Land Use Change and European Biofuel Policies

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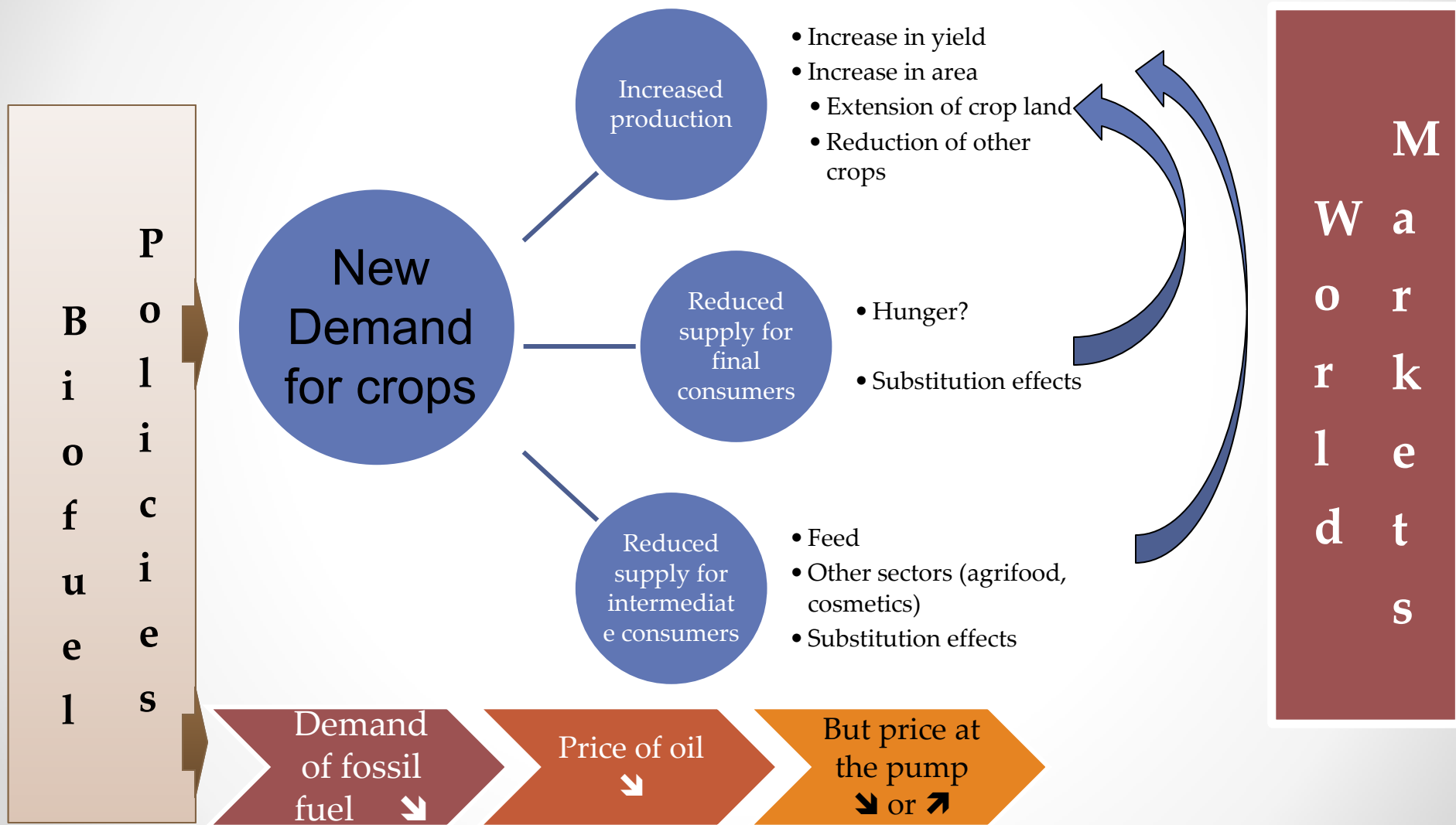*d.laborde@cgiar.org*

The views expressed by the author are not those of IFPRI or the European Commission

Why Biofuels?

- Energy policy?
  - Energy "Security"
  - Energy prices
  - Current account concerns
- Farm policy?
  - A silver bullet vs the WTO discipline
- An environmental policy?
  - Road transportation produces emissions…

If the latter, then Land Use Changes **matter**!

The core story → Use of Model

Biofuel Policies

New Demand for crops

- Increased production
  - Increase in yield
  - Increase in area
    - Extension of crop land
    - Reduction of other crops

- Reduced supply for final consumers
  - Hunger?
  - Substitution effects

- Reduced supply for intermediate consumers
  - Feed
  - Other sectors (agrifood, cosmetics)
  - Substitution effects

World Markets

Demand of fossil fuel ↘

Price of oil ↘

But price at the pump ↘ or ↗

A few facts:

Why ILUC exists and the role of international Trade

EU-27 Vegetable Oils Imports (tons)
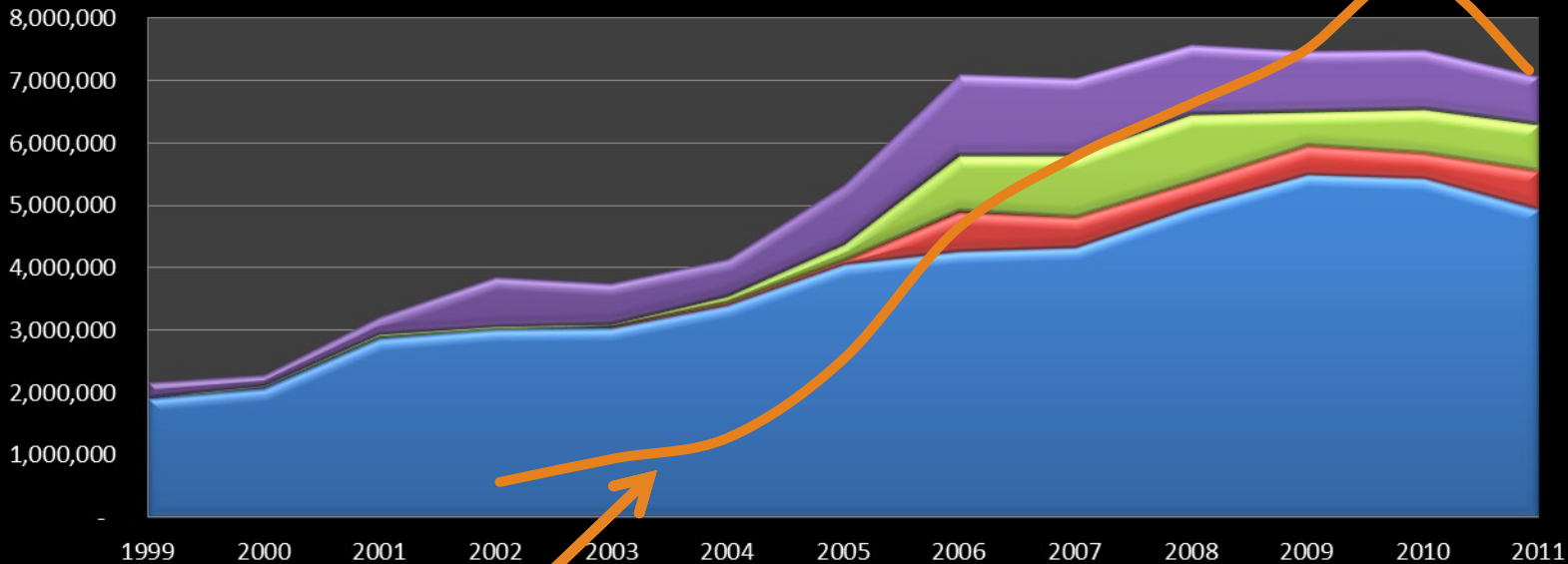
External trade EU 27 - Imports and Exports- Rape seed
Surge of rape seeds imports: 2011/2012: 3.8Mt Tons (more than 15% of EU production)
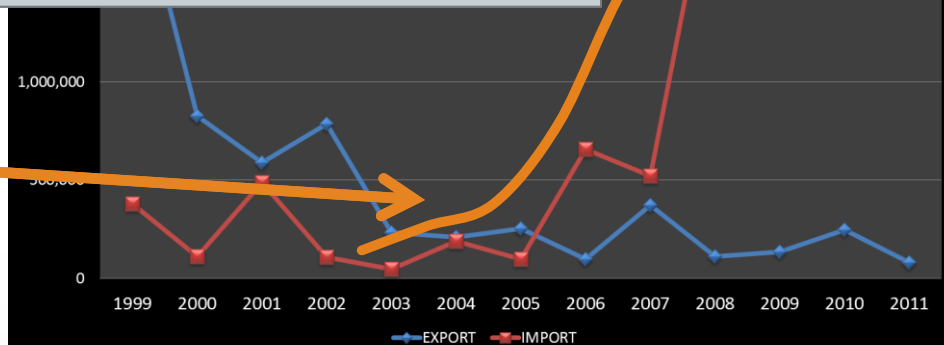
Evolution of the EU biodiesel production (different scale)

Preamble: iLUC or LUC

- An important and sensitive "policy" issue
- An issue that most models will never address: the spatial dimension
- Few empirical evidences about the relevance of the discrimination
- What matters is the net effects

- Simple arithmetic in the model:

    TOTAL LUC = direct LUC + indirect LUC

    ASSUMPTION: EU legislation works! Direct LUC is forbidden dLUC=0

    TOTAL LUC = 0 + iLUC

    The model computes the Total LUC and therefore we can get iLUC estimates.

Simulation Design

Modeling Biofuels in MIRAGE-Biof

- MIRAGE model: A Computable General Equlibrium Model
  - Multi country, Multi sectoral, and global
  - Recursive dynamic set-up
- Modified model and data components
  - Improvement in demand system (food and energy)
  - Improved sector disaggregation
  - New modeling of ethanol sectors
  - Co-products of ethanols and vegetable oils
  - New modeling of fertilizers
  - New modeling of livestocks (extensification/intensification)
  - Land market and land extensions at the AEZ level
- The model has been reviewed by different parties and publications based on the model are available in key academic journals.
- Role of the baseline

Scenarios and sensitivity analysis

- Central scenarios
  - Biofuel mandate:
    - Member states Action Plan
- Trade policy options:
    - Status Quo
    - Full Liberalization in the EU of Ethanol and Biodiesel
- Sensitivity Analysis
  - On linearity/non linearity issue
    - Estimation of crop LUC at a "half mandate", at a full mandate
      - But still weak on Ethanol: no saturation effects
  - On food consumption
    - Endogenous vs Fixed to Baseline level
  - On Co-products: with or without
  - Monte Carlo simulations on selected parameters
  - But in reality, much more uncertainties (see **Box 2**, 25 items related to LUC, but even more regarding net emissions…)
    - About the land (amount, location, carbon values)
    - About future technologies
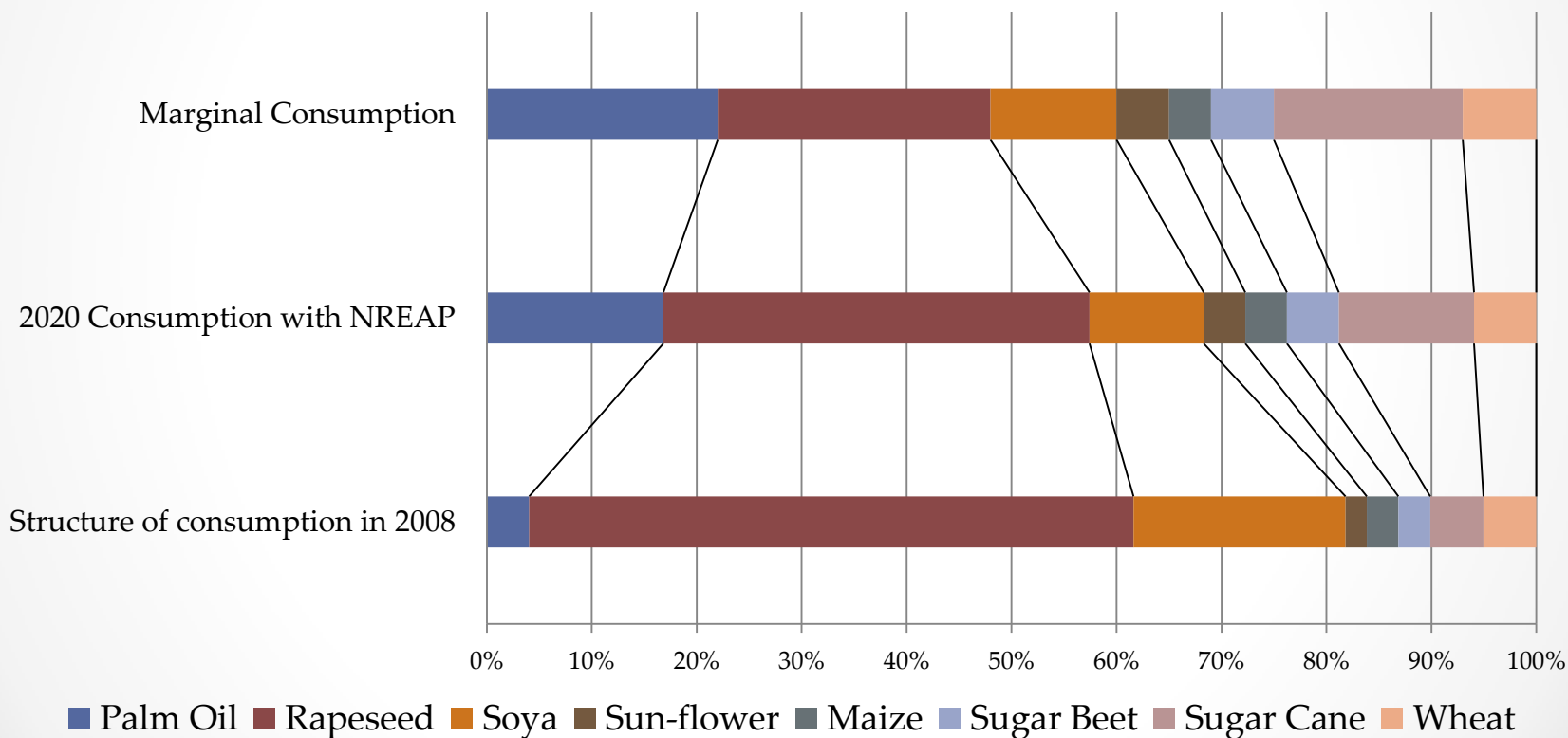   - Both behavioral and technical uncertainties

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Results

Additional EU consumption from 2008 to 2020 driven by NREAP: +16 Mtoe (to reach 27.2 Mtoe)

Consumption Structure

Legend: Palm Oil, Rapeseed, Soya, Sun-flower, Maize, Sugar Beet, Sugar Cane, Wheat

Categories: Marginal Consumption, 2020 Consumption with NREAP, Structure of consumption in 2008
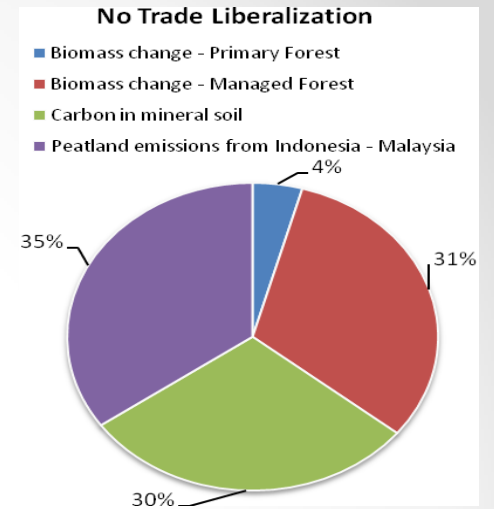
The LUC domino effect

Agricultural inputs for the additional EU biofuel consumption

97,640 Ton

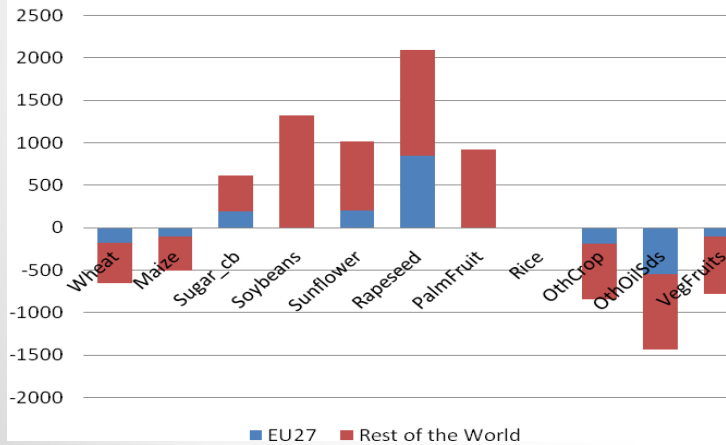Additional Agricultural production of Energy crops
101,688 Ton

Area for Energy Crops
4,800,703 Ha

Cropland area
1,738,156 Ha
(=60% of Belgium or 10% of France's arable land)

Land taken from pristine environments
340,000 Ha

No Trade Liberalization

- Biomass change - Primary Forest
- Biomass change - Managed Forest
- Carbon in mineral soil
- Peatland emissions from Indonesia - Malaysia

4%
35%
31%
30%

Origin of LUC CO2 emissions (additional mandate)

No Trade Liberalization

EU27   Rest of the World

Change in Cropland (additional mandate)

Emissions grCO2/MJ – 20 years time horizon

If considering oil leakage effects
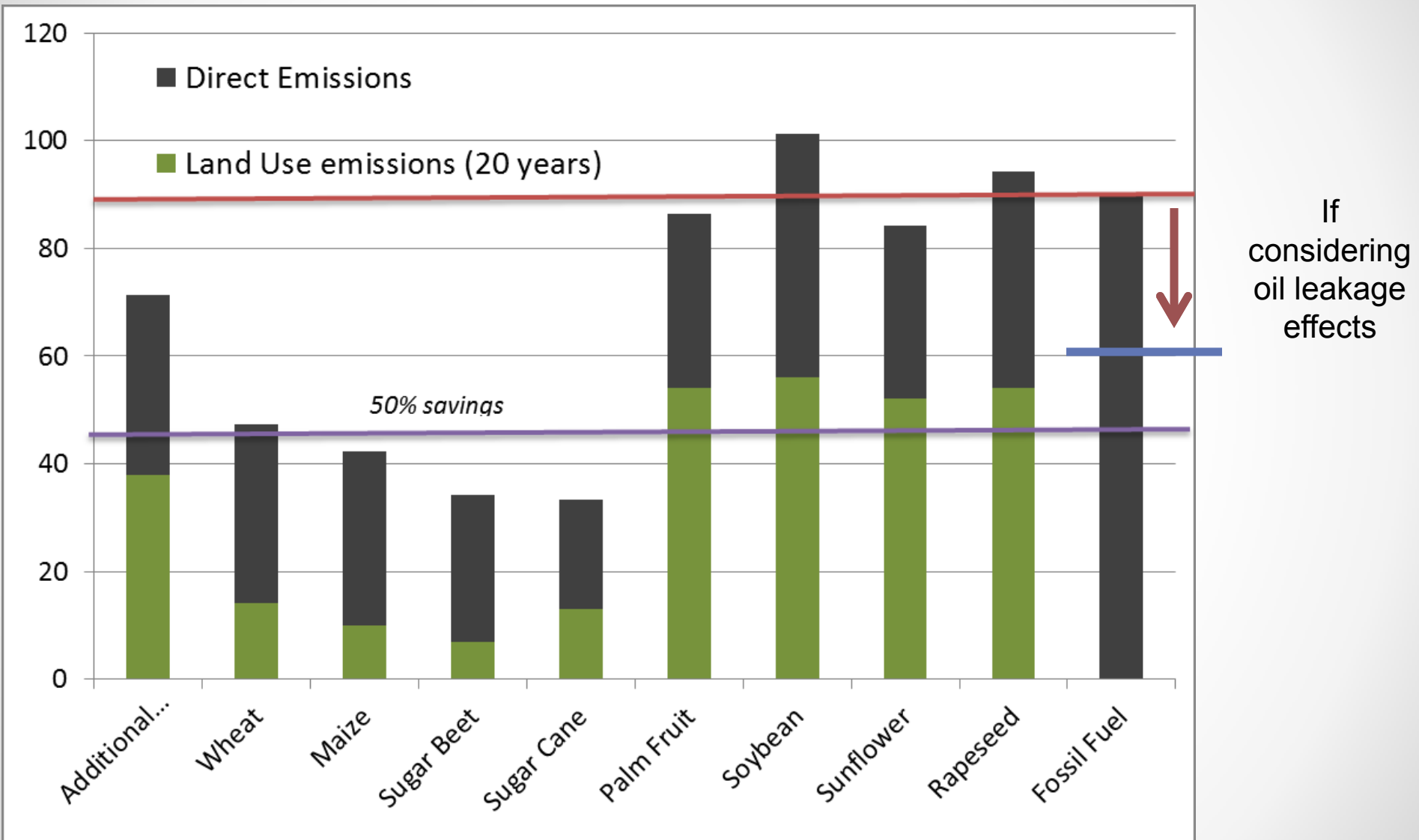
Total Land Use Emissions: 495 MtCo2 for 15.5 MToe

Understanding the results

Why Differences?

- Differences on the supply response
  o Location
  o Yield response

- Differences in the demand side
  o Role of Coproducts
  o Capacity to reduce existing demand
    ▪ From the livestock sectors
    ▪ From the other industries
    ▪ From the final consumers

- Differences in type of land converted
  o Initial land cover
  o Carbon stocks

Sensitivity Analysis

Graphs by Case
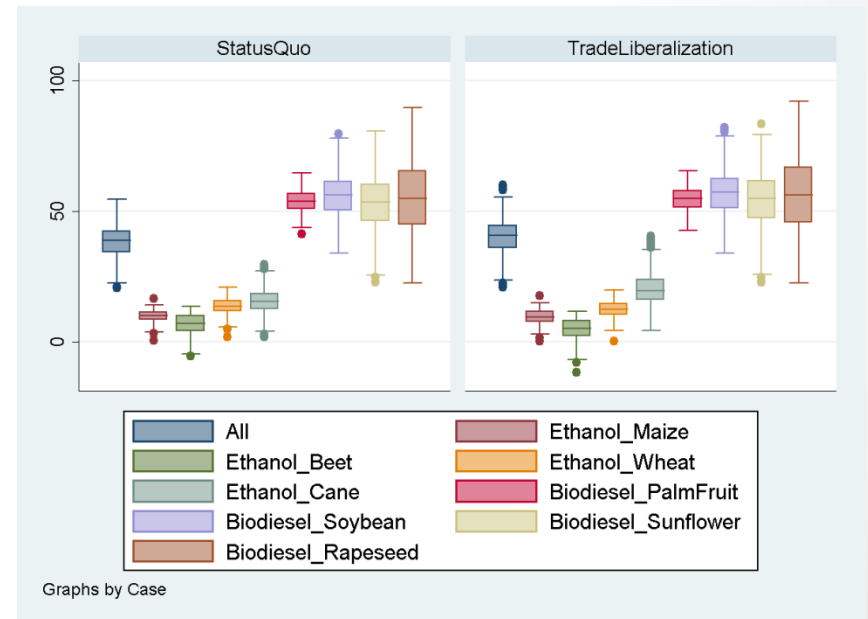
Policy Recommendations

1. Land use changes driven by biofuel policies are a **serious** concern. This finding is robust as more than 99 percent of crop LUC coefficients in the Monte Carlo analysis are positive.

2. LUC regulation and the Pandora Box: LUC for all, LUC for none? The real challenge is to <u>promote better land use practices for agriculture widely</u>. Biofuels remain a minor component in total land use changes.

3. Reducing the biofuel ambition is still the most direct way to limit additional land use emissions (evolution of political economy due to supply constraint in the EU)

4. Crop specific LUC *can* be difficult to implement. Increasing the minimal requirements of direct savings *can* be a better solution and will provide incentives for the sector to adopt the most efficient pathway.

5. Despite all uncertainties, our findings show the hierarchy between ethanol and biodiesel in terms of LUC. Additional breakdown can be considered. Therefore, promoting a larger share of ethanol than the current projection will be meaningful. Role of trade liberalization

6. Alternative trade policy options may be developed to promote good practices in terms of land conservation at a national level by trade partners (sustainability criteria, TRQ);

7. Using available technologies to increase yield e.g. biotech, and low carbon agricultural practices to reduce emissions;

8. Health check for biofuel policies and needs to have a flexible framework.