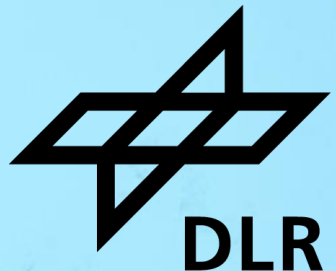


# **HOW DO ENVIRONMENTAL FUEL TAXES AFFECT CARBON EMISSIONS?**

## **ANALYSIS OF FUEL TAX EFFECTS IN NORDIC EUROPEAN COUNTRIES**

Welf Lücke, German Aerospace Center, Institute of Transport Research

WCTR 2023: World Conference on Transport Research - 19.07.2023



# Motivation and Research Question



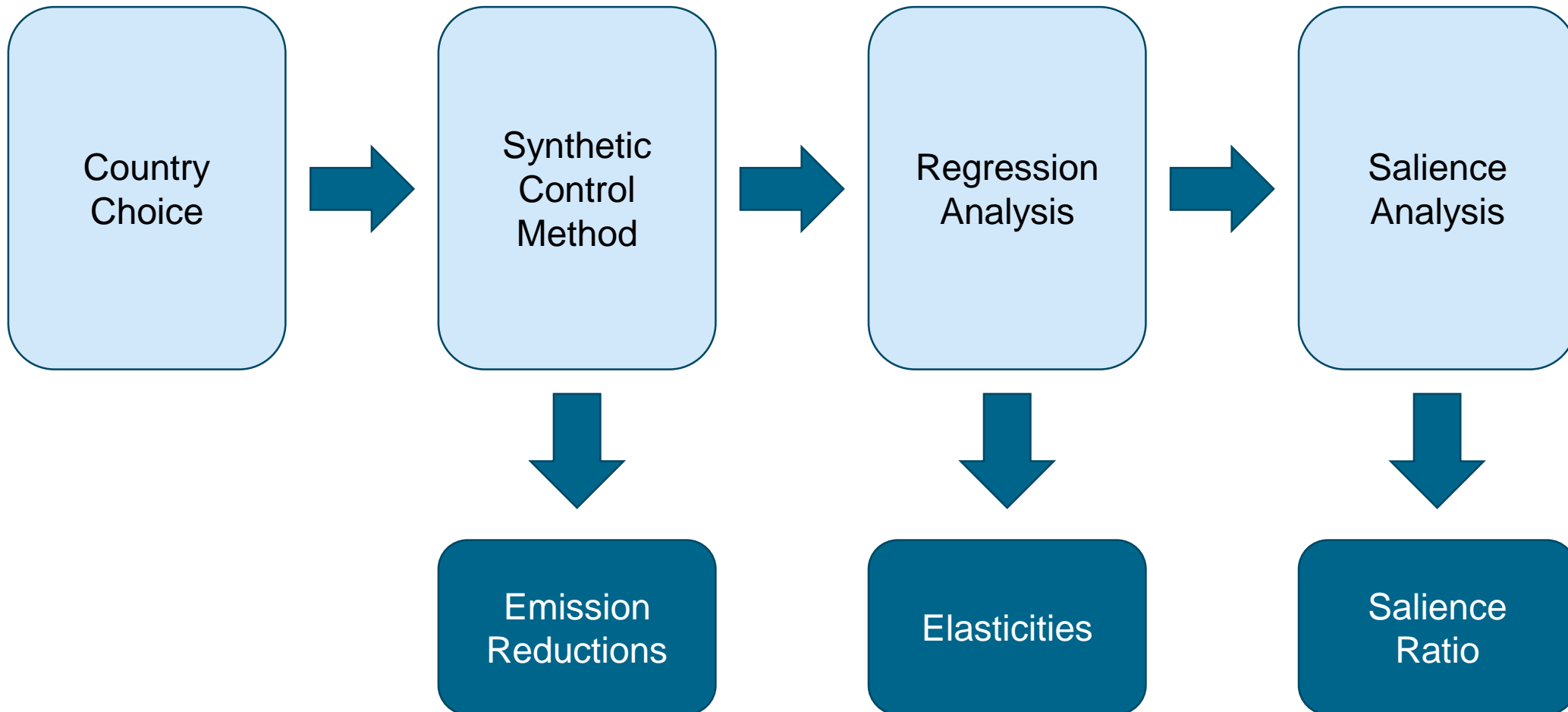
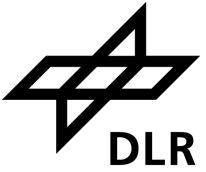
## **Emission Reduction from Fuel Tax Implementations**

How do fuel taxes reduce carbon emissions?

## **Perception of Tax Implementations**

Do fuel taxes have a bigger impact on emission reduction than fuel prices?

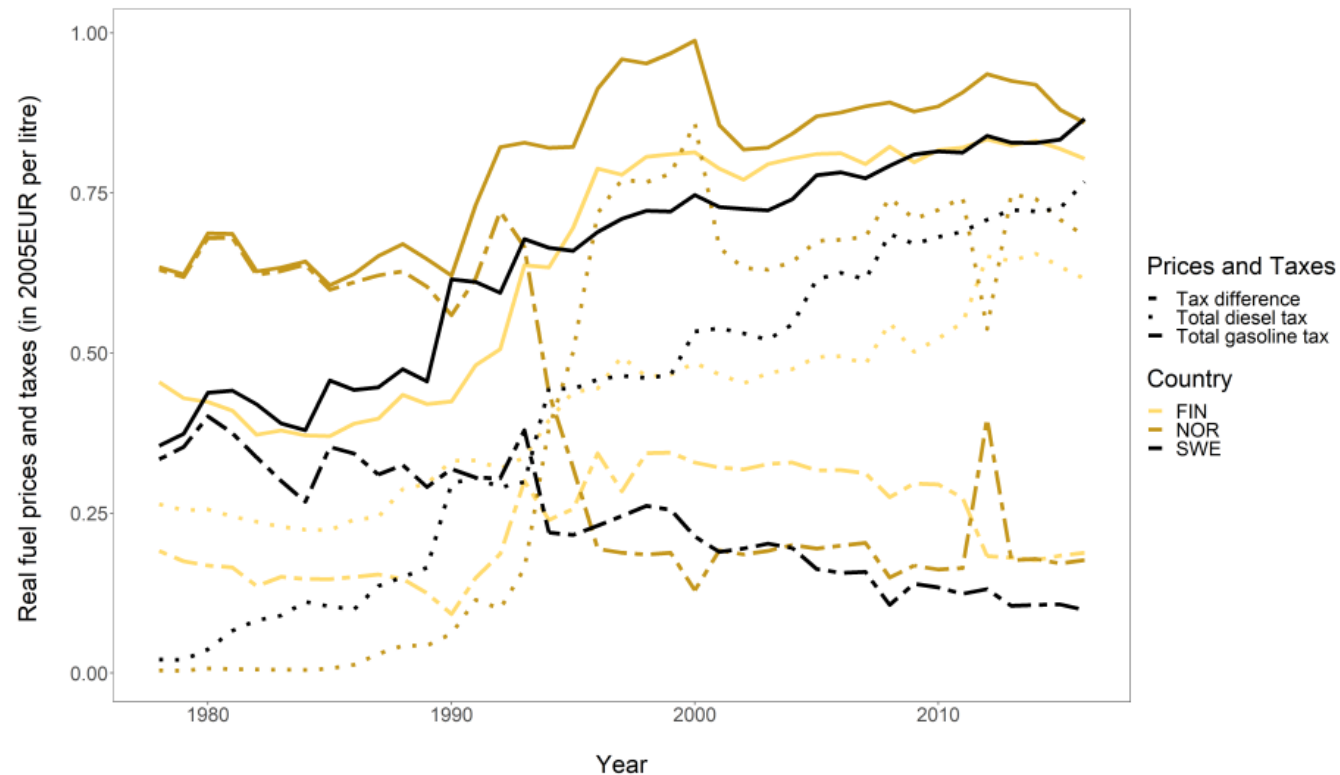
# Research Design



# Methodology – Country Choice



- Early tax implementation in three European countries in the North
  - Finland
  - Sweden
  - Norway



# Methodology - Synthetic Control Method



- Ex-post analysis
- Relaxed „parallel trends assumption“ is relaxed compared to DiD
- Data-driven method to estimate an optimal synthetic unit
- Key parameters: GDP per capita, Urbanization level, Total fuel consumption, Gasoline Share of total fuel consumption
- Time frame: 1990 to 2005
- Donor pool: OECD countries with exclusions

# Methodology – Tax Saliency



## Regression Analysis

OLS regression with instrumented variables

Elasticities of decomposed fuel price in tax and ex-tax price

Time frame: 1978 to 2015

Control variables: Trend, GDP per capita, Urban Population, Unemployment rate

$$\tau_{t,total}^v = \left( \sum^i \tau_{t,i} \right) \text{VAT}_t$$

$$p_t^v = p_t^* - \tau_{t,total}^v$$

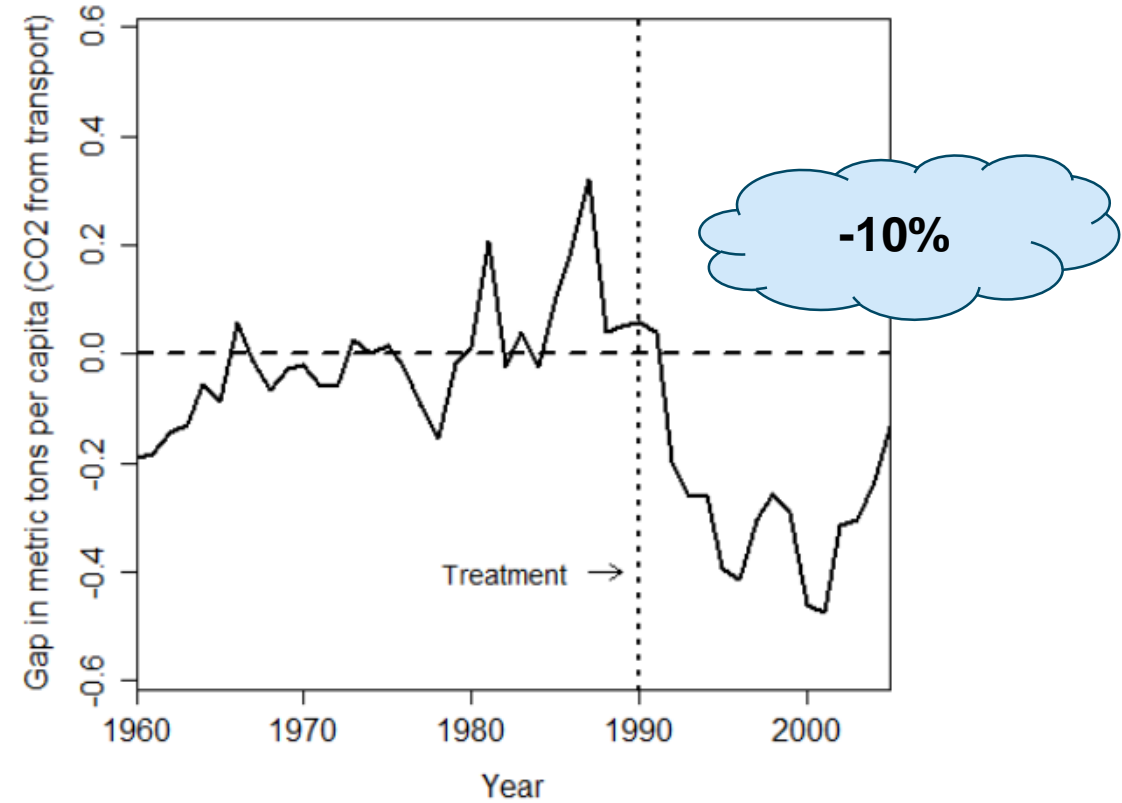
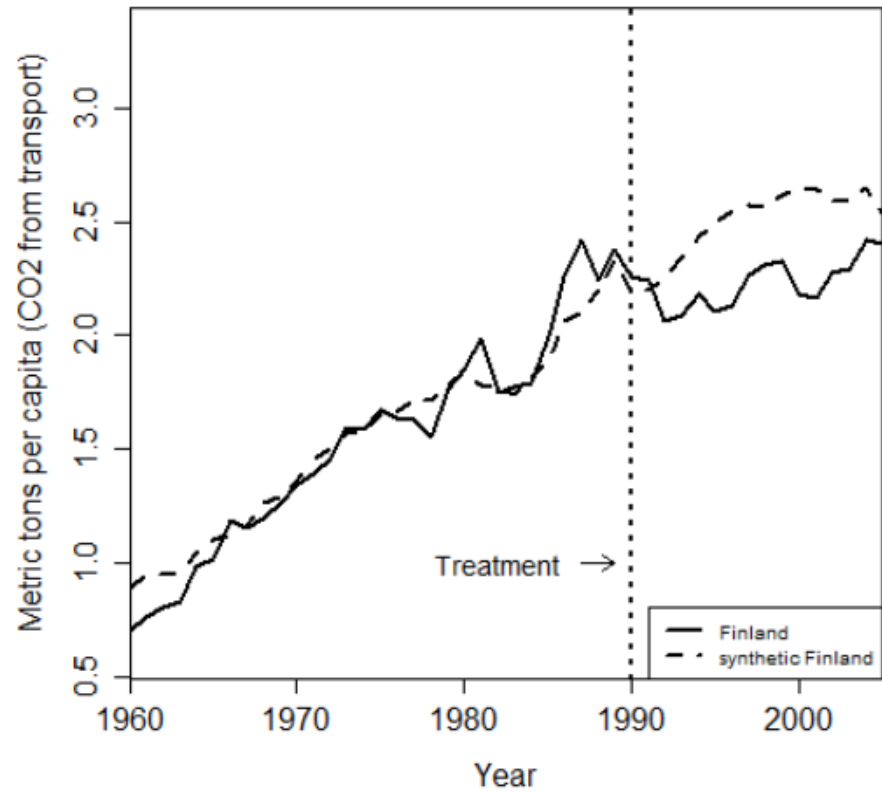


## Saliency Analysis

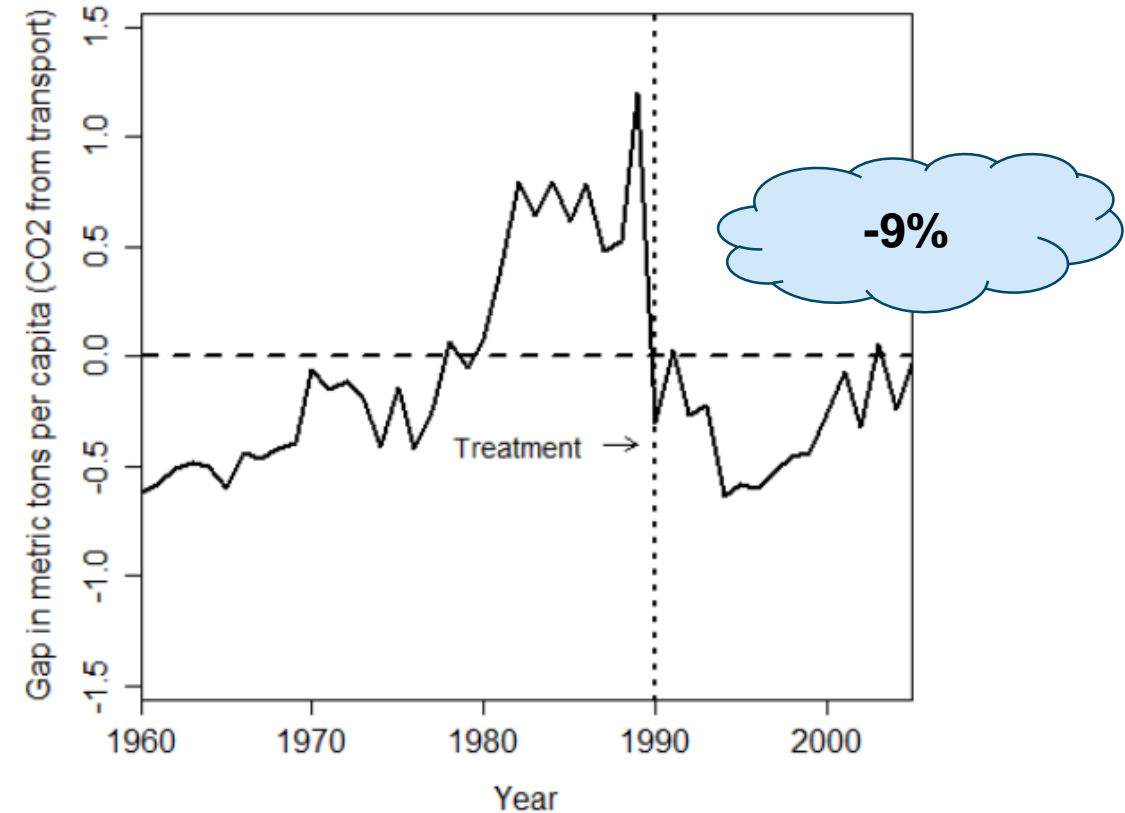
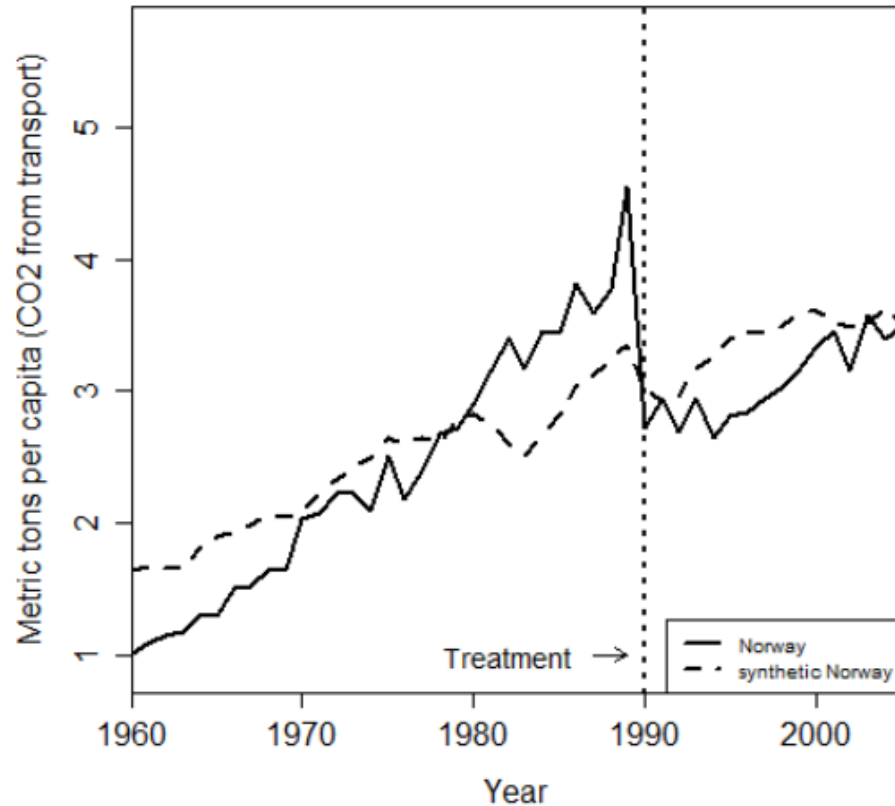
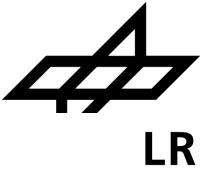
Tax effect = Ex-tax fuel price effect ?

If tax effect > ex-tax fuel price effect tax saliency is evident.

# Results – Emission Reduction - Finland



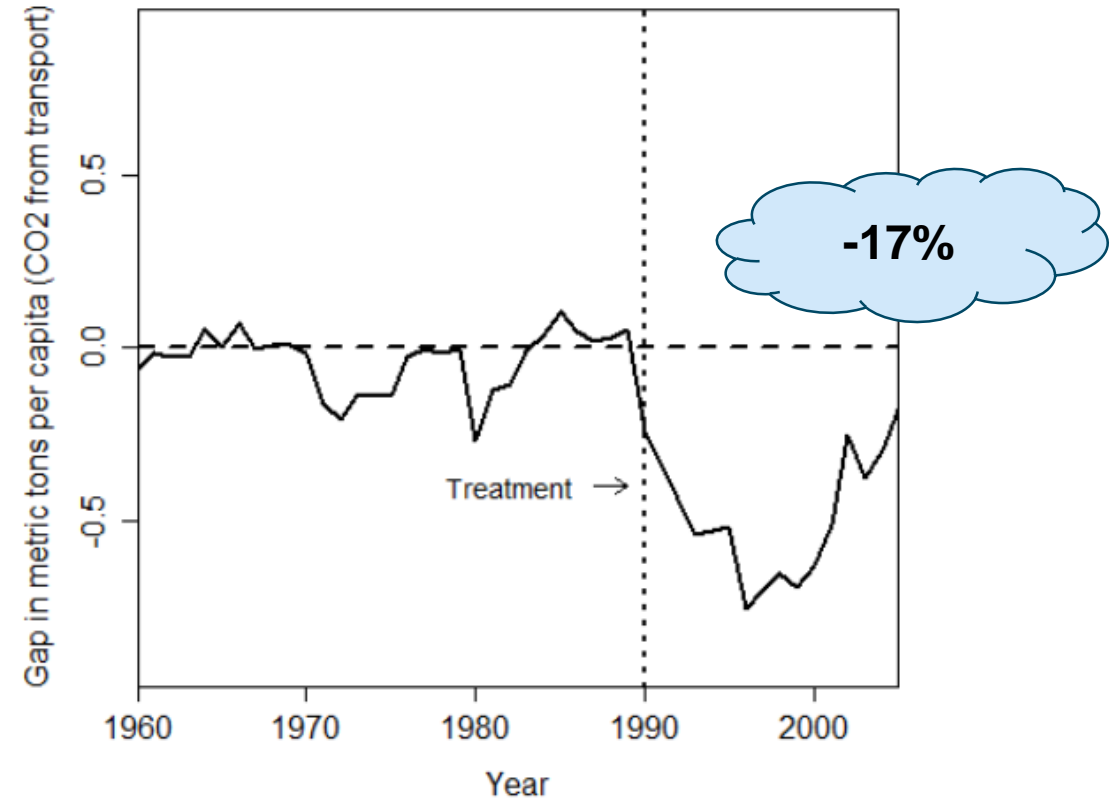
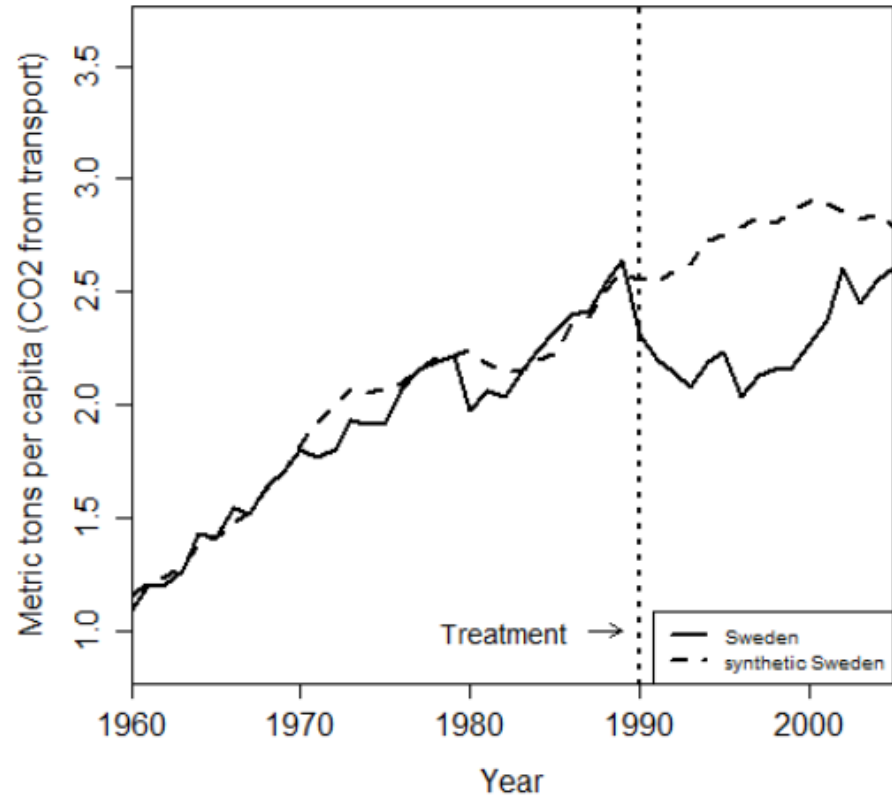
# Results – Emission Reduction - Norway



- Bad fit due to massive economic growth in the pre-treatment period



# Results – Emission Reduction - Sweden



# Results – Tax Saliency



- No significant results for total excise taxes in Norway and Sweden

OLS with control variables	Finland	Sweden (Carbon Tax)	Andersson (2019)
Ex-Tax Effect	-0.38**	-0.49**	-0.51**
Tax Effect	-0.41**	-0.88**	-1.57**
Saliency Ratio	1.1	1.8	3.1

Notes:

\*\*  $p < 0.01$

Saliency Ratio = Tax Effect / Ex-Tax Effect

Andersson, J. J. (2019). *Carbon Taxes and CO2 Emissions: Sweden as a Case Study*

- Carbon emissions can be reduced from environmental taxes (FI -10%; NO - 9%; SE -17%)
- Previous literature suggested that fuel taxes are salient in North America and Sweden
- No clear evidence for tax salience in Nordic European countries
- Problem:
  - No common framework how to quantify tax salience.
  - Price decomposition schemes and choice of control variables change tax elasticity estimates.
- Effects of environmental fuel taxes depend crucially on tax design, regulatory frameworks and country specific transport system

**Topic:** **How do Environmental Fuel Taxes effect Carbon Emissions?  
Analysis of Fuel Tax Effects in Nordic European Countries**  
WCTR 2023: World Conference on Transport Research

**Date:** 19.07.2023

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**Institute:** Institute of Transport Research

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