



INtegrating MainSTREAM Economic Indicators with Sustainable Development Objectives

The quantitative Assessment

Francesco Bosello

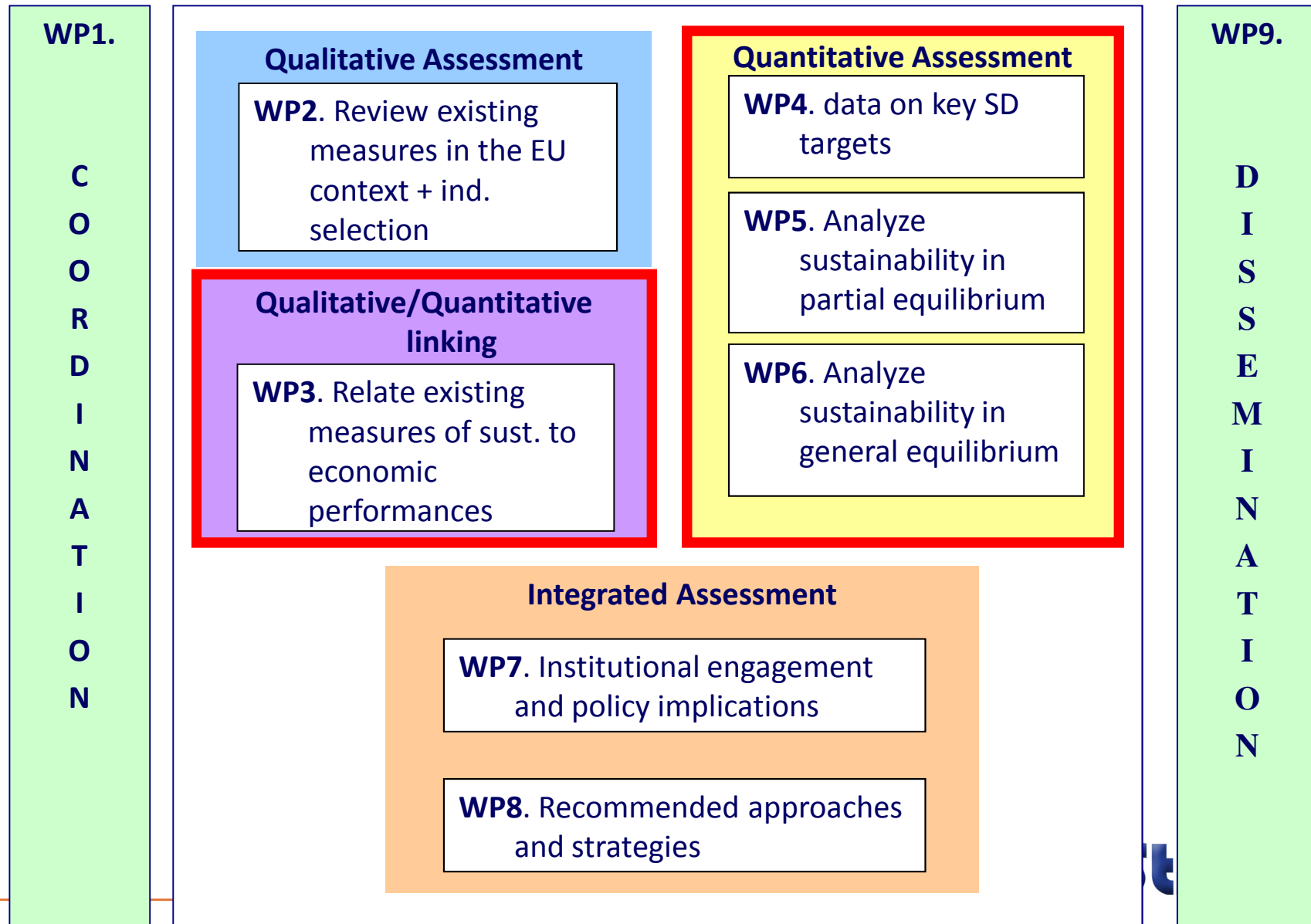
Fondazione Eni Enrico Mattei, University of Milan

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Key objectives of quantitative analyses

- ✓ Identifying and estimating the link between mainstream economic indicators and key well-being and sustainability indicators → statistical analyses and econometric techniques.
- ✓ Offering quantitative insight into the synergies and trade-offs implicit in Europe's pursuit of economic growth and environmental sustainability → bottom-up and top-down modelling approaches, EU wide and country analyses.
- ✓ Recommending new approaches to the use of SD indicator (and sets of indicators) based on their robustness, feasibility and suitability to EU policy objectives → role of composite indicators and new uses of existing tools → models.

Quantitative research @ IN-STREAM



Quantitative WPs indicator set

GDP

Household income

Employment/Unemployment

Labour Productivity

Value of built capital-Net investment

R&D expenditure/GDP

Government Debt

Comparative price level (and other indicators of convergence/competitiveness)

Energy Intensity of GDP

Direct external cost of pollution

DALY

PDF

GHG emissions

GHG intensity of GDP

Adjusted Net Savings

Volume of freight transport to GDP

“Cost to target”

Inequality indexes

Education (various)

At risk of poverty rate after social transfers

✓

5 taken from the EU SDS

✓

13 common to the EU SDS and the LS

✓

3 added by the IN-STREAM consortium

Statistical analysis

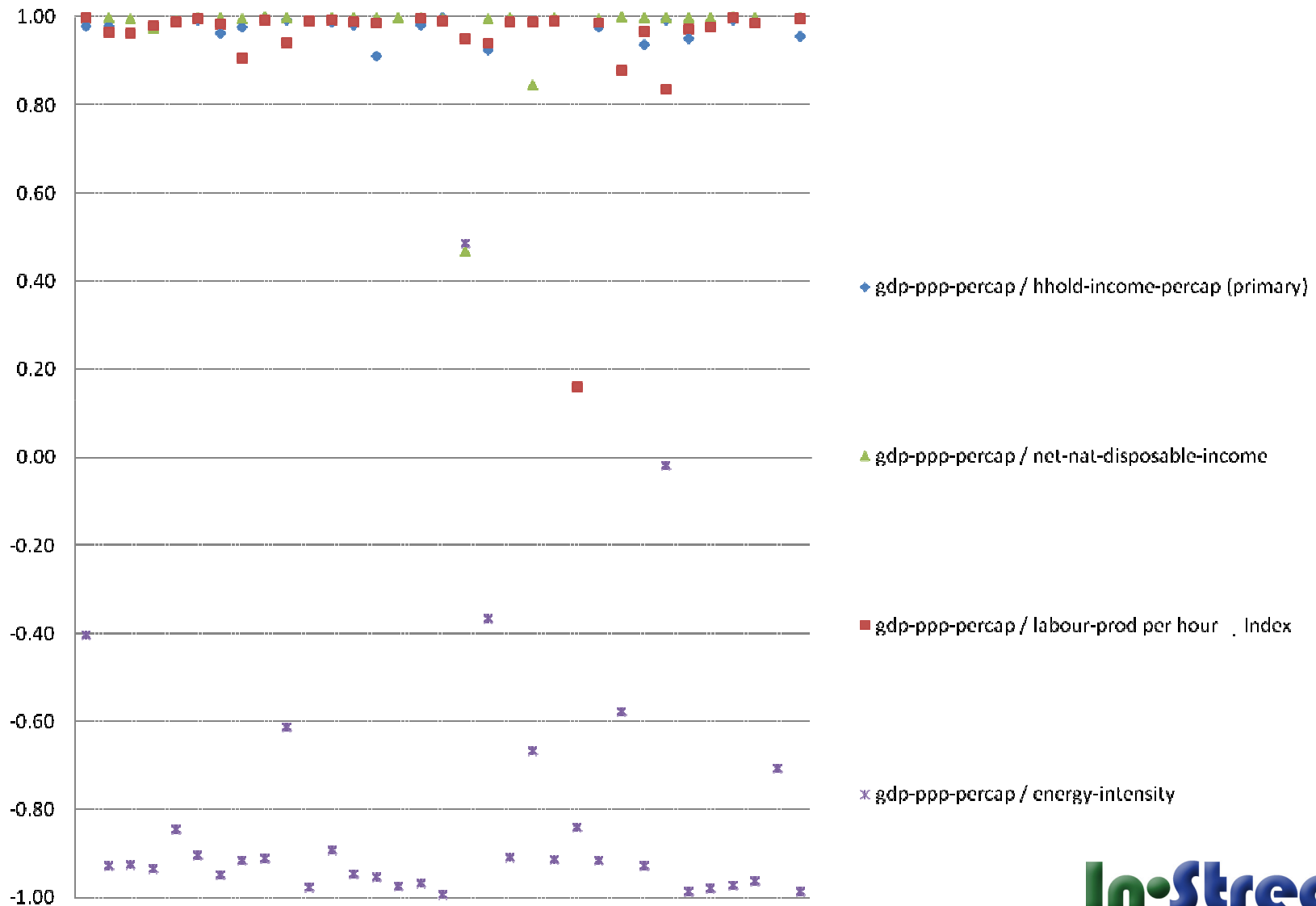
Tasks.

Estimate quantitative relationships:

- between In-Stream indicators and
- between In-Stream and Beyond-GDP indicators
- search for links between macro-economic benchmarks of economic performance and prosperity and performance in the social and environmental fields:
- Look for relationships beyond the state of the art

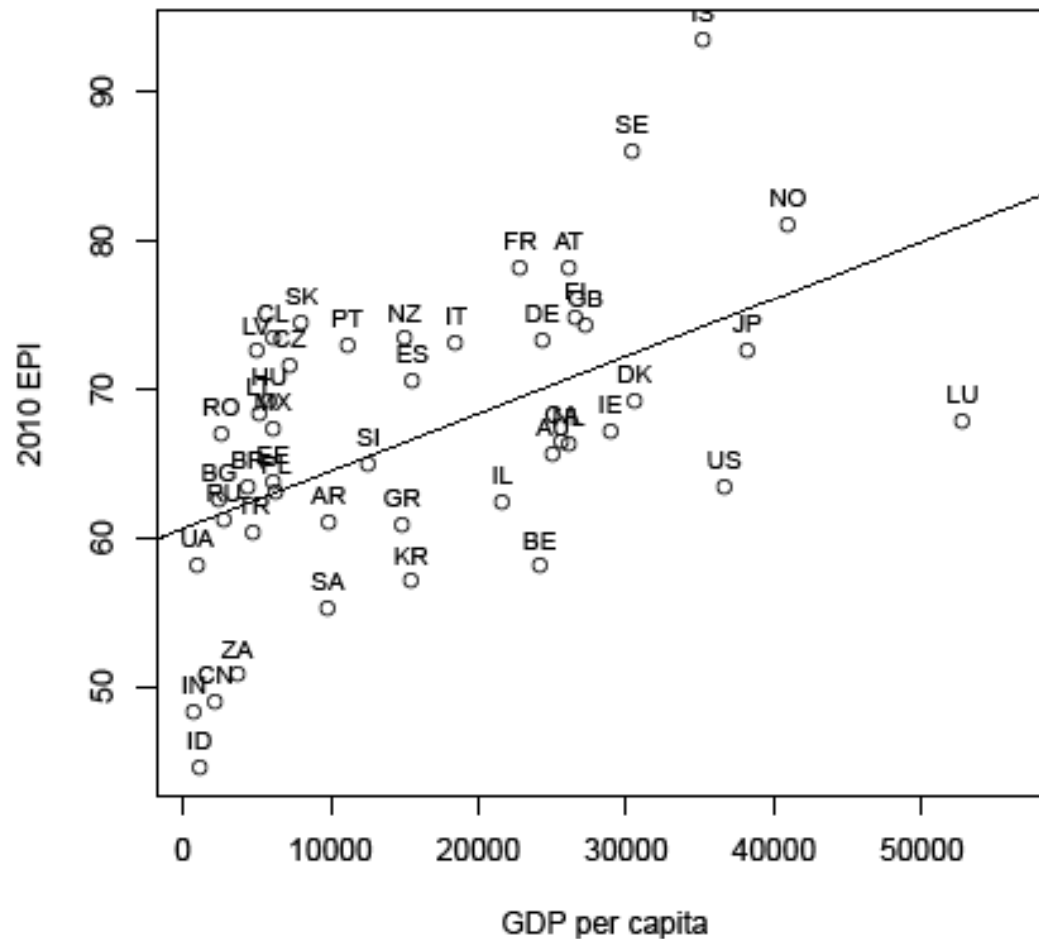
Methods: extensive correlation analysis, data mining, econometrics, principal component techniques

Statistical analysis ex. 1: correlation across indicators (selection)



Statistical analysis ex. 2: correlation GDP and EPI

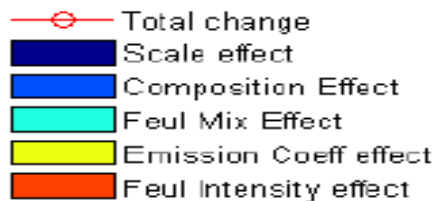
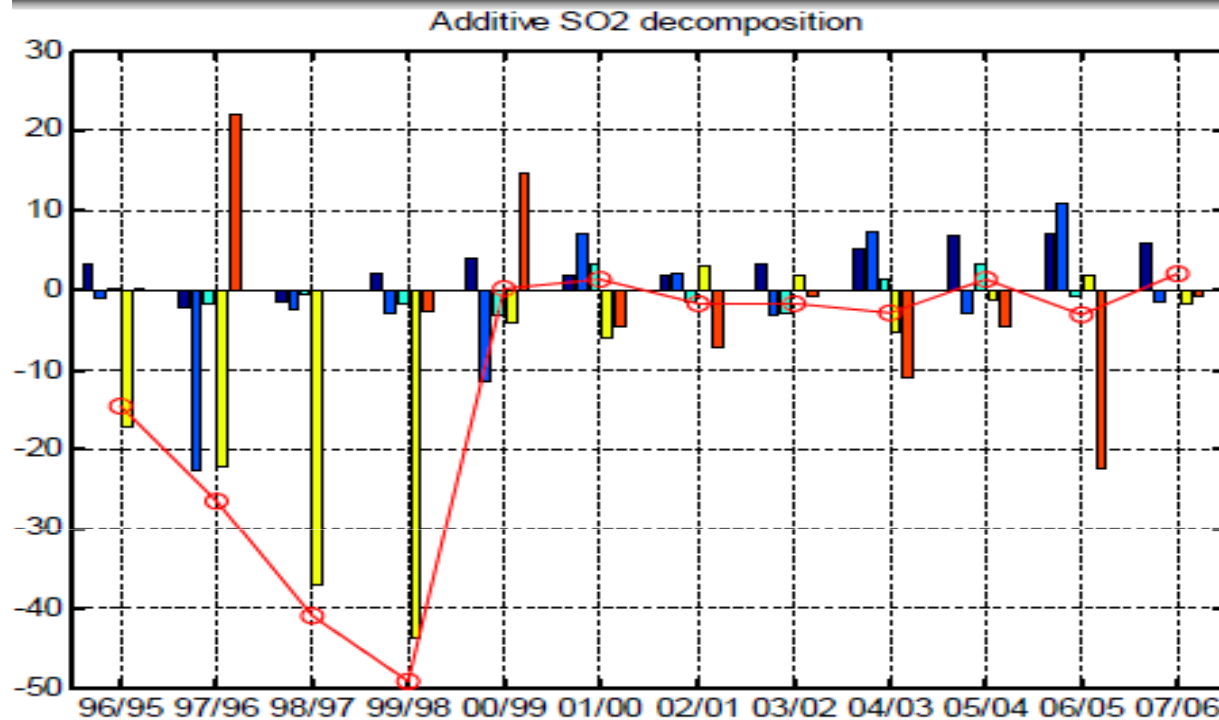
GDP per capita and 2010 Environmental Performance Index



Decomposition technique: explaining local air pollutants behaviour in the Czeck Republic

- Tasks:
- To assess the driving force of change in the emission amount of the basic air pollutants (SO_x, Particulate Matter, NO_x, CO, VOC) in the Czech Republic, in the period of 1995-2007
- Statistical decomposition analysis: the emission amount is decomposed into 5 determinants: (1) scale effect (2) composition effect (3) emission coefficient effect (4) fuel mix effect (5) fuel intensity effect

Local air pollutants in the Czeck Republic



1. During the transition period, 1995-1999, due to the EU requirement, firms invest on end-of-pipe technology to decrease their emission (SO_x, PM, NO_x) and fulfill the restriction
2. Fuel mix effect had less contribution firm did not change its behavior in terms of efficient mix of fuel consumption
3. As a natural consequence of command and control type regulation, the firms lost motivation after satisfying the limits We do not see the significant change in the emission level in 2000-2007
4. During the period analyzed, the composition effect did not play significant role in changing the emission level → structure of Czech economy does not seem to have changed to “cleaner” industry

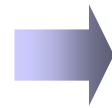
A modelling approach to sustainability: advantages



Sustainability (related to different social-economic scenarios) could be measured *ex-ante* and not only ex-post → Projections



A modelling framework provides a “**consistency grid**” → all the different dimensions of sustainability (and the performance of the indicators chosen to be part of “a” CI) are “connected” and mutually consistent.



A modelling framework offers a **controlled environment** where it can be easier to perform quantitative assessments and evaluations of the linkages between different indicators or sustainability dimension

A modelling approach to sustainability: drawbacks



The sustainability measure offered suffers from all the limitations connected to the model used (be it top-down, bottom-up etc.).



The sustainability concept and analysis is biased toward the economic/ environmental dimensions as it is usually (much) more difficult to “model” the social dimension



The sustainability analysis is primarily based on market values. It is sometimes possible to capture external costs and their impact on sustainability, however “existence values” are usually difficult to be embedded in a modelling exercise

Bottom-Up ex. (1): Human health and biodiversity indicators

- Tasks:
- Developing indicators for human health and biodiversity losses, considering external cost of pollution
- Analyze the performance of these indicators ex post (tested on the period 1990-2007) and in the future (“ex ante” contrasted against different future storylines)

→ The indicators are

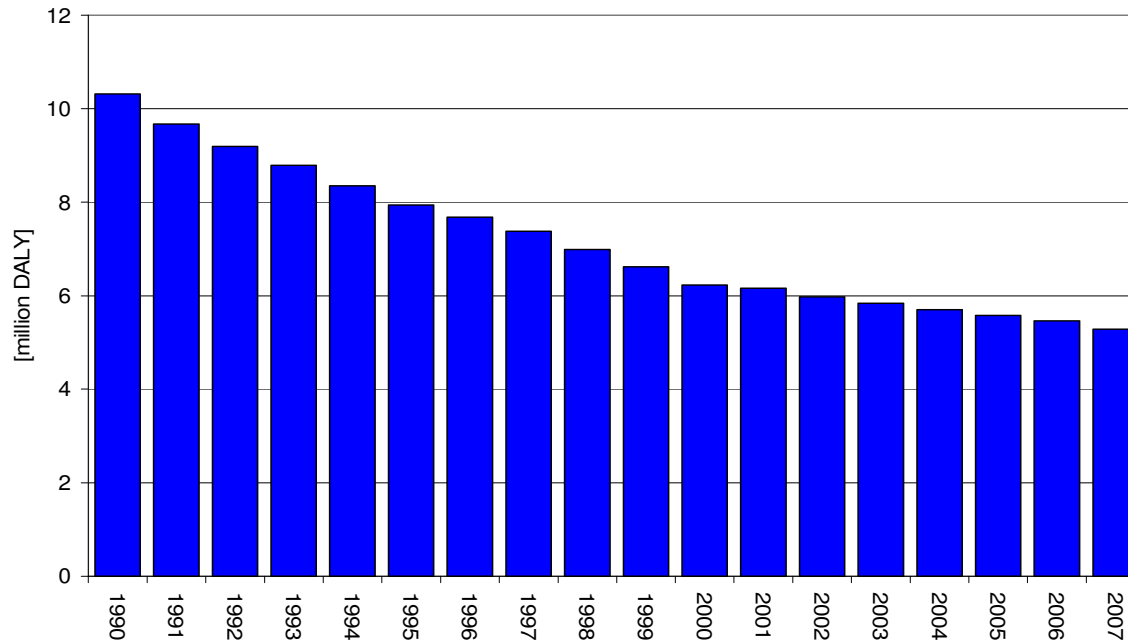
$DALY = \text{years of life lost (YOLL)} + \text{years lived with disability (YLD)}$

$PDF = 1 - S_{use}/S_{reference}$

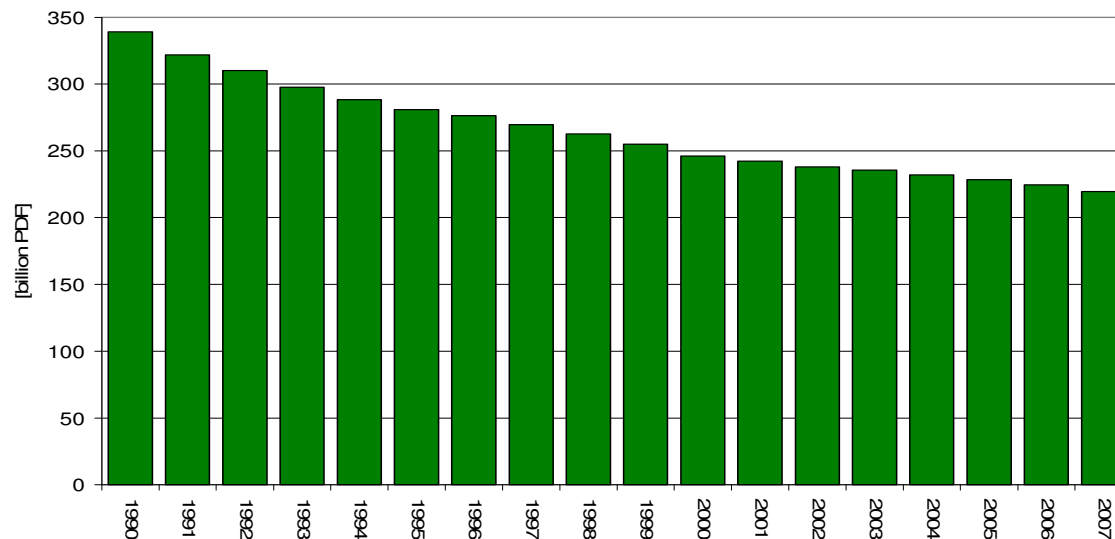
S_{use} = number of target plant species present in an occupied or converted land use type

$S_{reference}$ = average species number in the reference area type

Bottom-Up ex. (1): Human health and biodiversity indicators



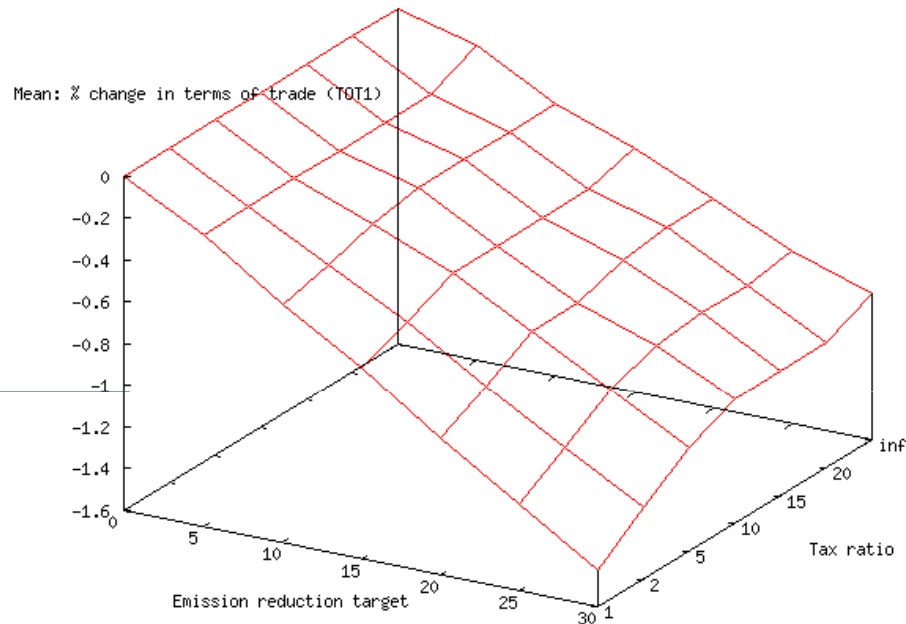
**Disability Adjusted
Life Years**



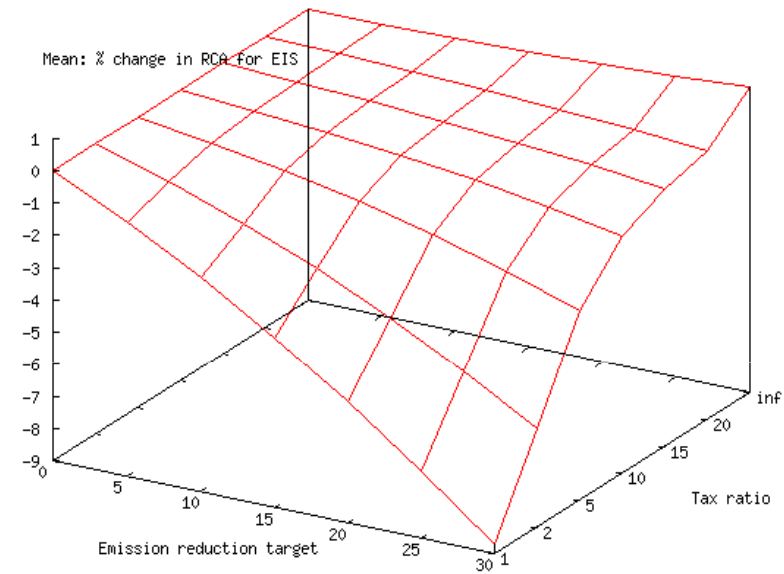
**Potentially
Disappeared
Fraction**

In-Stream

Top-Down (CGE) ex. (1): Environment(al policy) vs competitiveness



Mean of Terms-of-Trade (ToT) Changes with respect to Business-as-usual (BaU)



Mean of Revealed Comparative Advantage (RCA): Changes with respect to Business-as-usual (BaU) for Energy Intensive Industries (EIS)

Top-Down (CGE) ex. (1): Environment(al policy) vs competitiveness

- Terms of Trade are uniformly reduced as the emission reduction target becomes more stringent.

Variance low → Result robust

- RCA of EIS reduced with more stringent climate policies, but tax measures mitigate the effect

Variance relatively high → Result depends on Armington

- RCA of OTH increased with more stringent climate policies, but tax measures reduce the effect

Variance low → Result robust

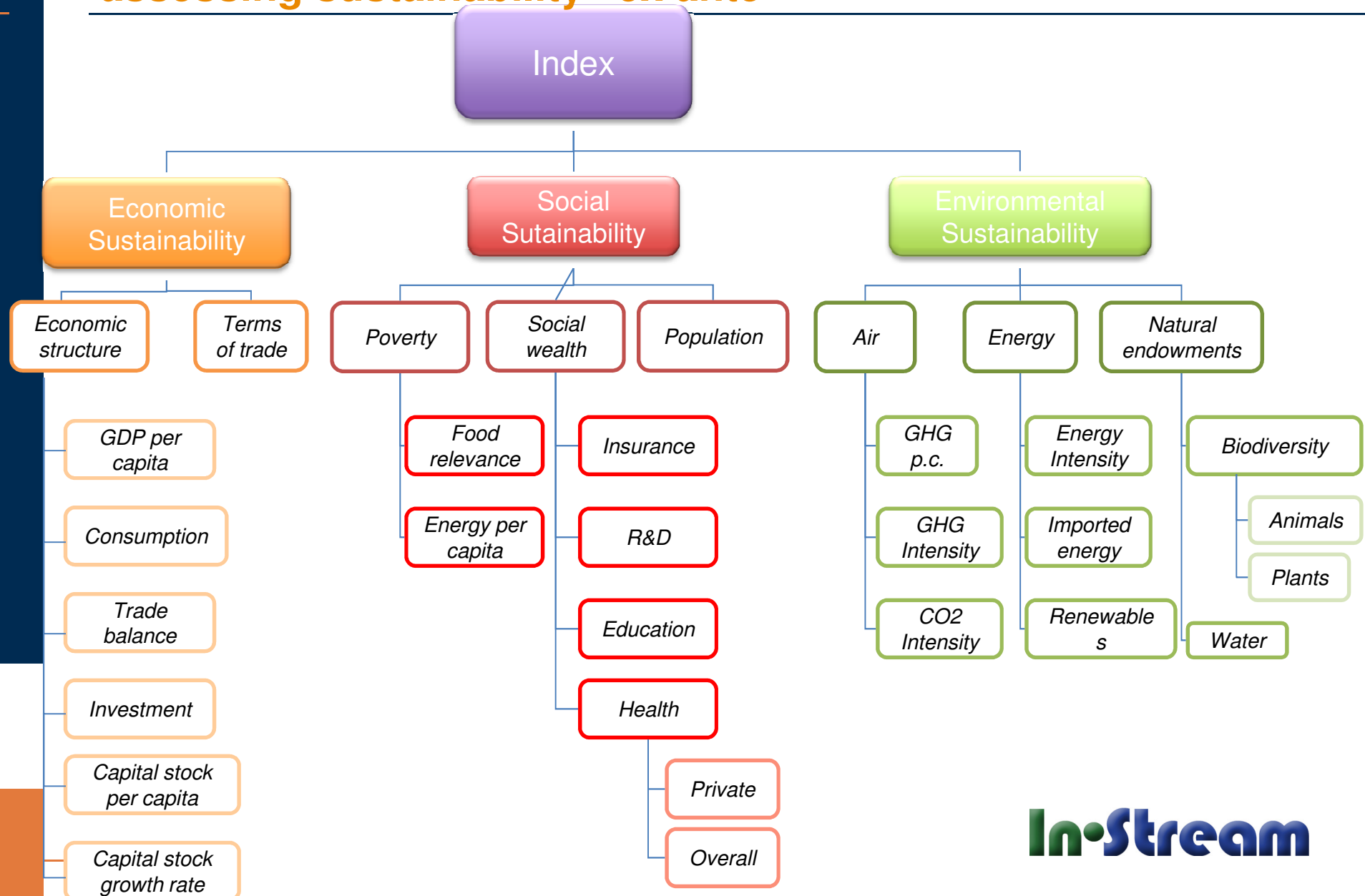
Top-Down (CGE) ex. (2): Building composite SI and assessing sustainability “ex ante”

Tasks:

- Assess how the CI performs in the BAU and in a policy for sustainability.
- Analysis of the linkages between the different sustainability pillars composing the CI
- Analysis of the CI additional informative capacity wrt GDP or single indicators

The policy: a mix between **mitigation** (curbing CO_2 emissions according to the Copenhagen target) **education and health care**: (national subsidy programs in countries that have not yet achieved the Millennium Development Goals) **improved water management** (10% increase in water efficiency) **technology development and transfer** (a subsidy to R&D and a technology transfer from industrialised to developing countries that leads to a 5% increase in productivity in energy related sectors)

Top-Down (CGE) ex. (2): Building composite SI and assessing sustainability “ex ante”



Currently under development

- With a bottom-up model: analysis of the relation between climate policies and dynamics in land use. E.g. trade off biofuel production, food prices and food production
- With a top-down model (downscaled CGE model): analysis of sustainability at the sub-national level (case study at the Lander level)
- Extensive sensitivity analysis of all the results

Thank You!