

Energy subsidies removal Macroeconomic adjustment and the role of revenues recycling

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Objective and Outline

- Use the Global CGE model GEM-E3 to examine the impact from removing energy subsidies on the economy and identify the key mechanisms that drive the adjustment of the economic system.
- The model is also used to explore the importance of the choice of alternative revenue recycling schemes in the overall system adjustment

Outline

- ✓ Brief presentation of ADVANCE project goals
- ✓ Energy subsidies countries' profiles and impact of removal
- ✓ Scenarios' set-up and selection of recycling options
- ✓ Description of the GEM-E3 model
- ✓ Results & Concluding remarks

ADVANCE project

- **ADVANCE:** “Advanced Model Development and Validation for Improved Analysis of Costs and Impact of Mitigation Policies”
- **EU-FP7** project funded for four years (start 01/2013)
- **Modelling teams and Models** involved: **PIK** (REMIND, MAgPIE), **IIASA** (MESSAGE), **PBL** (IMAGE/TIMER), **FEEM** (WITCH), **IPTS** (POLES), **UCL** (TIAM-UCL), **UPMF**, **Enerdata** (POLES), **ICCS/NTUA** (PRIMES, GEM-E3), **CIREN** (IMACLIM), **JGCRI** (GCAM), **NCAR** (iPETS), **NIES** (AIM), **RITE** (DNE21+)
- Develop next generation models, Improve diagnostics, model documentation and model validation (End Use technologies, Heterogeneity in consumer preferences, Behavioural modelling, Technical Change and Uncertainty, System Integration of Variable renewable electricity, Material and Energy Requirements, Non – Energy Infrastructure, Land-Water-Energy nexus.
 - Improve the representation of energy taxes and subsidies in IAMs

Energy Subsidies Scenarios in ADVANCE

- Inter model comparison (Jessica Jewel (IIASA)) focusing on:
 - ✓ What are impacts on emissions and clean energy of subsidy removal?
 - ✓ How would subsidy removal change the cost of climate stabilization?
- Key features
 - ✓ multi-model
 - ✓ focus on the low oil world (today's world) but explore key uncertainty of high oil world
 - ✓ quantify impact of subsidy removal on carbon price in a climate constrained world (focus on low oil world - today's world)

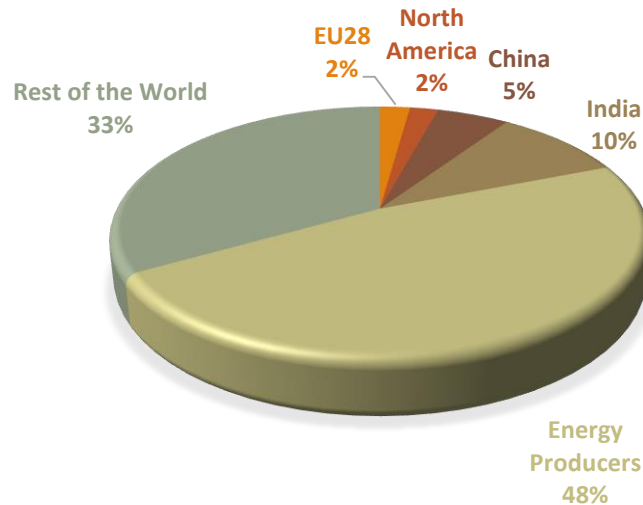
GEM-E3 identity

- GEM-E3 is a computable general equilibrium model with 38 sectors and 42 countries/regions (representing all EU member states and G-20 countries)
- The model performs recursively dynamic simulations until 2050 in five year time step
- All countries are linked through bilateral trade flows
- Agents adopt an optimising behaviour (firm maximise profits, household maximise utility)
- Unemployment in labour market is modelled via an estimated labour supply curve
- Capital is fully mobile across sectors
- The model is calibrated to GTAP 9 (base year 2011)
- Special focus on interactions between the economy, the energy system, the environment and the technological progress.

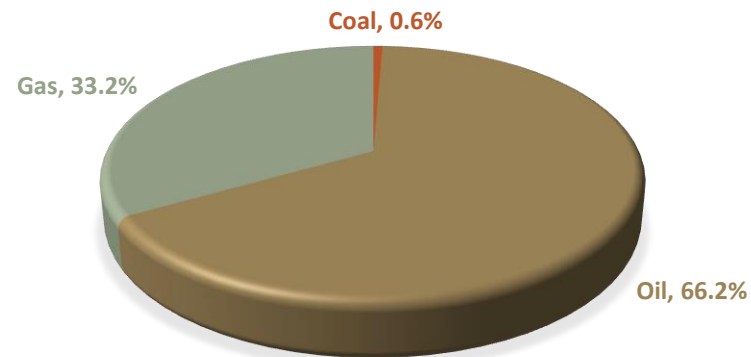
Scenarios examined

- Complete removal of energy subsidies after 2020 under: i) low oil prices ii) high oil prices.
- The removal of energy subsidies increases/decreases the surplus/deficit of the public budget (for certain energy producing countries where the opportunity cost approach has been used in estimating their total subsidies no supporting tax is assumed)
- Three alternative scenarios where funds are recycled back into the economy have been simulated. Recycling options include use of funds previously allocated to energy subsidies towards:
 - ✓ Reduction of general taxation
 - ✓ Lump sum transfers to households (default option)
 - ✓ Reduction of employers' social security contributions

Current Status of Energy subsidies at the World Level



SHARE IN WORLD SUBSIDIES, 2015



SHARE IN TOTAL SUBSIDIES

- ✓ Fossil fuel subsidies represent 0.6% of World GDP (~510 bn \$ 2015)
- ✓ Mainly used in Energy Producing and developing countries
- ✓ Largest Share in Oil (mainly for transport services)

Energy subsidies countries' profiles

- ✓ Removal of energy subsidies impacts on energy costs (energy intensive countries & industries) and is expected to impact on the competitiveness of goods in international markets
- ✓ Higher energy prices expected to impact on the non-energy exports of countries characterised by energy intensive industrial structure (i.e. Asian Economies)
- ✓ Higher energy prices affect consumption (income and substitution effect)
- ✓ Countries with no/low energy subsidies will be indirectly affected from the removal of energy subsidies in other countries, through higher cost of imports and changes in competitiveness of their goods in the global markets
- ✓ Overall effects differ depending on the choice of revenues recycling from subsidy removal

2015 (% of GDP)

Country/Region	Energy Subsidies	Total Economy Trade Openness [(Exports + Imports)/GDP]	Exports of energy intensive products	Exports of energy products
REP (<i>Arab Emirates, Azerbaijan, Iran, Kuwait, Nigeria, Qatar, Venezuela</i>)	8.8%	65%	1%	24.8%
Saudi Arabia	8.2%	91%	3%	44.7%
Indonesia	6.1%	49%	6%	5.4%
Russian federation	4.9%	46%	5%	13.0%
Argentina	3.2%	30%	3%	0.5%
Rest of the World	2.0%	75%	7%	4.8%
China	0.4%	51%	4%	0.1%
Mexico	0.3%	55%	4%	2.6%
Canada	0.3%	53%	7%	4.3%
EU28	0.3%	36%	3%	0.2%
Australia and New Zealand	0.1%	39%	7%	3.4%
Turkey	0.1%	51%	3%	0.0%

Subsidies phase out scenario: GDP

Subsidies phase out scenario, 2015-2050 cumulative change from Baseline, in %

	Gross Domestic		Private		
	Product	Investment	Consumption	Exports	Imports
EU28	0.1%	0.03%	0.3%	-0.8%	-0.4%
USA	0.05%	0.03%	0.3%	-0.9%	0.2%
China	-0.05%	0.03%	0.5%	-1.2%	0.3%
Saudi Arabia	-0.1%	-0.9%	3.1%	-2.3%	-1.3%
World	0.03%	-0.1%	0.1%		

Removal of subsidies has a small positive effect on world activity (distortion removed)

Removal of energy subsidies affects energy producers' exports (especially those with high subsidies in energy) and imports (income effects)

The recycling of subsidies back to households sustains consumption

Effects are lower for countries with no/low subsidies and are associated with:

- higher import costs of goods manufactured abroad, particularly energy and energy intensive goods manufactured in countries that remove subsidies
- Lower demand for exports to other countries/regions

Subsidies phase out scenario: Sectoral effects

Sectoral effects

- Removal of subsidies impacts negatively on production activity of energy intensive sectors in countries that had energy subsidies in place
- Removal of energy subsidies impacts negatively on the competitiveness of the respective sectors in the world markets
- In contrast removal of energy subsidies gives boost to the competitiveness of energy intensive sectors located in countries with no subsidies (like the USA)

Subsidies phase out scenario, Domestic production, 2020-2050 cumulative change from Baseline, in %

	<u>EU28</u>	<u>USA</u>	<u>China</u>	<u>Energy Producers</u>	<u>Rest of the World</u>	<u>World</u>
Agriculture	-0.7%	-1.6%	0.1%	6.2%	0.6%	0.7%
Energy	-1.0%	-0.8%	-3.0%	-13.0%	-6.5%	-5.5%
Energy intensive industries	2.4%	1.1%	-0.4%	-13.1%	-0.9%	-0.1%
Rest of industries/manufacturing	-0.2%	-0.1%	-0.4%	2.5%	0.3%	-0.1%
Services	0.0%	0.1%	0.1%	1.5%	0.3%	0.2%

Recycling options, Impact on GDP

Household income

- Support of household income increases consumption that addresses both domestic and imported goods
- Countries with no/low subsidies bear the dual effect of higher demand for their goods and rising cost of imports from countries with high subsidies (effect of removal of subsidies and higher domestic demand to satisfy)

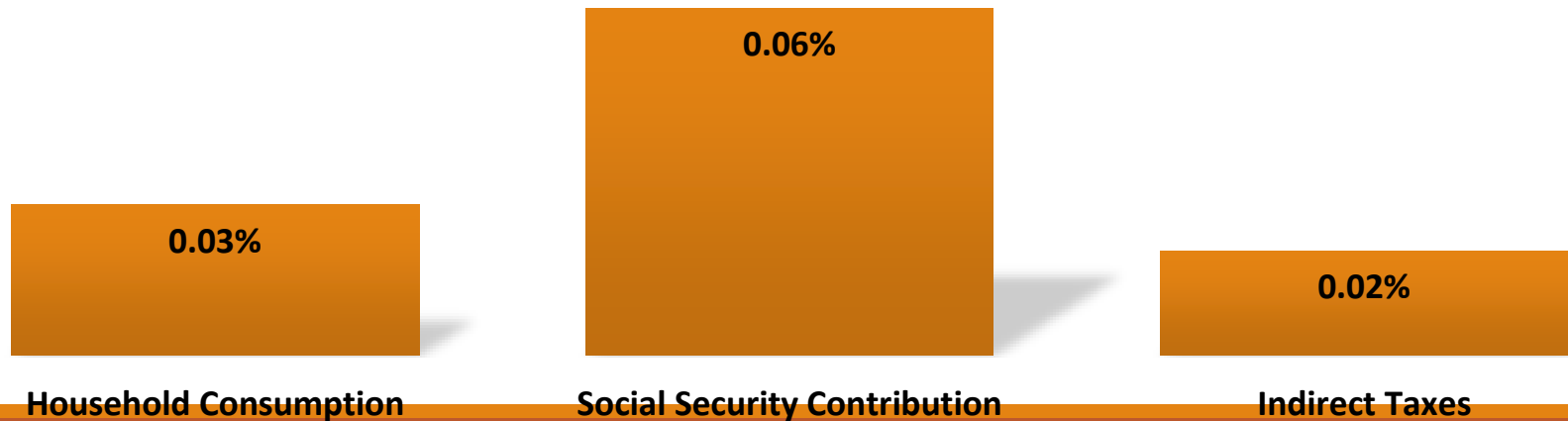
Labour Cost

- Social security contributions payments impacts on the competitiveness via lower unit and labour costs. Effects are higher for economies with high subsidies and those exporting labor intensive goods
- Countries benefit from cheaper imports of labour intensive goods when recycling takes place via social security contributions

General Taxation

- Most beneficial for energy exporters. Quite distortionary effect in the baseline is removed.

GDP (%change from reference)

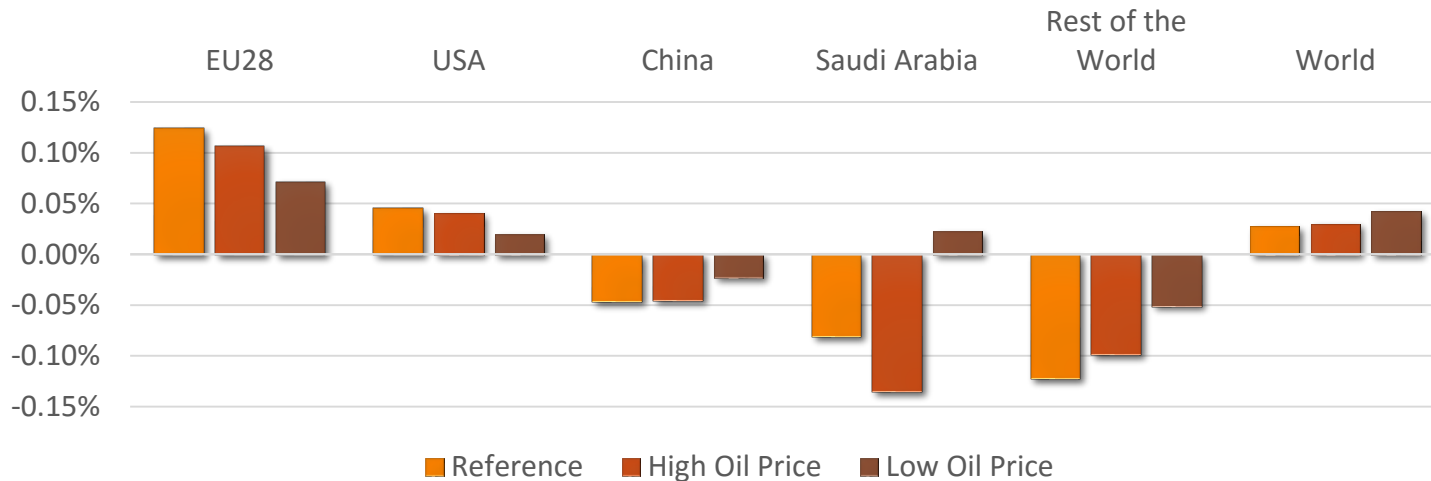


Recycling options, Sectoral Effects

- Social security payments lower the export prices and favour trade in labour intensive sectors.
- Payments to households increase demand for exports of countries with no/low subsidies to countries with subsidies
- Higher demand for imports in the case of payments to households from countries with high subsidies leaves countries with no/low subsidies faced with higher import prices

2020-2050 cumulative change from phase out scenario, in %	General taxation			Payment to HH			Social Security Payments		
	GDP	Investment	H. Consumption	GDP	Investment	H. Consumption	GDP	Investment	H. Consumption
EU28	0.15%	0.08%	0.94%	0.12%	0.03%	0.33%	0.15%	0.08%	0.91%
USA	0.04%	0.08%	0.98%	0.05%	0.03%	0.26%	0.04%	0.08%	0.95%
China	-0.12%	0.09%	1.25%	0.05%	0.03%	0.46%	0.12%	0.09%	1.20%
Energy Producers	0.29%	-0.86%	5.89%	0.08%	-0.85%	3.12%	0.06%	-0.89%	5.31%
Rest of the World	-0.07%	-0.02%	0.14%	0.12%	-0.09%	0.26%	0.12%	-0.03%	0.06%
World	0.06%	-0.02%	0.12%	0.03%	-0.07%	0.08%	0.02%	-0.03%	0.05%

GDP adjustment under different fossil prices



High Oil price trajectory

- Equal to Reference subsidy rates as \$/GJ have been used.
- The lower subsidy ratio to Oil price leads to smoother effect in GDP.
- Oil exporting countries face an additional cost as the substitution gains to other fossil fuels is higher.

Low Oil price trajectory

- In Saudi Arabia the gains from removing the distortion in fossil fuel prices is higher than the loss in competitiveness.

Concluding remarks

- ✓ Removal of energy subsidies at world level in the absence of other correcting policies increases world GDP.
- ✓ Impact significant for countries with high subsidies and countries with energy intensive industries
- ✓ Impact is most beneficial if recycling takes place via social security contributions
- ✓ Decrease in taxation and labour costs counterbalance the impact of higher energy prices
- ✓ Lowering of labour costs impacts mainly exports of labour intensive sectors and countries
- ✓ Payments to households increase consumption that addresses domestic and imported goods.
- ✓ Net effects depend on trade interconnections, trade openness and the production structure of each region