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# Do higher corporate taxes reduce wages?

## New evidence from Germany

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# 1. Introduction: Motivation



## Motivation

- Theoretical research (Auerbach 2006; Harberger 1962; Arulampalam/Devereux/Maffini 2012): higher business taxes reduce wages of employees (**tax incidence**) → relevant from **distributional perspective**!
- Expectations depend on assumptions regarding the mobility of capital and labor, the substitution of products, the substitutability of production factors, the bargaining framework, tax avoidance opportunities and the level of observation (Riedel 2011; Clausing 2012; Gravelle 2013)

## Empirical evidence on the incidence of corporate income taxation

- Mixed evidence with the share of corporate taxation falling on labor ranging from about 19% (Dwenger/Rattenhuber/Steiner 2017) to more than 50% (Arulampalam/Devereux/Maffini; Hassett/Mathur 2015)
- Recent meta study of Knaisch/Pöschel (2021) finds a relatively small semi-elasticity on wages (-0.11 to -0.24) and evidence for a publication bias
- Fuest/Peichl/Siegloch (2018) find for the German local business tax evidence a high elasticity of 0.388 (suggesting 50% burden on labor)

# 1. Introduction: Contribution



## Bench mark estimate of Fuest/Peichl/Siegloch (FPS, AER 2018)

1. Labor bears about 50% of the burden of the German local business tax with larger burden on manufacturing firms
2. Limited sample size for the universe of all German firms (44,464 observations over a period of 10 years; about 5,000 firms)
3. Bench mark estimate of FPS 2018 does not explicitly account for the FA regime of the German local business tax (Riedel 2010; Eichfelder/Hechtner/Hundsdoerfer 2018) or delays in shifting tax burdens on wages

## Findings of our study

1. **Weaker average** effect than FPS 2018  
→ **full sample of manufacturing sector**
2. Only significant evidence for analyses of **multi-establishment firms** at the **establishment level** → findings seem to be largely driven by **formula apportionment** and **tax avoidance** instead of **tax incidence**

## 2. Institutional setting and data



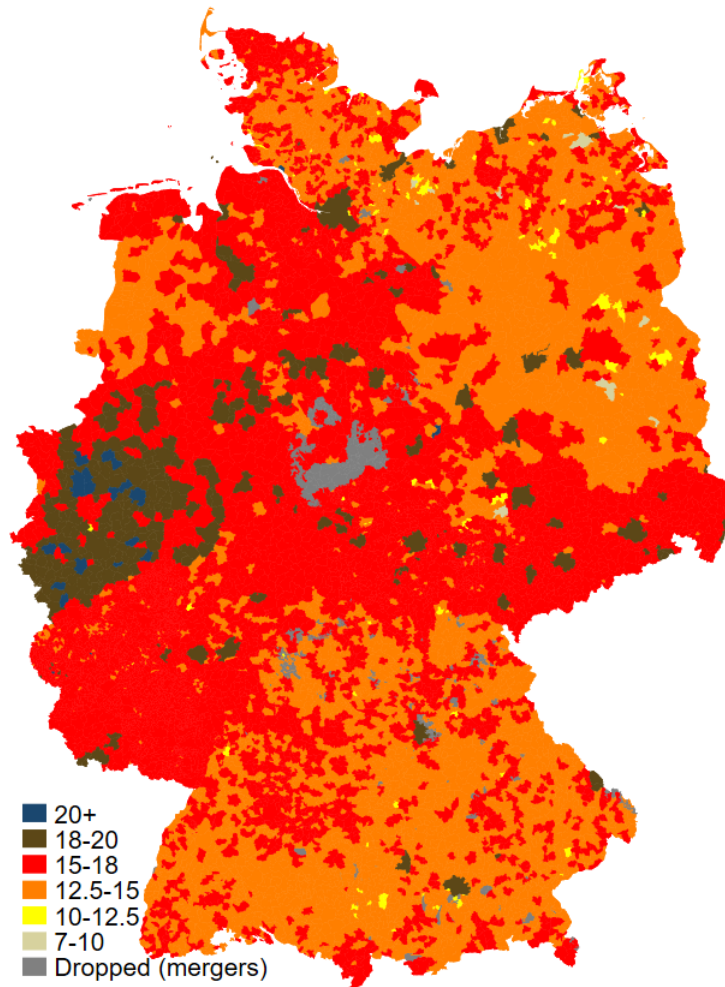
### German local business tax

- Local business tax with a basic rate (3.5% since 2008) and a local multiplier
- Local tax multiplier is set by the municipality → high variation of tax rates
- Formula apportionment regime with wages as sole apportionment factor for firms with establishments in different municipalities

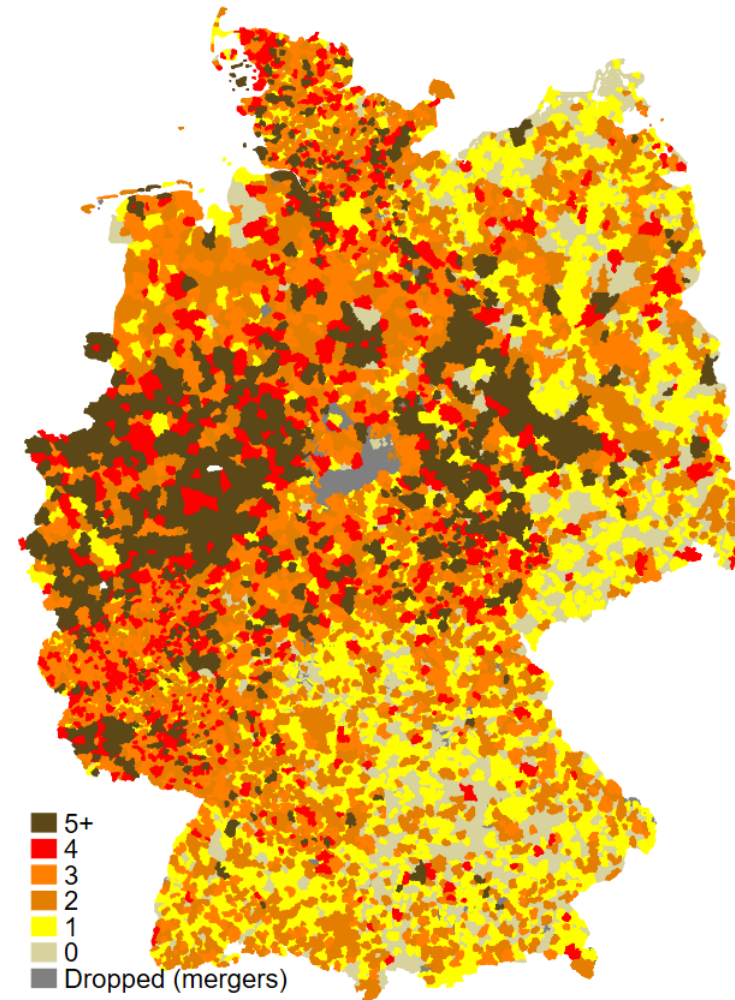
### AfiD panel Industriebetriebe

- High-quality administrative data of the German manufacturing sector (mandatory survey of a full sample of establishments with at least 20 employees!) → large incidence effects? (Gravelle 2013; FPS 2018)
- Information on wages and working hours at the establishment level → average wages per hour instead of median wages per hour in FPS 2018
- Observation period from 1995 to 2014 allows for a replication of the methodology of FPS 2018 for a sample from 2001 to 2010 (431,290 observations for about 50,000 establishments)

## 2. Institutional setting and data



LBT rates in 2014



LBT rate variations 1995-2014

### 3. Theory and empirical strategy



#### Theoretical background:

- **Tax incidence** (Gravelle 2013; Fuest/Peichl/Siegloch 2018):
  - Higher business taxes in a municipality reduce wages per hour
  - Adjustments of real wages take time → **delayed** effect
  - Effects should be observable at the **firm and the establishment** level
- **Formula apportionment and avoidance opportunities** (McLure 1981; Riedel 2010; Eichfelder/Hechtner/Hundsdoerfer 2018):
  - Firms with multiple establishments reallocate wages to low-tax municipalities → **only** observable at the **establishment** level
  - Tax avoidance activities should not take much time → **no delay**

**H1a:** Tax incidence will result in similar effects on **single- and multi-establishment** firms with **relevant delays, or**

**H1b:** Formula apportionment will only result in effects on **multi-establishment** firms at the establishment level **without delay.**

### 3. Theory and empirical strategy



#### Event study model

$$\text{Log wage}_{i,j,s,t} = \sum_{i=-4}^5 \beta_i \cdot D_{m,t}^v + \mu_i + \mu_j + \lambda_{s,t} + u_{i,t}$$

#### Distributed lag model

$$\text{Log wage}_{i,j,s,t} - \text{Log wage}_{i,j,s,t-1} = \sum_{i=-4}^5 \beta_j \cdot \left[ \ln(1 - \tau_{j,t-v}) - \ln(1 - \tau_{j,t-v-1}) \right] + \lambda_{s,t} + u_{i,t}$$

#### Generalized difference-in-differences model

$$\text{Log wage}_{i,j,s,t} = \ln(1 - \tau_{j,t}) + \mu_i + \mu_j + \lambda_{s,t} + u_{i,t}$$

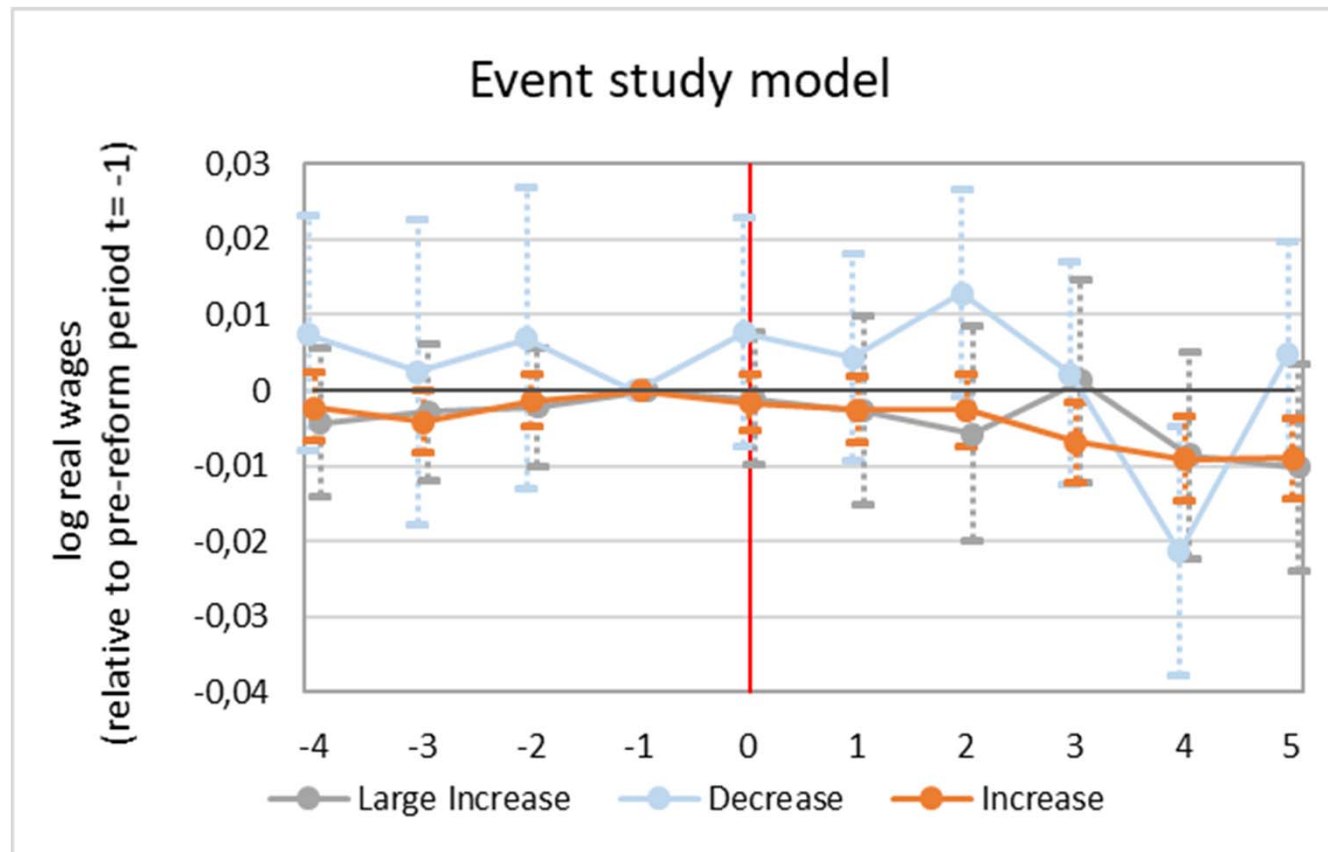
#### Main variables

- $\text{Log wage}_{i,j,s,t}$ : logarithm of the average wage per working hour of establishment  $i$ , municipality  $j$ , state  $s$  and time  $t$
- $\ln(1 - \tau_{j,t})$ : logarithm of the net of one minus the LBT rate
- $D_{m,t}$ : dummy variable for tax rate increases/decreases
- Establishment FE  $\mu_i$ , municipality FE  $\mu_j$ , and state and year FE



### 3. Theory and empirical strategy

#### Trend analysis – Event-study model on common trends

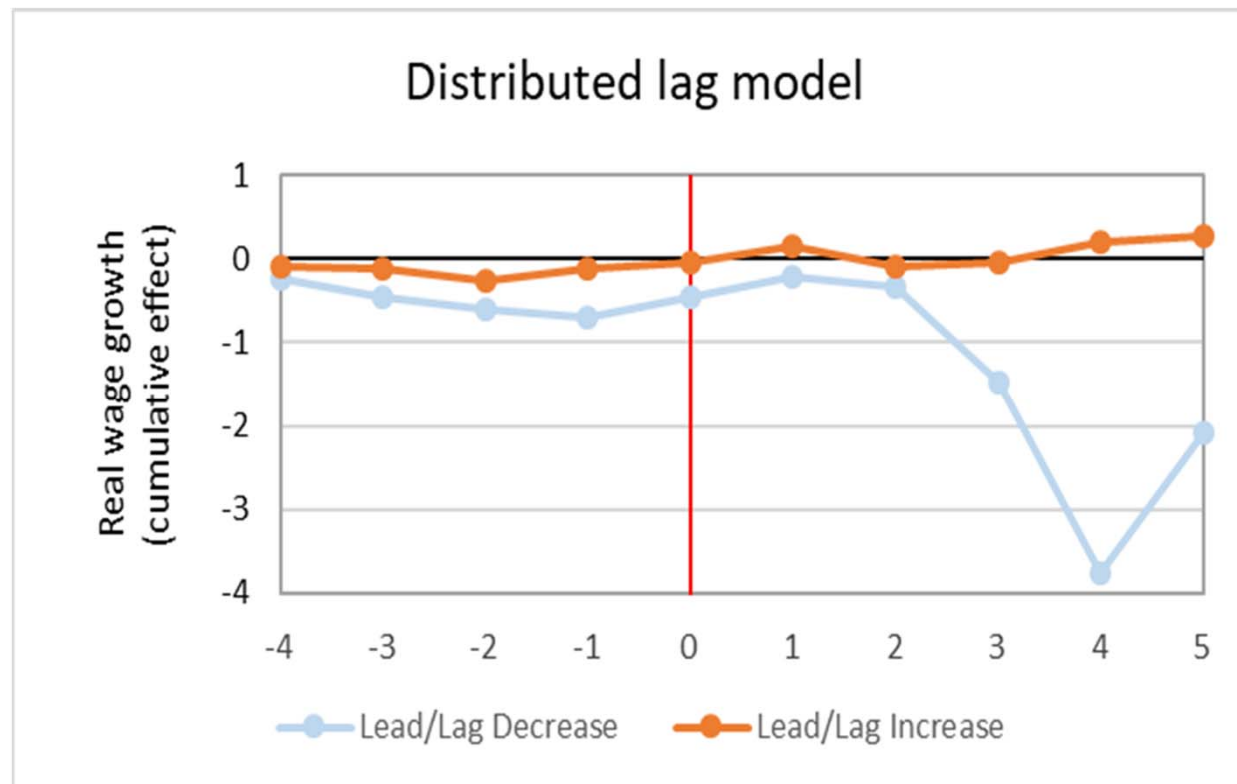




### 3. Theory and empirical strategy



#### Trend analysis – Event-study model on common trends



## 4. Results: Baseline results



| Model                            | 1                                  | 2                                | 3                                 | 4                                 | 5                                  | 6                                 |
|----------------------------------|------------------------------------|----------------------------------|-----------------------------------|-----------------------------------|------------------------------------|-----------------------------------|
| Dependent variable               | Log wage                           | Log wage                         | Log wage                          | Log wage                          | Log wage                           | Log wage                          |
| <b>Log net-of-LBT rate</b>       | <b>0.224***</b><br><b>(0.0855)</b> | <b>0.138*</b><br><b>(0.0759)</b> | <b>0.179**</b><br><b>(0.0880)</b> | <b>0.169**</b><br><b>(0.0788)</b> |                                    | <b>0.103</b><br><b>(0.101)</b>    |
| <b>Log net-of-LBT rate (t-1)</b> |                                    |                                  |                                   |                                   | <b>0.280***</b><br><b>(0.0853)</b> | <b>0.210**</b><br><b>(0.0977)</b> |
| Establishment controls t-2       | No                                 | No                               | No                                | Yes                               | Yes                                | Yes                               |
| County controls t-2              | No                                 | No                               | Yes                               | No                                | Yes                                | Yes                               |
| Establishment FE                 | Yes                                | Yes                              | Yes                               | Yes                               | Yes                                | Yes                               |
| Municipality FE                  | Yes                                | Yes                              | Yes                               | Yes                               | Yes                                | Yes                               |
| Year FE                          | No                                 | Yes                              | No                                | No                                | No                                 | No                                |
| Year x state FE                  | Yes                                | No                               | Yes                               | Yes                               | Yes                                | Yes                               |
| Observations                     | 431,290                            | 431,290                          | 330,340                           | 371,021                           | 425,451                            | 425,113                           |
| Adjusted within R <sup>2</sup>   | 0.0204                             | 0.0175                           | 0.0377                            | 0.0363                            | 0.0208                             | 0.0208                            |

Dependent variable is the logarithm of the average wage per employee of establishment  $i$  in year  $t$ ; Log net-of-LBT rate is the logarithm of the net-of-tax rate; establishment controls include the logarithm of the number of employees in  $t-2$ ; county controls include the logarithm of the GDP per capita, the logarithm of population counts and the unemployment rate in percentage points; we cluster standard errors at the establishment level and perform regressions by OLS; t-values are in parentheses; \*\*\*/\*\*/\* significant on 1 %/ 5 %/ 10 %-level.

## 4. Results: Firm types



| Model                            | 1                                 | 2                                | 3                                | 4                                 | 5                                 | 6                                |
|----------------------------------|-----------------------------------|----------------------------------|----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|
| Firm type                        | Single                            | Single                           | Single                           | Multi                             | Multi                             | Multi                            |
| Dependent variable               | Log wage                          | Log wage                         | Log wage                         | Log wage                          | Log wage                          | Log wage                         |
| <b>Log net-of-LBT rate</b>       | <b>-0.0165</b><br><b>(0.0993)</b> |                                  | <b>-0.0966</b><br><b>(0.126)</b> | <b>0.484***</b><br><b>(0.151)</b> |                                   | <b>0.340**</b><br><b>(0.168)</b> |
| <b>Log net-of-LBT rate (t-1)</b> |                                   | <b>0.0809</b><br><b>(0.0951)</b> | <b>0.144</b><br><b>(0.115)</b>   |                                   | <b>0.459***</b><br><b>(0.159)</b> | <b>0.241</b><br><b>(0.176)</b>   |
| Establishment FE                 | Yes                               | Yes                              | Yes                              | Yes                               | Yes                               | Yes                              |
| Municipality FE                  | Yes                               | Yes                              | Yes                              | Yes                               | Yes                               | Yes                              |
| Year x state FE                  | Yes                               | Yes                              | Yes                              | Yes                               | Yes                               | Yes                              |
| Observations                     | 306,232                           | 302,238                          | 302,006                          | 125,058                           | 123,213                           | 123,107                          |
| Adjusted within R <sup>2</sup>   | 0.0300                            | 0.0305                           | 0.0304                           | 0.00848                           | 0.00873                           | 0.00877                          |

Dependent variable is the logarithm of the average wage per employee of establishment  $i$  in year  $t$ ; Log net-of-LBT rate is the logarithm of the net-of-tax rate; we cluster standard errors at the establishment level and perform regressions by OLS; t-values are in parentheses; \*\*\*/\*\*/\* significant on 1 %/ 5 %/ 10 %-level.

## 4. Results: Single establishments



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| Model                          | 1                                 | 2                                | 3                                 | 4                              | 5                                 | 6                              |
|--------------------------------|-----------------------------------|----------------------------------|-----------------------------------|--------------------------------|-----------------------------------|--------------------------------|
| Dependent variable             | Log wage                          | Log wage                         | Log wage                          | Log wage                       | Log wage                          | Log wage                       |
| <b>Log net-of-LBT rate</b>     | <b>-0.0165</b><br><b>(0.0995)</b> |                                  |                                   |                                |                                   |                                |
| <b>Log net-of-LBT rate t-1</b> |                                   | <b>0.0869</b><br><b>(0.0951)</b> |                                   |                                |                                   |                                |
| <b>Log net-of-LBT rate t-2</b> |                                   |                                  | <b>0.00567</b><br><b>(0.0913)</b> |                                |                                   |                                |
| <b>Log net-of-LBT rate t-3</b> |                                   |                                  |                                   | <b>0.160</b><br><b>(0.109)</b> |                                   |                                |
| <b>Log net-of-LBT rate t-4</b> |                                   |                                  |                                   |                                | <b>0.233***</b><br><b>(0.101)</b> |                                |
| <b>Log net-of-LBT rate t-5</b> |                                   |                                  |                                   |                                |                                   | <b>0.163</b><br><b>(0.101)</b> |
| Establishment FE               | Yes                               | Yes                              | Yes                               | Yes                            | Yes                               | Yes                            |
| Municipality FE                | Yes                               | Yes                              | Yes                               | Yes                            | Yes                               | Yes                            |
| Year x state FE                | Yes                               | Yes                              | Yes                               | Yes                            | Yes                               | Yes                            |
| Observations                   | 306,232                           | 302,238                          | 298,302                           | 294,365                        | 292,441                           | 291,318                        |
| Adjusted R <sup>2</sup>        | 0.0300                            | 0.0305                           | 0.0305                            | 0.0305                         | 0.0306                            | 0.0306                         |

OLS models with establishment and year fixed effects; dependent variable is either a dummy variable with a value of zero if there is a positive investment (extensive margin) or the logarithm of investment for the establishments that invest (intensive margin); LBT rate is the effective local business tax rate in percentage points; establishment controls include the logarithm of sales and the logarithm of the capital stock; county controls include the logarithm of the GDP per capita, the logarithm of population counts and the unemployment rate in percentage points; we cluster standard errors at the municipality level and perform regressions by OLS; t-values are in parentheses; \*\*\*/\*\*/\* significant on 1 %/ 5 %/ 10 %-level.

## 4. Results: Multiple establishments



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| Model                          | 1                                 | 2                                 | 3                               | 4                              | 5                               | 6                               |
|--------------------------------|-----------------------------------|-----------------------------------|---------------------------------|--------------------------------|---------------------------------|---------------------------------|
| Dependent variable             | Log wage                          | Log wage                          | Log wage                        | Log wage                       | Log wage                        | Log wage                        |
| <b>Log net-of-LBT rate</b>     | <b>0.484***</b><br><b>(0.151)</b> |                                   |                                 |                                |                                 |                                 |
| <b>Log net-of-LBT rate t-1</b> |                                   | <b>0.459***</b><br><b>(0.159)</b> |                                 |                                |                                 |                                 |
| <b>Log net-of-LBT rate t-2</b> |                                   |                                   | <b>0.273*</b><br><b>(0.158)</b> |                                |                                 |                                 |
| <b>Log net-of-LBT rate t-3</b> |                                   |                                   |                                 | <b>0.297</b><br><b>(0.181)</b> |                                 |                                 |
| <b>Log net-of-LBT rate t-4</b> |                                   |                                   |                                 |                                | <b>0.301*</b><br><b>(0.178)</b> |                                 |
| <b>Log net-of-LBT rate t-5</b> |                                   |                                   |                                 |                                |                                 | <b>0.318*</b><br><b>(0.193)</b> |
| Establishment FE               | Yes                               | Yes                               | Yes                             | Yes                            | Yes                             | Yes                             |
| Municipality FE                | Yes                               | Yes                               | Yes                             | Yes                            | Yes                             | Yes                             |
| Year x state FE                | Yes                               | Yes                               | Yes                             | Yes                            | Yes                             | Yes                             |
| Observations                   | 125,058                           | 123,213                           | 121,379                         | 119,484                        | 118,560                         | 117,988                         |
| Adjusted R <sup>2</sup>        | 0.00848                           | 0.00873                           | 0.00858                         | 0.00854                        | 0.00865                         | 0.00854                         |

OLS models with establishment and year fixed effects; dependent variable is either a dummy variable with a value of zero if there is a positive investment (extensive margin) or the logarithm of investment for the establishments that invest (intensive margin); LBT rate is the effective local business tax rate in percentage points; establishment controls include the logarithm of sales and the logarithm of the capital stock; county controls include the logarithm of the GDP per capita, the logarithm of population counts and the unemployment rate in percentage points; we cluster standard errors at the municipality level and perform regressions by OLS; t-values are in parentheses; \*\*\*/\*\*/\* significant on 1 %/ 5 %/ 10 %-level.

## 4. Results: Multiple firm-level



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| Model                                       | 1                               | 2                               | 3                               | 4                               | 5                                | 6                                 |
|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|----------------------------------|-----------------------------------|
| Dependent variable                          | Log wage                        | Log wage                        | Log wage                        | Log wage                        | Log wage                         | Log wage                          |
| <b>Log net-of-LBT rate (unweighted)</b>     | <b>-0.234</b><br><b>(0.211)</b> |                                 |                                 |                                 |                                  |                                   |
| <b>Log net-of-LBT rate t-1 (unweighted)</b> |                                 | <b>-0.216</b><br><b>(0.205)</b> |                                 |                                 |                                  |                                   |
| <b>Log net-of-LBT rate t-2 (unweighted)</b> |                                 |                                 | <b>-0.323</b><br><b>(0.212)</b> |                                 |                                  |                                   |
| <b>Log net-of-LBT rate t-3 (unweighted)</b> |                                 |                                 |                                 | <b>-0.378</b><br><b>(0.254)</b> |                                  |                                   |
| <b>Log net-of-LBT rate t-4 (unweighted)</b> |                                 |                                 |                                 |                                 | <b>0.408**</b><br><b>(0.234)</b> |                                   |
| <b>Log net-of-LBT rate t-5 (unweighted)</b> |                                 |                                 |                                 |                                 |                                  | <b>-0.462**</b><br><b>(0.221)</b> |
| Establishment FE                            | Yes                             | Yes                             | Yes                             | Yes                             | Yes                              | Yes                               |
| Municipality FE                             | Yes                             | Yes                             | Yes                             | Yes                             | Yes                              | Yes                               |
| Year x state FE                             | Yes                             | Yes                             | Yes                             | Yes                             | Yes                              | Yes                               |
| Observations                                | 64,906                          | 64,209                          | 63,485                          | 62,745                          | 62,399                           | 62,144                            |
| Adjusted R <sup>2</sup>                     | 0.00872                         | 0.00900                         | 0.00886                         | 0.00891                         | 0.00894                          | 0.00896                           |

OLS models with establishment and year fixed effects; dependent variable is either a dummy variable with a value of zero if there is a positive investment (extensive margin) or the logarithm of investment for the establishments that invest (intensive margin); LBT rate is the effective local business tax rate in percentage points; establishment controls include the logarithm of sales and the logarithm of the capital stock; county controls include the logarithm of the GDP per capita, the logarithm of population counts and the unemployment rate in percentage points; we cluster standard errors at the municipality level and perform regressions by OLS; t-values are in parentheses; \*\*\*/\*\*/\* significant on 1 %/ 5 %/ 10 %-level.

## 4. Results: Robustness checks



- **Additional tests**
  - Event study models for different subsamples (single-establishment and multi-establishment firms)
  - Distributed lag models for different subsamples (single-establishment and multi-establishment firms)
  - Generalized difference-in-differences models at the firm level for different weights of LBT rates (wage-weighted, sales-weighted)
  - Generalized difference-in-differences models with more than one lagged variable for different types of firms (single-establishment firms and multi-establishment firms) at the establishment level and at the firm level
- **Further analyses**
  - Extension of our data base to 1995 until 2017
  - Extended analysis with distributed lag models



## 5. Conclusion



### Results and implications

Relying on a a) full sample of the b) manufacturing sector and c) using average wages per hour as dependent variable, we find

1. In comparison to FPS 2018 we find weaker effects with an implied elasticity of 0.224 (FPS 2018 0.556 for the manufacturing sector)
2. In subsample analyses, we find corresponding effects only for multi-establishment firms without strong evidence for temporal delays.
3. In addition, we do not find significant effects for multi-establishment firms, if we control for formula apportionment effects.
4. 2) and 3) suggest that our baseline findings are mainly driven by formula apportionment and not by tax incidence.