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Quantitative Modelling of European FNS Scenarios – Regionalization of Feed Supply Chains

Andre Deppermann¹, Petr Havlik¹, Joost Verfoort²

**¹ International Institute for Applied Systems Analysis
(IIASA), Austria**

² University of Oxford and University of Utrecht



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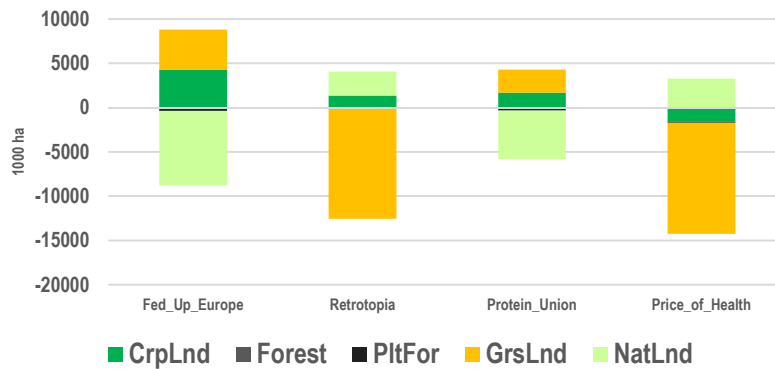
1) Scenario narratives → Quantified scenarios

2) Regionalization of feed supply chains in European livestock production

Identification of global drivers of change



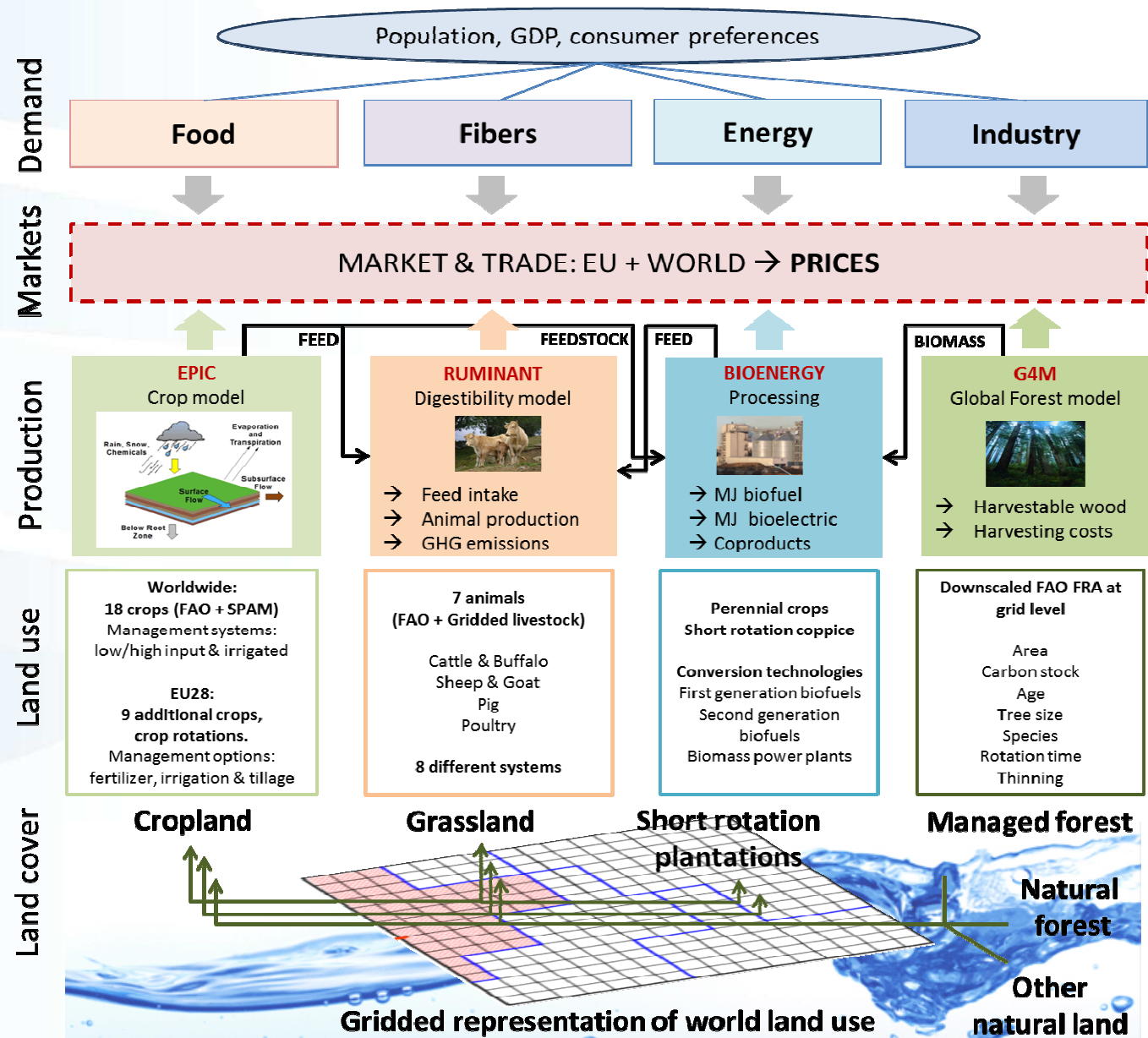
Narratives for EU focused scenarios from a stakeholder workshop



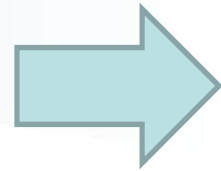
Quantification of scenarios with Agricultural Sector Model GLOBIOM

GLOBIOM

- Partial equilibrium model
- Linear programming approach
 - Maximization of consumer and producer surplus
 - Non linear expansion costs
 - Optimization constraints
- Base year: 2000
 - 10 years time steps till 2050



Exogenous assumptions

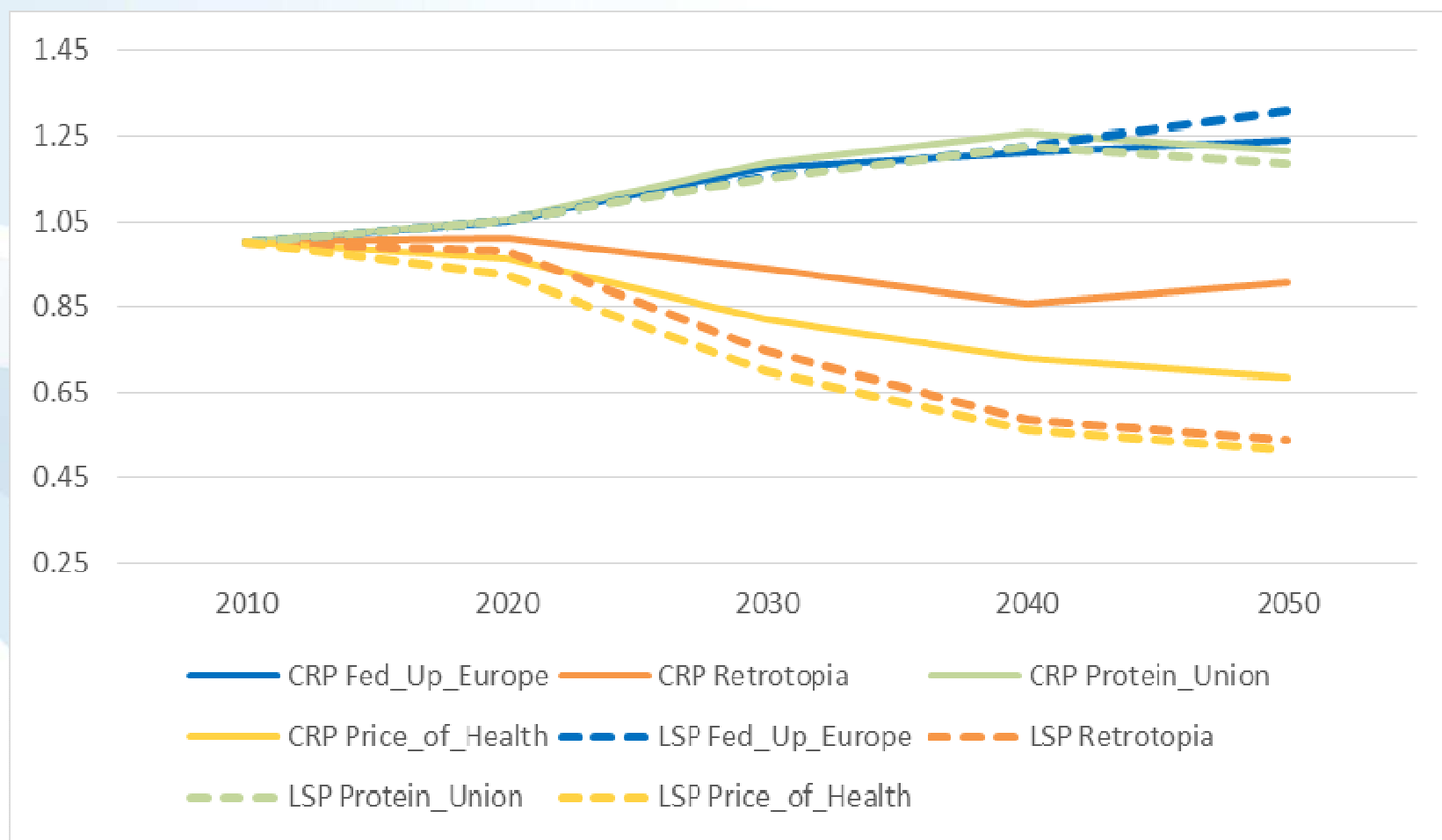


Model outputs

- Population growth
- GDP growth
- Crop and livestock productivity
- Diet preferences
- Trade openness
- Waste reduction
- Environmental policy
- ...

- Crop and livestock production and demand
- Agricultural prices
- Input use (Fertilizer, Water)
- Calorie consumption levels
- Land use
- Agr. Trade
- LULUCF Emissions
- ...

Production of crops (CRP) and livestock products (LSP) in the EU28 (Index 2010 = 1).



- Several elements of the narratives not straight forward to implement in a quantitative model
 - Regionalization of food systems important
 - Relates to consumer preferences and the level of integration of the food system
 - Is an important concept within the TRANSMANGO project
 - Not often explicitly addressed by large scale agricultural sector models
- Regionalization of feed supply chains as a first (explorative) step in GLOBIOM

Regionalization of feed supply chains

- Consumers' awareness of food production processes increases, as well as concern about diets/food choices
- Potentially preferences for livestock products raised with local feed (Wägeli and Hamm, 2012)
- A low self-sufficiency rate in protein feed is reported for many European countries (Früh et al., 2015, Erb et al. 2012)

Erb, K.-H., A. Mayer, T. Kastner, K.-E. Sallet, H. Haberl (2012). *The Impact of Industrial Grain Fed Livestock Production on Food Security: an extended literature review.* Commissioned by Compassion in World Farming, The Tubney Charitable Trust and World Society for the Protection of Animals, UK. Vienna, Austria.

Früh, B., B. Schlatter, A. Isensee, V. Maurer and H. Willer (2015). *Report on organic protein availability and demand in Europe.* Research Institute of Organic Agriculture (FiBL), Frick, Switzerland.

Wägeli, S. and Hamm, U. (2012). *Consumers Perception of Feed Origin in Organic Food Products Declared as Local.* Proceedings in Food System Dynamics, 317-329.

Model development: Implementation of Feed Substitution

Standard:

- Fixed input-output relations per management system (Leontief)
- Inputs defined by feedstuff

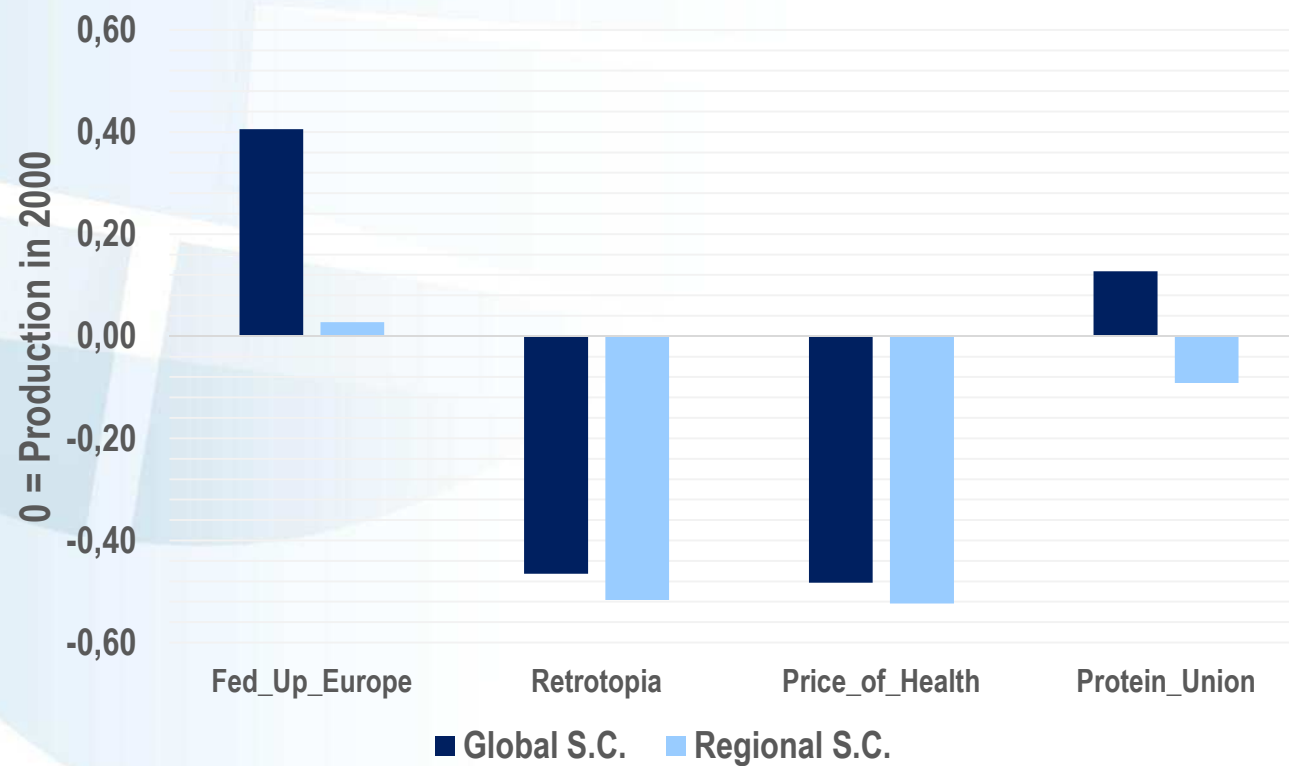
New approach:

- Define feed basket on protein and energy basis
- Allow deviation from original feed crop mix
 - Linearized quadratic cost function for deviation (→ marginally increasing)
 - Keep energy and protein balance and maximum shares of single feedstuff in the feed mix
- Allows for gradual substitution with bio-physical limits based on price incentives

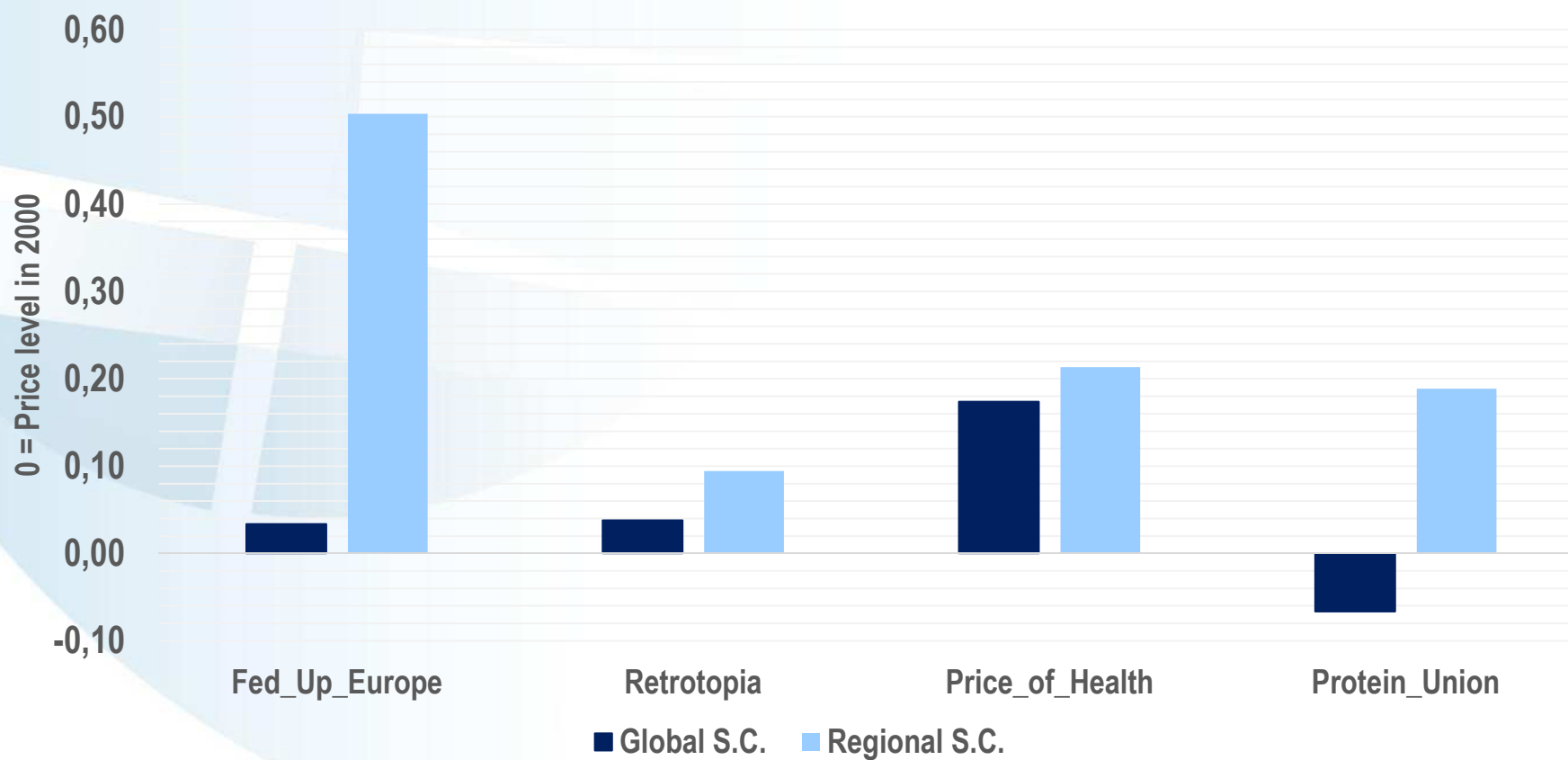
Analysis: regional feed supply

- Stakeholder developed scenarios as background scenarios
- Restrict feed input to regionally available feedstuff
- According to available data:
 - Ruminants: 2° x 2° degree cell (additionally accounting for country borders)
 - Pig and poultry at member state level
 - By-products from bioenergy production: member state level for pig and poultry
- In the following:
 - “global supply chains” (**Global S.C.**) versus “regional supply chains” (**Regional S.C.**)

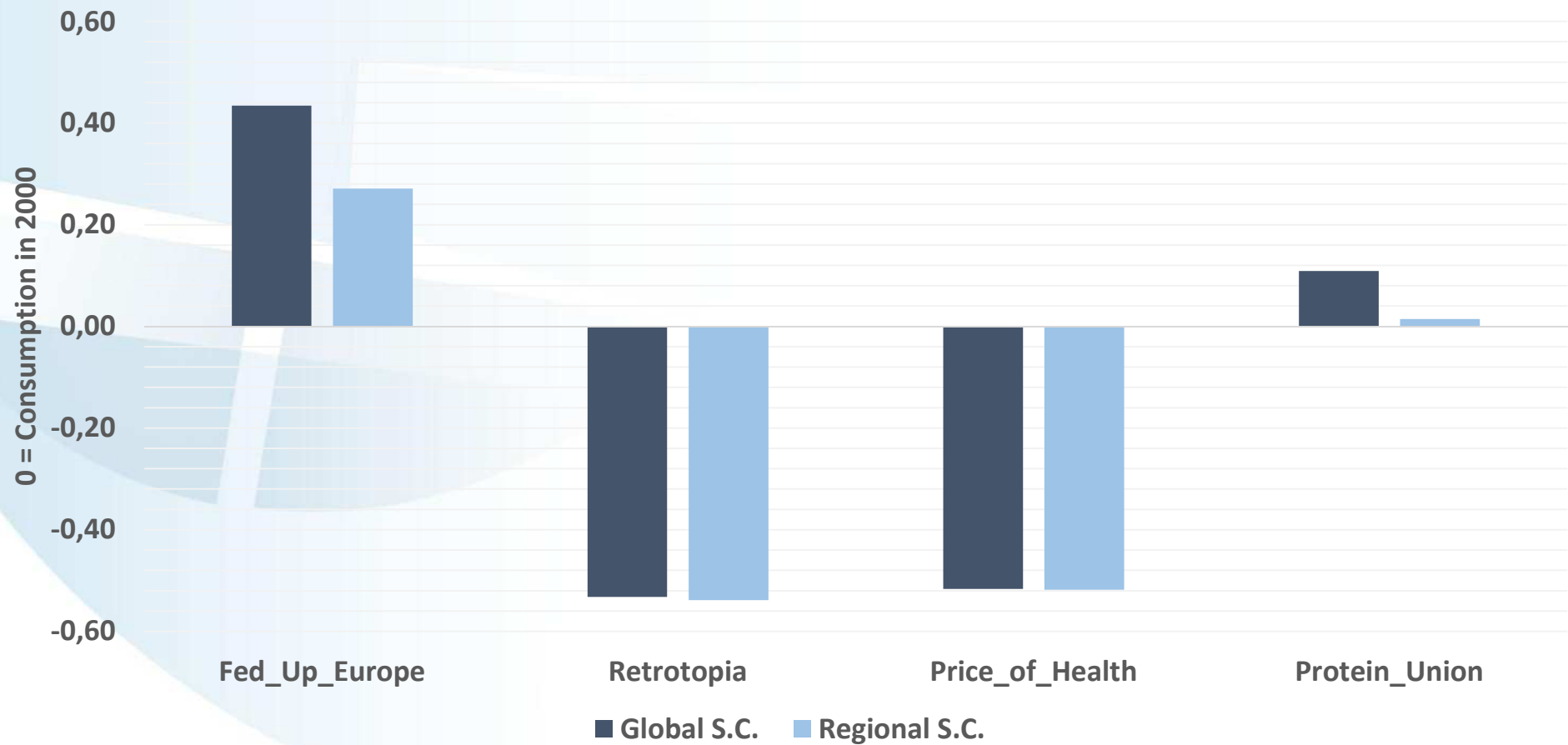
EU Livestock production changes (2050 to 2000)



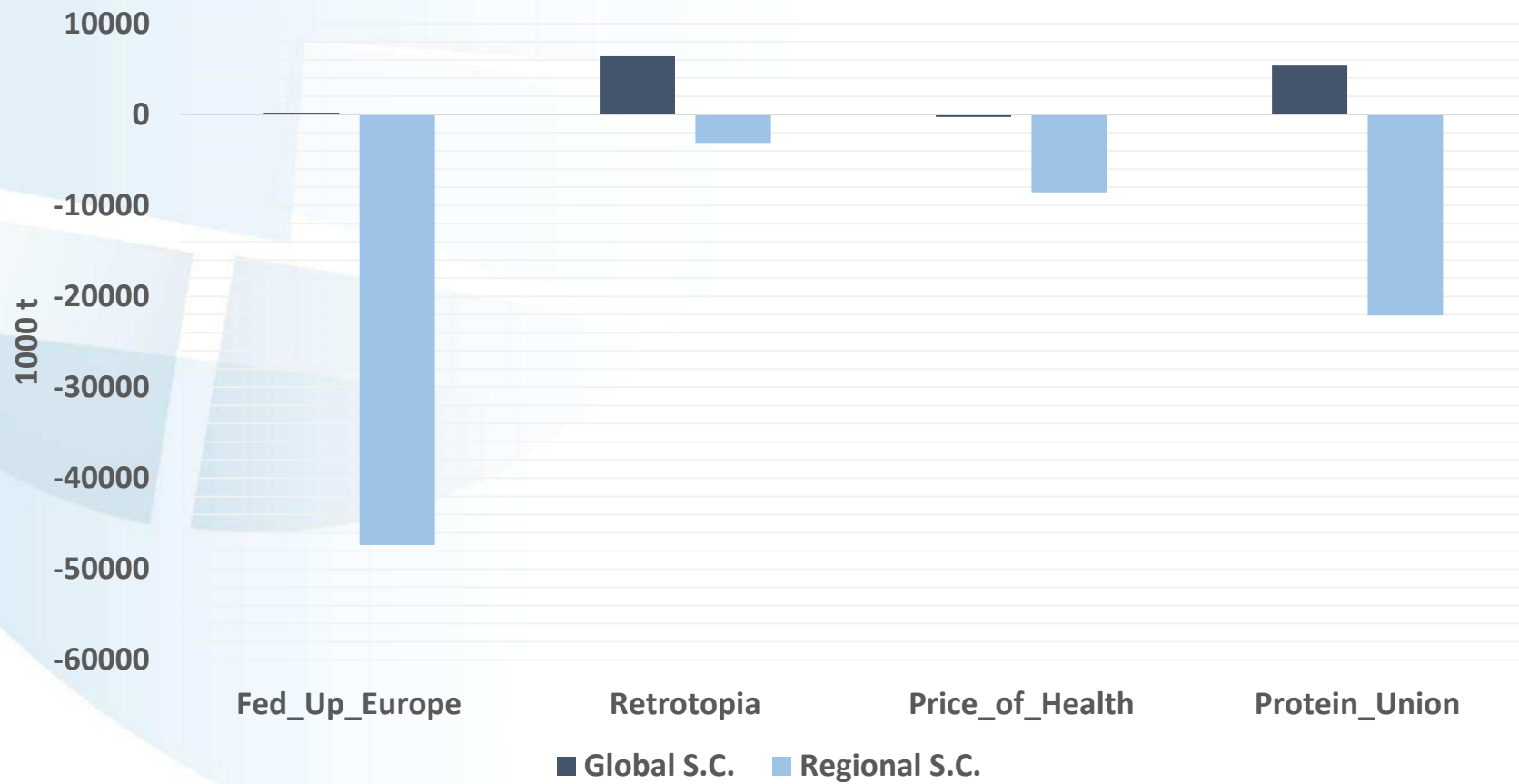
EU price level changes of livestock products (2050 to 2000)



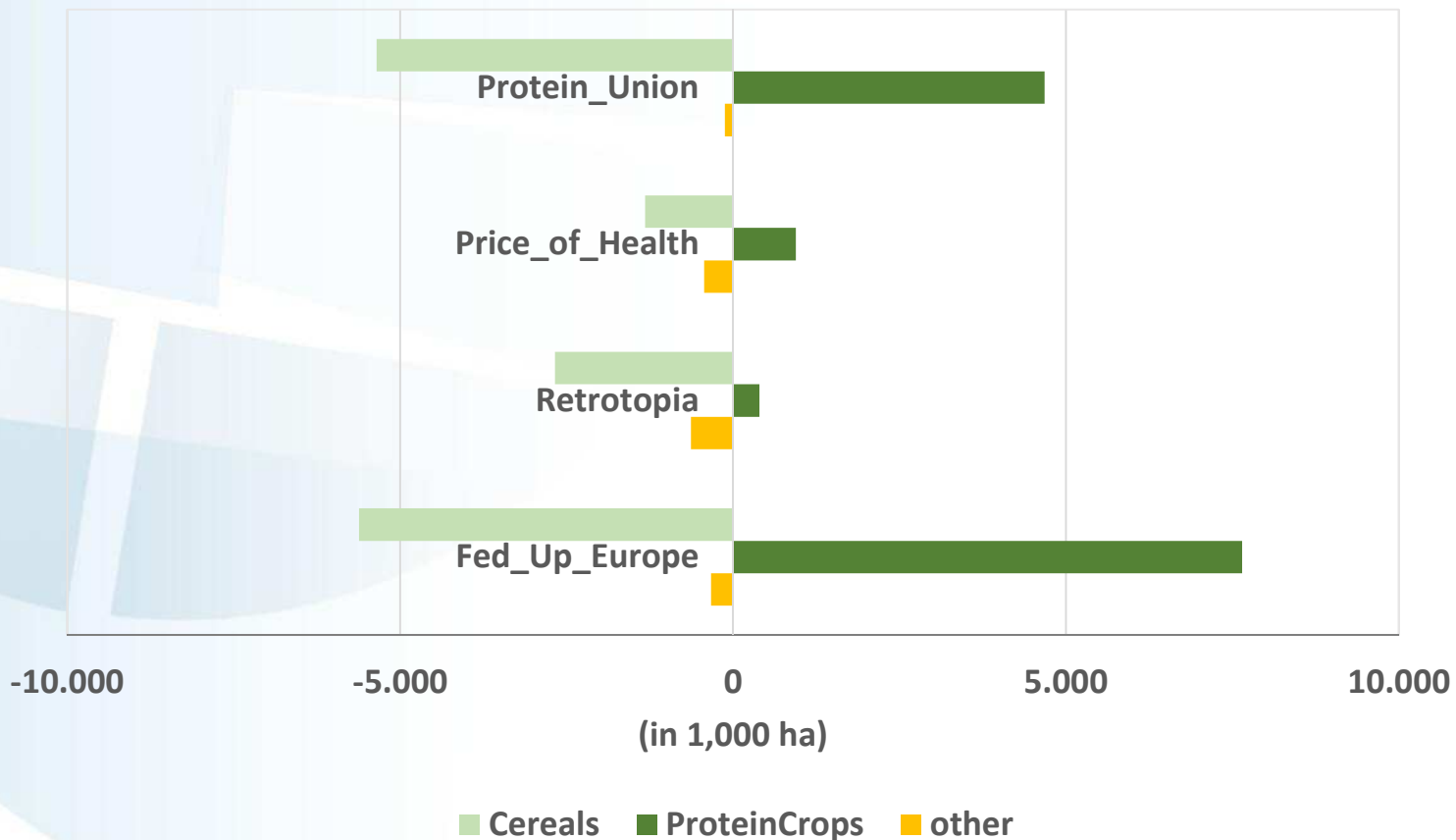
Domestic consumption of livestock products in EU countries (2050 to 2000)



EU net trade differences for livestock products (2050 to 2000)



Changes in area allocation in EU28 due to regionalization of feed supply (2050)



Conclusions

- Quantification of narratives needs appropriate model structure
- Model extension: first steps towards regionalization of agricultural structures
- Regionalization of feed supply chains in EU28:
 - Less livestock production
 - Huge differences in magnitude, depending on background scenario
 - Price changes mirror production impacts.
 - More imports of livestock products undermine concept of regional consumption
 - More protein crops produced in EU



Thank you for your attention!

depperma@iiasa.ac.at