Feeding the global population

Miodrag Stevanović
Potsdam Institute for Climate Impact Research - PIK
Brussels, 17. June 2014.

EUROPEAN COMMISSION
European Research Area

SEVENTH FRAMEWORK
PROGRAMME

PIK

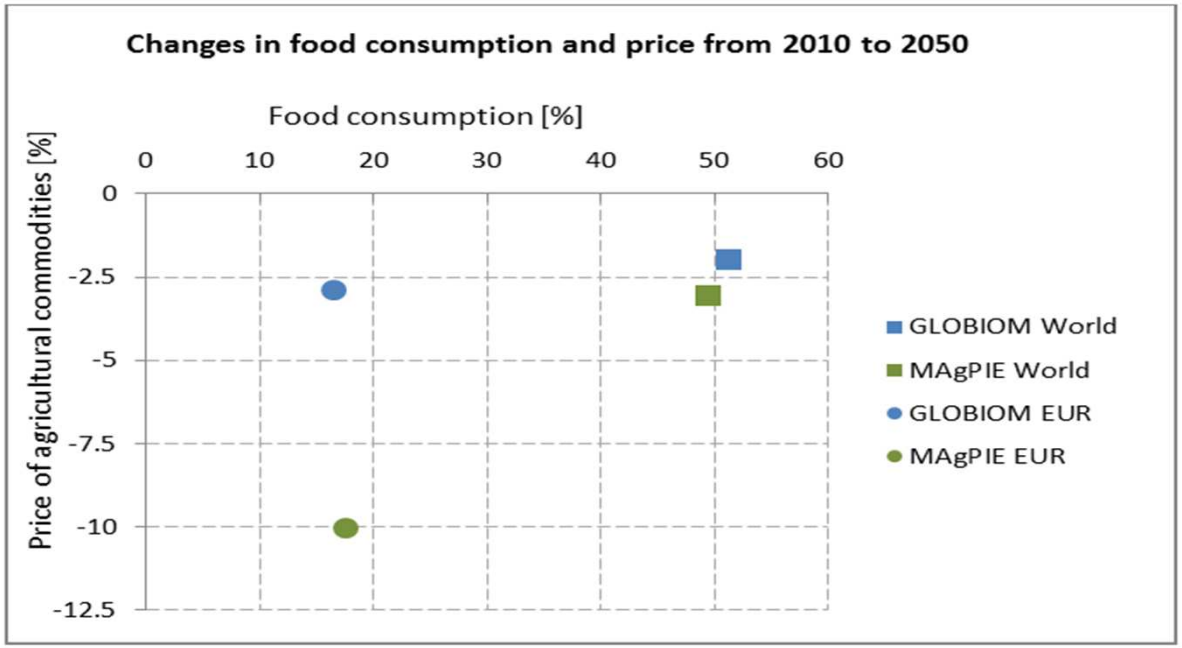
This research project has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under the grant agreement n° 266992 (Global IQ)

0- Outline

1. Introduction
2. Climate Change Challenge
3. Limited Adaptation to Climate Change
4. Conclusion

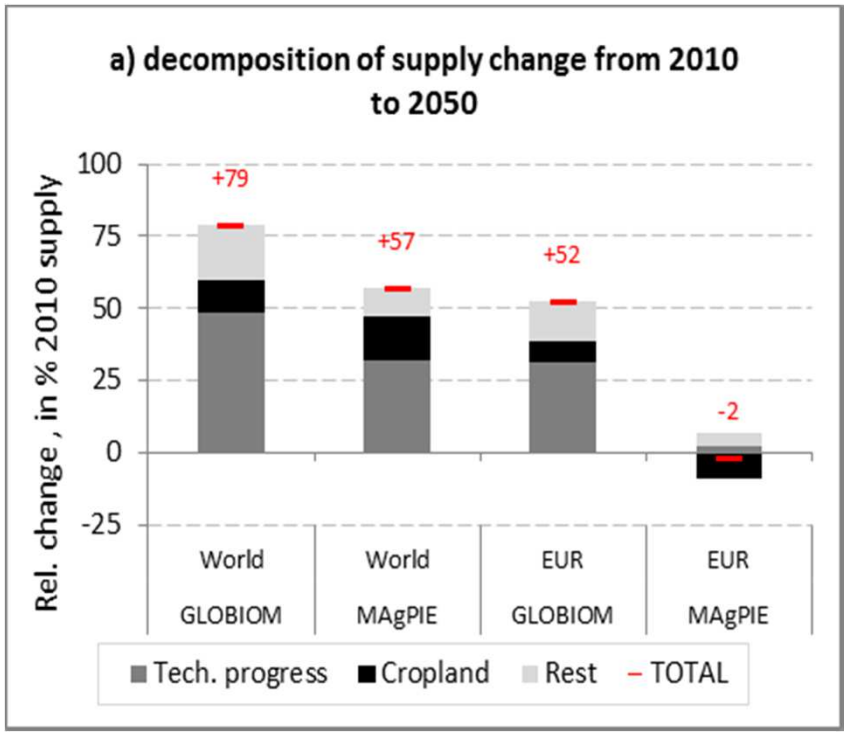
1- Introduction

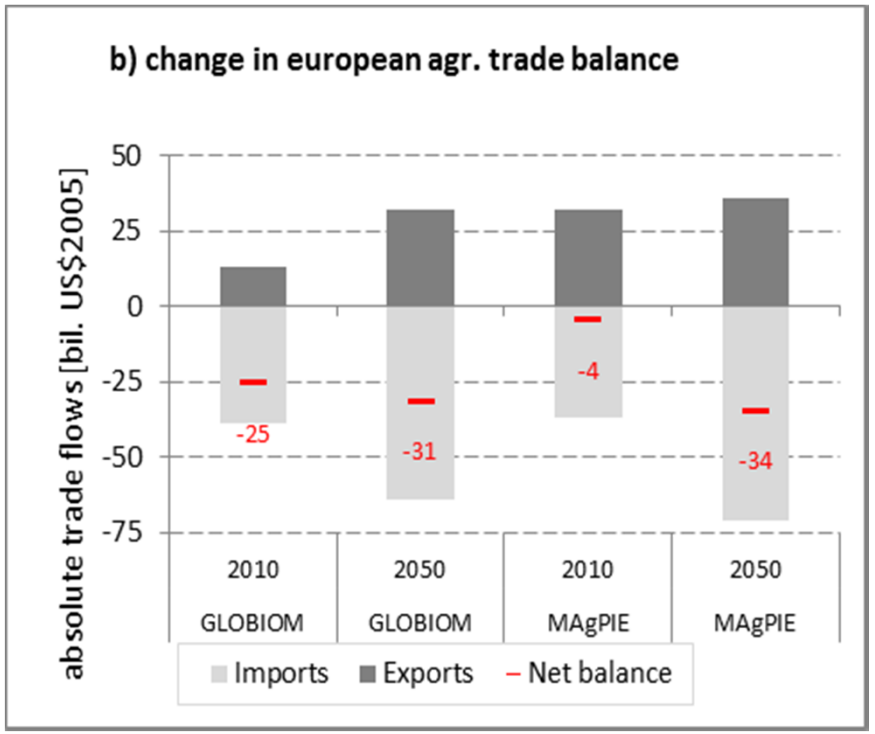
- Future demand for agricultural products will be driven by a larger and wealthier population.
  - 33% global population increase, 9% Europe (2010-2050)
  - 254% global GDP per capita increase, 200% Europe (2010-2050)
- Higher GDP/cap -> changes in preferences for food (milk, meat).
  - 50% global food calories increase, 18% Europe (2010-2050).



1- Introduction

- How is the additional supply achieved in the baseline scenario?





- Main drivers: technological progress and cropland expansion.
- Relocation of production across regions.

2- Climate Change Challenge

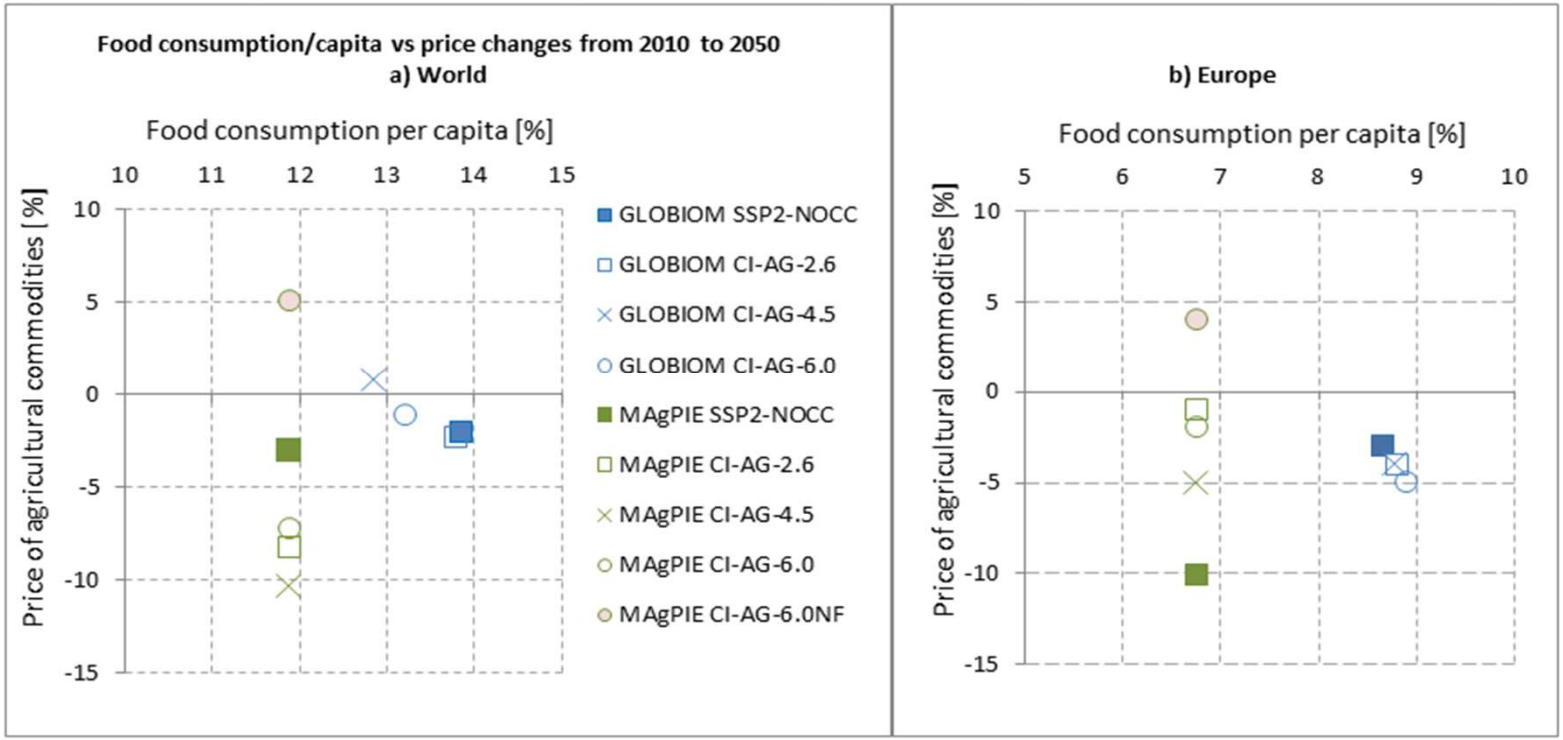
- Climate change poses a serious threat to all natural ecosystems and human well-being.

- Climate change scenarios:
  - One General circulation model (GCM):

	RCP-2.6	RCP-4.5	RCP-6.0
CO2 fertilization	x	x	x
No CO2 fertilization			x

  - Simulations EPIC-GLOBIOM and LPJmL-MAgPIE

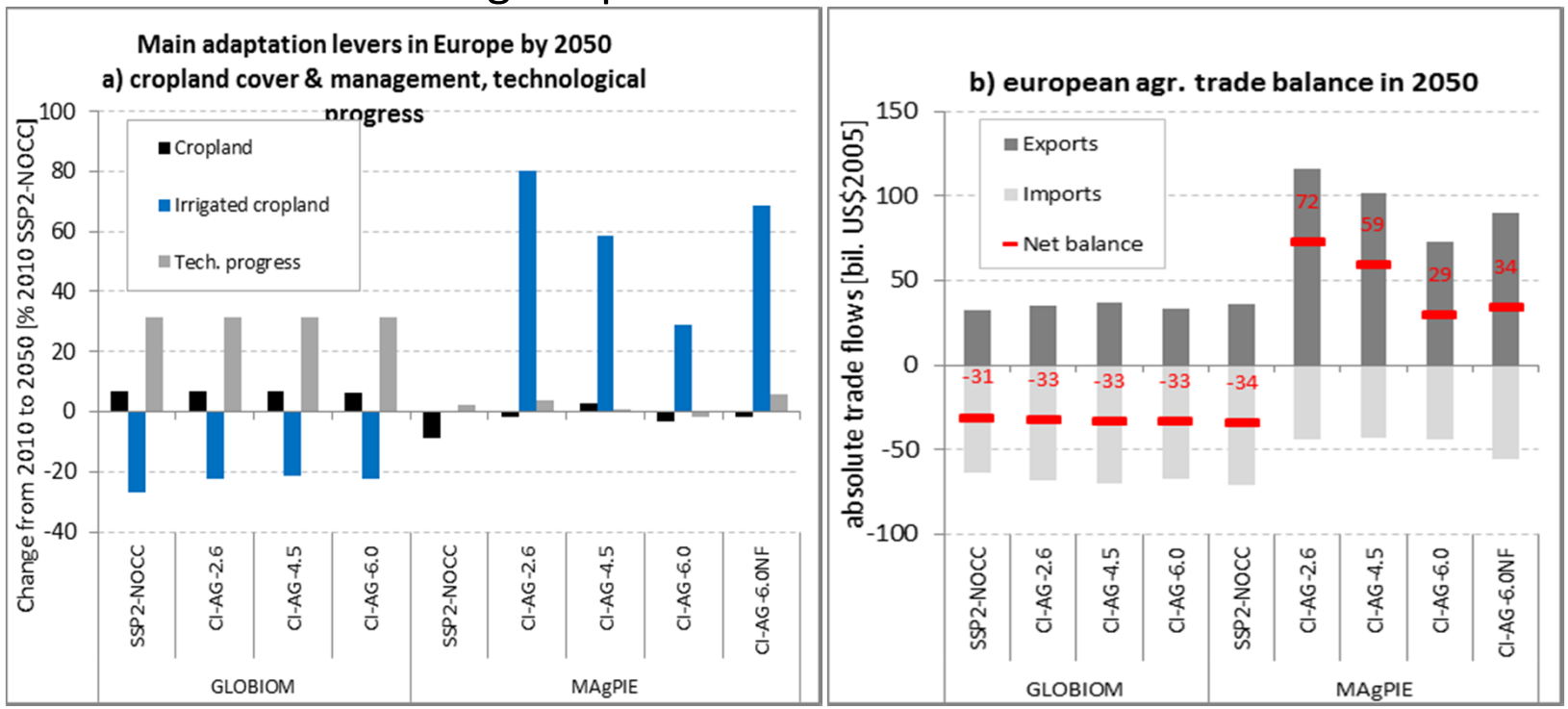
2- Climate Change Challenge



- If the aggregate global climate change effect on crop growth is positive (yield increasing), prices of agricultural goods decrease.
- Limited impact on consumers.
- However, regional impacts can be more heterogeneous and depends on a portfolio of attainable adaptation strategies.

2- Climate Change Challenge

- Adjustments in the agricultural production systems should occur to buffer climate change impacts.

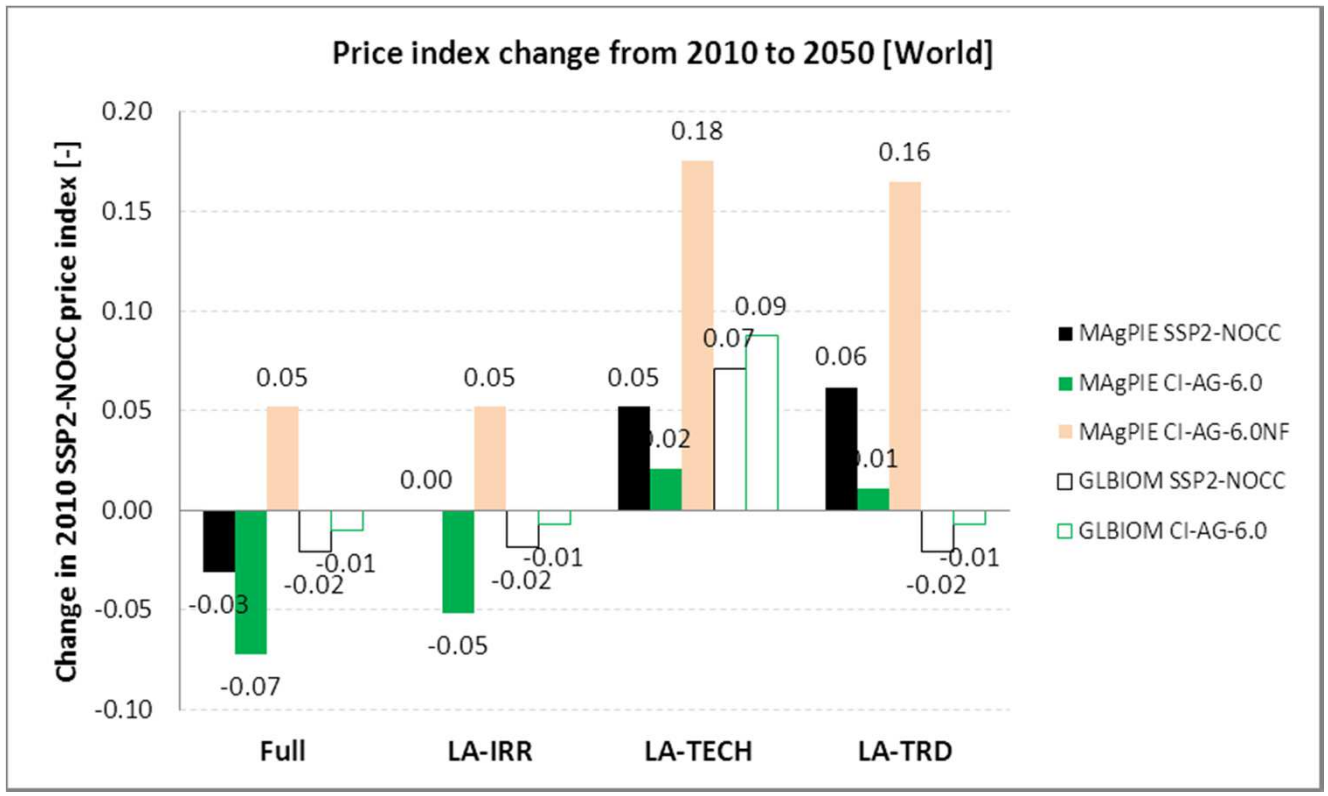


- Adaptation in Europe mainly through crop specialization, extended irrigated production and cropland relocation (intra- and inter-regionally)
- But also, European production depends on climate change induced differences in comparative advantage in the international markets.

3- Limited Adaptation to CC

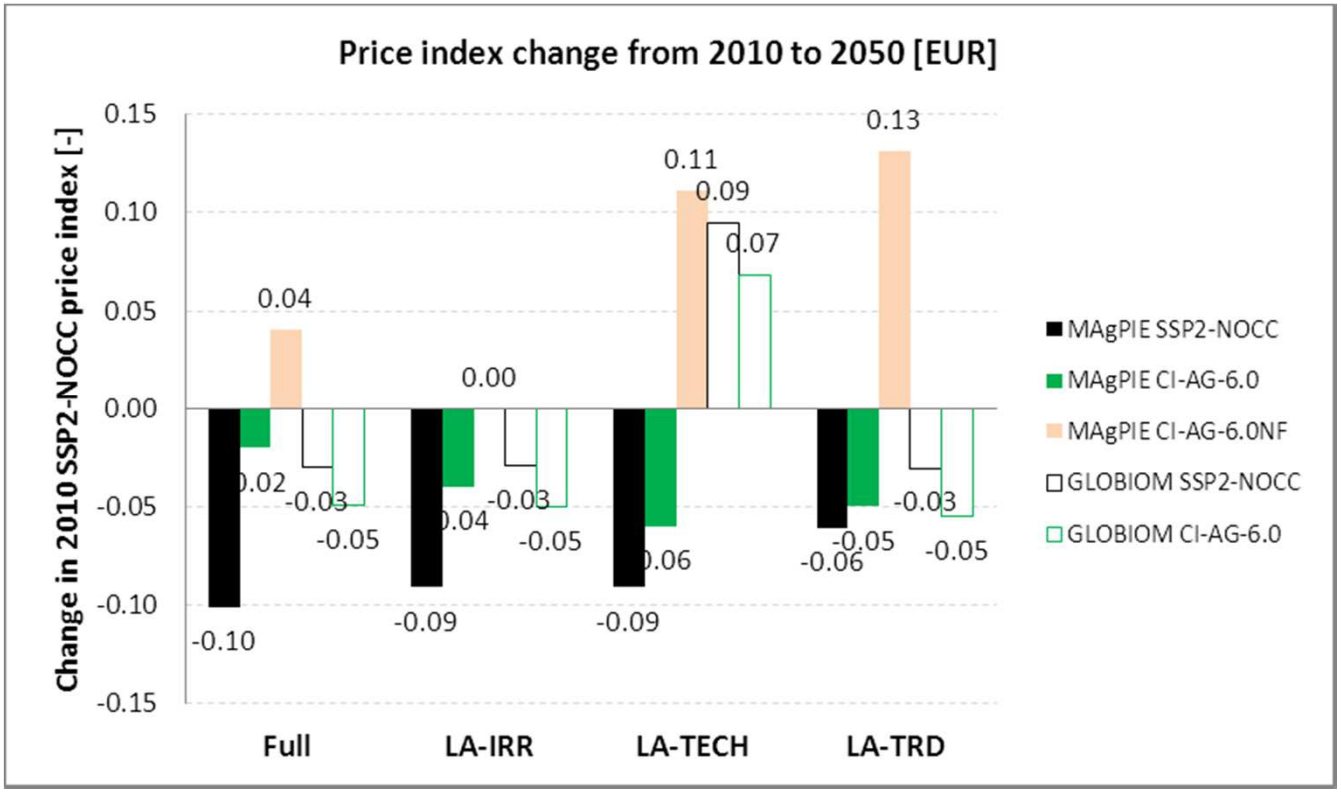
- Crucial Adaptation measures for agriculture:
  - cropland extension
  - shifts from rainfed to irrigated production systems
  - change in crop composition on cultivated area
  - investments in crop yield increasing technology
  - changes in international trade patterns
- Here, focus on limited availability of adaptation strategies:
  - Limited increase in irrigation systems (LA-IRR)
  - Limited yield increase due to technological improvements (LA-TECH)
  - Limited adjustments of trade flows (LA-TRD)
- When one adaptation measure is limited, response of other adaptations will also be reflected in changing of food prices.

3- Limited Adaptation to CC



- Globally, the limitations in technological improvements could be of greatest concerns for adapting to climate change.
- Spread in price change is not so large at the global level, but could be significant on a regional level.

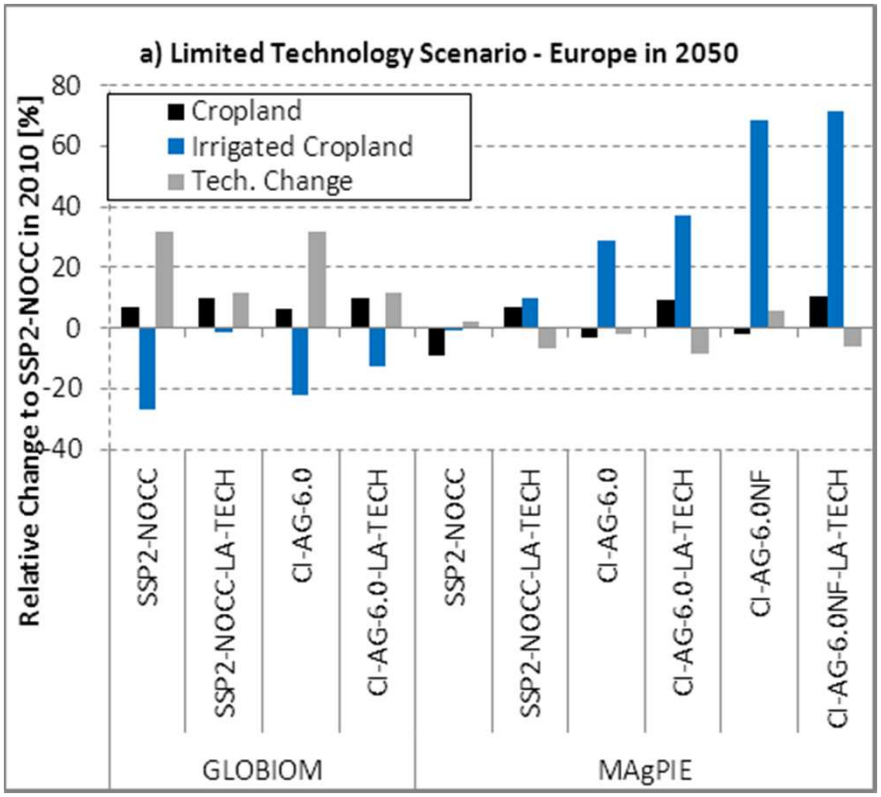
3- Limited Adaptation to CC

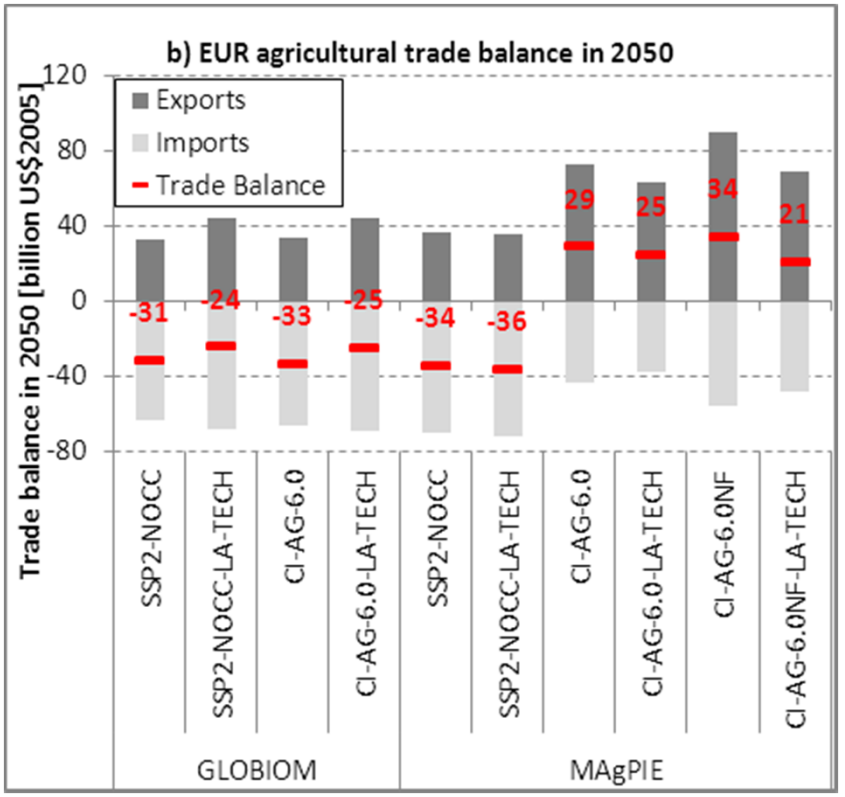


- For Europe, GLOBIOM results put equal weight on all limited adaptations.
- MAgPIE: more differentiated, and depends on inclusion of CO2 fertilization effect.

3 – Limited Adaptation to CC

- European supply under limited yield increasing technology (LA-TECH):





- Higher increases in cropland would occur if effect of investing in TC would be limited.
- Still, slower technological progress would most likely not hamper the climate change specific adaptations in regional supply capacities and related trade adjustments.

4- Conclusion

- The agricultural production sector shows a lot of flexibility when one adaptation strategy is constrained. Several adaptation measures are available and can substitute each other in the presence of partial limits to adaptation

- While at the global level trade is a quite important measure of adaptation in the global agricultural sector, for Europe irrigation and yield increasing technologies are more important

- The spread of changes of food prices does not pose a serious impact on consumers in Europe (could still be significant on a smaller regional scale)

Thank you !

EUROPEAN COMMISSION
European Research Area

SEVENTH FRAMEWORK
PROGRAMME

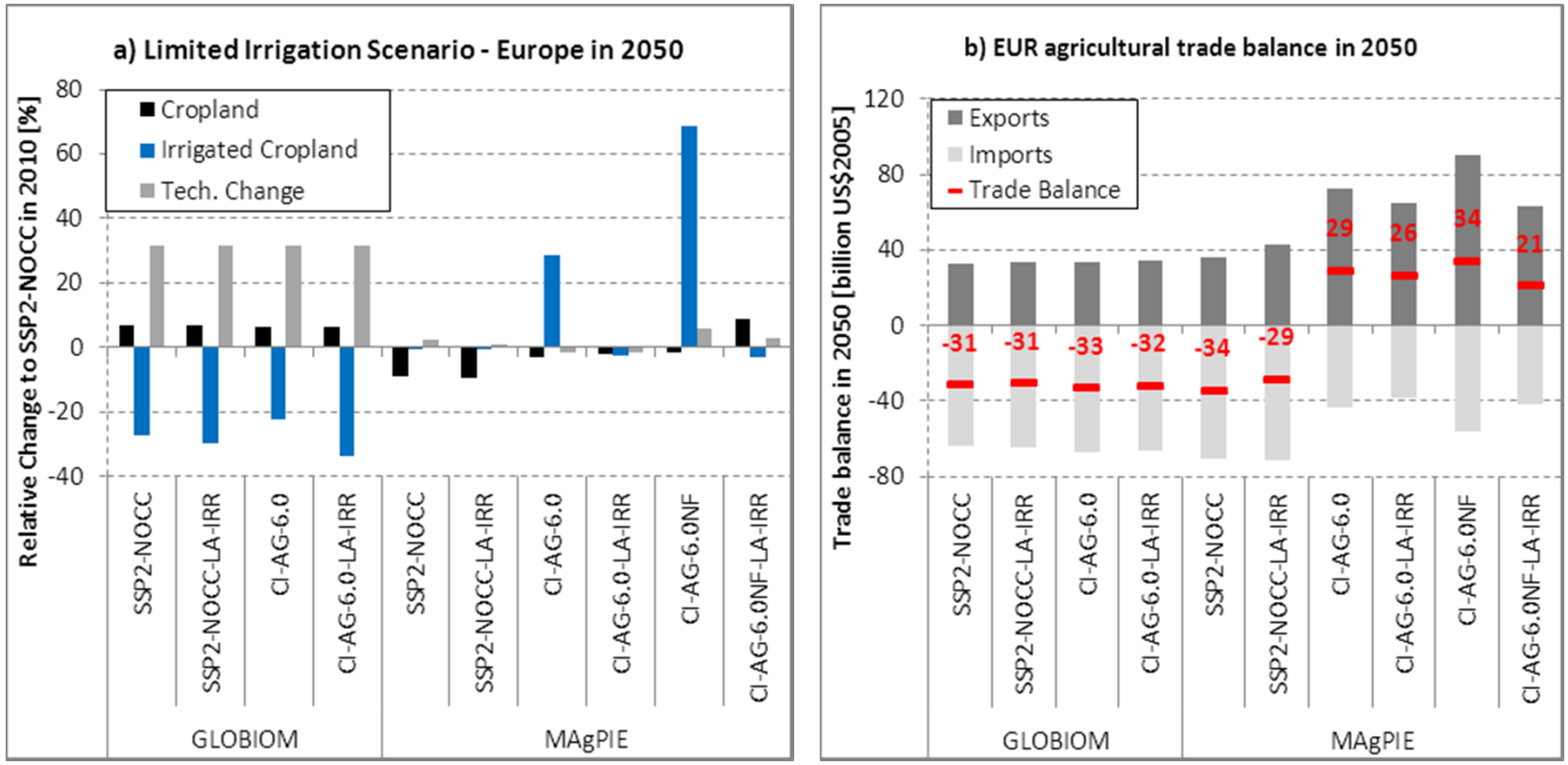
Contact: stevanovic@pik-potsdam.de
Jean-Pierre Amigues - Scientific coordinator (TSE)
Céline Claustre - Project manager (TSE)
Domenico Rossetti Di Valdalbero - European Commission Officer (EC)

PIK

This research project has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under the grant agreement n° 266992 (Global IQ)

Appendix I

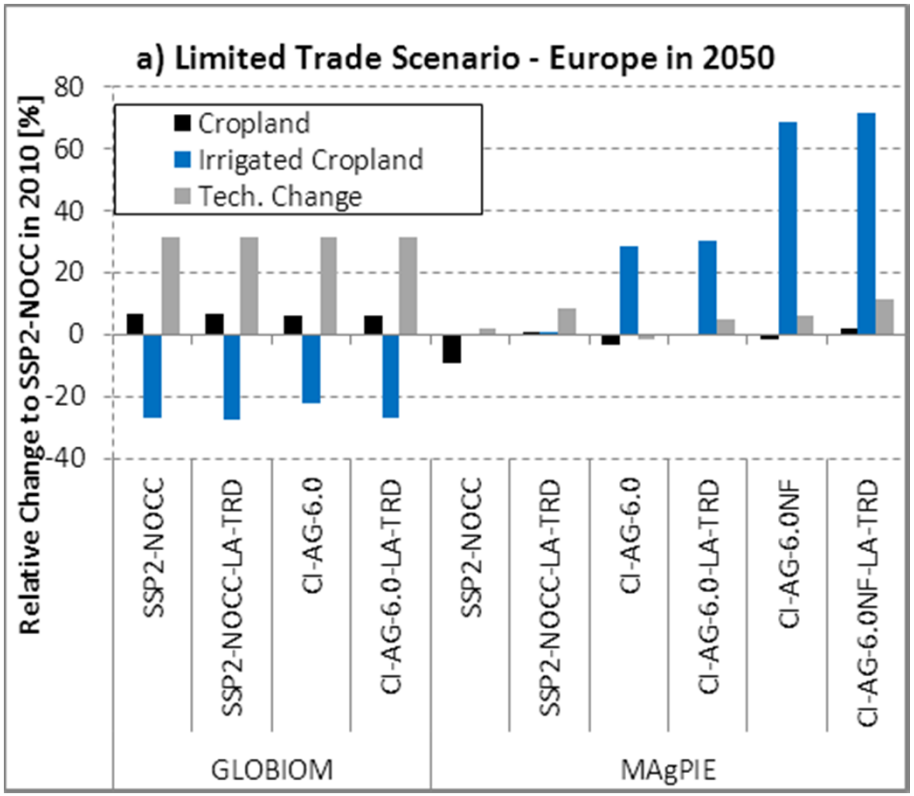
- European supply under limited irrigated agricultural production (LA-IRR):

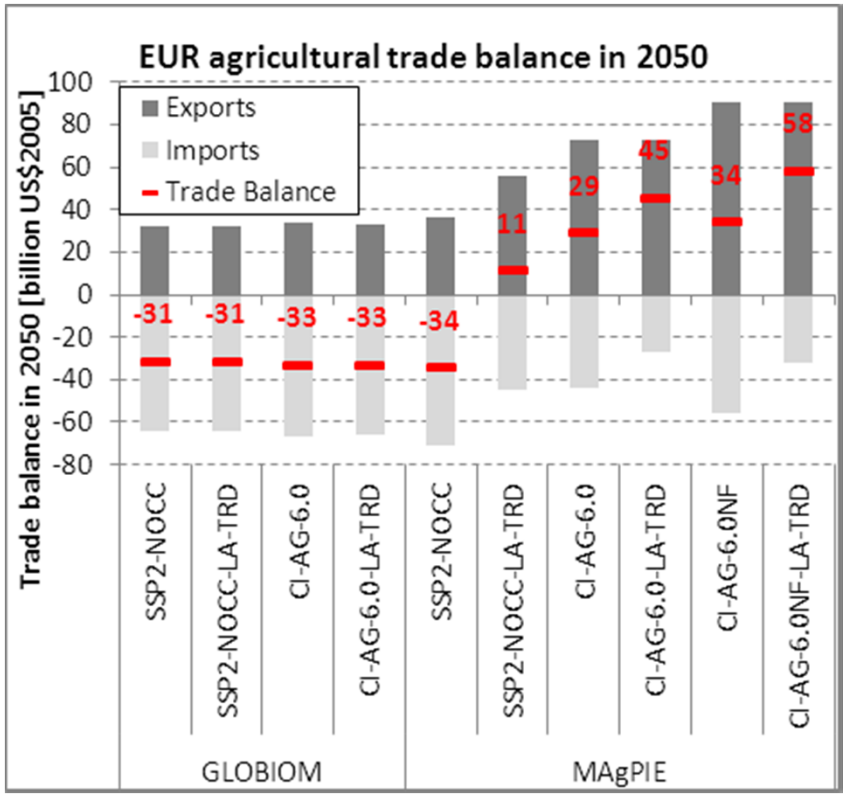


- Even if the expansion of irrigation is one of the largest adaptation levers, it is easily replaced so that overall changes in regional supply capacities and trade patterns are maintained.

Appendix III

- European supply under limited trade of agricultural products (LA-TRD):





- limited trade under climate change would not significantly alter the adaptation portfolios in Europe, with slightly more use of irrigation projected for both models and increase in supply and exports for MAgPIE.