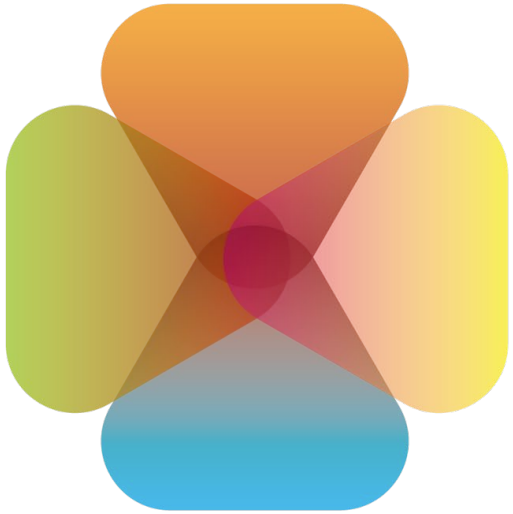

ACCREU
Assessing Climate Change Risk in EUrope

The macroeconomic dimension of adaptation in the EU: fiscal and distributional Implications & integrated policy assessment

Brussels, November 13 2026

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on behalf of the WP4 team

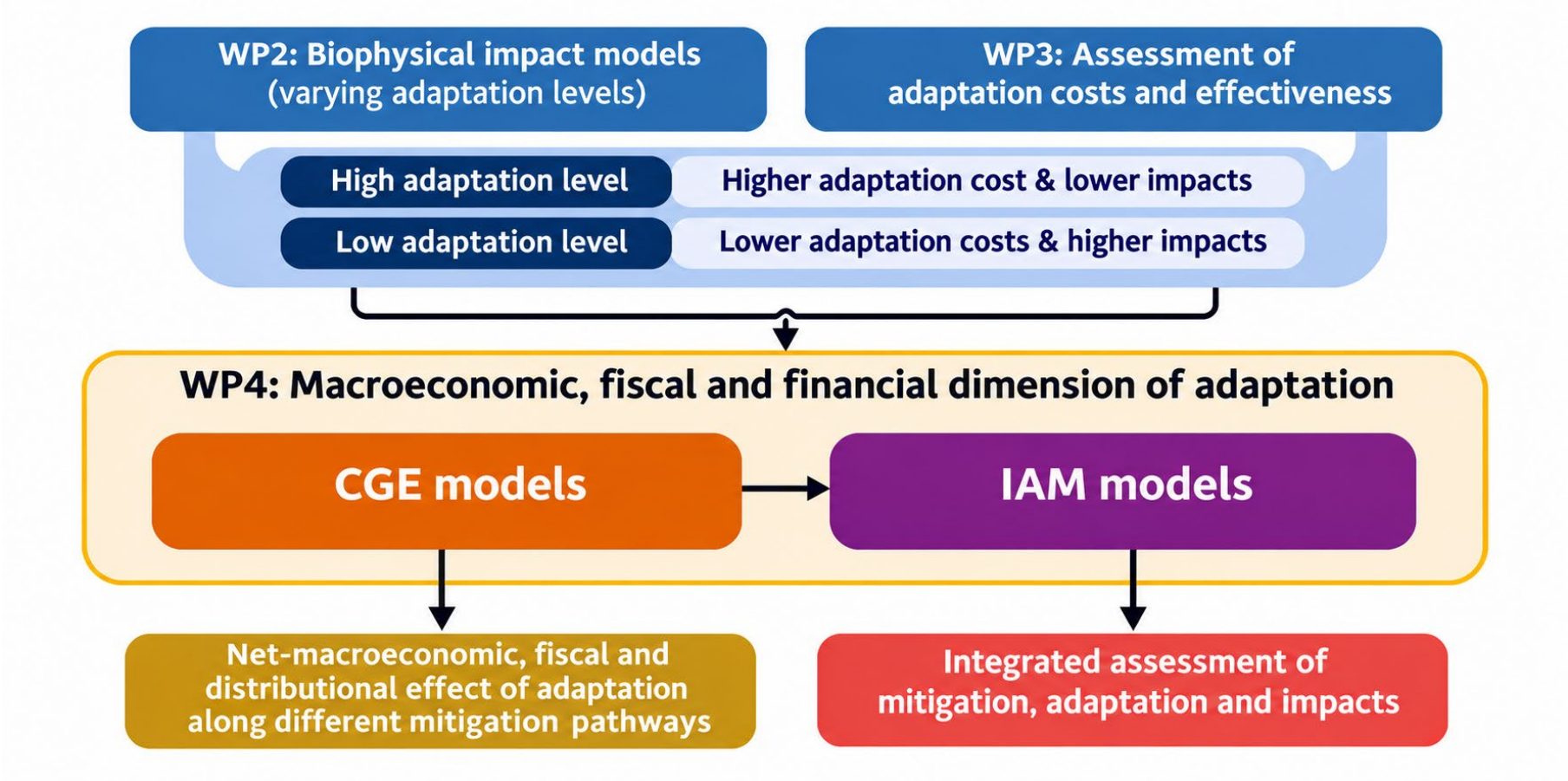
Main objectives of WP4

Goal 1: Deliver **ready-to-apply methods to integrate different levels and types of adaptation into macroeconomic models**

Goal 2: Develop the **integrated, macroeconomic analysis** of climate risk and adaptation, accounting for the **distributional, fiscal, and financial implications** across households, sectors, and regions

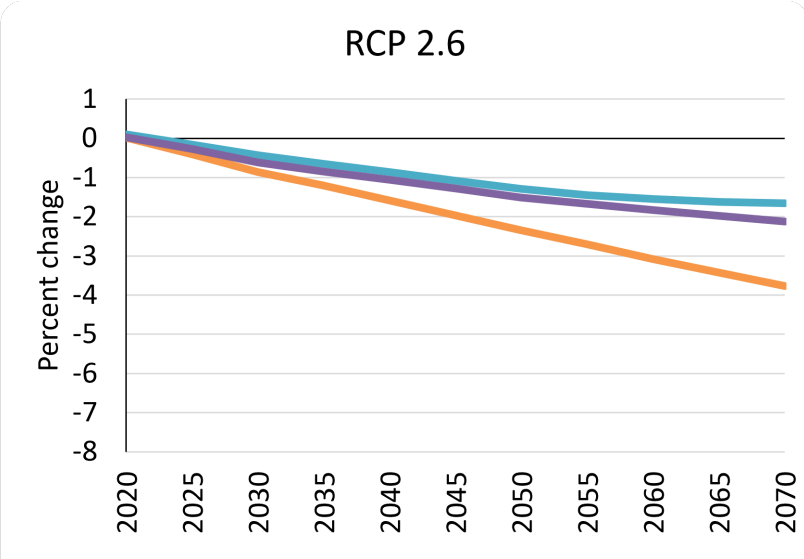
Goal 3: Identify **optimal, cost-effective and robust adaptation-mitigation policy combinations**

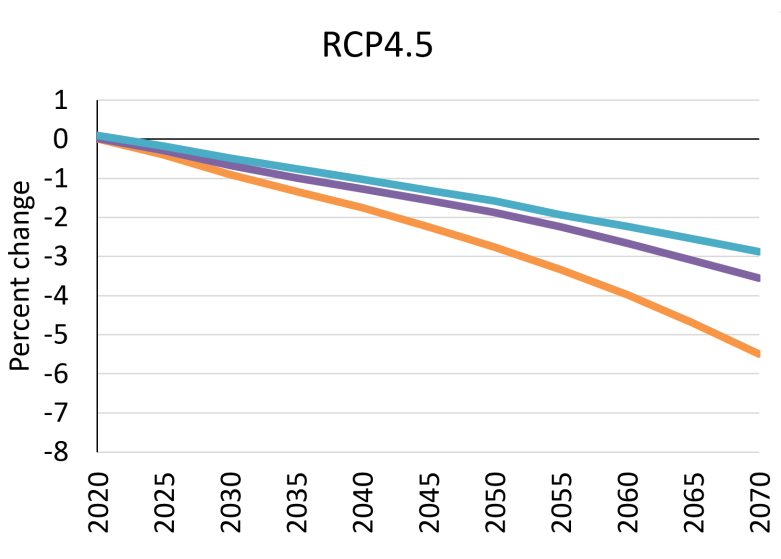
ACCREU workflow

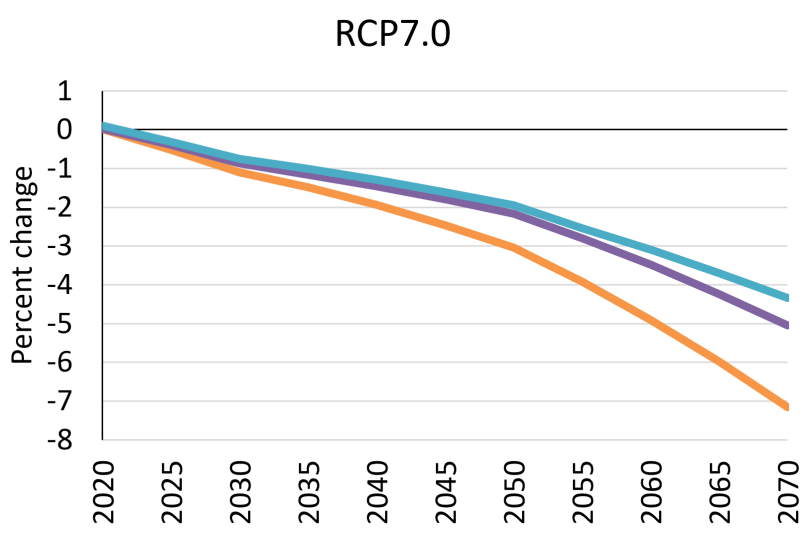


Analysis of macroeconomic and fiscal effects

Aggregate GDP effects EU27+UK





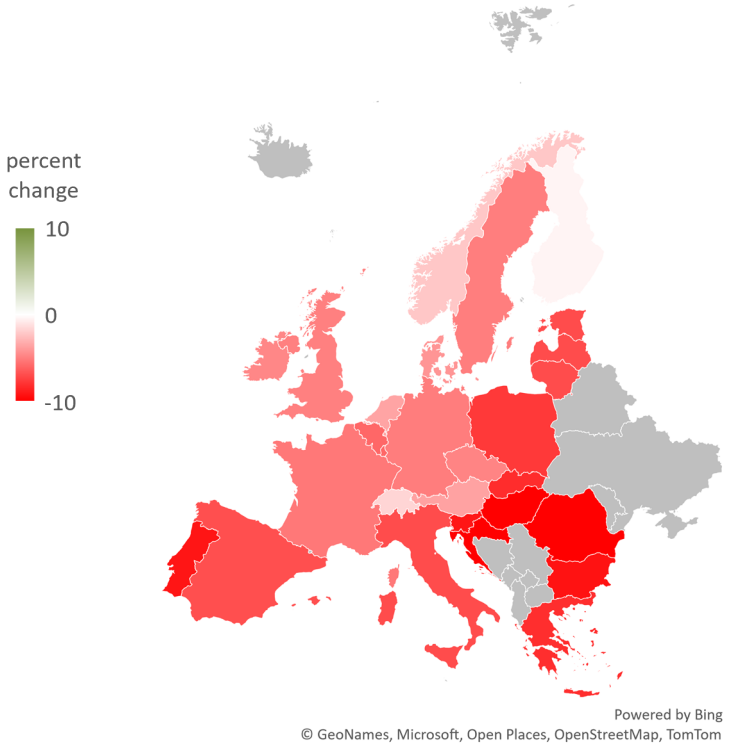


- GDP losses occur across all climate and adaptation scenarios
- Losses increase over time
- Macroeconomic effectiveness of high adaptation levels
- Higher warming scenarios are associated with higher losses & residual costs

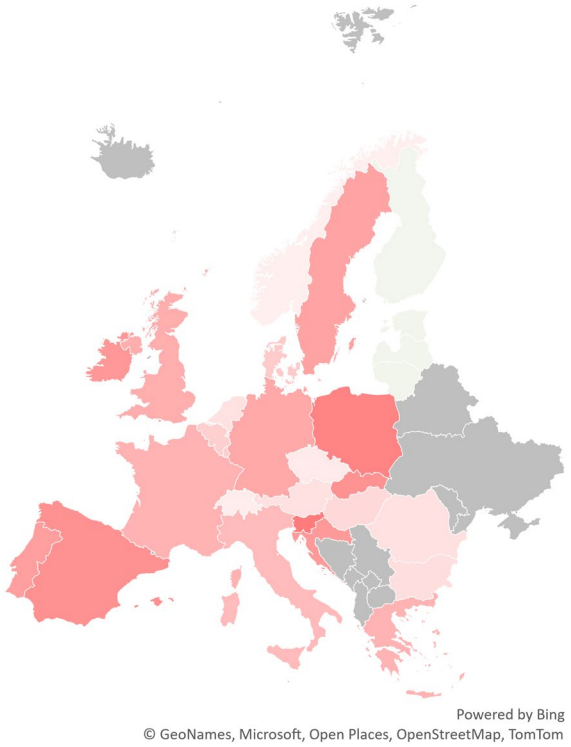
Adaptation levels:
low medium high

GDP effect by country in 2070 for RCP4.5

Low adaptation



High adaptation

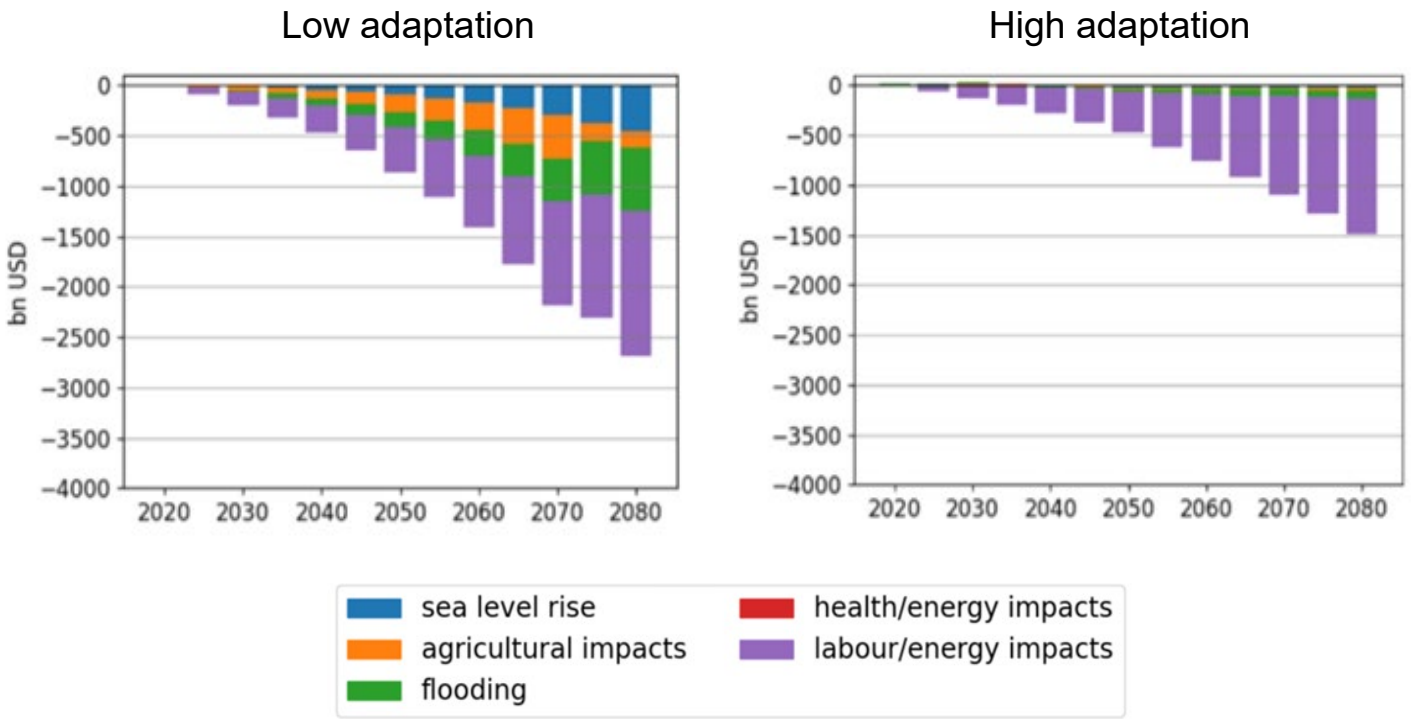


- High adaptation is consistently better in terms of GDP in all countries

- Significant regional differences

→ Central-Eastern Europe and Southern Europe are most at risk from climate change impacts

Aggregate GDP effect by impact chain for RCP4.5



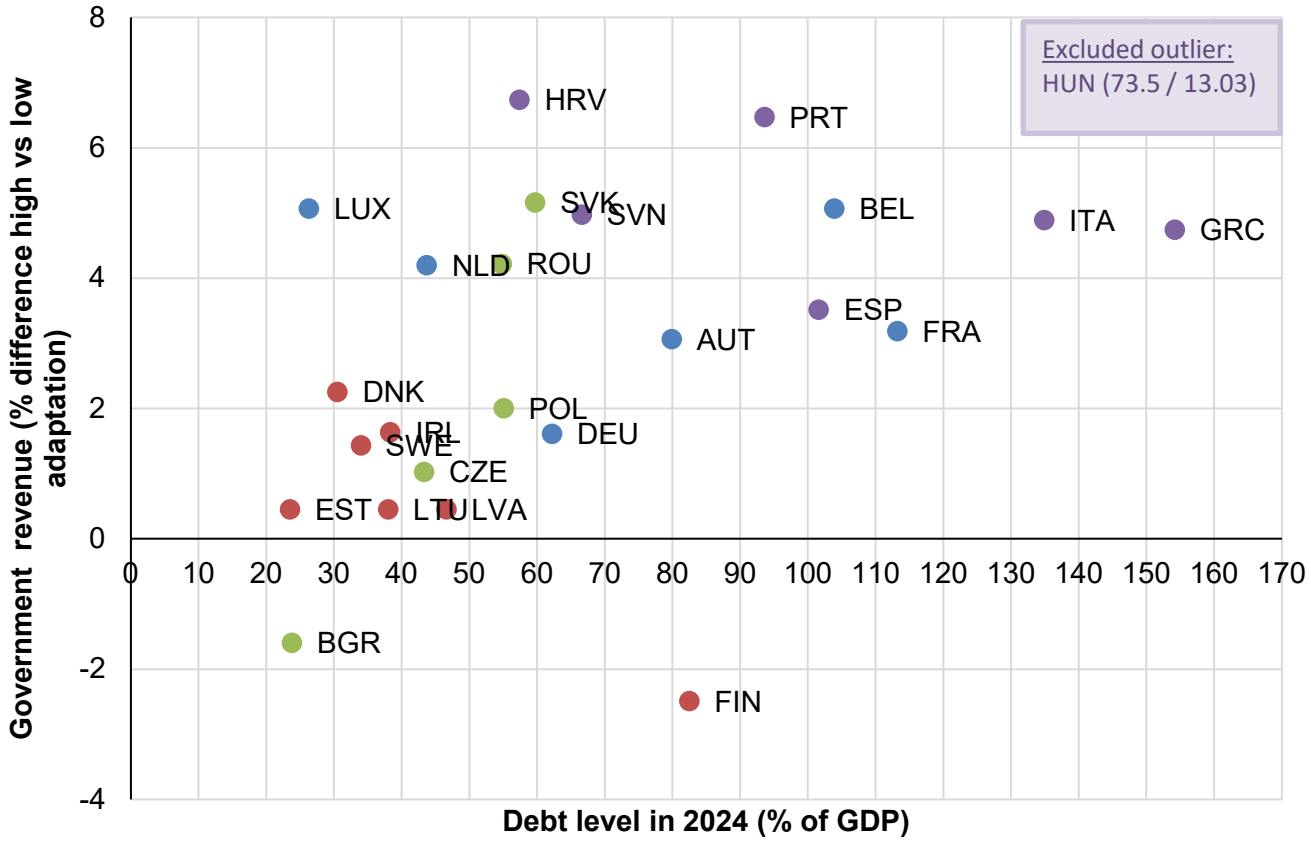
- Losses in labour supply and productivity, moderated by cooling, are the most prominent driver
- Impacts from sea level rise, river flooding and agriculture can be reduced considerably through high levels of adaptation

Fiscal effects: revenue and expenditure side



- Climate impacts reduce the tax base and thereby government revenue
- Given a balanced budget this reduces government expenditures
- Adaptation investment limits other spending options, especially in 2050
- By 2070, there are significant net-benefits of high adaptation on fiscal space relative to low adaptation

Net fiscal gains from adaptation relative to government debt



Debt-GDP-ratio: https://ec.europa.eu/eurostat/web/products-euro-indicators/w/2-22042025-ap

- All countries but BGR and FIN gain fiscal space by 2070 from high adaptation
- Role of adaptation in long term budget consolidation e.g., in GRC, ITA, FRA, ESP

Main take-aways

Significant macroeconomic costs of climate change, particularly under high warming scenarios by 2070

Strong regional disparities, with Central-Eastern and Southern Europe most vulnerable

Clear macroeconomic and fiscal benefits of adaptation, but residual damages remain

High adaptation levels enhance fiscal space, especially in 2070, as benefits of upfront investments materialize

Analysis of distributional effects

Deliverable 4.2 overview

D4.2 explores the **distributional implications of climate change impacts and adaptation measures** in the EU27+UK across three dimensions:

1 Between EU region inequality

- Regional inequality of climate impacts
- RCP7.0, 4.5 and 2.6

135
regions

2 Within countries inequality

- Climate impacts, mitigation and different adaptation levels
- RCP7.0 and RCP4.5

5
income quintiles

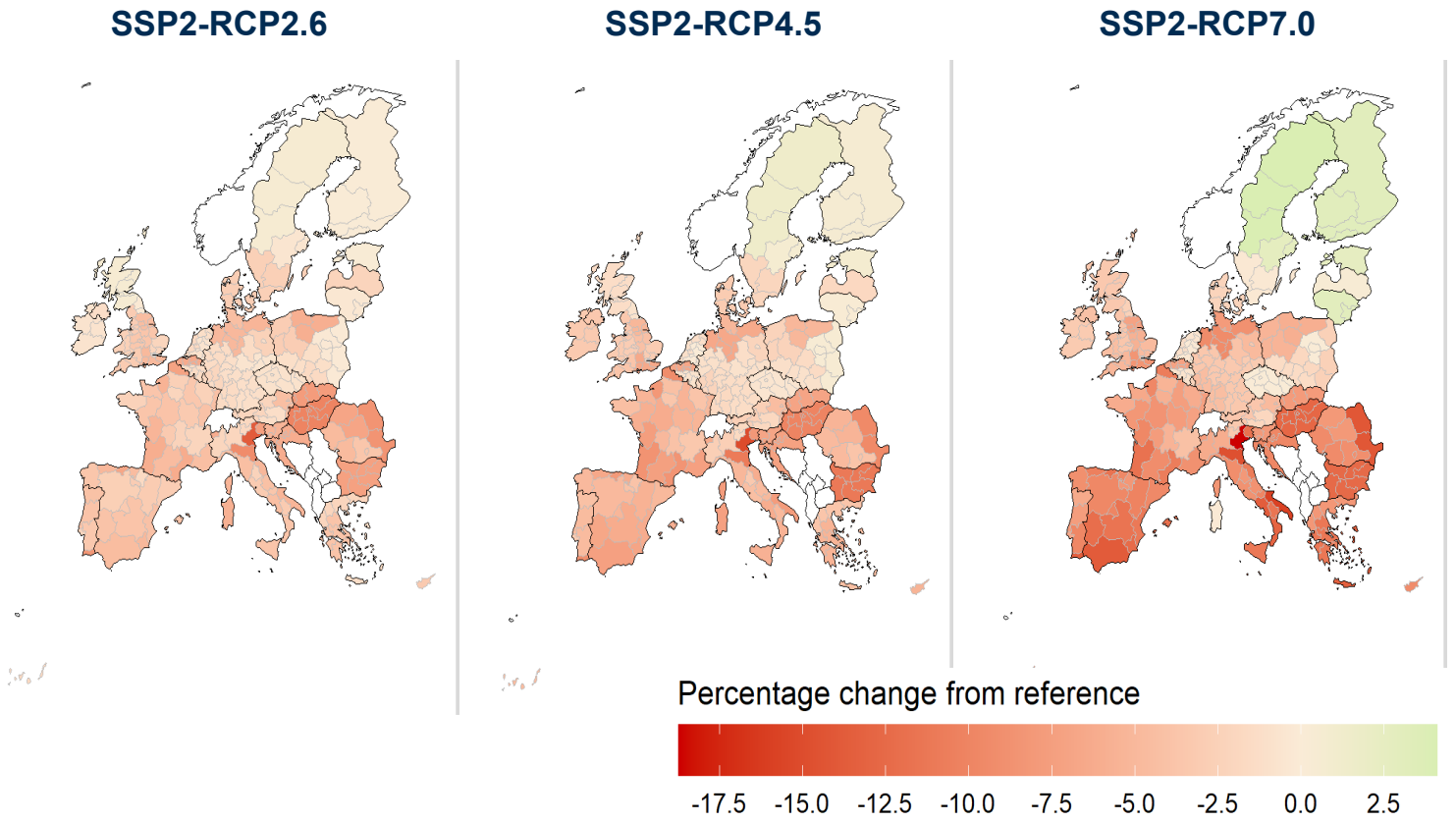
3 Within Austria: different financing schemes

- Flood risk and household impacts
- 3 risk recovery schemes

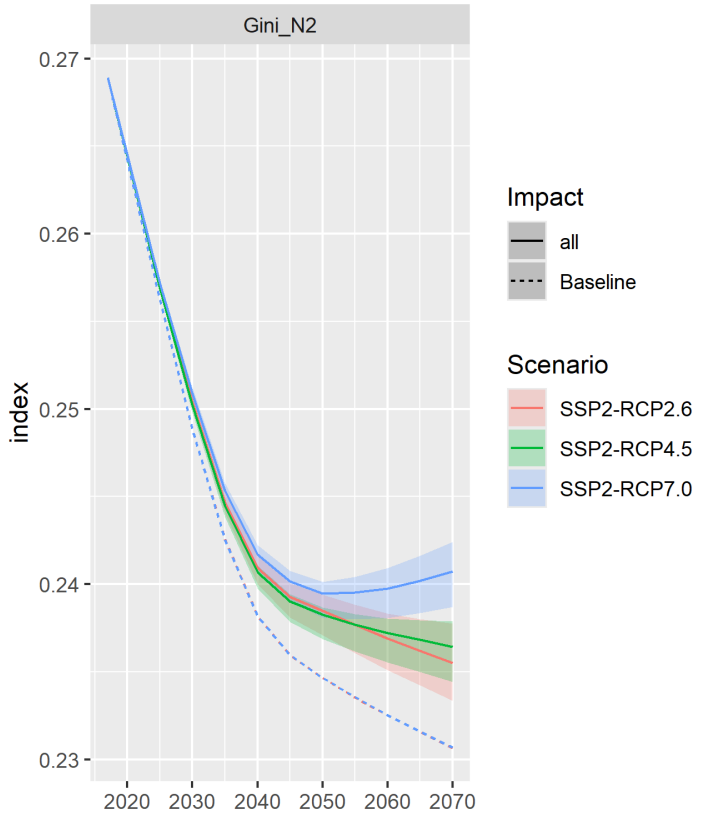
24
household groups

Climate change impacts and between-region inequality

GDP per capita change by 2070 (%)



Regional inequality (Gini)



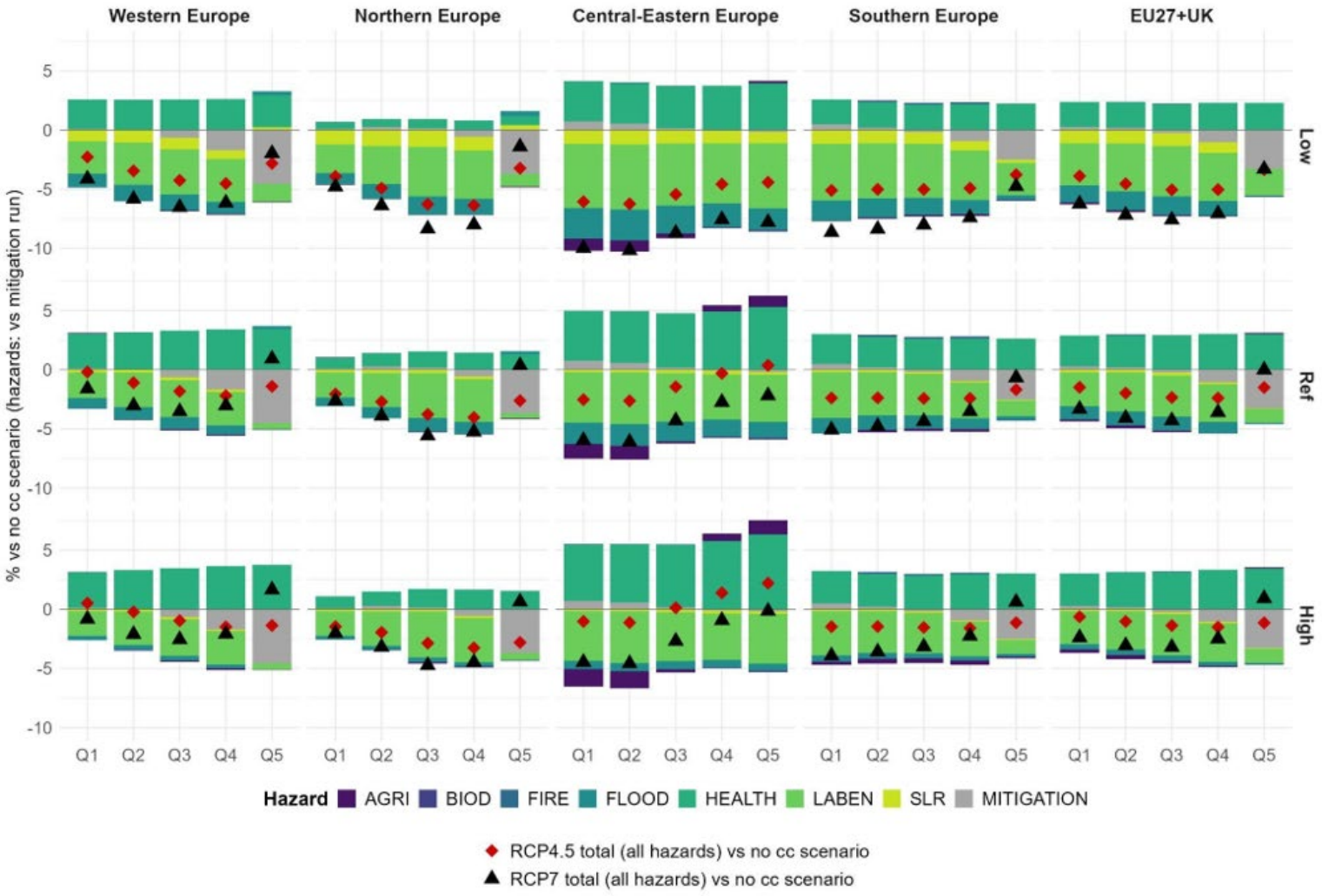
Poorer, southern and eastern regions lose most: up to −18.7% by 2070 (RCP7.0). Most affected regions are in Italy, Spain, Portugal, Greece, Romania and Croatia. Some northern regions gain.

Main drivers: labor impacts, riverine floods and sea-level rise.

Inequality is higher than in the no climate change scenario, especially under RCP7.0 after 2050.

Climate change impacts and adaptation: within-country inequality

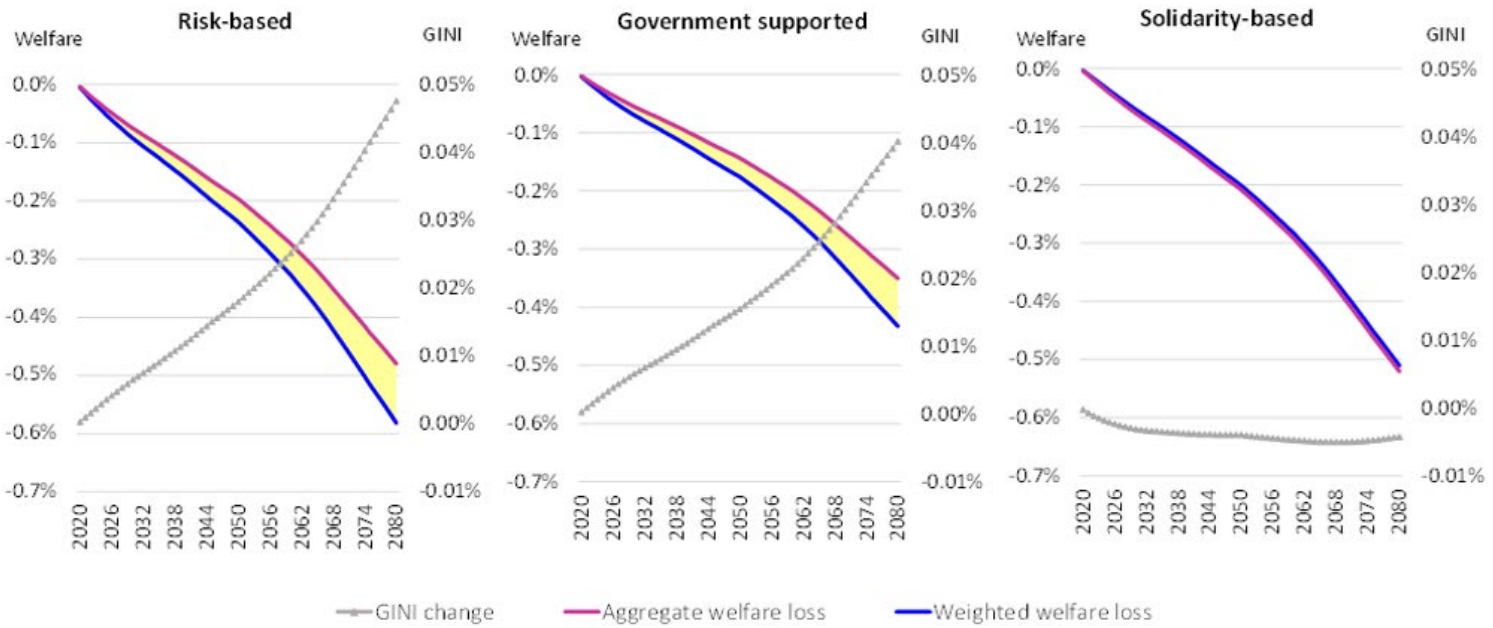
Income change by quintile and hazard, 2070 – RCP4.5 (%)



- **Household income in RCP4.5 (red diamonds) is on average higher than in RCP7 (black triangles).**
- **RCP 7 is regressive and RCP 4.5 slightly progressive**
- **Middle quintiles lose most in EU27+UK,** as their income depends heavily on labor earnings.
- **Adaptation shrinks losses for all quintiles** but not their regressivity in RCP7
- **Mitigation is progressive:** the richest quintile bears the largest income loss and inequality falls.
- **Combined RCP4.5 effect depends on adaptation:** inequality slightly up with low, slightly down with high adaptation.

Austria floods: 3 recovery schemes

24 household groups: income quartile × settlement type × flood exposure



RECOVERY SCHEMES:

- **Risk-based:** exposed households pay the full recovery cost.
- **Government supported:** 25% of costs covered by the public sector.
- **Solidarity-based:** costs shared by all households according to income, irrespective of exposure.

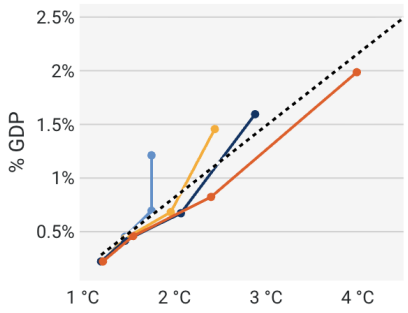
- **Risk-based:** Gini rises steadily
- **Government supported:** smaller losses, but Gini still rises.
- **Solidarity-based:** Gini stays flat
- **Trade-offs:** solidarity gives the largest GDP loss; risk-based is best for public finances; government support is best for GDP but weakest for public finances.
- **Targeted public support for low-income households** limits inequality at lower economic and fiscal cost.

Integrated Policy Assessment

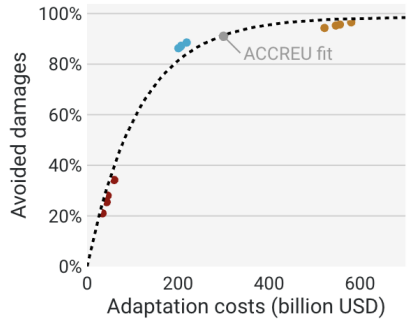
Sectoral damage and adaptation functions

Riverine flooding

GLOBAL DAMAGES (WITHOUT ADAPTATION)

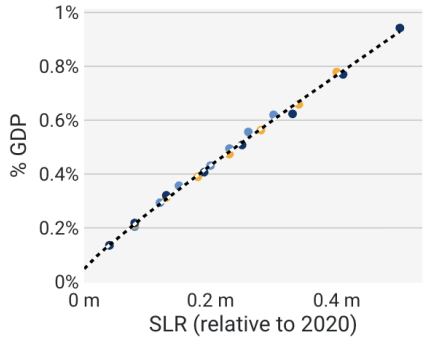


GLOBAL ADAPTATION COSTS

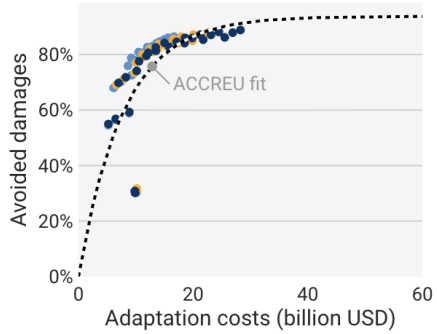


Sea-level rise

GLOBAL DAMAGES (WITHOUT ADAPTATION)

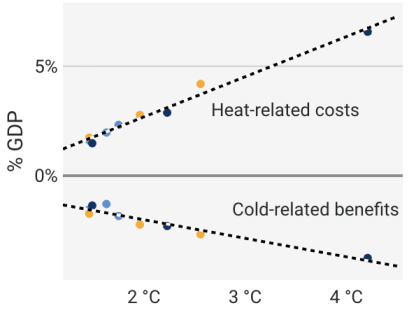


GLOBAL ADAPTATION COSTS

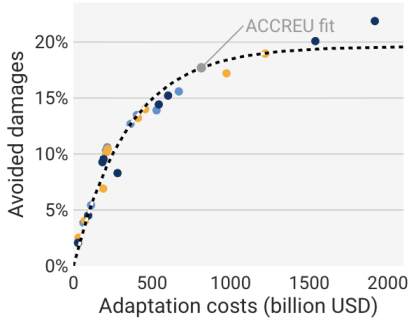


Labour productivity

GLOBAL DAMAGES (HEAT- AND COLD-RELATED, WITHOUT ADAPT.)

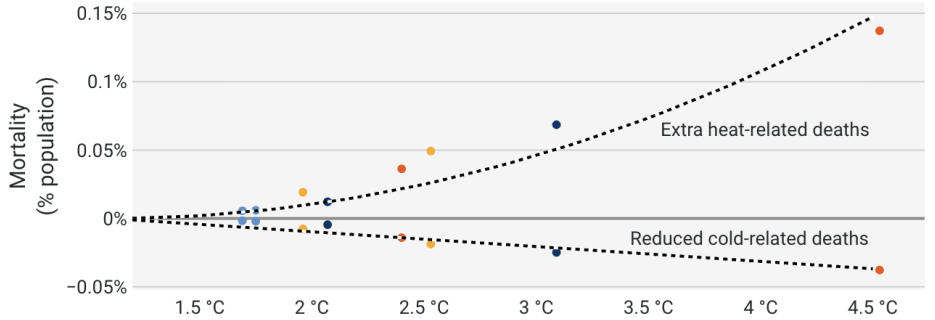


GLOBAL ADAPTATION COSTS (ONLY FOR HEAT-RELATED DAMAGES)



Mortality

GLOBAL MORTALITY (HEAT- AND COLD-RELATED, WITHOUT ADAPTATION)



Scenarios

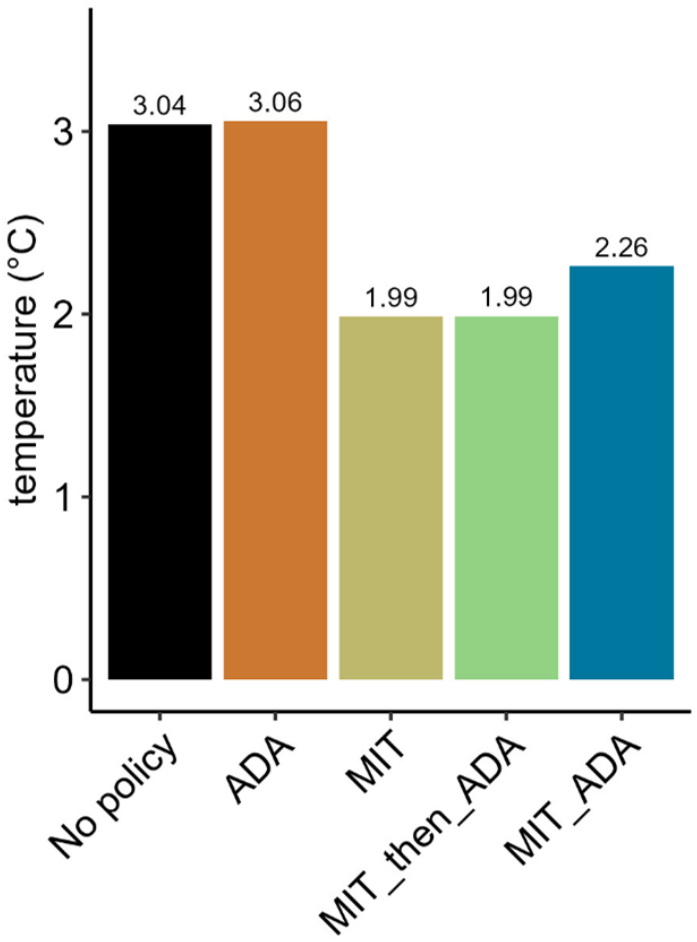
Adaptation assumption	No mitigation	Optimised mitigation
None	No policy	MIT
Optimised adaptation	ADA	MIT_then_ADA and MIT_ADA
Implementation gap	ADA_impl_gap	
Reduced effectiveness	ADA_red_eff	

Socio-economic limits to adaptation

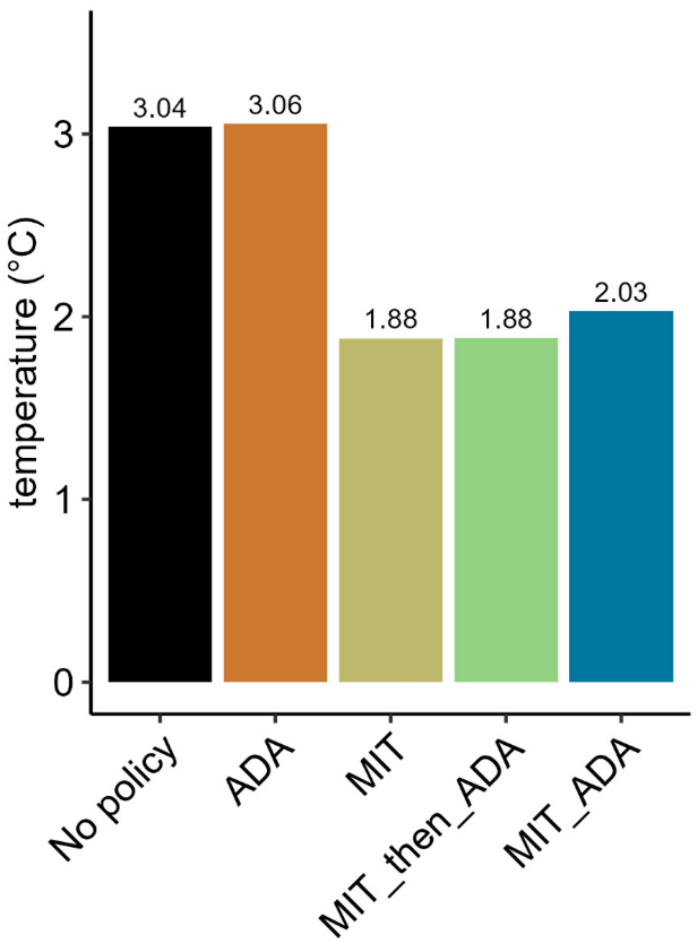
Unexpected failure of adaptation

Temperature

Without mortality

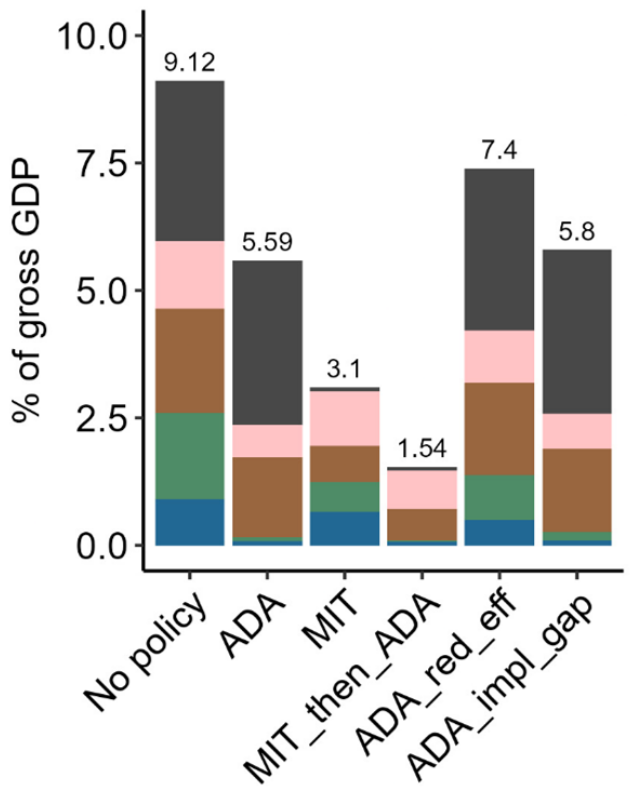


With mortality

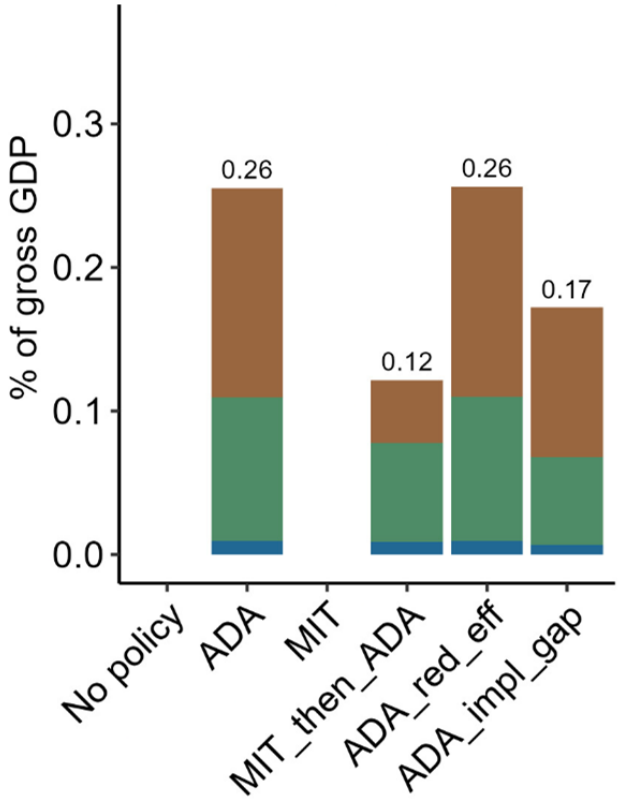


Damages and adaptation

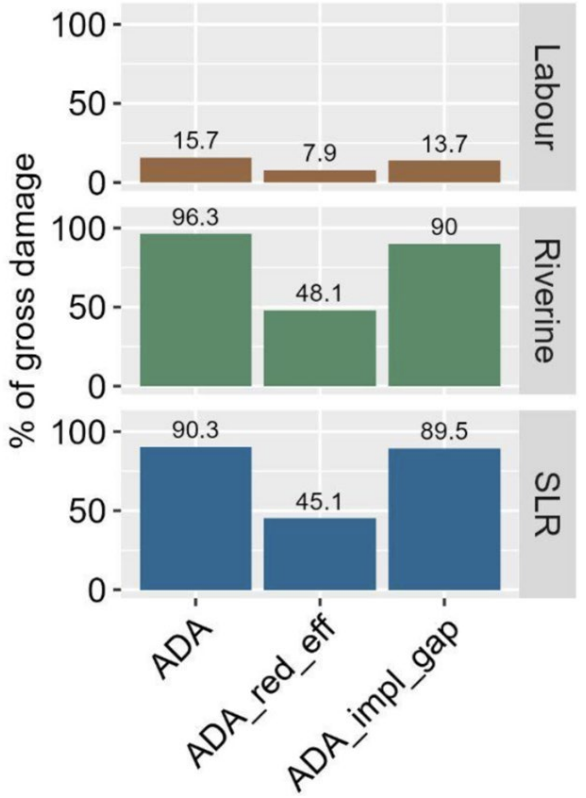
Damages (with mortality)



Adaptation costs



Adaptation level





Conclusion of IAM work

Novelty:

- Explicit sectoral decomposition
- Full adaptation effectiveness function
- Combined analysis mitigation vs adaptation
- Quantitative limitations to adaptation
- Non-market damages (mortality)

Limitations:

- Only 3 sectors
- Strong underestimation of total damages
- Adaptation much more optimistic than literature
- No full uncertainty range like COACCH
- CGE impacts vs direct impacts still needs research

Outcomes

Deliverables available on www.accreu.eu:

D4.1 Advancing impacts and adaptation in IAM and CGE models
D4.2 Integrated distributional analysis
D4.3 Fiscal and Financial Analysis
D4.4 Integrated analysis - Forthcoming

Manuscripts in preparation:

Campagnolo Lorenza, "Within-country distributional effects of climate change and adaptation in EU" Manuscript in preparation for submission to *Environmental & Resource Economics.*

Ingels, W.M., Tesselaar, M., Brusselaers, J., Aerts, J,C.J.H., & Botzen, W.J.W.B. (final round of revisions/reviews). Evaluation of flood insurance systems for businesses in a changing climate: an integrated model of flood risk and insurance markets. Under review at *Water Economics and Policy*.

Knittel, N., Campagnolo, L., Preinfalk, E., Bednar-Friedl, B., Lehner, A., Bacca, S., Haas, J., Hinkel, J., Lincke, D. Towards standardized adaptation modeling in CGE frameworks: Assessing sea level rise impacts and responses in Europe. Manuscript in preparation for submission to *Economic Systems Research*.

Lehner, A., Knittel N., Preinfalk, E., Bednar-Friedl, B., Watkiss, P., Hunt, A. Budgets in high water? Fiscal implications of flood adaptation in the United Kingdom. Manuscript in preparation for submission to *Environmental & Resource Economics.*

Van der Heyden M., Drouet L., Piontek F., Watkiss P., Sayer P., Hof A., Bosello F., De Cian E., Parrado R. & van der Wijst K., "Integrated Policy Assessment of adaptation, mitigation and residual damages" [TBD]

Preinfalk, E., Bachner, G., Knittel, N., Tesselaar, M. (2026). Spreading the risk, sharing the burden – A macroeconomic assessment of the distributional effects of flood risk financing schemes. In preparation for submission to *Risk Analysis.*