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COMBI
Calculating and Operationalising the Multiple Benefits of Energy Efficiency in Europe

Estimating macroeconomic impacts
Experiences from a EU-H2020 project

Wuppertal Institut

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7 March 2018

IEA Multiple Benefits Workshop, 5-7 March 2018

French Foreign Affairs Ministerial Conference Center

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649724.
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Project background & objectives

Quantification of multiple impacts of EE

Coordinated by Wuppertal Institut

- Quantification & monetization of multiple impacts
- By EU member state & 21 EEI actions
- Common framework scenarios: based on 21 energy efficiency improvement (EEI) actions
- Extended Cost-Benefit analysis

Air pollution	Resources	Social welfare	Macro economy	Energy system
air pollutants	material footprint	disposable income	employment/ GDP	energy system costs
health	abiotic/biotic	health	public budget	energy security
eco-system	energy/non-energy	productivity	Fossil fuel/ETS prices	
	unused extraction		Terms of Trade	
MANCHESTER 1824 The University of Manchester	Wuppertal Institut	MANCHESTER 1824 The University of Manchester; ABUD Advanced Building & Urban Design	Copenhagen Economics	Universiteit Antwerpen

Funded by EU Horizon 2020 EE12 (GA 649724, approx 1M€)

- March 2015 – May 2018

Multiple impact modelling

Overview

Input data

- energy savings

additional data: stocks, scenario levels etc.

- investment costs

Impacts modelling

Impact category	Modelling approach	Impacts covered (additional savings)
Air pollution	GAINS model (IIASA)	Air pollutants (NOx, PM10, PM2.5, SO2, VOC) Affected ecosystem area (acidification, eutrophication) Human health (through air pollution)
Resources	Life-Cycle modelling (Material Input per service unit/MIPS)	Ecological footprint (Biotic materials, fossil fuels, metal ores, minerals, unused extraction)
Social welfare	Socio-economic modelling	Health from indoor pollution Health from building conditions (asthma, excess winter deaths) Labour productivity (residential/tertiary buildings, transport)
Economy	Short-term: Input-Output modelling	Employment GDP Public budget
Economy	Long-term: CGE modelling	Fossil fuel prices EUA prices Structural effects
Energy system	LEAP modelling	Avoided combustion/investment in combustion plants De-rated capacity margin
Energy security	LEAP modelling	Energy intensity Fossil fuel imports Energy security index

COMBI online tool

Our objective

Assess macroeconomic effects of a more ambitious EE policy

Our starting point:
a **more ambitious EE policy** which
- Is running until 2030+
- Assumes more than 1600 TWh of energy savings annually
- Assumes a total investment of1330 billion EUR

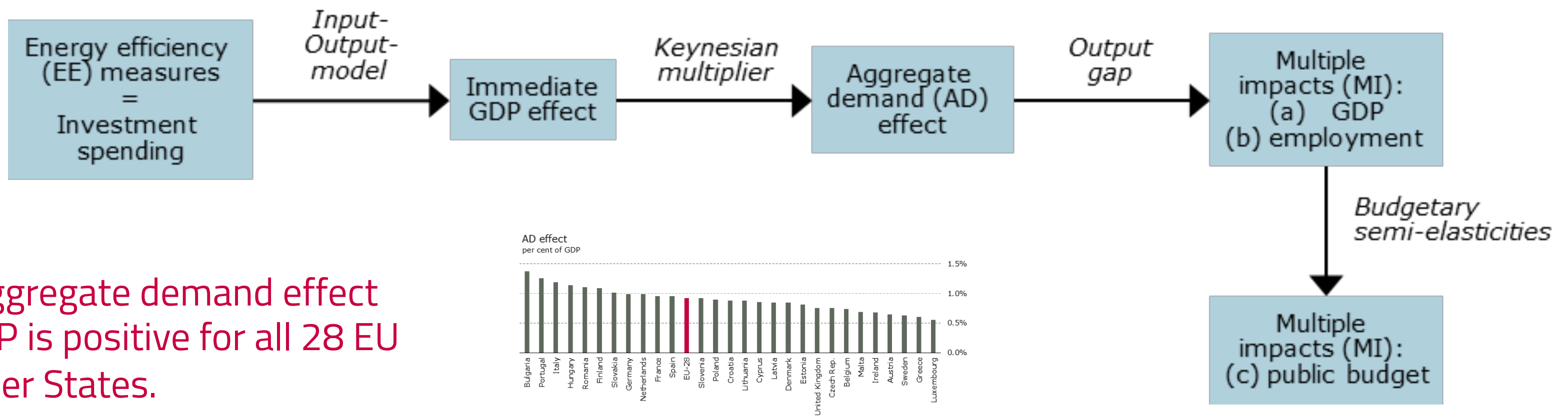
↓

Macroeconomic effects in 2030

	A) Business cycle effects		B) Structural effects
	‘short run’		‘long run’
Impacts	• GPD • Employment • Public budget		• Fuel prices and marginal abatement costs • Structural change (economy, competitiveness) • Total value created
Main method	• Input-Output-model (GTAP 9 database)		• General equilibrium model (CE model)

A) Business cycle effects in 2018

The policy is estimated to increase the EU GDP by 35 billion EUR in **2018** in countries with positive output gap



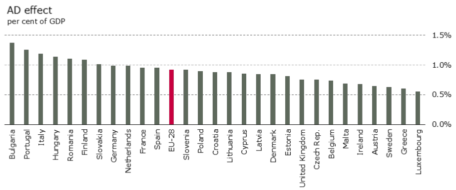
The aggregate demand effect on GDP is positive for all 28 EU Member States.

A) Business cycle effects in 2018

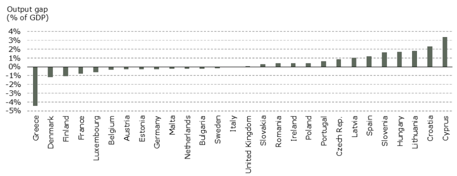
The policy is estimated to increase the EU GDP by 35 billion EUR in **2018** in countries with positive output gap

Energy efficiency (EE) measures = Investment spending → *Input-Output-model* → Immediate GDP effect → *Keynesian multiplier* → Aggregate demand (AD) effect → *Output gap* → Multiple impacts (MI): (a) GDP (b) employment → *Budgetary semi-elasticities* → Multiple impacts (MI): (c) public budget

The aggregate demand effect on GDP is positive for all 28 EU Member States.



For about half of the countries, this will be a beneficial fiscal stimulus given the current economic environment

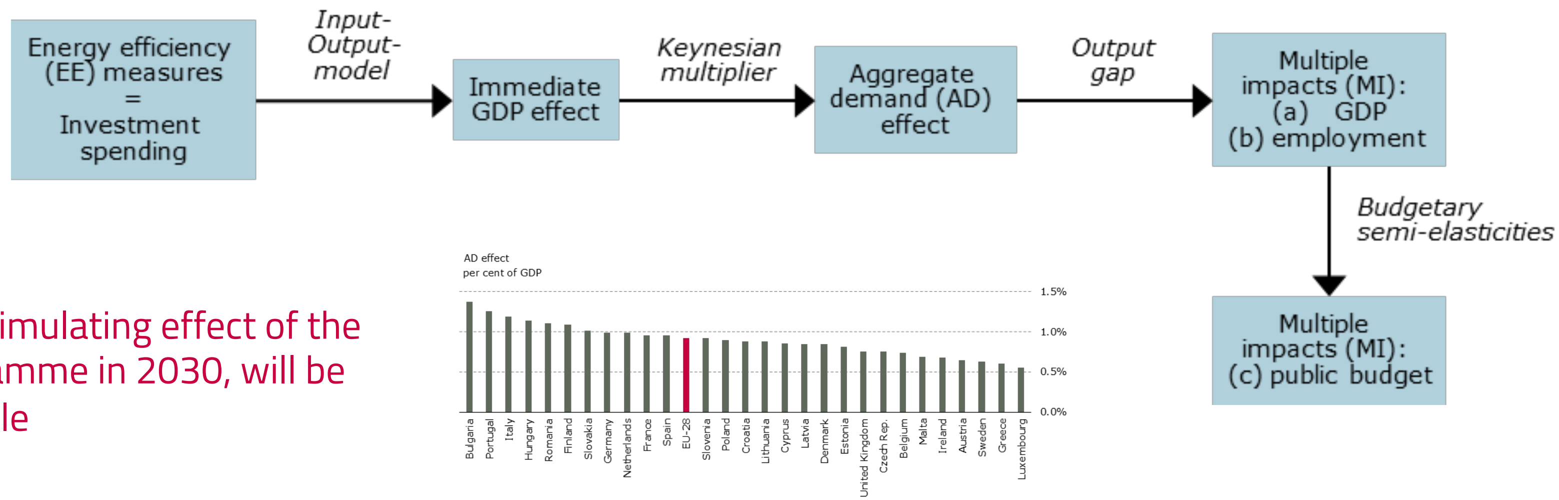


Our results for 2018, EU totals:

GDP	employment	Public budget
35 bn EUR	552,000 job-years	20 bn EUR

A) Business cycle effect 2030

The policy is estimated to have the potential of creating more than 2 million job-years in 2030



The stimulating effect of the programme in 2030, will be sizeable

This effect can be interpreted as a benefit in the countries that happen to be in an economic downturn in 2030

GDP

161 bn EUR

employment

2.3 mio job-years

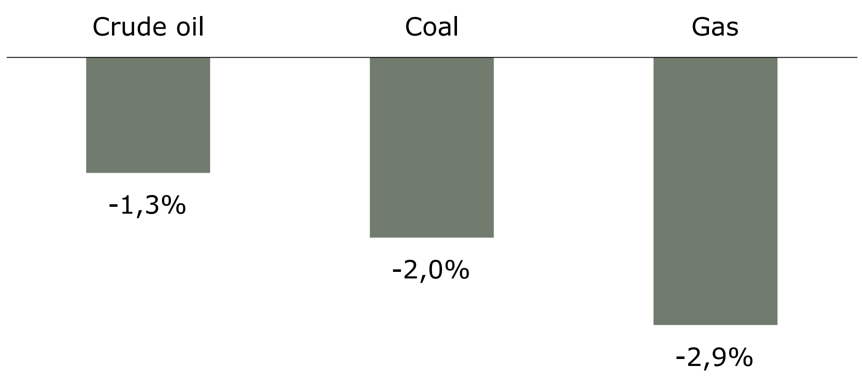
Public budget

86 bn EUR

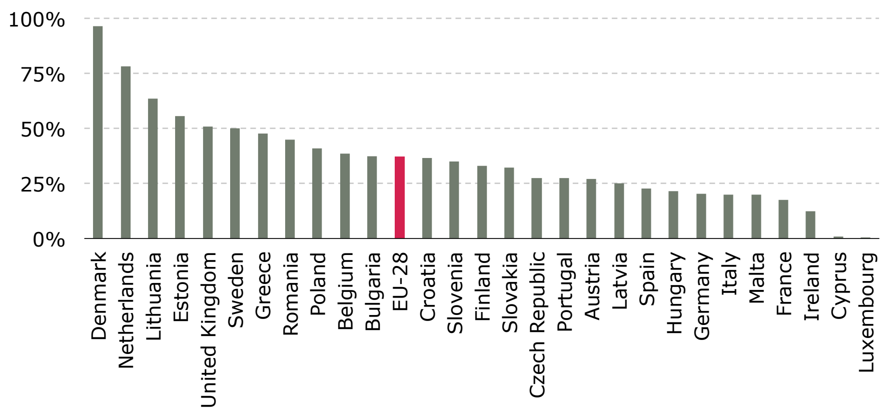
B) Structural effects 2030

Reductions in fossil fuel prices, and gains in terms-of-trade

EU fossil fuel prices



Export/import ratio of fossil fuels



Energy savings reduce prices

- COMBI initiatives reduce gas consumptions directly and coal consumption indirectly through lower electricity demand
- Demand for crude oil is primarily reduced through switch in transport modes and less overall transport use

EU countries are net importers of fossil fuels

- And will therefore on average benefit from reduced fossil fuel prices

Macro-economic impacts

Modelling issues

Inputs

- energy (cost) savings
- investment costs

→ selected monetary →

Modelling

Input-Output models

General/partial equilibrium models

Econometric models

→

Outputs

Employment

GDP

Public budget

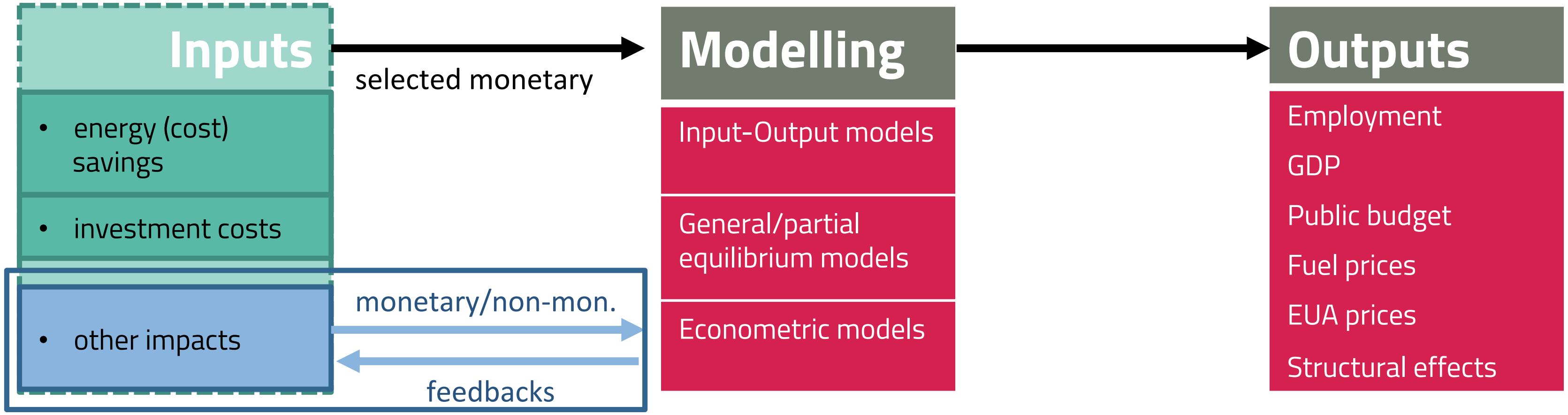
Fuel prices

EUA prices

Structural effects

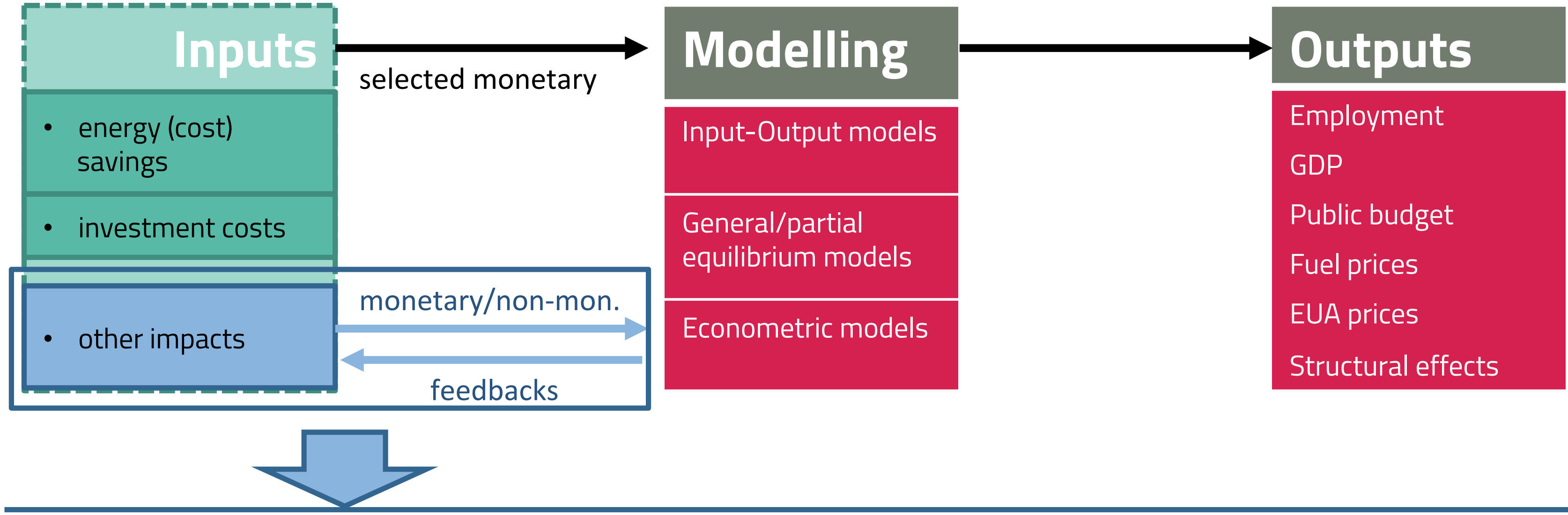
Macro-economic impacts

Modelling issues



Macro-economic impacts

Inclusion of other MIs & feedback loops



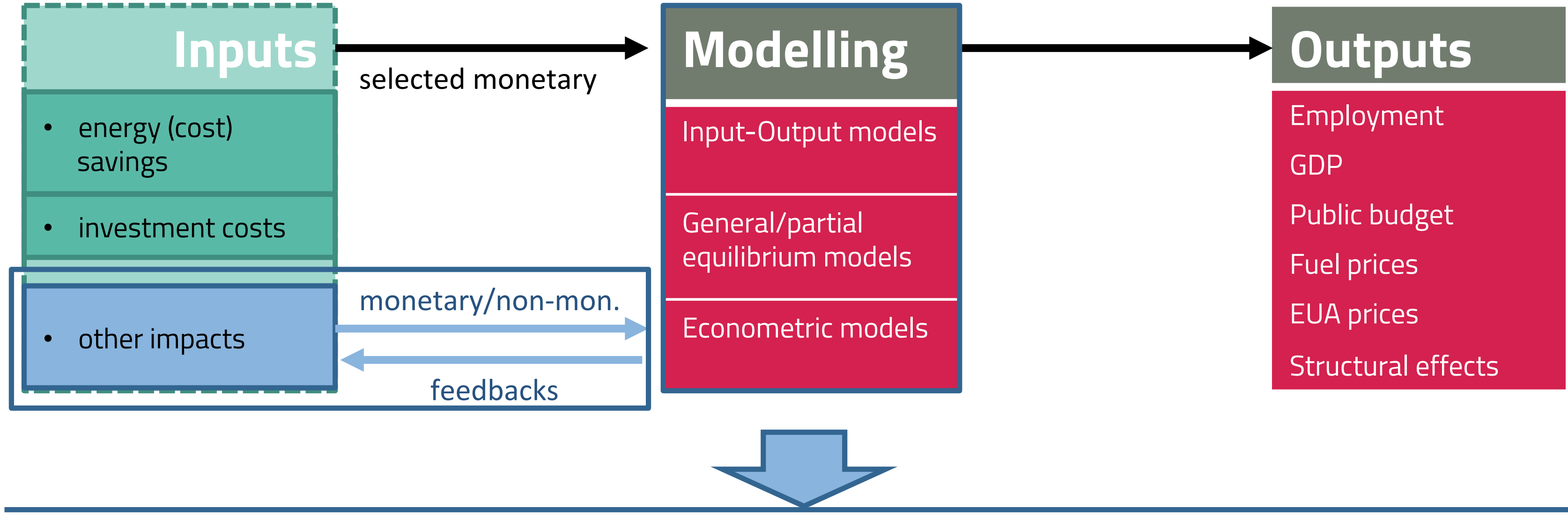
Examples for other MI-inputs

- energy costs → net incomes → expenditures
- better health →
  - labour productivity → commercial productivity
  - lower health costs → public budgets/taxes
- lower energy system costs → energy prices
- air pollution → ecosystems → agricultural output

Examples for feedbacks

- higher net incomes, employment, GDP →
  - poverty → investment in EE
  - health
  - additional energy demand (rebound)
- Lower energy prices →
  - disposable income/poverty
  - incentives for investment/fuel switch

Macro-economic impacts
Modelling issues



Model flaws

- IOM: predictability of output gaps
- GEM: problematic equilibrium assumptions
- Disaggregation levels (countries, sectors)
- Exclusion of MIs
- feedback loops
  - model-internal: energy prices → incomes →...
  - to MIs: see previous slide

Level of modelling detail/disaggregation

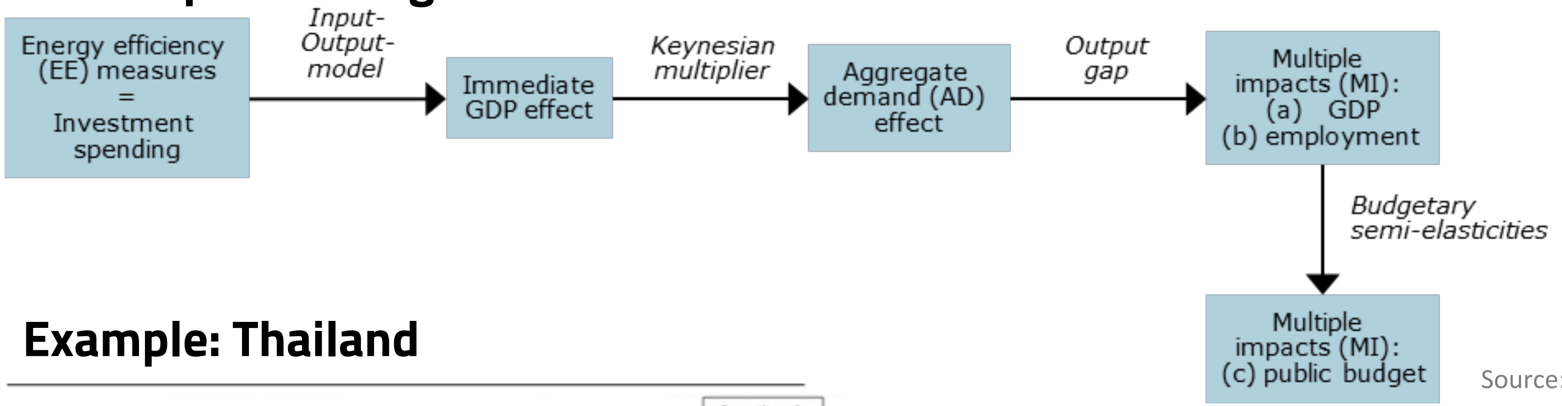
Example: Public budget

COMBI IOM vs. complex interconnections

Macro-economic impacts

Example complexity

COMBI: public budget



Source: COMBI D6.4 report

Example: Thailand

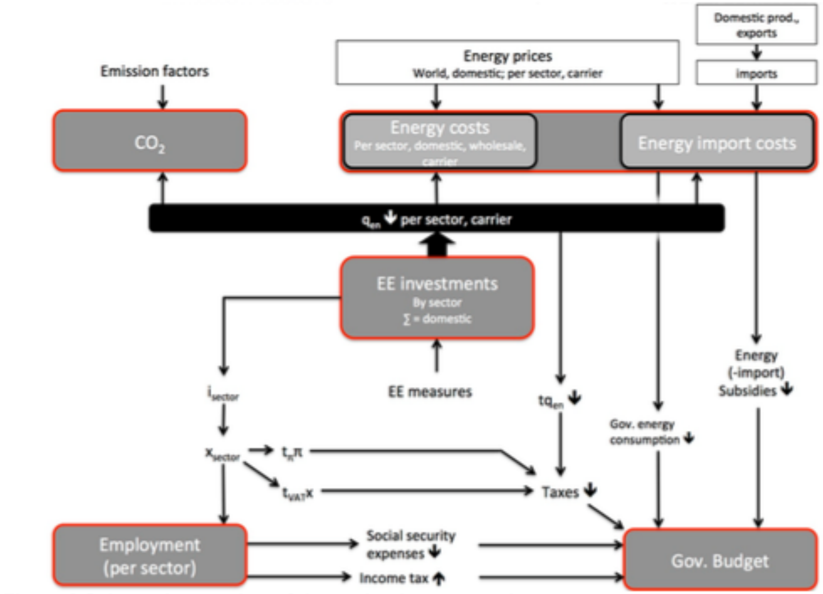


Figure 2 Schematic overview of the evaluation approach

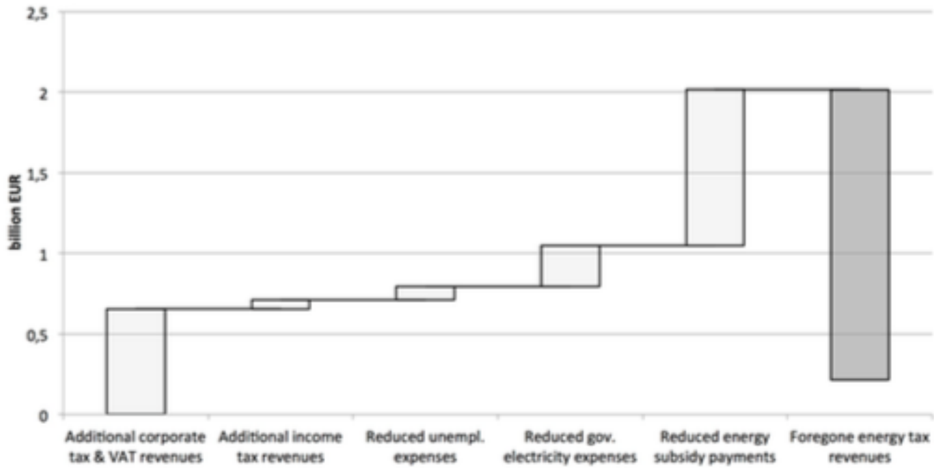
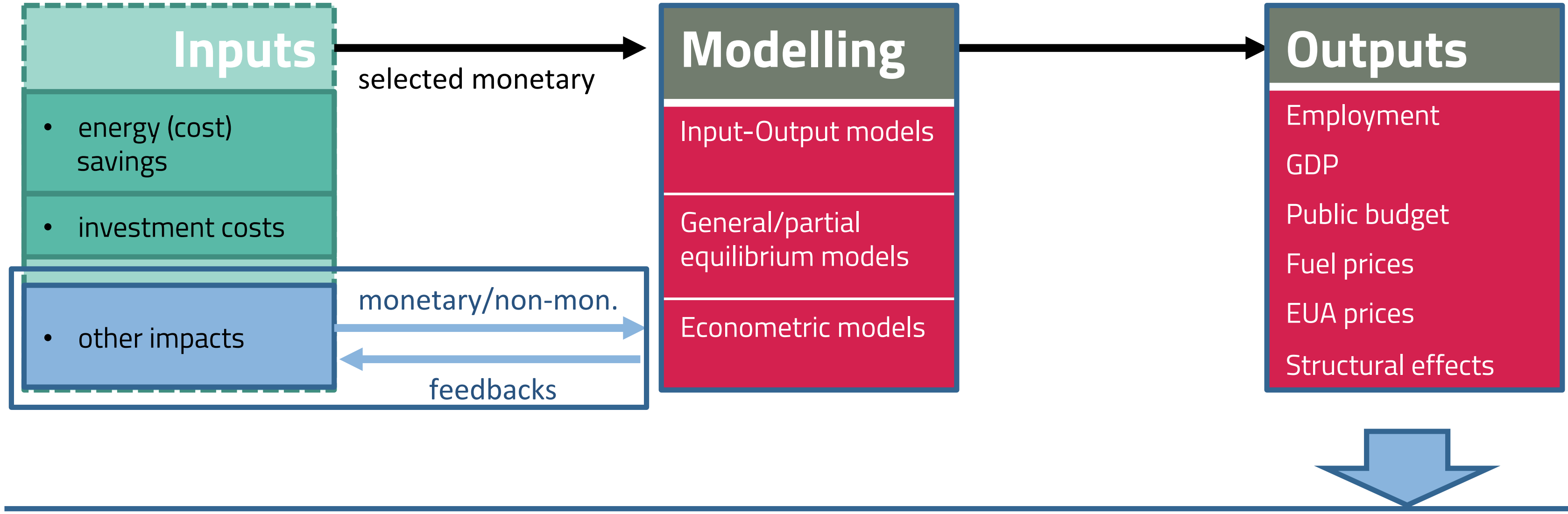


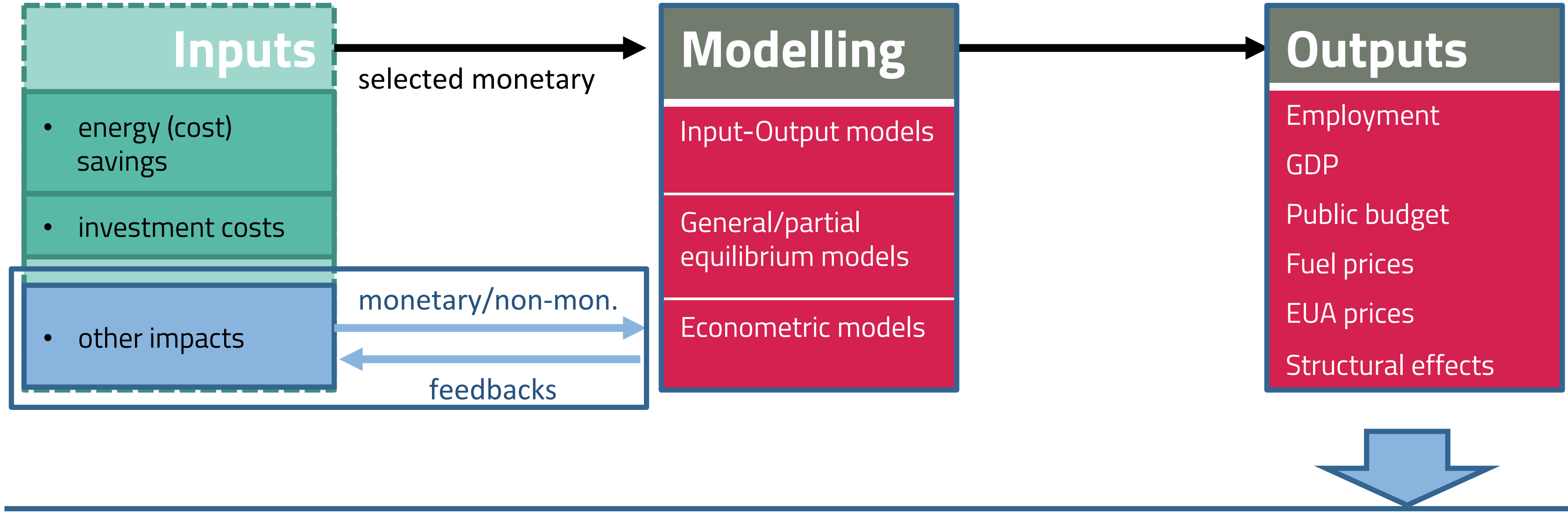
Figure 11 Composition of total effect on governmental budget in 2030 (average values)

Source: Suerkemper et al. 2016, https://doi.org/10.1007/s12053-015-9357-z

Macro-economic impacts
Modelling issues



Macro-economic impacts
Modelling issues



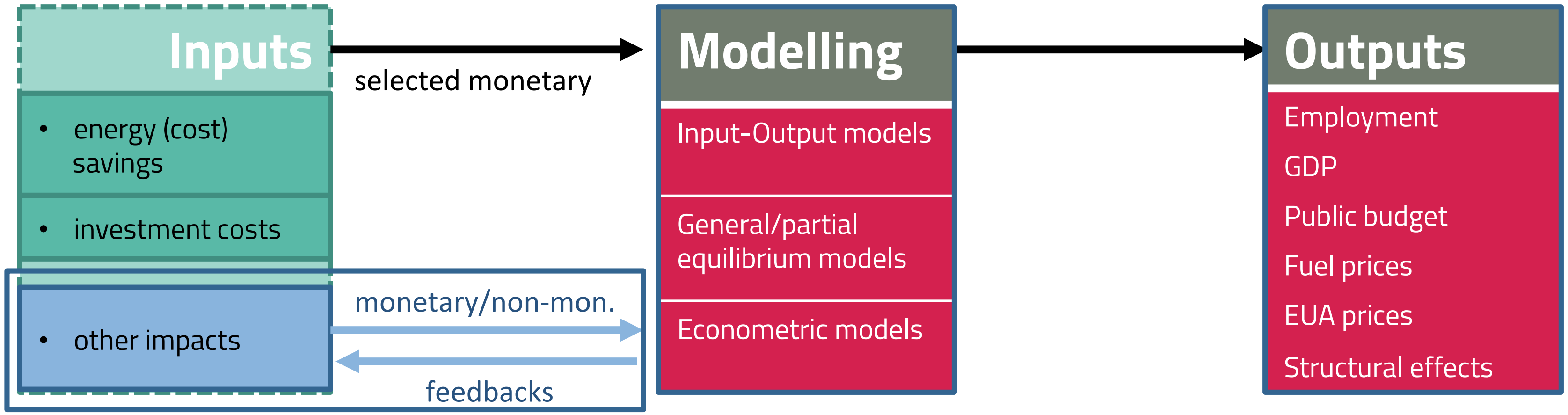
Aggregation of indicators (e.g. in CBA) **COMBI:**

Overlap danger: GDP = Gross Domestic Product 🛇

- Monetized employment 🛇
- Public budget ✓
- Other impacts: health, productivity, resources, energy system ✓

→ but these usually not included in economic modelling!

Macro-economic impacts
Modelling issues



Need for Integrated Assessment Model for multiple impacts quantification?

Thank you

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→ launch on 17 May 2018

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