Difference-in-Differences Design

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Applications of DID:
Corporate tax and Labor Demand

Empirical Example: Clemens Fuest et. al (2018)

Clemens Fuest, Andreas Peichl, and Sebastian Siegloch (2018) "**Do Higher Corporate Taxes Reduce Wages? Micro Evidence from Germany**" AER

- The authors estimates the causal effect of corporate taxes on workers' wages using DID method

Empirical Example: Clemens Fuest et. al (2018)

Motivation

- The incidence of corporate taxation is a key issue in public debates
- The distribution of the tax burden between labor and capital has important policy implications
  - Capital owners bear the burden of corporate taxation?
  - Workers bear the tax burden?
  - Tax reduces investment so that labor productivity and wages decline
- Credible empirical evidence on the causal effect of corporate taxes on wages is scarce

Empirical Example: Clemens Fuest et. al (2018)

Background

- They use DID method by exploiting the change in German local business tax (LBT) to identify the corporate tax incidence on wages
- From 1993 to 2012, on average about 10 percent of all municipalities adjusted their LBT rates annually
  - There are 17,999 tax changes in 10,001 municipalities between 1993 and 2012
  - Municipalities can only change the LBT rate
  - The tax base definition and rules are determined at the federal level

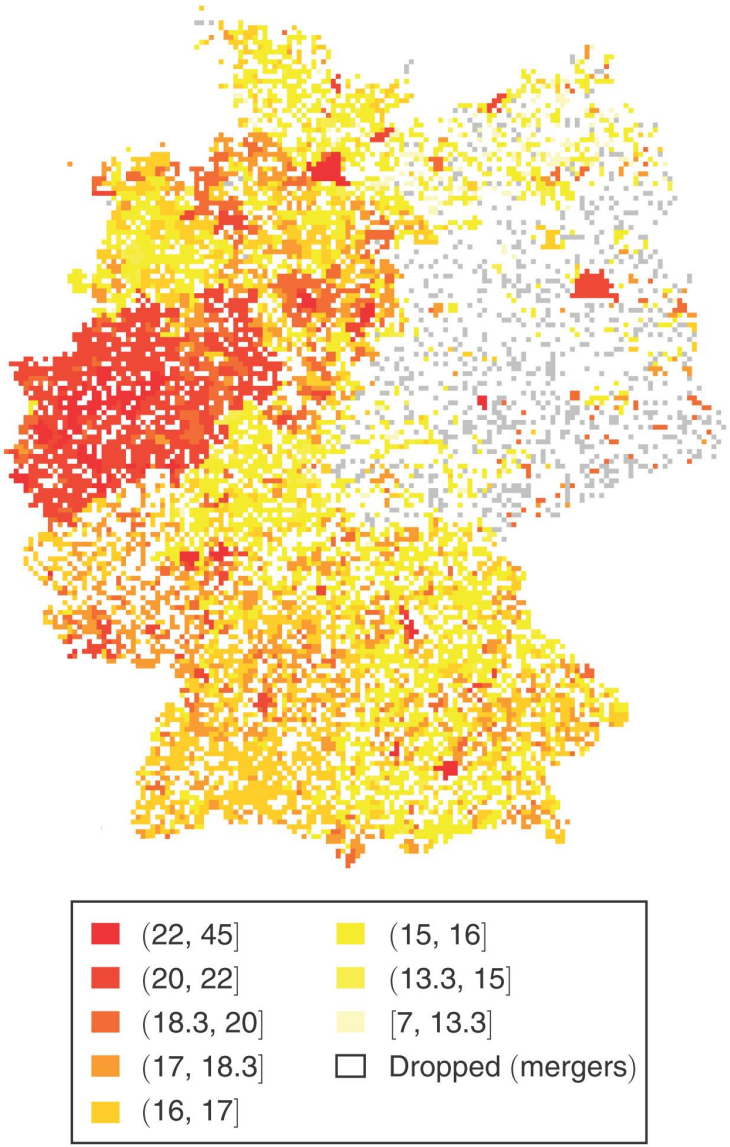
Empirical Example: Clemens Fuest et. al (2018)

Background

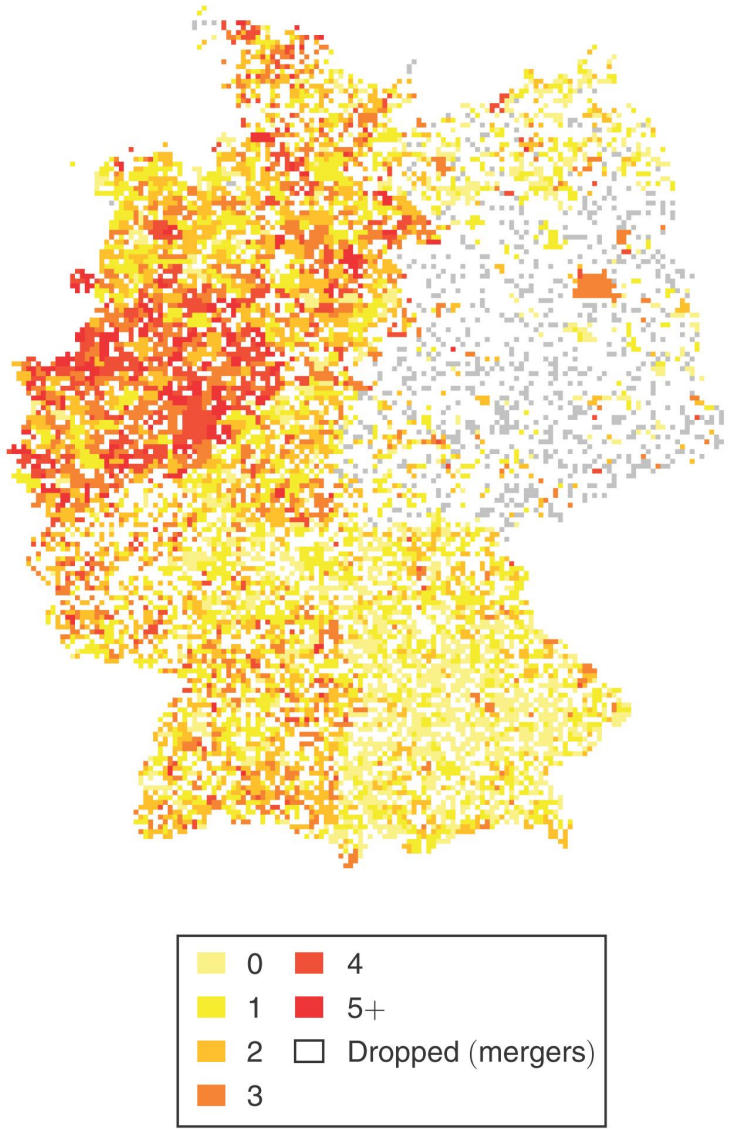
- LBT rate τ_{LBT} consists of two components:
  1. The basic rate t_{LBT}^{fed} is set at the federal level
  2. A local scaling factor θ_{LBT}^{mun}
     - Each year, the municipal council votes on next year's θ_{LBT}^{mun}
- The total LBT rate is given by
  - $\tau_{LBT} = t_{LBT}^{fed} \cdot \theta_{LBT}^{mun}$
- Their analysis relies on variation in τ_{LBT} induced by changes in θ_{LBT}^{mun}

LBT Rate and Local Scaling Factor

Panel A. Local tax rates in 2003



Panel B. Scaling factor changes per municipality, 1993–2012



Empirical Example: Clemens Fuest et. al (2018)

Data

- They use linked employer-employee data (LIAB) provided by the Institute of Employment Research (IAB)
- The LIAB combines administrative worker data with firm-level data
  - 1 percent stratified random sample of all German establishments
  - The term establishment refers to the fact that the observational unit is the individual plant, not the firm
  - Number of employees, industry, union status, self-rated profitability, and residence of the owner
  - It contains information on all employees in the sampled establishments: 1.6-2 million per year

Change in LBT Rate

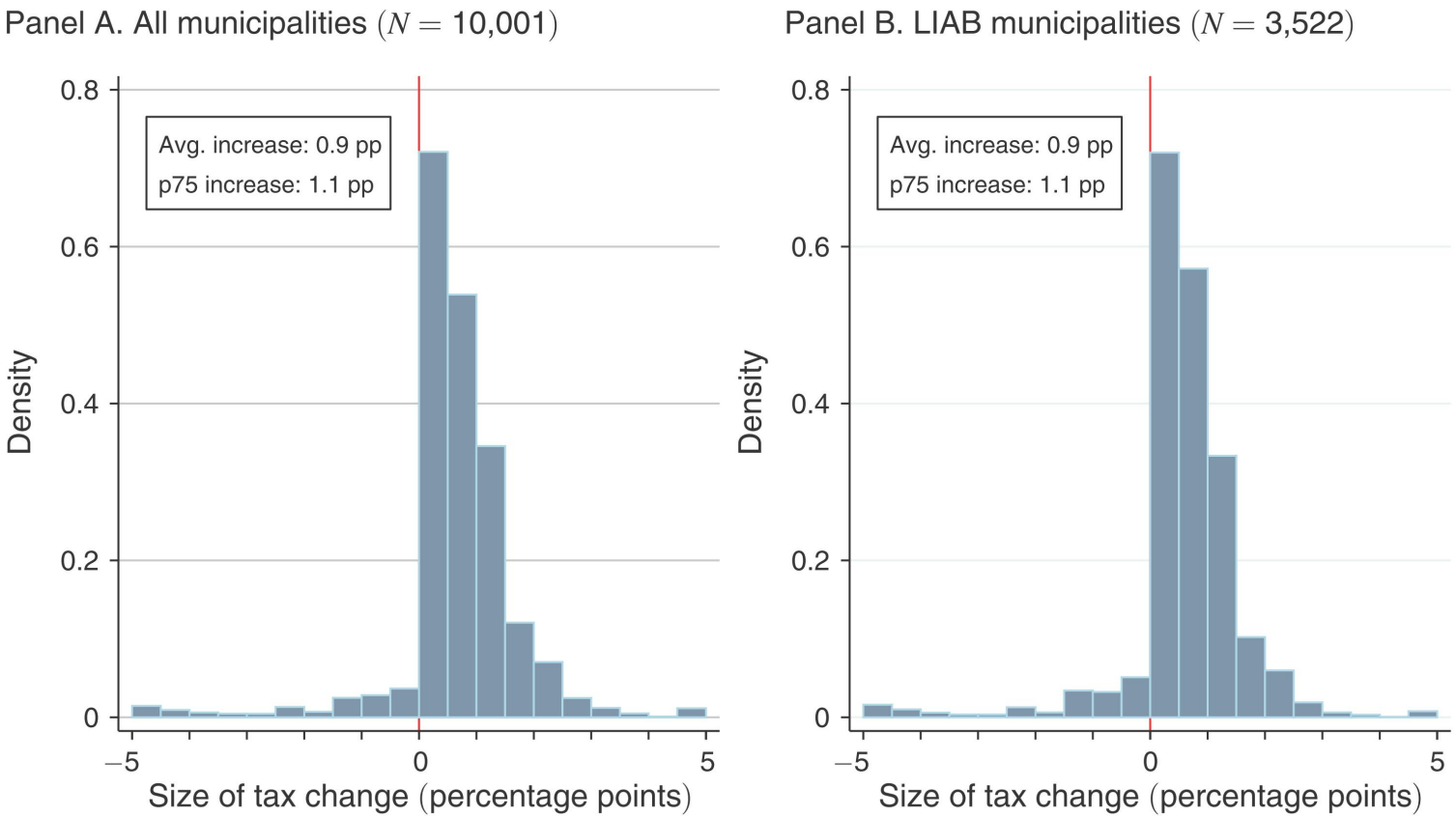


FIGURE 2. DISTRIBUTION OF LOCAL BUSINESS TAX CHANGES

Empirical Example: Clemens Fuest et. al (2018)

Identification Strategy

$$\ln w_{f,t}^{p50} = \sum_{j=-4}^{5} \gamma_j D_{m,t}^{j} + \mu_f + \mu_m + \psi_{s,t} + \varepsilon_{f,t}$$

- $\ln w_{f,t}^{p50}$: log median real full-time wage in firm f in year t
  - The firm f is located in municipality m, which is part of commuting zone (CZ) c and state s
- $D_{m,t}^{j}$: a set of dummies
  - Indicating an event happening j periods away in municipality m experiencing the following events:
    - Event 1: any LBT increase
    - Event 2: large tax increases
    - Event 3: tax decreases

Empirical Example: Clemens Fuest et. al (2018)

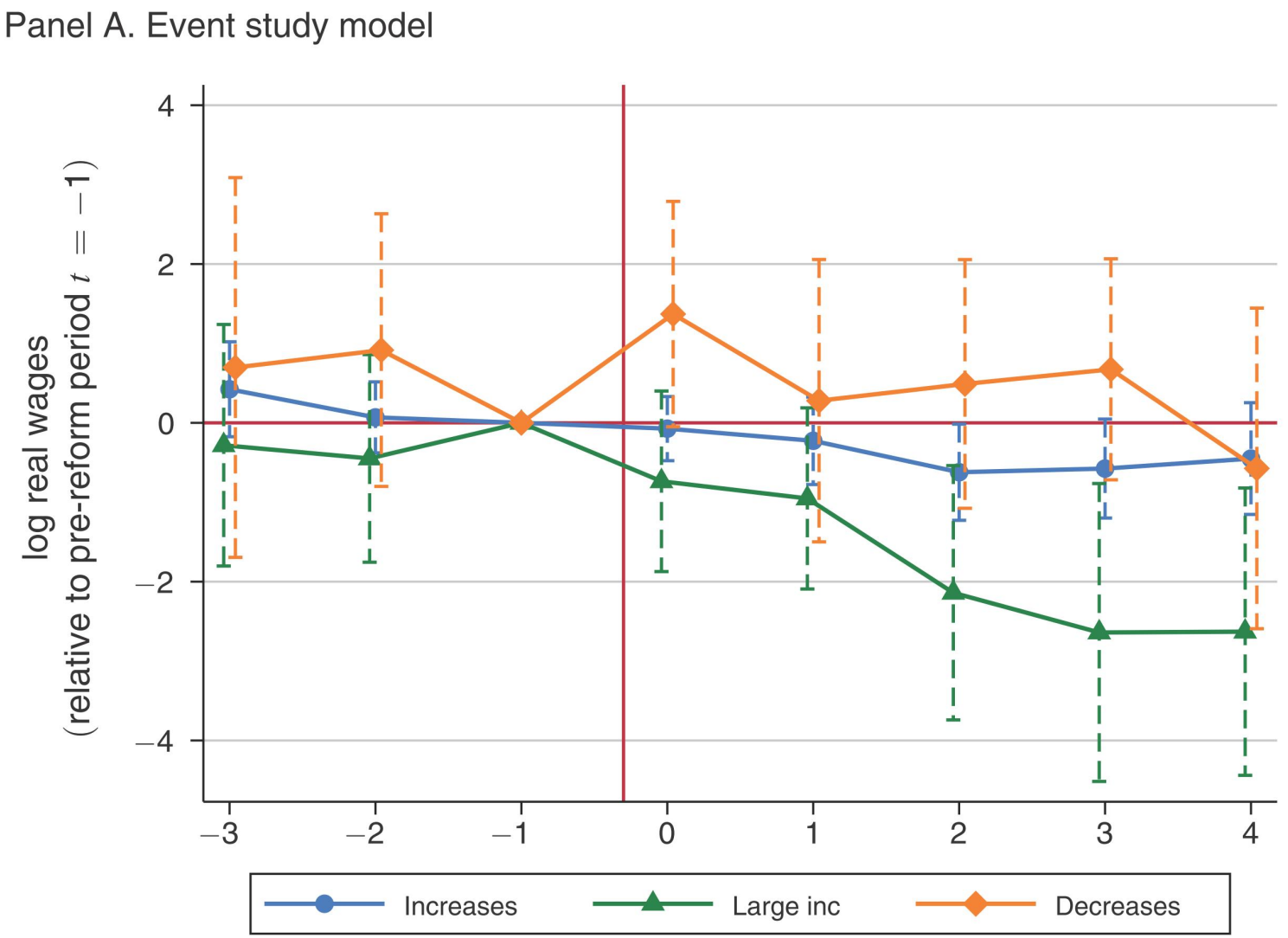
Identification Strategy

$$\ln w_{f,t}^{p50} = \sum_{j=-4}^{5} \gamma_j D_{m,t}^{j} + \mu_f + \mu_m + \psi_{s,t} + \varepsilon_{f,t}$$

- μ_f: firm-specific effect
- μ_m: municipality-specific effect
- $\psi_{s,t}$ state x year fixed effects

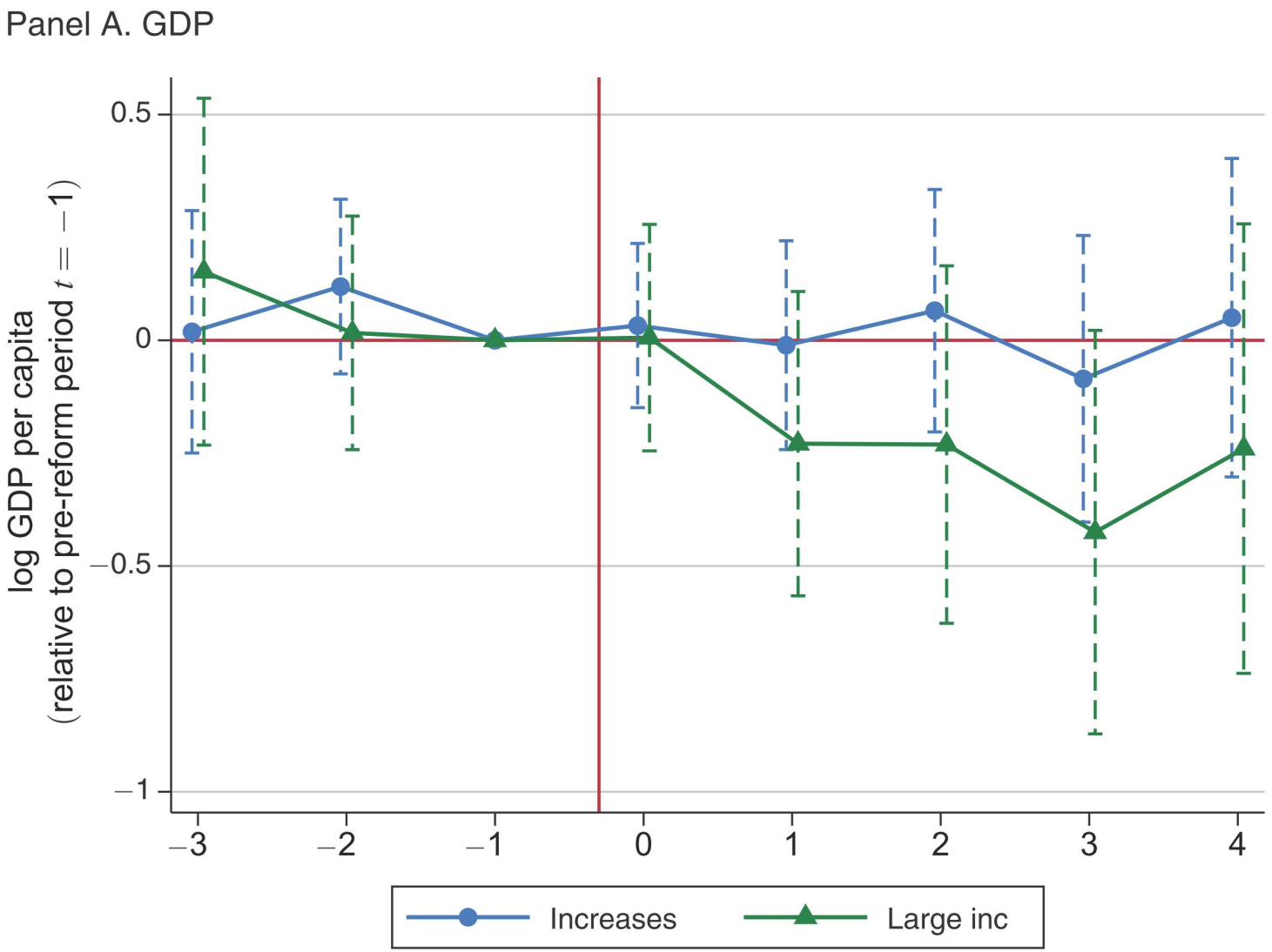
Examine Common Trend Assumption

Main Outcome



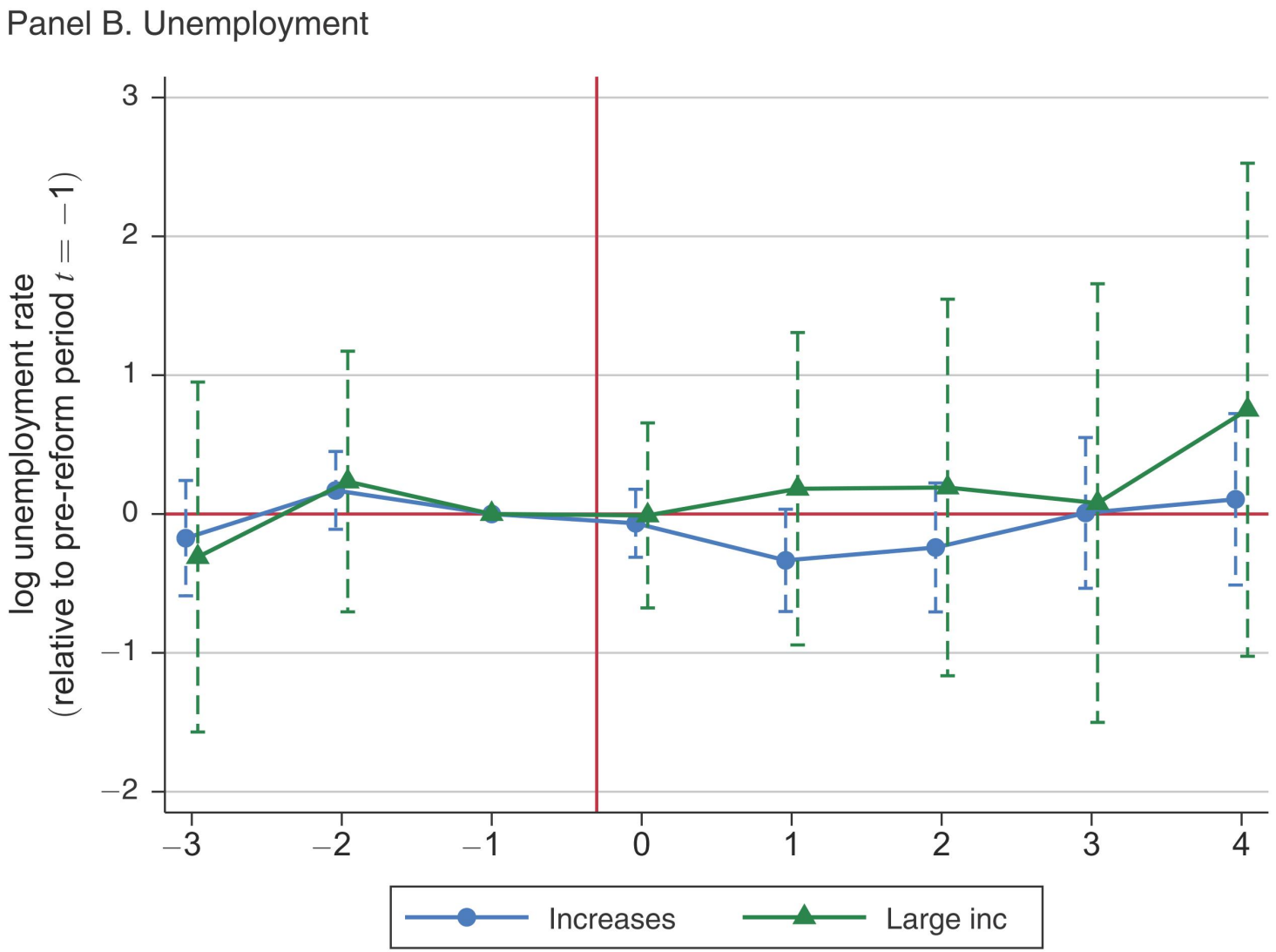
Examine Common Trend Assumption

Other Confounding Factors



Examine Common Trend Assumption

Other Confounding Factors



Empirical Example: Clemens Fuest et. al (2018)

Identification Strategy

- They use the following generalized DID model to estimate the average effect of a change in the LBT rate on wages

$$\ln w_{f,t}^{p50} = \delta \ln(1 - \tau_{m,t}) + \mu_f + \mu_m + \psi_{s,t} + \varepsilon_{f,t}$$

  - $1 - \tau_{m,t}$: net-of-tax rate
  - δ: measures the percent change in wages induced by a one percent increase in the net-of-tax rate

Empirical Example: Clemens Fuest et. al (2018)

Results

TABLE 1—DIFFERENCE-IN-DIFFERENCES ESTIMATES: BASELINE WAGE EFFECTS

	(1)	(2)	(3)	(4)	(5)	(6)
log net-of-LBT rate	0.388	0.229	0.386	0.396	0.343	0.399
	(0.127)	(0.110)	(0.127)	(0.128)	(0.164)	(0.118)
Incidence (I^w)	0.505	0.288	0.502	0.516	0.442	0.520
	(0.170)	(0.140)	(0.170)	(0.172)	(0.217)	(0.159)
"State × year" fixed effects	✓			✓	✓	✓
Year fixed effects		✓				
CZ × year fixed effects			✓			
Municipal controls $t-2$				✓		
Firm controls $t-2$					✓	
Worker shares						✓
Observations	44,654	44,654	44,654	44,654	25,241	44,654

Empirical Example: Clemens Fuest et. al (2018)

Results

- A 1 percent decline in the net-of-tax rate reduces wages by 0.39 percent
- They find that 51 percent of the corporate tax burden is passed onto workers
- Subgroup analysis:
  - Wage effects are close to zero for very large firms, foreign-owned firms, and for firms that operate in multiple jurisdictions
  - This can be explained by better profit-shifting capabilities of these firms
  - They also find that higher taxes reduce wages most for the low-skilled, women, and young workers