CIRCLE

Costs of Inaction and Resource scarcity:
Consequences for Long-term Economic growth

Macroeconomic consequences of climate change:

interactions between adaptation and mitigation

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Joint work with Kelly de Bruin

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Introduction

- Context: part of the CIRCLE project on costs of inaction
  - Other workstreams focus on air pollution and land-water-energy nexus
- Aim: assess the economic consequences of climate change
- Methodology:
  - Take existing impact estimates from literature
  - Calculate costs of environmental damages to the macro-economy and study how the economies adjust to the presence of environmental damages
  - Put into larger context of other major impacts of climate change

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Methodology for climate damages

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- Collaboration with experts from around the world and use of existing impact studies
  - Focus of this study is on economic consequences of market impacts
- Damages calculated in OECD's multi-sector, multi-region CGE model (ENV-Linkages) to 2060
  - Production function approach: link impacts to specific drivers of growth
  - Autonomous adaptation takes place via sectoral adjustments and international trade
- Stylised calculations with AD-DICE model to 2100
  - Baseline and damages to 2060 harmonised with ENV-Linkages
  - Explicit adaptation and mitigation policy variables

Selected impacts of climate change

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Included in the modelling

- Agriculture: yield changes for 8 crop sectors, and fisheries
- Coastal zones: capital and land losses due to sea level rise
- Health: diseases and labour productivity losses from heat stress
- Energy demand
- Tourism demand
- Capital damages from hurricanes

Stand-alone analysis

- Fatalities from heatwaves
- Urban damages from river floods
- Ecosystems: biodiversity (crude approximation)

Still not quantified

- Large-scale disruptive events, …

Regional cost of selected climate impacts

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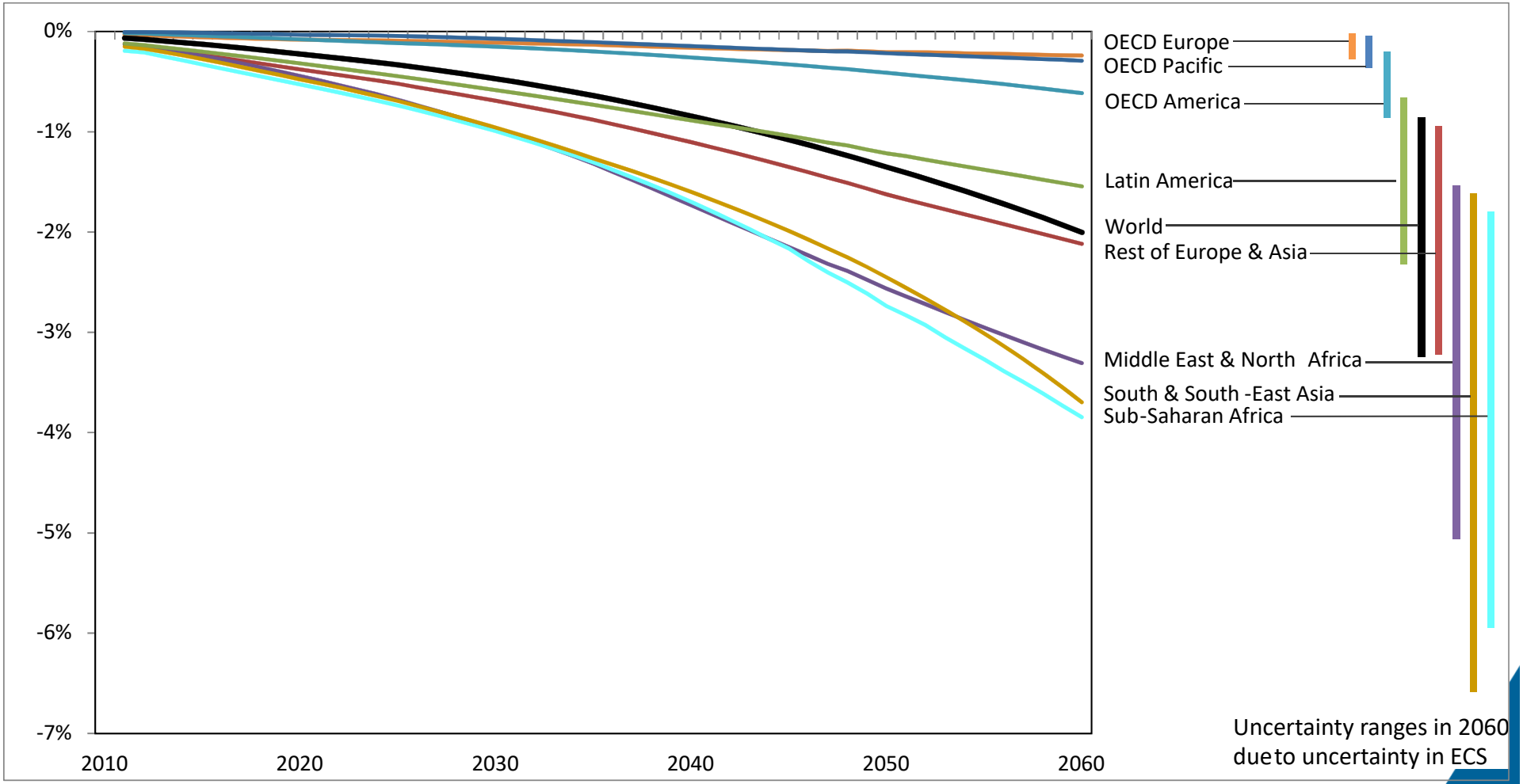

Source: ENV-Linkages calculations

The benefits of policy action

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- Assessment of benefits of policy action require insight into stream of future avoided damages
  - Not straightforward to assess with ENV-Linkages
  - Lack of sectoral adaptation information is also an issue
- As first step, use the AD-DICE model which is especially suited for this (as perfect foresight model)
  - AD-DICE is an augmented version of Nordhaus' DICE model, with explicit representation of adaptation
- Look at both adaptation and mitigation policies, and their interactions

The AD-DICE model

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- Unravel net damages into adaptation costs & residual damages
- (Gross) Damages increase exponentially with temperature
- Adaptation reduces gross damages into residual damages
- Flow and stock adaptation are imperfect substitutes
- The capital stock of adaptation can be built up with adaptation investments, but is subject to depreciation
- Total climate change costs thus consist of
  (i) mitigation costs;
  (ii) residual damages; and
  (iii) the sum of flow and stock adaptation costs

AD-DICE versus DICE

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	2060	2100
1. original DICE	1.5%	4.0%
2. 1 plus CIRCLE socioeconomic	1.6%	4.3%
3. 2 plus CIRCLE damages	1.7%	4.4%
4. 3 plus ECS3.0 (instead of 2.9)	1.8%	4.6%
5. 4 plus UK Treasury discounting	1.8%	4.6%
6. 5 plus Partial (flow) adaptation = **Central projection**	2.1%	5.8%

Source: AD-DICE calculations

Long-term damages

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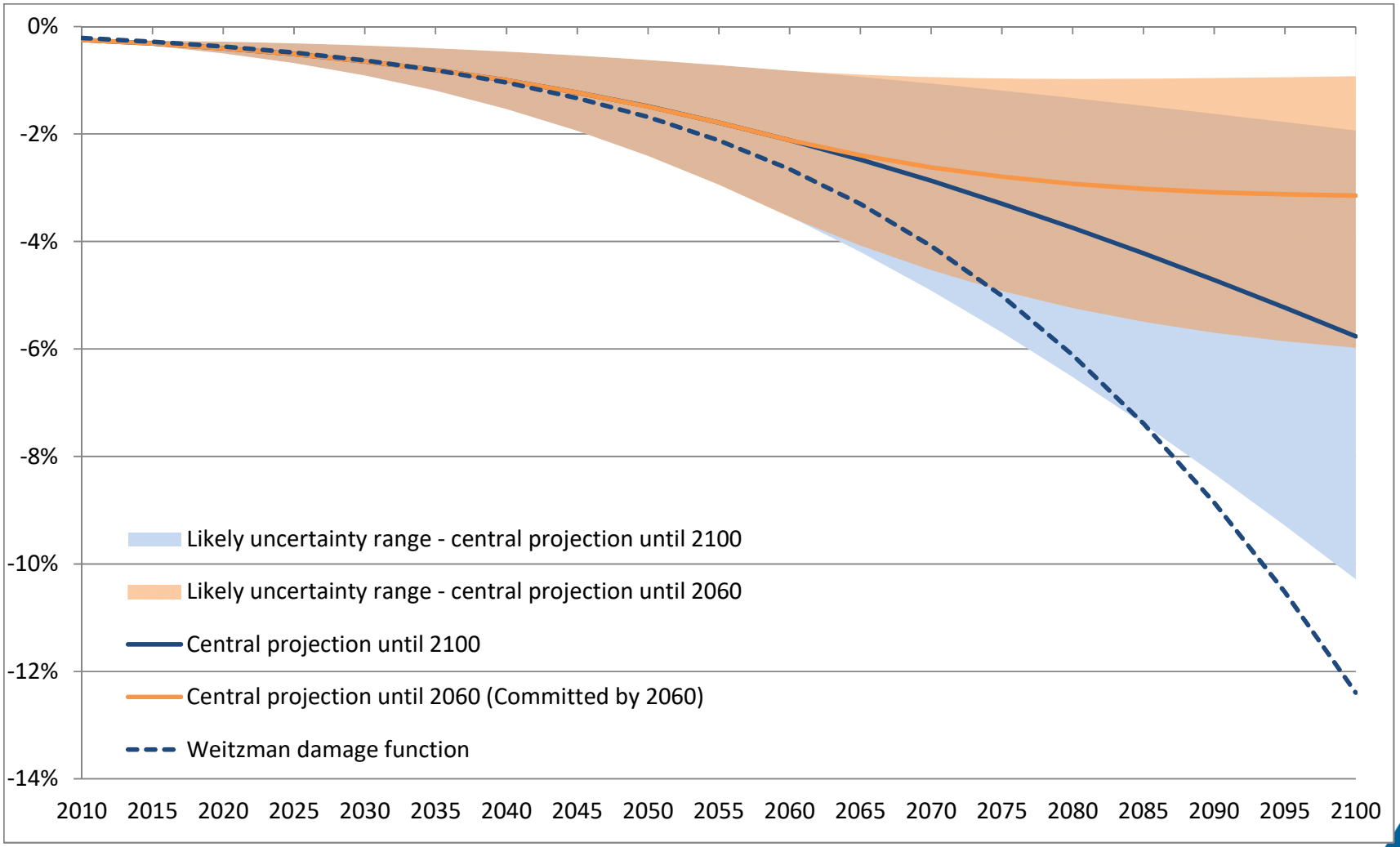

Source: AD-DICE calculations

Adaptation level (% of gross damages avoided)

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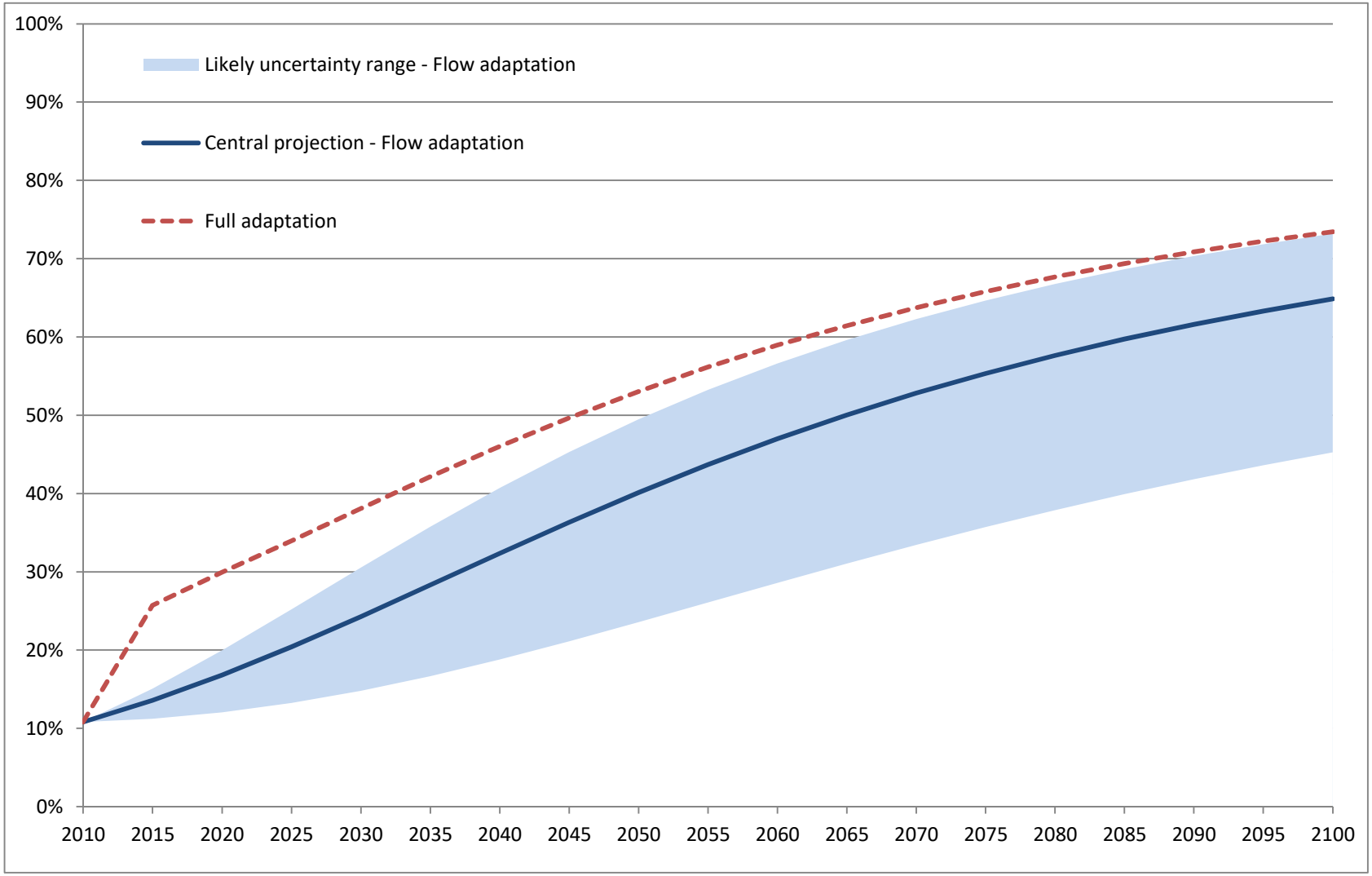
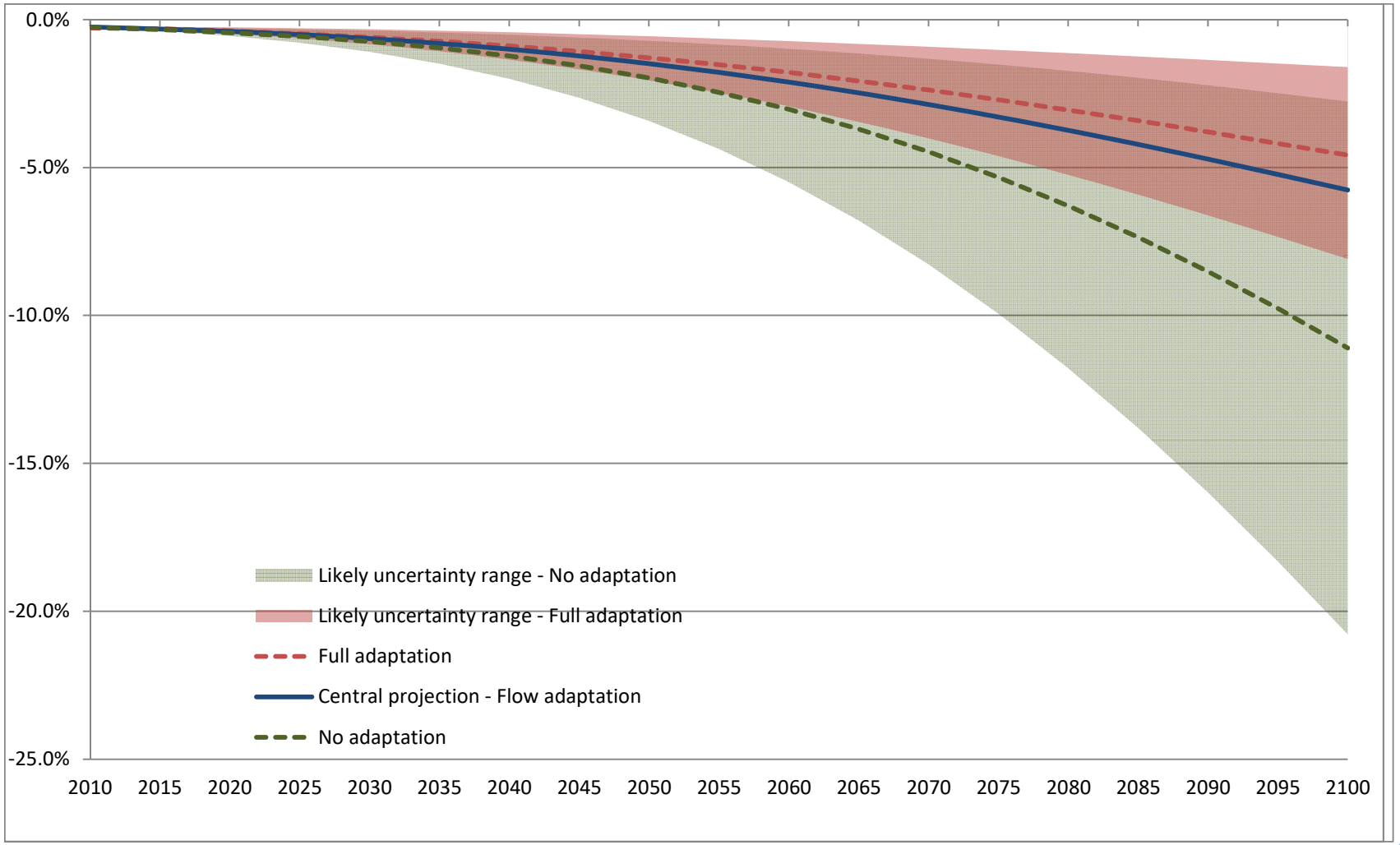


Source: AD-DICE calculations

Damages with adaptation policy control



Source: AD-DICE calculations

Damages with policy controls

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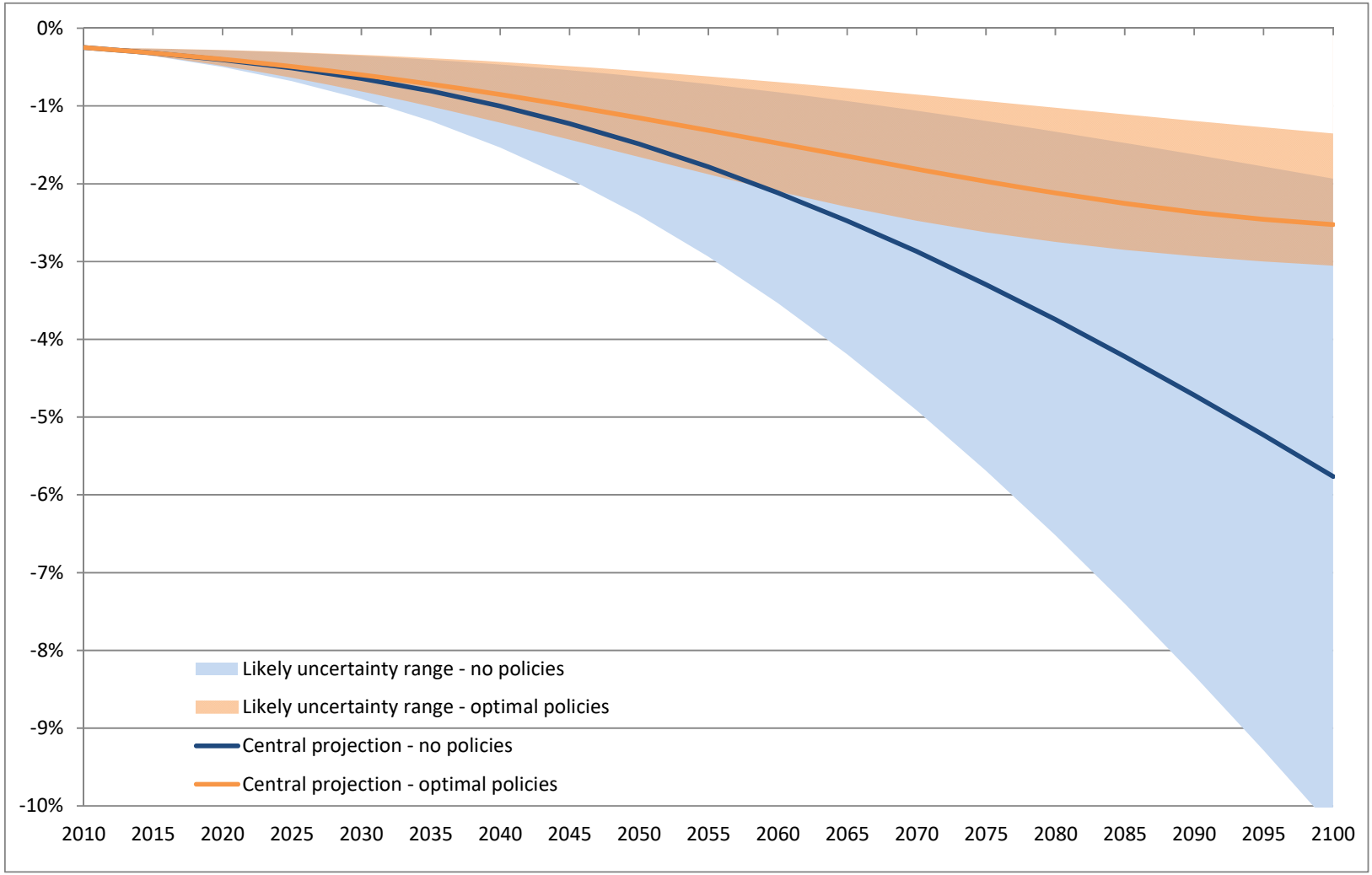

Source: AD-DICE calculations

Components of climate change costs

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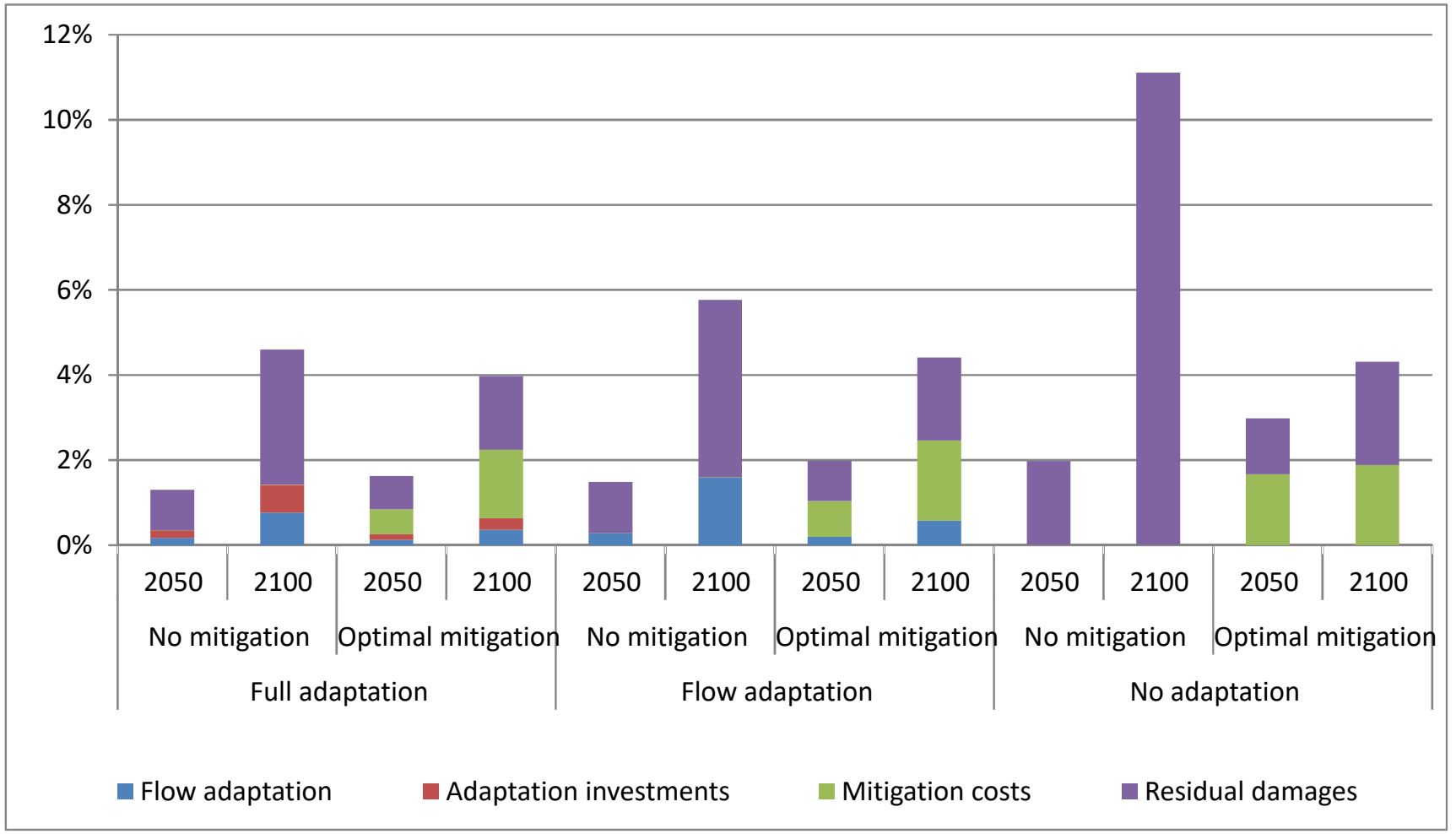

Source: ENV-Linkages calculations

Ongoing work: production function approach

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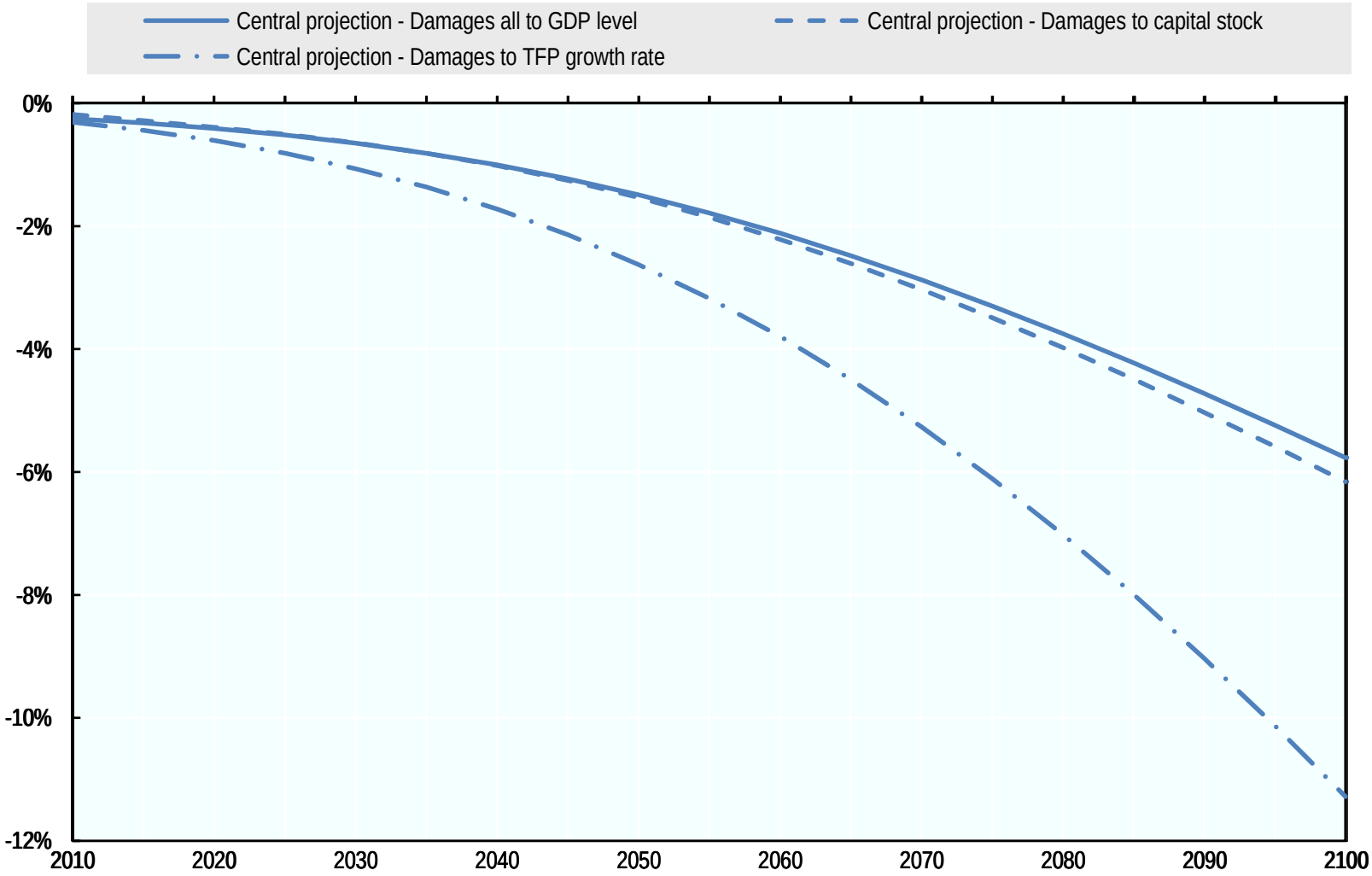

Source: AD-DICE calculations

Main messages

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Ambitious adaptation and mitigation can reduce future impacts and limit risks

- Ambitious policies can reduce macroeconomic costs by 2100 from 2-10% to 1-3%
- Adaptation is important to ensure consequences of climate change remain limited
- Ambitious global mitigation can help avoid half of the economic consequences and limit downside risks
- Distribution of policy costs and benefits across regions and sectors will not be proportional (but both imply a shift towards more services)

THANK YOU!

For more information:

www.oecd.org/environment/CIRCLE.htm

www.oecd.org/environment/modelling

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No-damage baseline GDP projection

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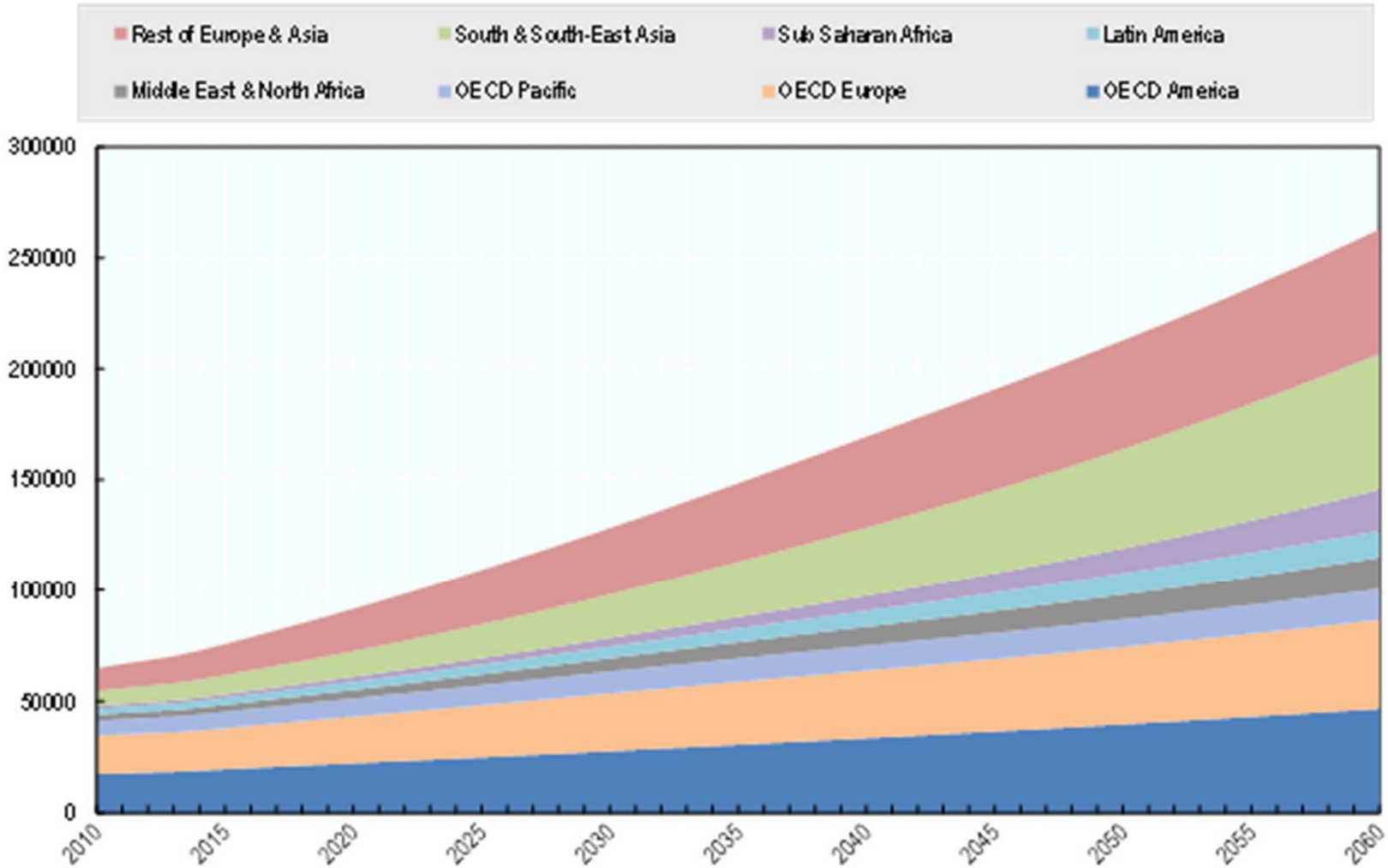

Source: ENV-Linkages calculations

Global damages under optimal mitigation – alternative discounting rules

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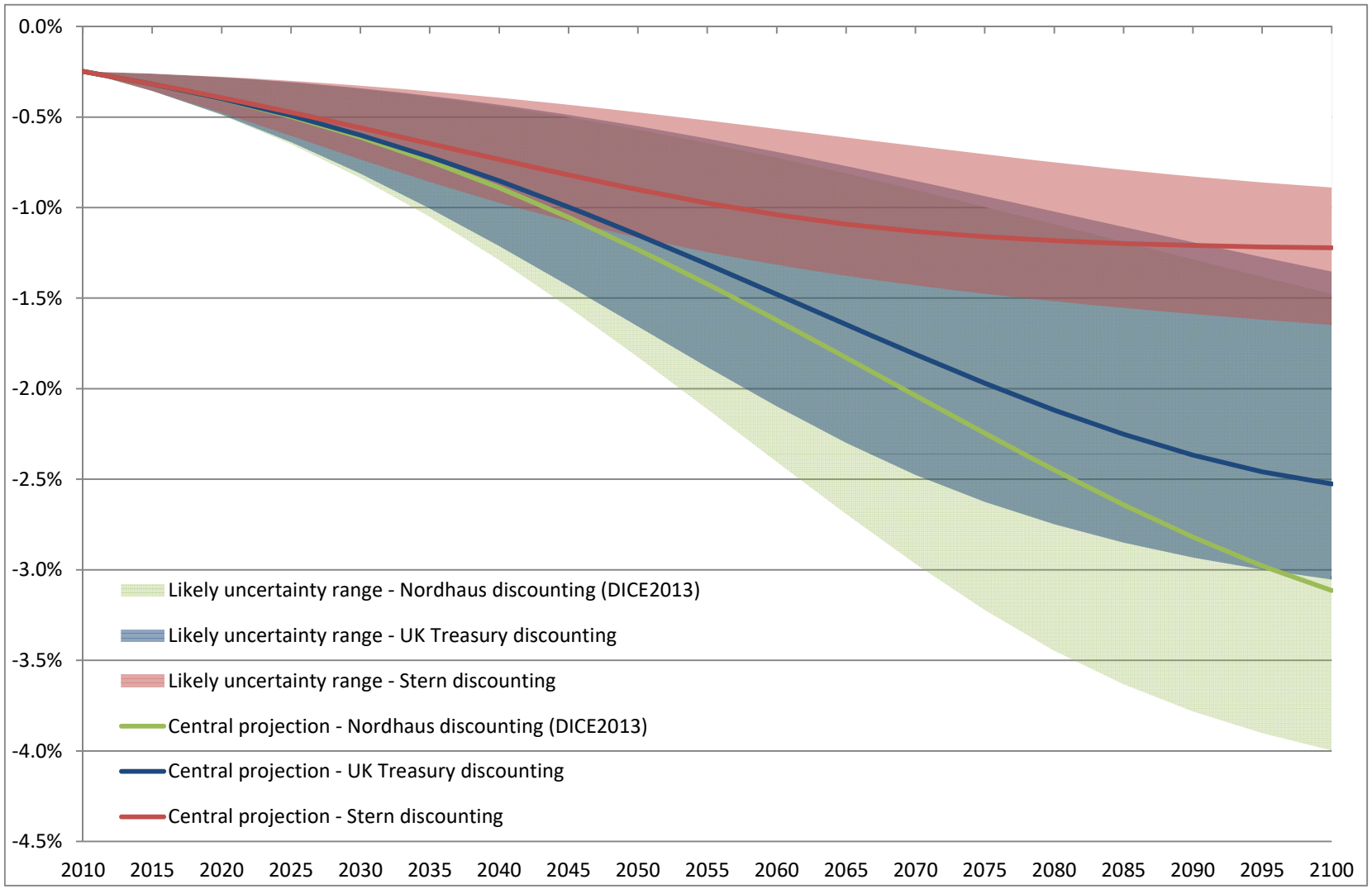

Source: AD-DICE calculations