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The impact of the proposed EU ETS 2 and the Social Climate Fund on emissions and welfare

Evidence from literature and a new simulation model

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Summary

The European Union will soon decide on the introduction of a separate Emissions Trading System for the buildings and road transport sectors (ETS2) and a Social Climate Fund (SCF) to mitigate its potential negative impact on households.

Under the ETS2, suppliers of fuels for buildings and road transport will have to purchase emissions allowances, with the total number of allowances available gradually decreasing over time. This would expose households to a carbon price and should thus incentivise them to seek lower carbon alternatives.

To mitigate the potential impact on lower-income households, a €27 billion SCF has been proposed, mainly to finance temporary income support, as well investments for reducing GHG emissions from heating and road transport.

We examine the literature for evidence on the effectiveness and economic and welfare impact of carbon pricing coupled with revenue redistribution. We find that emissions reduction is moderate, unless carbon prices are high, while the economic and welfare impacts depend on the redistribution mechanism. With targeted redistribution, the policy tends to be progressive, helping reduce energy poverty and emissions at the same time.

To add to the evidence base, we also present the findings of a novel modelling exercise analysing the impact of a theoretical carbon tax levied on all consumption goods. The simulation, based on Household Budget Survey data for Bulgaria, Germany, Hungary, Poland, and Romania, finds that a carbon tax designed to deliver a 40% GHG emissions reduction by 2033 compared to 2021 would have slightly negative GDP and employment impacts in all countries. At household level, welfare losses would be between 0.9% and 2.6% of total expenditure, slightly higher for the lower income deciles. However, with revenue redistribution, the theoretical carbon tax would become progressive and could reduce the energy poverty rate.

We conclude that the ETS2 is a necessary addition to the other components of the Fit for 55 package, as it can play a role in decarbonising the heating and road transport sectors, even if only minimal. We also conclude that the SCF, if linked to the carbon price, can be a crucial tool to address the challenges faced by lower income households during the decarbonisation process. An operational SCF with a special focus on Member States that have a poor track record in effective welfare interventions is a prerequisite for a successful introduction of the ETS2.

The EU ETS2 and the Social Climate Fund

The Fit for 55 package, the European Union's (EU) set of complementary legislative acts aimed at reducing GHG emissions by 55% by 2030, compared to 1990 levels, includes **the creation of a separate Emissions Trading System (ETS2) for the buildings and road transport (BRT) sectors**. The buildings sector accounts for 36% of the EU's energy related GHG emissions, though more than half of that is already covered in the existing ETS through power generation and district heating. Road transport is responsible for around 20% of GHG emissions and has been growing significantly over the last 30 years.

BRT are also covered in other components of the Fit for 55 package. The Effort Sharing Regulation (ESR), most notably, creates binding emissions reductions targets for the EU and Member States (MS) in non-ETS sectors including BRT. The revised regulation aims to reduce emissions in buildings, transport (non-ETS), small industry (non-ETS), and most of agriculture by 40% by 2030 compared to 2005 levels. In addition, the regulation on the emissions performance of cars and vans is also poised to become more ambitious as part of the package, with a full ban on sales of new Internal Combustion Engine (ICE) vehicles from 2035. Complementary to these existing legislative acts, the ETS2 is believed to create the right economic incentives for both producers and consumers in the BRT sectors to reduce emissions in line with the ESR, by exposing them to a market-based carbon price.

Under the European Commission (EC) proposal, the ETS2 would be a separate system. To reduce complexity, **the requirement to purchase emissions allowances (EUAs) would fall on suppliers of fuels in the BRT sectors** (regulated entities), not on households or transport users. These are the entities already defined for excise duty purposes that "release for consumption fuels used for road transport and heating and power generation in buildings". The activities already covered by the existing ETS and the fuels used for transport in the agricultural sector would both be excluded from this new system. Emissions would be allocated to regulated entities based on quantities of fuels sold and their respective emissions factor. Since carbon leakage is not seen as an issue,[1] there would be no free allocations. **A cap on the number of EUAs would be set based on the values agreed in the ESR for the year 2024**. After 2024, the cap decreases by the linear

[1] Carbon leakage is mainly considered an issue for other sectors, for example industry, as the carbon price may incentivise production in other jurisdictions that are not exposed to such pricing, with goods then imported into the EU. Due to the nature of the goods and their consumption, the possibility of carbon leakage in the BRT sector is low or inexistent.

reduction factor (LRF) of 5.15% per year. In 2028 the LRF would be increased to 5.43%.[2] The goal would be to generate a 43% reduction in emissions by 2030 compared to 2005. The total EUAs available from 2026 onwards would be published by the end of 2024. Regulated entities in the BRT sector would be required to purchase EUAs from 2026. To make the introduction of the system smoother, a higher quantity of EUAs (130% of the established quantity for 2026) would be sold in the first year to ensure prices are not too high (frontloading). As with the existing ETS, a Market Stability Reserve (MSR) would be created to mitigate price volatility, it would be started at 600 million EUAs in 2026. They would be released in the event of significant price deviations from the average.

The revenues collected, after deducting the various uses, including contributions to the EU budget or the Innovation fund, will be at the disposal of MSs. The proposal stipulates that the uses of the remaining funds are restricted to measures for the decarbonization of buildings or the acceleration of deployment of zero-emissions private or public transport. In addition, part of the funds collected will cover the creation of the Social Climate Fund (discussed below).

The theory of change of the ETS2 is similar to the existing system – a cap on total emissions is created that decreases at a known rate and emissions allowances are auctioned to market players who are obliged to purchase them based on their emissions. This creates the incentive to lower emissions at the least cost, while the revenues collected can be invested back into climate positive projects. In the long-term, the **artificially induced scarcity means that prices will increase until no more allowances are released into the system**. With the ETS2, the market players would be the suppliers of fuels for the BRT sectors. Most of the difference comes from the direct and visible impact on consumers, the difficulty in switching to low carbon alternatives and the potential regressivity – lower income households tend to spend a higher share of their income on housing related energy expenditure (less clear for road transport).

On the supply side, a successful ETS2 would see GHG emissions from the BRT sectors decrease at the expected rate due to investments in low-carbon technology and innovation. On the demand side, emissions would decrease through investments in energy efficiency or low carbon technologies, partially funded with the revenues created by auctioning allowances. To cushion the immediate impact on the most vulnerable households, some of the ETS2 revenues would also be used for temporary income support.

[2] The LRF would be revised if the average emissions between 2024 and 2026 are 2% or more than the 2025 number.

The interventions on the demand side would be governed through another component of the Fit for 55 package - the Social Climate Fund (SCF). Funded using a part of the ETS2 revenues, **the SCF would work as a revenue recycling method and can fund temporary income support and sustainable investments for households affected by energy, mobility or other types of poverty.**

In the EC's proposal, the SCF would be funded with a portion (25%) of the allowances auctioned under the ETS2. The budget will be €23.7 billion between 2025 and 2027 and €48.5 billion between 2028-2032. Half of the total estimated costs would be covered by contributions of MSs from their own resources, including the auctioning of their allocated allowances.

Each MS would have a maximum total allocation, based on the following criteria: i) population at risk of poverty in rural areas, ii) CO_2 emissions from fuel combustion in households, iii) percentage of households at risk of poverty with arrears on their utility bills, iv) total population, v) GNI per capita at PPS. For Romania this would amount to around €6.6 billion, almost 10% of the total. Only Poland, Italy, France, and Spain would receive higher allocations (Fig 1).

Figure 1: Social climate fund allocations, selected countries

Country	***Total Allocation (mil. €)***
Bulgaria	2 778.1
Germany	5 910.9
Hungary	3 129.8
Poland	12 714.1
Romania	6 682.9

Source: EC, 2021

The governance of the fund would adopt the milestones and targets approach of the Recovery and Resilience Facility (RRF), with payments only made after milestone completion. The Regulation would also allow MSs to implement the SCF through the managing authorities already in place for the European Social Fund Plus.

Every MS would need to present a Social Climate Plan aimed at providing support to households in accessing energy efficiency, low emissions mobility, and low emissions heating and cooling, in addition to mitigating the cost impact through income support.

In the EC proposal the fund is set at fixed amount (€72bn between 2024 and 2032) irrespective of the carbon price. The funding and allocation mechanisms ensure a

redistribution component from higher to lower income countries, and from higher to lower income citizens.

Legislative status and main points of contention

The proposal of the EC, discussed above, was published together with the other pieces of the Fit for 55 package in July 2021. It generated significant controversy, with several stakeholders calling for either changing, postponing, or scrapping it altogether.

Trade unions in particular argued that carbon pricing in the BRT sectors would be ineffective in lowering emissions because of the low price-elasticity of demand, especially for lower income households. Because of the essential character of the goods and low availability of low-carbon alternatives, the argument goes, consumers would not respond to changes in prices by lowering their consumption or switching to alternatives. Instead, since suppliers would pass on the cost to consumers' bills, the latter would be burdened with a higher cost of living. This view was echoed by a number of relevant EU political leaders, the French MEP Pascal Canfin calling the ETS2 "political suicide", as it would generate significant risk of backlash from citizens, while achieving very little in terms of emissions reductions.

Reflecting the challenging economic context, with record high energy prices and the war in Ukraine, the European Parliament (EP) adopted its amendments in June 2022, deciding **to postpone the application of the ETS2 to 2029.** The start date would be conditional on the results of an assessment, presented by the EC no later than 2026, on the evolution of energy and mobility poverty in the EU, the results of the SCF and the emissions reduction potential of a carbon price. For the commercial BRT sectors, the ETS2 would start in 2024, one year earlier than the EC proposal.[3] The EP amendments also stipulated that the **150 million EUAs previously earmarked for the Innovation Fund would instead be directed to the SCF**. The EP proposed a threshold of 50€/EUA for automatically triggering the release of 10 million EUAs from the MSR to reduce the price. Finally, the EP would also make it mandatory for regulated entities to provide cost breakdowns and ensure they do not pass through more than 50% of the EUA costs to final consumers.

The Council published its General Approach on 29 June 2022. It maintained most of the EC's proposal but **postponed the auctioning of EUAs by one year to 2027**. It also backed

[3] Some groups argued that decoupling commercial and private vehicles makes the policy ineffective and expensive

the EP's position to allocate 150 million EUAs to the SCF instead of the Innovation Fund. Through its ETS2 amendments, the Council also set yearly limits for the SCF and a total cap of €59 billion.

On the SCF, there were fewer controversial aspects. Most stakeholders agree that a system must be created to protect the most vulnerable EU citizens, especially in Central and Eastern Europe (CEE), from the additional costs brought by the transition (with or without the ETS2) and to help them invest in lower carbon alternatives for their energy use in BRT sectors. Most discussions focus on the amount and source of funding, the allocation among countries, and the mechanisms for implementation. On the latter, it has been argued that **some countries have lower capacity in targeting low-income households, who may end up facing higher costs** and limited support to bear them. In addition, as the EC proposed a fixed total envelope for the SCF regardless of the carbon price, it has been argued that, in the event of steep carbon price increases, the SCF could be insufficient. Another point of disagreement has been on the limits imposed to temporary income support versus investments to permanently reduce emissions (such as renovations or replacement of equipment). While national governments would prefer to have access to funds that can be quickly transferred to consumers, the EC's proposal favours incentivising investments in energy efficiency and lower-emissions technologies. Finally, some have highlighted the lack of control over building renovation for citizens living under rental or social housing contracts.

Thus, the EP's amendments to the EC proposal were not as far reaching as with the ETS2. The EP introduced the definition of **mobility poverty** and placed a focus on consumers who live in "rural, insular, peripheral, mountainous, remote and less accessible areas or less developed regions or territories, including less developed peri-urban areas, the outermost regions, and carbon-intensive regions with high unemployment". The EP would also extend the scope of direct income support to cover more types of interventions, including reductions in electricity taxes, beyond the immediate impact of the ETS2. Such income support should be capped at 40% of the total expenditure under Social Climate Plans. The EP would also extend the list of eligible activities with lasting emission reductions to include energy storage, smart grids, energy communities and district heating connections. The EP also emphasized measures targeting tenants and social housing within the Social Climate Plans. To address the possibility of the fund becoming insufficient in the event of increased carbon prices, the EP introduced an amendment stipulating that the amounts would be increased to reflect the evolution of EUA prices. Finally, the total envelope was set to a minimum of €11.1 billion from the date of entry into force until 2027, based on an additional 150 million EUAs previously earmarked for the Innovation Fund. From 2027 onwards the total funds would be established after the revision of the Regulation and the adoption of the new MFF.

The Council's General Approach proposed for the SCF to start in 2027 (also covering eligible expenses from 1 January 2026) and to end in 2032, with a total allocation ceiling of €59 billion irrespective of the carbon price and a total net redistribution between MSs of €18.6 billion. The temporary income support measures in the Social Climate Plans would be capped at 35%, lower than the EP proposal. The 50% co-financing obligation from MSs was eliminated, while maintaining the same allocation per country proposed by the EC.

Both files **are expected to be covered in the Trilogues scheduled for 12-16 December 2022.**

The impact of the ETS2 and the SCF: what does the literature say?

The ETS2 and the SCF represent a real-life policy application of carbon pricing with revenue recycling. While the particular details of implementation matter, the principles are relatively close to the theoretical model of cap-and-trade carbon pricing and revenue recycling.

Hence, to evaluate the opportunities and challenges of the ETS2 and the SCF, this section will review existing literature on the effectiveness of carbon pricing and revenue recycling in more general terms. The focus will be on reviewing evidence on the following points:

- **Whether a carbon price is effective for reducing emissions in the BRT sectors**
- **Whether a carbon price on BRT sectors has negative economic, welfare and distributional impacts on citizens**
- **Whether potential negative impacts can be mitigated through revenue recycling**

The EC's impact assessment on the possible extension of the ETS reviews the experience of several jurisdictions and finds **mostly positive evidence in terms of effectiveness of carbon pricing** in the BRT sectors. The EC's modelling shows significant emissions reductions across the range of carbon prices assumed – from €30/ton to €150/ton. The reductions by 2030 compared to the baseline range between 2.9% in buildings and 1.8% in road transport at the lower end, and 11.7% in buildings and 7.8% in road transport at the higher end. In terms of distributional impacts, the EC confirms the **higher impact on low-income households** even in high income countries – as their share of expenditure for heating and cooling of buildings is higher and the price elasticity of demand is lower.

However, the regressivity would not be significant for road transport, where expenditure patterns and price elasticities are less clearly linked to income.

Stenning et al. (2021) conducted a macroeconomic simulation on, among others, the introduction of a separate ETS to BRT with prices linked to existing ETS and presented the impacts on emissions in 2030, as well as distributional effects. They find limited additional emissions reductions compared to the baseline scenario – **around 5% by 2030 for heating and less than 1% for road transport.** As for distributional effects, the carbon price would lead to an increase of 6% in heating expenditure for the low-income households and only a 1% reduction in demand. This assumes an elasticity of 0.21 (an increase of 1% in price generates 0.21% decrease in consumption). For road transport, the expenditure of the lowest quartile household goes up by 3% and demand is reduced by 1%. The elasticity assumed is 0.30. They conclude that an **ETS on the BRT sectors would not be the most effective tool for reducing emissions significantly.** The BRT sectors tend to have lock-in effects – the equipment used has a long lifetime and switching is costly. This makes demand response to a carbon price relatively rigid, especially for lower income households for whom BRT are essential services. In the study, revenue recycling options are used to replace various taxes. This has positive effects on GDP but does not mitigate the impact on lower income households. In the actual EU policy proposal, the SCF is a relevant tool to compensate such households for the increases in BRT costs.

Maj et al. (2021) find that significant results in terms of emissions reduction of **–40% would require a price of €170/ton and show that a mix of complementary policies would be best suited to obtain the desired objectives.** They also find the BRT sectors to have low price elasticities, which implies that the high upfront costs of low-carbon alternatives are the main barrier to switching technologies and fuels. This means that the policy would be regressive in the absence of revenue recycling. On the other hand, revenue recycling is seen as weakening the effectiveness of carbon pricing though rebound effects.

Görlach et al. (2022) examine several design options for the ETS2 and SCF by assessing distributional impacts, both between MSs and between different income groups at EU level. At a price of €50/ton, the findings confirm the risk of regressivity of the introduction the ETS2, in the absence of compensation. The **losses range from 0.5% of income in the lowest decile to 0.3% in the highest.** When revenue recycling is introduced under two scenarios – equal per capita allocation at EU level or at MS level – the policy becomes progressive. The six lowest income deciles would experience net gains of the ETS2 with recycling. The analysis goes further and identifies high-intensity consumers as those within the first three income deciles that have energy expenditure as a share of income higher than one standard deviation above the median. There are 6.2 million people who

meet this criterion in the EU and most of them live in Bulgaria, Hungary, Poland, and Romania. Compensating all these consumers would require less than 10% of the revenue generated by the ETS2 - **around 25% of revenues would be enough to compensate all such energy-intensive consumers in the EU.** This, of course, assumes that such accurate targeting is feasible and cost-effective from an administrative point of view.

Held et al. (2022) assess the ETS2 and SCF based on criteria of equity and effectiveness. Using a static model, they find that the **SCF would ensure a significant redistribution towards poorer MSs, with Romania and Bulgaria being the top recipients on a per capita basis.** In addition, at a EUA price of €55, they find similar impacts within income quintiles at MS level. In all MSs, the impact as a percentage of expenditure is below 2%, but higher in low-income MSs. However, within countries the differences between quintiles are insignificant. They also find the SCF to be sufficient to cover the lower-income quintiles – 25% of the revenues (about half of the SCF allocation under the EC proposal) would be enough to compensate the first two quintiles in all MSs.

Gore (2022) conducts a static microsimulation based on HBS data to assess the cumulative impacts of the Energy Taxation Directive (ETD) reform and introduction of the ETSs and SCF. At €45/ton and looking at EU-wide expenditure deciles, the ETS2 would be slightly regressive, with welfare losses below 1% (shares of expenditures). The various revenue recycling options compensate that significantly. One option – 25% of ETS2 revenues plus new ETD revenues targeted to the poorest 50% creates welfare gains for the lowest decile of around €100 per household per year. **If all ETS2 revenues would be directed at the poorest 50% of households, the policy becomes strongly progressive.**

Bereghmans (2022) also finds CEE countries to be most affected by the cumulative effects of the ETD reform and the introduction of the ETS2. The results of the static simulation using HBS data and a €45/ton carbon tax show that Poland (2.1%) and Hungary (1.6%) would see the highest welfare losses. These losses could be mitigated **by recycling 25% or all of the revenues collected through ETS**, with most countries no longer having average welfare losses (except Poland and Germany).

Braungardt et al. (2022) analyse the adequacy of the SCF and confirm that the impact of the ETS2 is regressive especially for the buildings sector, where lower income households spend a higher share of their income on heating. The SCF, as proposed by the EC, contains a significant inter-MS redistribution effect, but this effect is reduced drastically at higher EUA prices, if the total envelope remains constant. Otherwise, the SCF seems to be sufficient to compensate vulnerable households for the additional BRT related costs. The targeting of such households is seen as a significant implementation challenge.

The World Bank (2022) also models a carbon tax for the non-ETS sectors in Bulgaria, Croatia, Poland, and Romania. It includes two scenarios: **(1) low-ambition starting at €15/ton in 2021** and reaching €50 in 2030, and **(2) Paris-aligned starting at €45/ton** and reaching €90 in 2030. Both scenarios result in reduced GHG emissions - the low-ambition scenario generates between 5 and 7% reductions compared to the baseline, while the Paris-aligned scenario has more divergent results ranging from 22% in Poland to 9% in Romania. If the revenues are used to reduce labour taxes, the GDP impact of the carbon tax would be positive in the short run and neutral in the longer run under both scenarios. In terms of employment**, Bulgaria, Croatia, and Romania would see net job growth under both scenarios, while for Poland the presence of a large coal base makes results less homogenous** (some regions are affected negatively while others positively).

As shown through this brief literature review, the evidence is mixed, and the heterogeneity in terms of methodology and data used makes the various findings difficult to compare. Overall, the potential regressive effects of an ETS for BRT are largely confirmed, while the impact on lower income households can be, if we ignore the implementation complexities, adequately mitigated by the SCF. In the next section, the results of a novel, comprehensive model covering five countries are presented.

A novel simulation model of the macro and microeconomic impact of carbon pricing

Carbon pricing is often seen as politically challenging, as its mechanism of action directly depends on increased costs to households. Faced with a higher cost of carbon intensive goods, people are incentivized to seek lower-carbon alternatives. The aggregate cost of solving the externality problem of GHG emissions is often believed to be high both at a macroeconomic and at the household levels.

To test the extent to which this is true, we[4] conducted **a simulation of a stylised general carbon tax, evaluating its impact on the economy and the welfare of the population.** The generalised carbon tax is significantly different from the proposed ETS2 and is more of a theoretical exercise, evaluating the impact of the most comprehensive solution to the externality: taxing all embedded emissions at the level of the consumer. This theoretical

[4] Energy Policy Group (RO), Institute for Structural Research (PL), Centre for the Study of Democracy (BG), Ideas into Energy GmbH (DE), Habitat for Humanity International Hungary (HU) - consortium part of the project “Distributional Impact of Carbon Pricing in Central and Eastern Europe”.

tax is applied for the entire economy and comes on top of the already exiting ETS price applicable to power generation, heavy industry, and aviation. While such a tax may not be feasible, the simulation can add to the body of evidence of carbon pricing and inform policy makers on the potential impact of an idealised policy, abstracting away any issues of implementation. In most realistic applications, the carbon pricing scheme would be less comprehensive and the associated impact less pronounced. In other words, our simulation shows the upper boundary of the likely impact of carbon pricing through a carbon tax. In addition, we consider that the carbon tax would be passed through entirely to consumers, which in reality, due to competitive pressure, may not be the case.

The carbon tax is conceptualised as the additional cost of GHG emissions embedded in consumption goods that can deliver the emissions reductions in line with a trajectory for climate neutrality by 2050. Thus, we study the impact of a generalised carbon tax – proportional to the carbon content of all consumption goods – on macroeconomic indicators, on consumer welfare, and expenditure patterns. In addition, we look at several revenue recycling options. **The countries covered are Bulgaria, Germany, Hungary, Poland, and Romania.**

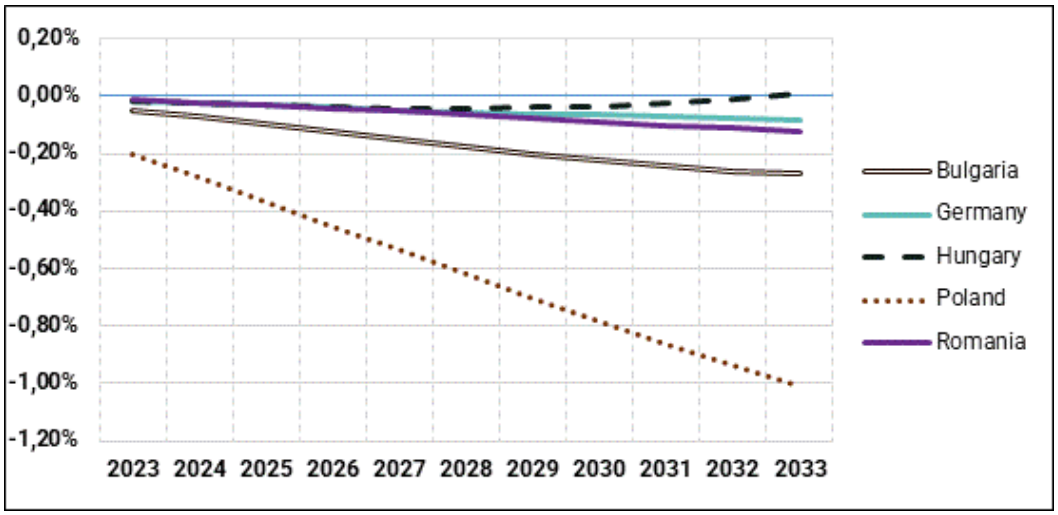
Macroeconomic impact

The analysis used a dynamic stochastic general equilibrium model, MEMO, to showcase the structural macroeconomic implications of carbon pricing.[5]

We find that the introduction of the carbon tax will have the largest impact on the Polish economy. According to the MEMO model results, **the carbon tax would decrease Polish GDP by 1% until 2032** compared to the baseline scenario (Figure 2). In Bulgaria, Romania, and Germany, a carbon tax would have a minor, negative impact on GDP. In Hungary, the carbon tax would bring a positive effect on GDP by 2033.

[5] More details can be found in the annex and in the upcoming report, to be published in 2023, that covers extensively the methodology and the results. The results are not final and need to be interpreted within the limitations of the macro- and micro-modelling exercise, the data availability and the new economic realities of high inflation and energy prices after Covid-19 and the invasion of Ukraine.

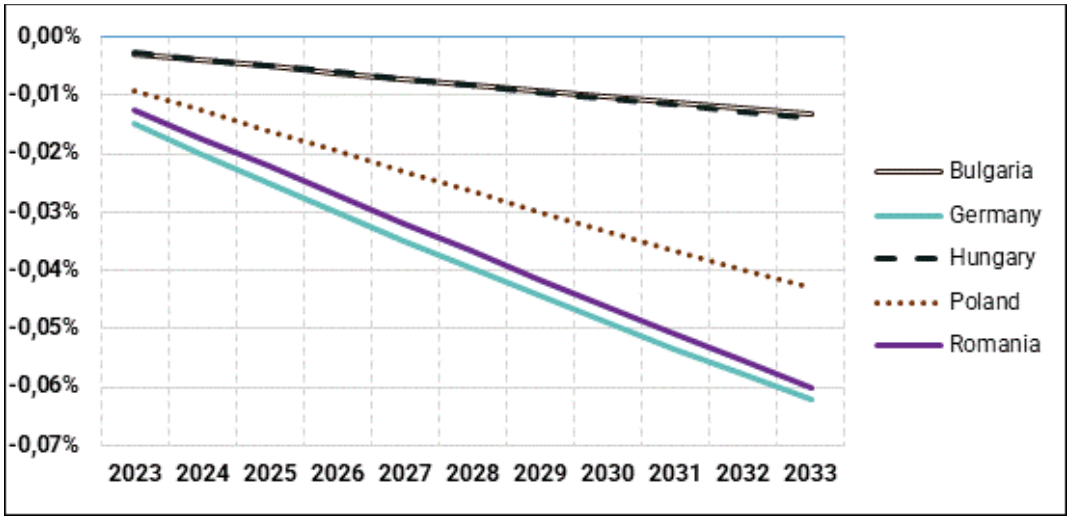
Figure 2: Differences in GDP level (% deviation from the no-carbon tax scenario)



Source: Modelling results

The impact that the introduction of a carbon tax would have on the labour markets of the five countries is relatively low (Figure 3). Compared to a baseline scenario (without carbon tax), **employment would decrease by 0.06% until 2033 in Germany and Romania, and by 0.04% in Poland.** The labour market impact in Hungary and Bulgaria would be negligible at around 0.01%.

Figure 3: Differences in employment (% deviation from the no-carbon tax scenario)



Source: Modelling results

Microeconomic impact

The results of the macroeconomic model, and especially carbon tax levels required to deliver 40% GHG emissions reductions by 2033 compared to 2021 (Table 1),[6] were fed into a microeconomic model. Once again, it should be highlighted that this tax would come on top of the already existing carbon price applied through the ETS.

The microsimulation starts by calculating all the changes in prices determined by the theoretical carbon tax. Based on these price changes, the welfare effects on households are estimated, accounting for consumption behaviour effects. The Quadratic Almost Ideal Demand System (QUAIDS) was used to accurately estimate the effect of these changes in carbon price on the consumption choices of households, capturing both direct and indirect responses.

Table 1: Theoretical carbon tax values used in the model

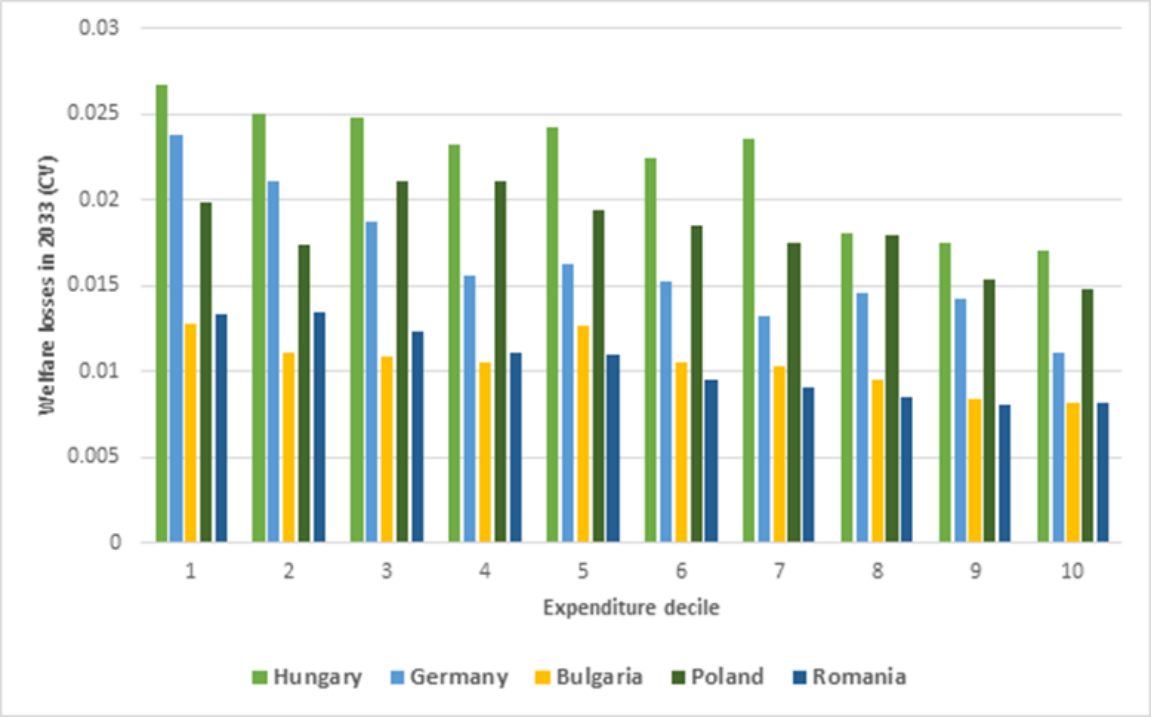
	Value in $/tonne CO2 in 2022	Value in $/tonne CO2 in 2033
Bulgaria	4,52	22,58
Germany	3,97	20,51
Hungary	14,57	73,54
Poland	7,26	36,42
Romania	2,95	15,17

Source: Modelling results

Figure 4 shows how welfare losses are distributed across the ten expenditure deciles in all five countries. The results refer to **losses in 2033, as computed iteratively starting from 2022** using the QUAIDS model. Welfare losses are measured using the compensating variation (CV), computed at the average point of each decile identified in the five national sets of HBSs. CV is roughly equivalent to the additional expenditure, in percentage terms, required after the theoretical carbon tax for household to maintain the same level of utility as before the tax.

[6] The differences in the tax levels between otherwise similar countries can be traced back to the economic structure of each country.

Figure 4: Welfare losses in 2033 prior to redistribution in the five countries

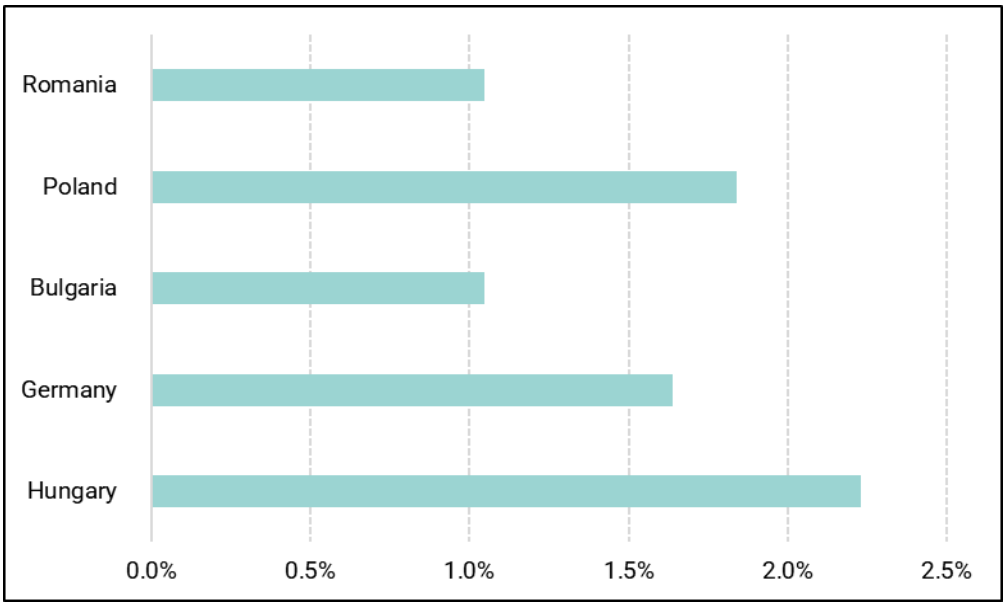


Source: Modelling results

Overall, **before redistribution, the carbon tax seems to display minor regressive tendencies**. This means that the relative burden imposed by the tax on households belonging to the lower income deciles in all five countries is higher than the burden for more affluent households.

Looking at country level, **Hungary has the highest average welfare losses in 2033**, calculated as the mean loss for the population (followed by Poland), while Bulgaria has the smallest (followed by Romania). Germany stands in the middle of the distribution of average losses in 2033. Nevertheless, the five countries are comparable, with their losses mainly ranging between 0.9% and 2.6% of total expenditure.

Figure 5: Average welfare losses at country level (%)



Source: Modelling results

Scenarios for redistribution

The revenues collected from the carbon tax can be redistributed. Three scenarios for redistribution were tested:[7] **(1) a lump-sum transfer scenario** that redistributes the revenues equally for all households, **(2) a price subsidy scenario** where revenues are used to alleviate the welfare effects of the price increases for lower income households, and **(3) a double-dividend scenario** in which revenues are used to reduce other distortionary taxes.

Based on these scenarios, we observe that **carbon pricing can improve the welfare of the least affluent when coupled with the right redistribution strategy**. This is the case for all five countries in the price subsidy or the lump-sum scenarios. In particular, this is relevant for countries with relatively high welfare losses, such as Hungary or Germany. Furthermore, lower-income countries, such as Romania and Bulgaria, also see the

[7] The redistribution method in the Fit for 55 proposal would be the implementation of the Social Climate Fund, which is meant to help households and transport users transition to lower carbon alternatives. The mitigating impact of the SCF can be much higher than the one modeled here.

average losses of the lowest deciles reduced dramatically - in some cases, they even gain after redistribution.

In addition, some revenue **redistribution approaches produce macro effects**. For example, reducing other distortionary taxes with the revenues obtained from the carbon tax is likely, for all the five countries, to primarily benefit the more affluent households, thus increasing wealth inequality. This is especially true for highly unequal countries in CEE, such as Romania. However, in cases such as Germany, seeking a double dividend could be particularly beneficial for the middle-income deciles.

The impact on **energy poverty** can also be estimated. To enable a comparative cross-country analysis, we use the definition of energy poverty by the EU Energy Poverty Observatory, which similarly uses HBS data. The indicator defines energy poor households as those whose total energy expenditure falls below M/2, with M being the median value of the population. Table 2 compares estimates of energy poverty from the 2022 baseline values without a carbon tax with 2033 estimates for a scenario with a carbon tax but without redistribution, as well as for each of the three revenue recycling scenarios in 2033.

Table 2: Energy poverty rates in multiple scenarios (%)

	Baseline (2022)	Post-tax scenario (2033)	Post-redistribution scenarios (2033)		
			Lump-sum	Double dividend	Price subsidy
Bulgaria	17.46%	18.22%	16.85%	18.01%	14.05%
Germany	8.25%	10.93%	8.34%	9.15%	6.02%
Hungary	13.29%	18.94%	14.65%	18.54%	13.55%
Poland	14.82%	19.55%	13.34%	15.35%	13.02%
Romania	18.81%	21.64%	16.75%	18.85%	14.85%

Source: Modelling results

In most countries, the carbon tax with redistribution through price subsidy or lump sum results in **slightly lower energy poverty rates than in the baseline**. The double-dividend scenario is associated with higher rates of energy poverty. However, the results seem to indicate that the impact on energy poverty is rather small, whether positive or negative, if the carbon tax is complemented by revenue recycling.

Conclusions and policy implications

The EU will soon decide on the introduction of a separate ETS for BRT and a Social Climate Fund to mitigate its impact. **Evidence on carbon pricing and revenue recycling for the BRT sectors has so far been mixed.** It tends to confirm expectations that emissions reductions directly caused by carbon pricing would likely be low, unless the price is very high. At the same time, the regressive tendencies of such carbon pricing can be mitigated through revenue recycling, which can have both a poverty alleviation impact in the short term and a structural impact on the energy performance of buildings and transport behaviour in the long run.

It is crucial to highlight that the **ETS2 should not be discussed in isolation, but only as one of many complementary interventions that aim to deliver the 55% GHG emissions reduction by 2030**. The ESR, the ETD, the EED, the emissions performance of cars and vans directive, plus the different funds made available through the regional policy, structural funds, the RRF and the dedicated SCF, will all play a role in achieving decarbonisation of BRT sectors. ETS2 seems more like a nudge in the right direction. By being exposed to the carbon price, households are incentivised to seek lower carbon alternatives that are offered or subsidised through a host of other policies.

The issue of implementation should also be addressed. While the ETS2 would be centrally managed based on the experience with the current EU ETS, the SCF would largely depend on MS level administrative capacity. The targeting required to reduce energy poverty and the impact of the ETS2 on the poorest will be more challenging for countries where existing welfare policies are plagued by large inclusion and exclusion errors.

Our economic simulations provide additional evidence on the macro- and microeconomic impacts of carbon pricing, but through a generalised theoretical carbon tax on all consumption goods, at levels required to achieve emissions reductions by 2033 in line with climate neutrality by mid-century in Bulgaria, Germany, Hungary, Poland and Romania. The findings suggest negligible impacts on GDP and employment in all the covered countries.

At the household level, welfare losses are between 0.9% and 2.6% of expenditure, slightly higher for lower income households. However, they could be mitigated by revenue recycling, particularly by targeting the lower deciles. Importantly, after revenue recycling, low-income households can improve their situation compared to a scenario in which no additional carbon tax would be imposed. In other words, an extension carbon pricing combined with the right revenue recycling mechanisms can even have a progressive

redistributive effect. Through adequate targeting, the carbon tax can reduce the rate of energy poverty in all the five countries.

In this context, we conclude that, together with the other pieces in the Fit for 55 package, the **ETS2 can play a complementary role in promoting emission reductions in the BRT sectors.** Given the relatively low impact, the gradual introduction of the ETS2 seems to be appropriate. In any case, the establishment of the SCF could provide a crucial tool for targeting energy poor households with income support in the short term and sustainable interventions for better performance of buildings and low carbon transport in the long term. We recommend linking the total envelope of the SCF to the carbon price and to give particular attention to implementation in MSs with historically low EU funds absorption rates and ineffective welfare policies.

References

Pollitt, M. G., Dolphin. G (2020) *Feasibility and Impacts of EU ETS Scope Extension. Road transport and buildings*. Center on Regulation in Europe. Available at: https://cerre.eu/wp-content/uploads/2020/12/CERRE_Feasibility-and-impacts-of-EU-ETS-scope-extension_December2020.pdf

European Commission (2021b): Proposal for a Regulation of the European Parliament and of the Council establishing a Social Climate Fund. Available at: https://ec.europa.eu/info/sites/default/files/social-climatefund_with-annex_en.pdf

European Commission (2021): Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability re-serve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757. Available at: https://ec.europa.eu/info/sites/default/files/revision-eu-ets_with-annex_en_0.pdf

Gore, T. (2022), Can Polluter Pays policies in the buildings and transport sectors be progressive? Assessing the distributional impacts on households of the proposed reform of the Energy Taxation Directive and extension of the Emissions Trading Scheme. Research report, Institute for European Environmental Policy.

Görlach, Michael Jakob, Katharina Umpfenbach, Mirjam Kosch, Michael Pahle, Théo Konc, Nils aus dem Moore, Johannes Brehm, Simon Feindt, Fabian Pause, Jana Nysten, Jan Abrell (2022): A Fair and Solidarity-based EU Emissions Trading System for Buildings and Road Transport. Kopernikus-Projekt Ariadne, Potsdam.

Held, B., Leisinger, C., Runkel, M. (2022), Criteria for an effective and socially just EU ETS 2. FEST and FÖS on behalf of CAN Europe, Germanwatch, Klima-Allianz Deutschland e.V. and WWF Deutschland.

Feindt, S., Kornek, U., Labeaga, J.M., Sterner, T., Ward, H. (2021), Understanding Regressivity: Challenges and Opportunities of European Carbon Pricing. Energy Economics 103 (November): 105550. https://doi.org/10.1016/j.eneco.2021.10555Benjamin

Maj, M., Rabiega, W., Szpor, A., Cabras, S., Marcu, A., Fazekas, D. (2021), Impact on Households of the Inclusion of Transport and Residential Buildings in the EU ETS, Polish Economic Institute, Warsaw.

Stenning, J., Bui, Ha, Pavelka, A. (2020) *Decarbonising European transport and heating fuels - Is the EU ETS the right tool?*, European Climate Foundation, Available at: https://europeanclimate.org/wp-content/uploads/2020/06/01-07-2020-decarbonising-european-transport-and-heating-fuels-full-report.pdf

World Bank (2022) *EU Regular Economic Report 7: Green Fiscal Reforms*, World Bank. Available at: https://www.worldbank.org/en/news/press-release/2022/04/14/green-fiscal-reforms-can-protect-vulnerable-households-and-boost-covid-19-recovery-efforts-in-europe.

Annex: further methodological considerations

This model combines two strands of research – input-output and general equilibrium modelling. The model consists of (1) the household sector, which seeks to maximise utility from consumption and leisure, (2) the private sector, which seeks to maximise profits, (3) the governmental sector, which collects various taxes and finances public consumption, and (4) the foreign sector responsible for trade with the rest of the world.

By using the MEMO model, the CO_2 emissions from the use of fossil fuels (coal, oil, and gas) were derived. The volume of carbon emissions in a particular sector was modelled as a linear function of the use of these fuels, with coefficients set to match sector data regarding emissions. Other non-carbon emissions were not modelled directly, such as those resulting from industrial processes, waste processing, agriculture, or natural carbon sinks. These emissions were treated in an indirect way in the post-processing phase of the modelling exercise. When running a carbon tax simulation, the agents in the model only react to the fossil fuel emissions modelled directly and do not, for example, reduce output in the agriculture sector to cut non-carbon emissions.

The second research instrument deployed for the analysis involved using information from the previously implemented macroeconomic model, MEMO, and feeding it to a microeconomic model that estimates a demand system for the five countries. From this perspective, calculating the incidence of a carbon pricing instrument requires calculating all the changes in prices that would occur in the economy as a response to a change in the carbon tax rate, followed by calculating the welfare effects of these changes on households. While shifts in the carbon price directly influence only a limited number of carbon-intensive sectors, such as transport or power generation, its indirect effects are more subtle but potentially more important for some categories of the population.

The precise tax levels for each country and each year are obtained from the DGSE macro-model, ensuring that effects on trade, domestic restructuring, and sectoral changes have already been accounted for in the first stage of the quantitative modelling. Furthermore, the simulated tax is endogenously determined to ensure the European-wide deep decarbonisation objectives of the European Green Deal. Taxes are distinctively computed for all five countries, resulting in five series of results that use inputs narrowly tailored to local conditions and needs. More precisely, we model an incremental tax whose annual levels are set to smoothen the emissions reduction pathways, with a final reduction rate of 40% by the end of 2033, compared to the baseline year of 2021.

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