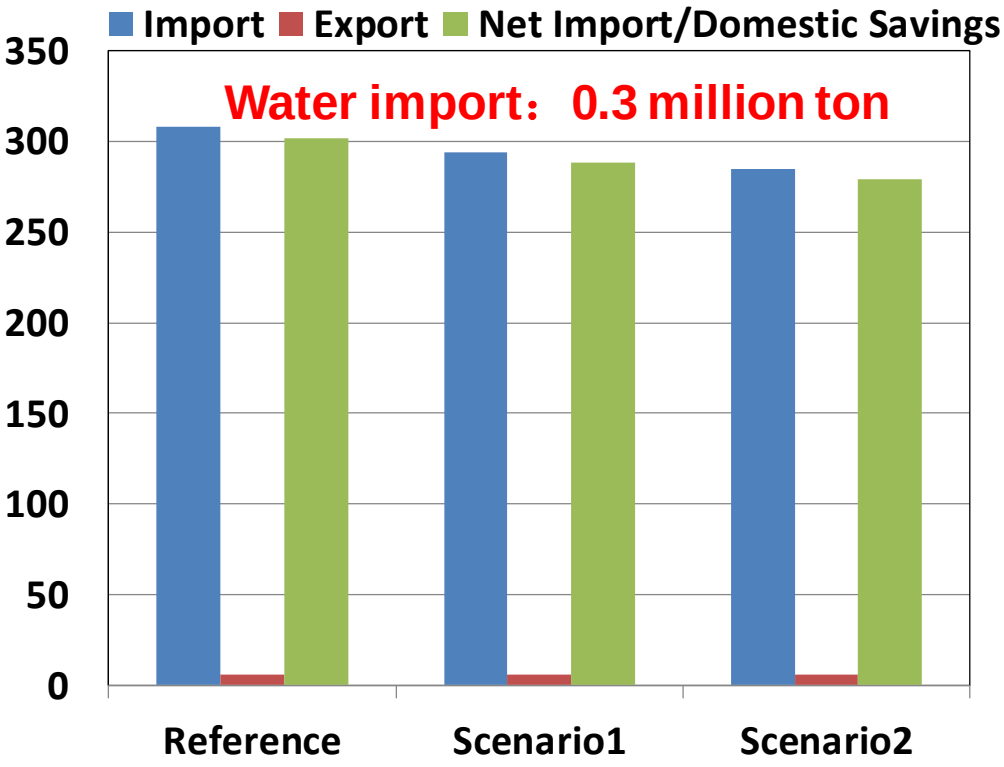
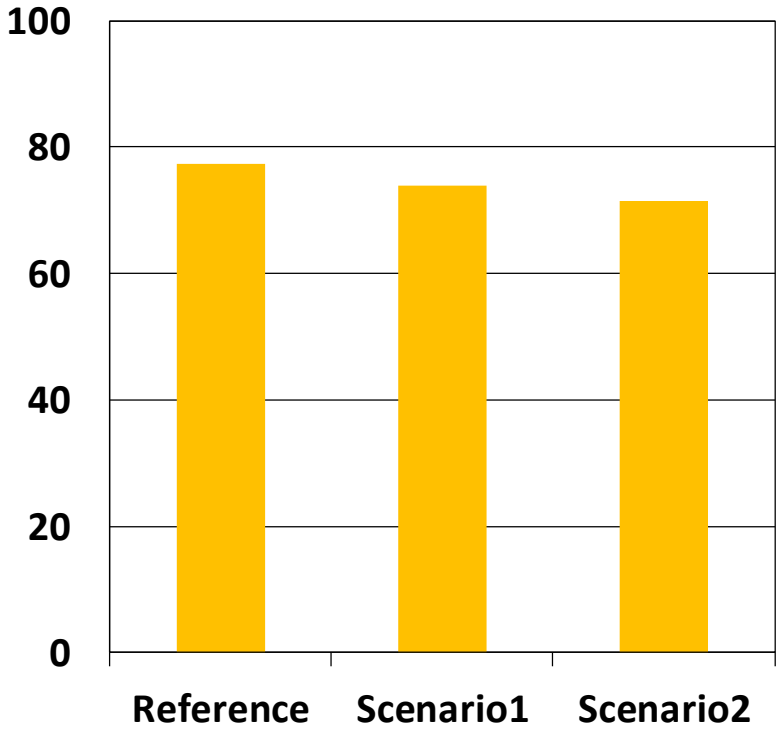
Global Footprints on Water and Land Resources through China's Food Trade

Virtual Water trade and Domestic Savings of China in 2030 (1000 ton)



Domestic Savings as 35%~40% of agricultural water withdrawal



Note: agricultural water withdrawal is from 2015

Reference： baseline；
Scenario 1： irrigation efficiency improve 0.5% annually
Scenario 2： rrigation efficiency improve 1% annually

Climate change impacts on food security: the role of market and trade

Wei Xie

China Center for Agricultural Policy(CCAP), Peking University
School of Advanced Agricultural Sciences, Peking University

Do you think the crop models overestimate climate change impacts?

-No farmer's adaptation

-No crop structure adjust

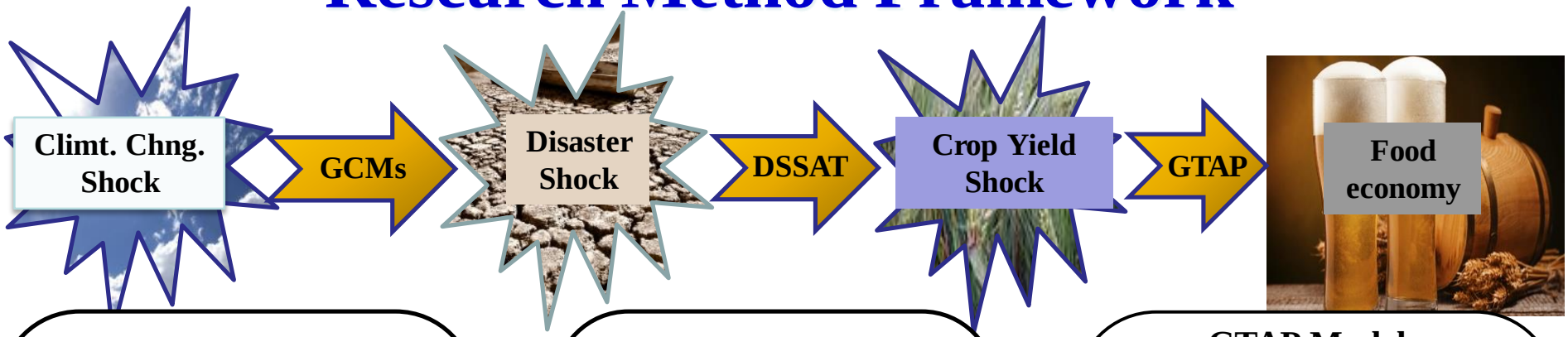
Research questions

- **What are the direct/physical impacts of climate change (CC) on agriculture?**
- **What are the impacts of CC on agriculture:**
  - **if considering the market response?**
    (price increase→labor and land supply increase →impact reduced)
  - **If considering the trade response?**
    (comparative advantage →export more →impact reduced)

Presentation

- **Methodology: an integrated physical and economic model**
- **Simulation Results:**
  - **Physical crop yield change**
  - **Economic impacts on food security**
- **Main conclusion and Policy Implications**

Research Method Framework



Emission scenario

Initial field

GCM

Simulation

Climate change (tmp, pre, …)

Barley phenophase

Barley planting region

Extreme climate

Most severe year ↓ Climatic conditions

CC Shock

Climate Data

Soil Conditions

Model

Crop Data

Management

DSSAT

Simulation

Distributions of Yield, Environmental Impact ,Resource Use

Yield Shock

GTAP Model

Crop

Production

Price

Demand

Feed

Food

Ind

Trade

Rest of World

Other

Production

Price

Demand

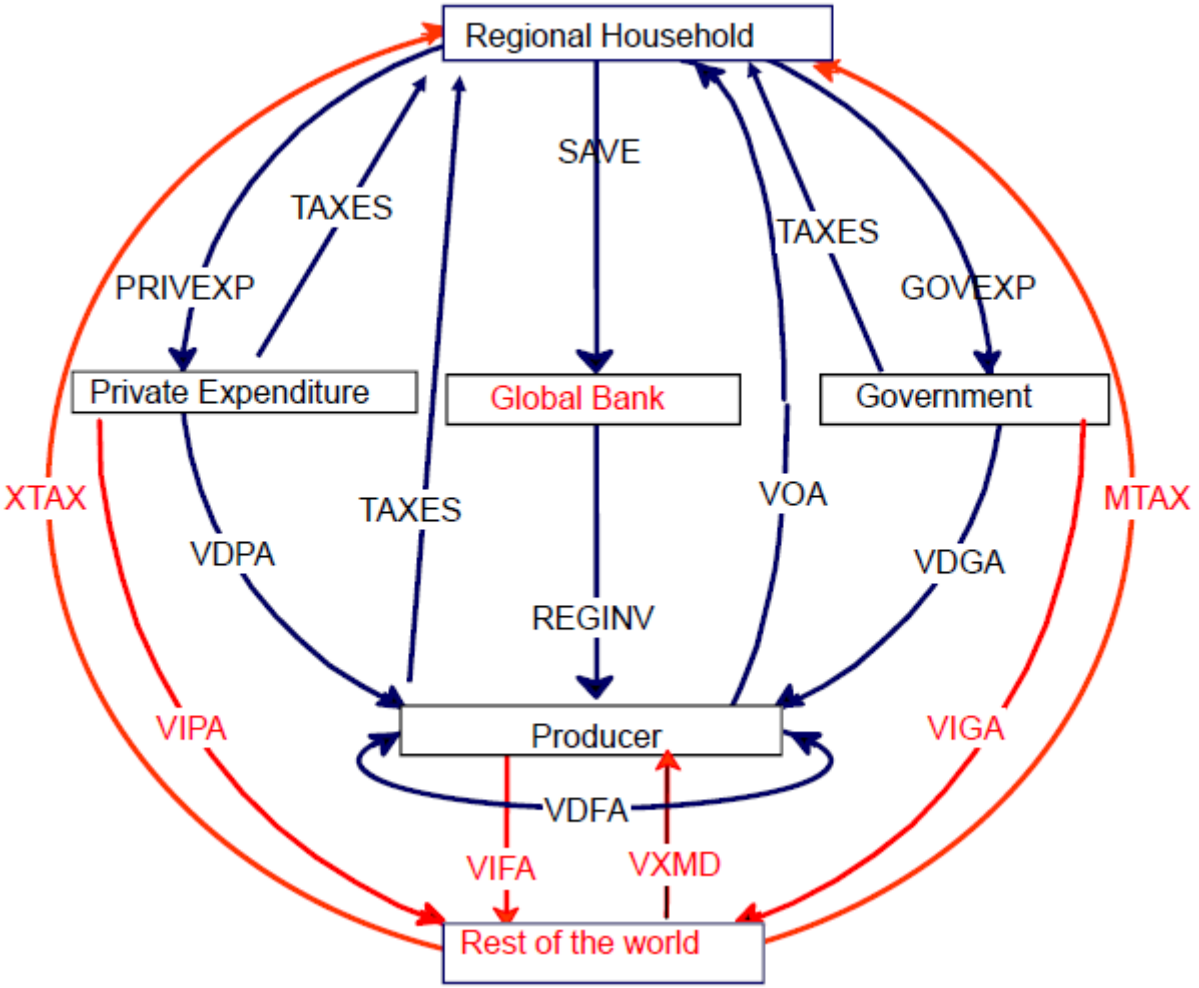
Feed

Indu stry

Food

Trade

Global model: Global General Equilibrium Model (GTAP)



Improvements of standard GTAP model and database:

- Maize,soybean,barley data are separated from other aggregate sectors;
- Land supply elasticity and substitution elasticity with others are adjusted according to the short situation after disasters
- Comparative static analysis

Base scenario and climate change scenarios

- **Base scenario:**
  - without climate change scenario
- **Climate change scenarios:**
  - with considering market response
  - with considering market + trade response

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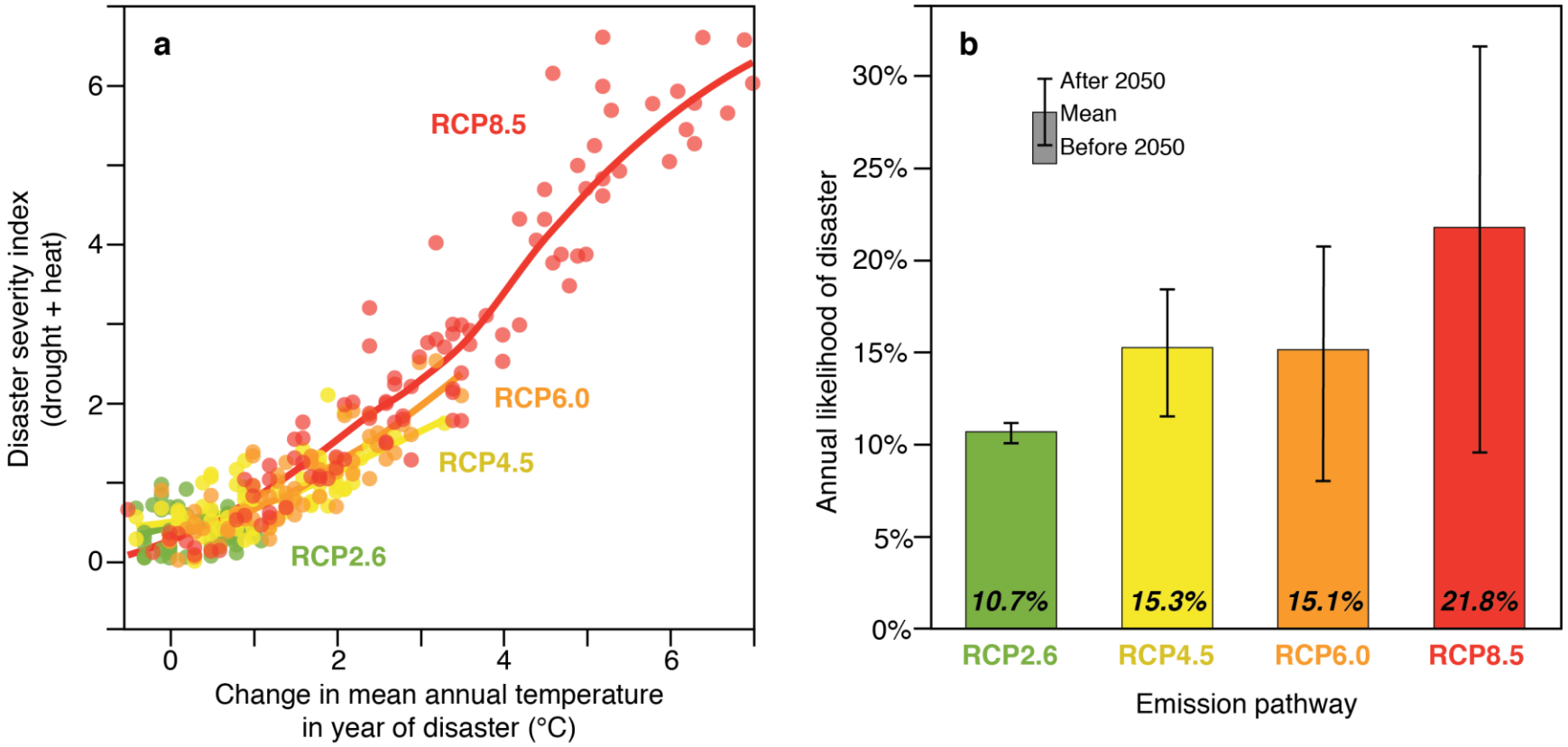
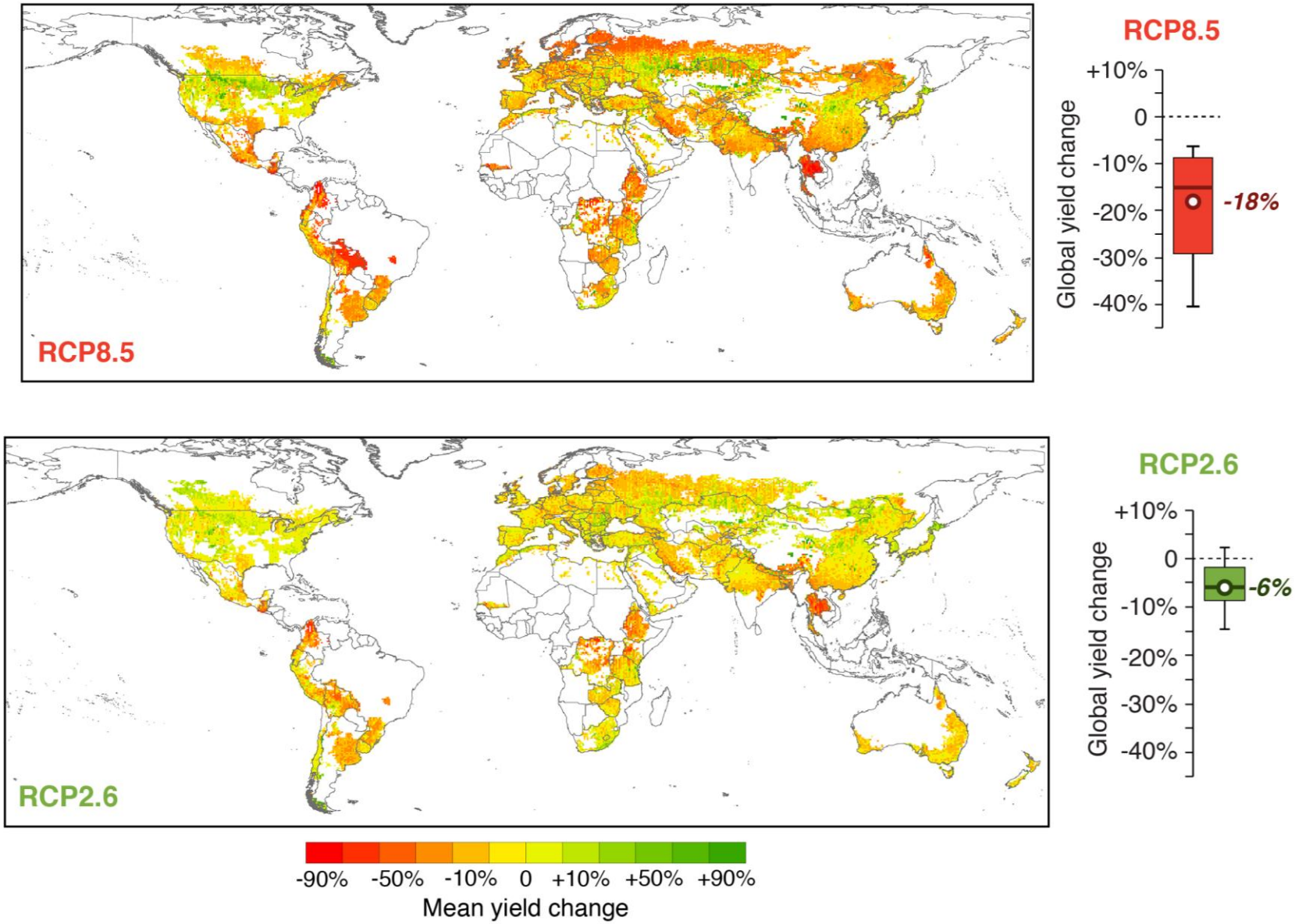
Extreme events under climate change



Barley yield change due to disasters



The annual impact (%) of climate change on crop yield under RCP 8.5

Nation	Rice	Wheat	Maize	Soybean
China	-0.10	-0.36	0.01	0.01
Australia & New Zealand	-0.21	-0.65	-0.34	-0.25
Japan	0.17	0.35	-0.46	-0.01
Korea	-0.04	0.28	-0.74	-0.13
Indonesia	-0.03	0.00	-0.40	-0.19
Malaysia	-0.09	0.00	-0.46	0.00
Philippine	-0.06	0.00	-0.35	-0.21
Thailand	-0.16	-0.97	-0.95	-0.30
Vietnam	-0.22	0.00	-0.78	-0.29
Canada	0.00	-0.04	-0.07	-0.31
USA	-0.34	0.11	-0.74	-0.87
Argentina	-0.09	-0.09	-0.45	-0.51
Brazil	-0.19	-0.43	-0.47	-0.36
EU_28	0.04	0.15	-0.23	-0.61
Rest of World	-0.24	-0.10	-0.38	-0.33

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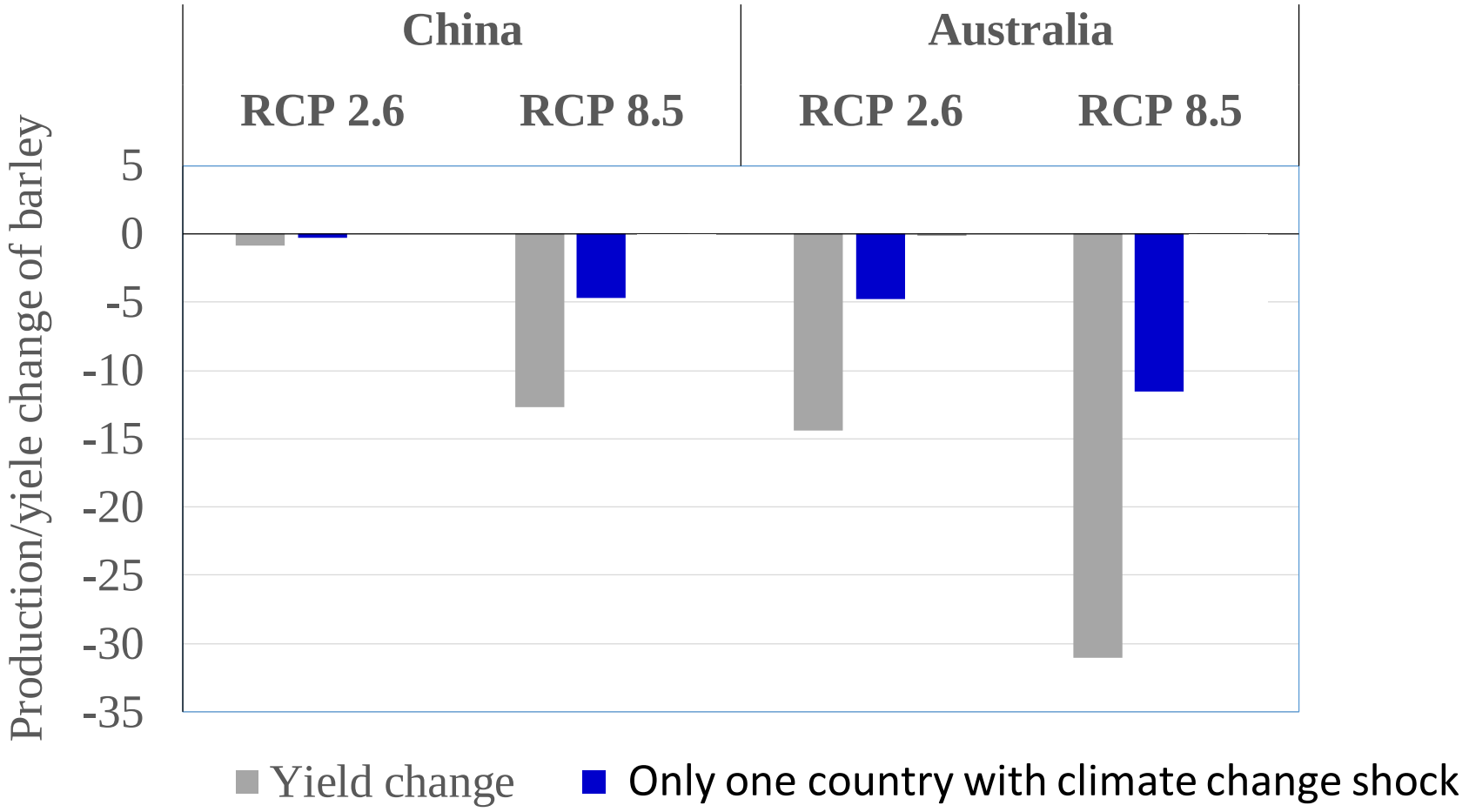
The impacts of extreme weather events on barley production, trade and price (%)

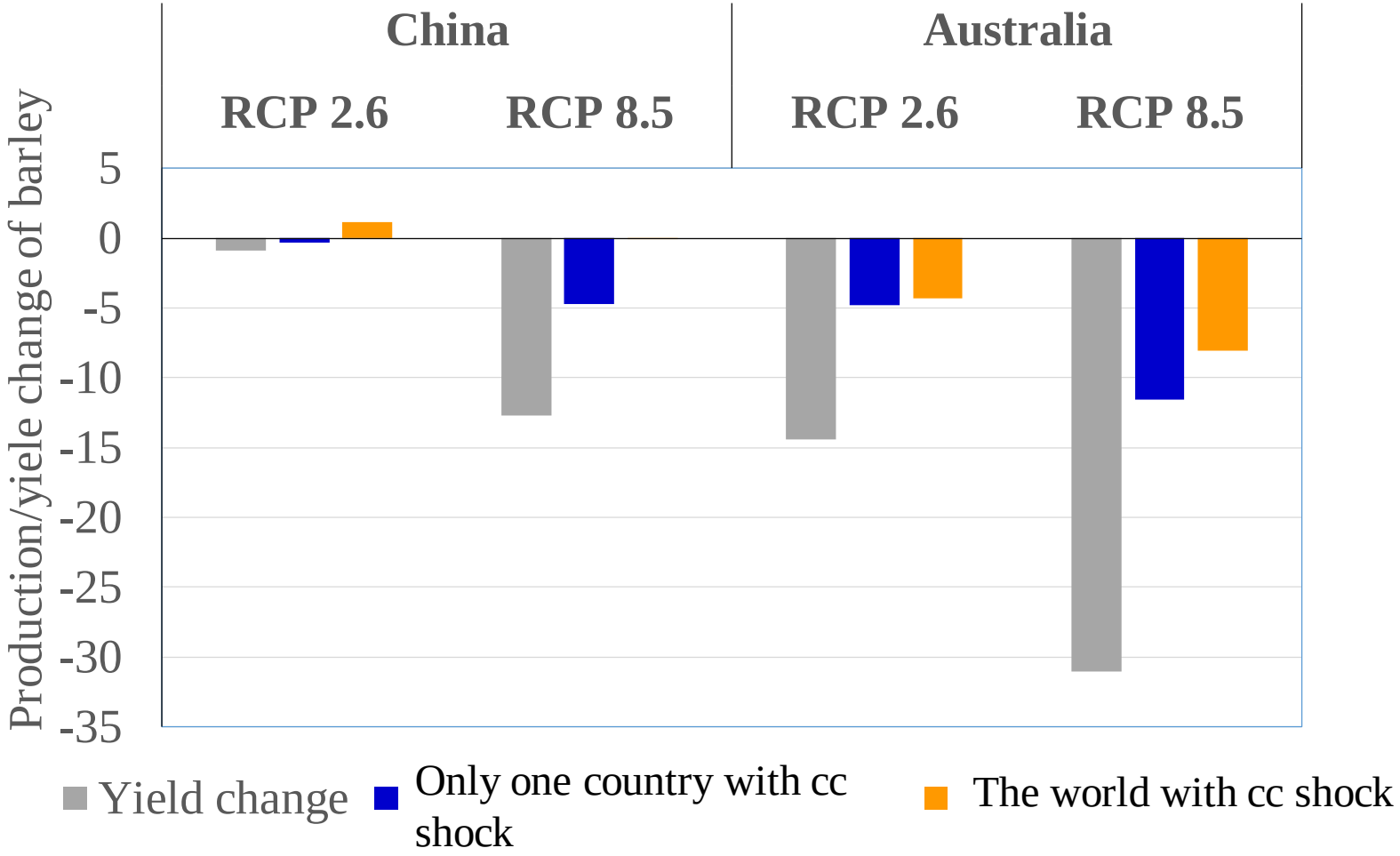
	China		Australia	
	RCP 2.6	RCP 8.5	RCP 2.6	RCP 8.5
Production	-0.29	-4.70	-4.30	-11.52
Import	0.16	2.67	4.28	12.37
Export	-0.77	-12.08	-4.80	-12.86
Supply	-0.05	-0.79	-0.15	-0.39
Price	0.33	5.66	3.38	9.68

Source: GTAP simulation

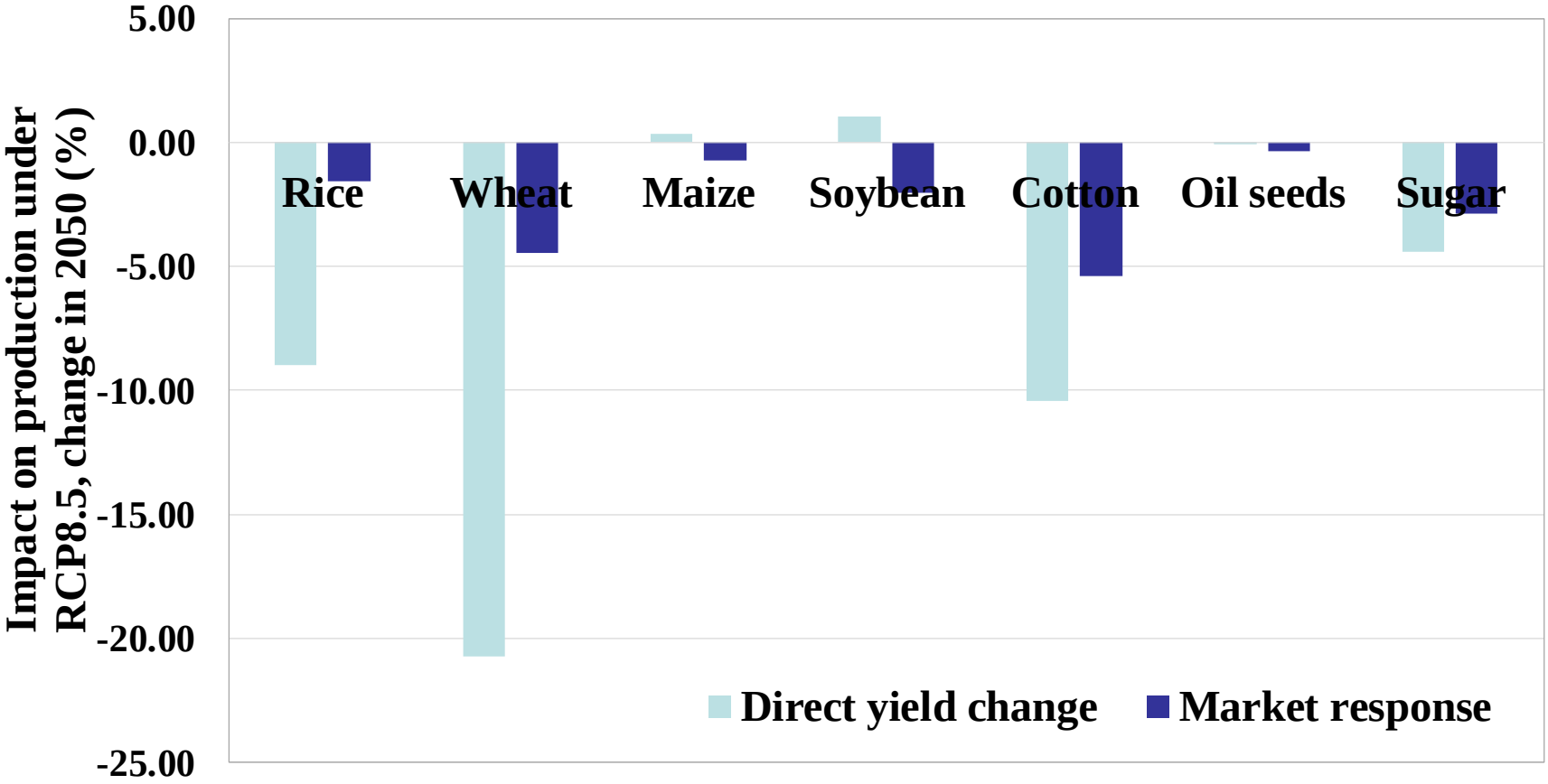
Climate change impacts with market response



Climate change impacts with market and trade response

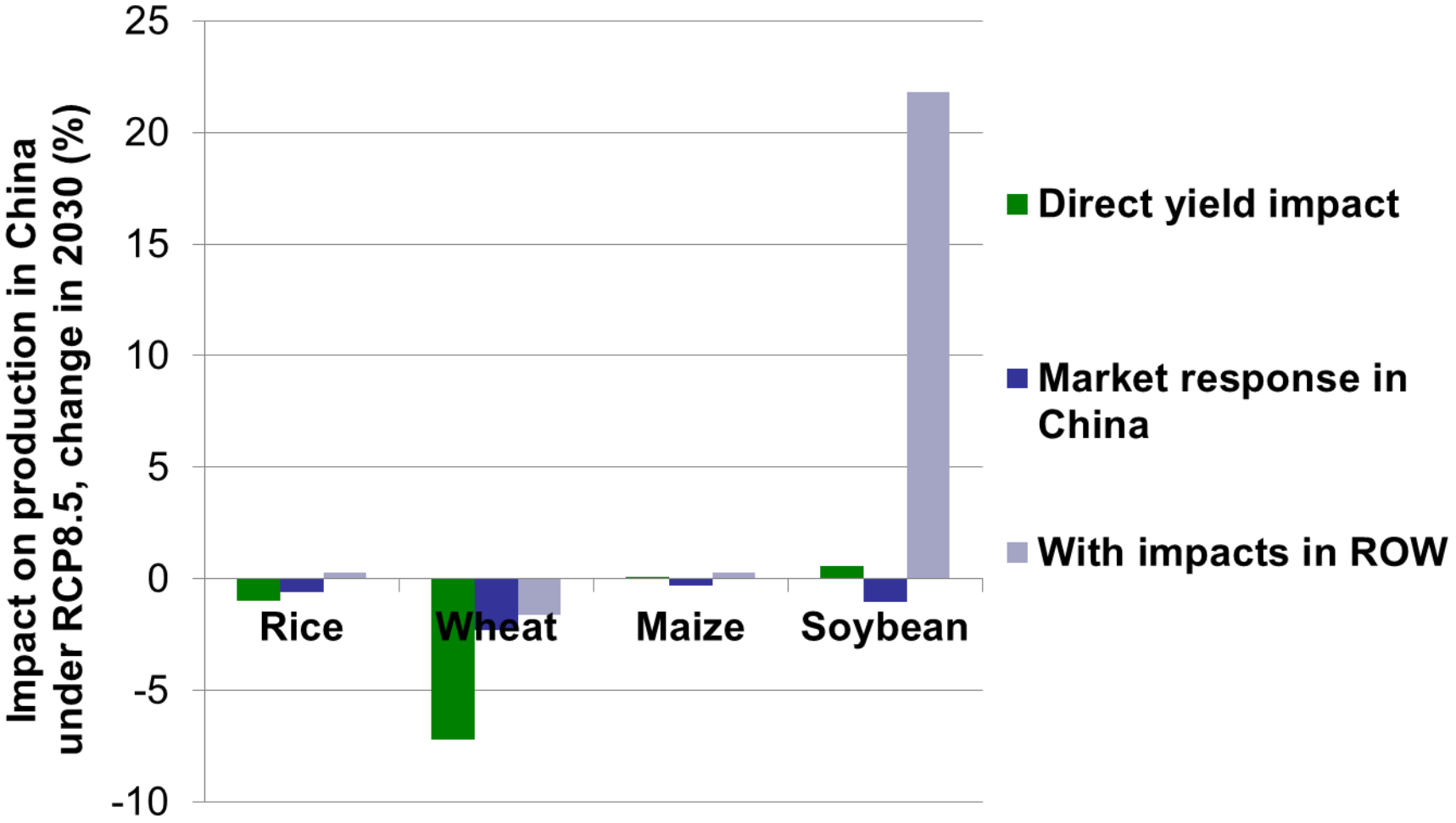


Comparison of impact of climate change on production:
1) direct yield change;
2) production change with considering market response

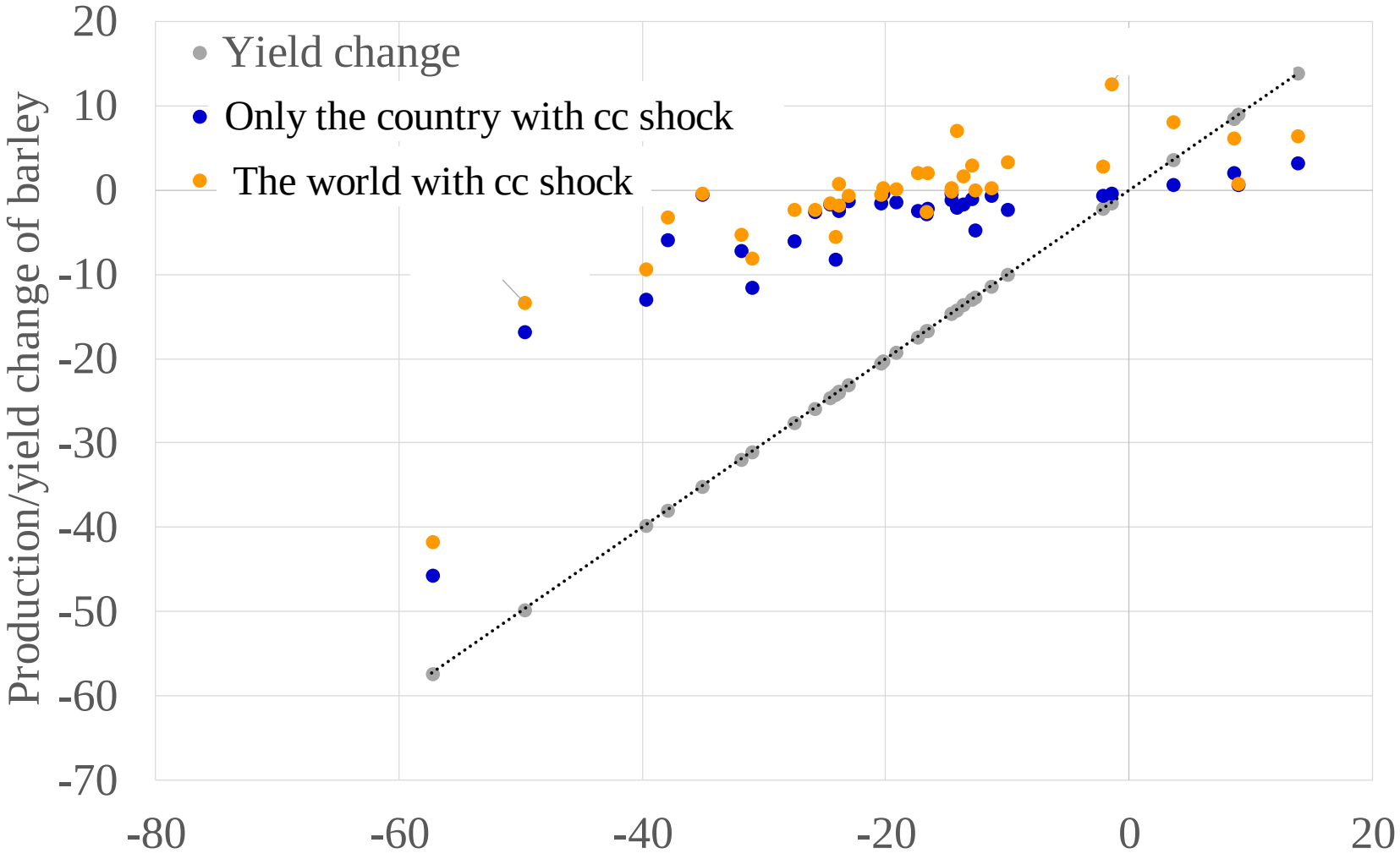


Comparison of impact of climate change on production:

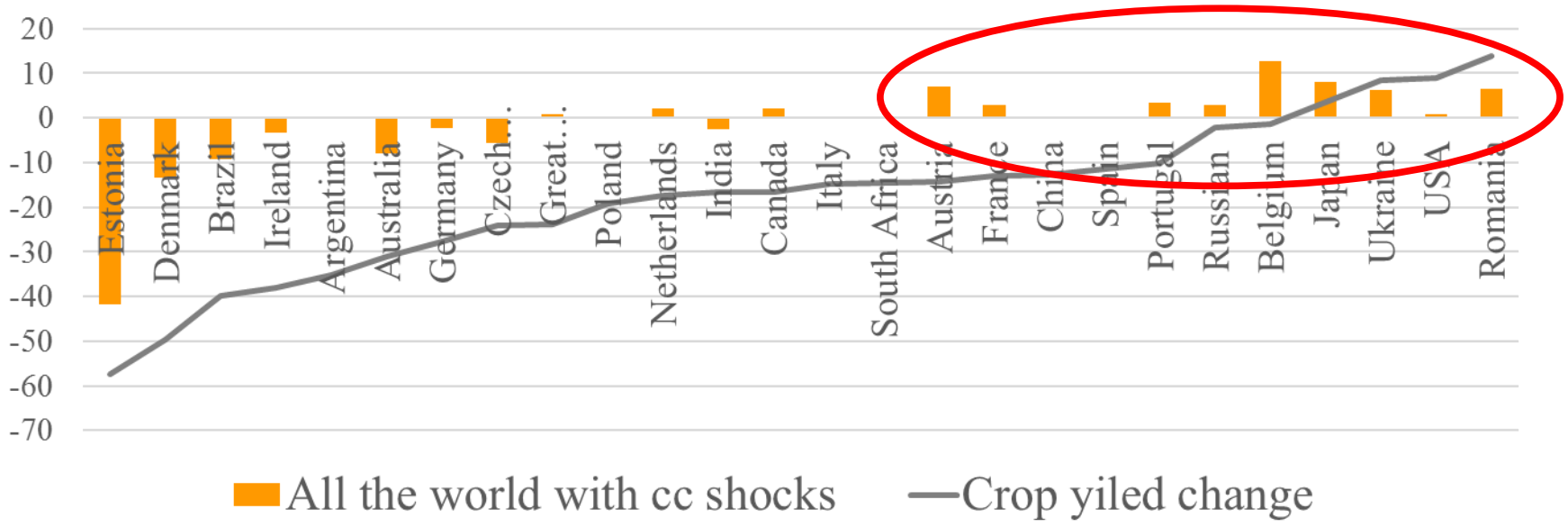
1) with vs w/o considering market response in China;
2) with vs w/o considering impact in the rest of world

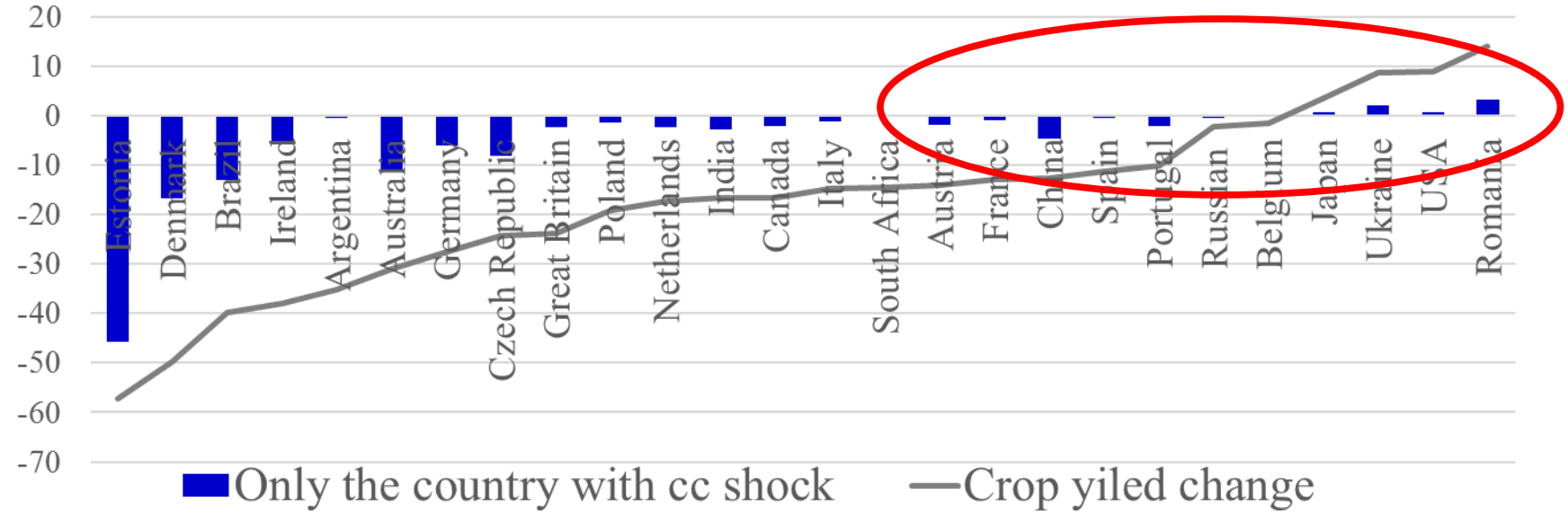


Climate change impacts with market and trade response



Climate change impacts with market and trade response





Main conclusions and policy implications

- Market and trade are important measures to adapt to climate change;
- Climate change impacts on agriculture production are not as severe as physical/crop model predicts, when considering the role of market and trade;
- High risk country of climate change especially should reduce price distortion and trade barrier to alleviate climate change impacts.

Any comments and suggestions are welcome!