

Implications of the Paris agreement in the context of long, med and short-term policies

Shinichiro Fujimori

9th , Dec., 2016

AIM International Workshop

NIES Oyama hall

Outline

- Paris agreement

- ✓ Short-term analysis

- How much is international emissions trading beneficial for NDC?

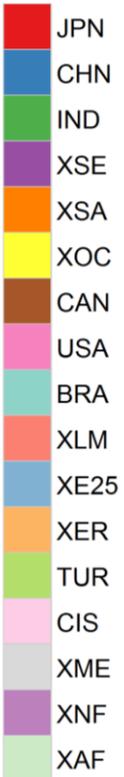
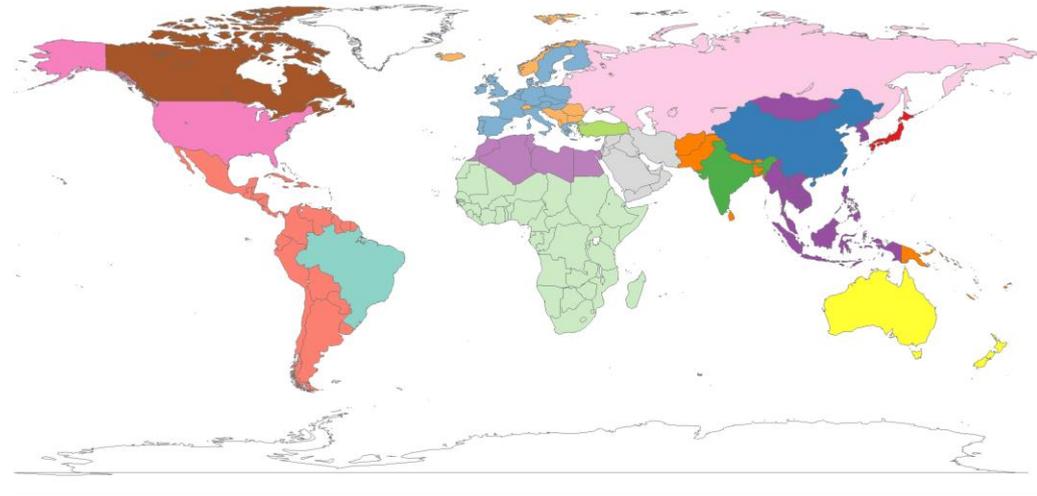
- ✓ Med- and long-term analysis

- What would be the bottle neck for the 2 degree climate stabilization under Paris Agreement?

- CGE related model activity

Method (1) : model

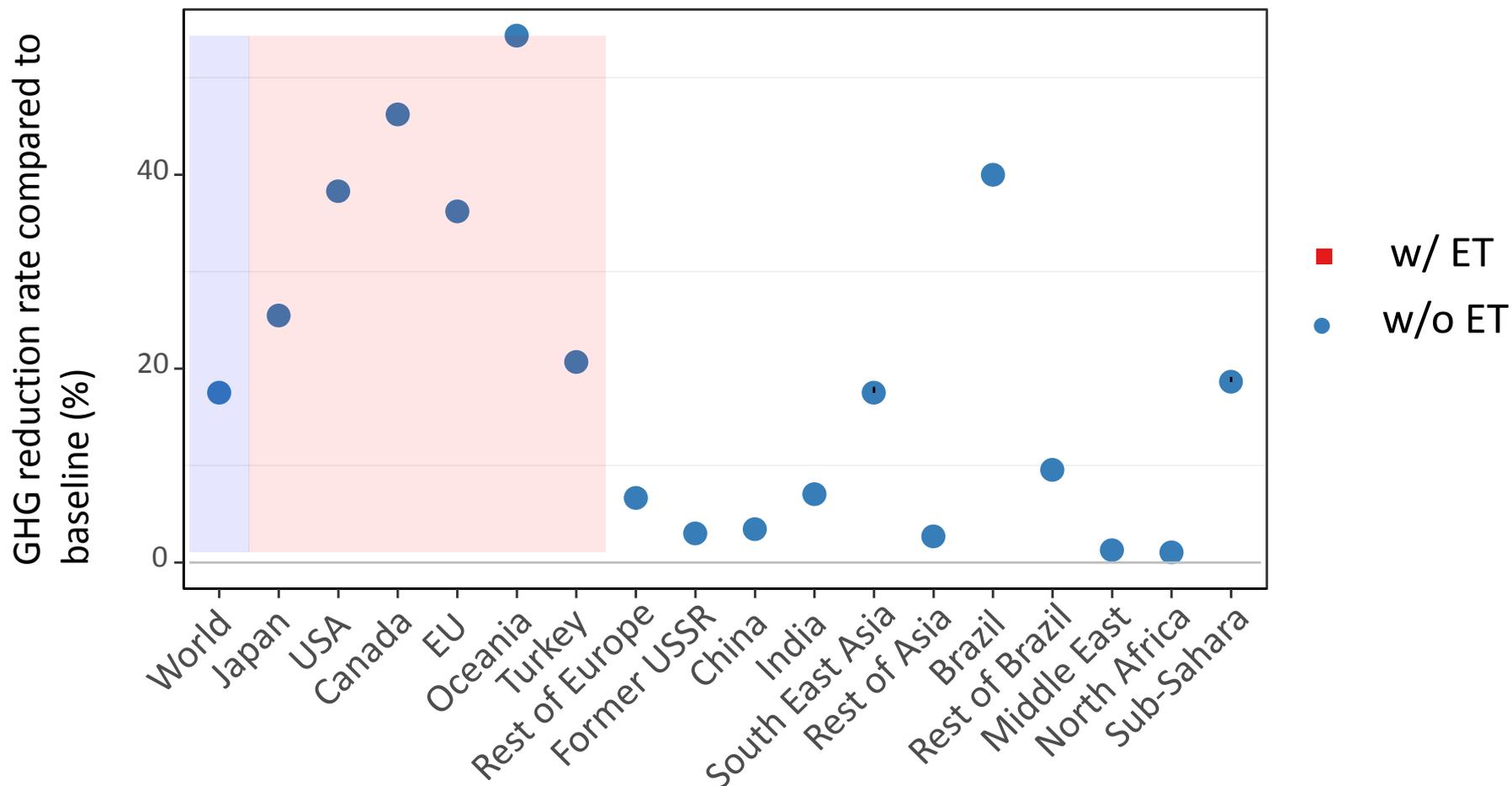
- General equilibrium global economic model
- 43 industrial sectors (Energy and agriculture are highly disaggregated) and 17 region.
- Recursive dynamic
- Domestic and international market is assumed
- Emissions; CO₂, CH₄, N₂O, SO_x, NO_x, CO, BC, OC, VOC, NH₃
- Simplified climate model MAGICC is used to make climate information
- There are two options in the representation of final energy demand
 - Conventional CGE type production function
 - AIM/Enduse technological detail information



NDC difficulties and emissions trading

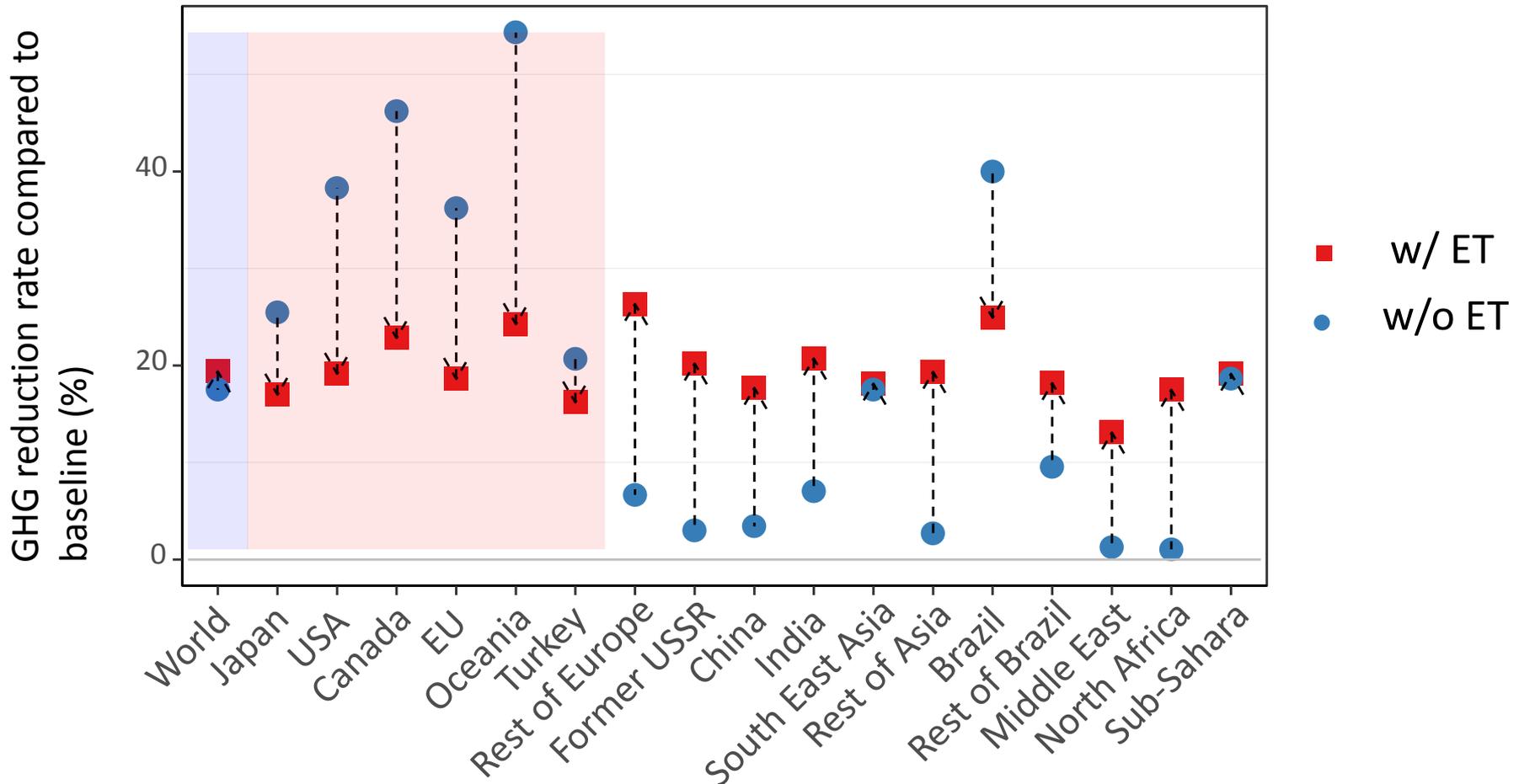
- Two scenarios
 - ✓ Without international emissions trading
 - ✓ With international emissions trading
- Both assume emissions target of NDC
- Global analysis

Regional emissions reduction rate



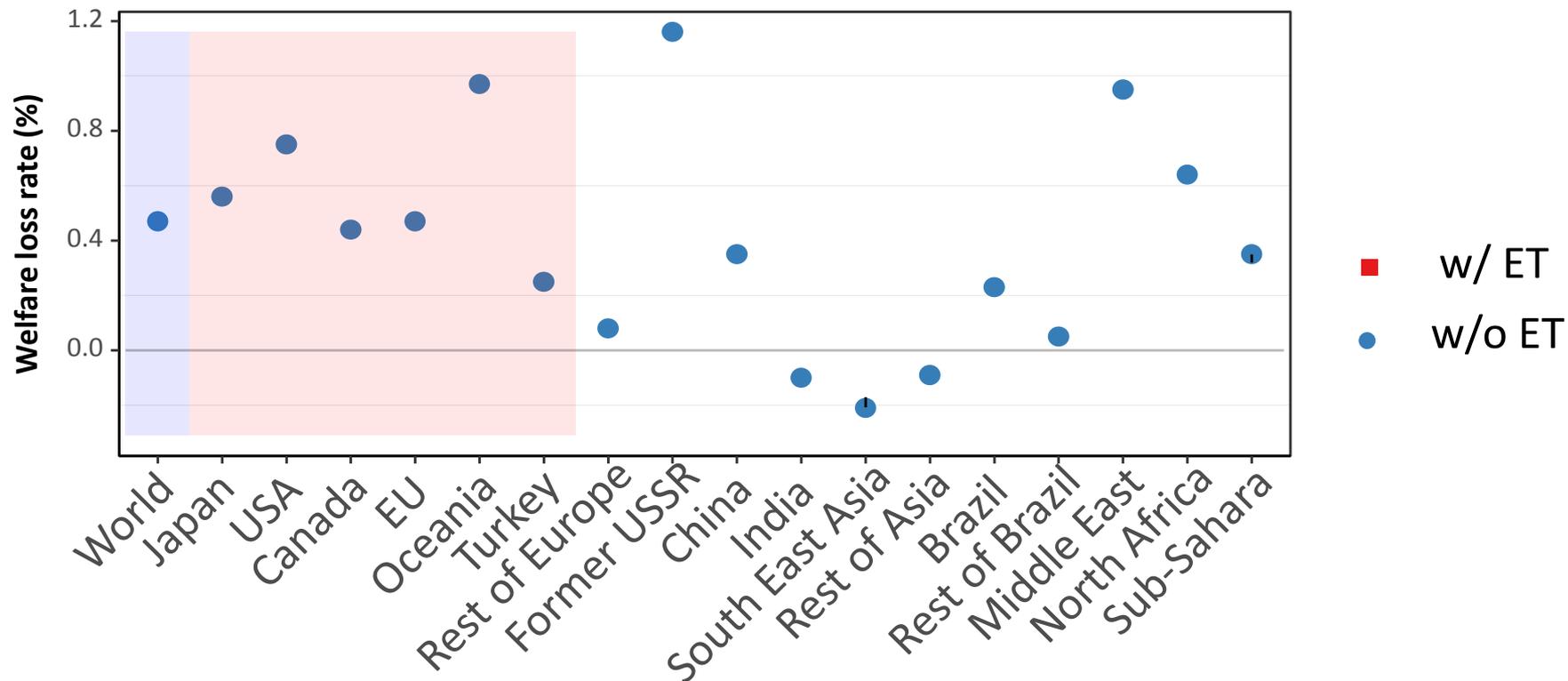
- OECD countries tend to have larger emissions reduction rate (see w/o ET)
- ET remarkably reduces OECD reduction rate while non-OECD tend to be opposite. There are some exceptions.

Regional emissions reduction rate



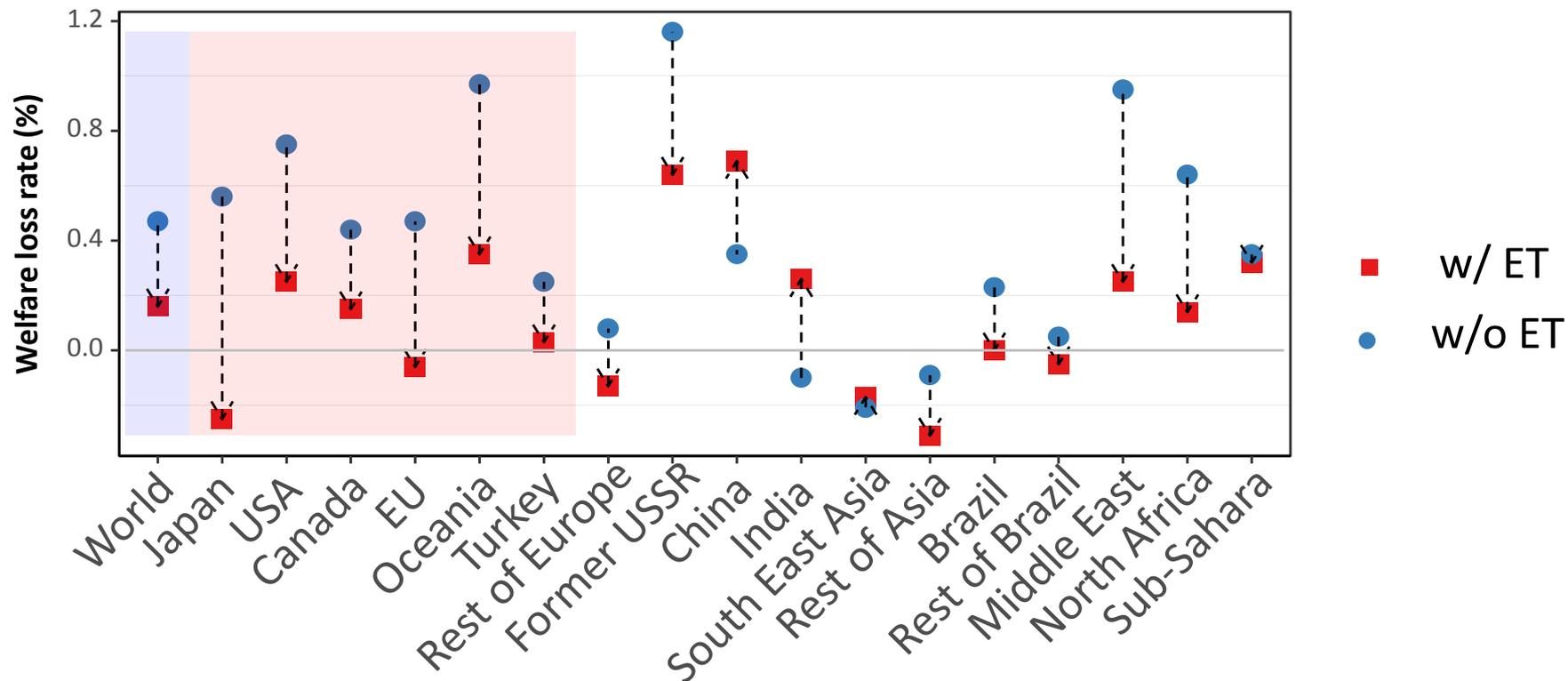
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Welfare loss in 2030 under INDC



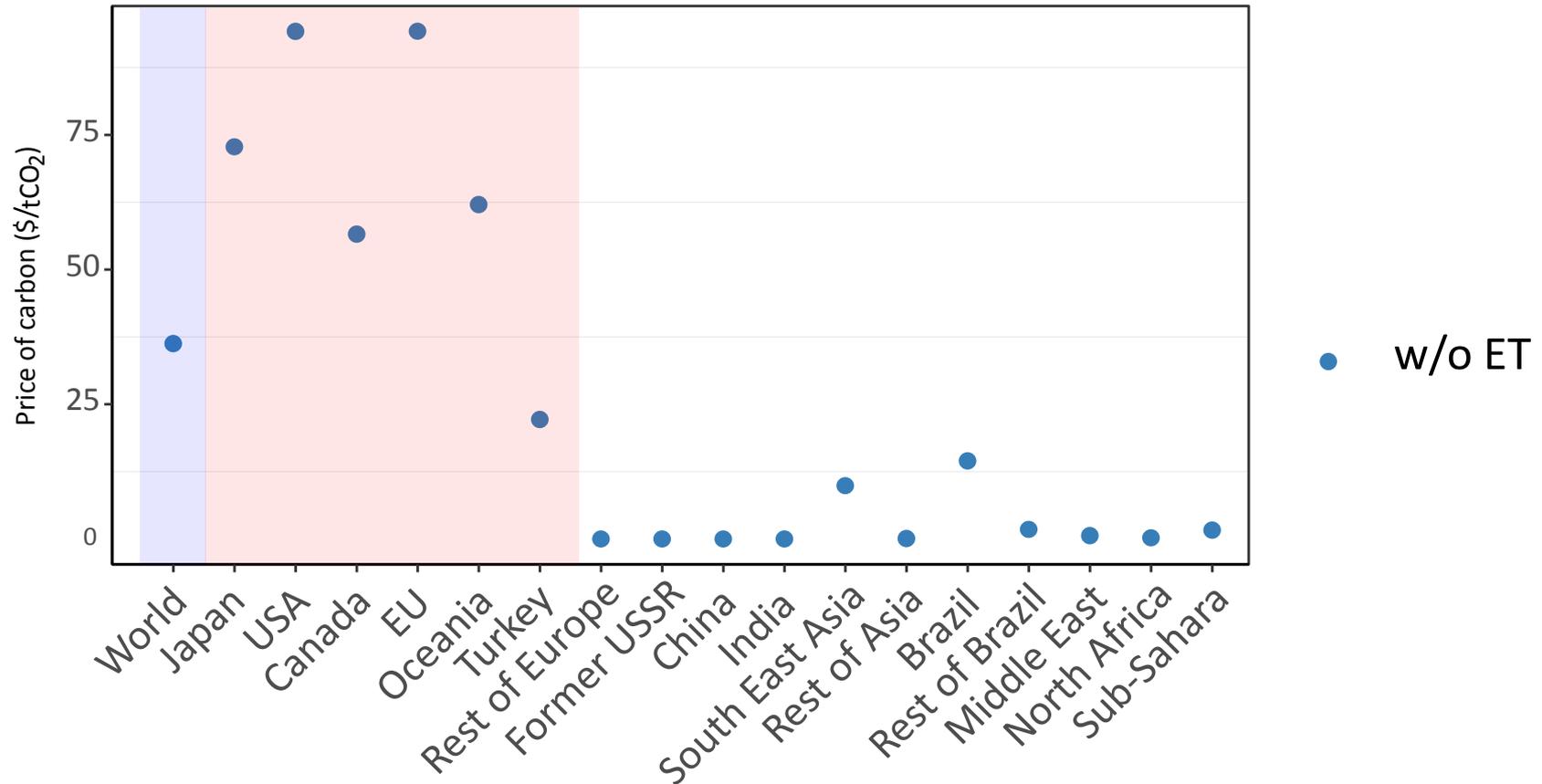
- Global mitigation cost without emissions trading is 0.5% (global total) but varies
- Decreases by 0.4% (80% of the loss is recovered)
- Winners are OECD countries
- Developing countries vary depending on carbon prices, its response and trade in international competitiveness

Welfare loss in 2030 under INDC



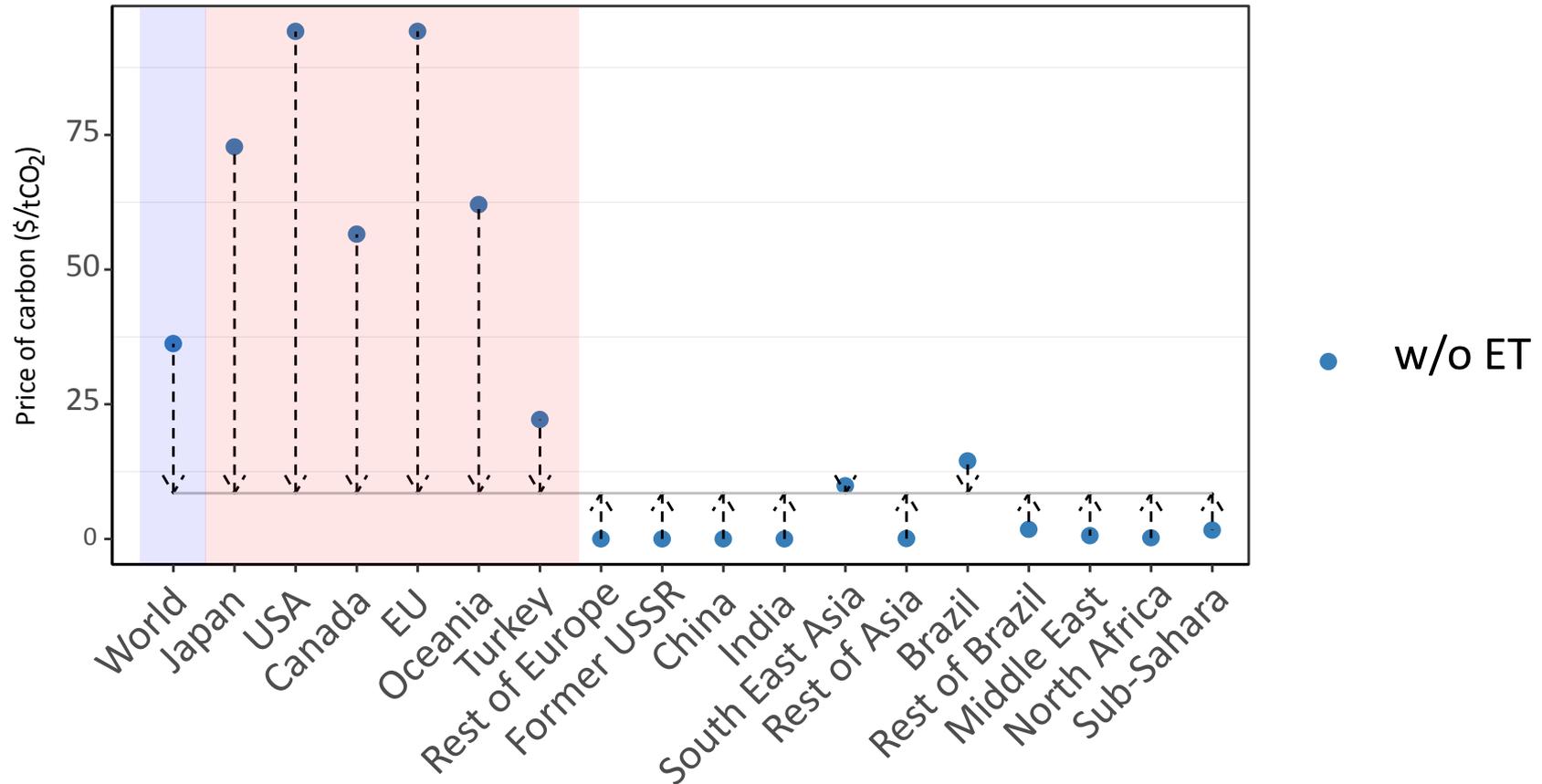
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Carbon price



- INDC has regional variety and OECD countries tend to have high carbon price
- If emissions trading is allowed, carbon price becomes 9\$/tCO₂.

Carbon price

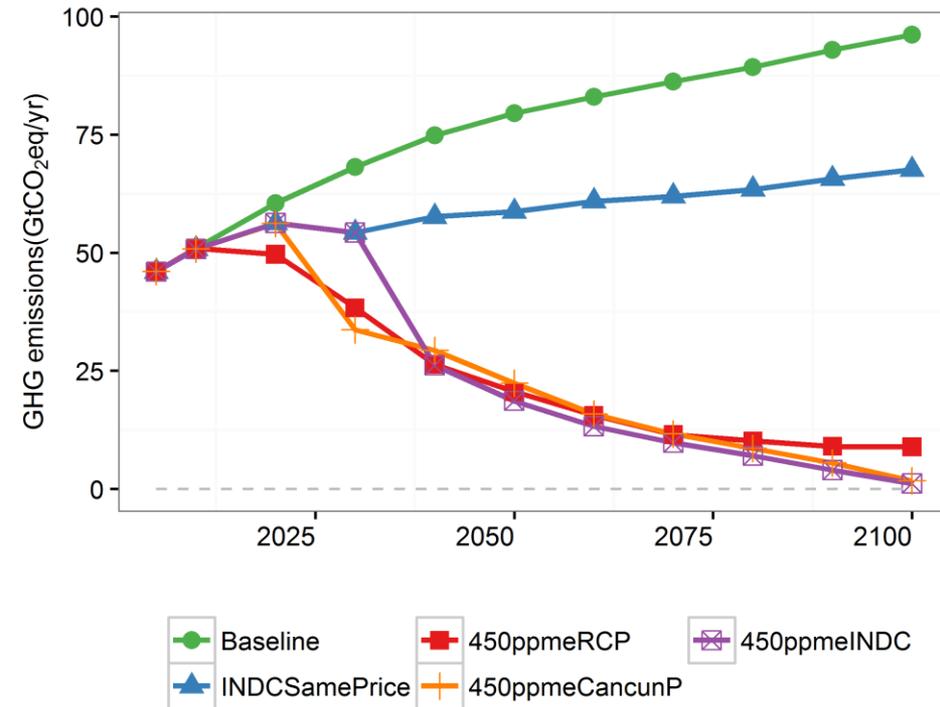


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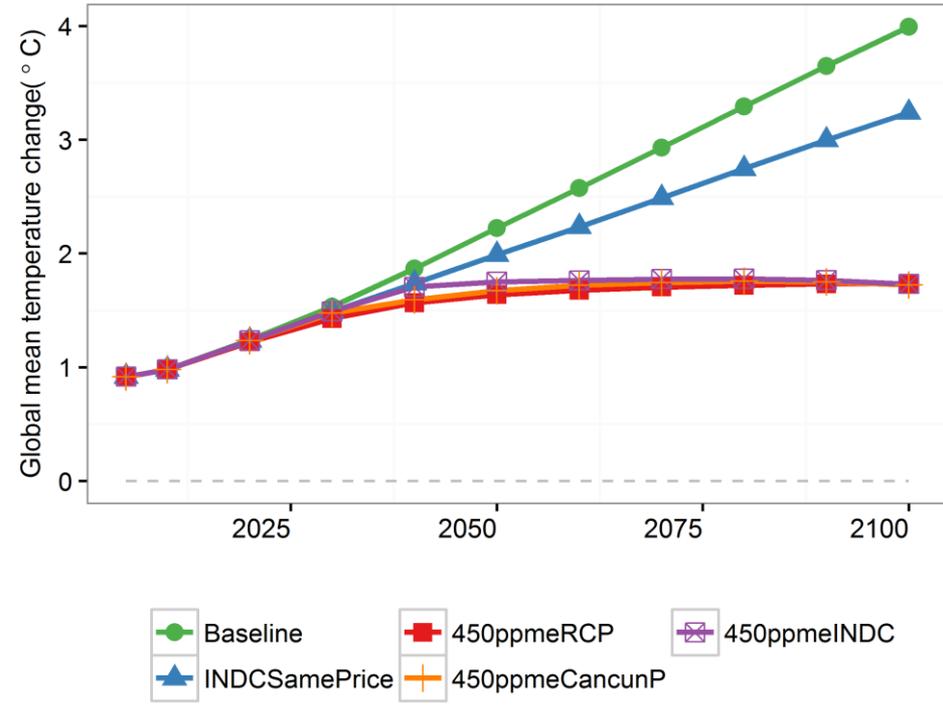
Long-term scenarios

Scenario name	GHG emissions reduction		
	2015-2020	2020-2030	2030-2100
Baseline	None		
INDCSamePrice	Cancun pledge	INDCs	Same carbon price in 2030
450ppmeRCP	Same as RCP2.6 emissions pathway		
450ppmeCancuunP	Cancun pledge	Equivalent to cumulative emissions in 450ppmeRCP	
450ppmeINDC	Cancun pledge	INDCs	Equivalent to cumulative emissions in 450ppmeRCP

GHG emissions and temperature



GHG emissions

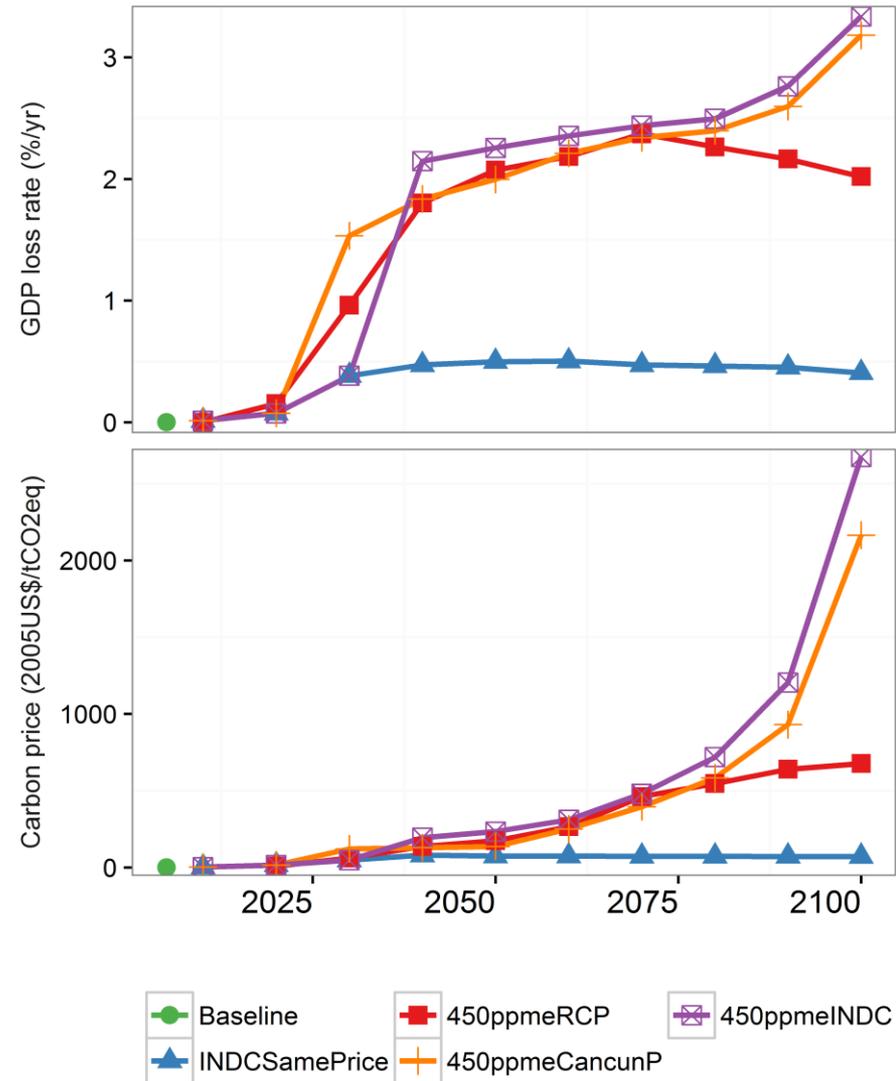


Global mean temperature

- Baseline and CurrentPolicy shows high temperature change
- 450ppm three satisfies 2°C target
- INDC 450ppm case has strong drop after 2030.

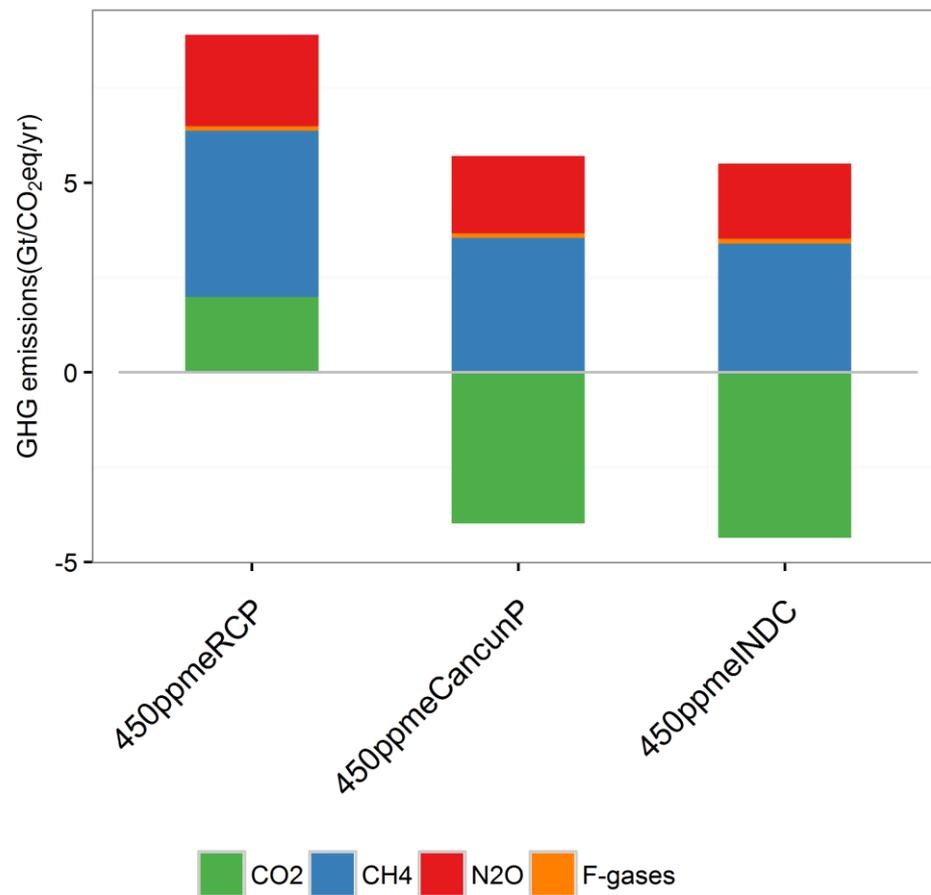
GDP loss and carbon price

- GDP differences are in near to med term (2030-2050) and long term (2100)
- Marginal carbon price in the high mitigation level is very sensitive to the small emissions difference (little potential to reduce more)



GHG emissions composition

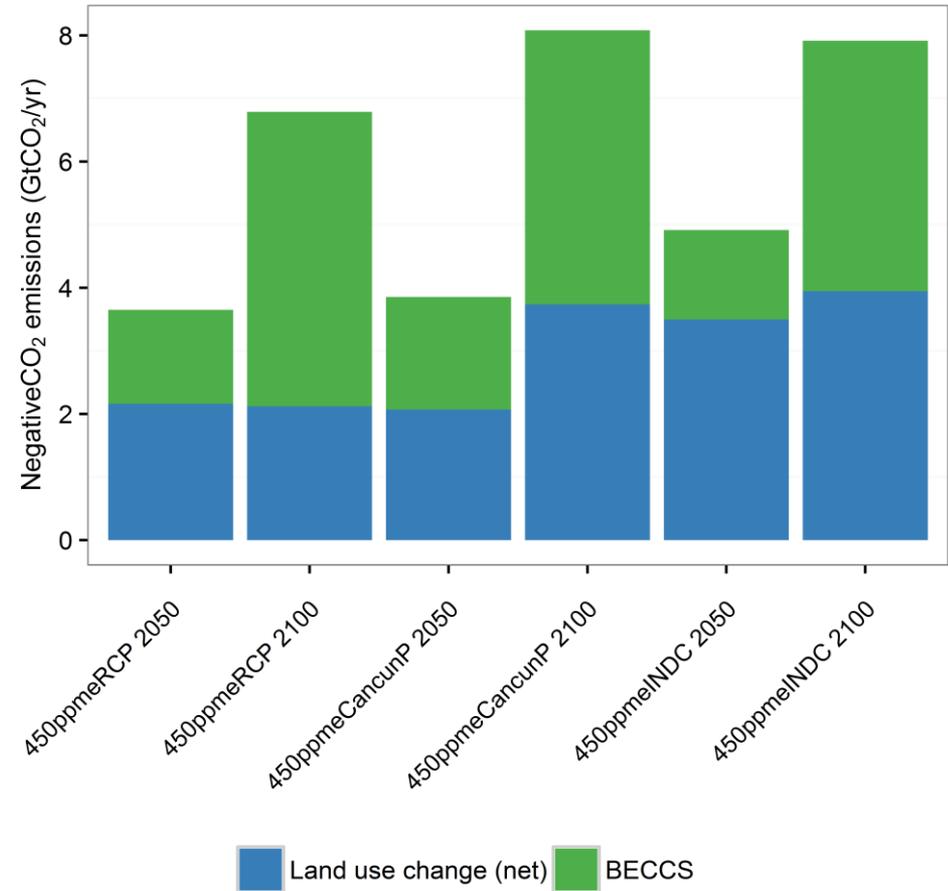
- Immediate emissions reduction (450ppmeRCP) can emit CO2 but Cancun and INDC become negative CO2 (net).
- Non-CO2 gas reduction potential is limited and their difference across scenarios are low



2100 global GHG emissions

Negative emissions source

- Land use pressure enlarged from the delay of emissions reduction



*Land use represents net emissions

Discussion

- Short-term
 - ✓ OECD countries have relatively high challenges but it can be mitigated by emissions trading
- Med- and long- term
 - ✓ INDC and 2 °C have to reduce emission either or both of
 - Drastic speed in med-term
 - Large negative CO₂ in long-term
 - ✓ Each of them has to be investigated more
 - ✓ Land related issue needs to be considered by broader sustainability (water, nitrogen and ecosystem)
 - ✓ Rapid emissions cut needs more realistic socioeconomic transitions (not only technological story)



LETTER

Will international emissions trading help achieve the objectives of the Paris Agreement?

OPEN ACCESS

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Shinichiro Fujimori^{1,2}, Izumi Kubota¹, Hancheng Dai¹, Kiyoshi Takahashi¹, Tomoko Hasegawa^{1,2}, Jing-Yu Liu¹, Yasuaki Hijioka¹, Toshihiko Masui¹ and Maho Takimi³

¹ Center for Social and Environmental Systems Research, National Institute for Environmental Studies (NIES), 16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan

² International Institute for Applied Systems Analysis, Schlossplatz-1, Laxenburg 2361, Austria

³ Mizuho Information & Research Institute, Inc., 2-3 Kanda-Nishikicho, Chiyoda-ku, Tokyo 101-8443, Japan

E-mail: fujimori.shinichiro@nies.go.jp

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Supplementary material for this article is available [online](#)

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**Abstract**

Under the Paris Agreement, parties set and implement their determined contributions (NDCs) to tackle climate change associated to reduce global mitigation costs. However, the

RESEARCH**Open Access**

Implication of Paris Agreement in the context of long-term climate mitigation goals

Shinichiro Fujimori^{1,2*} , Xuanming Su¹, Jing-Yu Liu¹, Tomoko Hasegawa^{1,2}, Kiyoshi Takahashi¹, Toshihiko Masui¹ and Maho Takimi³

Abstract

The Paris Agreement confirmed the global aim to achieve a long-term climate goal, in which the global increase in mean temperature is kept below 2 °C compared to the preindustrial level. We investigated the implications of the near-term emissions targets (for around the year 2030) in the context of the long-term climate mitigation goal using the Asia-Pacific Integrated Model framework. To achieve the 2 °C goal, a large greenhouse gas emissions reduction

AIM/CGE related model activity

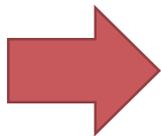
Past and moving forward

History of current AIM/CGE V2.0

- 2010: Start development
- 2011: Under development  RCP (Masui et al.; AIM/CGE V1.0)
- 2012: SSPs, AgMIP process
 - ✓ Many new modules and data were installed
 - ✓ Agriculture and land use
- 2013: Enduse coupling
 - ✓ Detailed energy technological selection is available
- 2014: Air pollutants from GAINS (LIMITS)
- 2015: Coupling with AIM/AFOLU and VRE module (ADVANCE)

2016 updates in Model application

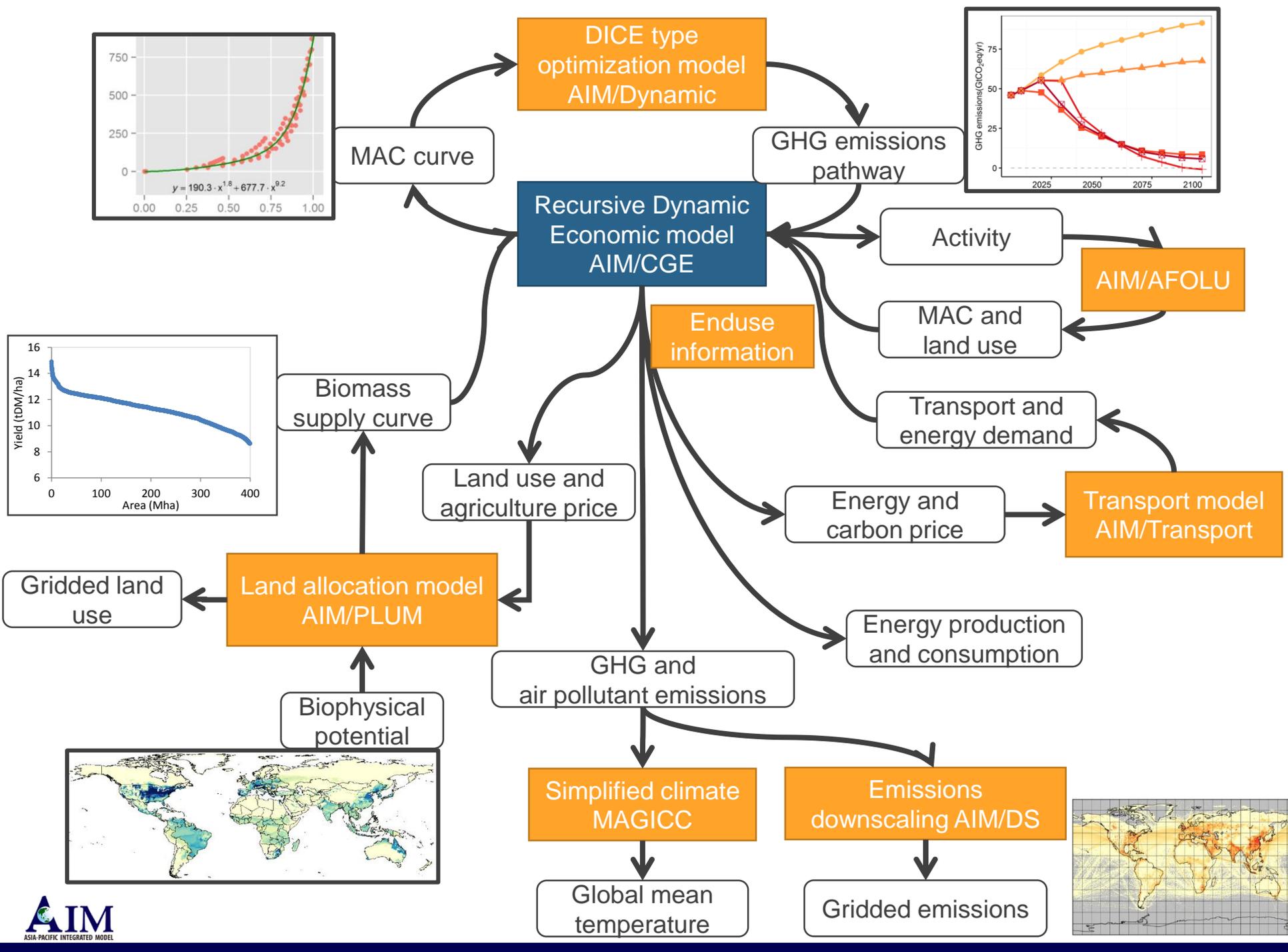
- NDC assessment
 - ✓ Papers for national models (India, Indonesia [Energy] , Indonesia [Land], Thailand, Vietnam)
 - ✓ Global analysis
 - ✓ Compilation in a book → early next year
- International community
 - ✓ IAM model comparisons
 - ADVANCE, CD-LINKS, EMF30, EMF33
 - ✓ SSP process



Keep the current visibility in international community & National model application

2016 updates in model development

- New models are coupled
- AIM/PLUM
 - ✓ Spatially explicit land use allocation model
 - ✓ Biomass supply curve → feedback to CGE
 - ✓ Downscale land use → bridging with other communities and models
- AIM/Transport
 - ✓ Detailed transport mode and technology selection
 - ✓ One of the key sectors for decarbonization
- DICE
 - ✓ Emissions pathways are computed with intertemporal optimization mechanism
- AIM/DS
 - ✓ Emissions downscaling model for ESMs

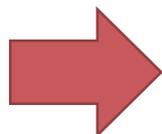


More International Policy: Sustainable Development Goals (SDGs)



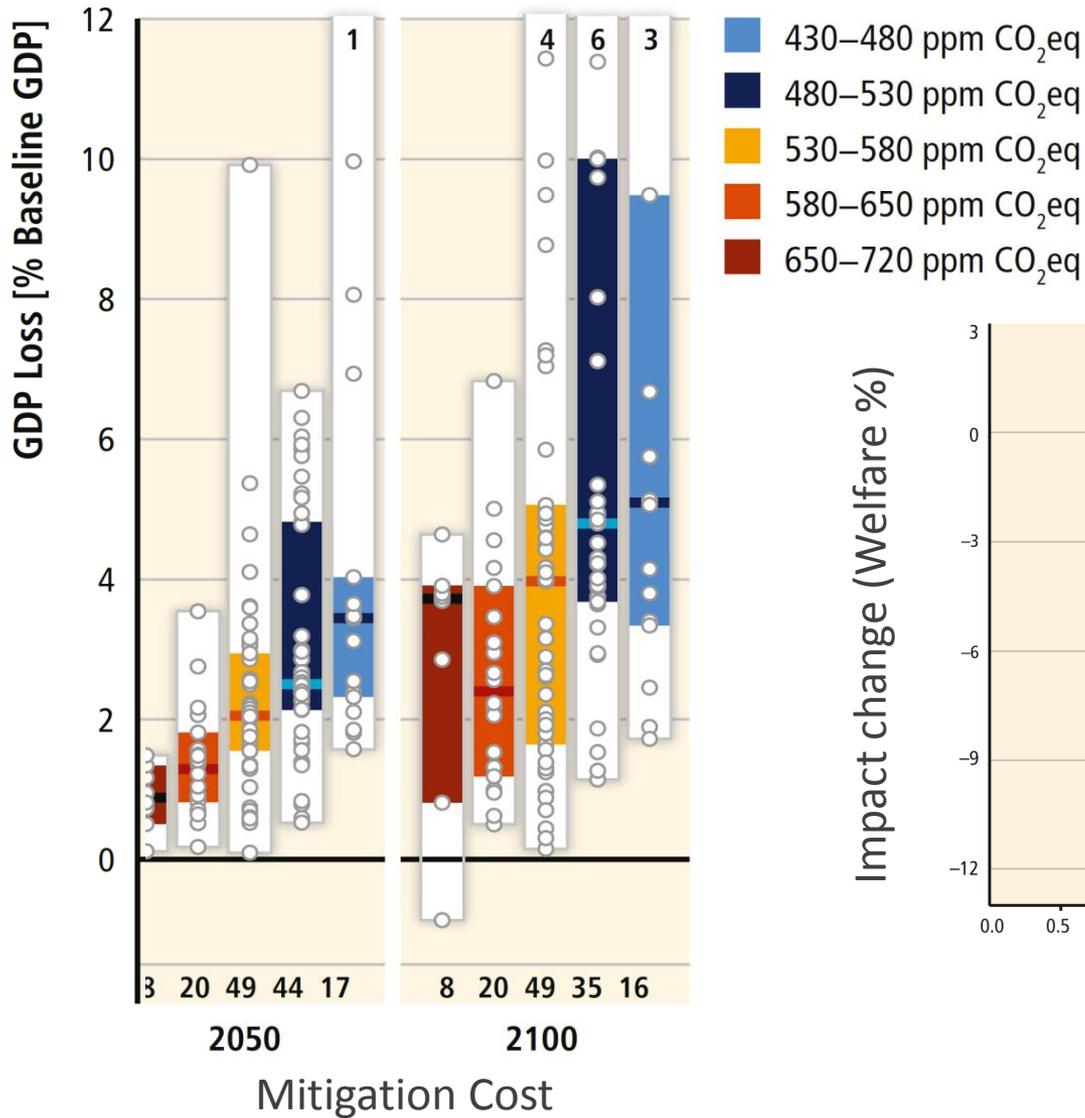
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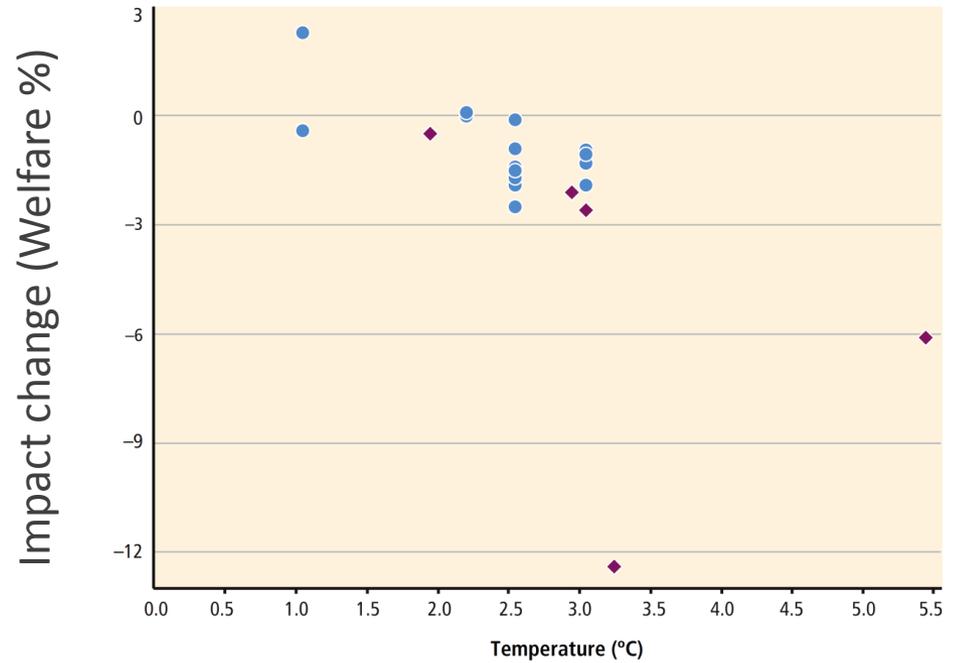


All models have further improvement/extension possibility

Comprehensive impact assessment



IPCC AR5



Impact Damage

Moving forward

- **IAV analysis (SSP/RCP/CMIP)**

- ✓ Health

- ✓ Labor productivity

- ✓ Water

- ✓ Biodiversity

- ✓ Agriculture

- ✓ Flood and sea level rise

- ✓ Air pollution

AIM original model is under development

H08

Collaboration with other institutes

CMAQ

- **Asian development and eradicate poverty**

- ✓ Household model (micro survey data)

- ✓ Infrastructure

- Keeping conventional mitigation analysis

- ✓ Energy supply detail ← MESSAGE

- ✓ Agricultural detail ← GLOBIOM

ご清聴ありがとうございました
Thank you for your attention

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Asia-Pacific Integrated Model

<http://www-iam.nies.go.jp/aim/index.html>

