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# Climate Change Impacts in the Mediterranean: The Economic Assessment of the CIRCE Project

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# Outline

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The CIRCE project

Aims and methods: the CGE approach in impact assessment

The ICES model

Impacts

Results

Conclusions

## CIRCE Project

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FP 6, 4-years Integrated research project, ended last March 2011

63 partners

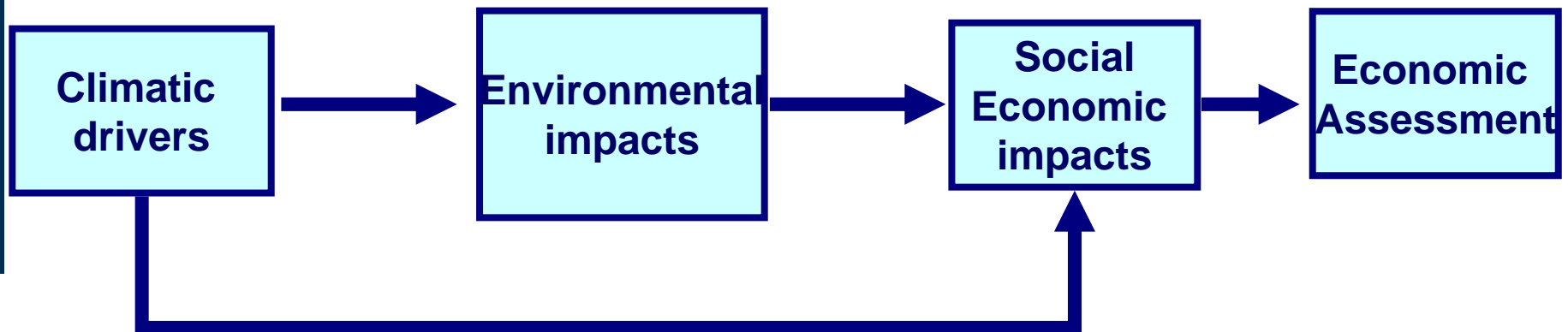
13 Research Lines

Aims: developing for the first time an integrated assessment of climate change impacts in the Mediterranean area.

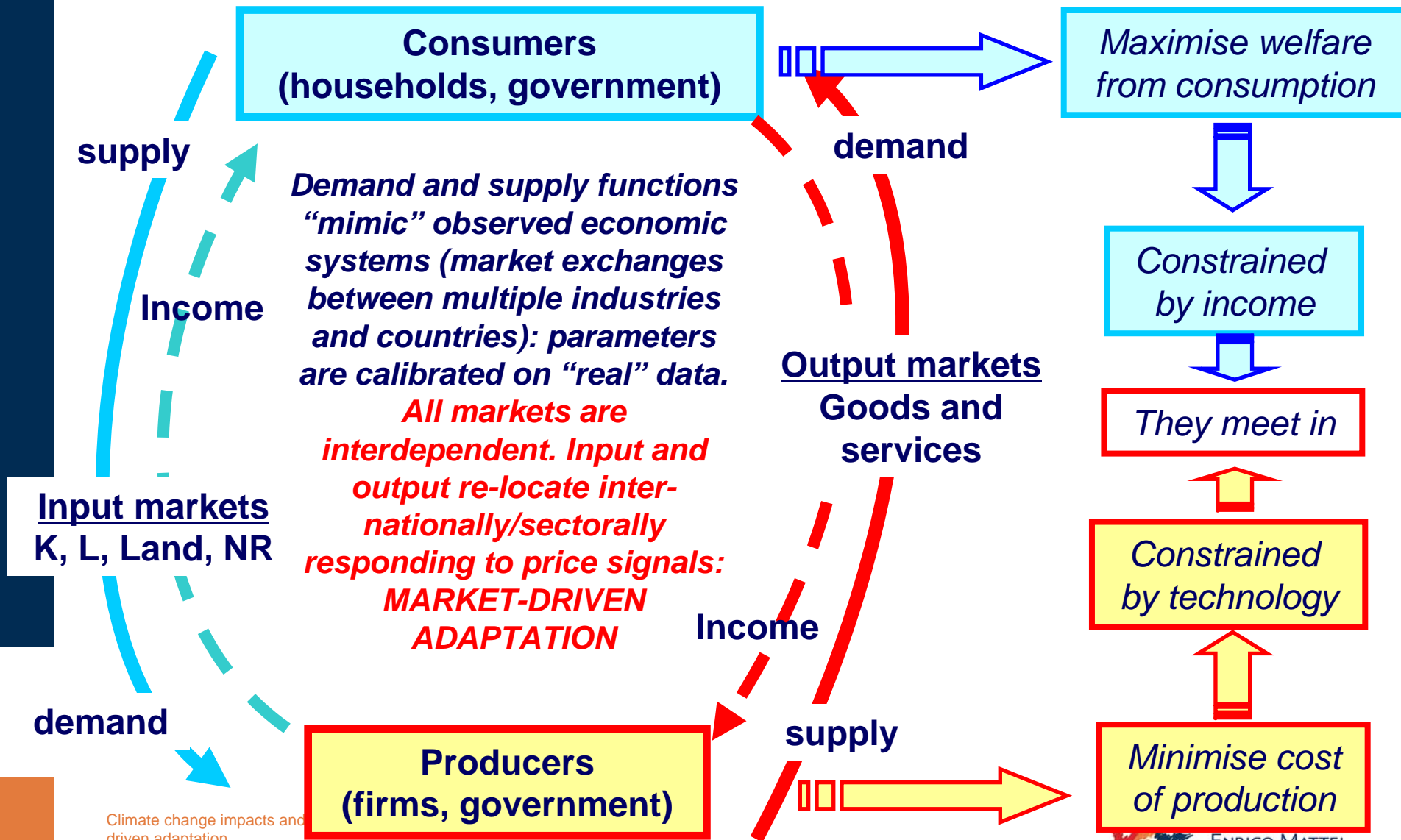
- to predict and to quantify physical impacts of climate change in the Mediterranean area;
- to evaluate the consequences of climate change for the society and the economy of the populations located in the Mediterranean area;
- to develop an integrated approach to understand combined effects of climate change;
- to identify adaptation and mitigation strategies in collaboration with regional stakeholders.

## This presentation

Work of RL 10 condensed in a CGE exercise: Assess the macro-economic implications of a set of environmental and economic impacts linked to anthropogenic climate change.  
Highlight impacts at the country and sectoral level → focussing on interdependences (market-driven adaptation → General equilibrium perspective)



# Sketching a CGE model



# The ICES Model

Recursive- dynamic CGE running 2001-2050

## *19 Regions/countries:*

Italy, Spain, France, Greece,  
Malta, Cyprus, Slovenia, Croatia,  
RFYug: Rest of Former Yugoslavia  
Albania, Turkey, Tunisia, Morocco,  
RoNAfrica: Rest of North Africa  
RoMdEast: Rest of Middle East  
RoNME: Rest of Non Mediterranean  
Europe  
RoA1: Rest of Annex 1  
ChInd: China and India  
RoW: Rest of the World

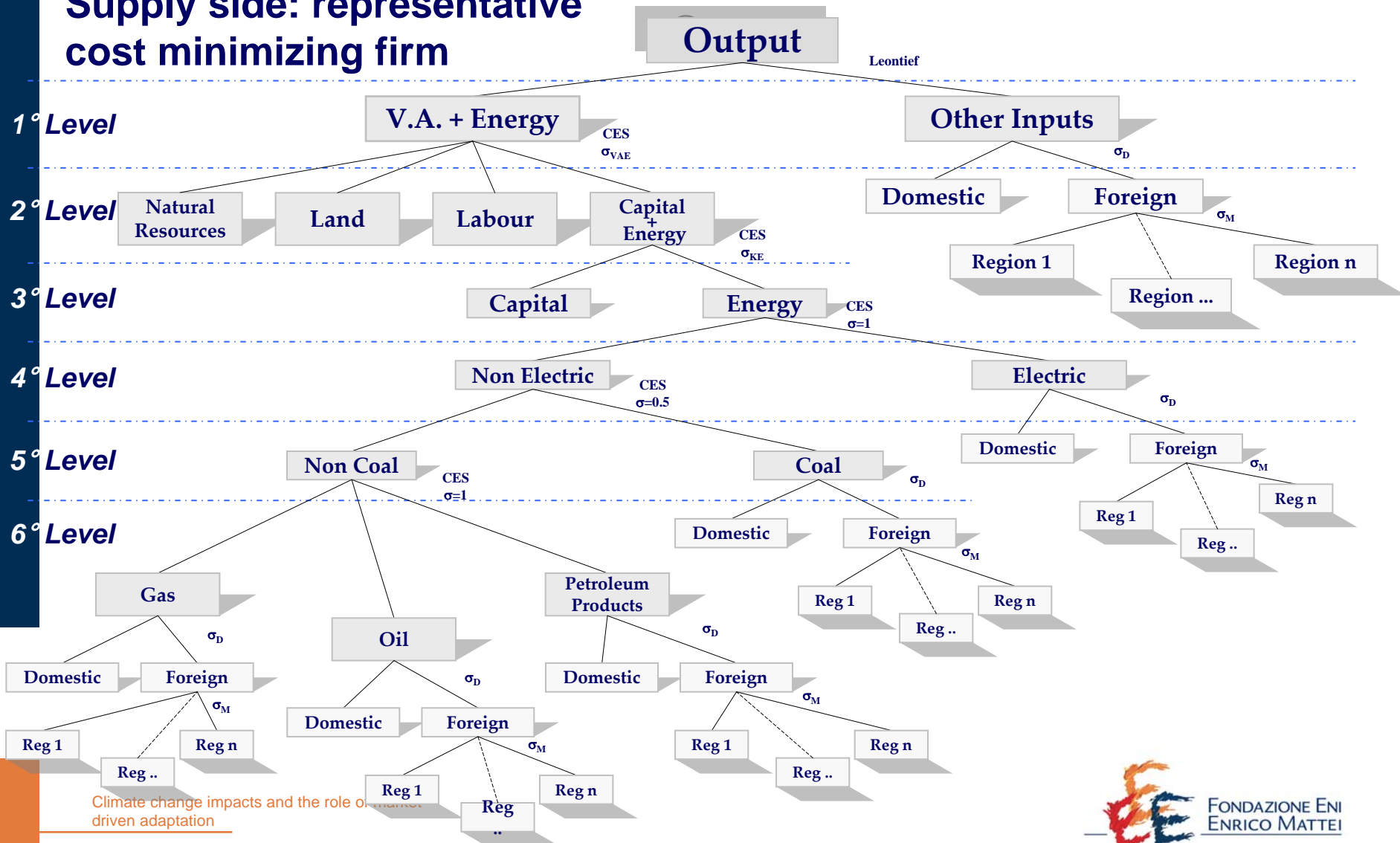
## *19 Sectors:*

Rice,  
Other Cereal Crops,  
Oil seeds,  
Plant and fibers,  
Livestock,  
Coal,  
Gas,  
Electricity  
Market Services

Wheat,  
Vegetable Fruit,  
Sugar cane,  
Other Cereals,  
Timber, Fishing,  
Oil,  
Oil Products,  
Other industries  
Non-Market  
Services

# The ICES Model

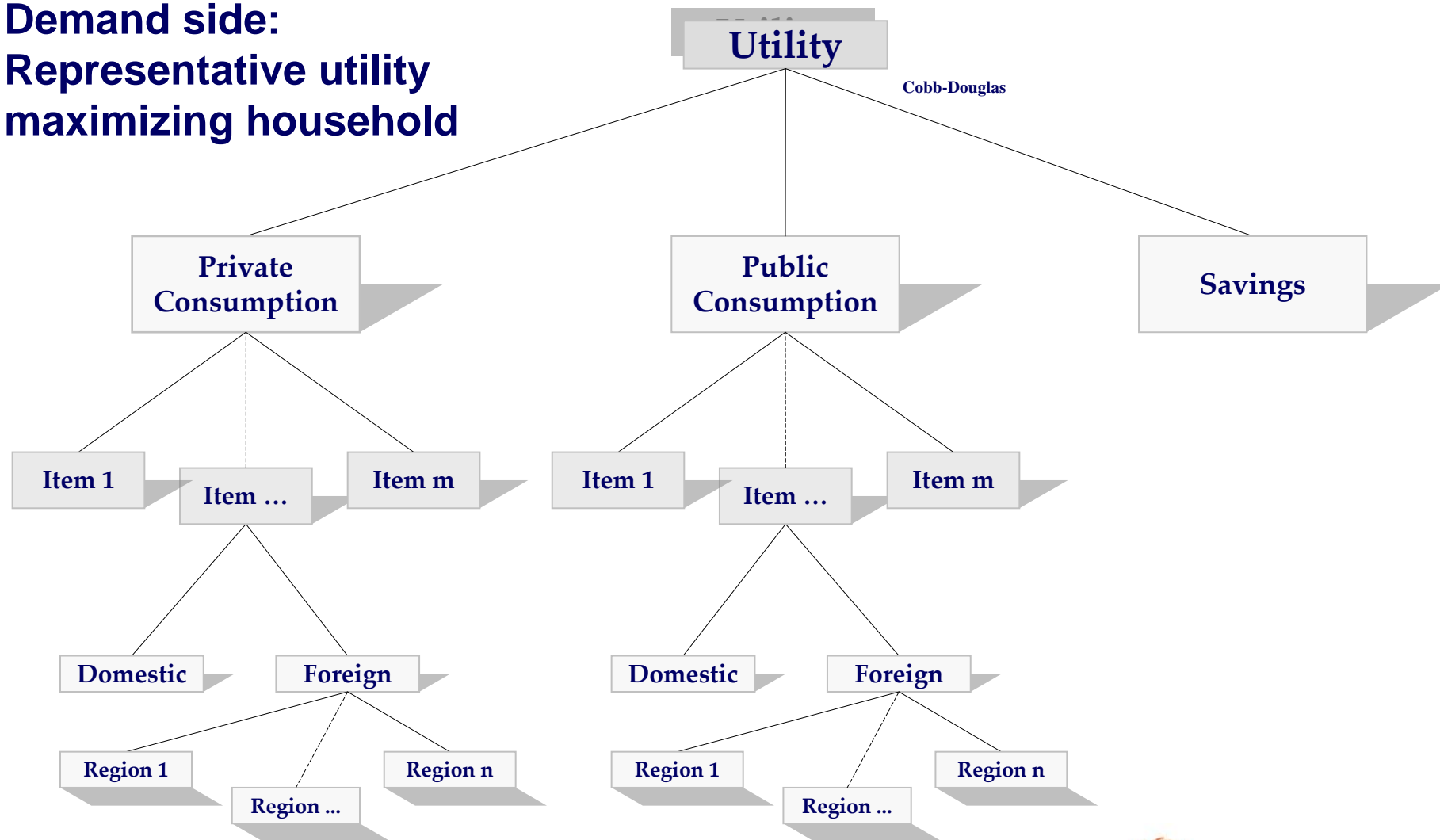
Supply side: representative cost minimizing firm



Climate change impacts and the role of  
driven adaptation

# The ICES Model

**Demand side:  
Representative utility  
maximizing household**





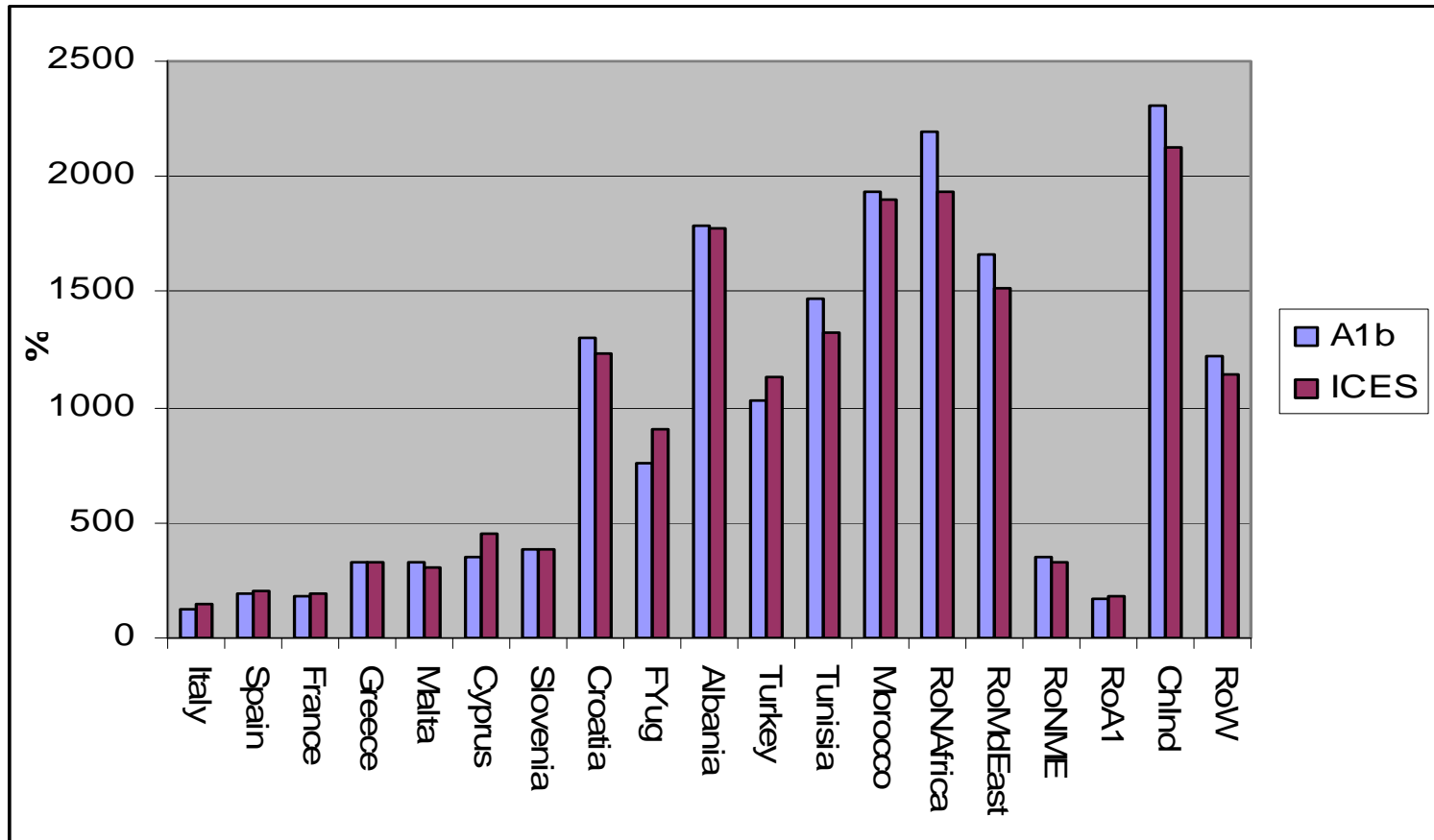
## Data Sources for Baseline Projections (2001-2050 without CC)

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- **GDP** replicates A1B SRES scenario growth rates (downscaling by IIASA)
- **Population/labour stock:** COMMON POLES IMAGE (van Vuuren et al., 2005)
- **Crops' productivity:** IMAGE 2.2, B1 Scenario (*RIVM, 2001*).
- **Fossil fuel reserves:** adjusted to mimic long-term price projections for Oil, Coal & Natural Gas → Energy Information Administration, U.S. Department of Energy

# The Baseline

## GDP growth rates 2001 - 2050 (%)



## Impacts Considered within the CIRCE exercise (“Economic” RL)

By the CIRCE project

- Water scarcity
- Migrations
- Agriculture
- Household energy demand
- Sea-level rise
- Tourism attractiveness
- Ecosystem/Biodiversity



By the CGE exercise

- na
- Change in labour productivity
- Change in crop yields (t per hect.)
- Change in demand for energy vectors (coal, gas, oil products, el.)
- Land loss to agriculture, physical capital losses
- Change in demand for recreational services
- na

## Climate Change Direct Impacts

%  
change  
2050  
wrt  
base.

(\*) % of  
total  
land

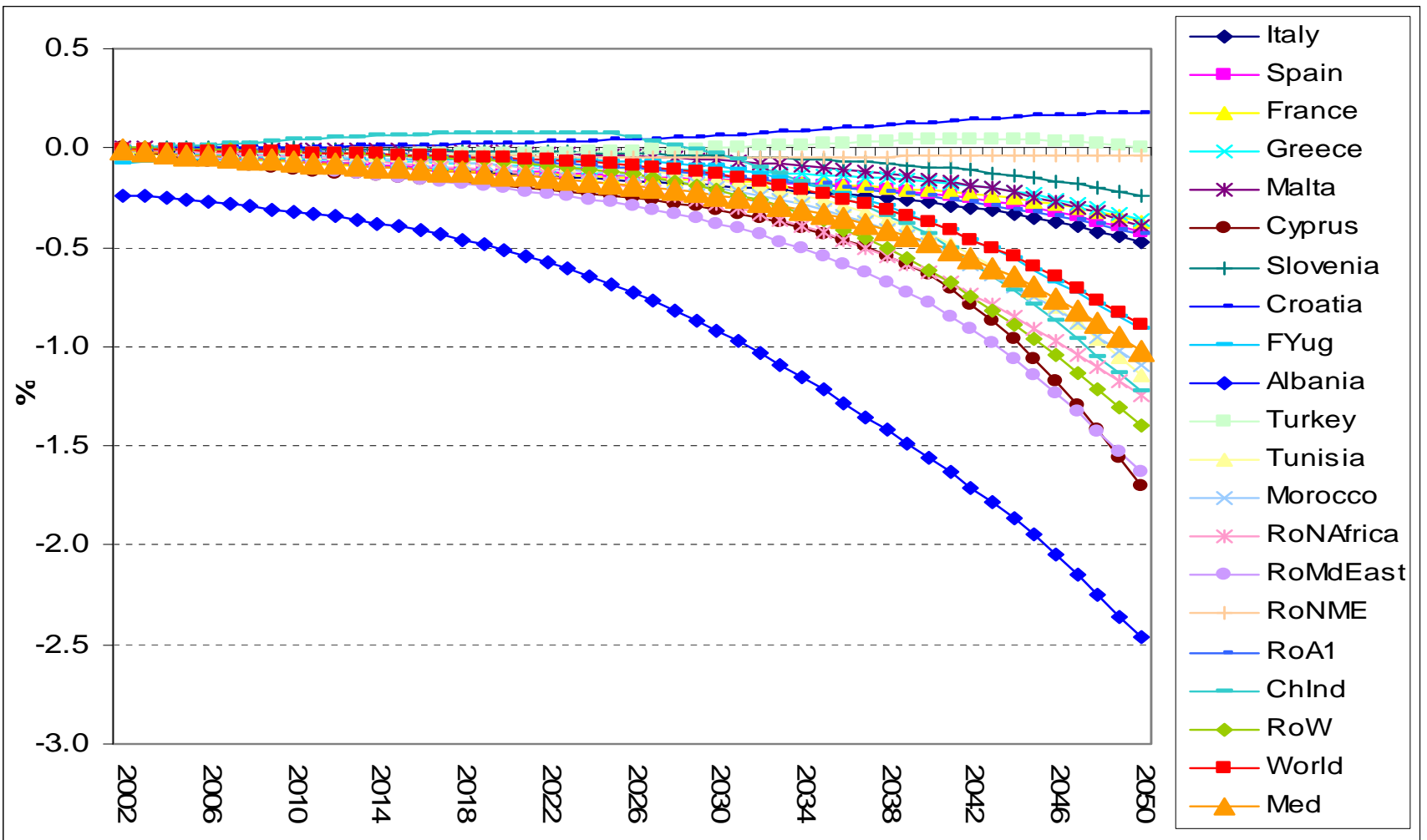
(\*\*) \$  
billion

Country/ region	Households' Energy Demand			Land Loss to S-L-R (*)	Tourism	
	Natural Gas	Oil Products	Electricity		Demand Shift	Expenditure flows(**)
Italy	-12.48	-15.61	0.73	-0.07	-1.26	-9.87
Spain	-12.45	-15.52	0.73	-0.02	-2.32	-7.78
France	-13.08	-16.45	0.78	-0.06	-0.64	-5.31
Greece	-12.00	-15.09	0.70	-0.17	-2.39	-1.97
Malta	-12.48	-15.61	0.73	0.00	-3.83	-0.07
Cyprus	-13.11	-17.38	0.74	-0.27	-3.67	-0.42
Slovenia	-12.48	-15.61	0.73	0.00	-0.55	-0.07
Croatia	-12.48	-15.61	0.73	-0.04	-3.16	-0.93
Fyug	-12.24	-15.35	0.71	-0.42	-1.04	-0.42
Albania	-12.00	-15.09	0.70	-0.27	-3.25	-0.33
Turkey	-13.11	-17.38	0.74	-0.08	-0.04	-0.15
Tunisia	-12.48	-15.61	0.73	-0.25	-4.87	-1.21
Morocco	-12.45	-15.52	0.73	-0.17	-4.19	-1.20
RoNAfrica	-12.51	-15.90	0.72	-0.07	-3.14	-13.24
RoMdEast	-13.11	-17.38	0.74	-0.42	-3.25	-56.83
RoNME	-13.72	-15.54	-2.09	-0.79	1.30	40.34
RoA1	-12.26	-16.17	0.11	-1.31	2.80	188.31
ChInd	nss	nss	20.37	-1.82	0.07	0.39
RoW	nss	-1.8262	15.69	-0.92	-1.88	-129.26

Climate change impact  
driven adaptation

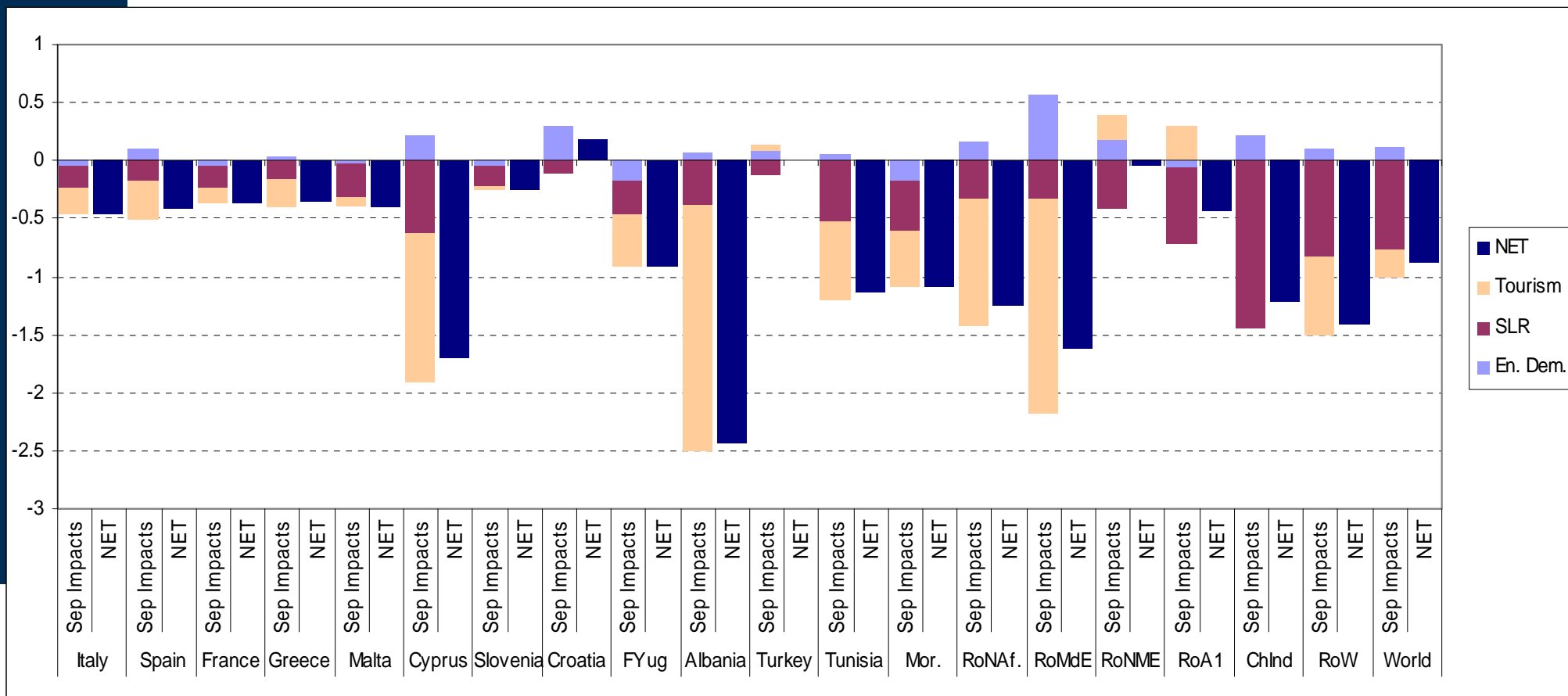
# Climate Change Impacts on GDP

% change of GDP wrt no CC baseline

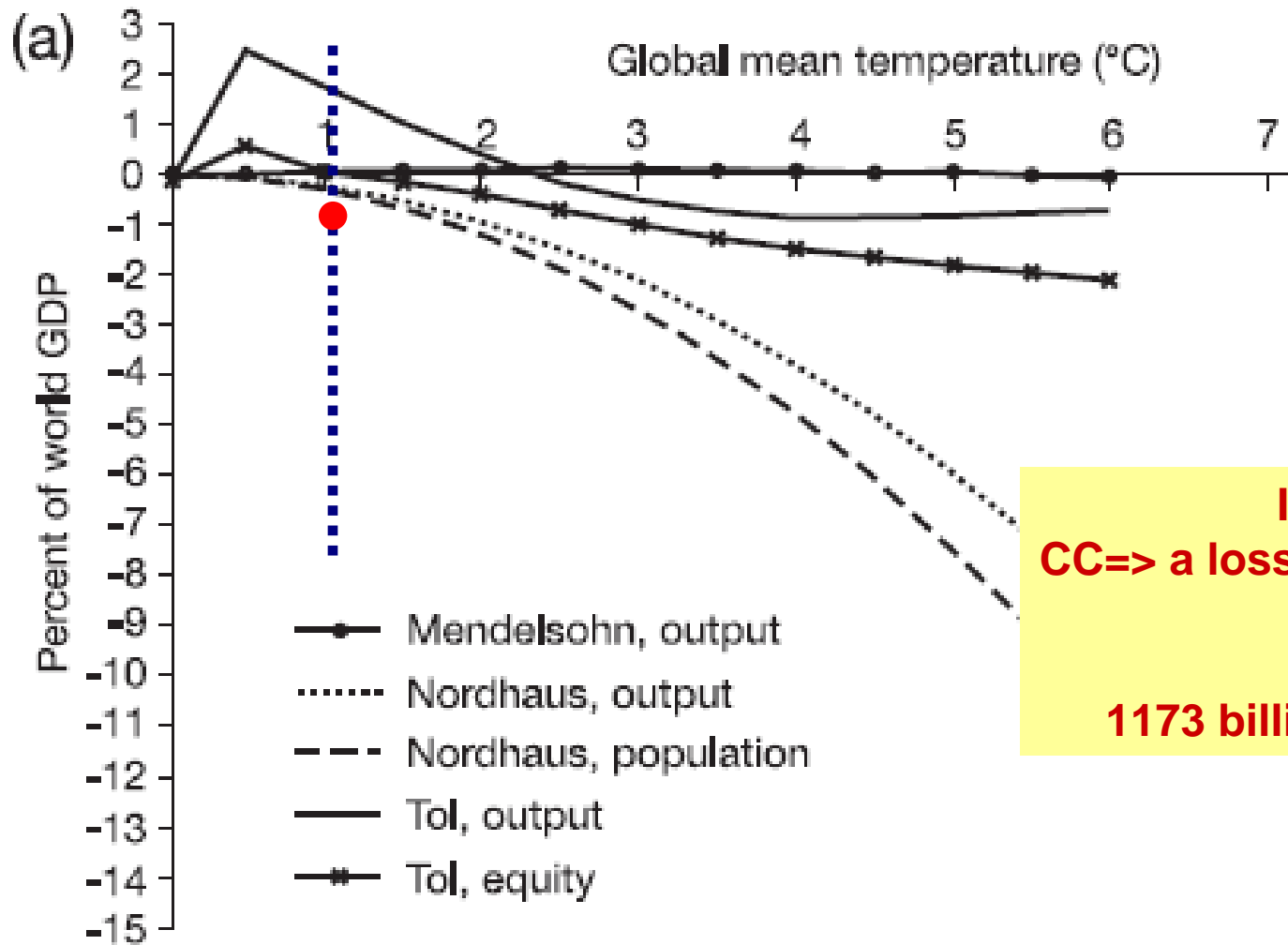


# Climate Change Impacts by “area”

% change of GDP wrt no CC 2050 baseline



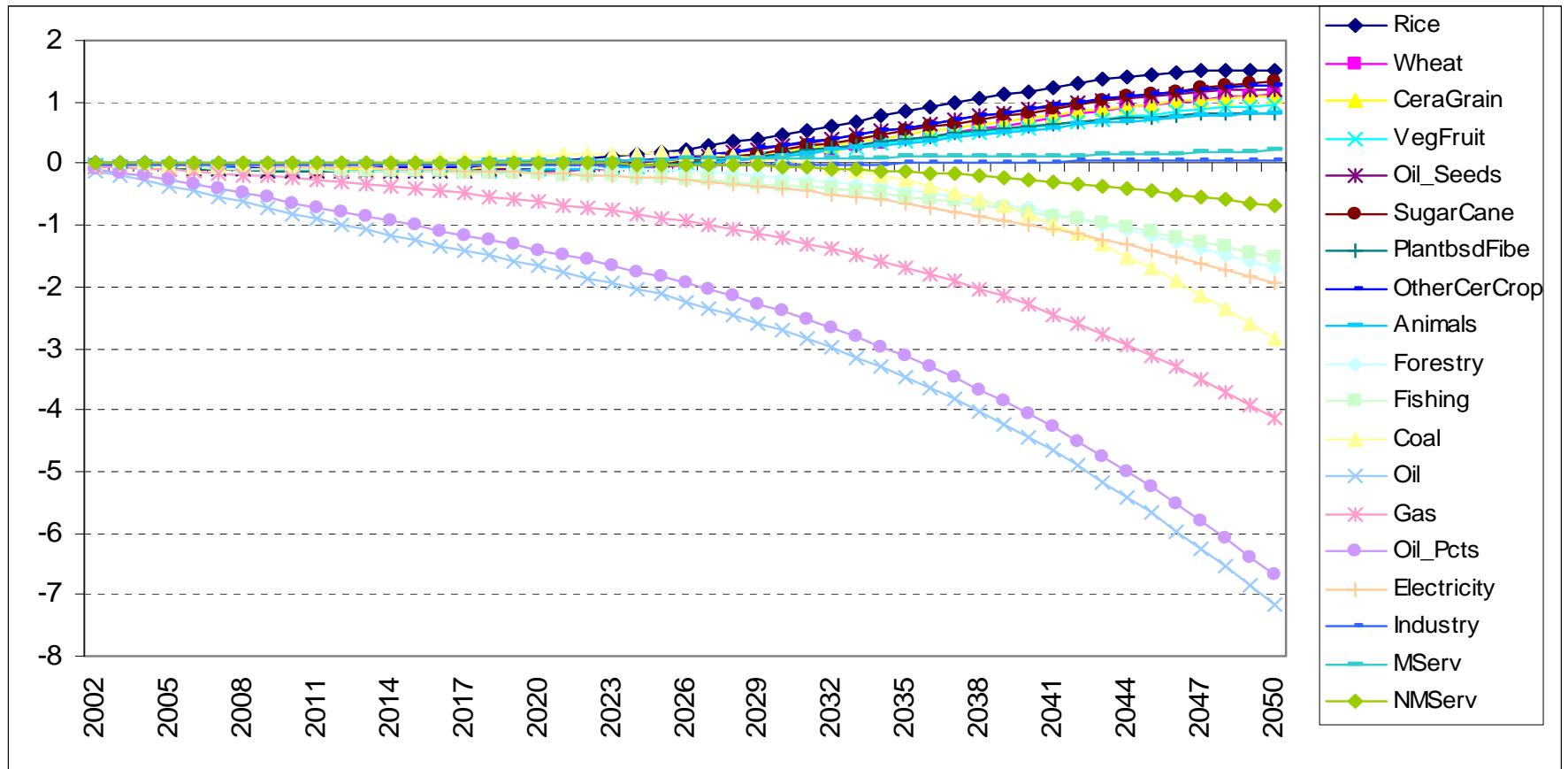
## A Comparison with the existing literature



**In 2050  
CC=> a loss of 0.9% of world  
GDP  
~  
1173 billions US \$ 2001**

# Tracking market feedback

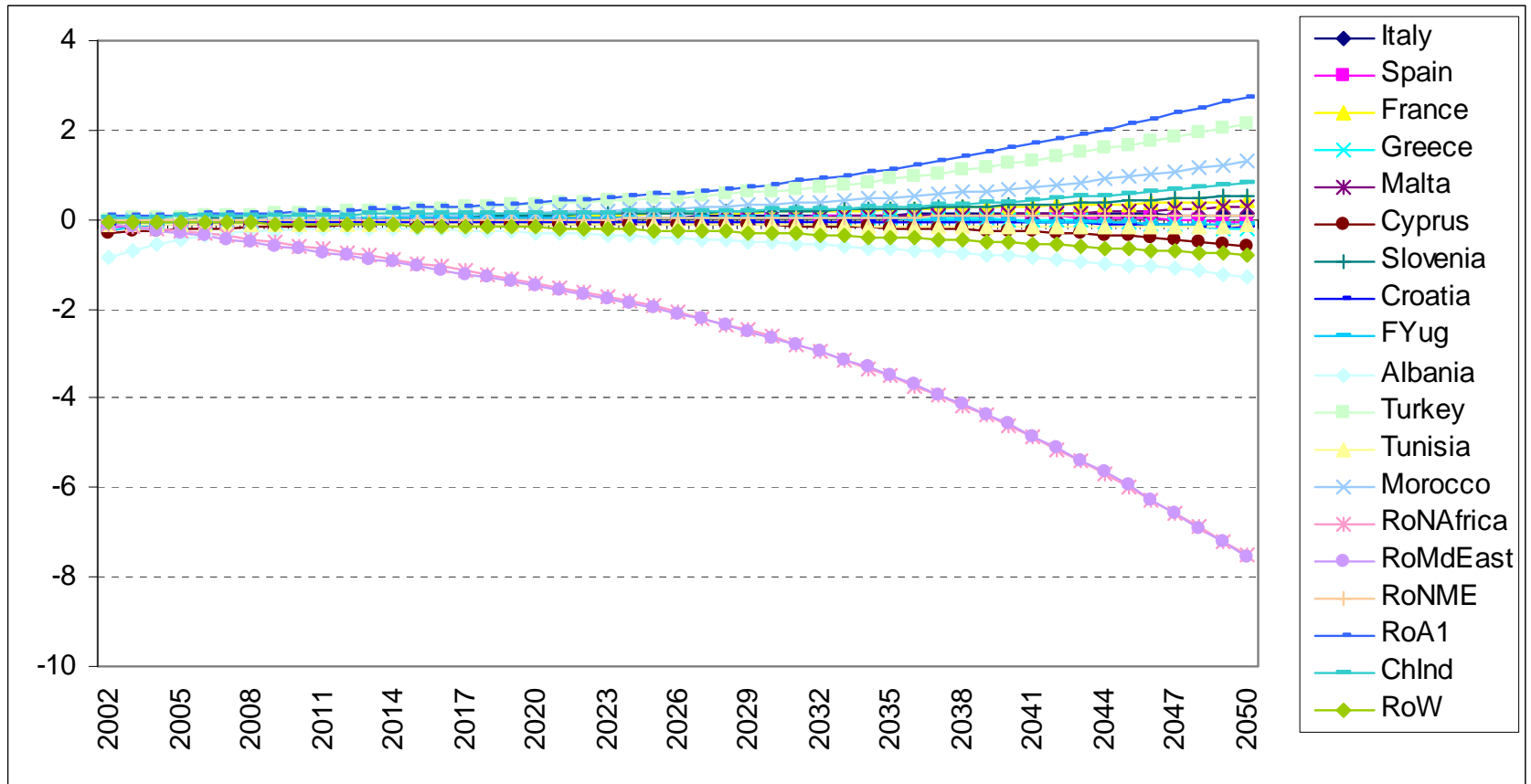
## Climate change impacts on world prices: % change wrt baseline





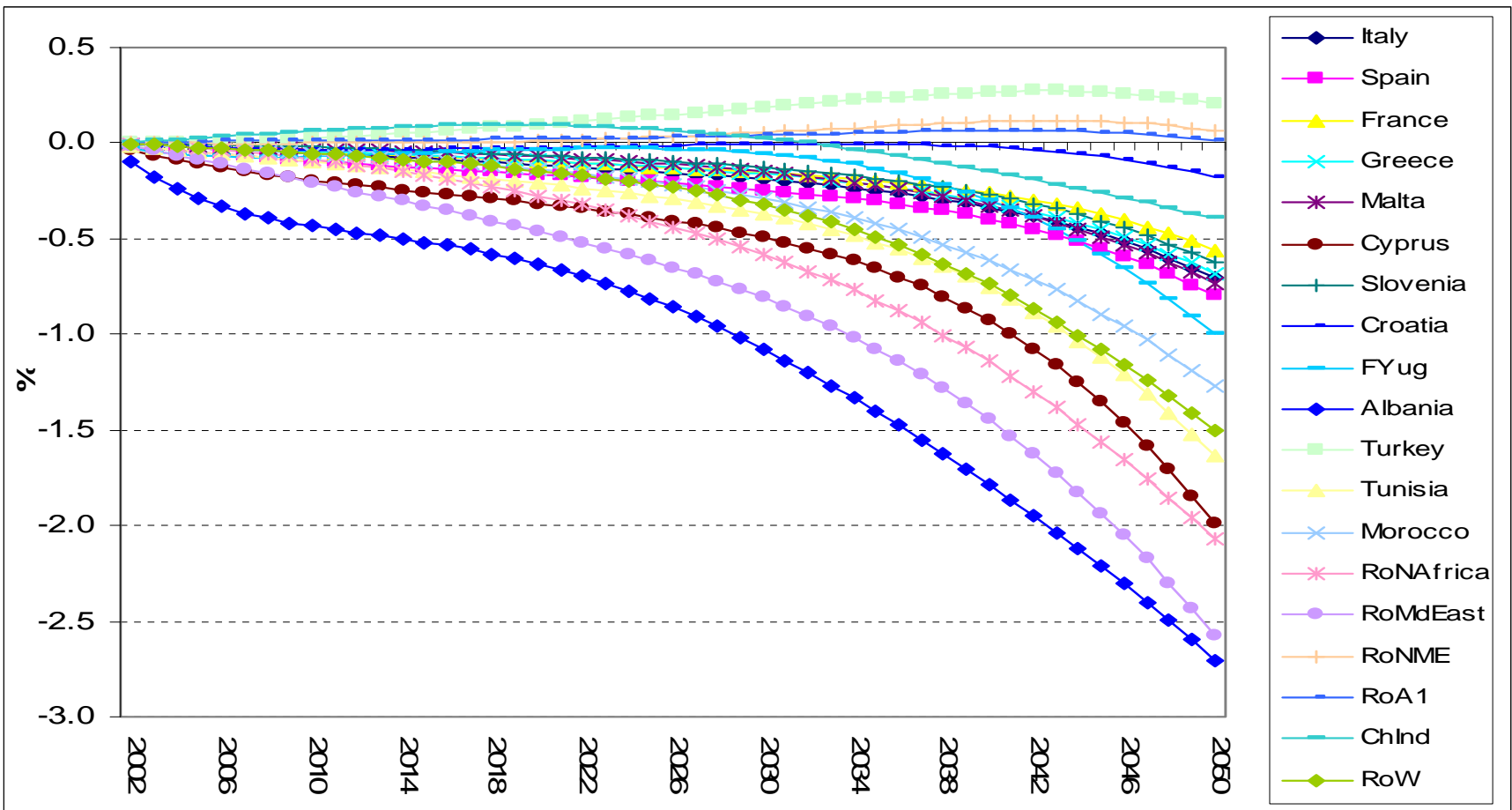
# Tracking market feedback

## Climate change impacts on terms of trade: % change wrt baseline



# Tracking market feedback

## Climate change impacts on investment flows: % change wrt baseline



## Conclusions

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In general “low” vulnerability of the Mediterranean area to the impacts considered (but low climate change, medium-term time horizon).

Apparently it is more a distributional issue than a scale issue.

Important differences between areas - North Med. less vulnerable than South Med. - and between countries.

Crucial the “detail”: aggregation hides “hot spot” for vulnerability

Market adjustments (e.g. factor substitution, demand re-composition and positive terms of trade effects) are not sufficient to eliminate losses. Climate change remains an issue even in the presence of market-driven adaptation.