Results from a project funded by DG Clima

Ex-post policy evaluation of Vehicle fuels tax in Ireland and France and Renewable energy auctions in Denmark and the Netherlands

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Overview

- Introduction to the project
- Outline of the Project Methodology
- Results and conclusions from the case studies
- General conclusions and lessons
- Appendix: CE's E3ME model and the FTT:Transport submodule

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Introduction to the Project

- DG Clima commissioned Ex Post Project as part of work programme supporting the European Semester
  - Semester process monitors 2020 targets and coordinates policy
  - Complements the EU Energy Initiative
  - Assists Member State (MS) policy coordination through ex ante guidance on structural reform programmes (including energy sector)
  - Requires monitoring and evaluation of policy effects
- Purpose of the Ex Post Project
  - Evaluate effectiveness of a selection of MS sectoral policies
  - Evaluate measures with a sufficient elapsed time and available data on emission trends, and which best inform future policy choices (esp. financial instruments)
  - Inform future policy design and implementation and application of evaluation methods

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Methodology – Ex Post Evaluation Design

- Selection criteria reflect practical need for data of policy trends, and reflect future policy interests
- Collection of information on the objectives and design of the selected measures – as the basis of an 'intervention logic'
  - Allows evaluation to consider relevance, effectiveness, efficiency, coherence and added value of measures
- Collection of monitoring data on sectoral emissions and costs of the implemented measures (Outturn)
- Counterfactual analysis of emissions (and economic) trends in the absence of policy measures using E3ME Simulation Modelling (the Baseline)
  - Provides analysis of emissions and economic trends by broad sector
- Comparison of the Outturn against the estimated Baseline (emissions and economic trends)

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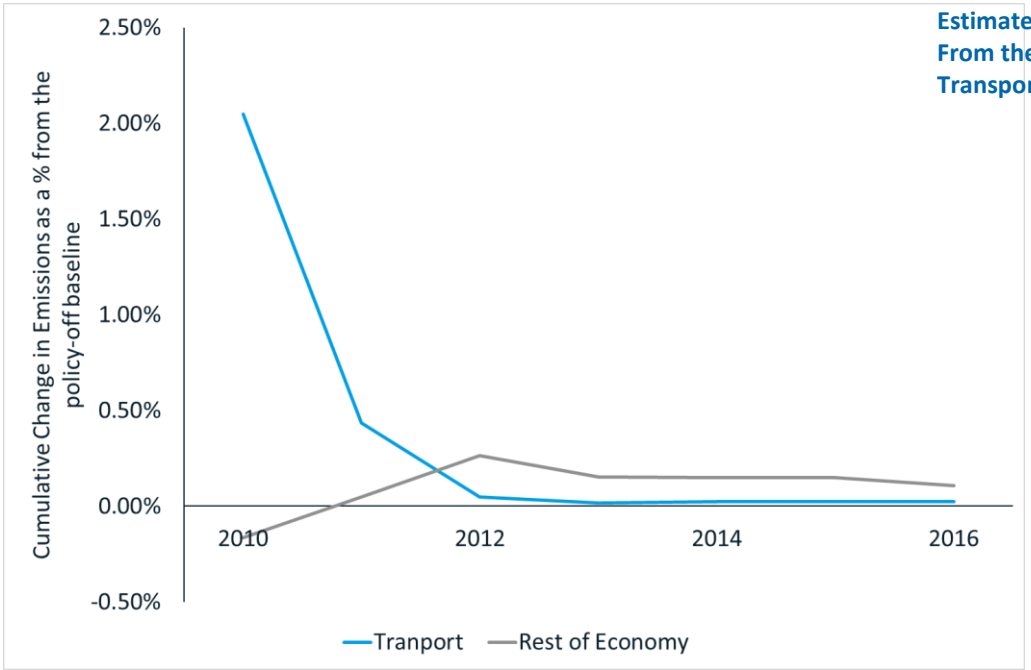
E3ME results suggest that economy-wide emissions increased slightly with the French bonus-malus scheme

- Change in the levelized cost of vehicles (£/km): electric vehicles become cheaper, luxury petrol vehicles become more expensive
- Small negative effect on employment
- Administrative cost per mt CO2 abated very expensive
- Increase in transport emissions despite shifts in the total vehicle stock towards lower-emitting more fuel-efficient vehicles
- A side-effect was that French consumers were encouraged to purchase diesel vehicles



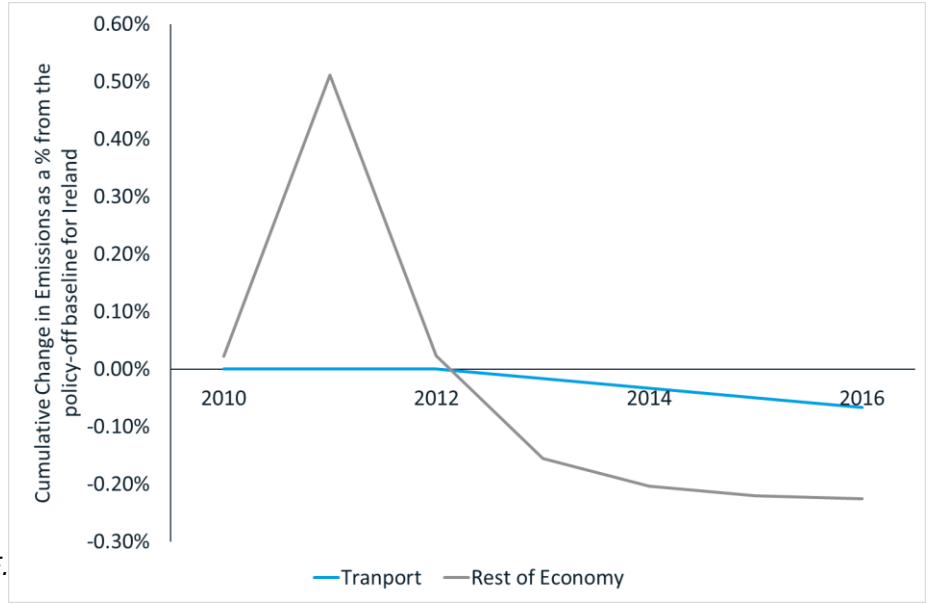
Estimated cumulative change in emissions (%)
From the policy off baseline
Transport sector vs rest of economy

Source: CE, E3ME.

E3ME results suggest that road transport emissions have decreased in Ireland with the carbon-based Vehicle Registration Tax and Motor Tax in place

- The carbon-based VRT and MT was effective in driving a shift in sales towards more effective vehicles
- VRT and MT
  - led to an increase in the levelised cost (£/km) for most vehicles
  - leading to a decrease in sales for most vehicle types
  - leading to decreases in consumer spending
  - an overall negative effect on government tax revenue
  - slight drop in employment in the automobile sector
- The main unexpected side-effect of the measure was the strong shift towards diesel vehicles, which have been raising concerns on health issues related to the emissions of NO_X and PM issues

Estimated cumulative change in emissions (%) from the policy off baseline# transport sector and rest of economy



Source: CE, E3ME.

The Bonus Malus and the VRT & MT

- The tax policy pursued by Ireland seems better calibrated towards reducing total vehicle demand and pushing the vehicle purchase profile towards lower-emitting vehicles due to the absence of a bonus component.
- The Irish vehicle registration tax programme is slightly less expensive and more effective at reducing both road transport emissions, and total emissions.

France:

- Change in the levelized cost of vehicles (£/km): electric vehicles become cheaper, luxury petrol vehicles become more expensive
- Increase in transport emissions despite shifts in the total vehicle stock towards lower-emitting more fuel-efficient vehicles
- A side-effect was that French consumers were encouraged to purchase diesel vehicles

Ireland:

- The main unexpected side-effect of the measure was the strong shift towards diesel vehicles, which have been raising concerns on health issues related to the emissions of NO_X and PM issues

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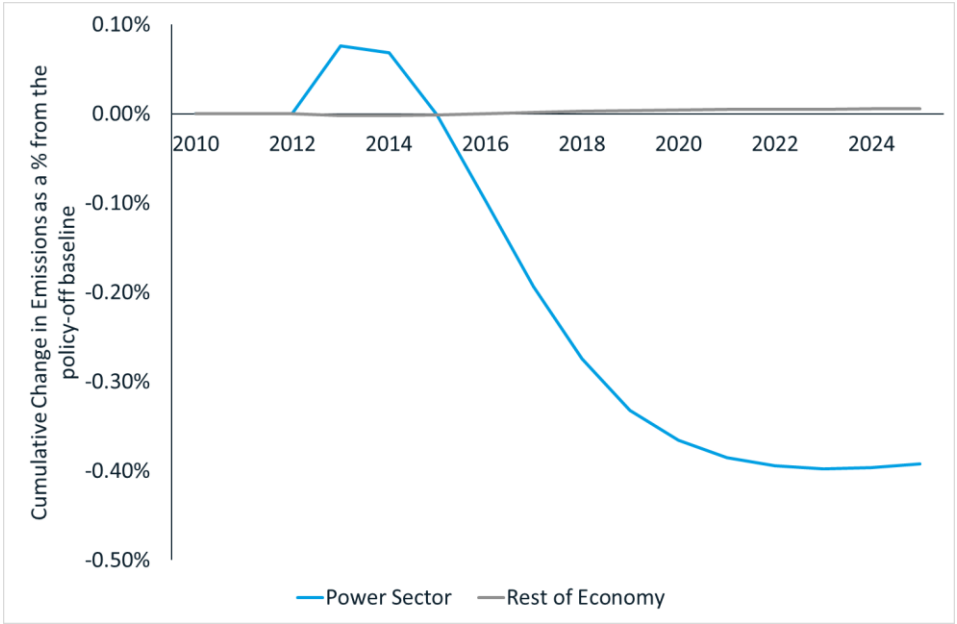
E3ME results suggest that emissions decreased slightly as a result of the Danish reverse auction programme

- Introducing the reverse auction programme leads to a shift in generation to investment in intensive offshore wind from conventionally less costly forms of energy generation.
- From a climate policy perspective, one should note that almost 40% of the displaced generation comes from onshore wind rather than fossil fuel capacity; essentially fewer onshore turbines are built while offshore capacity is expanded considerably.

Estimated cumulative change in emissions (%) from the policy off baseline for the power sector and rest of the economy



- Negligible impact on the main economic indicators and employment
- After 2019 renewables generating capacity for technologies not targeted by programme (i.e: solar, onshore) become a smaller share of total energy production

Current impacts to 2016 have been estimated and projected to 2030.
Source: CE, E3ME.

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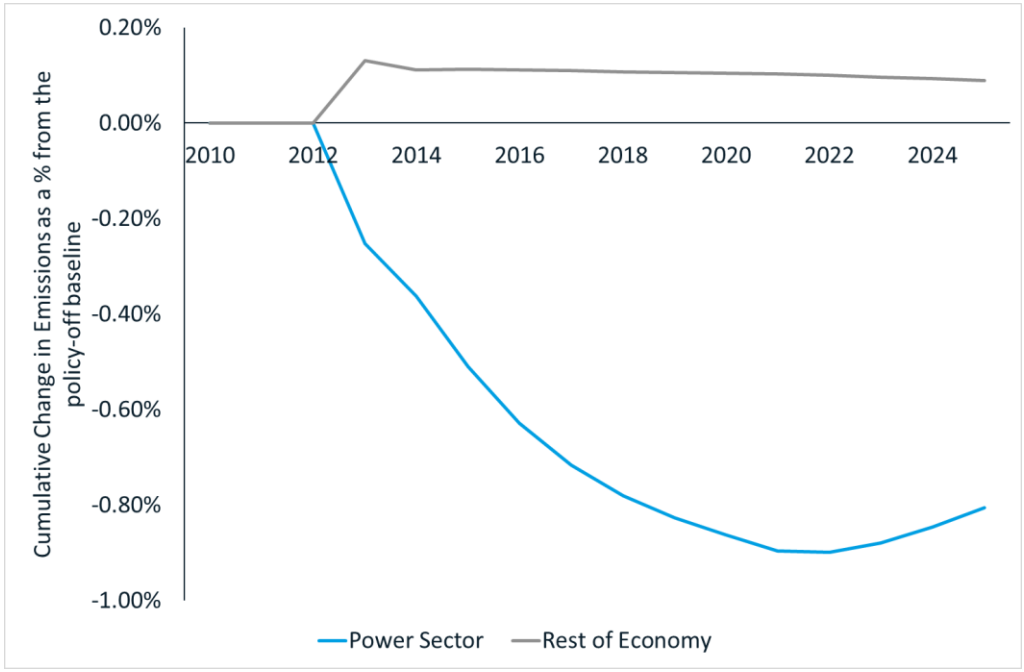
E3ME results suggest that emissions decreased slightly with the RES auction pursued in the Netherlands

- Introducing the RES auction programme lead to a decrease in generation from fossil fuel intensive technologies, with an increase in generation from renewables.
- The policy had slightly positive effects on GDP, investment, output, consumption, and employment over the period modelled - longer-term effects are more ambiguous

Estimated cumulative change in emissions (%) from the policy off baseline for the power sector and rest of the economy



- After 2020 renewables generating capacity for some technologies begins declining (i.e. onshore wind)

Current impacts to 2016 have been estimated and projected to 2030.
Source: CE, E3ME.

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Reverse Auction (DK) and RES Auction (NL)

Denmark:

- Introducing the reverse auction programme leads to a shift in generation to investment in intensive offshore wind from conventionally less costly forms of energy generation.
- From a climate policy perspective, one should note that almost 40% of the displaced generation comes from onshore wind rather than fossil fuel capacity; essentially fewer onshore turbines are built while offshore capacity is expanded considerably.

Netherlands:

- Introducing the RES auction programme lead to a decrease in generation from fossil fuel intensive technologies, with an increase in generation from renewables.
- The policy had slightly positive effects on GDP, investment, output, consumption, and employment over the period modelled - longer-term effects are more ambiguous

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In both DK & NL emissions fell slightly, driven by the changes in the electricity generation mix

Cumulative Emissions savings	
Cumulative emissions savings from 2013-2016	
Denmark	0.087 mt CO2
Cumulative emissions savings from 2012-2016	
Netherlands	1.4 mt CO2

Source: CE, E3ME.

- The Danish reverse auction seems markedly more expensive than the RES auction pursued in the Netherlands where more than one technology was targeted under the policy.
- The Danish reverse auction was expressly aimed to encourage offshore wind generation development on top of developing renewable low-carbon energy generation. The inclusion of other renewable energy policies would have allowed a more direct comparison of the efficacy of the programs in reducing emissions and encouraging promotion of renewable energy generation.
- In the longer term, both policies continue to promote changes in the mix of generation technologies

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General conclusions

- **Policy objectives** – emission reduction is the general aim – specific objectives relate to the take-up of low carbon technologies
- **Relevance** – measures tend to be part of wider low carbon programmes justified in large part by the pursuit of EU policy
- **Effectiveness** – positive achievement of 'take-up' of technologies; but with small cumulative effects on emissions achieved to-date.
  - Sector emission reduction, but rebound / wider economic effects can lead to overall economy-wide increase in emissions
- **Efficiency** – difficult to estimate and compare costs per tonne CO2 saved – issues of defining direct costs and economic impacts
  - NO negative effects on GDP. Negligible employment effects
- **Coherence** – measures defined as part of broader packages, raising issues of coherence between measures
- **Added value** – measures establish basis for long-term structural market changes in support of EU low carbon goals

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Some lessons

- **Policy making**
  - Understanding technological change – and incentives required
  - Need to be clear what the role of measures are within packages and to consider the optimal mix
  - Safeguard long-term benefits – locking in technological change and implied need for commitments for long-term policy
  - Prepare and publish Impact Assessments of measures – aid to evaluation and subsequent policy revision – including fiscal impacts
- **Evaluation**
  - Although focus of evaluation tends to be selected measures – need to consider assessment and evaluation of packages
  - More formal provisions for ex post evaluation, including consideration of deadweight effects
  - Improving definition and clarity of direct costs associated with measures (administration costs) and fiscal effects

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Appendix – E3ME

A computer-based global model for the economy, energy and environment, covering 59 regions

The model consists of collections of stochastic behavioural equations and accounting identities

Based on an accounting framework and designed for projections for business and policy analysis

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What are the key dimensions & features of E3ME?

Detailed Coverage

- 59 regions (33 European, 26 World)
- 70/44 economic sectors and 42/28 consumption categories
- 23 fuel users of 12 fuels

Comprehensive

- whole energy, environment and economy system
- two way feedback between each module
- covers many policy instruments

Highly Empirical

- 1970-2014 database
- 28 stochastic equations
- relationships validated from data
- econometrics allows for short-medium and long term analysis

Consistent

- based on system of national accounting
- input-output tables
- bilateral trade

Forward Looking

- annual projections to 2050
- behavioural equations with effects from previous outcomes
- ex-ante scenario analysis (ex-post is also feasible)

Modular

- E3: Energy, Environment, Economy and material modules
- power generation sub-module
- research can be decentralised

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What are the typical model outputs of E3ME?

Economy

- **GDP** and its **aggregate components** (household expenditure, investment, government expenditure & international trade)
- **sectoral** output **&** GVA, prices, trade & competitiveness effects
- **sectoral** international **trade** in **bilateral** format & can be presented by trade blocs
- **consumer prices & expenditures**, & implied household **distributional** effects

Labour Market

- **sectoral employment** by gender
- **labour force** and **participation rate** by gender and age groups
- **unemployment** rate and level
- **sectoral wage** rate
- **real income** of different **socio-economic** groups
- **GINI** coefficients

Energy & Environment

- **energy demand**, by users and by fuel
- energy **prices**
- **power** sector detailed results
- **CO_2 emissions** by sector and by fuel
- **other** air-borne **emissions**
- **material demands** (DMC, DMI, DE, M, X, TMR), by users and by materials

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Features of the E3ME model

Structural

- disaggregation of variables

Organized around a Social Accounting Matrix

- i.e. on accounting principles, e.g. System of National Accounts

Dynamic

- behavioural equations with effects from previous outcomes: i.e. history matters

Estimated on cross-section & time-series data

- identifies current-year responses and long-term trends
- allows sectoral and regional differences

Features of the E3ME model (continued)

Open as regards economic policy, i.e. no assumptions of full employment, budget balance, or balance of payments equilibrium

"Scenario" approach

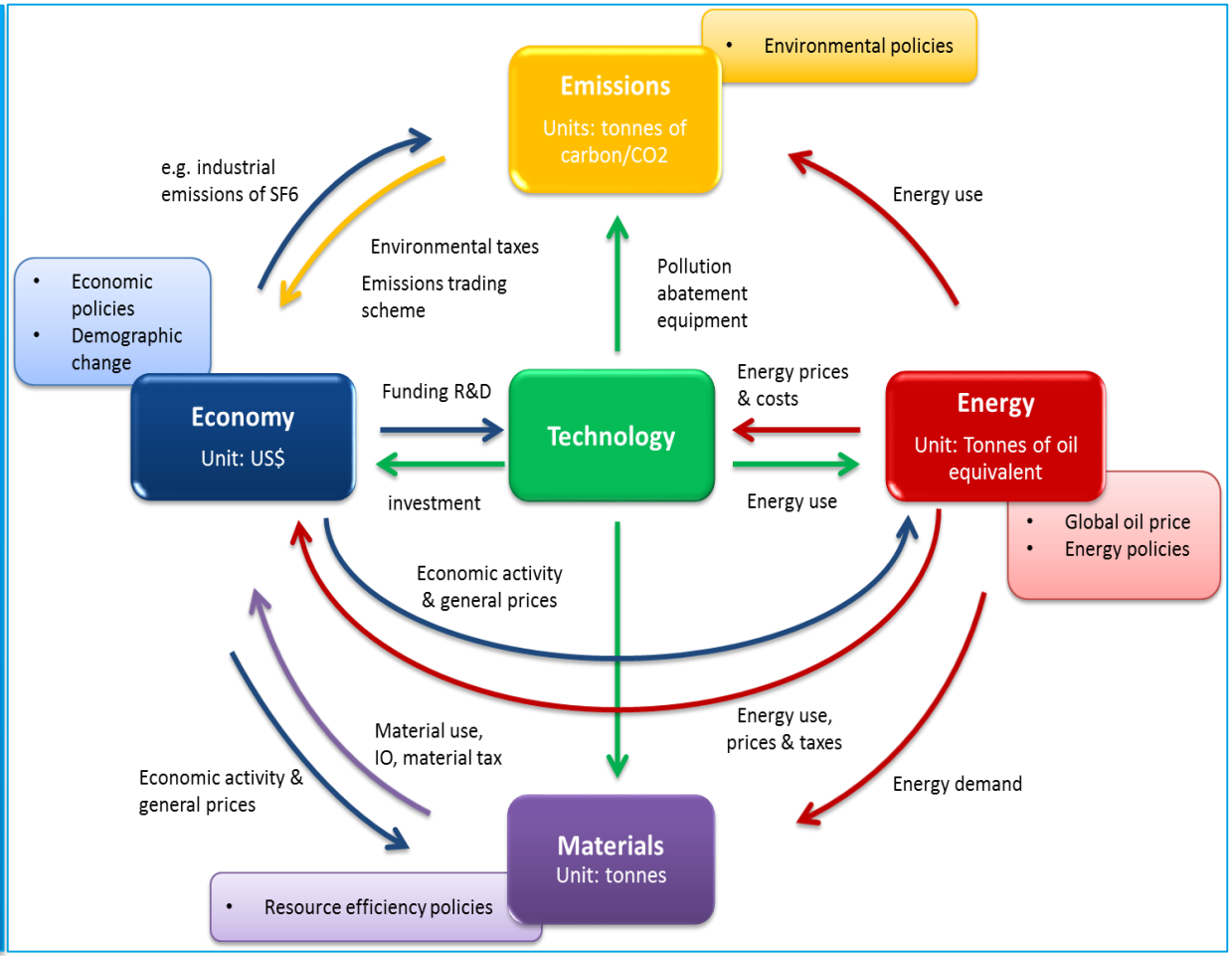
- computation of many scenarios with comparisons of policy packages and provides quantified explanation of results

Treatment of uncertainty

- in parameter estimates (econometric estimation of error distribution)
- in assumptions and policies (by scenario analysis)

E3ME as an E3 model

- Each component of the model is shown in its own box
- Exogenous factors are shown on the outside edge for each component
- The linkages between the components are shown by arrows that indicate which values are transmitted



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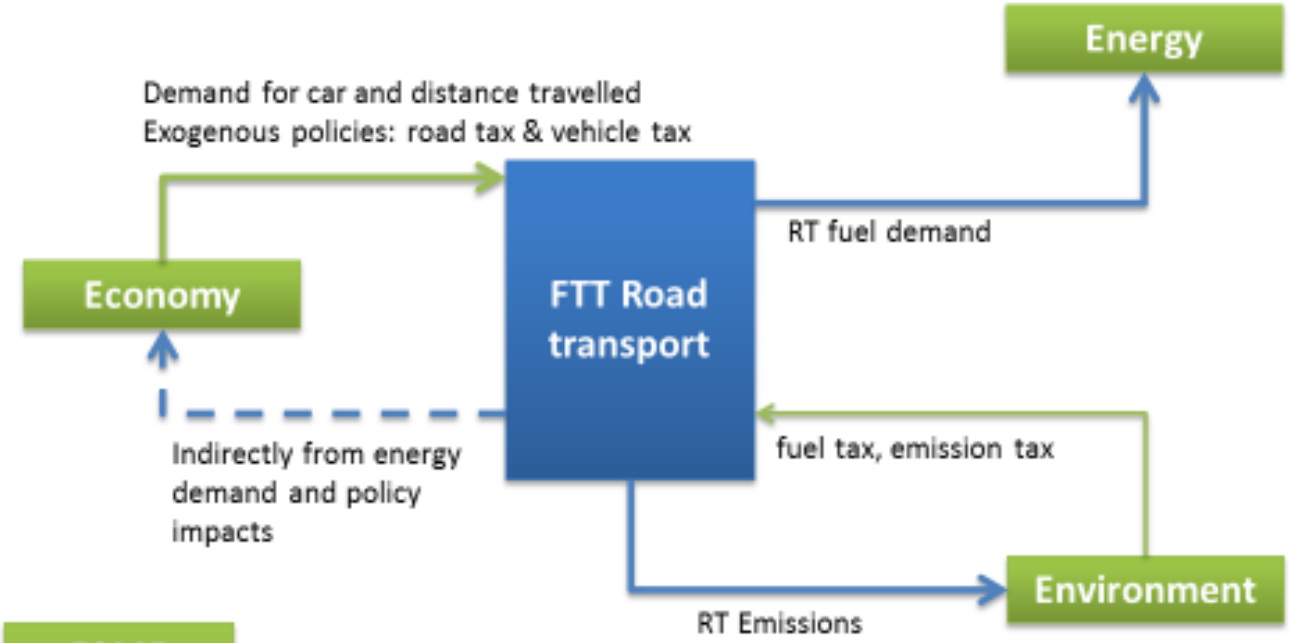
E3ME-FTT Transport

- Global transport sector model
- Endogenous technology diffusion
- 25 technologies, 59 world regions
- price of cars assumptions - different for each region



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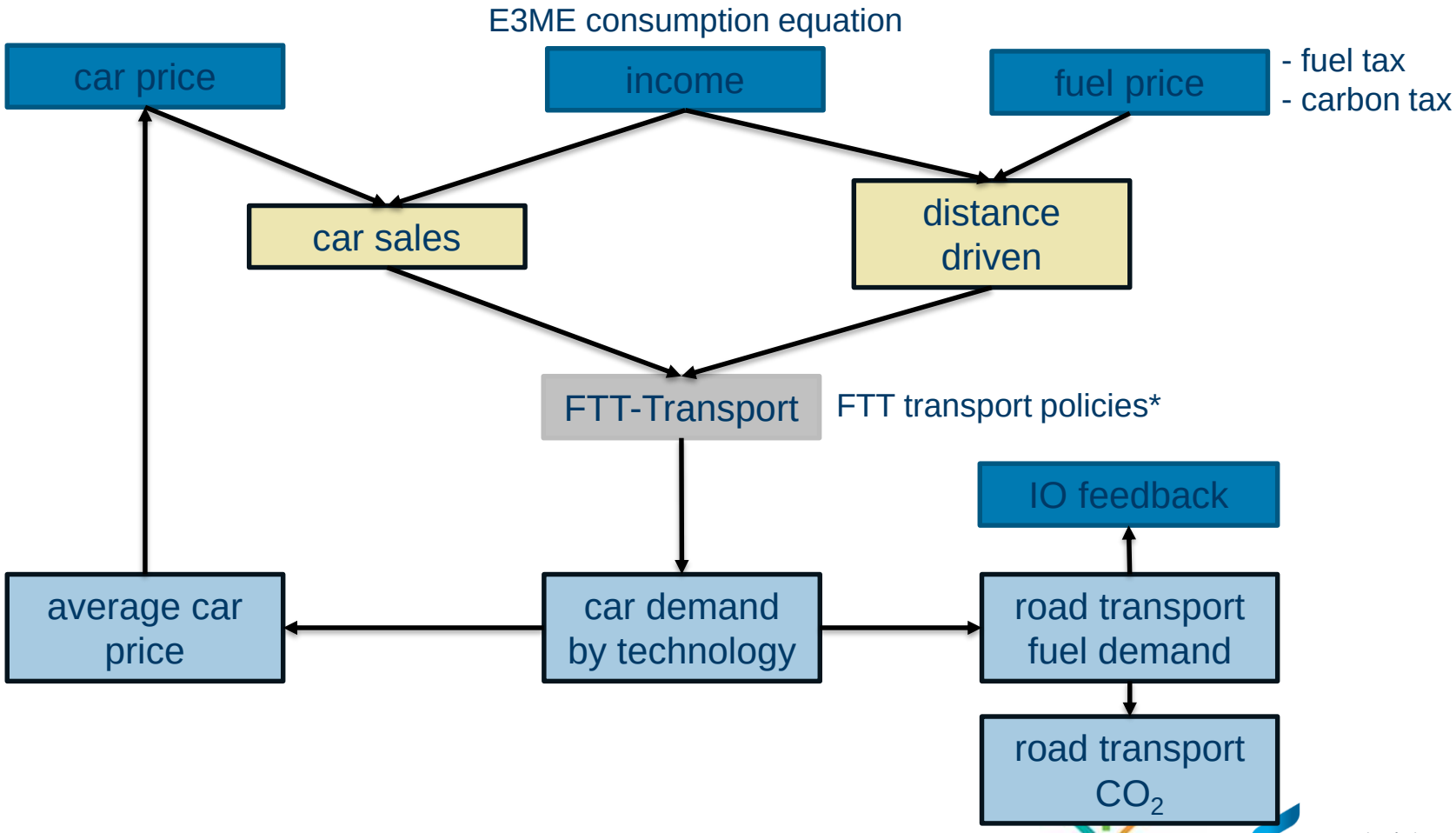
E3ME-FTT Transport



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