	-0.8	-0.4	-0.2	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
39	sL	public administration	-1.5	-1.1	-0.6	-0.3	-0.3	-0.2	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
40	sM	education	-1.2	-1.1	-0.8	-0.4	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
41	sN	health and social service	-1.6	-1.5	-1.1	-0.6	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
42	sO	other public services	-0.7	-1.3	-1.4	-0.7	-0.4	-0.5	-0.5	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3

Source: author

Table 26. Change in sectoral accounting profit in ETS+CBAM Moderate scenario, % YoY

No.	code	Activities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	s01	agriculture	-1.0	-0.4	0.1	-0.4	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
2	s02	forestry	-0.2	-0.7	-0.5	-0.5	-0.5	-0.5	-0.5	-0.3	-0.3	-0.2	-0.2	-0.3	-0.2	-0.2	-0.3	-0.2	-0.2
3	sB	fishing	4.2	2.8	2.0	0.9	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
4	s10	coal and peat mining	-29.7	-22.1	-12.3	-8.1	-6.7	-5.4	-3.7	-1.2	-0.5	-0.2	-0.1	0.0	0.0	0.1	0.1	-0.4	-0.5
5	scru	crude oil extraction	-2.5	-2.1	-1.7	-2.5	-2.4	-2.4	-2.4	-3.0	-3.5	-3.3	-3.1	-2.9	-3.2	-3.3	-3.2	-3.1	-3.0
6	sgas	gas extraction	-4.5	-4.9	-1.3	-4.3	0.3	0.8	1.4	6.2	7.3	8.5	9.8	11.3	0.1	0.3	0.3	0.3	0.3
7	s112	oil and gas extraction services	-0.3	-0.6	-0.4	-0.5	-0.5	-0.6	-0.6	-0.5	-0.6	-0.5	-0.5	-0.5	-0.7	-0.8	-0.8	-0.8	-0.8
2	s13	metal ore mining	-2.8	-1.4	0.2	0.9	0.7	0.3	0.3	0.1	0.2	0.2	0.2	0.2	0.4	0.5	0.5	-0.1	-0.1
3	s14	other minerals mining	-0.6	5.0	5.9	2.7	1.4	1.3	1.2	0.8	0.7	0.6	0.6	0.5	0.7	0.8	0.8	0.8	0.8
10	sDA	food production	-1.3	-1.4	-1.5	-1.0	-0.9	-0.8	-0.8	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
11	sDB	textile and clothing production	7.6	7.1	7.6	2.9	1.2	1.2	1.2	0.4	0.3	0.2	0.1	0.0	0.3	0.3	0.3	0.5	0.5
12	sDC	manufacture of leather products	21.1	21.6	22.5	11.6	6.9	6.8	6.7	4.2	3.8	3.4	3.2	3.1	3.9	4.0	4.1	4.9	4.9
13	sDD	wood processing	3.6	2.2	2.1	0.4	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.3	-0.3	-0.2	-0.2
14	sDE	pulp and paper production	0.7	0.7	0.9	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1
15	s231	production of coke	-23.1	-28.4	-6.2	-9.1	-10.1	-10.9	-11.8	-1.6	-1.3	-1.4	-1.4	-1.3	-3.5	-3.2	-3.1	-3.0	-2.9
16	s232	production of petroleum products	-2.9	-1.7	-0.4	-0.7	-0.9	-0.9	-0.9	-0.7	-0.8	-0.8	-0.8	-0.8	-1.0	-1.0	-1.0	-1.0	-1.0
17	sDG	chemical production	-31.5	-10.9	6.0	1.2	-0.3	-0.2	-0.2	-0.8	-0.9	-0.9	-1.0	-1.0	-0.8	-0.8	-0.8	-0.5	-0.5
18	sDH	production of plastic products	-2.8	1.1	3.7	1.5	0.6	0.5	0.5	0.3	0.3	0.2	0.2	0.1	0.2	0.3	0.2	0.3	0.3
19	sDI	manufacturing of other non-metallic mineral products	0.7	-0.1	-0.2	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
20	sDJ	metallurgy	2.2	0.2	-0.2	0.4	0.6	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.4	0.4	0.5	-0.3	-0.3
21	sDK	manufacturing of machinery and equipment	7.8	6.0	5.8	2.7	1.5	1.3	1.2	0.9	0.9	0.8	0.7	0.7	0.9	0.9	0.9	0.7	0.7
22	sDL	manufacturing of electrical equipment	10.5	8.3	7.7	3.8	2.2	1.9	1.8	1.3	1.2	1.0	1.0	0.9	1.1	1.1	1.1	1.1	1.1
23	sDM	manufacturing of vehicles	8.2	5.4	5.6	2.8	1.6	1.4	1.4	1.0	0.9	0.8	0.8	0.8	1.0	1.0	1.0	0.9	0.9
24	sDN	manufacturing of other products	5.4	3.4	3.2	1.6	1.0	0.5	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.3	0.3
25	s40	electricity generation	-4.3	-3.8	-1.9	-1.4	-1.3	-1.3	-1.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.3	-0.3	-0.4	-0.4
26	s41	distribution of water	-3.0	-2.9	-2.4	-1.4	-1.0	-0.9	-0.9	-0.4	-0.4	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5	-0.5
27	sF	construction	-2.6	-3.3	-3.2	-1.6	-1.1	-1.1	-1.1	-0.5	-0.5	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5	-0.5
28	sG	wholesale and retail trade	-3.8	-3.7	-3.1	-1.8	-1.1	-1.1	-1.1	-0.5	-0.4	-0.4	-0.4	-0.4	-0.6	-0.6	-0.6	-0.7	-0.7
29	sH	hotels and restaurants	-2.8	-3.3	-3.3	-1.8	-1.2	-1.1	-1.1	-0.6	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6	-0.6
30	s601	railway	-4.3	-3.2	-1.4	-1.2	-1.1	-1.2	-1.1	-0.6	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.5	-0.5
31	s602	other land transport	-2.3	-2.3	-1.9	-1.1	-0.8	-0.7	-0.7	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4
32	s603	pipelines	-3.2	-2.2	-1.6	-1.1	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.9	-0.9	-0.9	-1.0	-1.0
33	s61	water transport	12.2	12.4	13.3	6.5	3.7	3.5	3.3	2.3	1.9	1.7	1.6	1.5	1.7	1.7	1.7	2.1	2.0
34	s62	air transport	13.2	10.5	9.8	4.7	2.6	2.4	2.2	1.8	1.5	1.3	1.2	1.1	1.2	1.2	1.2	1.5	1.5
35	s63	additional transport activities	-0.9	-0.2	0.8	0.2	-0.1	-0.1	-0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	s64	post and telecommunications	-0.6	-1.4	-1.7	-0.9	-0.6	-0.6	-0.6	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3
37	sJ	financial services	-1.2	-1.4	-1.2	-0.7	-0.6	-0.6	-0.6	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3
38	sK	real estate	-0.7	-1.3	-1.3	-0.8	-0.6	-0.6	-0.6	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3
39	sL	public administration	-1.8	-1.5	-0.9	-0.6	-0.5	-0.5	-0.5	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3
40	sM	education	-1.6	-1.5	-1.1	-0.7	-0.5	-0.5	-0.5	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3
41	sN	health and social service	-2.0	-2.0	-1.6	-0.9	-0.7	-0.6	-0.6	-0.3	-0.3	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3
42	sO	other public services	-1.5	-1.9	-2.0	-1.0	-0.7	-0.7	-0.7	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4

Source: author

Table 27. Change in sectoral accounting profit in ETS+CBAM Extreme scenario, % YoY

No.	code	Activities	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	s01	agriculture	-0.7	-0.8	0.0	-0.8	-1.1	-1.2	-1.4	-1.1	-1.2	-1.3	-1.4	-1.5	-0.5	-0.6	-0.6	-0.6	-0.6
2	s02	forestry	-0.1	-1.1	-0.6	-0.9	-1.0	-1.1	-1.2	-0.8	-0.9	-0.9	-0.9	-1.0	-0.2	-0.2	-0.2	-0.2	-0.2
3	sB	fishing	4.1	2.1	1.5	0.3	-0.3	-0.4	-0.7	-0.4	-0.6	-0.8	-0.9	-1.1	0.3	0.2	0.2	0.1	0.1
4	s10	coal and peat mining	-33.1	-23.3	-12.8	-9.1	-8.5	-8.3	-7.8	-4.3	-4.1	-4.3	-4.5	-4.7	0.7	0.7	0.8	0.8	0.9
5	scru	crude oil extraction	-7.0	-6.6	-5.3	-5.0	-5.2	-5.3	-5.5	-4.7	-4.7	-4.8	-4.9	-5.1	-3.8	-3.7	-3.6	-3.5	-3.5
6	sgas	gas extraction	-13.8	-19.5	-12.8	-13.8	-11.2	-10.8	-10.4	-6.8	-6.7	-6.7	-6.7	-6.7	-2.0	-1.9	-1.7	-1.4	-1.2
7	s112	oil and gas extraction services	-1.4	-2.2	-1.6	-1.8	-2.0	-2.3	-2.5	-1.9	-2.0	-2.1	-2.2	-2.4	-0.9	-1.0	-1.0	-1.0	-1.0
2	s13	metal ore mining	-2.7	-1.5	0.0	-0.4	-0.4	-0.9	-1.0	-0.6	-0.6	-0.6	-0.6	-0.6	0.6	0.8	1.0	1.1	1.3
3	s14	other minerals mining	0.0	4.2	5.6	2.4	1.4	1.0	0.6	0.7	0.5	0.3	0.2	0.0	1.3	1.2	1.1	1.0	1.0
10	sDA	food production	-1.2	-1.7	-1.6	-1.5	-1.6	-1.6	-1.8	-1.4	-1.4	-1.5	-1.6	-1.7	-0.7	-0.7	-0.7	-0.7	-0.7
11	sDB	textile and clothing production	9.4	7.4	8.5	3.5	2.1	2.0	1.6	1.1	0.9	0.7	0.5	0.4	0.9	0.7	0.5	0.3	0.2
12	sDC	manufacture of leather products	23.4	22.8	24.7	14.5	11.7	12.1	12.2	9.5	9.2	9.1	9.1	9.3	7.3	6.9	6.4	5.9	5.5
13	sDD	wood processing	4.4	2.1	2.2	0.3	-0.3	-0.6	-0.8	-0.7	-0.8	-0.9	-1.0	-1.1	-0.1	-0.2	-0.2	-0.3	-0.3
14	sDE	pulp and paper production	1.0	0.4	0.8	-0.1	-0.5	-0.6	-0.7	-0.6	-0.6	-0.7	-0.8	-0.9	-0.1	-0.2	-0.2	-0.2	-0.3
15	s231	production of coke	-50.4	-51.7	-13.3	-11.0	-6.1	-1.9	0.9	0.6	1.1	1.5	1.6	1.4	-0.4	-0.5	-0.6	-0.7	-0.8
16	s232	production of petroleum products	-4.3	-4.1	-2.0	-2.3	-2.8	-3.1	-3.4	-2.4	-2.6	-2.8	-3.0	-3.2	-0.9	-1.0	-1.0	-1.1	-1.2
17	sDG	chemical production	-29.2	-11.3	6.5	1.4	0.1	-0.1	-0.4	-0.7	-0.9	-1.1	-1.3	-1.4	-0.4	-0.5	-0.7	-0.8	-0.9
18	sDH	production of plastic products	-2.4	0.3	3.4	1.1	0.4	0.1	-0.2	0.0	-0.2	-0.3	-0.5	-0.6	0.6	0.5	0.4	0.3	0.3
19	sDI	manufacturing of other non-metallic mineral products	0.6	-0.2	-0.2	-0.3	-0.4	-0.6	-0.8	-0.5	-0.6	-0.6	-0.7	-0.7	0.1	0.0	0.0	0.0	0.0
20	sDJ	metallurgy	2.6	0.7	-0.2	0.2	0.3	-0.5	-0.6	-0.1	-0.1	-0.1	-0.1	0.0	0.9	1.0	1.0	1.1	1.2
21	sDK	manufacturing of machinery and equipment	7.6	5.1	5.4	2.4	1.5	1.0	0.6	0.8	0.6	0.4	0.3	0.2	1.5	1.5	1.4	1.3	1.3
22	sDL	manufacturing of electrical equipment	10.5	7.5	7.4	3.6	2.5	2.0	1.6	1.5	1.2	1.1	0.9	0.8	1.7	1.6	1.5	1.4	1.3
23	sDM	manufacturing of vehicles	8.1	4.6	5.3	2.6	1.6	1.2	0.9	1.0	0.8	0.6	0.5	0.4	1.6	1.5	1.4	1.3	1.3
24	sDN	manufacturing of other products	5.0	2.4	2.7	1.1	0.6	-0.4	-0.7	-0.2	-0.3	-0.5	-0.6	-0.7	0.8	0.7	0.7	0.7	0.7
25	s40	electricity generation	-6.7	-6.9	-3.2	-2.6	-2.2	-1.8	-1.4	-0.7	-0.6	-0.5	-0.4	-0.4	-0.2	-0.2	-0.2	-0.2	-0.1
26	s41	distribution of water	-3.7	-4.2	-3.3	-2.5	-2.4	-2.4	-2.5	-1.7	-1.7	-1.7	-1.7	-1.7	-0.4	-0.4	-0.4	-0.4	-0.4
27	sF	construction	-3.2	-4.2	-3.9	-2.7	-2.5	-2.7	-2.9	-2.0	-2.0	-2.0	-2.1	-2.1	-0.7	-0.6	-0.6	-0.5	-0.5
28	sG	wholesale and retail trade	-4.6	-5.0	-4.3	-3.4	-3.1	-3.3	-3.4	-2.4	-2.4	-2.5	-2.6	-2.6	-0.8	-0.8	-0.8	-0.7	-0.7
29	sH	hotels and restaurants	-3.3	-4.0	-3.9	-2.7	-2.5	-2.6	-2.8	-2.0	-2.0	-2.0	-2.1	-2.2	-0.8	-0.8	-0.7	-0.7	-0.7
30	s601	railway	-5.7	-4.6	-2.2	-2.1	-2.2	-2.4	-2.5	-1.7	-1.6	-1.7	-1.8	-1.9	-0.4	-0.4	-0.4	-0.4	-0.4
31	s602	other land transport	-2.8	-3.2	-2.5	-2.0	-1.9	-2.0	-2.1	-1.4	-1.5	-1.5	-1.6	-1.6	-0.4	-0.4	-0.4	-0.3	-0.3
32	s603	pipelines	-3.6	-2.8	-2.3	-1.8	-1.7	-1.8	-2.0	-1.7	-1.7	-1.7	-1.8	-1.9	-1.3	-1.3	-1.3	-1.2	-1.3
33	s61	water transport	11.5	10.0	11.9	5.4	3.1	2.4	1.5	1.5	1.0	0.5	0.0	-0.4	2.7	2.5	2.2	1.9	1.7
34	s62	air transport	12.1	7.4	7.7	2.6	0.6	-0.2	-1.3	-0.4	-1.0	-1.5	-2.0	-2.5	1.9	1.7	1.5	1.2	1.1
35	s63	additional transport activities	-1.6	-1.7	-0.3	-1.1	-1.5	-1.8	-2.2	-1.4	-1.5	-1.7	-1.8	-2.0	0.1	0.1	0.0	0.0	0.0
36	s64	post and telecommunications	-1.1	-2.1	-2.2	-1.6	-1.7	-1.7	-1.9	-1.3	-1.3	-1.4	-1.5	-1.6	-0.4	-0.4	-0.4	-0.4	-0.4
37	sJ	financial services	-1.7	-2.5	-2.0	-1.7	-1.8	-2.0	-2.2	-1.5	-1.5	-1.6	-1.7	-1.8	-0.3	-0.3	-0.3	-0.3	-0.3
38	sK	real estate	-1.2	-2.3	-2.1	-1.8	-1.9	-2.1	-2.3	-1.6	-1.6	-1.7	-1.8	-1.9	-0.4	-0.4	-0.4	-0.4	-0.4
39	sL	public administration	-2.3	-2.4	-1.5	-1.4	-1.4	-1.6	-1.7	-1.1	-1.2	-1.2	-1.3	-1.3	-0.2	-0.2	-0.2	-0.2	-0.2
40	sM	education	-2.1	-2.4	-1.7	-1.5	-1.5	-1.7	-1.8	-1.2	-1.2	-1.3	-1.3	-1.4	-0.2	-0.2	-0.2	-0.2	-0.2
41	sN	health and social service	-2.5	-2.8	-2.2	-1.7	-1.7	-1.8	-1.9	-1.3	-1.3	-1.4	-1.4	-1.5	-0.3	-0.3	-0.3	-0.3	-0.3
42	sO	other public services	-1.9	-2.6	-2.5	-1.8	-1.8	-1.9	-2.0	-1.4	-1.5	-1.5	-1.6	-1.7	-0.4	-0.4	-0.4	-0.4	-0.4

Source: author

Table 28. Sectoral emissions from fuel combustion in BAU scenario, million tonnes of CO2-eq

	code	Activities	2016	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2040 to 2016 emissions, %
1	s01	agriculture	20.8	20.4	20.7	20.8	20.8	20.8	20.7	20.7	20.6	20.6	20.5	20.4	20.3	20.3	20.2	20.1	20.1	20.0	-4%
2	s02	forestry	2.2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	-16%
3	sB	fishing	3.4	3.1	3.2	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	1%
4	s10	coal and peat mining	7.8	8.2	8.0	7.9	7.7	7.6	7.4	7.3	7.1	6.9	6.8	6.6	6.4	6.3	6.2	6.1	6.1	6.0	-24%
5	scru	crude oil extraction	21.4	19.4	19.6	19.8	19.6	19.5	19.3	19.1	19.0	18.8	18.6	18.5	18.3	18.2	17.8	17.5	17.2	16.9	-21%
6	sgas	gas extraction	13.5	12.2	12.3	12.4	12.4	12.6	12.8	13.1	13.4	13.7	14.1	14.5	14.6	14.6	14.7	14.7	14.7	14.7	9%
7	s112	oil and gas extraction services	7.6	6.9	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.0	7.0	7.0	7.0	-9%
8	s13	metal ore mining	11.5	10.5	10.4	10.4	10.7	10.9	11.1	11.2	11.2	11.2	11.3	11.3	11.3	11.4	11.5	11.6	11.7	11.8	2%
9	s14	other minerals mining	2.8	2.6	2.7	2.8	2.9	2.9	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.3	3.3	20%
10	sDA	food production	14.5	15.2	15.3	15.2	15.1	15.1	15.0	14.9	14.9	14.8	14.7	14.6	14.6	14.5	14.4	14.4	14.3	14.3	-1%
11	sDB	textile and clothing production	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	16%
12	sDC	manufacture of leather products	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	74%
13	sDD	wood processing	7.6	5.3	5.5	5.6	5.6	5.6	5.6	5.6	5.5	5.4	5.3	5.2	5.0	5.0	4.9	4.8	4.7	4.7	-38%
14	sDE	pulp and paper production	26.6	24.8	25.2	25.4	25.4	25.3	25.2	25.1	24.9	24.8	24.5	24.3	24.1	24.0	23.9	23.8	23.7	23.6	-11%
15	s231	production of coke	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	46%
16	s232	production of petroleum products	39.1	30.1	30.2	30.3	30.2	30.2	30.1	30.0	29.9	29.7	29.6	29.4	29.3	29.2	28.9	28.7	28.4	28.1	-28%
17	sDG	chemical production	24.4	31.1	26.6	28.1	28.5	28.4	28.4	28.4	28.1	27.7	27.3	26.8	26.7	26.5	26.5	26.6	26.6	26.7	9%
18	sDH	production of plastic products	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	18%
19	sDI	manufacturing of other non-metallic mineral products	21.5	20.8	21.1	21.1	21.2	21.2	21.2	21.2	21.2	21.1	21.1	21.0	20.9	20.9	20.9	20.9	20.8	20.8	-3%
20	sDJ	metallurgy	159.6	169.1	169.6	168.8	167.9	167.1	166.7	165.8	166.8	168.0	169.1	170.2	171.8	173.3	175.0	176.8	178.7	180.0	13%
21	sDK	manufacturing of machinery and equipment	12.0	10.8	11.5	12.0	12.3	12.5	12.7	12.8	12.8	12.8	12.8	12.7	12.7	12.7	12.8	12.9	13.0	13.1	9%
22	sDL	manufacturing of electrical equipment	1.9	1.6	1.8	1.9	2.0	2.0	2.0	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.4	24%
23	sDM	manufacturing of vehicles	6.0	5.4	5.8	6.0	6.1	6.2	6.3	6.4	6.5	6.5	6.5	6.5	6.6	6.6	6.7	6.8	6.8	6.9	15%
24	sDN	manufacturing of other products	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-2%
25	s40	electricity generation	599.2	609.5	605.2	602.7	600.5	598.7	596.6	594.3	591.9	588.8	585.0	580.2	577.1	574.9	572.9	570.8	568.8	566.7	-5%
26	s41	distribution of water	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	-7%
27	sF	construction	28.3	27.8	27.5	26.9	26.7	26.5	26.4	26.2	26.1	26.0	25.9	25.8	25.7	25.6	25.4	25.2	25.0	24.9	-12%
28	sG	wholesale and retail trade	4.6	4.4	4.3	4.2	4.1	4.1	4.1	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.8	3.8	-18%
29	sH	hotels and restaurants	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-15%
30	s601	railway	8.8	8.1	8.1	8.0	8.0	8.0	7.9	7.9	7.8	7.8	7.8	7.7	7.7	7.6	7.6	7.5	7.5	7.4	-16%
31	s602	other land transport	16.2	15.9	15.8	15.7	15.6	15.5	15.5	15.4	15.4	15.3	15.3	15.2	15.2	15.1	15.0	14.9	14.9	14.8	-9%
32	s603	pipelines	85.0	79.1	78.7	77.9	77.3	76.8	76.3	75.9	75.6	75.3	75.1	75.0	74.6	74.2	73.5	72.8	72.1	71.4	-16%
33	s61	water transport	2.5	1.9	2.1	2.3	2.4	2.4	2.5	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.9	3.0	3.0	3.1	20%
34	s62	air transport	17.4	13.4	14.9	16.0	16.5	16.9	17.3	17.7	17.9	18.2	18.4	18.6	18.9	19.2	19.4	19.7	19.9	20.2	16%
35	s63	additional transport activities	8.3	7.6	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	-6%
36	s64	post and telecommunications	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-9%
37	sJ	financial services	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-11%
38	sK	real estate	7.9	7.7	7.7	7.7	7.7	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.5	7.5	7.5	7.5	-5%
39	sL	public administration	10.3	10.0	10.0	10.0	9.9	9.9	9.9	9.8	9.8	9.8	9.7	9.7	9.6	9.6	9.6	9.5	9.5	9.4	-8%
40	sM	education	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	-11%
41	sN	health and social service	3.1	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.8	-9%
42	sO	other public services	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	-9%
		Total industrial emissions from combustion, mln tCO2-eq	**1207.9**	**1200.4**	**1195.8**	**1195.4**	**1192.7**	**1189.8**	**1187.1**	**1183.6**	**1181.1**	**1178.0**	**1174.1**	**1169.2**	**1166.5**	**1164.8**	**1162.9**	**1161.1**	**1159.5**	**1157.2**	**-4%**

Source: author

Table 29. Sectoral emissions from fuel combustion in CBAM Moderate scenario, million tonnes of CO2-eq

	code	Activities	2016	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2040 to 2016 emissions, %
1	s01	agriculture	20.8	20.7	20.8	20.9	20.8	20.8	20.7	20.6	20.5	20.5	20.4	20.3	20.2	20.1	20.0	20.0	19.9	19.8	-5%
2	s02	forestry	2.2	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.8	-19%
3	sB	fishing	3.4	3.2	3.3	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	5%
4	s10	coal and peat mining	7.8	6.8	6.2	5.8	5.5	5.3	5.2	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-34%
5	scru	crude oil extraction	21.4	18.2	18.2	18.1	18.0	17.9	17.8	17.6	17.4	17.2	16.9	16.7	16.5	16.2	15.9	15.6	15.4	15.1	-29%
6	sgas	gas extraction	13.5	12.2	12.3	12.4	12.4	12.5	12.6	12.8	13.0	13.1	13.3	13.6	13.8	13.8	13.9	13.9	13.9	14.0	3%
7	s112	oil and gas extraction services	7.6	6.9	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.9	6.9	6.9	6.9	6.9	6.9	-10%
8	s13	metal ore mining	11.5	10.6	10.5	10.6	10.8	10.9	11.0	11.1	11.1	11.2	11.2	11.2	11.3	11.3	11.3	11.3	11.3	11.3	-1%
9	s14	other minerals mining	2.8	2.8	3.0	3.2	3.3	3.3	3.4	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.7	3.8	3.8	38%
10	sDA	food production	14.5	15.2	15.1	14.9	14.7	14.6	14.5	14.4	14.3	14.3	14.3	14.2	14.2	14.1	14.1	14.1	14.0	14.0	-4%
11	sDB	textile and clothing production	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	37%
12	sDC	manufacture of leather products	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	202%
13	sDD	wood processing	7.6	5.1	5.0	4.9	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	-35%
14	sDE	pulp and paper production	26.6	24.5	24.2	23.9	23.6	23.3	23.1	23.0	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	-14%
15	s231	production of coke	1.2	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	25%
16	s232	production of petroleum products	39.1	29.4	29.5	29.6	29.6	29.5	29.5	29.4	29.2	29.0	28.8	28.6	28.4	28.1	27.9	27.6	27.4	27.1	-31%
17	sDG	chemical production	24.4	28.5	25.8	27.5	28.0	28.0	28.1	28.2	28.2	28.2	28.1	28.0	27.9	27.9	28.0	28.2	28.3	28.5	16%
18	sDH	production of plastic products	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	31%
19	sDI	manufacturing of other non-metallic mineral products	21.5	20.9	20.9	20.8	20.7	20.7	20.6	20.6	20.6	20.6	20.6	20.6	20.7	20.7	20.7	20.7	20.7	20.7	-4%
20	sDJ	metallurgy	159.6	170.3	170.5	171.5	172.1	172.6	172.8	172.5	171.5	171.2	171.0	170.5	168.9	168.5	167.9	167.3	166.8	166.4	4%
21	sDK	manufacturing of machinery and equipment	12.0	11.4	12.0	12.4	12.6	12.8	12.9	13.1	13.3	13.5	13.7	13.8	14.0	14.3	14.5	14.6	14.8	15.0	24%
22	sDL	manufacturing of electrical equipment	1.9	1.9	2.0	2.2	2.3	2.4	2.4	2.5	2.5	2.5	2.6	2.6	2.6	2.7	2.7	2.7	2.8	2.8	47%
23	sDM	manufacturing of vehicles	6.0	5.9	6.2	6.6	6.7	6.9	7.0	7.1	7.2	7.3	7.4	7.4	7.5	7.6	7.7	7.8	7.9	8.0	34%
24	sDN	manufacturing of other products	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-1%
25	s40	electricity generation	599.2	593.0	582.0	574.0	568.5	564.5	561.5	559.4	558.3	557.4	556.5	555.5	554.3	553.7	552.9	552.1	551.3	550.4	-8%
26	s41	distribution of water	2.4	2.4	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	-12%
27	sF	construction	28.3	26.8	26.2	25.5	25.1	24.9	24.7	24.5	24.3	24.2	24.0	23.9	23.8	23.6	23.4	23.2	23.0	22.9	-19%
28	sG	wholesale and retail trade	4.6	4.1	4.0	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.3	-27%
29	sH	hotels and restaurants	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-23%
30	s601	railway	8.8	7.7	7.6	7.5	7.5	7.4	7.3	7.3	7.2	7.2	7.1	7.1	7.0	7.0	6.9	6.8	6.8	6.7	-24%
31	s602	other land transport	16.2	15.6	15.4	15.1	15.0	14.9	14.9	14.8	14.7	14.7	14.6	14.5	14.5	14.4	14.3	14.2	14.2	14.1	-13%
32	s603	pipelines	85.0	75.8	74.6	73.3	72.5	71.9	71.3	70.8	70.3	69.7	69.2	68.7	68.2	67.6	67.0	66.3	65.6	65.0	-24%
33	s61	water transport	2.5	2.2	2.5	2.8	3.0	3.1	3.3	3.4	3.4	3.5	3.6	3.6	3.7	3.7	3.8	3.9	3.9	4.0	58%
34	s62	air transport	17.4	15.4	17.3	19.1	20.1	20.7	21.3	21.9	22.3	22.6	22.9	23.1	23.3	23.6	23.9	24.3	24.6	24.9	43%
35	s63	additional transport activities	8.3	7.6	7.7	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	-4%
36	s64	post and telecommunications	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-13%
37	sJ	financial services	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-15%
38	sK	real estate	7.9	7.6	7.6	7.5	7.5	7.5	7.5	7.4	7.4	7.4	7.4	7.4	7.4	7.3	7.3	7.3	7.3	7.3	-8%
39	sL	public administration	10.3	9.8	9.6	9.5	9.4	9.4	9.3	9.3	9.3	9.3	9.2	9.2	9.2	9.2	9.1	9.1	9.1	9.1	-12%
40	sM	education	1.9	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	-16%
41	sN	health and social service	3.1	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	-14%
42	sO	other public services	2.3	2.3	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.0	2.0	2.0	2.0	2.0	2.0	-15%
		Total industrial emissions from combustion, mln tCO2-eq	**1207.9**	**1177.2**	**1164.3**	**1158.8**	**1153.7**	**1149.4**	**1146.3**	**1143.8**	**1141.2**	**1139.4**	**1137.6**	**1135.5**	**1132.1**	**1130.4**	**1128.1**	**1125.9**	**1123.7**	**1121.6**	**-7%**

Source: author

Table 30. Sectoral emissions from fuel combustion in CBAM Extreme scenario, million tonnes of CO2-eq

	code	Activities	2016	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2040 to 2016 emissions, %
1	s01	agriculture	20.8	20.8	20.9	21.0	20.9	20.8	20.8	20.6	20.5	20.4	20.3	20.2	20.1	20.0	19.8	19.7	19.6	19.5	-6%
2	s02	forestry	2.2	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	-20%
3	sB	fishing	3.4	3.2	3.3	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4	3%
4	s10	coal and peat mining	7.8	6.5	5.9	5.5	5.3	5.2	5.1	5.1	5.2	5.2	5.3	5.3	5.4	5.4	5.4	5.4	5.4	5.5	-30%
5	scru	crude oil extraction	21.4	17.7	17.4	17.1	16.8	16.5	16.3	16.0	15.7	15.4	15.1	14.8	14.5	14.2	13.9	13.6	13.3	12.9	-39%
6	sgas	gas extraction	13.5	12.2	12.2	12.2	12.1	12.1	12.1	12.2	12.2	12.2	12.2	12.3	12.3	12.4	12.4	12.4	12.5	12.5	-7%
7	s112	oil and gas extraction services	7.6	6.9	6.9	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.7	6.7	6.7	6.7	6.6	6.6	6.6	6.6	-14%
8	s13	metal ore mining	11.5	10.4	10.5	10.6	10.7	10.8	10.9	11.1	11.2	11.3	11.5	11.6	11.8	11.8	11.9	12.0	12.0	12.1	6%
9	s14	other minerals mining	2.8	2.8	3.0	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.8	3.9	3.9	4.0	4.1	4.1	4.2	4.2	53%
10	sDA	food production	14.5	15.3	15.2	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.3	14.2	14.1	14.1	14.0	14.0	13.9	13.9	-4%
11	sDB	textile and clothing production	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	56%
12	sDC	manufacture of leather products	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	322%
13	sDD	wood processing	7.6	5.1	5.0	4.9	4.8	4.8	4.8	4.9	5.0	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	-31%
14	sDE	pulp and paper production	26.6	24.5	24.0	23.7	23.5	23.4	23.3	23.3	23.3	23.3	23.3	23.2	23.2	23.2	23.2	23.2	23.2	23.2	-13%
15	s231	production of coke	1.2	1.6	1.7	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	38%
16	s232	production of petroleum products	39.1	29.0	28.8	28.7	28.5	28.3	28.1	27.9	27.6	27.4	27.1	26.8	26.5	26.3	26.0	25.7	25.4	25.0	-36%
17	sDG	chemical production	24.4	29.3	26.8	29.0	30.0	30.7	31.3	31.9	32.3	32.6	32.9	33.1	33.3	33.6	33.9	34.1	34.3	34.6	41%
18	sDH	production of plastic products	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	44%
19	sDI	manufacturing of other non-metallic mineral products	21.5	20.8	20.8	20.7	20.6	20.6	20.6	20.6	20.6	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	-4%
20	sDJ	metallurgy	159.6	171.1	173.6	175.2	175.8	176.4	177.1	177.6	174.7	174.0	174.0	174.8	176.3	177.0	177.8	178.7	179.7	180.8	13%
21	sDK	manufacturing of machinery and equipment	12.0	11.3	11.8	12.3	12.7	13.0	13.3	13.7	14.2	14.6	14.9	15.3	15.6	15.8	16.1	16.3	16.6	16.8	39%
22	sDL	manufacturing of electrical equipment	1.9	1.9	2.1	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.7	2.8	2.8	2.9	2.9	3.0	3.0	3.1	60%
23	sDM	manufacturing of vehicles	6.0	5.9	6.2	6.6	6.8	7.0	7.2	7.3	7.5	7.7	7.9	8.0	8.2	8.3	8.4	8.6	8.7	8.8	47%
24	sDN	manufacturing of other products	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2%
25	s40	electricity generation	599.2	589.7	577.0	568.4	563.4	560.0	557.8	556.5	555.9	555.4	555.0	554.7	554.5	554.0	553.6	553.2	552.8	552.4	-8%
26	s41	distribution of water	2.4	2.3	2.3	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.0	2.0	2.0	2.0	2.0	-16%
27	sF	construction	28.3	26.6	25.9	25.1	24.6	24.2	23.9	23.5	23.3	23.0	22.8	22.5	22.3	22.0	21.8	21.6	21.4	21.1	-25%
28	sG	wholesale and retail trade	4.6	4.1	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.3	3.2	3.2	3.1	3.1	3.0	3.0	2.9	-37%
29	sH	hotels and restaurants	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	-31%
30	s601	railway	8.8	7.6	7.4	7.3	7.2	7.2	7.1	7.0	6.9	6.9	6.8	6.7	6.7	6.6	6.5	6.5	6.4	6.3	-28%
31	s602	other land transport	16.2	15.4	15.2	14.9	14.8	14.6	14.5	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	-18%
32	s603	pipelines	85.0	74.8	73.1	71.3	70.0	68.9	67.9	66.9	66.0	65.2	64.3	63.5	62.7	61.9	61.1	60.3	59.5	58.6	-31%
33	s61	water transport	2.5	2.2	2.5	2.8	3.0	3.1	3.3	3.4	3.6	3.7	3.8	3.8	3.9	4.0	4.1	4.2	4.2	4.3	70%
34	s62	air transport	17.4	15.4	17.1	18.8	19.8	20.5	21.2	21.9	22.4	22.9	23.3	23.7	24.0	24.4	24.8	25.1	25.4	25.7	48%
35	s63	additional transport activities	8.3	7.6	7.6	7.7	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	-6%
36	s64	post and telecommunications	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-19%
37	sJ	financial services	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	-21%
38	sK	real estate	7.9	7.6	7.5	7.4	7.4	7.3	7.3	7.2	7.2	7.2	7.2	7.1	7.1	7.1	7.0	7.0	7.0	6.9	-12%
39	sL	public administration	10.3	9.7	9.5	9.4	9.3	9.2	9.1	9.1	9.1	9.0	9.0	9.0	9.0	8.9	8.9	8.9	8.8	8.8	-14%
40	sM	education	1.9	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	-20%
41	sN	health and social service	3.1	2.9	2.9	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	-17%
42	sO	other public services	2.3	2.2	2.2	2.1	2.1	2.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.9	-20%
		Total industrial emissions from combustion, mln tCO2-eq	**1207.9**	**1172.4**	**1158.3**	**1152.0**	**1147.1**	**1143.6**	**1141.9**	**1140.9**	**1137.3**	**1135.8**	**1135.0**	**1134.9**	**1135.5**	**1135.0**	**1134.6**	**1134.2**	**1133.8**	**1133.4**	**-6%**

Source: author

Table 31. Sectoral emissions from fuel combustion in ETS BAU scenario, million tonnes of CO2-eq

	code	Activities	2016	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2040 to 2016 emissions, %
1	s01	agriculture	20.8	20.4	20.7	20.8	20.8	20.8	20.7	20.7	20.6	20.6	20.5	20.4	20.3	20.3	20.2	20.1	20.1	20.0	-4%
2	s02	forestry	2.2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	-16%
3	sB	fishing	3.4	3.1	3.2	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	1%
4	s10	coal and peat mining	7.8	8.2	8.0	7.9	7.7	7.6	7.4	7.3	7.1	6.9	6.8	6.6	6.4	6.3	6.2	6.1	6.1	6.0	-24%
5	scru	crude oil extraction	21.4	19.4	19.6	19.8	19.6	19.5	19.3	19.1	19.0	18.8	18.6	18.5	18.3	18.2	17.8	17.5	17.2	16.9	-21%
6	sgas	gas extraction	13.5	12.2	12.3	12.4	12.4	12.6	12.8	13.1	13.4	13.7	14.1	14.5	14.6	14.6	14.7	14.7	14.7	14.7	9%
7	s112	oil and gas extraction services	7.6	6.9	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.0	7.0	7.0	7.0	-9%
8	s13	metal ore mining	11.5	10.5	10.4	10.4	10.7	10.9	11.1	11.2	11.2	11.2	11.3	11.3	11.3	11.4	11.5	11.6	11.7	11.8	2%
9	s14	other minerals mining	2.8	2.6	2.7	2.8	2.9	2.9	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.3	3.3	20%
10	sDA	food production	14.5	15.2	15.3	15.2	15.1	15.1	15.0	14.9	14.9	14.8	14.7	14.6	14.6	14.5	14.4	14.4	14.3	14.3	-1%
11	sDB	textile and clothing production	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	16%
12	sDC	manufacture of leather products	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	74%
13	sDD	wood processing	7.6	5.3	5.5	5.6	5.6	5.6	5.6	5.6	5.5	5.4	5.3	5.2	5.0	5.0	4.9	4.8	4.7	4.7	-38%
14	sDE	pulp and paper production	26.6	24.8	25.2	25.4	25.4	25.3	25.2	25.1	24.9	24.8	24.5	24.3	24.1	24.0	23.9	23.8	23.7	23.6	-11%
15	s231	production of coke	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	46%
16	s232	production of petroleum products	39.1	30.1	30.2	30.3	30.2	30.2	30.1	30.0	29.9	29.7	29.6	29.4	29.3	29.2	28.9	28.7	28.4	28.1	-28%
17	sDG	chemical production	24.4	31.1	26.6	28.1	28.5	28.4	28.4	28.4	28.1	27.7	27.3	26.8	26.7	26.5	26.5	26.6	26.6	26.7	9%
18	sDH	production of plastic products	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	18%
19	sDI	manufacturing of other non-metallic mineral products	21.5	20.8	21.1	21.1	21.2	21.2	21.2	21.2	21.2	21.1	21.1	21.0	20.9	20.9	20.9	20.9	20.8	20.8	-3%
20	sDJ	metallurgy	159.6	169.1	169.6	168.8	167.9	167.1	166.7	165.8	166.8	168.0	169.1	170.2	171.8	173.3	175.0	176.8	178.7	180.0	13%
21	sDK	manufacturing of machinery and equipment	12.0	10.8	11.5	12.0	12.3	12.5	12.7	12.8	12.8	12.8	12.8	12.7	12.7	12.7	12.8	12.9	13.0	13.1	9%
22	sDL	manufacturing of electrical equipment	1.9	1.6	1.8	1.9	2.0	2.0	2.0	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.4	24%
23	sDM	manufacturing of vehicles	6.0	5.4	5.8	6.0	6.1	6.2	6.3	6.4	6.5	6.5	6.5	6.5	6.6	6.6	6.7	6.8	6.8	6.9	15%
24	sDN	manufacturing of other products	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-2%
25	s40	electricity generation	599.2	609.5	605.2	602.7	600.5	598.7	596.6	594.3	591.9	588.8	585.0	580.2	577.1	574.9	572.9	570.8	568.8	566.7	-5%
26	s41	distribution of water	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	-7%
27	sF	construction	28.3	27.8	27.5	26.9	26.7	26.5	26.4	26.2	26.1	26.0	25.9	25.8	25.7	25.6	25.4	25.2	25.0	24.9	-12%
28	sG	wholesale and retail trade	4.6	4.4	4.3	4.2	4.1	4.1	4.1	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.8	3.8	-18%
29	sH	hotels and restaurants	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-15%
30	s601	railway	8.8	8.1	8.1	8.0	8.0	8.0	7.9	7.9	7.8	7.8	7.8	7.7	7.7	7.6	7.6	7.5	7.5	7.4	-16%
31	s602	other land transport	16.2	15.9	15.8	15.7	15.6	15.5	15.5	15.4	15.4	15.3	15.3	15.2	15.2	15.1	15.0	14.9	14.9	14.8	-9%
32	s603	pipelines	85.0	79.1	78.7	77.9	77.3	76.8	76.3	75.9	75.6	75.3	75.1	75.0	74.6	74.2	73.5	72.8	72.1	71.4	-16%
33	s61	water transport	2.5	1.9	2.1	2.3	2.4	2.4	2.5	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.9	3.0	3.0	3.1	20%
34	s62	air transport	17.4	13.4	14.9	16.0	16.5	16.9	17.3	17.7	17.9	18.2	18.4	18.6	18.9	19.2	19.4	19.7	19.9	20.2	16%
35	s63	additional transport activities	8.3	7.6	7.7	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	-6%
36	s64	post and telecommunications	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-9%
37	sJ	financial services	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-11%
38	sK	real estate	7.9	7.7	7.7	7.7	7.7	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.5	7.5	7.5	7.5	-5%
39	sL	public administration	10.3	10.0	10.0	10.0	9.9	9.9	9.9	9.8	9.8	9.8	9.7	9.7	9.6	9.6	9.6	9.5	9.5	9.4	-8%
40	sM	education	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	-11%
41	sN	health and social service	3.1	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.8	-9%
42	sO	other public services	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	-9%
		Total industrial emissions from combustion, mln tCO2-eq	**1207.9**	**1200.4**	**1195.8**	**1195.4**	**1192.7**	**1189.8**	**1187.1**	**1183.6**	**1181.1**	**1178.0**	**1174.1**	**1169.2**	**1166.5**	**1164.8**	**1162.9**	**1161.1**	**1159.5**	**1157.2**	**-4%**

Source: author

Table 32. Sectoral emissions from fuel combustion in ETS+CBAM Moderate scenario, million tonnes of CO2-eq

	code	Activities	2016	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2040 to 2016 emissions, %
1	s01	agriculture	20.8	20.4	21.2	21.4	21.4	21.4	21.4	21.3	21.3	21.2	21.1	21.0	21.0	20.9	20.8	20.7	20.6	20.5	-1%
2	s02	forestry	2.2	2.0	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	-34%
3	sB	fishing	3.4	3.1	3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	1%
4	s10	coal and peat mining	7.8	8.2	6.1	5.6	5.3	5.1	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	-40%
5	scru	crude oil extraction	21.4	19.4	18.1	18.1	18.0	17.9	17.7	17.6	17.4	17.1	16.9	16.6	16.4	16.1	15.8	15.5	15.2	15.0	-30%
6	sgas	gas extraction	13.5	12.2	12.0	12.0	11.8	11.8	11.9	12.0	12.2	12.4	12.7	13.0	13.2	13.3	13.3	13.3	13.3	13.3	-2%
7	s112	oil and gas extraction services	7.6	6.9	4.2	3.9	3.6	3.4	3.2	3.1	3.1	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	-64%
8	s13	metal ore mining	11.5	10.5	10.5	10.5	10.6	10.7	10.8	10.8	10.8	10.9	10.9	10.9	11.0	11.0	11.1	11.2	11.2	11.1	-3%
9	s14	other minerals mining	2.8	2.6	3.0	3.2	3.3	3.3	3.4	3.4	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.7	3.8	37%
10	sDA	food production	14.5	15.2	14.6	14.2	13.8	13.5	13.1	12.6	12.6	12.5	12.4	12.4	12.3	12.2	12.1	11.9	11.8	11.7	-20%
11	sDB	textile and clothing production	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	38%
12	sDC	manufacture of leather products	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	230%
13	sDD	wood processing	7.6	5.3	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	-81%
14	sDE	pulp and paper production	26.6	24.8	15.9	15.1	14.3	13.5	12.7	12.0	12.0	12.0	11.9	11.9	11.9	11.7	11.5	11.4	11.2	11.1	-58%
15	s231	production of coke	1.2	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-99%
16	s232	production of petroleum products	39.1	30.1	27.8	28.0	28.1	28.2	28.3	28.4	28.3	28.2	28.0	27.9	27.7	27.5	27.3	27.1	26.9	26.7	-32%
17	sDG	chemical production	24.4	31.1	21.5	21.5	20.4	18.8	17.1	15.3	15.2	15.1	15.0	14.9	14.8	14.4	14.0	13.6	13.3	13.0	-47%
18	sDH	production of plastic products	0.9	0.9	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	-49%
19	sDI	manufacturing of other non-metallic mineral products	21.5	20.8	19.9	19.5	19.0	18.6	18.0	17.4	17.4	17.4	17.4	17.4	17.3	17.2	17.1	16.9	16.8	16.6	-23%
20	sDJ	metallurgy	159.6	169.1	105.7	95.7	85.7	76.0	66.9	58.6	58.3	58.0	57.8	57.5	57.4	55.9	54.5	53.2	51.7	50.3	-68%
21	sDK	manufacturing of machinery and equipment	12.0	10.8	4.1	3.8	3.4	3.0	2.7	2.4	2.4	2.4	2.4	2.4	2.5	2.4	2.4	2.4	2.3	2.3	-81%
22	sDL	manufacturing of electrical equipment	1.9	1.6	2.1	2.2	2.3	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.7	39%
23	sDM	manufacturing of vehicles	6.0	5.4	6.0	6.3	6.5	6.6	6.7	6.8	6.8	6.9	7.0	7.1	7.1	7.2	7.2	7.3	7.4	7.4	24%
24	sDN	manufacturing of other products	0.6	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-20%
25	s40	electricity generation	599.2	609.5	523.7	505.5	488.8	472.9	457.4	442.2	441.1	440.0	438.9	437.8	436.6	432.9	429.1	425.3	421.6	417.9	-30%
26	s41	distribution of water	2.4	2.4	2.0	1.9	1.8	1.8	1.7	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.4	-40%
27	sF	construction	28.3	27.8	26.0	25.2	24.7	24.4	24.1	23.8	23.7	23.5	23.4	23.3	23.1	23.0	22.8	22.6	22.4	22.2	-21%
28	sG	wholesale and retail trade	4.6	4.4	4.0	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.2	3.2	-30%
29	sH	hotels and restaurants	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	-30%
30	s601	railway	8.8	8.1	7.2	7.1	7.0	6.9	6.7	6.6	6.6	6.5	6.5	6.4	6.4	6.3	6.2	6.2	6.1	6.0	-32%
31	s602	other land transport	16.2	15.9	15.3	15.0	14.9	14.8	14.6	14.5	14.4	14.4	14.3	14.3	14.2	14.1	14.0	13.9	13.8	13.7	-15%
32	s603	pipelines	85.0	79.1	55.4	51.0	47.0	43.3	39.9	36.9	36.5	36.1	35.8	35.4	35.1	34.3	33.4	32.6	31.9	31.2	-63%
33	s61	water transport	2.5	1.9	2.4	2.7	2.9	3.0	3.1	3.2	3.3	3.3	3.4	3.4	3.5	3.5	3.6	3.6	3.7	3.7	46%
34	s62	air transport	17.4	13.4	16.9	18.5	19.3	19.7	20.1	20.4	20.8	21.0	21.3	21.5	21.7	21.9	22.0	22.2	22.4	22.7	30%
35	s63	additional transport activities	8.3	7.6	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7	7.7	7.7	-7%
36	s64	post and telecommunications	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-14%
37	sJ	financial services	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-15%
38	sK	real estate	7.9	7.7	8.1	8.1	8.2	8.2	8.3	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	6%
39	sL	public administration	10.3	10.0	9.8	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.6	9.6	9.6	9.6	9.6	9.6	-7%
40	sM	education	1.9	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	-13%
41	sN	health and social service	3.1	3.0	3.0	3.0	3.0	3.1	3.1	3.2	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	2%
42	sO	other public services	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.1	-9%
		Total industrial emissions from combustion, mln tCO2-eq	**1207.9**	**1200.4**	**988.7**	**955.0**	**921.0**	**887.6**	**855.7**	**825.1**	**823.0**	**821.0**	**819.0**	**816.9**	**814.8**	**807.2**	**799.7**	**792.3**	**785.0**	**777.7**	**-36%**

Source: author

Table 33. Sectoral emissions from fuel combustion in ETS+CBAM Extreme scenario, million tonnes of CO2-eq

	code	Activities	2016	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2040 to 2016 emissions, %
1	s01	agriculture	20.8	21.2	21.5	21.3	20.6	19.6	18.3	16.9	16.0	15.1	14.3	13.5	12.7	12.7	12.6	12.5	12.4	12.3	-41%
2	s02	forestry	2.2	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	-49%
3	sB	fishing	3.4	3.2	3.2	3.2	3.2	3.1	3.0	2.9	2.8	2.8	2.7	2.6	2.5	2.5	2.5	2.5	2.5	2.5	-26%
4	s10	coal and peat mining	7.8	6.4	5.6	5.2	4.8	4.5	4.3	4.0	3.9	3.8	3.7	3.6	3.5	3.6	3.6	3.6	3.7	3.7	-52%
5	scru	crude oil extraction	21.4	17.7	17.4	17.1	16.8	16.5	16.2	15.8	15.5	15.2	14.8	14.5	14.1	13.7	13.3	13.0	12.6	12.3	-43%
6	sgas	gas extraction	13.5	11.7	10.8	10.2	9.3	8.6	7.9	7.3	6.9	6.6	6.2	5.9	5.6	5.5	5.4	5.4	5.3	5.3	-61%
7	s112	oil and gas extraction services	7.6	3.9	2.9	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.8	1.8	1.7	1.7	1.7	-78%
8	s13	metal ore mining	11.5	10.4	10.2	10.2	10.1	10.0	9.7	9.5	9.3	9.1	8.9	8.7	8.5	8.5	8.6	8.7	8.8	8.9	-22%
9	s14	other minerals mining	2.8	2.8	3.0	3.2	3.3	3.3	3.4	3.4	3.5	3.5	3.5	3.5	3.6	3.6	3.7	3.7	3.8	3.8	38%
10	sDA	food production	14.5	14.6	12.6	11.3	10.0	8.7	7.6	6.6	6.2	5.8	5.4	5.0	4.7	4.7	4.6	4.6	4.6	4.5	-69%
11	sDB	textile and clothing production	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-45%
12	sDC	manufacture of leather products	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	160%
13	sDD	wood processing	7.6	1.5	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-91%
14	sDE	pulp and paper production	26.6	15.1	11.0	9.7	8.4	7.4	6.5	5.7	5.3	5.0	4.7	4.4	4.1	4.1	4.1	4.1	4.1	4.1	-85%
15	s231	production of coke	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-100%
16	s232	production of petroleum products	39.1	27.4	27.8	27.8	27.5	26.9	25.9	24.5	23.5	22.3	21.2	20.0	18.8	18.6	18.3	18.1	17.9	17.6	-55%
17	sDG	chemical production	24.4	23.3	12.1	9.4	6.7	4.7	3.5	2.8	2.5	2.3	2.2	2.1	2.0	2.0	2.0	1.9	1.9	1.9	-92%
18	sDH	production of plastic products	0.9	0.7	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-78%
19	sDI	manufacturing of other non-metallic mineral products	21.5	19.5	16.4	14.7	12.9	11.2	9.7	8.4	7.8	7.2	6.7	6.2	5.8	5.8	5.8	5.8	5.9	5.9	-73%
20	sDJ	metallurgy	159.6	95.6	46.4	35.8	29.0	24.8	22.1	20.3	19.6	19.0	18.4	18.0	17.5	17.7	17.8	18.0	18.2	18.4	-88%
21	sDK	manufacturing of machinery and equipment	12.0	3.4	1.8	1.7	1.5	1.5	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.3	1.3	1.3	1.3	-89%
22	sDL	manufacturing of electrical equipment	1.9	1.9	1.9	1.9	1.8	1.6	1.4	1.3	1.2	1.1	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	-48%
23	sDM	manufacturing of vehicles	6.0	5.6	5.7	5.8	5.6	5.1	4.6	4.0	3.8	3.5	3.3	3.1	3.0	3.0	3.1	3.1	3.1	3.2	-47%
24	sDN	manufacturing of other products	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-50%
25	s40	electricity generation	599.2	518.2	427.9	388.2	350.6	315.7	284.0	255.4	240.3	226.1	212.9	200.5	188.9	188.6	188.4	188.1	187.9	187.7	-69%
26	s41	distribution of water	2.4	2.0	1.5	1.3	1.2	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	-78%
27	sF	construction	28.3	26.3	25.0	23.8	22.9	21.9	20.8	19.5	18.7	17.8	17.0	16.1	15.3	15.1	15.0	14.9	14.8	14.6	-48%
28	sG	wholesale and retail trade	4.6	4.0	3.8	3.7	3.6	3.5	3.5	3.6	3.7	3.8	3.9	3.9	4.0	3.9	3.9	3.8	3.8	3.7	-19%
29	sH	hotels and restaurants	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	-55%
30	s601	railway	8.8	7.2	6.7	6.4	6.1	5.8	5.5	5.1	4.9	4.7	4.5	4.3	4.0	4.0	4.0	4.0	3.9	3.9	-56%
31	s602	other land transport	16.2	15.3	14.8	14.3	13.9	13.4	12.9	12.5	12.1	11.8	11.5	11.2	10.8	10.7	10.6	10.5	10.4	10.3	-36%
32	s603	pipelines	85.0	52.8	34.1	28.4	23.9	20.4	17.5	15.2	14.0	12.9	11.9	11.0	10.2	10.1	10.0	9.9	9.8	9.6	-89%
33	s61	water transport	2.5	2.1	2.3	2.5	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.3	2.4	2.4	2.5	2.5	2.5	0%
34	s62	air transport	17.4	14.9	15.6	16.4	16.5	16.1	15.5	14.8	14.4	13.9	13.3	12.7	12.0	12.2	12.4	12.5	12.6	12.7	-27%
35	s63	additional transport activities	8.3	7.6	7.4	7.3	7.0	6.7	6.4	6.0	5.8	5.6	5.4	5.2	5.0	5.0	5.0	5.0	4.9	4.9	-41%
36	s64	post and telecommunications	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-39%
37	sJ	financial services	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-34%
38	sK	real estate	7.9	8.1	8.6	8.6	8.5	8.1	7.6	6.9	6.4	6.0	5.6	5.2	4.8	4.8	4.8	4.8	4.8	4.7	-40%
39	sL	public administration	10.3	9.8	9.9	9.7	9.5	9.1	8.6	7.9	7.4	7.0	6.6	6.2	5.8	5.8	5.8	5.8	5.8	5.7	-44%
40	sM	education	1.9	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.2	1.2	-38%
41	sN	health and social service	3.1	3.1	3.3	3.4	3.5	3.6	3.6	3.5	3.3	3.2	3.0	2.8	2.6	2.6	2.6	2.6	2.6	2.6	-15%
42	sO	other public services	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.6	1.5	1.5	1.5	-35%
		Total industrial emissions from combustion, mln tCO2-eq	**1207.9**	**966.2**	**782.0**	**715.4**	**653.9**	**597.8**	**546.5**	**499.5**	**474.0**	**449.7**	**426.6**	**404.6**	**383.8**	**382.8**	**381.8**	**380.8**	**379.7**	**378.7**	**-69%**

Source: author