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# Carbon costs and industrial firm performance:

Evidence from international microdata

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# Findings

- 1. Carbon costs differ widely across countries, sectors, and over time**
- 2. Carbon costs do not significant affect performance of average firm**
- 3. Effect heterogeneity**
  - Employment reduction in Leakage sectors (small firms) and capital-intensive firms
  - Leakage sectors show increased investment,  
but no increase in losses and exit probability

# Motivation and contributions

## 1. Multidimensionality

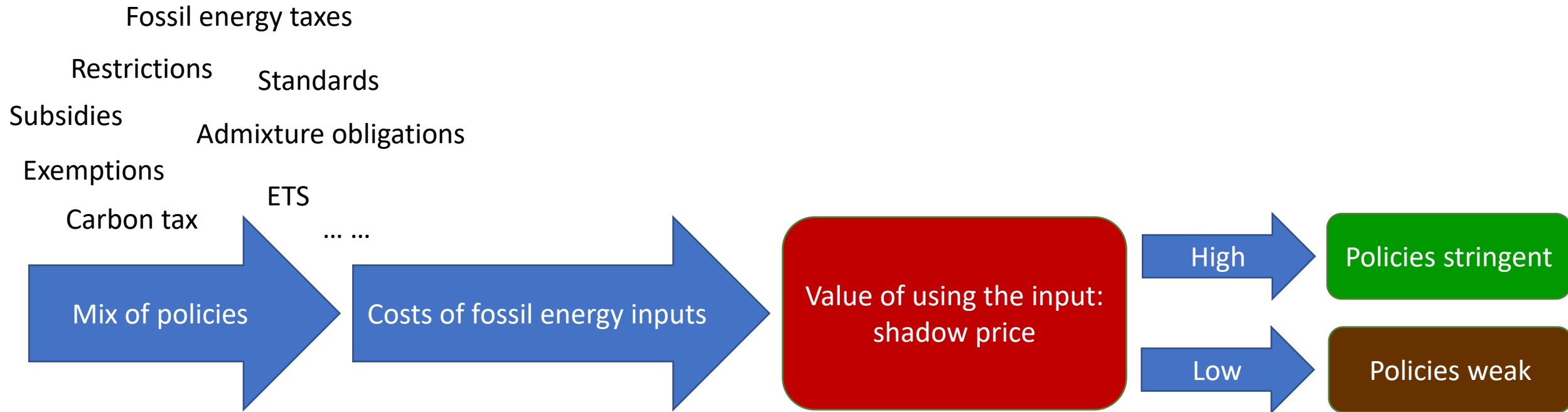
- Integral carbon costs: shadow prices of fossil energy
- 15 industrial sectors, 32 countries, 2000-2014
- Much higher than explicit carbon prices
- Large variation

## 2. External validity

- International microdata: BvD Orbis Historical
- ~ 20 mln firm-year observations, 2000-2019
- Good representation of small and large firms
- Focus on national firms (unconsolidated statements)



# Shadow prices of fossil energy



(see: Van Soest et al., 2006; Althammer and Hille, 2016)

# FE-IV model

$$\text{Firm performance}_{isct} = \beta \text{Carbon costs}_{sct} + \text{Controls}'_{isct} \gamma + \alpha_i + \delta_t + \epsilon_{isct}$$

1. **Sales revenue**
2. **Investment:** growth of Tangible fixed assets
3. **Employment:** number of employees
4. **Productivity:** TFP
5. **Profitability:** ROA (Net income/Total assets)
6. **Firm exit:** binary var. (1 after last reported year)

## Firm and time fixed effects

Robustness: *sector-by-time FE, and no FE*

**Controls:** Size, leverage, GDP per capita

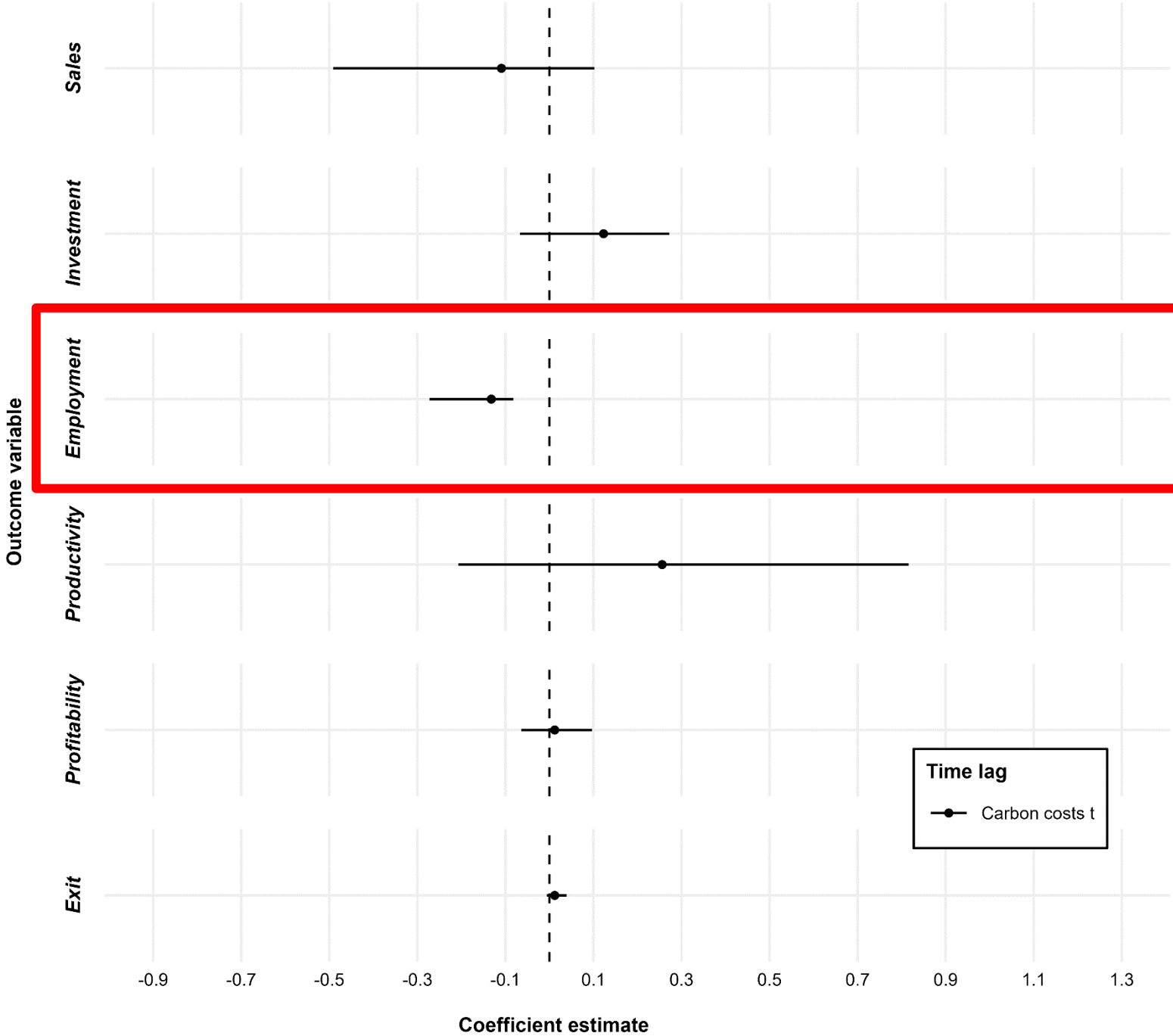
Robustness: asset tangibility, and no controls

**Errors:** Wild bootstrapped, clustering at both Country and Sector levels

# Effects for average firm

Only significant employment reduction

Longer-run effects are somewhat larger



# Trade-off between economy and environment

## Illustration for carbon cost increase by USD 50/tCO<sub>2</sub>e

- Employment -2.5%
- Environmental benefits: national industrial CO<sub>2</sub>-emissions -10% to -20%
  - Simulations for France (Marin and Vona, 2021) and NL respectively (Bollen et al., 2020)

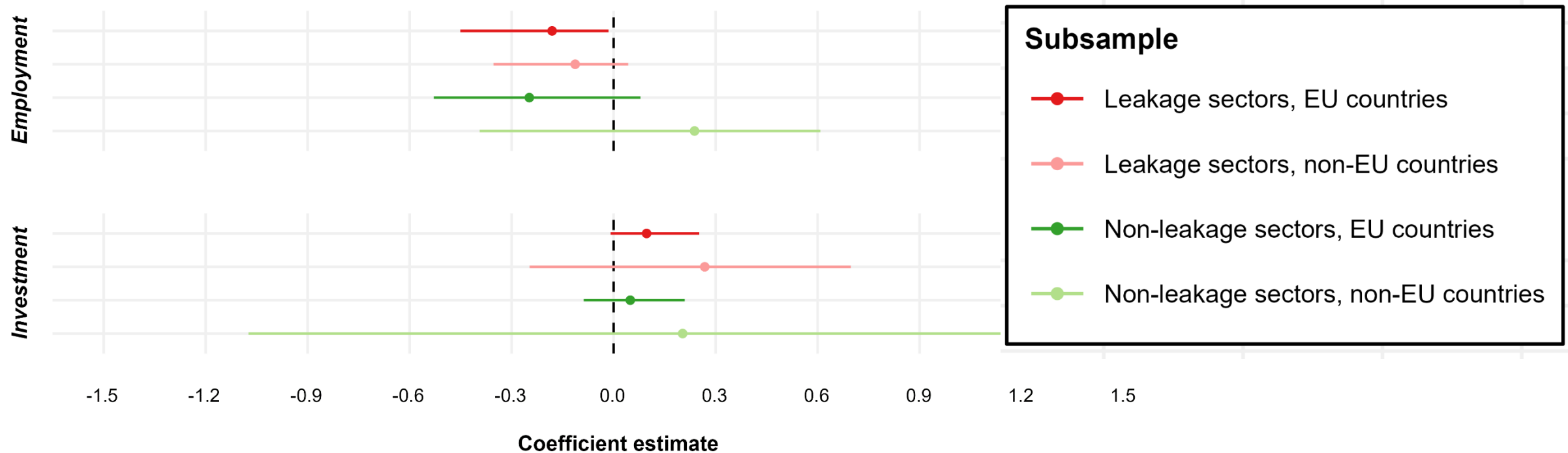
### Note:

Economic damage can be highly local, due to concentration in clusters and small number of firms





# Effects are most clearly observed in EU countries



# Conclusions and discussion

1. **International evidence, integral measure of carbon costs**
2. **Little evidence for adverse economic effects and relocation**
3. **Effects concentrated in small subgroups (mainly leakage sectors)**

➔ **Explanations:** Adjustment, anticipation, other performance drivers, still relatively low costs

➔ **Relocation and leakage in the future:**

- Consider relative stringency and integral perspective
- CGE models inform about potential long-term sectoral effects
- Analyze policies to mitigate leakage (CBAM, subsidies, standards, green product demand, ...)



# Thank you!

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***CPB Discussion Paper***

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