



Modelling scenarios for the transition to a resource efficient economy

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for a circular economy**

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Key results

- ▶ The business-as-usual will strongly endanger the services of nature and induce lower growth and employment.
- ▶ A global cooperation on policy measurements to keep global warming below 2°C and to boost resource efficiency would not only allow
 - ⇒ staying within planetary boundaries,
 - ⇒ but would also be beneficiary for green growth and jobs globally and in the EU.
- ▶ If a global consensus on binding policies cannot be achieved in the near future the EU should go ahead. It will reach the environmental targets, and a first mover advantage will create an economic success stronger than in the case of global cooperation. This may cause others to follow.
- ▶ Changing values and behaviours of civil society have a big potential to a reduction in resource use.

The models

- ▶ Two economic models GINFORS (GWS) and EXIOMOD (TNO) belong to the family of Environmentally Extended Global Multi Regional Input-Output (EE-GMRIO) models.
 - ⇒ models assess the interconnections between the environment and economy (energy use & emissions, resources)
 - ⇒ with the ability to analyze impacts on economic sub-sectors and specific resource products.
- ▶ Three key differences between GINFORS and EXIOMOD
 - ⇒ main source of historical data:
 - GINFORS is based on the WIOD database, a global multiregional time-series of Input-Output tables with accompanying socio-economic and environmental data.
 - EXIOMOD is based on EXIOBASE, which provides more sectoral detail but reports only for one historical year.
 - ⇒ theoretical foundation:
 - GINFORS: Neo- Keynesian
 - EXIOMOD: Neoclassical

- ⇒ Parameterization:
 - GINFORS: Econometric estimation
 - EXIOMOD: by assumption.

- ▶ Both models linked with the bio-physical model LPJmL (PIK),
 - ⇒ investigates the interdependencies between land use changes, greenhouse gas emissions, water availability and crop growth.
 - ⇒ works on a detailed grid cell base and covers the whole globe.

POLFREE Scenarios at a Glance

- ▶ ‘Global Cooperation’ – All countries co-operate through international agreements introducing harmonized economic and regulatory policy instruments with a year by year rising intensity to pursue decarbonisation and a resource-efficient global economy.
- ▶ ‘EU Goes Ahead’
 - ⇒ EU: ambitious climate and resource policy, mainly economic and regulatory instruments
 - ⇒ Non- EU countries : only a moderate climate policy.
- ▶ ‘Civil Society Leads’ – Main difference to “EU Goes Ahead”: In the EU **civil society** drives resource-efficiency through voluntary changes in preferences and behaviour. Policies are introduced to facilitate such changes.
- ▶ A ‘Business-as-Usual’ scenario:
 - ⇒ EU: maintains the actual climate policy, no resource policy
 - ⇒ Non-EU: No environmental policy at all.

Targets

- ▶ **Global Cooperation:** The policy mix was designed to meet the following overarching targets in the EU and globally in 2050:
 - ⇒ A reduction of CO2 emissions by 80% compared with 1990,
 - ⇒ A reduction of the cropland footprint by 30 % compared with 2005,
 - ⇒ A reduction of raw material consumption (RMC) to 5 tons per capita,
 - ⇒ A water exploitation index below 20% in all countries.

- ▶ **EU Goes Alone and Civil Society Leads:**
 - ⇒ EU: The same targets as in Global Cooperation
 - ⇒ Non EU: Only moderate climate policy: Policy mix was designed so that globally the 4 degree emission path was met.

Conclusion 1: Different modelling approaches may produce very different projections

Results:

- ▶ GINFORS/LPJmL coupling: targets described above could largely be achieved in the different scenarios with the policy mixes.
- ▶ EXIOMOD/LPJmL coupling: this was not the case.

Reasons:

- ▶ Different parametrizations:
 - ⇒ GINFORS all price and income elasticities estimated econometrically,
 - ⇒ EXIOMOD all price and income elasticities assumed.

- ▶ **Critical assumptions of EXIOMOD:**
 - ⇒ Price elasticity of intermediate demand zero: taxes on resource intensive intermediate demand have no direct effect on resource use.
 - ⇒ Price elasticity of consumption -1 and of imports -5 are relatively high in absolute terms: Public innovation fund improves resource efficiency of firms: Supply curves shift to the right, new equilibrium with lower prices and higher production: Rebound effects!
 - ⇒ Consequences: Additional ad hoc assumptions concerning resource productivity to meet the targets.
- ▶ We rely on empirically estimated parameters: The remainder of this presentation is focused on the results of the GINFORS/LPJmL model coupling.

Policy Mixes in the target scenarios (main instruments)

	Global Cooperation	EU Goes Ahead	Civil Society Leads
Climate policy	upstream carbon tax, regulation of the share of renewables, regulations and economic instruments favouring e-mobility & investment in energy efficiency of buildings	<p>Difference to Global Cooperation:</p> <p>In EU:</p> <p>Economic instruments are designed, so that they do not endanger international competitiveness</p> <ul style="list-style-type: none"> e.g. taxes on final demand instead of upstream taxes or direct compensation of taxes <p>In Non-EU:</p> <ul style="list-style-type: none"> Moderate climate policy that allows to stay at 4 degree warming pathway No resource policy action 	<p>Difference to EU Goes Ahead:</p> <p>In EU:</p> <ul style="list-style-type: none"> Resource policy instruments : Instead of top down bottom up, changes driven by intrinsic motivation of consumers more leisure time, less total consumption <p>In Non-EU:</p> <p>The same as in EU Goes Ahead</p>
Decoupling of economic development and the use of minerals	regulation for recycling, upstream tax, public innovation fund for the material efficiency		
Sustainable agricultural land and water use	regulation for water abstraction of agriculture, information programs to avoid food waste & to reduce yield gaps, tax on meat consumption		
ETR	tax revenues are used for a reduction of taxes on goods and services with low carbon and resource contents		

Key Model Results

Conclusion 2: Business-as-usual:

- global warming 5-6 degrees, high resource extraction
- high resource and food prices, low growth and employment.

Conclusion 3: Global Cooperation: Changes against business as usual:

- environmental targets globally achieved,
- reduction of resource demand: lower resource and food prices
- Rising investment and lower costs: Rising GDP and employment

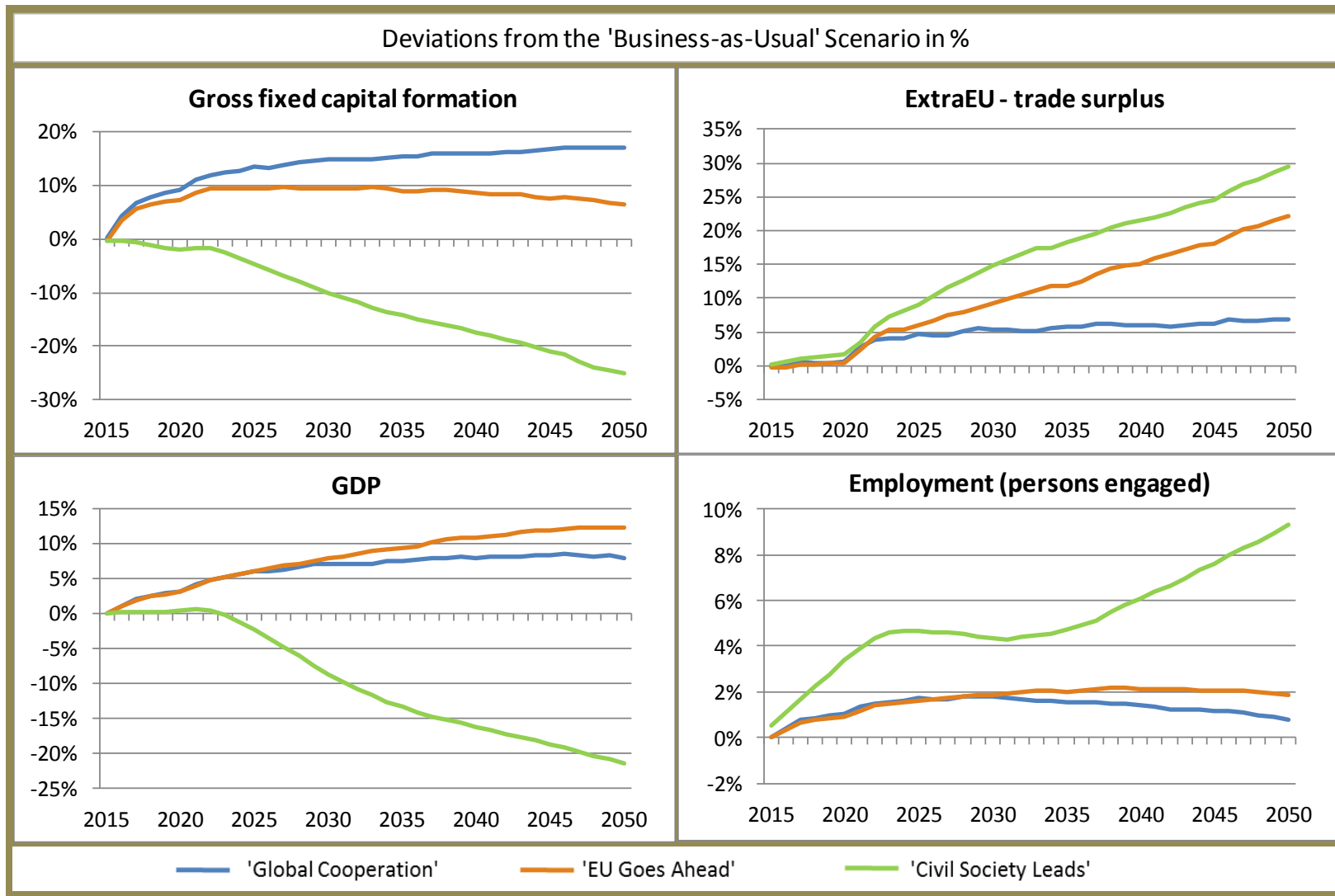
Conclusion 4: EU Goes Ahead: changes against Global Cooperation

- environmental targets will be met only in the EU,
- No substantial reduction in global resource demand and prices,
- Rising investment and lower costs only in the EU: First mover advantage, rising GDP and employment in the EU

Conclusion 5: Civil Society Leads: Changes against EU Goes Ahead:

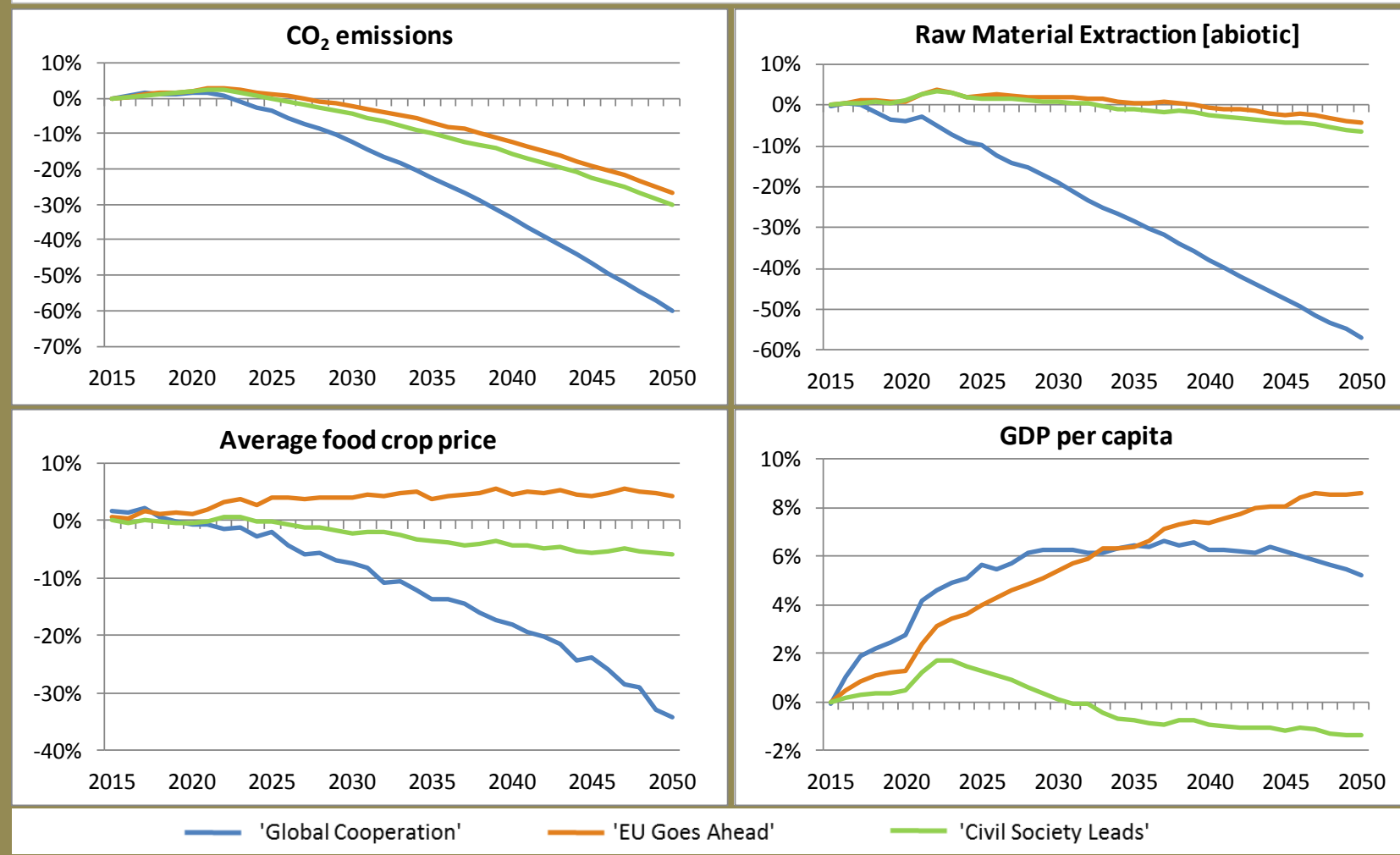
- lower consumption, GDP and investment,
- higher employment

EU: Impacts on economic indicators



Impacts: the global dimension

Deviations from the 'Business-as-Usual' Scenario in %



Thank you for your attention.
