



# The cost of climate change on households and families in the EU

EXECUTIVE SUMMARY



European Economic  
and Social Committee



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*This study is based on data from Eurostat, Household Budget Survey, 2010 and 2015. The responsibility for all conclusions drawn from the data lies entirely with the authors.*

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## Foreword



### By Séamus Boland

*President of the Civil Society Organisations' Group  
European Economic and Social Committee*

I am pleased to present this study on "*The cost of climate change on households and families in the EU*" carried out by the Euro-Mediterranean Centre on Climate Change (CMCC). I believe its findings will act as an important aid to the formulation of climate change policy, particularly policy which speeds up the achievement of international targets to reduce carbon emissions set by the EU along with its partners.

One of the main frustrations for the implementation of climate change directives was and continues to be the perceived resistance among electorates, coupled with a reluctance by governments to develop imaginative measures, which are attractive and feasible to householders in terms of implementation. Change of behaviour is extremely difficult in any circumstance and requires strong communication between stakeholders. It will be necessary for people to 'own' the change and to become leaders in their own community, so that others can have the confidence to follow them. Fortunately, many individuals, through their membership of civil society organisations, are intensely involved with communities stricken by fires and floods, which have resulted in homelessness, dislocation and loss of life. It is their experience that needs to be listened to, and even more importantly, their advice.

However, behaviour will undoubtedly be influenced by the cost of change to households. For many households, be they families, single- or multiple-person households, the cost of climate change could be prohibitive and an added source of pre-existing anxiety towards change. As the impact of climate change becomes more and more visible (fires, flooding and extreme weather events), it has become clear that the budgets of all Member States must include a contingency to deal with the consequences of such change. It is equally clear that continuous demand on these budgets will become unsustainable, unless we change radically the behaviour of all people. For people already affected by poverty, this request to change behaviour will be extremely difficult in terms of having the resources to support them. The danger is that if people do not change or worse, become resistance enablers, then we will have to accept that valuable time will be lost.

Therefore, the design and even the distribution of social transfer systems need to be prioritised with urgency. Most of the Member states are already planning such systems. However, time is running out and if we are to take seriously the statement of António Guterres, Secretary-General of the United Nations, that the planet is boiling, then we also know that time has run out.

It is our contention that this study will be extremely informative to the agencies tasked with bringing about change. I am sure that it will stimulate the discussion on the distributional implications of climate change and it is in itself a call for further research.

*Séamus Boland  
September 2023*

## Abstract

This study investigates the major climate-related risks for households in the EU by quantifying the relationship between a set of selected climate-hazards metrics, households’ income by source, and sector-specific expenditures, capturing both the climate induced cost of impacts and adaptation measures. This analysis is complemented with the assessment of mitigation policy costs for households using a mixed modelling approach.

The report highlights the distribution of climate change costs by type (income source- and selected good/service expenditure-related) across regions (NUTS1 level) and socioeconomic characteristics of households (poor, medium income and rich households). In addition, the implications of climate change costs on income distribution and risk of poverty are analysed. The vulnerabilities of EU households highlighted in this study call for risk-specific policy measures at national and EU level and the transversality of climate change costs, especially in Southern EU, will require horizontal policy integration.

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This report provides a comprehensive assessment of the **economic costs of climate change impacts, adaptation, and mitigation for EU27 households**. It examines three major channels through which the climate cost can affect households, i) changes in **expenditure** patterns, ii) reductions or increases in **labour productivity**, iii) reductions or increases in the availability and value of **assets**.

A review of the recent literature on the costs of climate change impacts and adaptation in Europe reveals important gaps.

1. Most **economic impact assessments have focused on the economy-wide costs of selected climate change impacts or adaptation actions or mitigation policies**. There are no studies quantifying all three dimensions jointly. Adaptation costs are usually the least analysed dimension.
2. In the **economy-wide impact assessments**, the costs of climate change are measured in terms of GDP or sectoral output changes; the overall impact on household is in general disregarded and so is the distribution of this impact across households.
3. Other **modelling literature** have focused on the **direct impacts** of climate change on key production factors and assets (labour, land, and capital), and commodities/services (energy, health, food).
4. The **empirical literature** has mainly analysed the climate change economic implications for specific sectors, commodities, and services in selected regions/countries.

The **study statistically assesses the empirical relations between climate-related hazards** (mean temperature, Cooling Degree Days -CDDs-, Heating Degree Days -HDDs-, Standard Precipitation Index -SPI-, and burnt area), **various expenditure types** (health, food, energy, insurance, total expenditure), **and income sources** (sectoral labour income, total labour income, imputed rent which approximate housing value, and monetary income, which includes labour income, imputed rent, profits, investments and transfers) in EU27<sup>1</sup>. The study sets off from historical data recorded in two waves (2010 and 2015) of the European Household Budget Surveys (HBSs) by Eurostat and from ERA5 meteorological data, which provides the most complete currently possible picture of past weather and climate<sup>2</sup>. The estimated

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<sup>1</sup> The analysis covers all EU28 Member States for 2010 and 2015 (Eurostat Household Budget), excluding Austria (all years) and the Netherlands for 2010. We focused our analysis on EU27, i.e. we excluded the UK that is no longer part of the EU since 2020.

<sup>2</sup> ECMWF Reanalysis v5 (ERA5): <https://www.ecmwf.int/en/about/media-centre/focus/2023/fact-sheet-reanalysis>

empirical relationships are used to develop **two scenarios describing the future potential costs of climate change impacts and adaptation for households** when considering future climate projections from CMIP6<sup>3</sup> and socioeconomic pathways from SSP<sup>4</sup>.

In addition, the study assesses **the implications for EU households of two mitigation scenarios** through modelling and microsimulation analysis.

The outcome of the analysis is a characterization of the costs of climate change impacts and adaptation in 2050 for EU households living in different **NUTS1 regions** under moderate and severe climate change scenarios<sup>5</sup>. The climate change cost definition includes changes in **income sources** as well as variations in **expenditure patterns** that may be related to specific poverty issues. The results are detailed for **three socio-economic groups** (terciles) defined in terms of the equivalised annual average expenditure of households (poor, medium income, and rich households). Poverty and inequality metrics at country level give a synthesis of climate change cost for EU households.

The assessment of economic costs of climate change impacts and adaptation **reveals a North-South gradient**. Health, food, and electricity expenditure increase mostly in Southern EU and fall or remains constant in Northern (and Eastern) EU. The contraction in labour income prevails in the South of the EU and the negative impact on monetary income (labour income, asset/investment remuneration and social transfers) affects nearly all EU countries, with the exception of the Eastern regions.

**Climate-induced health expenditure** of EU households marks the highest increase among all expenditure types, rising by 0.3% and 6.2% under moderate and severe warming, respectively. **The highest increase** in health expenditure is projected to take place in **Cyprus and Greece**, followed by **Spain, Croatia, Italy, and Portugal** (Figure S1, Panel A). In the severe warming scenario, rising health expenditure also characterises regions in North and East Europe. **In Southern regions, the effect will be regressive**, meaning that the poorest households would face the largest increase in health expenditure compared to the richer socio-economic groups.

Climate change will also cause an increase in average household **food expenditure** in most EU countries, between 0.81% and 0.74% across climate change scenarios. **The highest increase in food expenditure is expected in Cyprus, Greece, Spain, Italy, and Portugal** (Figure S1, Panel B). The climate related increase in food expenditure is regressive in Eastern EU, i.e. the poorest households would face a significantly larger increase in food expenditure.

**Energy expenditure** will slightly drop in the EU, between 0.5% and 1% across climate change scenarios. The drop characterises most of the EU Member States excluding the very North of Europe, namely Denmark, Estonia, Finland, Ireland, and Sweden (Figure S1, Panel C). This is mainly due to a **contraction of gas expenditure** by 14% (19%) observed across all EU under the moderate (severe) climate change scenario (Figure S1, Panel E). This result masks a **moderate increase in electricity expenditures** by 3.3% (4.2%) under the moderate (severe) climate change scenario (Figure S1, Panel D). Poor households would need to increase electricity expenditure relatively more than rich ones in Northern and Southern EU<sup>6</sup>.

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<sup>3</sup> Specifically, we consider the NEX-GDDP-CMIP6 global daily downscaled bias-corrected projections (DOI: 10.7917/OFSG3345) using the median value of 14 global climate models (ACCESS-ESM1-5, BCC-CSM2-MR, CMCC-CM2-SR5, CMCC-ESM2, FGOALS-g3, GFDL-CM4, GFDL-ESM4, GISS-E2-1-G, MIROC-ES2L, MIROC6, MPI-ESM1-2-HR, MPI-ESM1-2-LR, MRI-ESM2-0, orESM2-LM), using the air temperature and precipitation variables.

<sup>4</sup> O'Neill et al. (2014)

<sup>5</sup> Severe impacts are associated with an end-of-the-century temperature increase by 4.8°C compared to pre-industrial levels whereas moderate impacts with an end-of-the-century temperature increase by 2.9°C. Technically, these two scenarios correspond to SSP245 and SSP585.

<sup>6</sup> These results do not take into account the recently observed prices spikes.

Only half EU households in the sample relies on **insurance to protect their dwellings** from multiple hazards, and this kind of private adaptation would be intensified mainly under severe climate change impacts. At the EU level, insurance expenditure is projected to increase due to severe climate change impacts (+10.4 % on average), driven by very large increases in Lithuania and Greece (Figure S1, Panel F).

At the EU level, the **total expenditure** of households decreases by 1.2% (1.5%) under the moderate (severe) climate change scenario (Figure S1, Panel G) compared to a no climate change scenario (no temperature increase compared to the historical period, 1995-2014). The reduction of expenditure, mainly concentrated in the South of EU and in Greece (-11% and 10.4%), is probably related to budget constraints namely a concomitant contraction of labour income due to climate change that can be observed in Figure S1 (Panel H and M). Households living in the South of EU will experience a rise of their spending on health, electricity, food due to climate change, but the overall contraction in income would limit households’ ability to cope with the residual costs of climate change and to adapt, without increasing their risk of falling below the poverty line.



Figure S1– Percentage changes in climate change impact and adaptation costs for EU households in 2050 under moderate and severe climate change scenarios with respect to a future without climate change.

Climate change will also influence income sources. Overall impacts on **labour income** are small (0.73% and -0.02% under the moderate and severe climate impacts). **The highest reduction in labour income is registered in Greece, -5.2% (-4%),** followed by France, Croatia, and Hungary (Figure S1, Panel H). The regional distribution of impacts reflects the different economic structure of regions. At the EU level, moderate (severe) impacts increase **agricultural income** by 5.5% (8.6%), **industrial income** by 2.4% (0.8%), and **service income** by 4.3% (1.7%). The magnitude of impacts is very different across sectors and ranges between -50% and 150% in agriculture, and -20% and 10% in industry and services. Regarding **agriculture, the areas at greatest risk are in Greece, Hungary, and Eastern Spain.** The economic impacts of climate change scenarios for households receiving their income from the industry and service sectors reveals the same North-South divide found for agriculture. The projected loss across all sectors in Greece highlights a structural fragility of this country towards future climate scenarios. The income loss in the South of EU affects poor households more than rich ones and impact, lower in magnitude but similarly regressive, emerges also in the Northern EU under severe climate change scenario.

The overall impact on **the value of EU dwellings** (approximated by **imputed rent**) under climate change ranges between -0.2% and -0.4% (Figure S1, Panel L). The temperature change (cold and hot extremes) as well as exposure to flood risk are the main drivers. At the regional level, this joint effect leads to an appreciation of the value of dwellings in the North, (e.g., in Finland, Lithuania and Latvia) and to a reduction in the South (e.g., Cyprus, Greece, and Italy).

The overall climate change impact on income sources (**monetary net income** including labour income, asset value and social transfers, net of taxes) is negative in the EU reducing by 0.8 % (1.1%) under the moderate (severe) climate change scenario. Monetary net income shrinks across almost all terciles and macro-regions, probably due to the negative effect on investments and rent revenues, despite the redistributive effect of social transfers. **The highest losses are observed in the Southern EU.** The impact is progressive in all macro-regions excluding the North EU region under severe warming.

Table S1 highlights in which regions households are negatively (orange) or positively (green) affected by climate change and whether poor households bear the higher (regressivity, R) or lower (progressive, P) burden than the rich households. The areas towards which corrective national and EU policies should focus are those highlighted in orange. However, the **priority should be given to areas characterised at the same time by negative impacts on households and regressivity.** In the case of severe climate change scenario, these are:

- Electricity expenditure, insurance expenditure, labour and monetary income in the Northern EU;
- Food expenditure in the Eastern EU;
- Health expenditure, electricity expenditure, insurance expenditure and total labour (service) income in the Southern EU.

Table S1: Cost of climate change impacts and adaptation by type and macro-region across scenarios. Green cells highlight a reduction of costs (reduction of expenditure or increase in income), orange cells highlight an increase in costs. The distribution of cost across terciles can be progressive (P) or regressive (R)

	Moderate climate change (SSP2-4.5)											
	Expenditure						Income					
	Health	Food	Energy	Gas	Electricity	Insurance	Total labour	Agriculture	Industry	Service	Imputed rent	Monetary
North	P	P	P	P	R	P	R	P	P	R	P	P
West	R	P	R	P	P	P	P	R	P	P	R	P
East	R	R	P	R	R	P	R	R	R	R	R	P
South	P	P	R	P	R	R	R	P	P	P	P	P

Severe climate change (SSP5-8.5)												
	Expenditure						Income					
	Health	Food	Energy	Gas	Electricity	Insurance	Total labour	Agriculture	Industry	Service	Imputed rent	Monetary
North	R	P	P	P	R	R	R	P	P	P	R	R
West	P	P	R	P	P	P	R	R	R	R	R	P
East	R	R	P	R	P	R	R	P	P	P	P	P
South	R	P	R	P	R	R	R	P	P	R	P	P

The report then focuses on the implications of climate change impacts, adaptation and mitigation on income inequality and **population at-risk-poverty**. The climate-induced poverty prevalence computed with monetary net income increases for almost all analysed countries suggesting that **social transfers are not sufficient to compensate for the climate-induced losses in the asset and labour revenues**. The climate impact hitting poor households through assets can be inferred also by looking at the lower magnitude and heterogeneity of change in the population at-risk-poverty measured on the labour income. The mitigation policies seem beneficial to reduce poverty prevalence (computed on the labour income) in all analysed EU countries.

To conclude, the report highlights that:

- EU subnational regions and socio-economic groups will bear differentiated impacts from climate change.
- The analysis covers major types of expenditures and various sources of income that are impacted by climate change or used to adapt to it. Losses affecting income sources are the common measures of climate costs, we complement them with climate-induced expenditures that are a direct consequence of impacts or that are used to adapt to climate change.
- The increased household expenditure on specific goods/services such as health, food and energy can put a heavy burden on poor households, who would face a reduction in the capability to diversify their consumption and limitations in their ability to adapt, both of which would increase their likelihood of experiencing multidimensional poverty.
- Negative and regressive (worsening the wellbeing of the poor households) impacts on a wide set of expenditure goods/services and income sources will be observed in Southern Europe (Greece in particular), marginally in the Northern and Eastern EU (food expenditure).
- Poor households living in the South of Europe will increase their spending on health, electricity, food; their condition is further worsened by the overall contraction in income.
- Climate change impacts increase the population at risk of poverty across EU; mitigation scenarios will likely reduce it, favouring a faster growth of low-skilled labour remuneration compared to high-skilled one.
- Income support measures for low-income households, as currently planned in Greece and Romania, should be strengthened and tailored to the most vulnerable segments of a given population. The potential role of social transfers in compensating for the impacts of climate change on poverty and inequality calls for more research on the role of compensatory measures related to this specific risk.
- Horizontal policy integration is expected to lead to more effective policy making compared to a silo-thinking approach considering the nexus between agriculture, energy, and health, which will face major disparities and could contribute to the risk of compounded adverse outcomes for households.



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