

New Member States
Climate Protection and Economic Growth

“Macroeconomic implications of a burden sharing non-ETS GHG target in Bulgaria and Romania”

Policy Brief

Authors i.a.o.

Kostas Fragkiadakis **

Carlo C. Jaeger *

Nicos Nikiforakis **

Frank Meissner *

Leonidas Parousos **

Franziska Schütze *

* Global Climate Forum

** E3-Modelling

Global Climate Forum e.V.

Neue Promenade 6,

D-10178 Berlin, Germany

www.globalclimateforum.org

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1 Overview and methodology

In the course of the project “New Member States Climate Protection and Economic Growth - Case Study Bulgaria and Romania”¹ a new effort sharing decision (ESD Decision No. 406/2009/EC²) for the fair distribution of non-ETS emission reduction efforts was decided and implemented in October 2009. Hence, this study serves as a supplementary study, investigating the changes in economic effects, given the new effort sharing decision.

This study assesses the macroeconomic implications of an EU wide effort sharing GHG emissions reduction scheme for the Bulgarian and Romanian economies. With an overall EU GHG target at -40% compared to 1990 (-36.5% compared to 2005), two scenarios have been examined and compared: a least cost implementation and a burden sharing scheme. The GEM-E3-NMS computable general equilibrium model was used to quantify the effects of the alternative GHG emission reduction scenarios.

The burden sharing scheme involves the allocation of emission allowances based on a GDP/capita approach. The main concept of the GDP/capita approach is that countries that are below the EU average will receive additional permits and countries above will receive fewer permits. The exact allocation scheme was derived from Hermann et al. (2014), covering only the non-ETS sectors, as an approximation of a possible GDP/capita effort sharing approach. The ETS-sector is left unchanged, due to the fact that its permits are allocated via the EU-wide trading system.

For the purpose of this study, the authors assumed that the national non-ETS targets will not be attained at the country level but rather at the aggregate EU28 level. They serve only as an initial allocation of emission allowances that can be traded. This study assumes that the difference between the initial allocation of emission allowances and the available cost-efficient potentials would then be traded or transferred. Although this setup partly differs from the way that the national non-ETS targets set for 2020 will be met (i.e. by the implementation of national policies and measures and only in small parts by tradable permits), it is necessary to use it in order to evaluate the impact that financial transfers to support carbon abatement efforts within the GEM-E3-NMS model has on the Bulgarian and Romanian economies.

The findings reported in this policy brief are related to the study “New Member States Climate Protection and Economic Growth: A Case Study for Bulgaria and Romania” (GCF 2014). This project focused on the assessment of the economic implications for Bulgaria and Romania in case the EU adopted a 40% target. The 40% GHG target was imposed at the aggregate EU level

¹ which can be downloaded on www.globalclimateforum.org

² <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009D0406>

without sector specific targets (i.e. no distinction between ETS and non-ETS). The GHG abatement effort among member states and economic sectors has been based on a least cost approach: i.e. gradual exploitation of abatement options starting from the cheapest until the overall target is met. As a result, the ETS and non-ETS GHG emission reductions were 50% and 23% respectively compared to 2005. In Hermann et al. (2014) a different split between ETS and non-ETS sectors is given, based on the EU Commission’s Impact Assessment on the 2030 climate and energy framework (EUC, 2014) with 43% and 30% respectively. We have evaluated the implications of a burden sharing scheme for both setups. In particular, two alternative scenario sets have been quantified:

Scenario Set I We use the initial cost-efficient scenario from the GCF (2013) study, with an ETS/non-ETS split of 50%/23%. We normalize (see Table 3) the non-ETS burden sharing figures from Hermann et al. (2014), so that the reductions of all member states represent a 23% emission reduction. Therefore an implementation of such normalised reductions is comparable with the findings in the NMS-project modelling. The economic implications of this burden sharing mechanism for Bulgaria and Romania are presented in chapter 4.

Scenario Set II The EU40 scenario was quantified again with two additional constraints for GHG emission reduction targets: i) ETS 43% compared to 2005 and ii) non-ETS target 30% compared to 2005 levels. This allows implementing the burden sharing mechanism presented in Hermann et al. (2014) (see Table 11) Results are presented in chapter 5.

Table 1 provides an overview of the main features of the scenarios quantified with the GEM-E3-NMS model.

Table 1: GHG targets in the alternative scenarios

		EU GHG-target 2030	EU ETS/non-ETS targets 2030	EU ETS/non-ETS reductions from model output 2030
Reference Scenario	least cost	-	-	-
Scenario Set I				
EU40	least cost	-40%	-	-50% / -23%
EU40 BS	burden sharing	-40%	-50% / -23%	-50% / -23%
Scenario Set II				
EU40_43_30	least cost	-40%	-43% / -30%	-43% / -30%
EU40_43_30 BS	burden sharing	-40%	-43% / -30%	-43% / -30%

2 Implementation of burden sharing

This study focuses on the effects of a burden sharing approach in the non-ETS sectors, hence the ETS-sectors are out of the scope of this study. Nevertheless, the ETS approach follows mainly a market-based and therefore a least cost approach of EU emission reductions. Permits are allocated to the ETS emitters (power plants, factories). Thus, abatement costs are (relatively) well known and the decision of the implementation of mitigation measures is made on a microeconomic level.

The difficulty for non-ETS emissions is that a multitude of emitters with low emissions (e.g. cars, buildings) exist and emissions cannot be allocated to their emitters easily (e.g. emissions from agriculture). Therefore permits are defined at national levels and national policies (e.g. carbon taxes) force or incentivize emitters to reduce energy consumption and related GHG-emissions. The allocation of non-ETS emission is a result of negotiations on EU level. Usually the allocation is based on model-optimization, e.g. by setting reduction targets in a «least cost case» (EU40).

In a least-cost-approach, emission reductions take place in countries (and sectors) with the lowest carbon abatement costs. Lower-income countries generally are confronted with lower mitigation costs (at the marginal cost frontier) than countries with higher income per capita. Hence, shifting emission reductions from lower to higher income countries will result in higher aggregated costs and therefore in larger GDP losses for the EU as a whole.

The idea behind a burden sharing mechanism based on a GDP-per-capita-approach is to increase the allocation of emission permits for lower income countries and decrease it for higher income countries (as compared to a cost-optimal allocation). Based on that, a burden sharing mechanism differs from a «least cost case» - presented in EU40 – such that per definition the cumulative EU-GDP is lower than in a «least cost case». Thus, the allocation is sub-optimal with respect to the cumulative EU GDP.

To diminish the negative GDP effects of a burden sharing approach for the EU as a whole, the actual national emission reductions should nevertheless be more aligned to the «least cost case». Lower income countries would then be supported accordingly by higher income member states in achieving this additional emission reduction. This could be achieved either through a trade of emission permits between countries or a financial compensation scheme. In both cases, member states that have a higher emission reduction target under a burden sharing approach would have to pay transfers (e.g. Austria, Luxembourg and Sweden) to countries with lower income (e.g. Bulgaria and Romania). Member states that have a lower target would receive these transfers in return for additional emission reductions.

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The amount of transfers results from the product of emission-differences per year and the annual price of CO₂. For the purpose of this study, we assume that the transfer mechanism is organised by a EU entity and will not take place bilaterally.

In addition, it is important to note that the results depend on the choice of use of the income that is generated through additional permits. In the current study, the additional revenues are used to reduce production costs in the case of firms and to increase households' income in the case of households.

A further important aspect that is not analysed in this study is the time line of the financial transfers among member states or member states and the EU. We assumed that the transfer takes place per year depending of the actual carbon price and the amount of GHG-emissions that Bulgaria and Romania are willing to mitigate in addition to the burden sharing targets. A different transfer schedule will change the effects on the economic parameters.

We further assume that the absolute difference between the target allocation based on a burden sharing approach and the cost-efficient distribution of emission reductions is tackled by this mechanism. Depending on the eventual political design of these mechanisms, the resulting transfers could be lower.

3 Scenario Set I - 40% EU28 target

3.1 EU40 - Least cost scenario

Within the study “New Member States Climate Protection and Economic Growth: A Case Study for Bulgaria and Romania”, the GEM-E3-NMS model was used to quantify the economic implications of a 40% EU GHG emission reduction target from 1990 levels (36.5% compared to 2005). This target has been set at the EU level and hence no individual targets for ETS and non-ETS have been applied. The result was a least cost allocation of the abatement effort among sectors and member states. The evaluation showed that the GHG reduction for the non-ETS-sectors will be 23.1% (compared to 2005) and for the ETS sectors 50.5% (compared to 2005), with a carbon price of 58 euro/tonne CO₂eq in 2030. Table 2 presents the main macroeconomic results of the EU40 least-cost emission reduction case for Bulgaria and Romania (derived from the NMS-project report).

Table 2: GDP, Bulgaria and Romania in a 40% EU wide target & least cost scenario

		EU40 - least cost	
		2030	2015-2030
% change from reference	Romania	-0,70%	-0,27%
	Bulgaria	-1,33%	-0,63%
	EU28	-0,23%	-0,10%
Absolute change from reference (bn euro)	Romania	-0,7	-3,7
	Bulgaria	-0,5	-3,0
	EU28	-36	-209

Source: GEM-E3-NMS

The overall GDP impact for Bulgaria and Romania was found to be negative (-1.3% and -0.7% changes from reference in 2030) as these two countries are characterized by high energy and GHG intensities per unit of economic output. In order to investigate alternatives that would ease the adjustment process of Bulgaria and Romania towards a low carbon economy, a 40% target based on a burden sharing mechanism according to GDP per capita considerations (adopted from Hermann et al. (2014)) was quantified.

3.2 EU40 - Burden sharing scenario

3.2.1 Scenario definition

The burden sharing scheme involves only the EU28 non-ETS GHG emissions (according to the GEM-E3-NMS simulations, GHG emissions from non-ETS sectors amount to 2,025 billion tonnes of CO₂ eq in 2030). In this version two GHG emission reduction constraints were imposed on the model, one for ETS and one for non-ETS. Hence, there will be two carbon prices resulting from the simulations. The member state allocation of the non-ETS target is based on Hermann et al. (2014). Based on this allocation Romania has a national target of 61.9 Mt CO₂ eq. which essentially means that it receives 10.3 Mt CO₂ eq. in 2030 additional to the least cost scenario. Bulgaria in 2030 has a national target of 21.9 Mt CO₂ eq., hence it will receive an additional 6.0 Mt CO₂ eq. compared to the least cost case.

The additional permits are then further distributed to firms and households; based on their share in total non-ETS GHG emissions. Thus, industries/households with high shares of emissions will receive proportionally more permits. Within the model it is assumed that earnings from permit sales are used by the firms so as to reduce their unit cost of production (option that promotes competitiveness) and by the households so as to increase their disposable income (option that favours consumption).

Table 3: Burden sharing allocation based on GDP/Capita rule (normalized to non-ETS -23%)

Country	non-ETS reduction compared to 2005	Country	non-ETS reduction compared to 2005	Country	non-ETS reduction compared to 2005
Austria	-29%	France	-22%	Netherlands	-29%
Belgium	-32%	UK	-27%	Poland	-1%
Bulgaria	-1%	Greece	-6%	Portugal	-5%
Cyprus	-25%	Hungary	-3%	Slovakia	-8%
Czech Republic	-4%	Ireland	-29%	Slovenia	-10%
Germany	-36%	Italy	-26%	Sweden	-14%
Denmark	-37%	Lithuania	-2%	Romania	-2%
Spain	-21%	Luxembourg	-50%	Croatia	-11%
Estonia	-12%	Latvia	-9%	EU28	-23%
Finland	-32%	Malta	-17%		

Source: Normalized figures of Hermann et al. (2014)

Table 4 shows carbon prices for the reference scenario, the least cost scenario and the burden sharing scenario. In the EU40 least cost scenario the GHG emission reductions are driven by an EU-wide carbon price that increases constantly up to 2030. To evaluate the burden-sharing scheme, the ETS / non-ETS split produced by the EU40 least cost scenario was introduced as additional constraint. If each member state and sector in this setup received the GHG emissions produced in the EU40 least cost case as initial allocations, the carbon price in both the ETS and non-ETS sectors would be identical and the same as in EU40 least cost (i.e. 57.9 euro/t CO₂ in 2030). However, the different allocations among countries imply different income transfers among sectors and hence the carbon price especially in the Non-ETS sectors is slightly higher in the burden sharing scenario as compared to the least cost case.

Table 4: Carbon prices in Scenario Set I – euro/t CO₂

		2015	2020	2025	2030
Reference scenario	Carbon Price*	12	20	29	44
EU40 least cost scenario	Carbon Price*	12	21	33	58
EU40 BS scenario	ETS-Carbon Price	12	20	32	57
	non-ETS-Carbon Price	12	19	35	59

Source:GEM-E3-NMS,* no target in ETS and non-ETS GHG emissions in these scenarios

Following the main idea of a burden sharing mechanism, Bulgaria and Romania receive a higher amount of tradable emission permits, as shown in the following table. In 2030, Bulgaria receives an amount of 6 Mt CO₂eq and Romania 10.3 Mt CO₂eq.

Table 5: Emissions and emission permits in Scenario Set I, Bulgaria and Romania in Mt CO₂ eq.

	non-ETS emissions from EU40 least cost scenario	Additional permits according to burden sharing	non-ETS emissions from EU40 least cost scenario	Additional permits according to burden sharing
	Bulgaria		Romania	
2015	20.3	1.8	61.7	0.8
2020	18.7	3.4	61.3	5.3
2025	17.5	4.5	57.3	8.8
2030	15.9	6.0	51.6	10.3

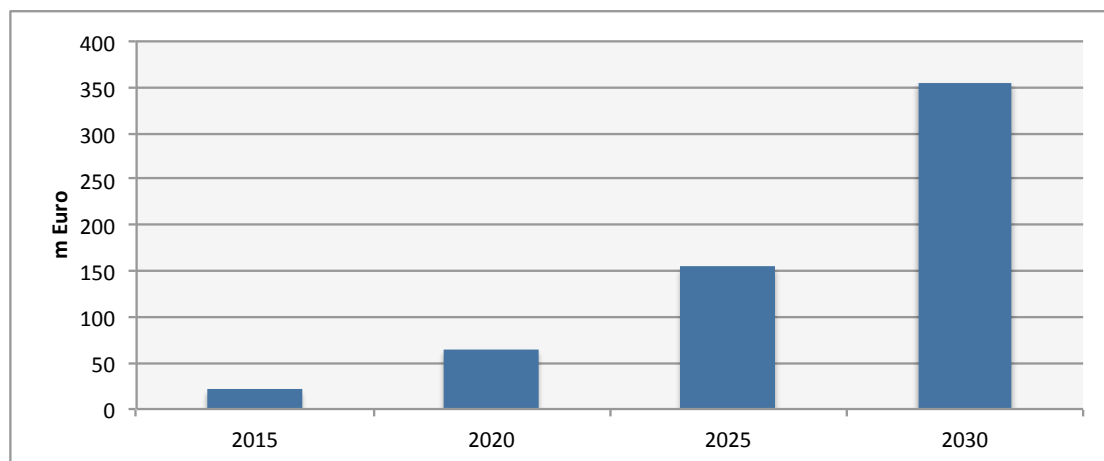
Source: GEM-E3-NMS

3.2.2 Results for Bulgaria

Based on the non-ETS carbon prices (described in Table 4) and the number of allocated additional permits (Table 5), Bulgaria will benefit with around 2 bn euro in cumulative terms with steadily increasing annual transfers until 2030 (See Figure 1).

The macroeconomic results for Bulgaria are presented in Table 6 (for 2030) and Table 7 (2015-2030). The consumption of goods and services increases due to additional household income. Savings are not affected significantly as interest rates remain similar to the reference levels.

Figure 1: Benefit from permit allocation Bulgaria EU40 BS, in m euro



Source: GEM-E3-NMS

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Increased consumption leads to a higher level of production; which in turn increases labour demand and thus employment. Production and employment gains boost nominal wages and the rate of return on capital. Rising production factor costs diminish the reduction of the unit cost of production achieved by the use of revenues generated by the acquisition of additional permits. The net effect is a small increase in the unit cost of production. Higher wages and employment further boost consumption (the total effect in household consumption is 232 m euro in 2030). Part of the additional consumption (both intermediate and final) addresses imported goods, thus reducing the positive effects on GDP. At the same time, the non-optimal allocation of allowances has a negative effect on the overall adjustment process at the EU level (EU GDP is projected to be lower than the optimal case). This also has a small negative effect (-0.2% in 2030) on Bulgaria’s exports as the demand of other EU countries weakens.

Table 6: EU40 BS - Bulgaria results on macroeconomic aggregates, 2030

	Least Cost	Burden Sharing		
In 2030	In bn euro		Difference from least cost scenario (bn euro)	Difference from least cost scenario (%)
GDP	34	34	0.09	0.26%
Benefit from permits allocation	0	0.36	0.36	
Consumption	21	22	0.23	1.09%
Investment	7	7	0.04	0.60%
Exports	19	19	-0.03	-0.19%
Imports	19	19	0.15	0.80%
Employment (m. persons)	2.62	2.63	0.01	0.56%

Source: GEM-E3-NMS

Table 7: EU40 BS - Bulgaria results on macroeconomic aggregates , 2015 -2030

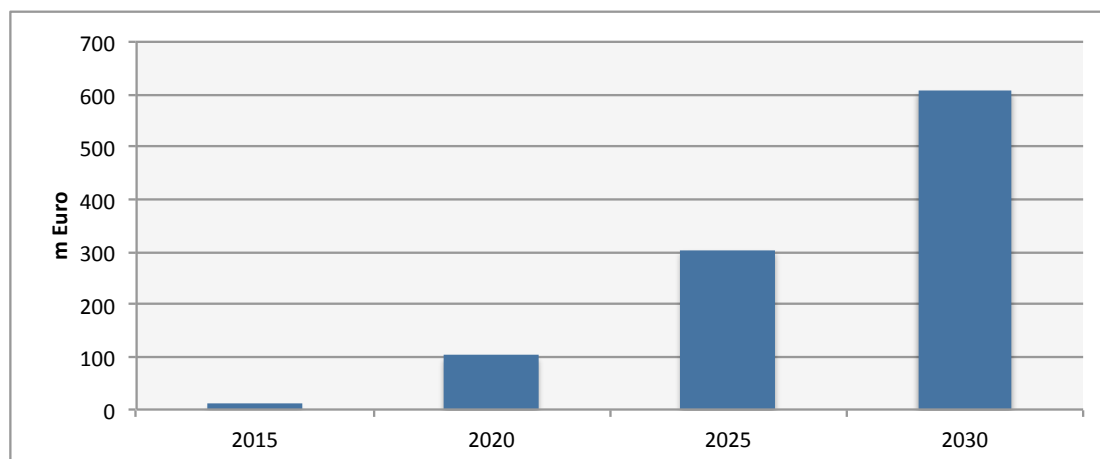
	2015-2030	2015-2030
	Cumulative difference from least cost (bn euro)	Cumulative difference from least cost scenario (%)
GDP	0.41	0.09%
Benefit from permits allocation	2.04	
Consumption	1.05	0.36%
Investment	0.19	0.21%
Exports	-0.15	-0.06%
Imports	0.68	0.27%
Employment (m. persons)	-	0.19%

Source: GEM-E3-NMS

3.2.3 Results for Romania

Romania benefits from receiving higher GHG permits compared to the least cost case (610 m euro in 2030). Figure 2 provides an overview of the trajectory of benefits between 2015 and 2030.

Figure 2: Benefit from permit allocation Romania EU40 BS, in m euro



Source: GEM-E3-NMS

Table 8 shows the macroeconomic impacts for Romania of the burden sharing scenario in 2030. An increase in real wages and employment boosts consumption by 1,090 m euro (1.51% of GDP). As opposed to Bulgaria, this additional consumption is mainly directed towards the domestic economy since the Romanian economic structure is characterized by a lower share of imports. This is the main reason why Romania is found to benefit more from the burden sharing allocation scheme than the Bulgarian economy.

Table 8: EU40 BS Romania results on macroeconomic aggregates, 2030

	Least Cost	Burden Sharing		
2030	In bn euro		Difference from the least cost scenario (bn euro)	Difference from least cost scenario (%)
GDP	101	101	0.45	0.45%
Benefit from permits allocation	0	0.61	0.61	
Consumption	72	74	1.09	1.51%
Investment	22	22	0.13	0.58%
Exports	39	38	-0.38	-0.99%
Imports	41	41	0.39	0.95%
Employment (m. persons)	7.86	7.91	0.05	0.59%

Source: GEM-E3-NMS

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A transfer based on the burden sharing mechanism increases Romania’s GDP compared to the least cost case by 0.16% (2.175 bn euro) in the period 2015 to 2030 (see Table 9). The benefits from permit allocation sum up to 3.6 bn euro, while consumption (public and private) is increased by 0.5% (5.3 bn euro).

Table 9: EU40 BS Romania results on macroeconomic aggregates ,2015 -2030

	2015-2030	2015-2030
	Cumulative difference from least cost in bn euro	Cumulative% difference from least cost scenario
GDP	2.17	0.16%
Benefit from permits allocation	3.57	
Consumption	5.28	0.53%
Investment	0.59	0.20%
Exports	-1.89	-0.38%
Imports	1.81	0.33%
Employment (m. persons)	0.25	0.19%

Source: GEM-E3-NMS

Bulgaria receives a larger transfer than Romania (as a share of GDP) but the net effect on its GDP is lower (Romania plus 0.45% as compared to the least cost case; Bulgaria plus 0.26% in 2030). This result can be attributed to the following characteristics of the respective economies:

- The share of imports in GDP is much greater in Bulgaria (55%) than in Romania (40%). For each 1.00 euro of additional demand in Bulgaria only 0.45 euro remain in the domestic economy while in Romania 0.60 euro remain domestically.
- The unemployment rate in the GEM-E3-NMS reference scenario for 2030 (GCF, 2014) is much higher in Bulgaria (11.1%) than in Romania (7.5%). Therefore an increase in domestic demand will have a relatively higher effect in real wages in Romania due to the lower unemployment rate (when unemployment rate is low the additional demand for labor will tend to increase wages. In Bulgaria where unemployment rate is high) the increased demand for labour has not a significant increasing effect on wages). Hence household income grows more in the case of Romania.

4 Scenario Set II – EU40%, ETS -43% and non-ETS -30%

4.1 EU40_43_30 - Least cost scenario

As the cost-efficient allocation between ETS & non-ETS emission reductions in the study (GCF, 2014) was different from the one presented in the European Commission’s 2030 Impact Assessment and used by Hermann et al. (2014)

(this can be attributed to a number of reasons including differences in the model version chosen and specific scenario assumptions e.g. on the implementation of non-EU GHG policies etc.) it was decided to run two additional simulations:

1. A version of the least cost case where the EU-wide 40% GHG emission reduction would be split to a 43% reduction in the ETS sectors and to 30% reduction in the non-ETS sectors. This scenario is named EU40_43_30 hereafter.
2. An additional burden sharing scenario based on the EU40_43_30 scenario, called EU40_43_30 BS.

The total EU GHG emission reduction target is still -40% compared to 1990 emissions. Table 10 provides the macroeconomic impacts for Bulgaria and Romania.

Table 10: GDP, Bulgaria and Romania in EU40_43_30 least cost scenario

		ETS -43% /Non ETS -30%	
		2030	2015-2030
% change from reference	Romania	-0,65%	-0,28%
	Bulgaria	-1,23%	-0,81%
	EU28	-0,24%	-0,13%
Absolute change from reference (bn euro)	Romania	-0,7	-3,9
	Bulgaria	-0,4	-3,8
	EU28	-37	-269

Source: GEM-E3-NMS

The emission reduction targets for ETS (-43%) and non-ETS (-30%) were met by introducing two additional constraints that generated the following carbon prices: 59 euro/t CO₂ for ETS and 113 euro/t CO₂ respectively for non-ETS in 2030.

4.2 Burden sharing scenario – EU_40_43_30 BS

4.2.1 Scenario definition

The burden sharing allocation of the national GHG emission of the EU40_43_30 scenario is based on Hermann et al. (2014). These national targets involve only the EU28 non-ETS GHG emissions that in this scenario setup amount to 1,800 bn. tonnes of CO₂ eq. in 2030. According to this scheme, Romania and Bulgaria receive additional 15 and 8 Mt of CO₂ respectively in 2030 compared to the EU40_43_30 least cost scenario.

³ -30% as compared to -23% in the previous case.

Table 11: Burden sharing allocation based on GDP/Capita rule (non-ETS -30%)

Reduction in 2030 based on Burden Sharing (GDP/Capita)					
Country	non-ETS reduction compared to 2005	Country	non-ETS reduction compared to 2005	Country	non-ETS reduction compared to 2005
Austria	-40%	France	-35%	Netherlands	-42%
Belgium	-39%	UK	-32%	Poland	-10%
Bulgaria	-4%	Greece	-22%	Portugal	-18%
Cyprus	-24%	Hungary	-10%	Slovakia	-13%
Czech Republic	-16%	Ireland	-42%	Slovenia	-20%
Germany	-36%	Italy	-30%	Sweden	-44%
Denmark	-51%	Lithuania	-9%	Romania	-6%
Spain	-26%	Luxembourg	-72%	Croatia	-11%
Estonia	-12%	Latvia	-9%	EU28	-30%
Finland	-39%	Malta	-17%		

Source: Hermann et al. (2014)

The non-ETS carbon price that is the basis for the calculation of monetary effects of permit allocation in the EU40_43_30 BS scenario increases up to ca. 120 euro/t CO₂ in 2030. This is double the price of the EU40 EU BS scenario where the non-ETS reduction target is only 23% (in this case: 30%). This difference and the higher amounts of additional permits are reasons for higher monetary transfers to Bulgaria and Romania.

Table 12: Carbon prices for Scenario Set II– euro/t CO₂

		2015	2020	2025	2030
Reference Scenario	Carbon Price*	12	20	29	44
EU40_43_30 least cost scenario	ETS-Carbon Price	12	20	32	41
	non-ETS-Carbon Price	12	19	35	113
EU40_43_30 BS scenario	ETS-Carbon Price	12	20	32	47
	non-ETS-Carbon Price	12	20	36	120

Source: GEM-E3-NMS,* nod distinction between ETS and non-ETS prices in this scenario

In the following table the corresponding emission permits for the EU40_43_30 least-cost scenario and the additional permits based on the burden-sharing mechanism are depicted.

Table 13: Emissions and emission permits, Scenario Set II, Bulgaria, Romania in Mt CO₂ eq

	non-ETS emissions from EU40_43_30 EU least cost scenario	Additional permits compared to efficient allocation	non-ETS emissions from EU40_43_30 EU least cost scenario	Additional permits compared to efficient allocation
	Bulgaria		Romania	
2015	20.3	0.8	61.7	1.5
2020	18.7	3.1	61.1	6.1
2025	17.4	5.5	56.9	10.7
2030	13.4	7.8	43.7	15.3

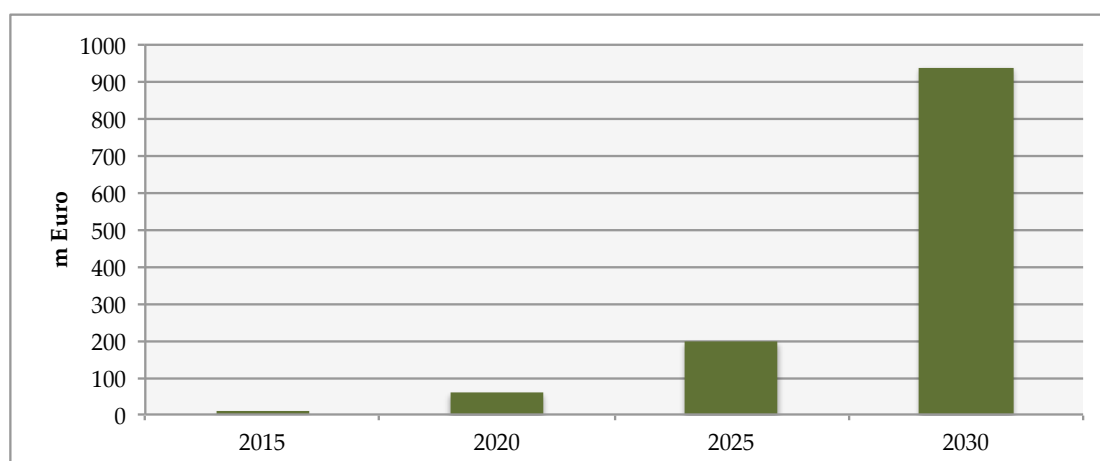
Source: GEM-E3-NMS

4.2.2 Results for Bulgaria

Bulgaria receives 942 m euro in allocated permits, which represents 2.6% of its GDP in 2030. The trajectory of permits in the period 2015-2030 is presented in Figure 3.

As in the previous scenario, firms use part of this amount to reduce their unit production costs and households receive part of it as a lump sum transfer to support their income. The additional household income is mainly used to increase consumption of goods and services. Savings are not significantly altered as interest rates remain similar to those of the reference case. Increased consumption leads to higher level of production and hence higher employment (employment in this scenario increases by 1.2% as compared to the least cost case in 2030). The increased demand for labour and additional production lifts wages and the rate of return on capital. Despite firms using their emission allowances to reduce production costs, production costs increase as the prices of the primary production factors climb up. Higher wages and employment further boost consumption (the total effect in household consumption is 570 m euro (2.7% of GDP in 2030)).

Figure 3: Benefit from permit allocation Bulgaria EU40_43_30 BS, in m euro



Source: GEM-E3-NMS

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Most of the additional consumption is directed to sectors that are related to the decarbonisation of the economy, e.g. equipment, thus increasing imports in these sectors. Exports are negatively affected both by the increase of production costs and by the slackened EU demand.

Table 14: EU40_43_30 BS Bulgaria results on macroeconomic aggregates, 2030

	Least Cost	Burden Sharing		
2030	In bn euro		Difference In bn euro	% difference from least cost scenario
GDP	34	34	0.18	0.53%
Benefit from permits allocation	0	0.94	0.94	
Consumption	21	22	0.57	2.70%
Investment	7	7	0.10	1.40%
Exports	19	19	-0.13	-0.68%
Imports	19	19	0.36	1.92%
Employment (m. persons)	2.63	2.66	0.03	1.14%

Source: GEM-E3-NMS

Table 15: EU40_43_30 BS Bulgaria results on macroeconomic aggregates, 2015 -2030

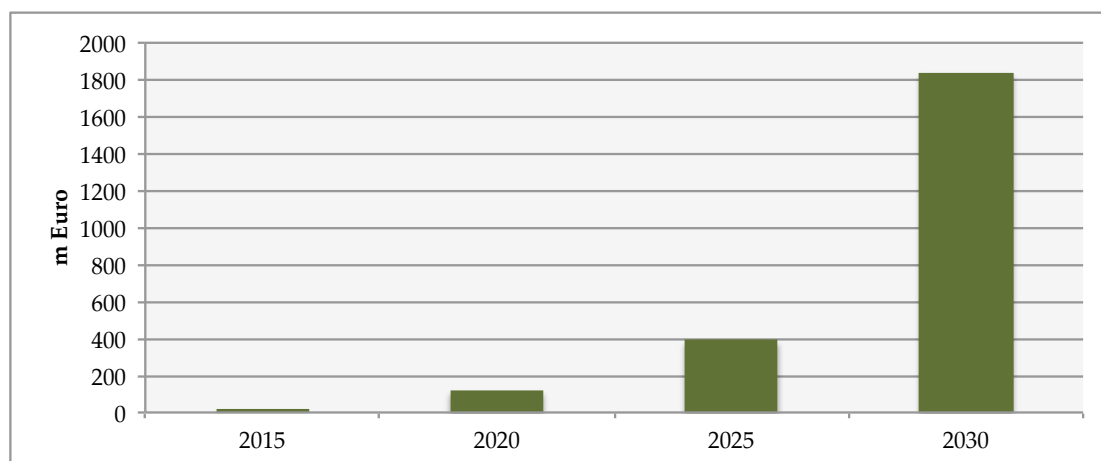
	2015-2030	2015-2030
	Cumulative difference from least cost in bn euro	Cumulative % difference from least cost scenario
GDP	0.66	0.15%
Benefit from permits allocation	3.68	
Consumption	1.99	0.69%
Investment	0.34	0.38%
Exports	-0.37	-0.16%
Imports	1.27	0.50%
Employment (m. persons)	0.14	0.32%

Source: GEM-E3-NMS

4.2.3 Results for Romania

Romania benefits from the permit allocation with an extra 1830 m euro, which increases real wages and employment, boosting consumption by 2650 m euro (3.7% of GDP) in 2030 (see Figure 4 for the trajectory of benefits).

Figure 4: Benefit from permit allocation Romania EU40_43_30 BS, in m euro



Source: GEM-E3-NMS

As in the canonical burden sharing scenario, the largest proportion of the increase in consumption is directed toward the domestic economy leading to higher effects on consumption and to lower effects on imports. Again, this structural difference between the two economies together with the higher unemployment rates in Bulgaria, explain why Romania benefits more than Bulgaria from additional permits.

Table 16: EU40_43_30 BS Romania results on macroeconomic aggregates - 2030

	Least Cost	Burden Sharing		
2030	In bn euro		Difference from least cost scenario (bn euro)	Difference from least cost scenario (%)
GDP	101	102	0.99	0.98%
Benefit from permits allocation	0	1.83	1.83	
Consumption	72	75	2.65	3.67%
Investment	22	22	0.29	1.34%
Exports	39	38	-1.01	-2.63%
Imports	41	42	0.93	2.30%
Employment (m. persons)	7.87	7.98	0.12	1.40%

Source: GEM-E3-NMS

Table 17: EU40_43_30 BS Romania results on macroeconomic aggregates - 2015 - 2030

	2015-2030	2015-2030
	Cumulative difference from least cost (bn euro)	Cumulative difference from least cost scenario (%)
GDP	3.664	0.27%
Benefit from permits allocation	7.178	
Consumption	9.554	0.95%
Investment	1.049	0.36%
Exports	-3.641	-0.73%
Imports	3.298	0.60%
Employment (m. persons)	0.412	0.33%

Source: GEM-E3-NMS

5 Comparison

The following two tables (Table 18 and 19) show the results of the two scenario sets, each comparing the least cost scenario with the burden sharing scenario for (a) a 50%/23% ETS/-non-ETS split resulting from the NMS-project and (b) on a 43%/30% split implemented for this study. Therefore the results reflect a possible range of economic effects of an EU burden sharing system.

In both scenario sets and for both countries, the impact of the additional emission permits is positive.

As expected the impact on Romanian and Bulgarian GDP is much higher in the EU_40_43_30 BS scenario compared to the EU40 BS as the burden sharing allocation implies higher income transfers. The main findings however remain the same as Romania is found to benefit more than Bulgaria.

Table 18: Comparison of cumulative differences, EU40 BS vs. EU40_43_30 BS - Bulgaria

	2015-2030	2015-2030
	EU40 BS	EU40_43_30 BS
	bn euro	
GDP	0.41	0.8
Benefit from permits allocation	2.04	3.68
Consumption	1.05	1.99
Investment	0.19	0.34
Exports	-0.15	-0.37
Imports	0.68	1.27

Source: GEM-E3-NMS

Table 19: Comparison of cumulative differences in EU40 BS vs. EU40_43_30 BS - Romania

	2015-2030	2015-2030
	EU40 BS	EU40_43_30 BS
	bn euro	
GDP	2.17	3.66
Benefit from permits allocation	3.57	7.18
Consumption	5.28	9.55
Investment	0.59	1.05
Exports	-1.89	-3.64
Imports	1.81	3.30

Source: GEM-E3-NMS

6 Conclusion

This study assessed the macroeconomic effects on the Bulgarian and Romanian economies of an EU wide burden sharing scheme to reduce GHG emissions. The implemented burden sharing scheme follows a GDP per capita approach, adopted from Hermann et al. (2014). According to this burden sharing mechanism and based on the two scenario sets Bulgaria and Romania could receive benefits from permits allocation in the order of 2.04 – 3.68 bn euro (Bulgaria) and 3.57 – 7.18 bn euro (Romania).

The main finding is that both economies benefit from the proposed burden sharing allocation of GHG emissions since it leads to higher GDP and employment rates as compared to the least cost scenarios. The additional GDP in percentage terms compared to the least cost case in 2030 is 0.5% for Bulgaria and 1% for Romania. The increase in GDP for both countries is mainly driven by increased investment and household consumption.

The burden sharing scheme implies higher initial financial transfers (as a percentage of GDP) to Bulgaria compared to Romania. However, Romania benefits more than Bulgaria, since the additional demand (induced by the transfers) for goods and services used for GHG abatement is mainly absorbed by domestic production sectors. The qualitative findings are the same even when different GHG emission targets for non-ETS sectors are considered.

Additionally to these short-term and mid-term effects, there are positive long-term effects as well. The reduction of fossil fuel imports and the diversification of energy supply will make the economies more resilient in the long-term. The quantification of these are however beyond the scope of the current study.

On a political level, the results of this study imply that it would be beneficial for low income member states if the EU installs a mechanism for the non-ETS sectors which facilitates their adjustment process by taking into account possible financing constraints. This mechanism would help bridging the gap

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between an equity-based burden sharing approach and the cost-efficient allocation of emission reductions. Such a mechanism would not only benefit low-income member states, increases the plausibility of attaining the non-ETS targets, only at a marginal expense for the EU as a whole. The actual design of such a mechanism, however, is also beyond the scope of this study.

References

EUC (2014), *A policy framework for climate and energy in the period from 2020 up to 2030*, European Commission, COM(2014) 15 final, <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014SC0015&from=EN>

GCF (2014), Meissner F., Mangalagiu D., Paroussos L., Jaeger C., *New Member States - Climate Protection and Economic Growth: Case Study Bulgaria and Romania*, Global Climate Forum, Study for the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

Hermann H., Healy S., Graichen V., Gores S., (2014), *Options for non-ETS target setting in 2030*, Oeko Institut.