



This project is funded by the European Commission's
Directorate-General Climate Action



EU Transport GHG: Routes to 2050 II

Knock-on consequences of relevant potential policies

Richard Smokers (TNO), Huib van Essen (CE), Ian Skinner (TEPR)

June 29 2011, Diamant Conference Center, Brussels

Partners

www.eutransportghg2050.eu



Transport and
Environmental
Policy
Research

TNO innovation
for life

Objectives of Task 3

- **Main Aim:** Systematic exploration of GHG-related knock-on consequences, for the vehicle fleet, of three relevant potential policies
 - Speed limits
 - Fiscal instruments
 - Vehicle CO₂ legislation for passenger cars
- Obtain order of magnitude estimates with respect to the impacts at fleet level for the relevant knock-on consequences
- Where possible, obtain order of magnitude estimates with respect to the impact of various knock-on consequences on cost effectiveness of GHG mitigation instruments

Knock-on consequences

- 2nd order impacts on the size, composition and usage of the fleet, as well as
- possible changes in vehicle design and other characteristics
- that may occur in response to an implemented policy in addition to the intended 1st order impacts
- Knock-on consequences may either:
 - enhance or reduce the impact of the policy (e.g. on CO₂ emissions)
 - increase or reduce costs of the policy
 - and thereby improve or deteriorate the policy's cost effectiveness

Objectives of this stakeholder meeting

- Present & discuss results based on draft final version of the paper

Speed related instruments



Speed-related policy: type of effects



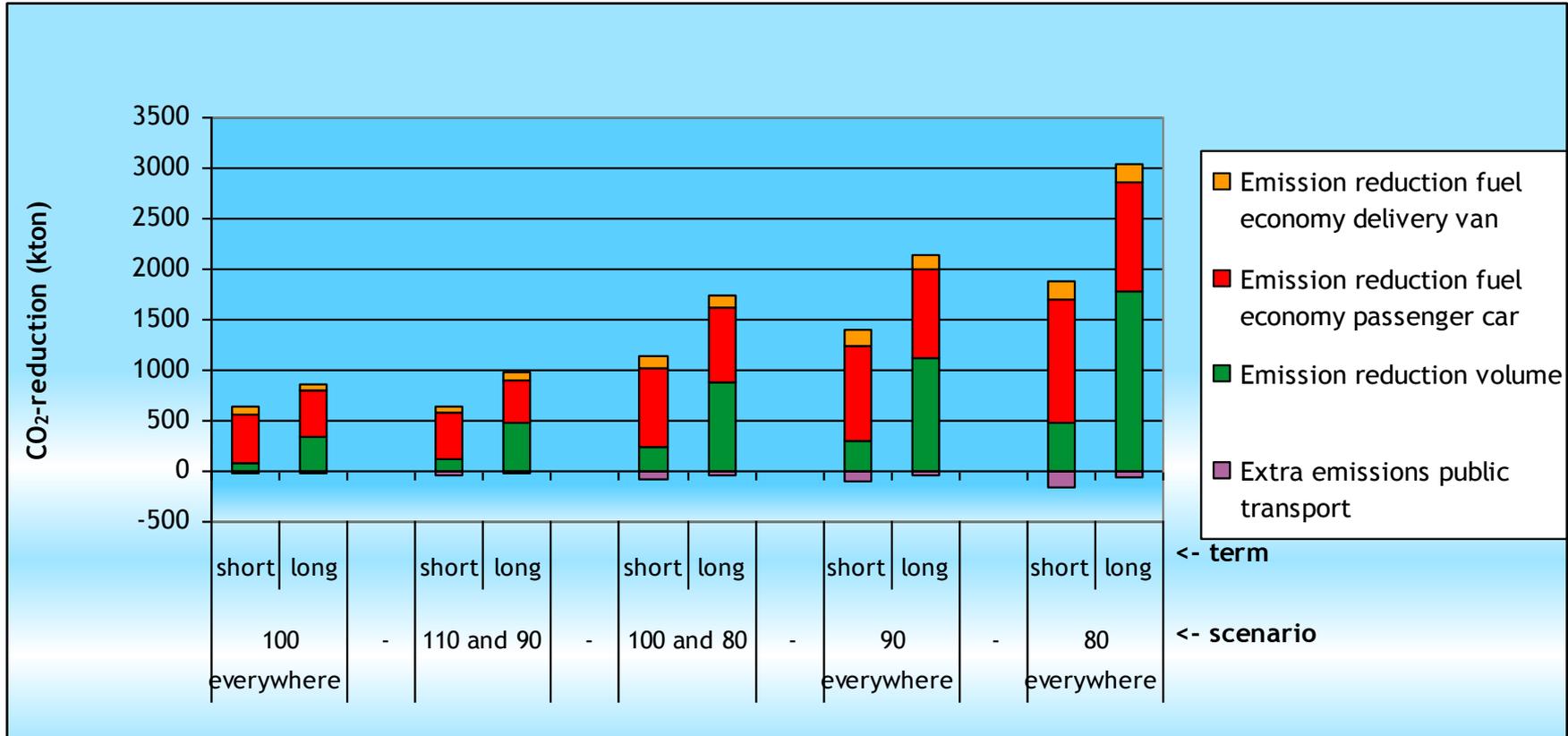
- Direct GHG impact:
 - Improved fuel efficiency of vehicles
 - Significant, e.g. 7-15% for speed limit of 100 km/h on motorways
- Knock-on effects on transport demand:
 - Total transport demand
 - Modal shift to other modes
 - Shifts between vehicle types of the same mode
- Knock-on effects on vehicle design and sales:
 - Size of the fleet
 - Fleet composition (changes in sales)
 - Vehicle design (new vehicle models)
- Other knock-on effects:
 - GHG impacts of changes in accident rates and congestion levels
 - Less “highway avoidance” behaviour
 - Infrastructure

Speed-related policy: quantification of knock-on effects



- Most knock-on effects not included in quantification of GHG impacts of speed-related policy
- Quantification of demand effects:
 - Linked to travel time budget (constant with decreasing speeds?)
 - Two studies available, both on motorway speed limits
 - Impacts relatively high (up to same order as direct effect)
 - Effects highest on the long term and when alternatives available
- Impacts on vehicles and other impacts:
 - Just qualitative assessments available
 - No evidence that impacts are likely to be significant

Speed-related policy: impacts of demand effects of lower speed limits (study for NL)



Speed-related policy: recommendations



- Speed limits can have significant impacts on GHG emissions of transport
- Transport demand and modal split impacts:
 - most significant (positive) knock-on effect
 - up to the same order as the direct impact on fuel efficiency of vehicles
- Other GHG knock-on consequences:
 - poorly understood
 - likely to be insignificant

Fiscal instruments



Fiscal instruments: Scope of assessment and knock-on consequences



- Scope:
 - Taxes/incentives that aim to stimulate purchase and ownership of low CO₂ / more fuel efficient cars by changing (relative) costs of purchasing and ownership
- Knock-on consequences:
 - Of relevance to CO₂ emissions:
 - size and composition of fleet
 - use of cars
 - Not relevant to CO₂ emissions:
 - second hand market and social consequences
 - Dependent on whether incentives are designed to: Increase revenue; be revenue-neutral; or reduce revenue
 - Assessment assumes no wider changes, e.g. in external factors or additional policy instruments

Fiscal instruments: CO₂ impact of knock-on consequences on fleet



Purchase of new cars

Ownership of all cars

Revenue
increasing



Fleet size declines (short)
Turnover declines, older
vehicles retained for longer,
cars used more and differently;
fleet increases (long)



Fleet size declines (medium),
life span declines
Turnover declines, cars used
more; fleet increases (long)

Revenue
neutral



Older, larger vehicles retained
for longer, cars used more;
fleet increases (long)



Lifespan of older, larger
cars declines
Cars used more; fleet
increases (long)

Revenue
decreasing



Fleet turnover increases;
older cars scrapped earlier
Fleet size increases; cars used
more



Fleet turnover increases
Fleet size increases;
lifespan of cars increases;
cars used more

Fiscal instruments: Net impacts on CO₂ emissions and drivers??



Purchase of new cars

Ownership of all cars

Revenue increasing

Fleet size declines (short)
Turnover declines, older vehicles retained for longer, cars used more and differently; fleet increases (long)

Fleet size declines (medium), life span declines
Turnover declines, cars used more and differently; fleet increases (long)

Revenue neutral

Older, larger vehicles retained for longer, cars used more; fleet increases (long)

Lifespan of older, larger cars declines

Cars used more; fleet increases (long)

Revenue decreasing

Fleet turnover increases; older cars scrapped earlier
Fleet size increases; cars used more

Fleet turnover increases

Fleet size increases; lifespan of cars increases; cars used more

Fiscal instruments: Findings, unknowns and implications on knock-on consequences



- Findings:
 - There is a range of knock-on consequences (i.e. second order impacts) that act to decrease and increase CO₂ emissions
 - CO₂ impacts of knock-on consequences of revenue-increasing instruments appear to be less likely to have negative impacts than those with other revenue impacts
- Unknowns:
 - Second order impacts on CO₂ generally erode first order benefits – net impacts of instruments depend on balance of **first and second** impacts
 - Little evidence was found to quantify most second order impacts – assumed that impacts on size of fleet, car use dominate CO₂
 - Studies note that results of such assessments are often sensitive to changes in assumptions on elasticities
- Implications for policy:
 - Consider all second order impacts, as far as possible, in ex ante assessment
 - Chances of delivering CO₂ reductions improved if complementary instruments to counteract lower costs of use are introduced in parallel

Vehicle CO₂ legislation

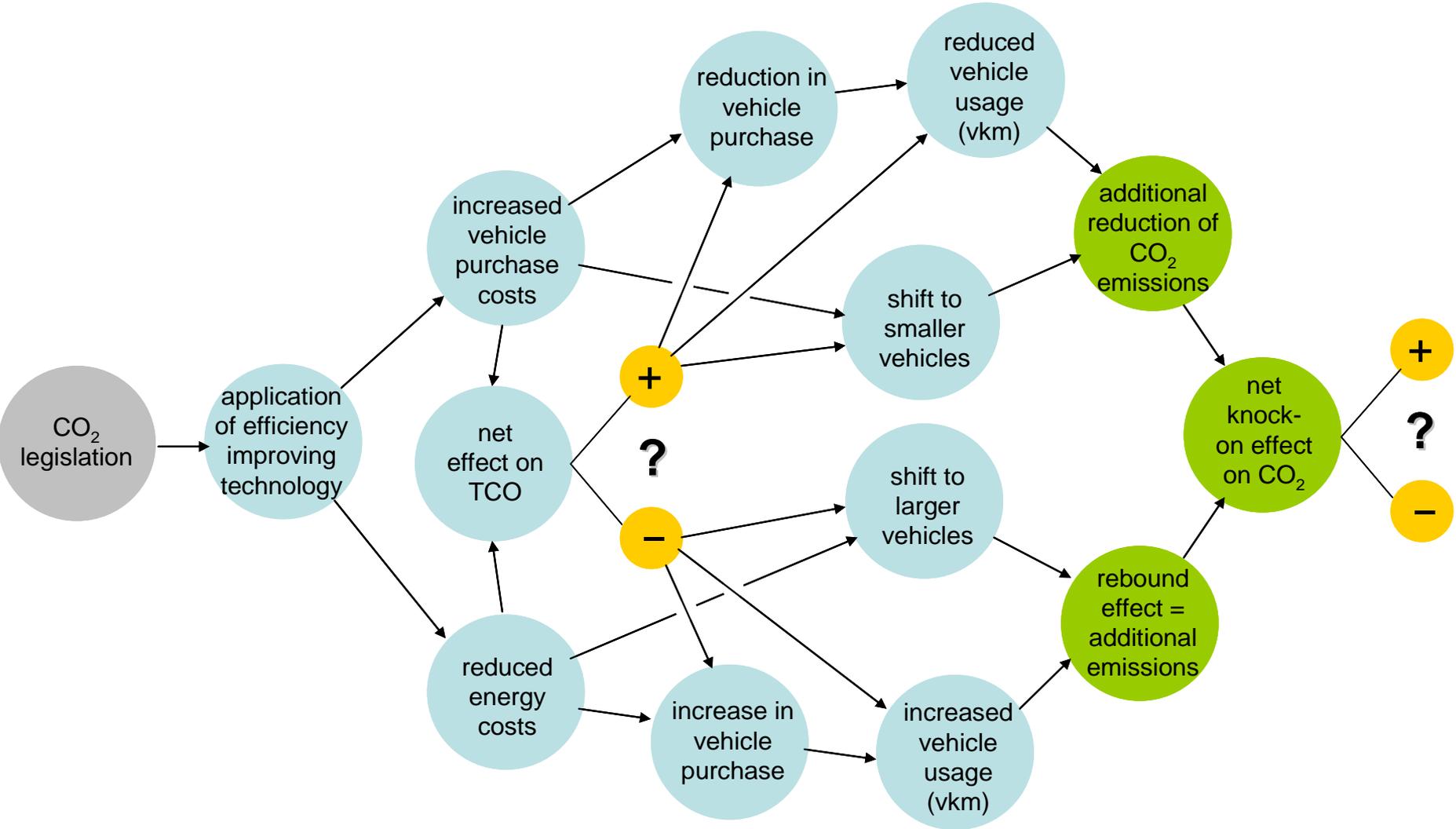


Knock-on consequences of vehicle CO₂ legislation



- Focus on CO₂ legislation for cars and light commercial vehicles with targets set for 2015 and 2020
- CO₂ legislation for road vehicles results in:
 - lower fuel consumption => lower fuel costs per km
 - vehicle purchase price increase
 - other vehicle characteristics
 - vehicle portfolio offered by OEMs } → net effect on TCO ?
- These changes are likely to lead to 2nd order impacts on purchasing behaviour as well as vehicle usage:
 - **Positive** knock-on consequences enhance the CO₂ emission reduction or reduce the overall costs of achieving a given level of CO₂ emission reduction. Both effects improve the cost-effectiveness of the policy measure.
 - **Negative** knock-on consequences (rebound effects) reduce the CO₂ emission reduction, leading to reduced cost-effectiveness of the policy measure.
- Indication that RW/TA ratio increases for more efficient cars
 - Decrease RW impact of CO₂ legislation

CO₂ legislation: 2nd order effects resulting from changes in vehicle purchase and usage costs



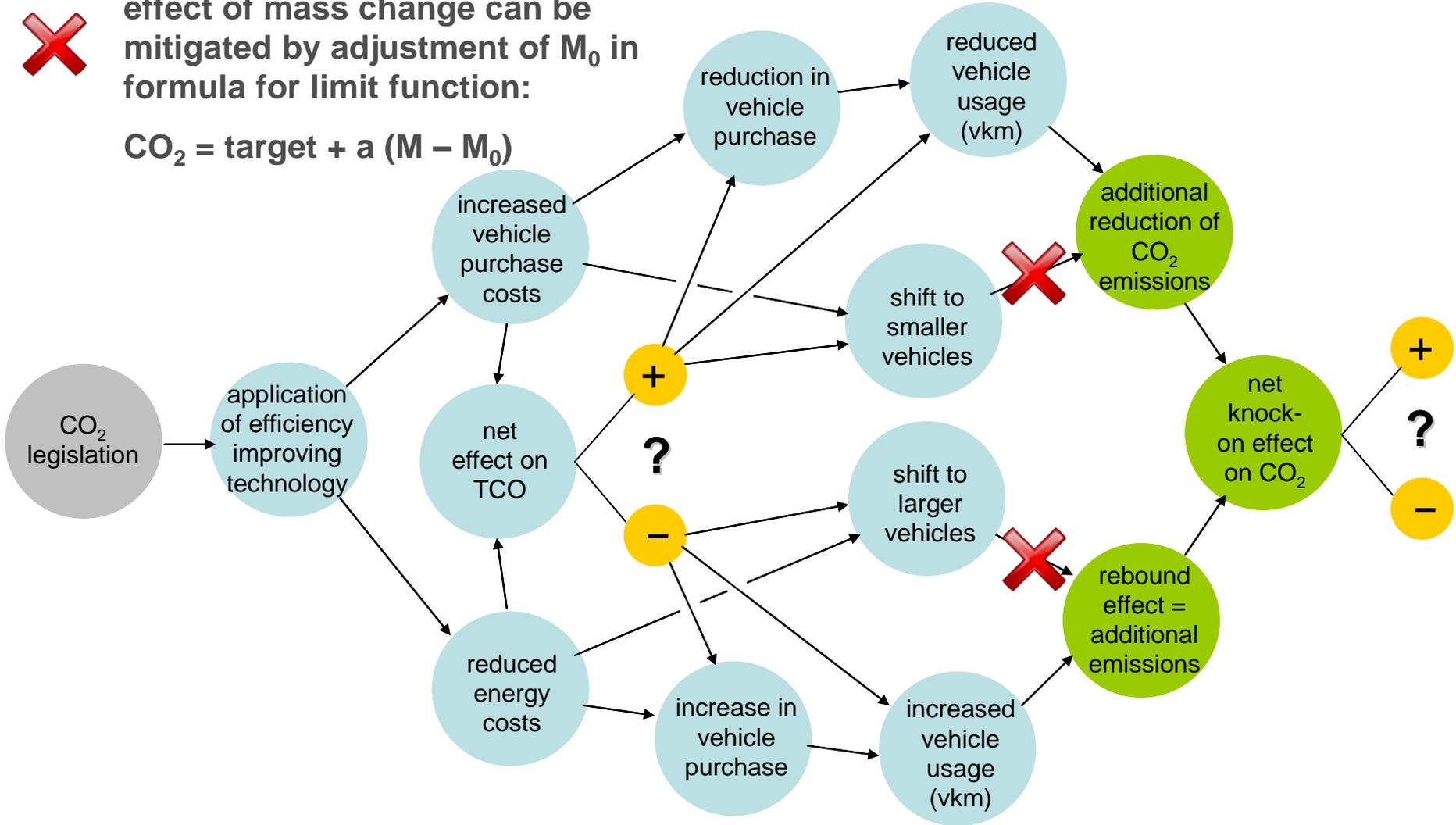
impacts through fuel switch are excluded for sake of simplicity

CO₂ legislation: 2nd order effects resulting from changes in vehicle purchase and usage costs



effect of mass change can be mitigated by adjustment of M_0 in formula for limit function:

$$CO_2 = \text{target} + a (M - M_0)$$



impacts through fuel switch are excluded for sake of simplicity

CO₂ legislation: 2nd order impact on CO₂ emission reduction relative to 1st order estimate



	130 g/km ¹ in 2015	95 g/km ² in 2020
• Increased purchase costs lead to:		
– Shift towards smaller vehicles	+ / 0	+ / 0
– Reduced demand for vehicles	+	+
• Reduced fuel costs per km lead to:		
– Increased vehicle use	-	-
• Reduced total cost of ownership per kilometre leads to:		
– Shift towards larger vehicles	- / 0	- / + / 0
– Increased demand for vehicles	-	- / +
– Increased vehicle use	-	- / +
=====		
• Net effect, based on qualitative reasoning	-	+

1) relative to baseline without legislation

- = decrease of net reduction (rebound)

2) relative to 130 g/km in 2020

+ = increase of net reduction

CO₂ legislation: Conclusions



- Net 2nd order effect strongly depends on:
 - How additional costs for CO₂ reducing technology work out in retail price. This depends on:
 - fiscal stimulation measures in Member States
 - cost reductions + strategic pricing + marketing strategies for other new technologies by OEMs
 - Fuel price
- If purchase price remains constant CO₂ legislation definitely leads to rebounds that may reduce net CO₂ impact by 10 to 30%
- Relevance of subject deserves improvements of knowledge / methods:
 - Application of knowledge on elasticities from literature not straightforward
 - Results from modelling confirm “detailed balance” but sometimes inconsistent with insights literature
 - e.g. dominant effect of retail price and purchase behaviour
- Post 2020 CO₂ legislation will likely not suffer from rebounds, while positive knock-on consequences may enhance its effect and effectiveness
 - Result of strongly non-linear cost curves

Knock-on consequences: Conclusions

- net impact of 2nd order effects depends on detailed balance
 - available evidence does not allow easy quantifications for 2 out of 3 measures
- speed
 - positive knock-on consequences on GHG reduction especially in longer term
- fiscal
 - try to focus on revenue-increasing instruments to avoid rebounds
 - introduce complementary instruments in parallel to counteract lower costs of use
- CO₂ legislation
 - until 2020 rebound effects likely
 - possibly enhanced by fiscal stimulation measures
 - but net effect is detailed balance sensitive to energy price, fiscal regimes and OEM price strategies
 - post 2020 targets expected to lead to positive knock-on effects