THE JOINT ECONOMIC CONSEQUENCES OF CLIMATE CHANGE AND AIR POLLUTION

Rob Dellink
Environment Directorate, OECD

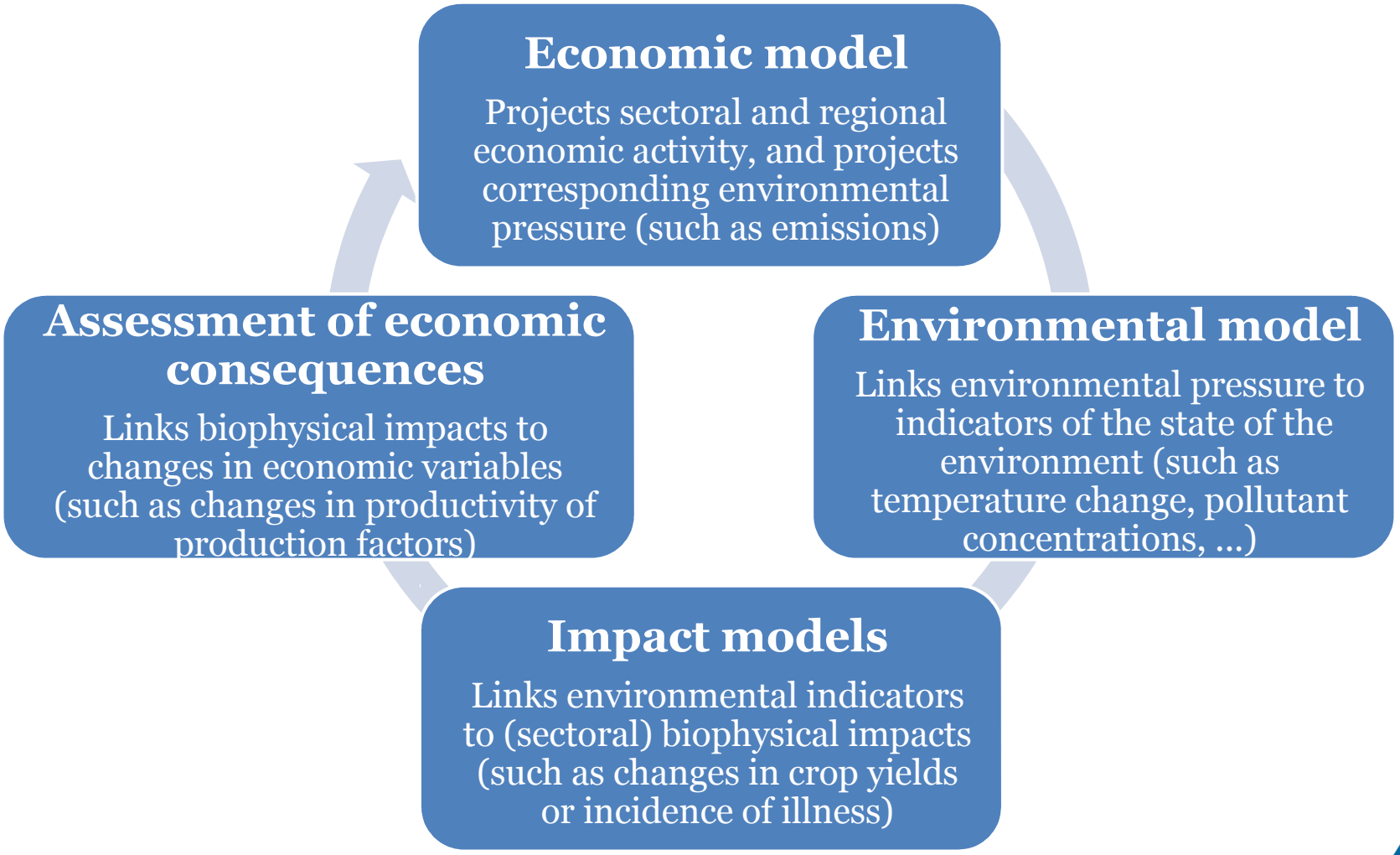
Impacts conference 2017

OECD
BETTER POLICIES FOR BETTER LIVES

Climate change and air pollution

- Joint analysis of climate change and air pollution to identify synergies and trade-offs
  - Climate change and (outdoor) air pollution are both important environmental problems, with global repercussions
  - Significant overlap in the drivers of emissions
  - Significant overlap in the affected sectors
- This presentation looks at economic interactions
  - Hard to find reliable biophysical information
  - Focus on baselines / cost of inaction, not co-benefits
  - Main contribution: consistent framework

Methodology

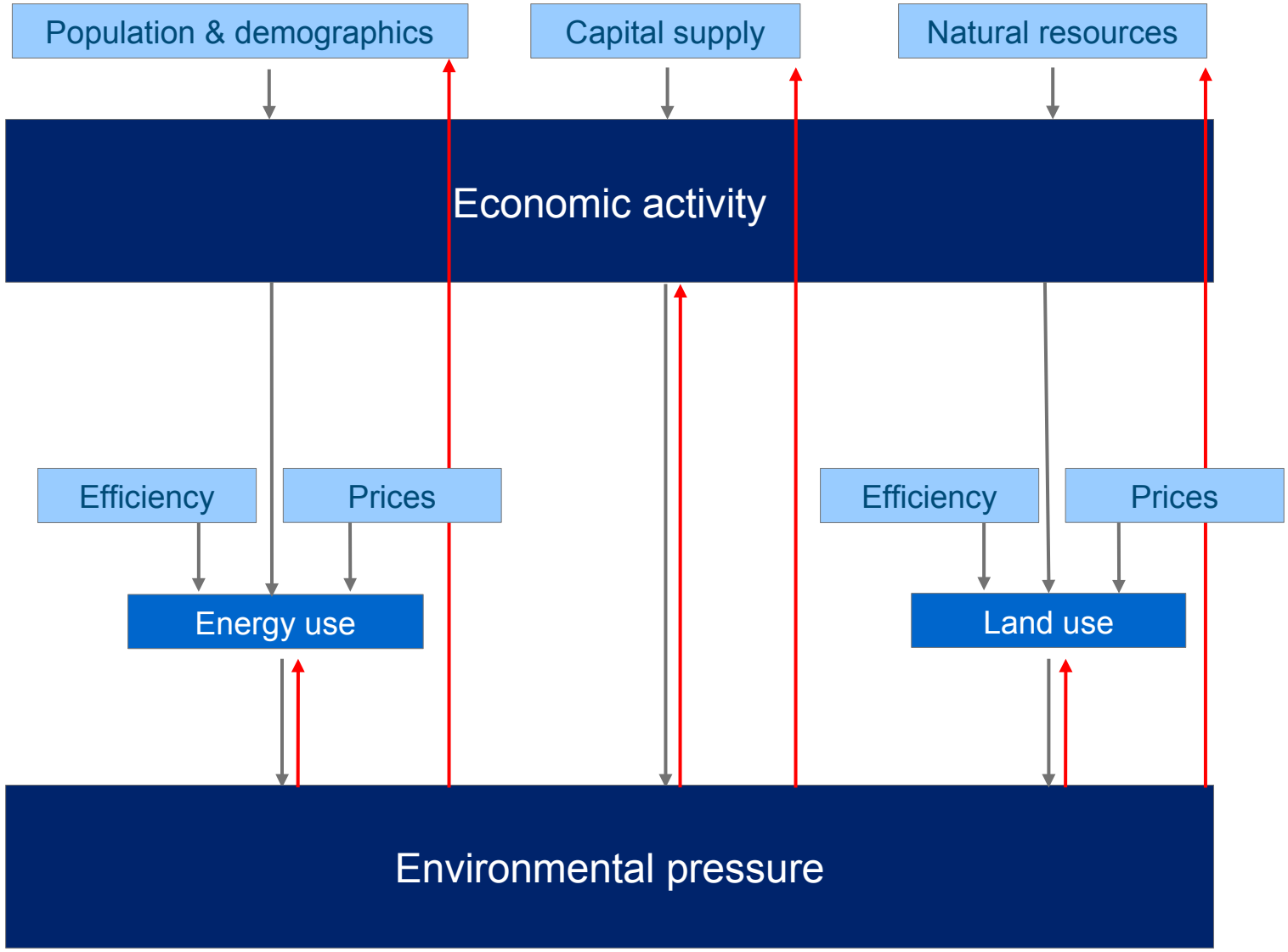


The ENV-Linkages model

- Computable General Equilibrium (CGE) model
  - Multi-regional (25), multi-sectoral (35)
  - Full description of economies
  - All economic activity is part of a closed, linked system
  - Simultaneous equilibrium on all markets
  - Structural trends, no business cycles
- Dynamics
  - Solved iteratively over time (recursive-dynamic)
  - Capital vintages
- Link from economy to environment
  - Greenhouse gas and outdoor air pollution emissions linked to economic activity
  - Feedbacks from climate and air pollution damages on economy

4

Environmental Outlook to 2050 & CIRCLE



CIRCLE

The Economic Consequences of Climate Change

OECD

OECD
BETTER POLICIES FOR BETTER LIVES

Selected impacts of climate change

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

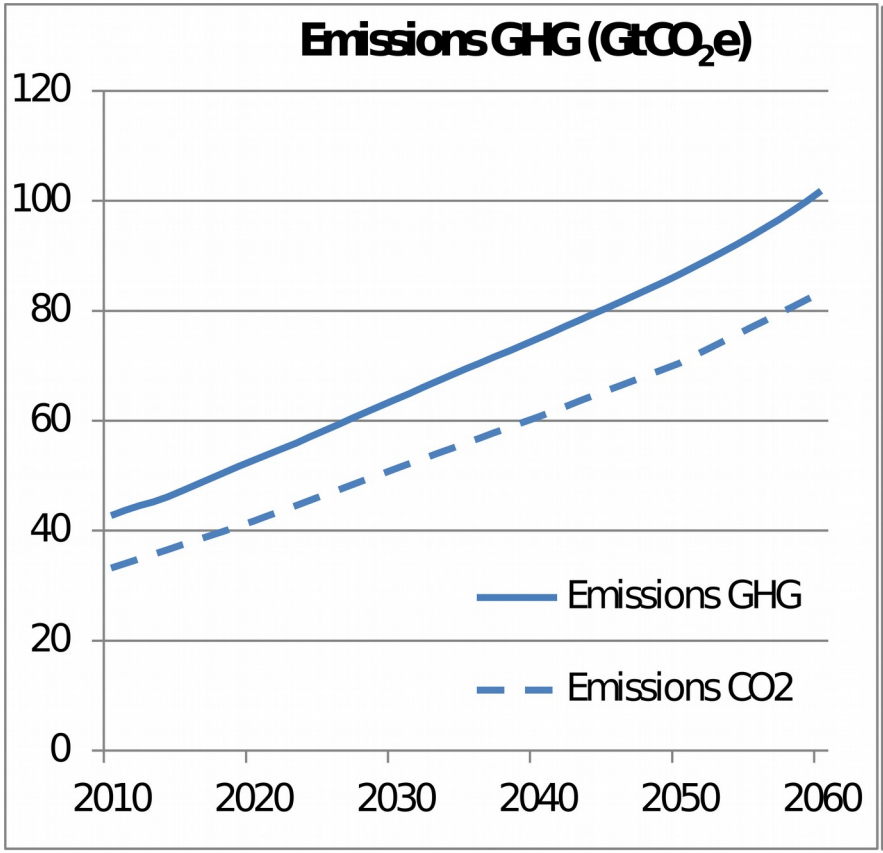
Stand-alone analysis

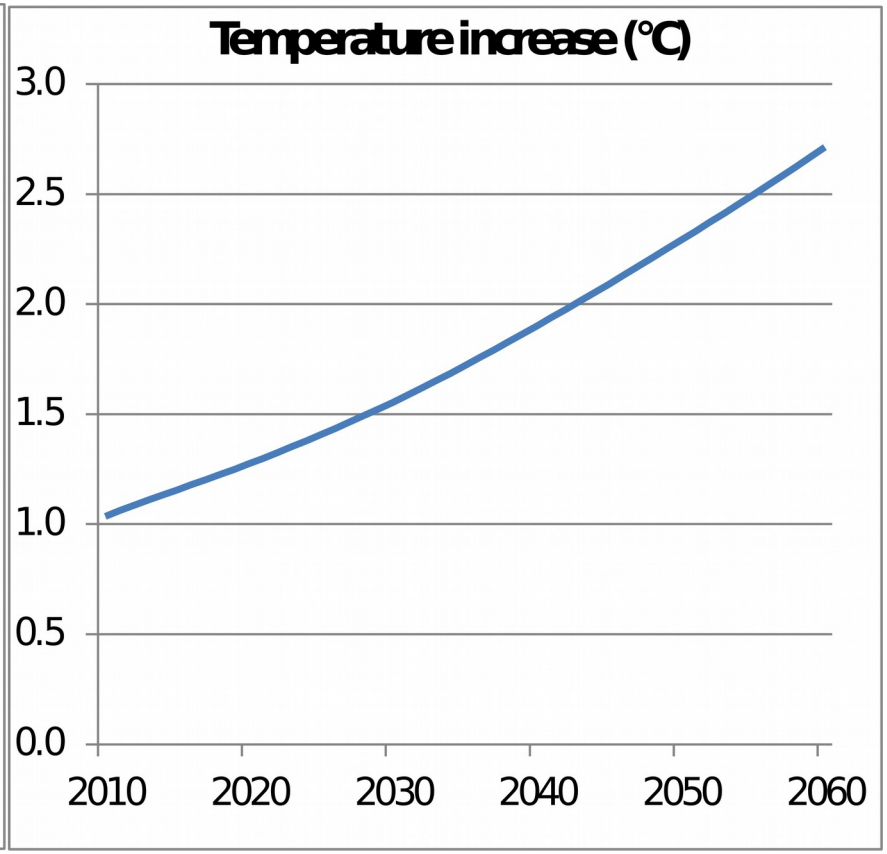
- Fatalities from heatwaves
- Urban damages from river floods
- Ecosystems: biodiversity (crude approximation)

Still not quantified

- Large-scale disruptive events, ...

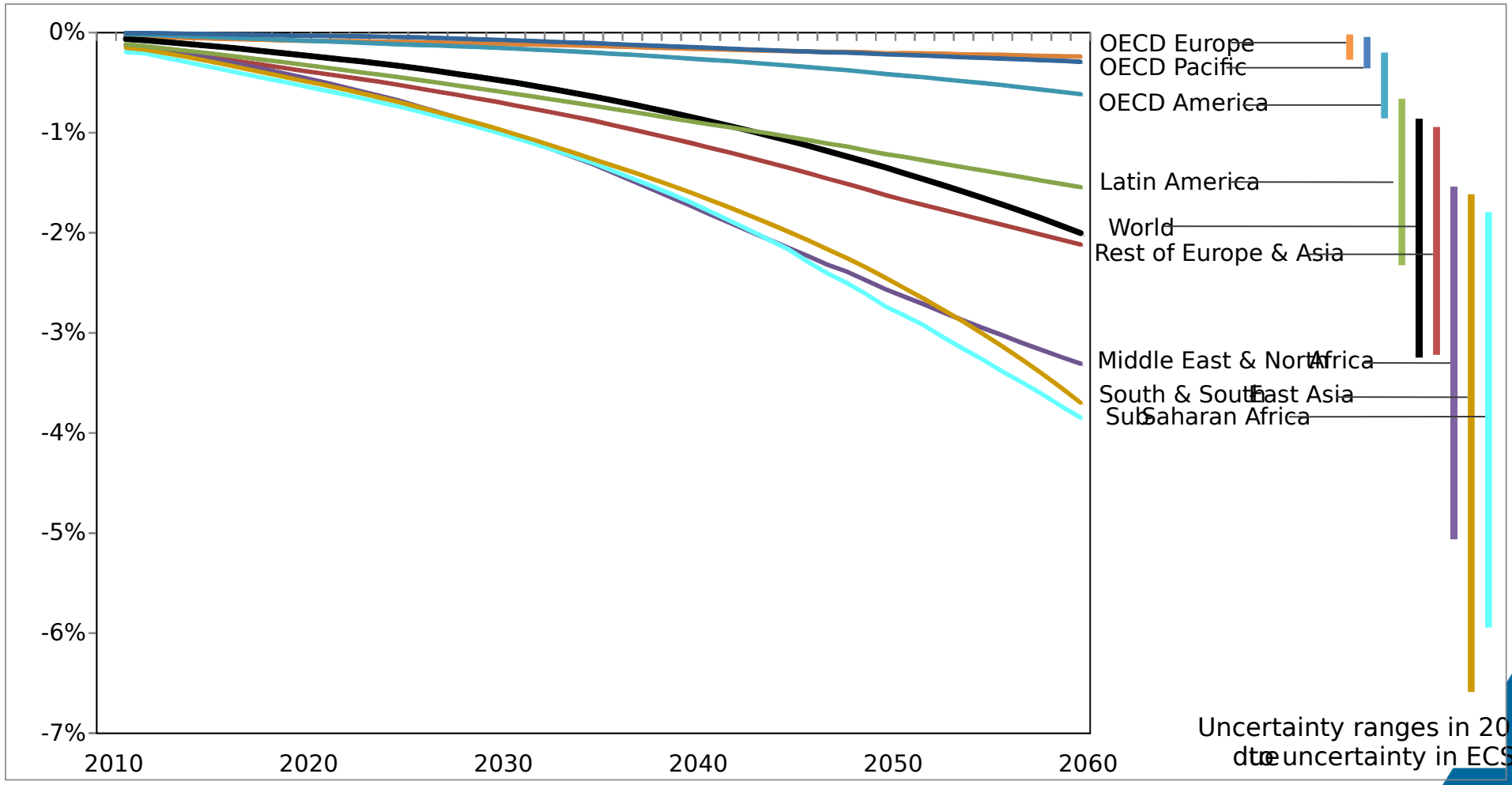
Emissions and temperature increase





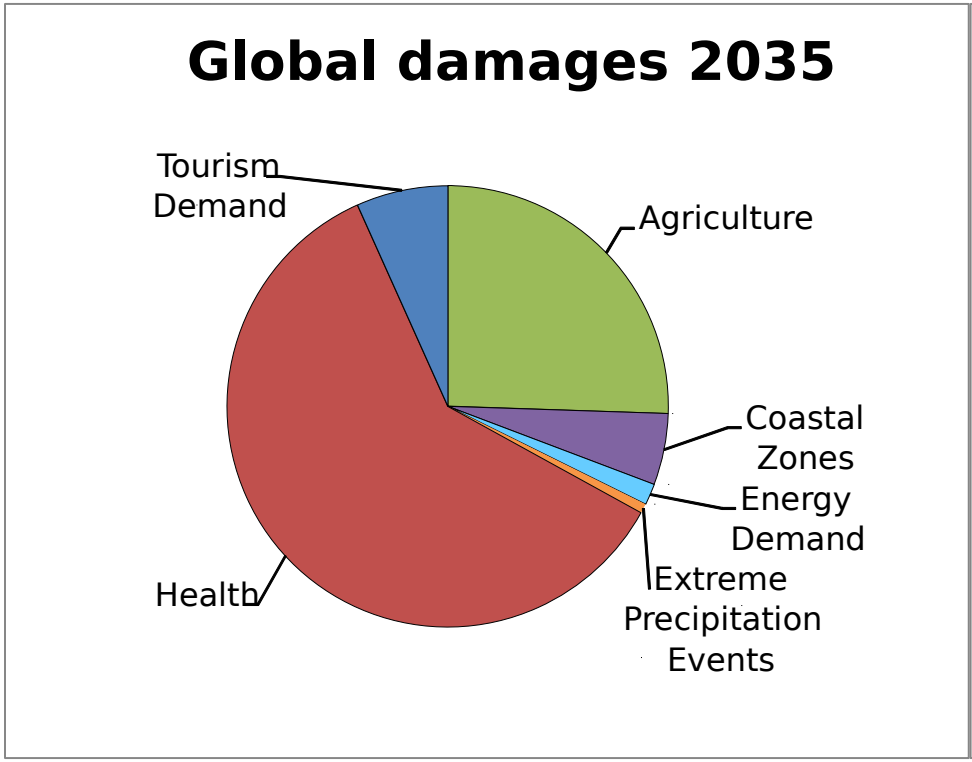
Source: OECD (2015), The Economic Consequences of Climate Change

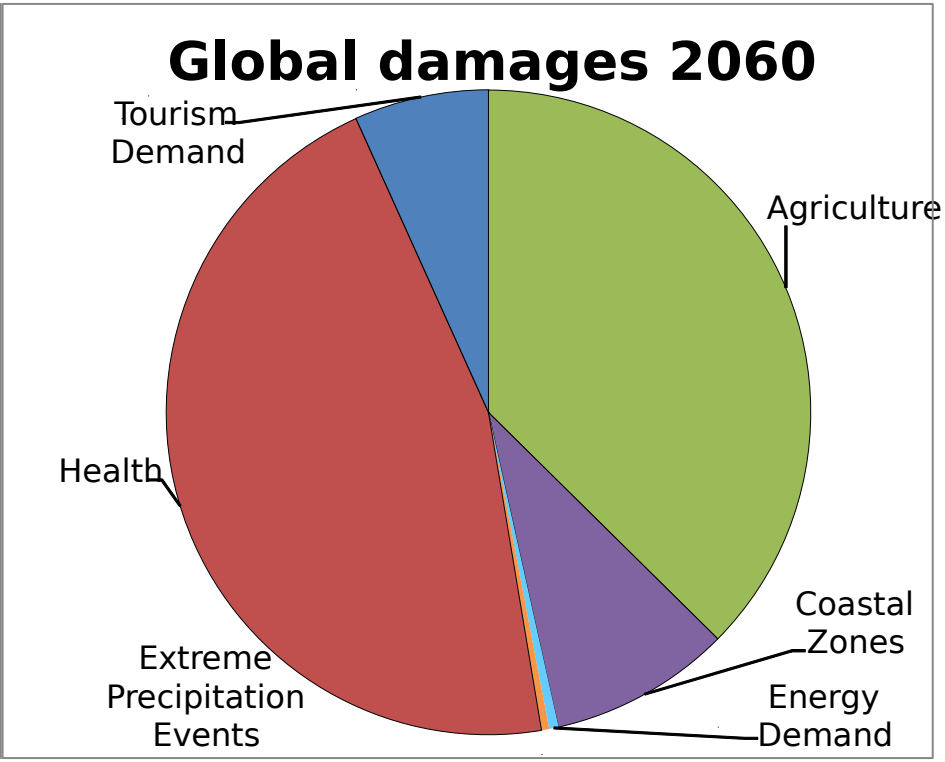
Regional cost of selected climate impacts



Source: OECD (2015), The Economic Consequences of Climate Change

Global importance of different impacts





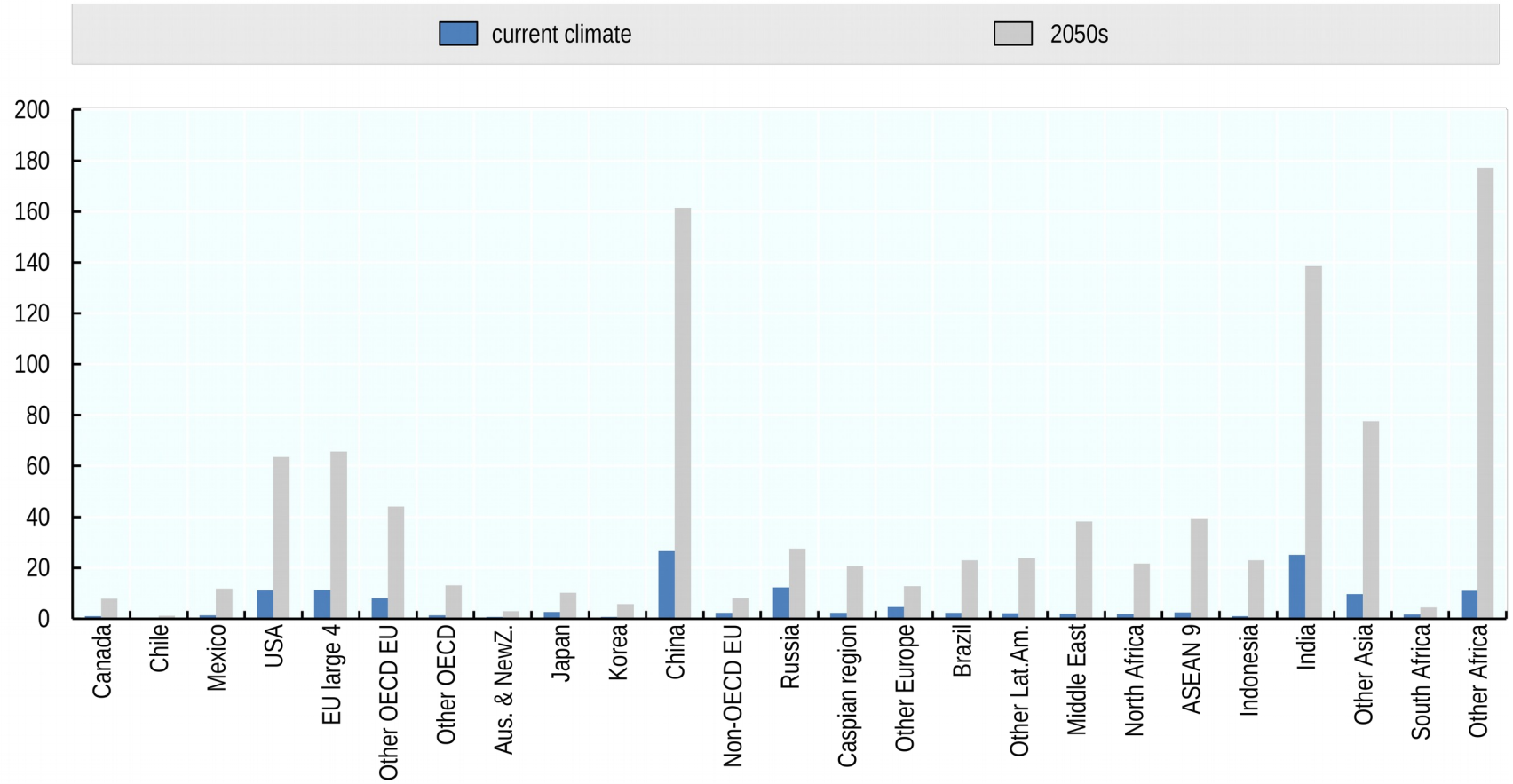
Global GDP loss:

2035: 0.3-1.0%

2060: 1.0-3.3%

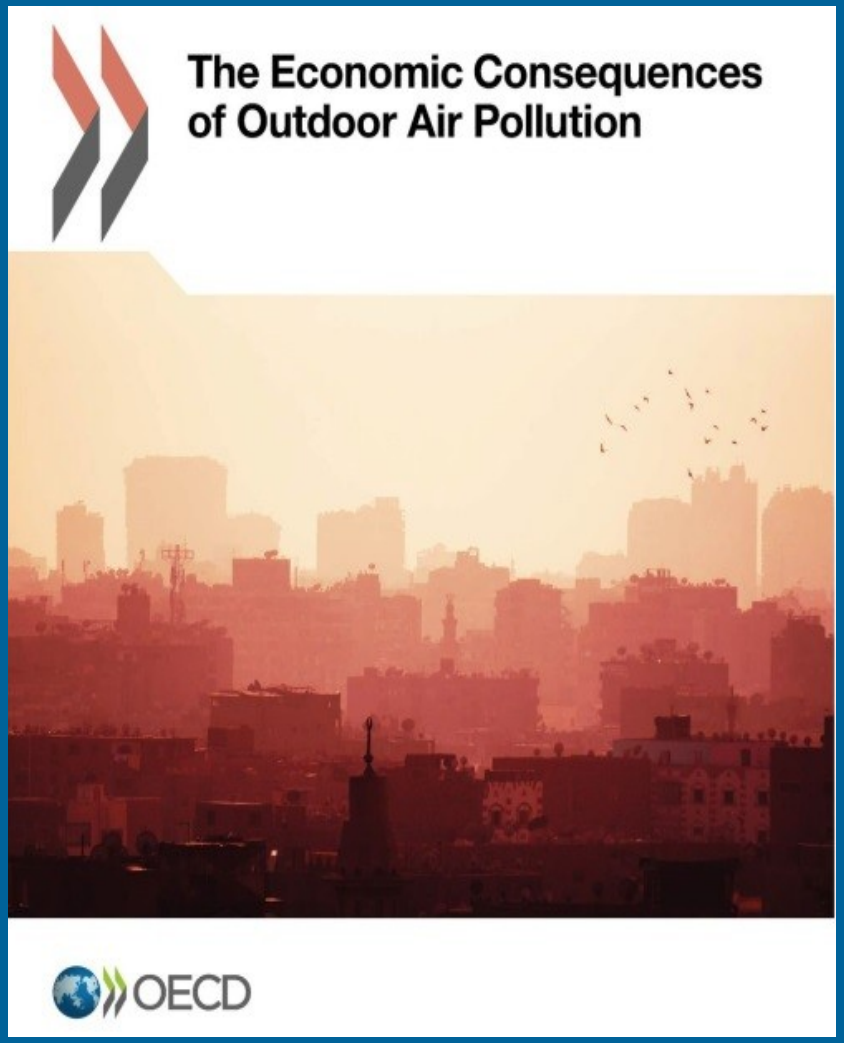
Source: OECD (2015), The Economic Consequences of Climate Change

Premature deaths from climate change: heat stress



Source: OECD (2015), The Economic Consequences of Climate Change

CIRCLE



OECD
BETTER POLICIES FOR BETTER LIVES

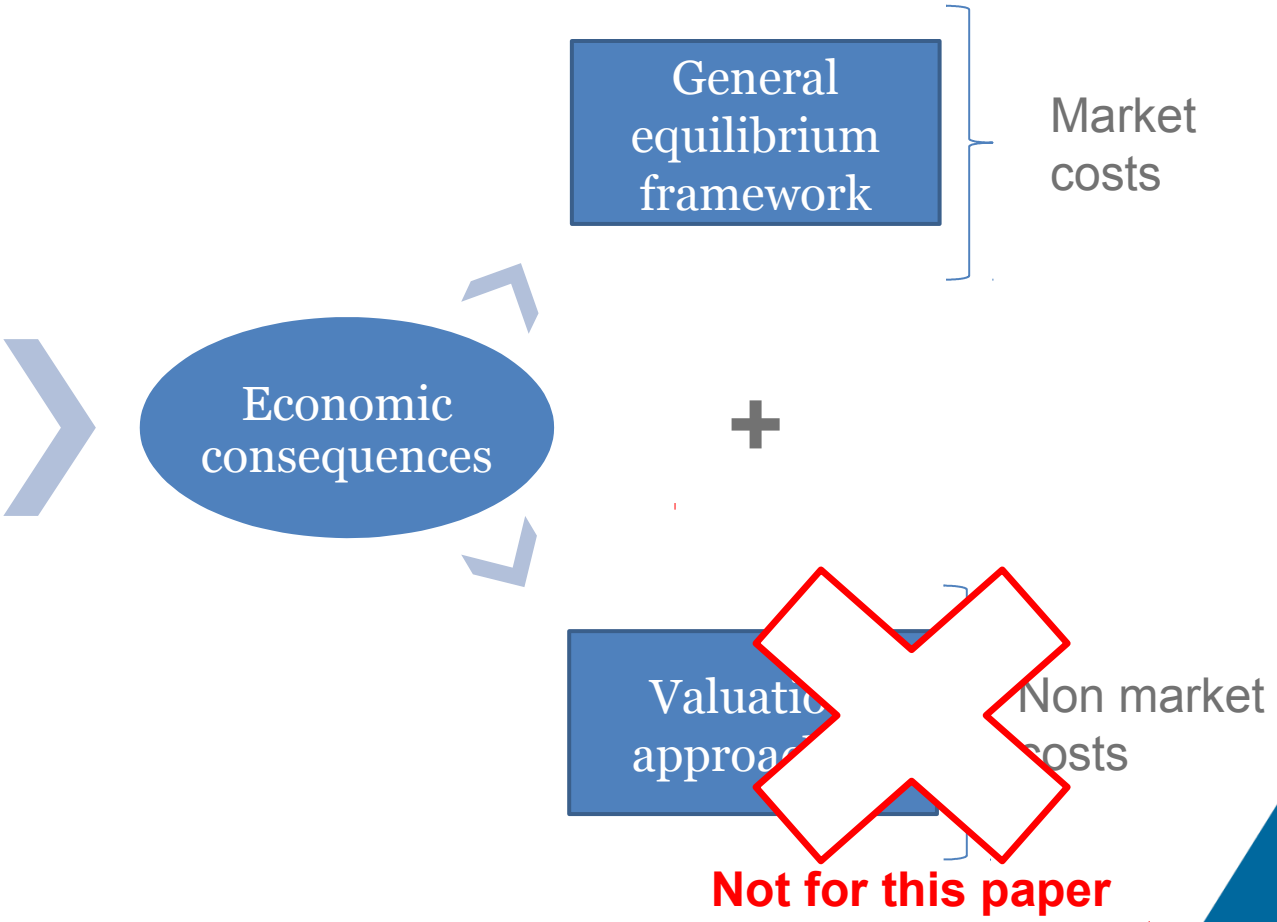
Impacts of air pollution

Health impacts

- Mortality
- Morbidity: illness (especially respiratory and cardiovascular diseases)

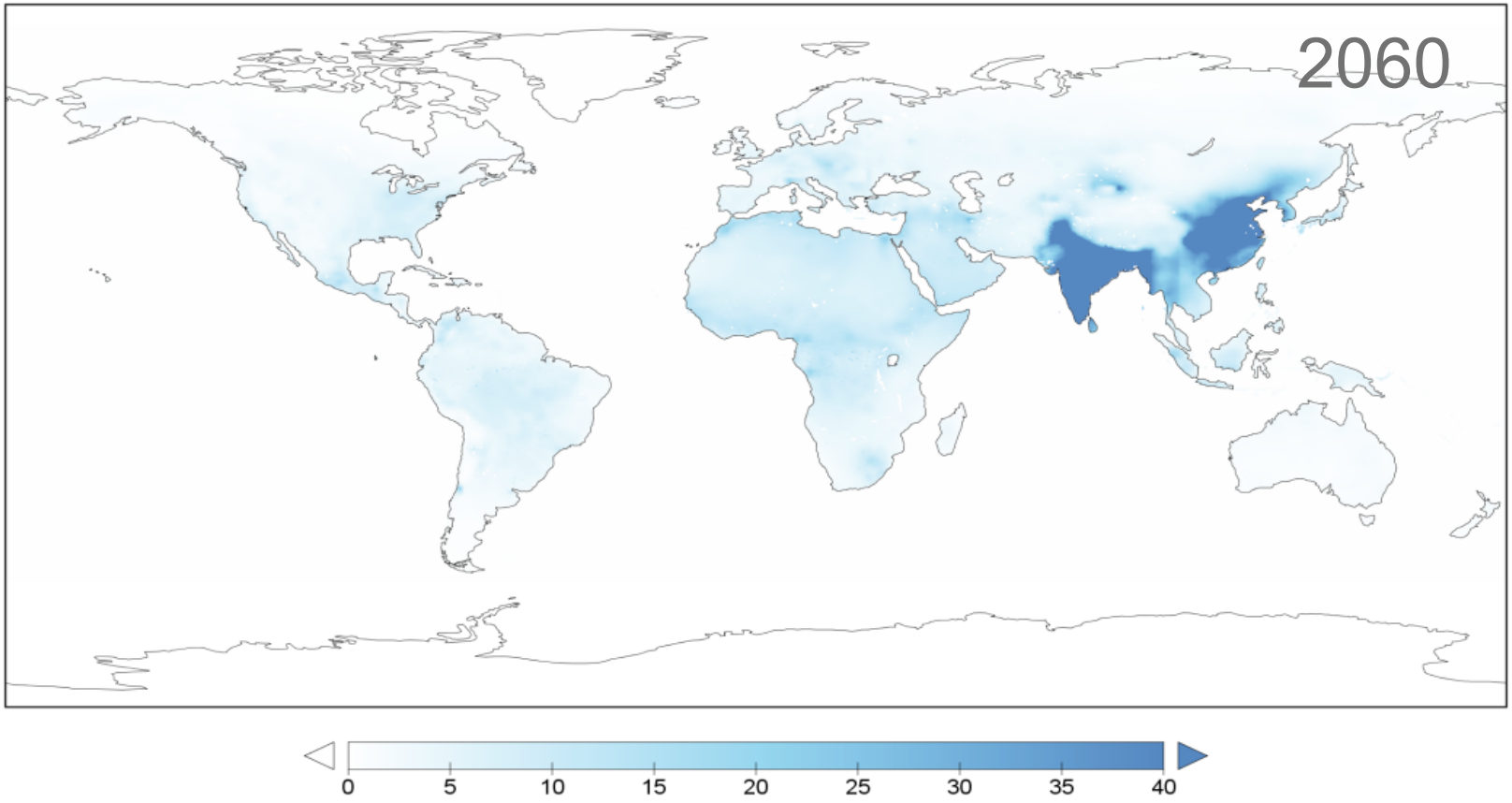
Agricultural impacts

- Crop-specific yield losses



Concentrations of air pollutants

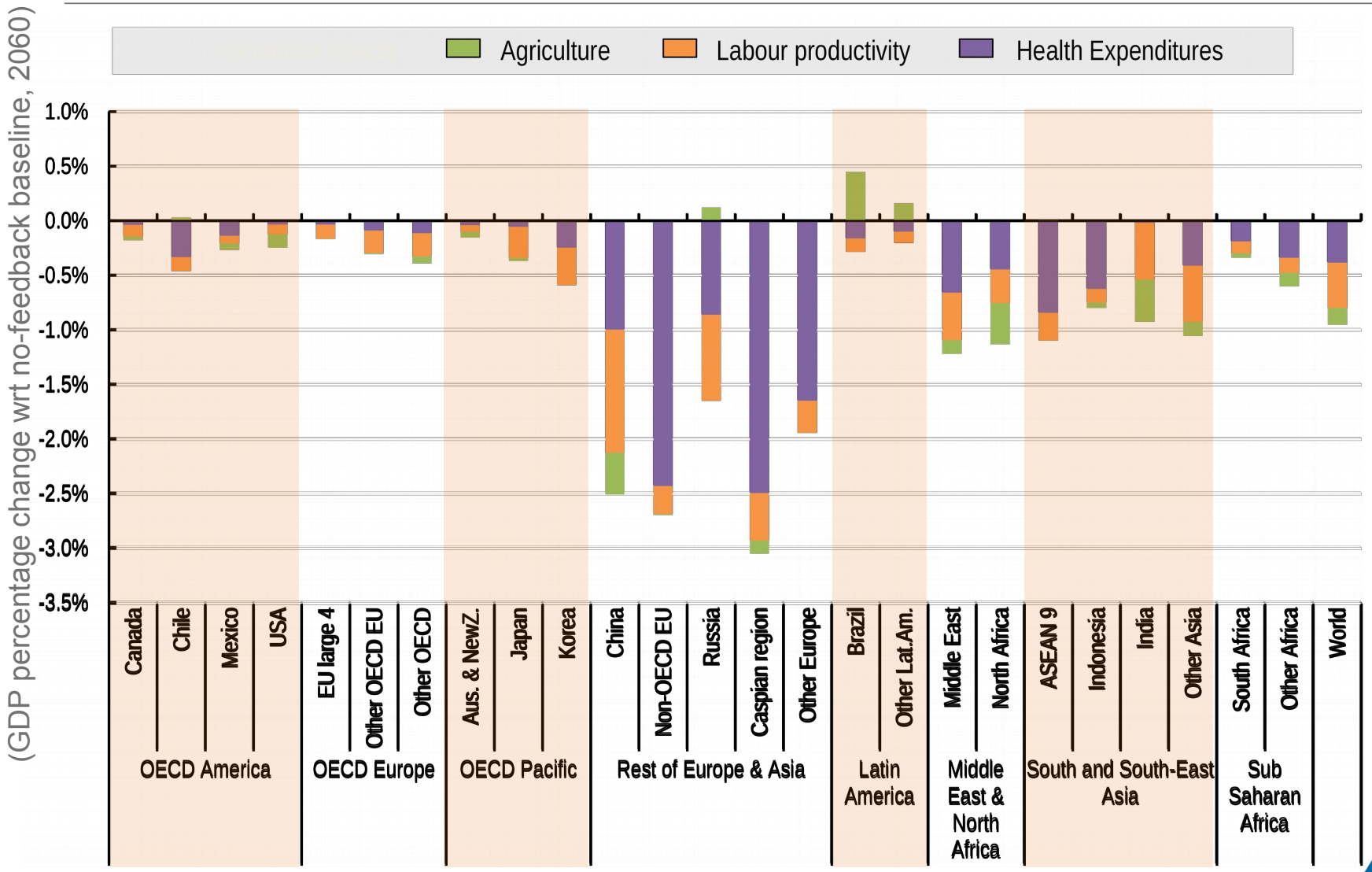
Annual average total anthropogenic PM2.5 (µg/m3)



Concentrations calculated with TM5-FASST (EU JRC Ispra)

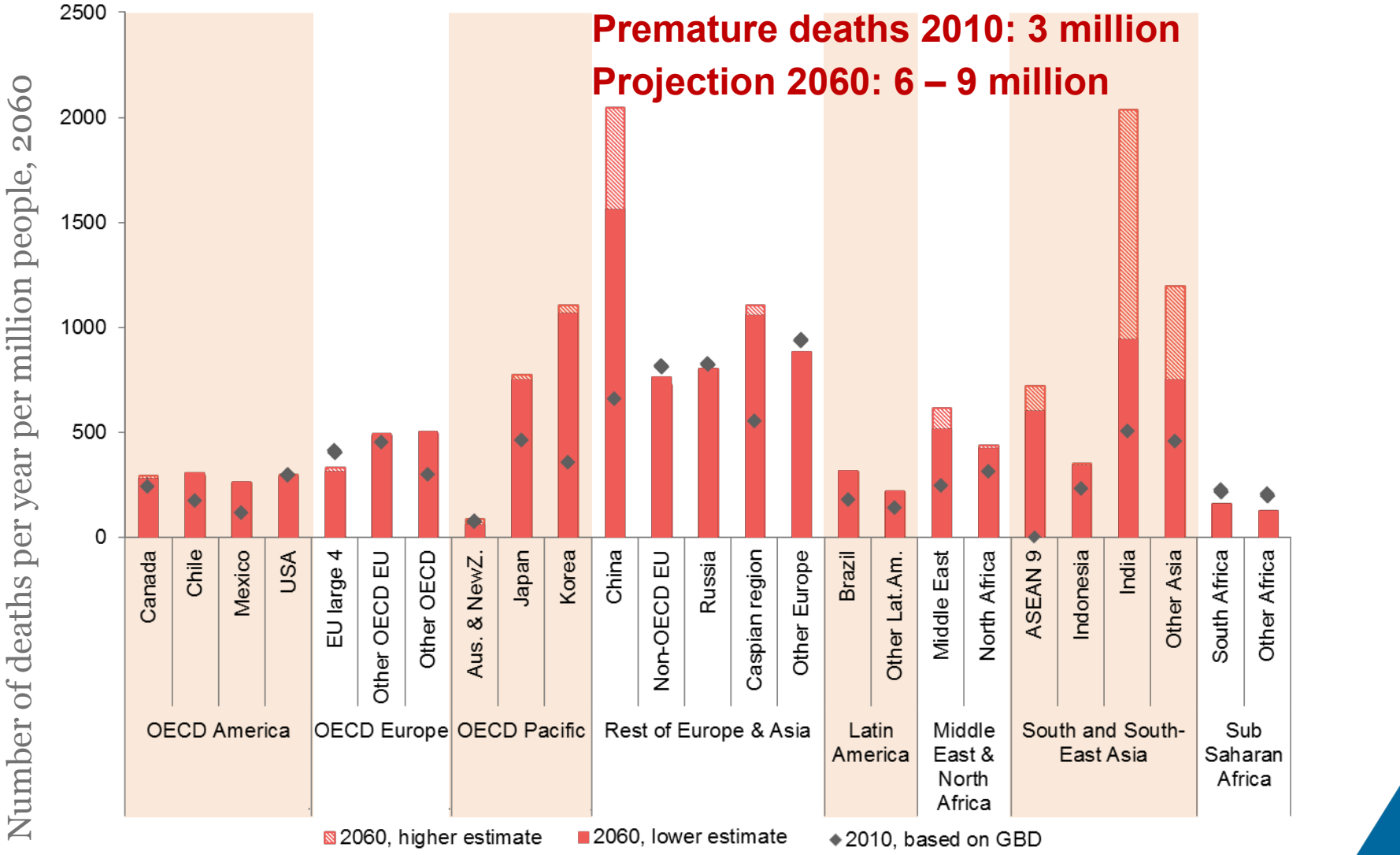
Source: OECD (2016), The Economic Consequences of Outdoor Air Pollution

Projected market costs of outdoor air pollution, 2060



Source: OECD (2016), The Economic Consequences of Outdoor Air Pollution

Premature deaths caused by outdoor air pollution



Source: OECD (2016), The Economic Consequences of Outdoor Air Pollution

The joint consequences

Types of interactions

1. Effects of impacts & economic consequences on emissions

   e.g. climate damages reduce production and emissions of polluting industries

2. Effects of state of environment (temp., conc.) on impacts

   e.g. changes in weather affect ozone formation

3. Effects of impacts on impacts

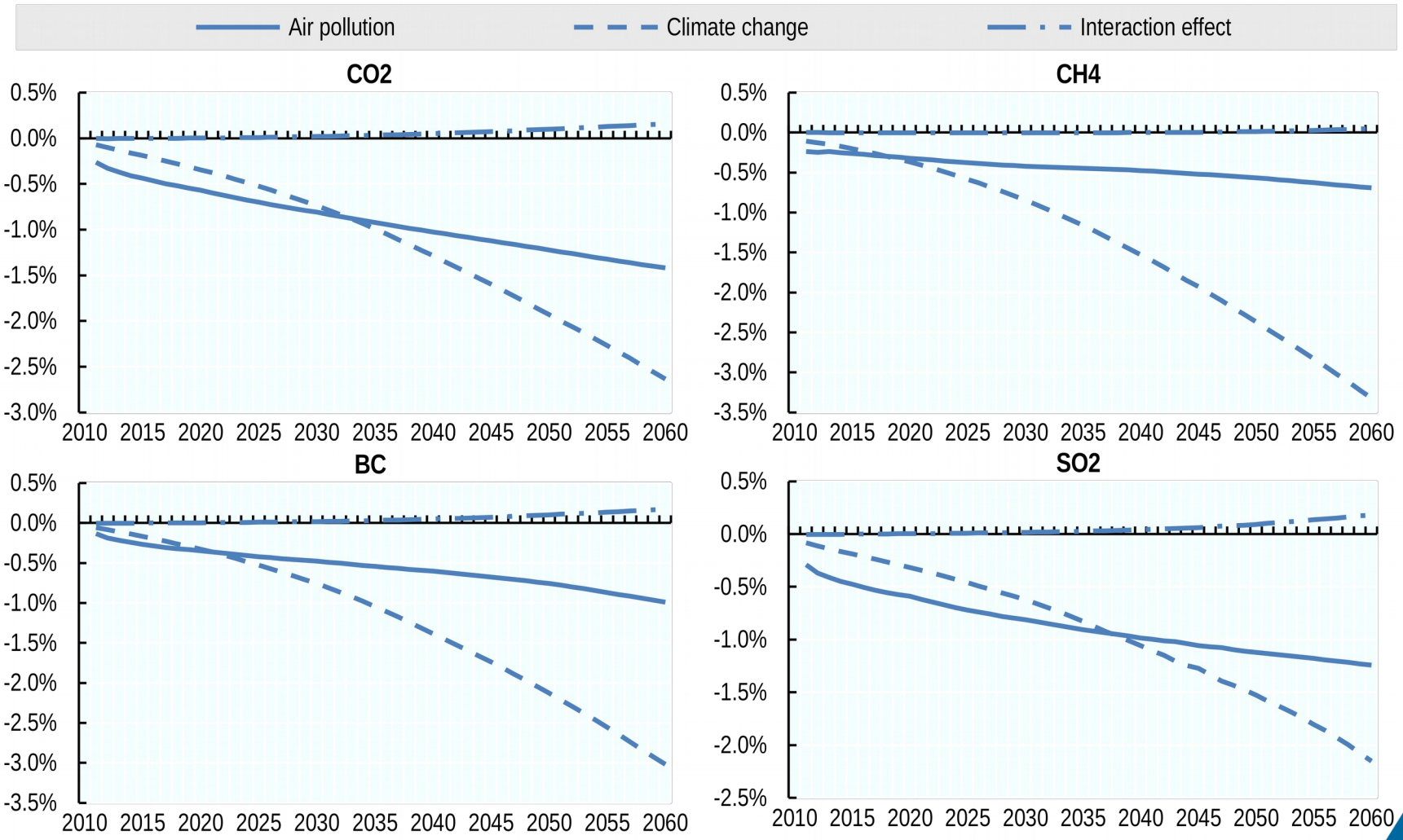
   e.g. pollution illnesses increase fatalities from heatwaves

4. Effects of economic consequences on economic cons.

   incl. CGE interaction effects and other non-linearities

More significant interactions when considering consequences of policies!

1. Interactions through emissions

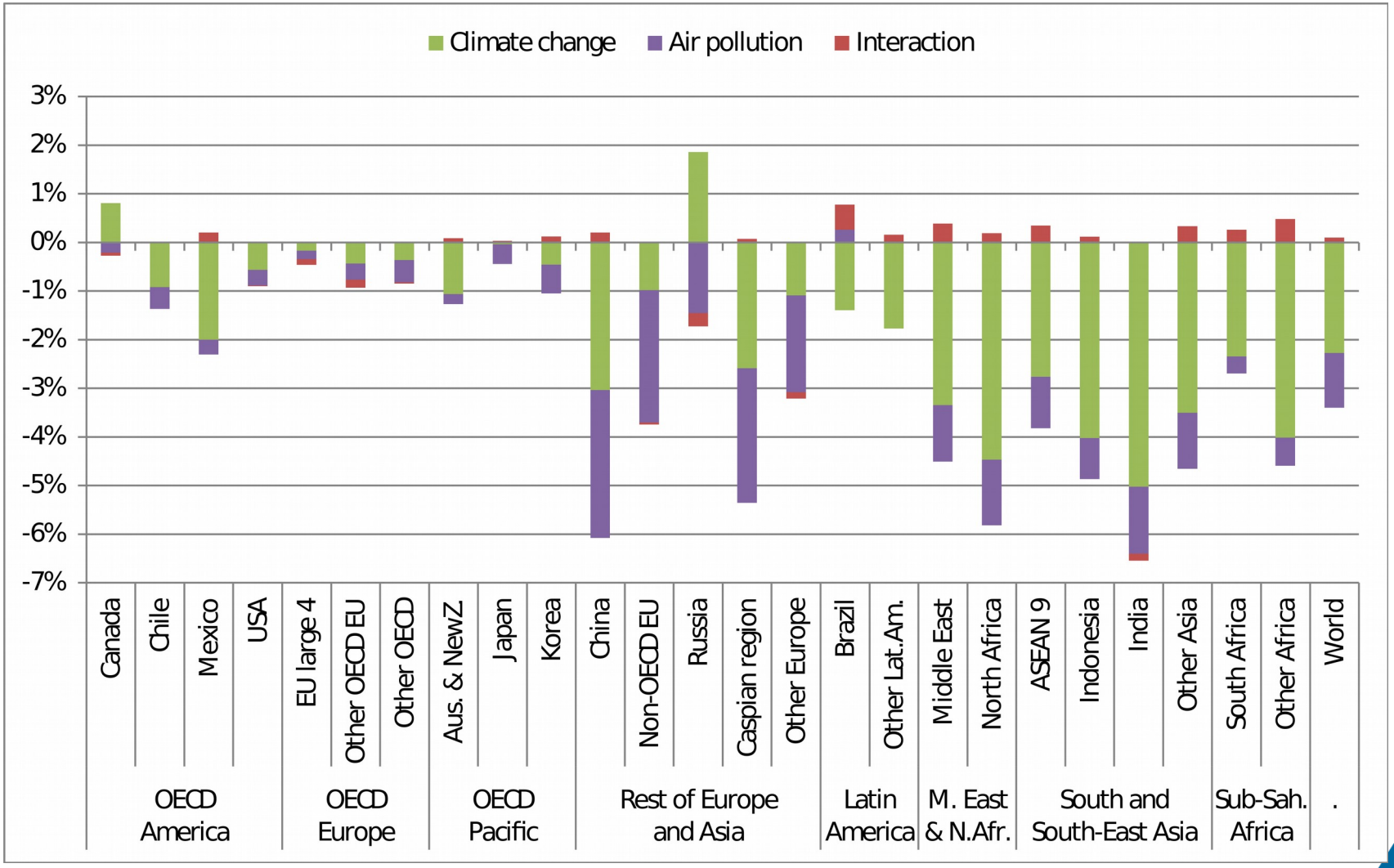


(percentage change wrt no-feedback baseline, 2060)

2. & 3. Biophysical linkages: for future research

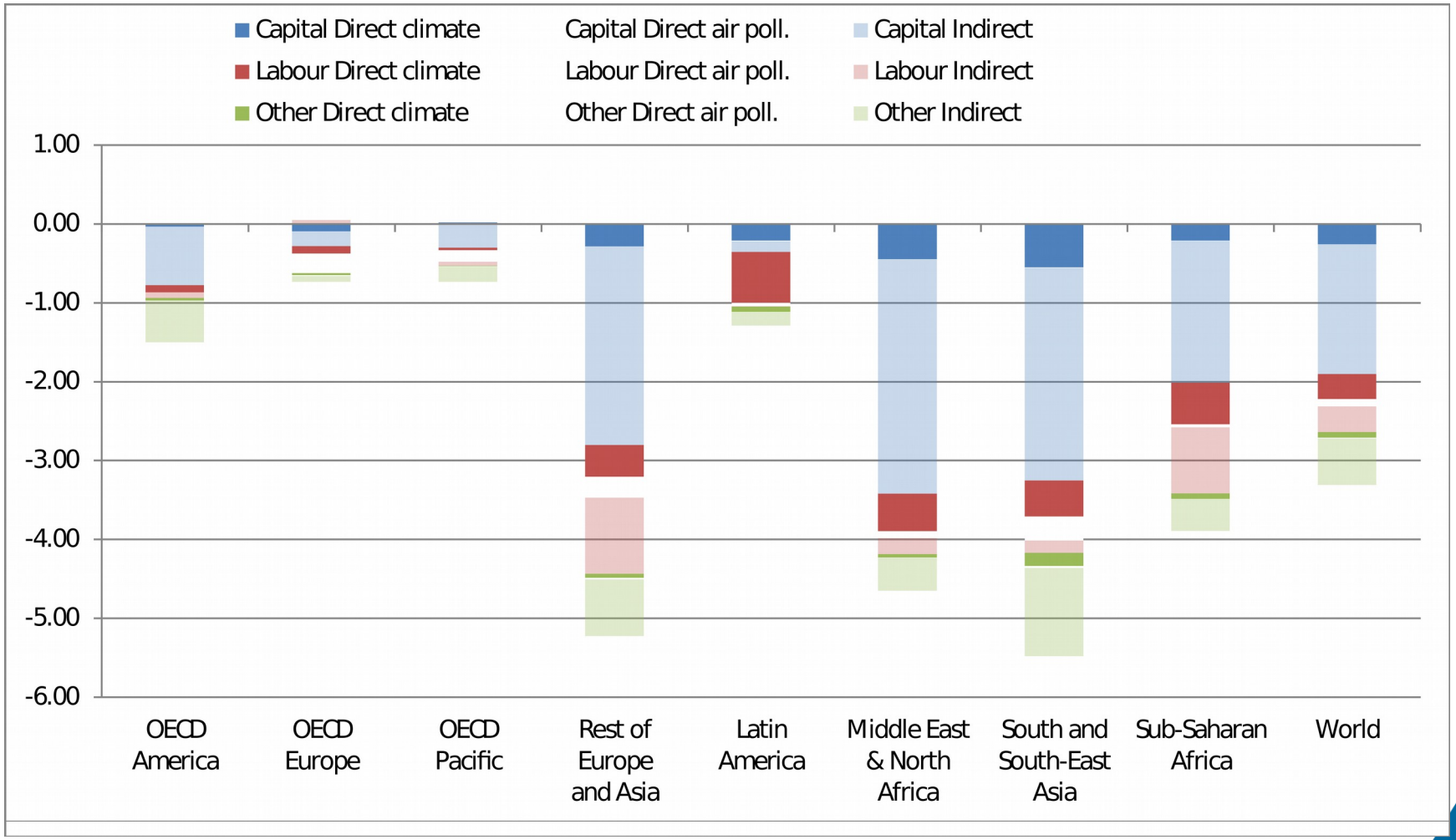
- Physical (state-of-environment) interactions
  - → Climate change is part of calculations of PM and O3 concentrations
  - → Air pollutants are part of carbon cycle model
- Interactions through joint effects on health
  - → Lack of data to quantify; default assumption is additive effects
  - → Distinguish between mortality and morbidity effects
  - → Problem in assessing mortality-morbidity relationships
- Interactions in agriculture
  - → Assess through use of crop models
- Other potential impact interactions
  - → Tourism: effects from pollution unclear, as are interactions
  - → Energy demand: significant effects only for policy scenarios?

4. Economic interactions: effects on GDP



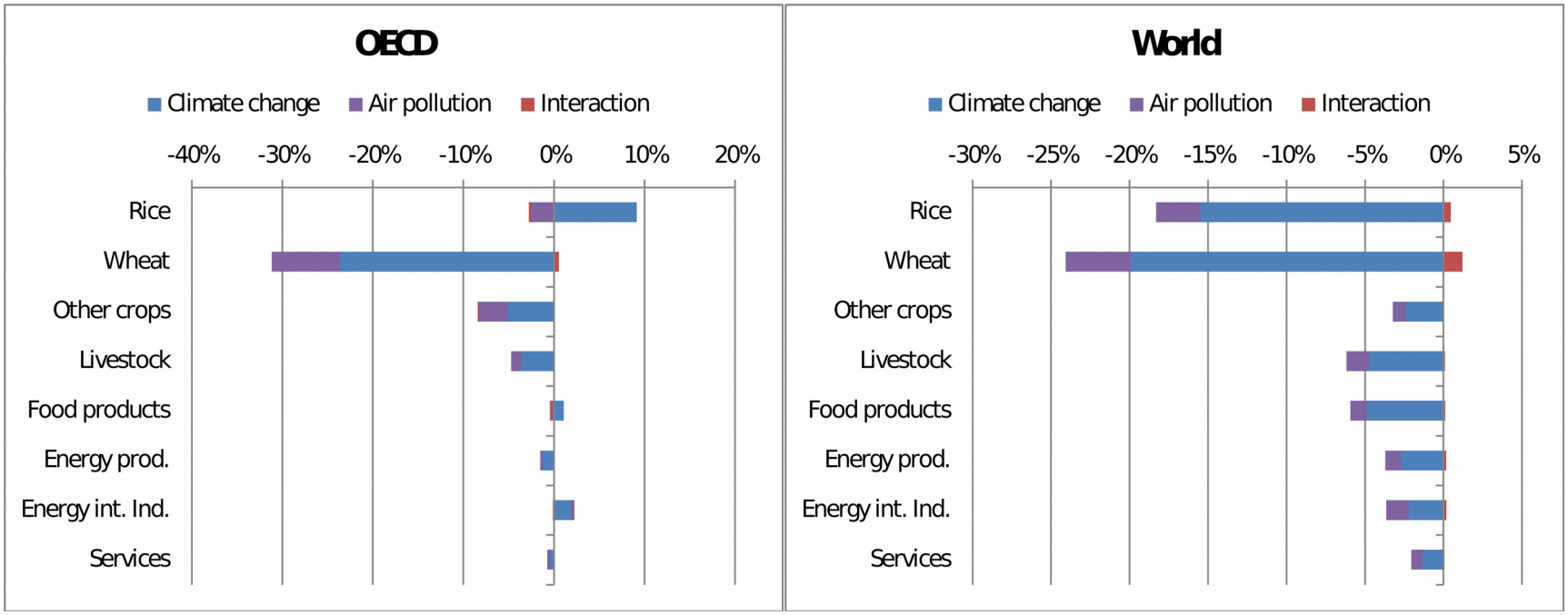
(percentage change wrt no-feedback baseline, 2060)

4. Economic interactions: effects on production factors



(percentage change wrt no-feedback baseline, 2060)

4. Economic interactions: effects on specific sectors



(percentage change wrt no-feedback baseline, 2060)

Conclusions

1. Feedback effects through changes in emissions are very limited
2. & 3. Biophysical feedbacks unclear
4. Economic feedbacks limited at global level
   - Some regions hardly any economic interaction effects
   - Some regions significant trade effects (+)
   - Some regions significant economic adaptation effect (+)
   - Some regions significant non-linearity effect (-)

More significant interactions through reactions to policies!

THANK YOU!

For more information:

www.oecd.org/environment/modelling

rob.dellink@oecd.org

OECD
BETTER POLICIES FOR BETTER LIVES

The OECD CIRCLE project

CIRCLE: **C**osts of **I**naction and **R**esource scarcity: **C**onsequences for **L**ong-term **E**conomic growth

- Calculating the costs of inaction:
  - Quantify how changes in environmental quality, climate change, natural resources affect the economy, and prospects for long-term growth
- Regional and sectoral quantitative approach where possible, coupled with more general insights where needed
  - Market impacts: production function approach
  - Non-market impacts: valuation approach