

# **An Economy-wide Assessment for Global Agricultural Impacts of Climate Change**

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14 April 2009

ADBI, Tokyo

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# Presentation Outline

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- Based on the ADBI Working Paper No. 131  
*“Agricultural Impact of Climate Change: A General Equilibrium Analysis with Special Reference to Southeast Asia”*
- Background
- The Methodology
- Agricultural Impact Analysis
- Conclusions

# Background

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- Climate change is likely to be the most significant global challenge of the 21<sup>st</sup> century
- Agriculture is one of the most vulnerable sector to the climate change
- And its impact is unlikely to be evenly distributed across regions.
  - Low latitude and developing countries are expected to lose more

# Background (cont'd)

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- Southeast Asia has a relatively large dependence on agriculture.
  - Contributing 10% of GDP and 1/3 of employment
- Agriculture is especially important for poverty reduction in the region
- High exposure to agricultural trade makes it vulnerable to international market shocks.

# Objective

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- Investigate the impacts to global climate change on agriculture
- Provide an economy-wide assessment of the impacts on the world economy, and specially, the Southeast Asian economies

# Methodology

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- Most existing studies are focusing on agriculture only, ignoring the cross-sectoral interaction
  - Crop simulation model
  - Agro-ecological zone (AEZ) model
  - Cross-section regression model (Ricardian)

# Methodology

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- A dynamic computable general equilibrium (CGE) model of global economy
  - Optimizing behavior
  - Endogenous response to price signals
  - Commodity and factor markets clear
  - Detailed region and sector disaggregation
  - Incorporate results of sectoral studies as exogenous shocks

# Scenarios for assessing the agricultural impacts of climate change

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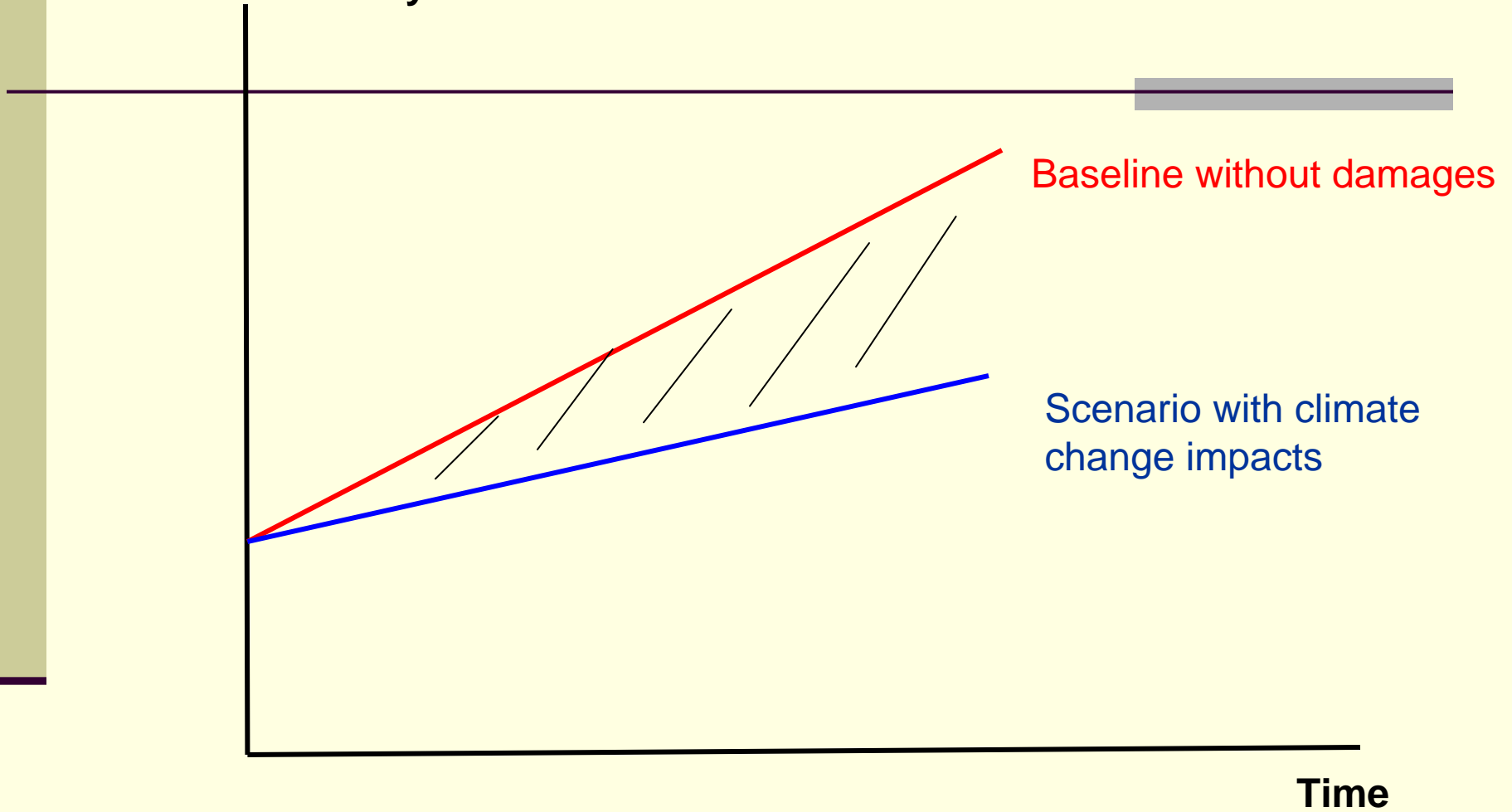
## ■ Baseline scenario

- Global growth from 2004-2080 under assumption of no climate change impacts on economic activities
- Provide a reference for examining the effects of climate change

## ■ Agricultural damage scenario

- Productivity in crop agricultural sectors would be lower due to projected changes in climate
  - The assumed productivity shocks are based on a recent study by Cline (2007)

**Economic activity**



**Baseline without damages**

**Scenario with climate change impacts**

**Time**

# Cline's projection for 2080s

Climate variables	Land area	Farm area
Base levels		
Temperature (°C)	13.15	16.20
Precipitation (mm/day)	2.20	2.44
By 2080s	4.3	0.3
Temperature (°C)	18.10	20.63
Precipitation (mm/day)	2.33	2.51

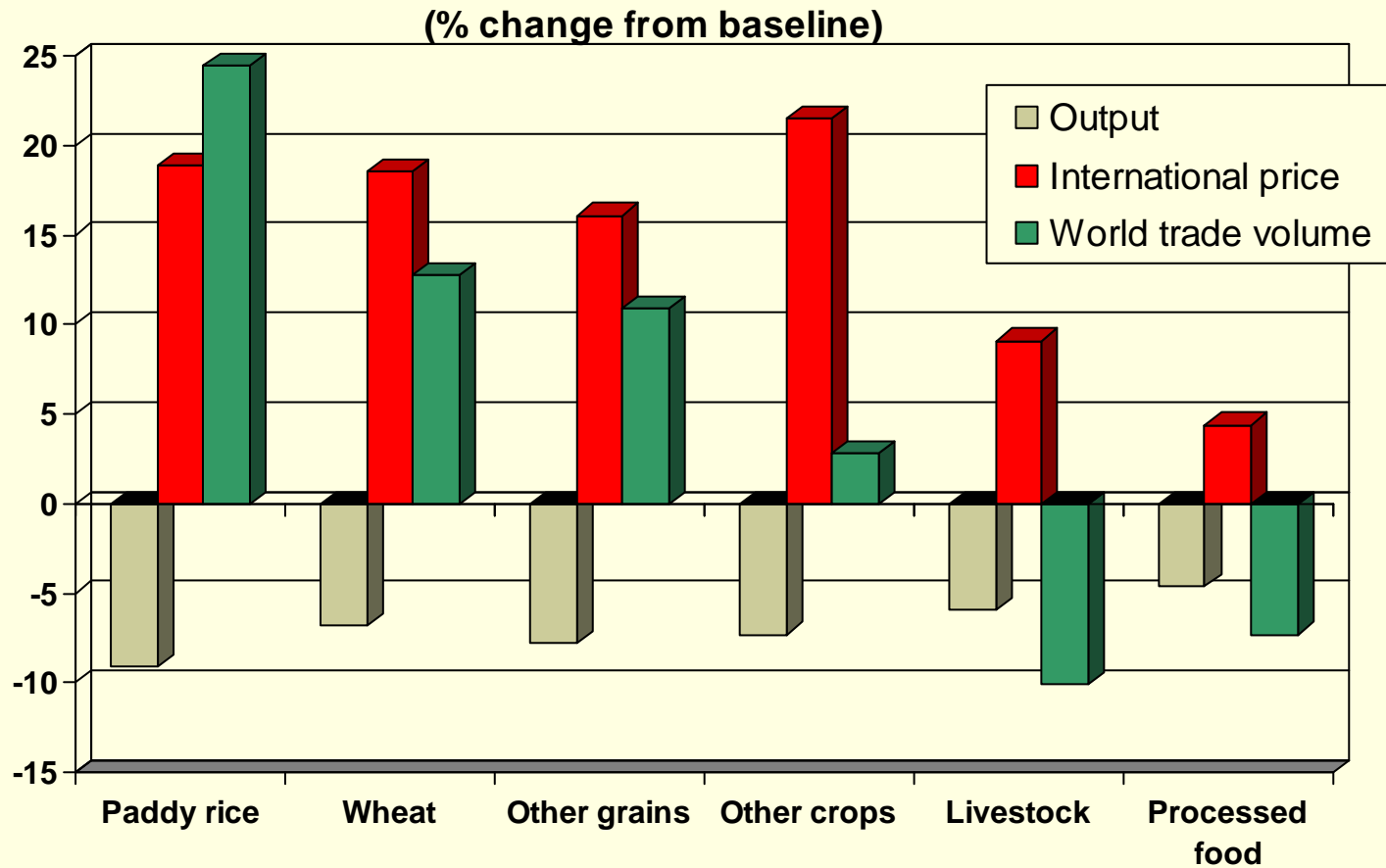
# Cline's projection for 2080s (cont'd)

Impacts crop productivity	w/o cf	with cf
World	-15.9	-3.2
Industrial countries	-6.3	7.7
Developing countries	-21.0	-9.1
Africa	-27.5	-16.6
Asia	-19.3	-7.2
China	-7.2	6.8
Latin America	-24.3	-12.9

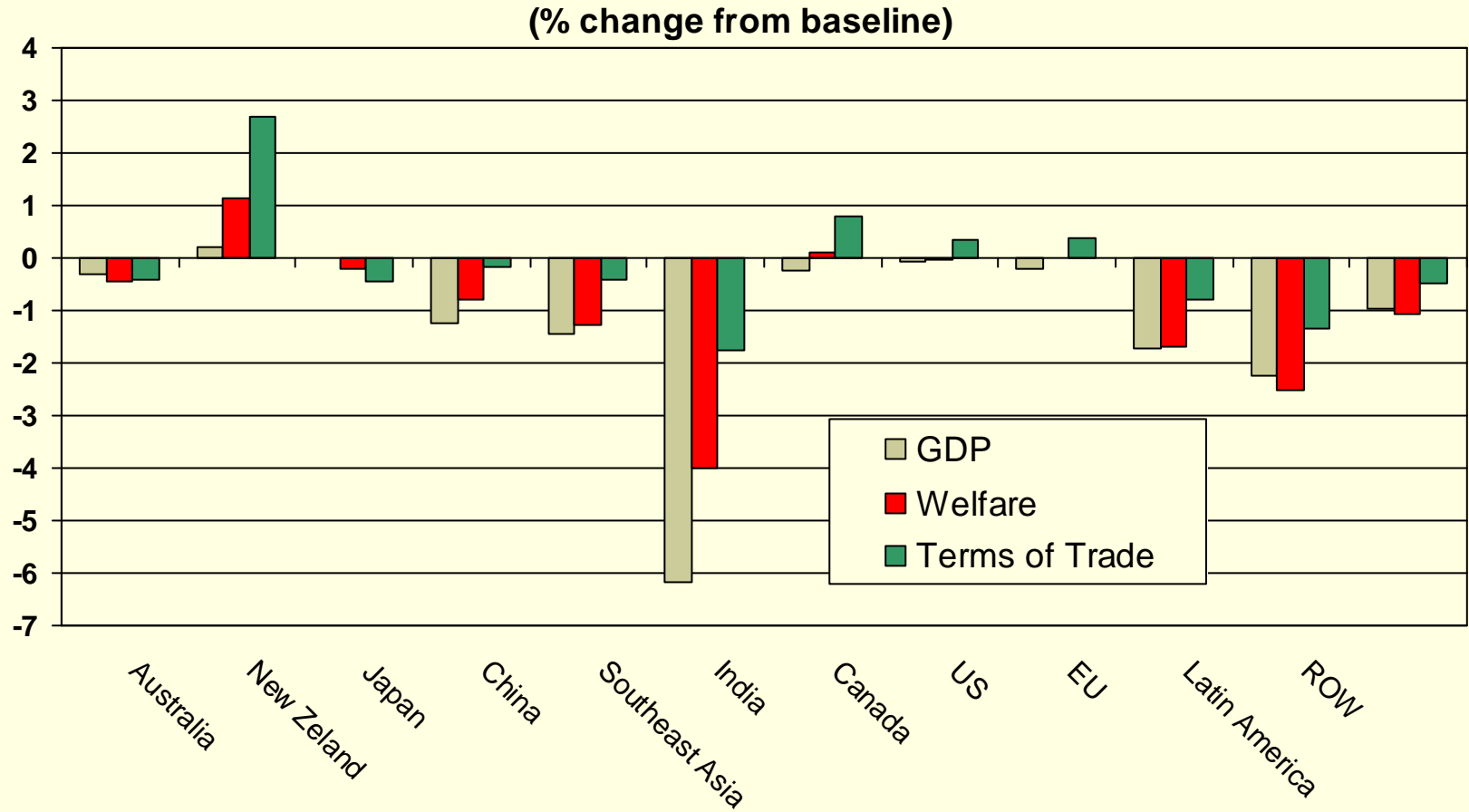
# Cline's projection for 2080s (cont'd)

Impacts crop productivity	w/o cf	with cf
Indonesia	-17.9	-5.6
Malaysia	-22.5	-10.9
Philippines	-23.4	-11.9
Thailand	-26.2	-15.1
Viet Nam	-15.1	-2.0

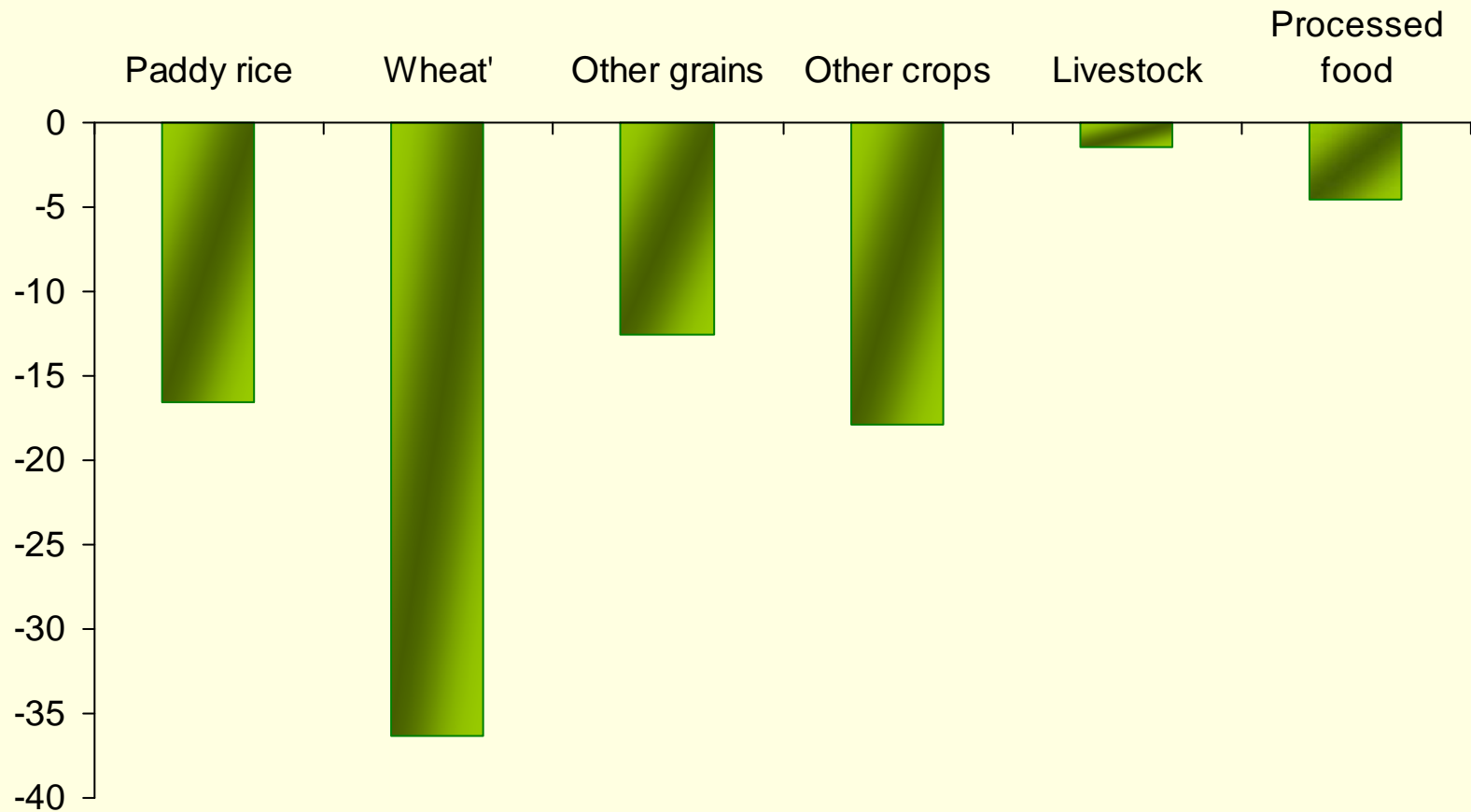
# Impact on global output and price, 2080



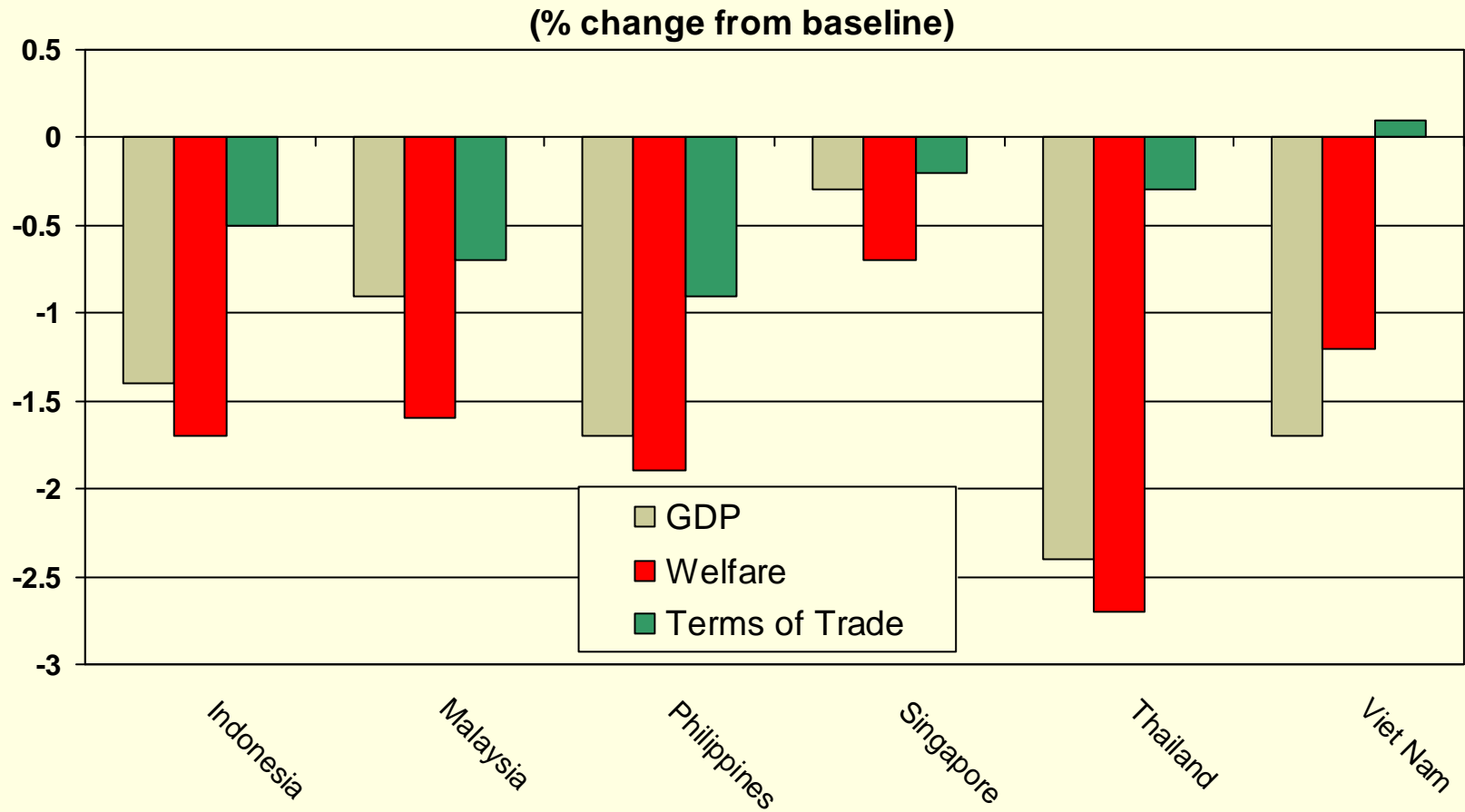
# GDP, welfare and terms of trade, 2080



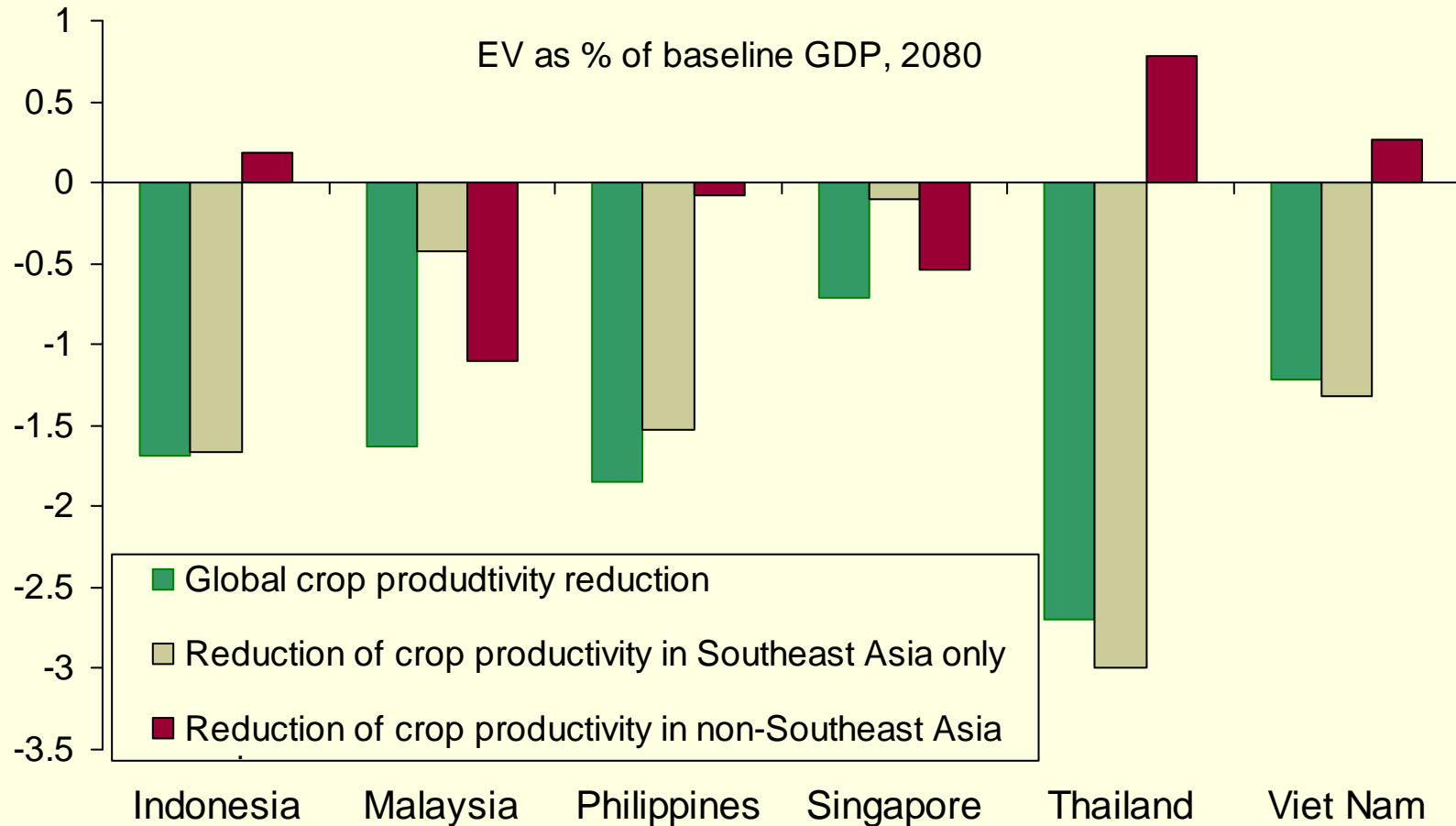
# Changes in Southeast Asia's Ag&Food Output, 2080



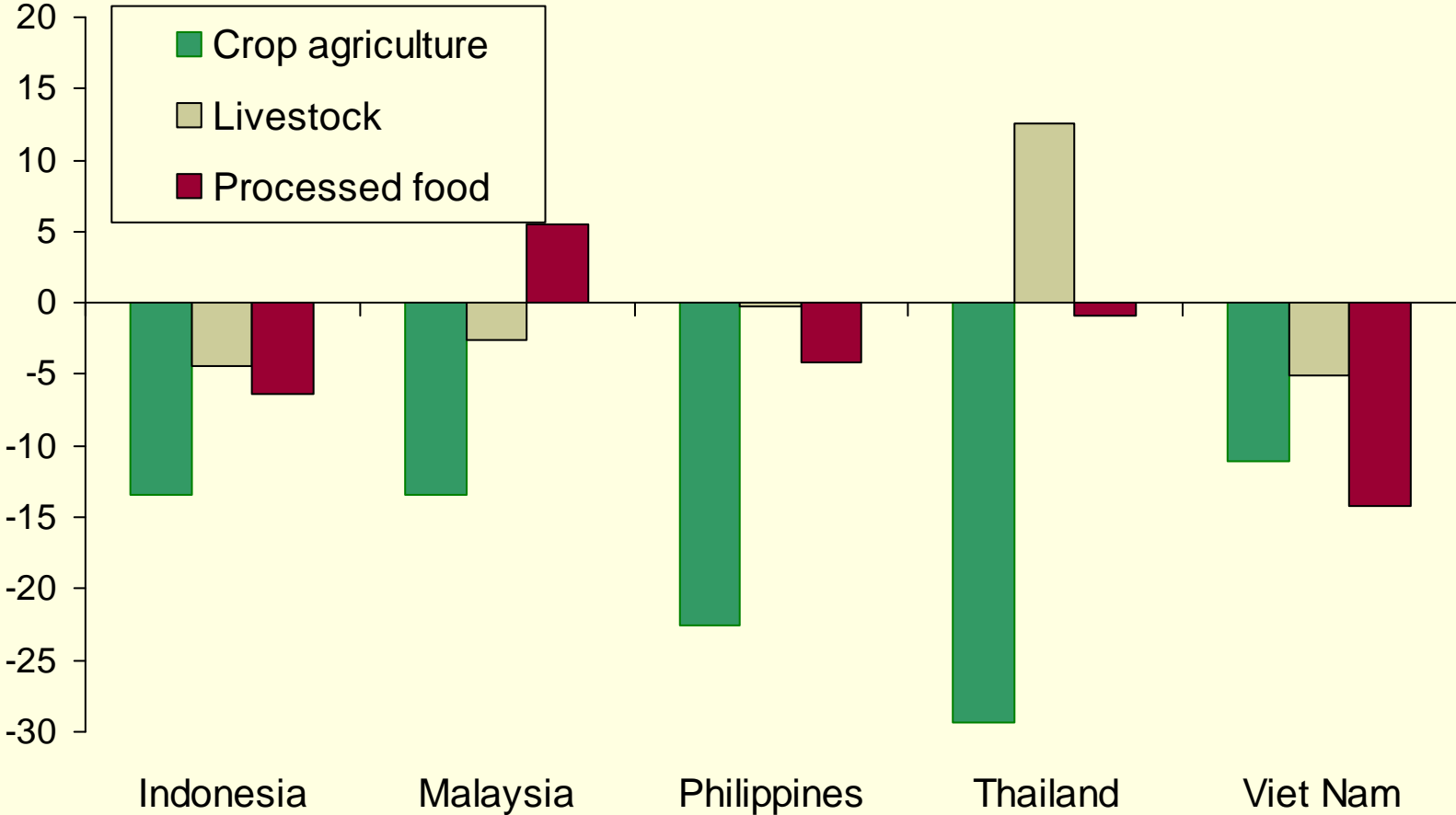
# GDP, welfare and terms of trade for SEA economies, 2080



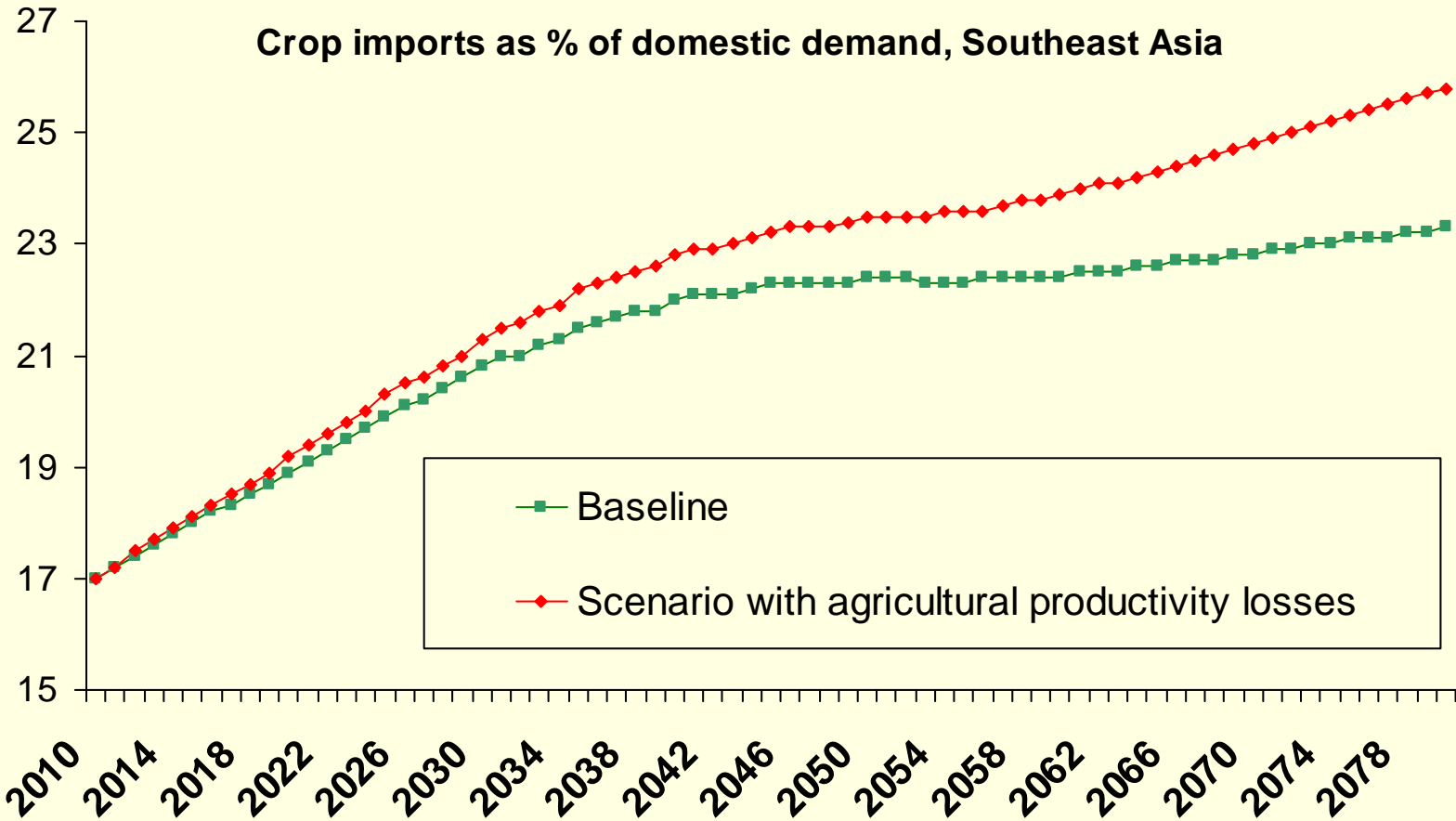
# Decomposition of welfare impacts



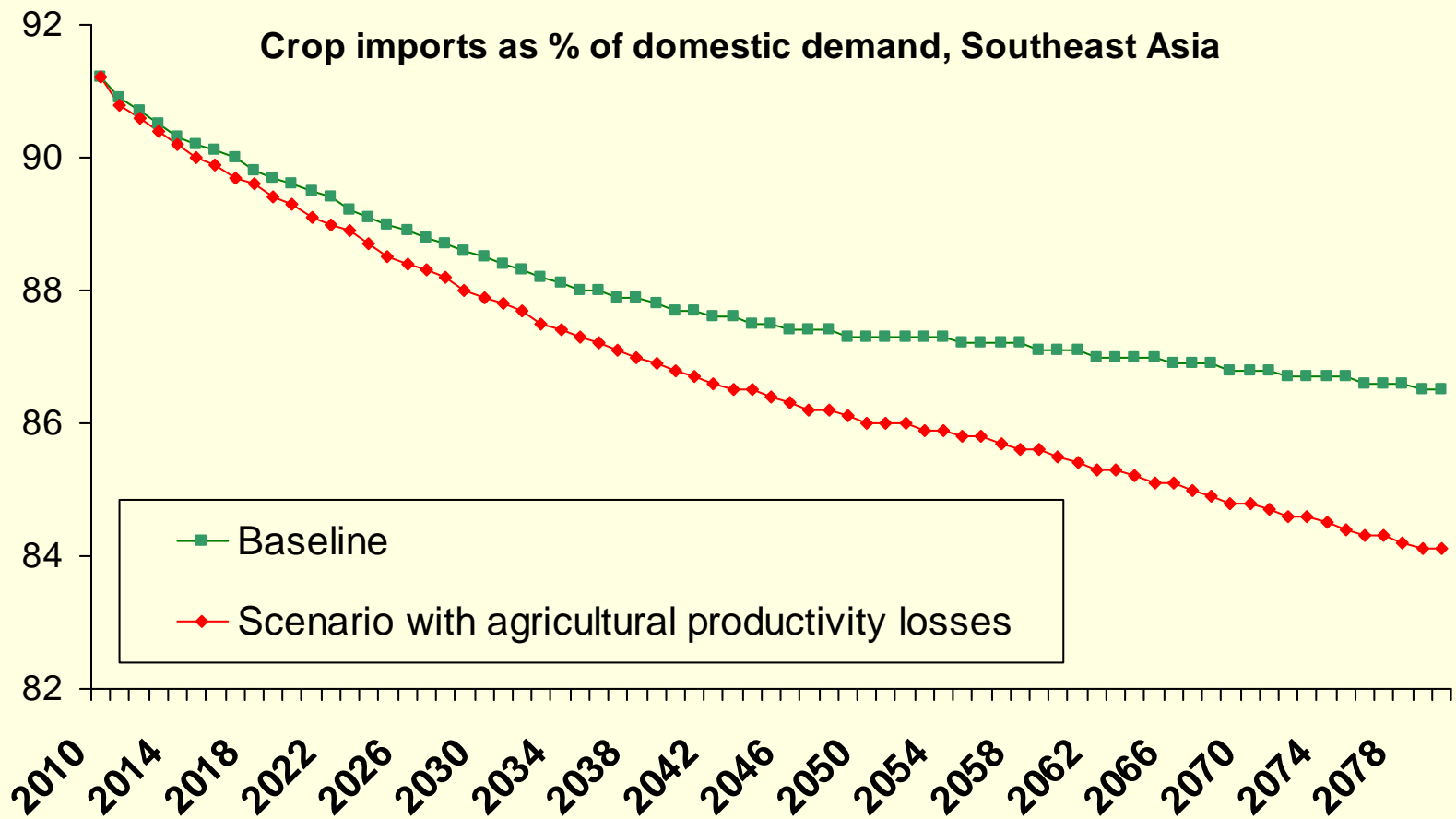
# Changes in Ag&Food Output, 2080



# Import Dependence of Crop Agriculture of SEA



# Grain Self-sufficiency Ratio of SEA, 2010-80



# Varied distributional impact across economies – changes in factor returns

	Capital	Unsk. Labor	Skilled Labor	Land
Indonesia	-2.0	-1.5	-2.8	9.6
Malaysia	0.3	-1.6	-1.8	4.9
Philippines	0.2	-2.0	-2.6	0.9
Singapore	-0.2	-1.0	-1.2	-8.7
Thailand	-0.9	-4.0	-3.3	-4.3
Viet Nam	-1.5	-1.6	-2.3	3.9

# Alternative baseline – slowdown in ag. TFP growth in Southeast Asia

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- The baseline scenario assumes that agricultural productivity grows at the same rate of manufacturing and services sectors.
- But there have been evidences that the growth of agricultural productivity has significantly slowed down since 1980s, especially in East and Southeast Asia.
- An alternative baseline assumes 1 percentage point lower annual agricultural TFP growth in Southeast Asia.

# Simulation results based on alternative baseline: Impact on Southeast Asia

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	GDP	Welfare
Original baseline	-1.4	-1.7
Alternative baseline	-1.3	-2.0

# Conclusions

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- The aggregate impacts of climate change-induced global agricultural damage on global economy are moderate.
- But the impacts are not evenly distributed across the world.
- Some significant in global agricultural production and trade, and consequently, in distribution of income, are unavoidable.

# Conclusions (cont'd)

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- The aggregate output losses for most Southeast Asian economies are modest, given their anticipated declining agricultural share in economy.
- But their increased dependence on agricultural imports may lead them to lose more from the TOT deterioration.
- Reversing the trend of declining agricultural productivity in SEA would be an important strategy for them to cope with the potential risks from the expected climate change

# Caveat! great uncertainties, and covers a small part of whole story!

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- A lots of damages caused by global warming are not considered here.
  - Market impacts
    - Forestry, fishery, sea-level rise, water availability, tourism, etc.
  - Non-market impacts
    - Health, ecosystem, leisure, etc.

衆瞽  
摸象之圖

