Employment Effects of Local Business Taxes*

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Abstract

This is the first paper to thoroughly investigate the employment effects of corporate taxation. Higher taxes are theoretically shown to have a negative impact on employment through reduced investments, if labor is regionally mobile. I test this prediction by exploiting the specific setting of local business taxation in Germany, where on average 10% of the 11,441 municipalities change their tax rate each year. Relying on rich administrative linked employer-employee panel data, I provide non-parametric and parametric evidence that employment declines if business tax rates increase. For given wages, a one euro increase in an establishment's tax bill leads to a reduction in the wage bill by 20 cents over two years. I empirically show that the negative employment effect is triggered by reduced (net) investments and leads to lower production levels.

JEL Classification: H22, H25, J21, J23, J38

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1 Introduction

Many economists and policymakers believe that lower corporate taxes encourage business activities and thereby create jobs (see Kotlikoff, 2014; Obama, 2014, for two recent examples). The implied mechanism is simple: lower corporate taxes increase investments, which in turn raise employment. In the public finance literature, there is ample theoretical and empirical evidence on the first part of this mechanism, demonstrating that higher corporate tax rates increase the user cost of capital, which in turn reduces investment (see, e.g. Chirinko, 1993; Hassett and Hubbard, 2002; Bond and Van Reenen, 2007, for surveys). In contrast, the effects of corporate profit taxation on employment are hardly ever discussed.

Given the proliferation of the belief that lower corporate taxes simulate employment, the lack of theoretical and empirical attention is somewhat surprising. Nonetheless, there might be a simple explanation for this, namely that corporate taxes are usually studied in an international context where tax rates are set at the national level. The conventional assumption in such a context is that labor is internationally immobile, which rules out employment effects a priori. Another reason for the lack of attention might lie in econometric identification problems, given that studies exploiting cross-country corporate tax differentials usually have difficulties defending the common trend assumption, whereas single-country analyses often lack compelling variation in tax rates.

This paper aims to fill this research gap and estimate the employment effects of corporate taxation. I focus on the *local* business tax in Germany, which is set at the municipal level. On average, 10% of the 11,441 German municipalities change their tax rate each year. Thus, there is sufficient variation in tax rates to be exploited, while the common trend assumption can be arguably upheld. In addition, municipalities are small jurisdictions and labor in Germany has been found to be mobile across municipal borders (Burda and Hunt, 2001; Elhorst, 2003; Niebuhr et al., 2012).

I show theoretically that, in such a context, higher local corporate taxes lead to lower employment, with the negative employment effect going through lower investments and a reduction in the capital stock. I empirically test my theoretical hypothesis using rich administrative linked employer-employee panel data from 1998 to 2008, combined with data on the universe of the German municipalities. Given the frequent tax rate changes and the large number of tax jurisdictions, I exploit the within-municipality variation of tax rates over time for identification.

First, I use a non-parametric event study design to show that employment decreases when local business taxes increase. Next, I estimate a parametric model to quantify the size of the employment effect, finding an employment elasticity with respect to the effective statutory tax rate of -0.8 after two years. I also translate this elasticity into a money metric measure: for given wages, a one euro increase in the company's tax bill leads to a decrease in the total wage bill by 20 cents after two years. I find that employment adjusts exclusively at the extensive margin. In line with my theoretical model, I further show that the negative employment effect goes through reduced investment, leading to lower output. Moreover, I provide evidence backing the assumption of regional labor mobility.

The employer-employee data allow me to check the robustness and plausibility of my estimates by testing for heterogeneous effects. A placebo test using establishments that are exempt from the local business tax shows a precisely estimated zero effect. I find no or only small negative employment effects for smaller, non-corporate and service sector establishments, which face much lower tax burdens in Germany (Gebhardt and Siemers, 2011) and may adjust consumer prices more easily than firms from the industrial sector, which mainly compete on the global market. Looking at different worker groups, I show that only full-time employment reacts to business tax changes, which is in line with a model of mobile labor and some fixed costs of changing jobs.

As mentioned above, there is hardly any empirical evidence on the employment effects of business taxation. Harju and Kosonen (2013) estimate the effects of Finnish tax reforms on business and avoidance activities of small *non-corporate* firms. Among the various outcomes, they also investigate labor demand reactions. In line with my findings, they do not find an employment effect for non-corporate firms. Carroll et al. (2000) analyze how the hiring decisions of sole proprietors are affected by tax cuts triggered by the U.S. Tax Reform Act of 1986. They find that a 10% increase in the marginal *net of* tax rate increases the mean probability of hiring by 12%. Finally, this paper is related to the work of Suárez Serrato and Zidar (2014), who estimate the reduced form effects of U.S. state corporate taxes on business location.[1]

Overall, I provide the first comprehensive estimates of negative employment effects of business taxation. Aside from being an interesting result per se, my findings

[1] Naturally, my paper is also related to the literature estimating the incidence of the corporate tax on wages (see, e.g. Felix and Hines Jr., 2009; Dwenger et al., 2011; Arulampalam et al., 2012; Liu and Altshuler, 2013; Fuest et al., 2013).

have further important implications, supporting existing and long-standing theoretical arguments that the mobility of production factors is crucial when analyzing the real effects of corporate taxation. In this context, the jurisdictional level at which a tax is set has been neglected in the discussion. Clearly, the regional tax setting level affects the appropriate mobility assumption. In fact, with labor mobility increasing over time – across municipalities, U.S. state borders, and within the European Union or the Americas – the channel shown in this paper might become increasingly relevant in the future, even for business taxes set on higher jurisdictional and/or geographical levels.

The remainder of the paper is structured as follows. Section 2 briefly describes the institutional design of German business taxation. In Section 3, I theoretically show that profit taxes have a negative employment effect if labor is mobile. In Section 4, I present the datasets used. The empirical analysis is conducted in Section 5, before Section 6 concludes.

2 Institutional setting

Corporate firms (*Kapitalgesellschaften*) in Germany are liable to local business tax (LBT) and corporate tax (CT).[2] In general, the local business tax applies to all corporate firms in the industrial and service sector, while most firms in the agricultural and public sector are not liable to LBT. Moreover, certain professions such as journalists, physicians or lawyers are exempt. The tax base, Y, is the same for both LBT and CT and essentially comprises operating profits since 1998.[3] Importantly, the LBT due could be deducted from the tax base until 2007.

The tax rate of the local business tax, τ_{LBT}, comprises two components: the basic federal rate (*Steuermesszahl*), τ_{fed}, which is set at the national level; and a local tax rate (*Hebesatz*), τ_{mun}, set at the municipal level. The local tax rate works as a multiplier to the federal rate: $\tau_{LBT} = \tau_{fed} \cdot \tau_{mun}$. The basic federal rate was at 5.0% from 1998 to 2007 and decreased to 3.5% in 2008. The local tax rate usually varied between 250% and 450% during the period from 1998 to 2008 (5th and 95th percentiles). The local tax rates for year t are passed by the municipal councils

[2] The taxation of non-corporate firms (*Personengesellschaften*) is different in two ways: first, they face slightly different rules for the LBT; and second, they are liable to personal income tax (PIT) instead of CT. Therefore, I discuss the institutional setting for these firms separately, below.

[3] From 1998 to 2007, half of the long-term debt service was added to Y. After 2008, the long-term debt service was replaced by 25% of all interest payments exceeding 100,000 euros.

during the budgeting for t, which usually takes place in the last three months of year $t-1$. It is important to note that a municipality can only adjust the local tax rate; it cannot change the tax base nor the liability criteria, which are both set at the federal level. Further note that neither municipalities nor states can set their own taxes on labor income. The personal income and payroll taxes are exclusively determined at the federal level.

In terms of the corporate tax, the tax rate, τ_{CT}, has undergone several changes in recent years. An imputation system existed in Germany until 2000, whereby retained profits were subject to a tax rate of 45% in 1998 and 40% in 1999 and 2000, while dividends were taxed at a rate of 30% during that time. From 2001, retained and distributed profits were equally taxed at 25% (26.5% in 2003). In 2008, τ_{CT} was lowered to 15%. In all years, a so-called solidarity surcharge, $soli$, of 5.5% of the CT rate is added.

In order to calculate the total effective tax rate for corporate firms, LBT and CT rates are added, before the deduction of the LBT liabilities from the tax base has to be taken into account. The effective (statutory) marginal tax rate[4] for corporate firms, τ_{EMTR}^{corp}, from 1998 to 2007, is

$$\tau_{EMTR}^{corp} = \frac{\tau_{CT} \cdot (1 + soli) + \tau_{fed} \cdot \tau_{mun}}{1 + \tau_{fed} \cdot \tau_{mun}}.$$

After 2008, the denominator is 1, given that the LBT can no longer be deducted from the tax base. Assuming a local tax rate of 350%, the average EMTR decreased from 0.55 in 1998 to 0.28 in 2008, with an average value of 0.41 over the whole sample period. For a local tax rate of 250% (450%), the average τ_{EMTR}^{corp} is 0.38 (0.43).[5]

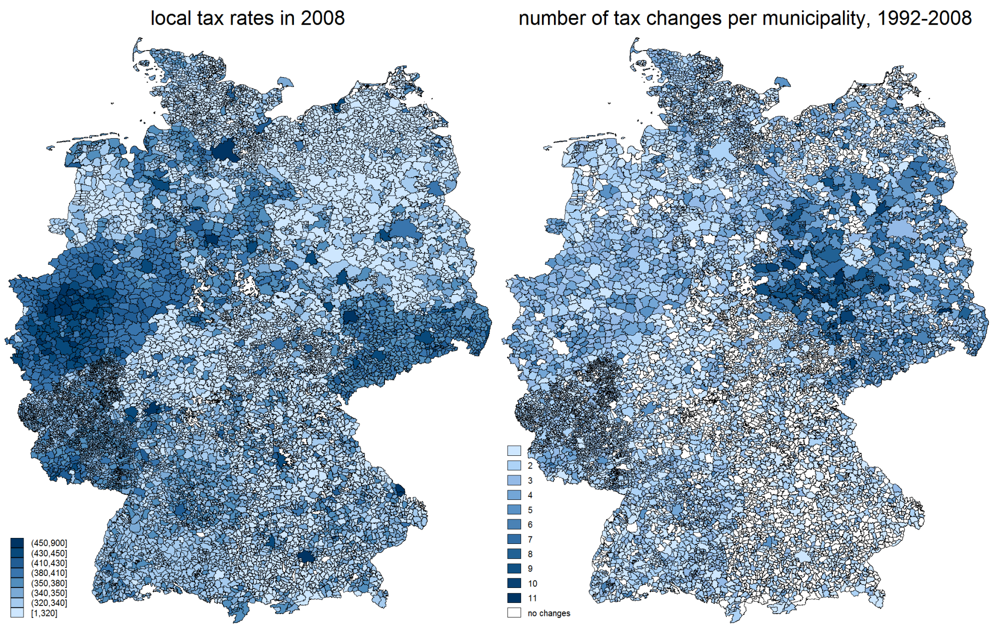
Regarding the geographical and administrative setting, Germany has a total

[4] Note that this is an effective *statutory* marginal tax rate, as opposed to a more conventional measure of the effective marginal tax rate, which includes tax base parameters.

[5] Non-corporate firms are not subject to CT, but PIT (on operating profits assigned to the proprietor), which is progressive and where marginal rates consequently depend on the taxable income. In terms of LBT, the definition of the base also differs compared to corporate firms. Non-corporate firms have an allowance of 24,500 euros. In addition, a share of the business tax liabilities can be deducted from the PIT base: $1.8 \cdot \tau_{fed} \cdot Y$ from 2001 to 2007 and $3.8 \cdot \tau_{fed} \cdot Y$ since 2008. Moreover, there was a reduced τ_{fed} for small non-corporate firms prior to 2008: for every 12,000 euros exceeding the allowance of 24,500 euros, τ_{fed} was raised by one percentage point so that the full basic federal rate of 5.0% had to be paid with a taxable income starting from 72,500 euros. Assuming that firms' profits are so high that companies are in the highest PIT bracket and face the top marginal tax rate, τ_{PIT}^{top}, the effective marginal tax rate for a non-corporate firms $\tau_{EMTR}^{non-corp}$ from 1998 to 2007, is $\tau_{EMTR}^{non-corp} = \frac{\tau_{PIT}^{top} \cdot (1+soli) + \tau_{fed} \cdot \tau_{mun}}{1+\tau_{fed} \cdot 1.8}$. Since 2008, the denominator of the fraction has been set to $1 + \tau_{fed} \cdot 3.8$.

surface area of 357,000 km^2 (137,838 mi^2). Given 11,441 municipalities, the average municipality is small, with an area of roughly 31 km^2 (12 mi^2). As in many other countries, there are different administrative entities at different levels of geographical aggregation, whereby municipalities are the smallest entities. The next larger type of jurisdiction is the county (*Kreis*), of which there are just over 400 in Germany; thus, on average, 28 municipalities make up a county. Larger municipalities – usually cities with more than 100,000 inhabitants – constitute their own county (*kreisfreie Stadt*). The next higher level, despite not being an official jurisdiction, is the labor market region, also known as the commuting zone. In general, labor market regions delineate independent economic areas around an economic center, where the appendant areas are defined on commuter flows. In this paper, I follow the rather narrow definition of the Federal Institute for Research on Building, Urban Affairs and Spatial Development, which differentiates between 258 labor market regions (see Eckey et al., 2006). Thus, there are on average 44 municipalities per labor market region. At the highest regional level, there are 16 federal states (*Bundesländer*).

Figure 1: Cross-sectional and time variation in local tax rates



Source: Statistical Offices of the Länder

Figure 1 depicts Germany's 11,441 municipalities and visualizes the substantial cross-sectional and time variation in local tax rates.[6] While the left panel of the figure shows the cross-sectional variation in local tax rates in 2008, with darker colors showing higher tax rates, the right panel shows the number of tax changes that a

[6] The data stem from the statistical authorities of the federal states, see Section 4.

municipality experienced between 1992 and 2008, with darker colors indicating more changes.[7]

Table 1: Time variation in local tax rates, 1992-2008

% of municipalities with a tax change by year			
	any change	increase	decrease
1993	13.9	11.7	2.2
1994	15.9	13.6	2.3
1995	17.5	15.4	2.1
1996	14.4	12.5	1.8
1997	11.4	9.7	1.7
1998	19.3	16.1	3.2
1999	5.4	4.3	1.1
2000	8.4	7.4	1
2001	12.7	11.5	1.3
2002	8.6	7.9	0.7
2003	9.8	9.1	0.8
2004	8.8	8.2	0.6
2005	11	10.4	0.7
2006	7.8	7	0.8
2007	4.4	3.7	0.8
2008	4.0	3.2	0.8
overall	10.8	9.4	1.4
number of tax changes per municipality			
	changes	municipalities	in %
	0	2577	22.5
	1	3215	28.1
	2	3076	26.9
	3	1402	12.3
	4	556	4.9
	5	264	2.3
	6+	315	3.0

Source: Statistical Offices of the Laňder. *Notes:* The average change is 20 points (6%). N=11,441 per year.

Taking a closer look at the within-municipality time variation of the local tax rates, which is later used to identify the tax effect on wages, Table 1 shows that on average 10% of the municipalities (i.e. about 1,100 municipalities) change their local tax rate per year. The average change amounts to 20 points, which is an increase of 6% and corresponds to a rise in the effective statutory tax rate of 1.3% for a corporate firm during that period. Most municipalities increase local tax rates over time. The bottom of Table 1 shows that the changes in local tax rates are not concentrated among a few municipalities, but rather are widespread. Almost 80 percent of the municipalities changed their tax rates at least once during the observation period.

[7] Note that the sample period of my employment data is 1998-2008. Nonetheless, I use up to six lags of the local tax rate in the empirical analysis, showing the variation starting from 1992.

3 Theoretical framework

In this section, I use a simple microeconomic model of a firm to show under which circumstances profit taxation affects a firm's employment decision. Let there be a representative, price-taking firm that produces with a production function F and input factors capital K and labor L. I assume that F is a standard neoclassical production function with positive and decreasing returns to scale, $\frac{\partial F(\cdot)}{\partial i} = F_i > 0, \frac{\partial^2 F(\cdot)}{\partial i^2} = F_{ii} < 0, \frac{\partial^2 F(\cdot)}{\partial i \partial j} = F_{ij} > 0$ with $i, j \in \{K, L\}, i \neq j$. Furthermore, I assume that $F(K, L)$ is strictly concave, implying that $F_{LL}F_{KK} - F_{KL}^2 > 0$. This strict concavity assumption is needed to ensure positive profits, which is obviously necessary for this analysis.

The firm faces a profit tax τ. A share $\alpha \in [0, 1]$ of the capital costs can be deducted from the tax base. Alternatively, α can be interpreted as the share of capital financed by debt. Payments on debts, i.e. interests, can usually be deducted from the tax base, while payments on equity are normally paid out of the after-tax profits, $0 < \alpha < 1$. Therefore, the company's after-tax profits Π are

$$\Pi = (1 - \tau)[pF(K, L) - wL] - (1 - \alpha\tau)rK,$$

where r is the interest rate, w the wage and p the output price. Firms choose capital K and employment L so that Π is maximized. Maximization yields the following first order conditions, determining factor demands

$$F_L = \frac{w}{p} \tag{1}$$

$$F_K = \frac{(1 - \alpha\tau)}{(1 - \tau)} \frac{r}{p}. \tag{2}$$

Labor demand is not directly affected by the profit tax, as shown by equation (1), since labor costs are fully deductible from the tax base. The same would be true for the capital demand, if $\alpha = 1$, i.e. if all capital costs were deductible from the profit tax base. In such a case, τ would affect neither L nor K.

In the following, I assume that $0 < \alpha < 1$, which is true for Germany and most industrialized countries where interest payments are deductible from the tax base (while dividends are not). Totally differentiating[8] equations (1) and (2) yields

$$F_{LL}dL + F_{LK}dK = \frac{1}{p}dw - \frac{1}{p^2}dp \tag{3}$$

$$F_{KK}dK + F_{LK}dL = \frac{1-\alpha\tau}{(1-\tau)p}[dr - \frac{1}{p}dp] + \frac{(1-\alpha)r}{(1-\tau)^2 p}d\tau. \tag{4}$$

As mentioned above, the average German municipality is small. Hence, I assume that neither output prices nor non-tax costs of capital are affected by changes in the municipal tax rate, i.e. $dp = dr = 0$. Furthermore, I assume that labor is perfectly mobile across jurisdictional borders. These assumptions will be discussed below. Consequently, a change in the local tax rate leaves wages in the competitive sector unchanged, i.e. $dw = 0$ (cf. also Fuest et al., 2013). Given this, equation (3) simplifies to $dL = -\frac{F_{LK}}{F_{LL}}dK$. Substituting into equation (4) and rearranging shows that capital decreases as the profit tax rate increases

$$\frac{dK}{d\tau} = \frac{(1-\alpha)rF_{LL}}{(1-\tau)^2 p[F_{LL}F_{KK} - F_{KL}^2]} < 0, \tag{5}$$

since $F_{LL} < 0$ and, by the strict concavity assumption, $F_{LL}F_{KK} - F_{KL}^2 > 0$. The effect on employment is

$$\frac{dL}{d\tau} = \underbrace{-\frac{F_{LK}}{F_{LL}}}_{>0}\frac{dK}{d\tau} < 0. \tag{6}$$

Hence, I find a negative employment effect of business taxation that goes through capital. The rationale is straightforward: higher business taxes reduce capital. Due to the positive cross partial derivative ($F_{KL} > 0$), the marginal product of labor has to decrease. According to condition (1), the marginal product of labor equals the real wage. If w and p are given, F_L cannot decrease. Thus, the marginal product of labor has to remain at its pre-tax reform level. This can only be achieved by reducing L given $F_{LL} < 0$. Hence, the central result of my theoretical model is that employment decreases if business taxes rise. This hypothesis will be empirically tested in Section 5. In addition, I will also provide evidence on the underlying channel of this effect going through reduced investments and eventually leading to lower output.

[8] To keep it simple, I assume that $d\alpha = 0$.

From the exposition thus far, it is clear that the negative employment effect hinges on the assumption that wages are not affected by business tax changes. However, when looking at changes of national corporate taxes, this assumption seems quite unrealistic. Based upon the seminal work by Harberger (1962), many general equilibrium studies have shown that labor bears a substantial share of the corporate tax burden through lower wages in small open economies (see, e.g. Kotlikoff and Summers, 1987, or Gravelle, 2013, for a survey of computable general equilibrium studies). Nonetheless, these studies analyze the incidence of corporate taxes in an international context and *under the assumption* that labor is immobile. This result can also be sketched within the partial framework developed above by looking at the other limiting case of perfect labor immobility ($dL = 0$). It immediately follows from equations (3) and (4) that $\frac{dw}{d\tau} = \frac{1-\alpha}{(1-\tau)^2} \frac{F_{LK}}{F_{KK}} < 0$. Thus, employment (and wage) effects crucially depend on the mobility assumptions of the factor inputs and the resulting corporate tax incidence on factor prices.

While the two polar cases of perfect labor mobility and perfect labor immobility are rather of theoretical interest, the analysis shows that if labor is somewhat mobile within the labor market region, local business taxes have a negative effect on employment. As discussed in Section 2, the LBT rate is set by the municipality, which is a rather small jurisdiction. It seems reasonable that workers do not restrict their (on the) job search to their municipality, but are at least willing to accept jobs within the county or the labor market region. Note that, in this respect, labor market regions are explicitly delineated based upon commuter flows. In fact, the regional worker mobility in Germany has already been demonstrated in other studies (Burda and Hunt, 2001; Elhorst, 2003; Niebuhr et al., 2012). I provide further evidence of this mobility when testing the underlying assumption of the theoretical model in Section 5.3.

As mentioned above, most of the theoretical literature draws upon general equilibrium models to analyze corporate tax effects on production factors and their respective prices. Given that this study does not focus on the incidence of the corporate tax, I have opted for a partial analysis, which yields the same insights under the specific assumptions made and is more tractable (for related inter-regional general equilibrium models, see, e.g. McLure, 1969, 1970 or Jones, 1982).

4 Data

I combine two distinct data sources: first, administrative data on the universe of German municipalities; and second, detailed administrative linked employer-employee data.

Municipal and regional data. In terms of municipal data, I use statistics provided by the Statistical Offices of the 16 German Federal States (*Statistische Landesämter*). The states collect information on the fiscal and budgetary situation of the municipalities. After combining and harmonizing the annual state specific datasets, I obtain a panel on the universe of municipalities from 1992 to 2008 covering more than 194,000 municipality-years.[9] Most importantly, the dataset contains information on the local tax rate, as well as the population size and municipal expenses and revenues. Moreover, I add data on regional GDP and unemployment rates on the more aggregate county (*Kreis*) level to control for local labor market conditions.

Linked employer-employee data. I merge the municipal data to the linked employer-employee dataset (LIAB) provided by the Institute of Employment Research (IAB) in Nuremberg, Germany (Alda et al., 2005). The employee data are a 2% sample of the administrative employment statistics of the German Federal Employment Agency (*Bundesagentur für Arbeit*), called the German Employment Register, which covers all employees paying social security contributions or receiving unemployment benefits (Bender et al., 2000). The employee data are recorded annually on June 30th and include information on wages, age, tenure, occupation, employment type (full-time, part-time or marginal employment) and qualification. I differentiate between three skill groups: high-skilled workers have obtained a college/university degree; medium-skilled have either completed a vocational training or obtained the highest high school diploma (*Abitur*); and low-skilled have neither completed a vocational training nor obtained the *Abitur*. Civil servants are excluded as they are rarely observed in the social security data. I observe between 1.6 and 2.0 million workers per year.

The employer component of the LIAB is the IAB Establishment Panel (Kölling, 2000), which is a stratified random sample of the universe of all German establish-

[9] As noted above, I use lags of the local tax rate in my empirical analysis and thus need a longer panel for the municipal data than for my linked employer-employee data, the latter of which runs from 1998 to 2008.

ments. The term “establishment” refers to the fact that the observational unit is the individual plant, not the firm; there can be several plants per firm.[10] The employer data covers establishments with at least one worker for whom social insurance contributions were paid. Among others, I extract the following variables: output, investment, number of employees, industry affiliation, total wage bill, legal type (corporate vs. non-corporate), full-time working hours and self-rated profitability (measured on a four-point scale ranging from good to poor).

Table 2: Descriptive statistics, 1998-2008

sample	baseline			non-corporate			non-liable		
	mean	sd	N	mean	sd	N	mean	sd	N
number of employees	249	1189	46599	25	136	23932	241	735	42722
real monthly average wage	2514	883	46599	1762	678	23932	2630	887	41681
annual investment (in thousands)	3718	25976	28372	222	2776	11846	3318	20096	26517
annual output (in millions)	69	545	34172	3	25	17831	325	7678	26003
annual EBITDA (in millions)	23	207	34172	1	11	17831	314	7668	26003
share non-corporate firms (in %)	0	0	46599	100	0	23932	17	38	42722
share corporate firms (in %)	100	0	46599	0	0	23932	25	43	42722
share other legal types (in %)	0	0	46599	0	0	23932	58	49	42722
share manufacturing sector (in %)	49	50	46599	34	47	23932	0	7	42722
share construction sector (in %)	13	34	46599	16	37	23932	0	5	42722
share transportation sector (in %)	6	24	46599	6	23	23932	1	7	42722
share service sector (in %)	32	47	46599	44	50	23932	18	38	42722
share public sector (in %)	0	0	46599	0	0	23932	65	48	42722
share agricult / energery sector (in %)	0	0	46599	0	0	23932	14	35	42722
share other sectors (in %)	0	0	46599	0	0	23932	2	15	42722
share part of multi-plant firm (in %)	32	47	46599	6	24	23932	35	48	42722
share single-plant firm (in %)	67	47	46599	94	24	23932	61	49	42722
share no info on single/multi plant (in %)	0	7	46599	0	4	23932	4	18	42722
munic. collection rate	342	41	11132	337	41	7355	340	43	10187
munic. population (in thousands)	23	108	11132	15	64	7355	22	87	10187
munic. expenses (in millions)	79	664	11132	50	373	7355	74	507	10187
munic. revenues (in millions)	77	600	11132	51	324	7355	74	482	10187
district GDP (in millions)	5075	5021	11132	4489	4165	7355	4629	4803	10187
district unemp. rate (in %)	11	6	11132	12	6	7355	12	6	10187

Source: LIAB and Statistical Offices of the Länder. *Notes:* All money variables in 2008 euros. Output corresponds to total assets in the financial sector.

Sample selection and descriptive statistics. My observation period runs from 1998 to 2008. For my baseline sample, I select corporate establishments that are liable to LBT and do not change legal form.[11] The first three data columns of

[10] In the context of the German business tax, the tax base of firms with multiple establishments is divided between municipalities according to formula apportionment based upon the wage bill of the individual plants. I test below for differences between single and multi-establishment firms.

[11] As discussed in Section 2, the LBT treatment of non-corporate firms is quite different and it is impossible to calculate the precise EMTR for these firm types. For this reason, I exclude non-corporate establishments from the baseline sample and analyze them separately below. As the choice of the legal form might be endogenous to tax changes, I also excluded plants changing their legal form. However, robustness checks show that my estimates are not sensitive to the exclusion of these legal from changers.

Table 2 show some descriptive statistics of my baseline sample, which comprises 46,599 establishment-year observations and 11,171 municipality-year data points. The average establishment has 249 employees and pays a monthly wage of 2,521 euros (all money variables are in 2008 euros). The average annual output is 69 million euros.[12] 68% of the plants are in the industrial sector (manufacturing, construction and transportation). The average establishment is located in a small town with about 23,000 inhabitants and a local tax rate of 342%. Data columns 4 to 6 show the sample of non-corporate plants, which are on average considerably smaller, more represented in the service sector and situated in similar municipalities. The last three columns of Table 2 show the basic characteristics for non-liable establishments, which are used for the placebo tests below. Reassuringly, the placebo and baseline samples seem comparable in terms of employment size and municipal characteristics. On the other hand, the placebo plants are substantially larger in terms of output and investments, which is mostly due to plants from the mining and energy sector.

5 Empirical analysis

In this section, I empirically investigate the employment effects of business taxation. The analysis is divided into three parts. First, I use an event study research design to provide non-parametric evidence of the employment effect of local business taxes. Second, I estimate a parametric difference-in-difference model to assess the size of the employment effect and test for heterogeneous worker and establishment effects (Section 5.2). Third, I test the central mechanisms underlying the theoretical model, i.e. (i) the employment effect going through capital and (ii) intra-regional labor mobility.

5.1 Event study

In this subsection, I use a non-parametric event study design to demonstrate the employment effect of LTBs. I estimate the following equation:

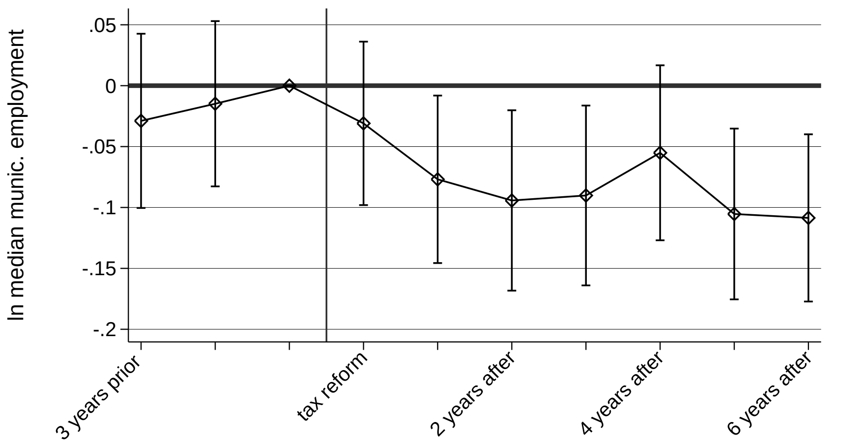
$$\ln L_{m,t} = \sum_{j=-3}^{6} \alpha_{t+j} TAXINCREASE_{m,t+j} + \mu_m + \mu_t + \varepsilon_{m,t}, \tag{7}$$

[12] Note that there is considerable item non-response in the establishment survey for investment and output.

where $\ln L_{m,t}$ is the natural logarithm of the median employment in municipality m at time t. $TAXINCREASE_{m,t+j}$ is a dummy variable indicating a local tax increase in municipality m at time $t+j$, with $j = -3, ...6$.[13] Moreover, I add municipality and year fixed effects to the regression equation (μ_m, μ_t), using the within-municipality variation in tax changes to identify the effect.

The model is designed to provide a causal interpretation of the relationship between local tax rates and employment. Including future reform dummies in a model of current employment is a direct test of reverse causality in the spirit of Granger, whereby the coefficients of the anticipatory reform dummies should not be statistically different from zero. Moreover, including lagged reform dummies allows me to shed light on the evolution of employment after a reform has taken place.

Figure 2: Event study estimates: baseline model



Source: LIAB. Notes: The figure plots the coefficients (diamonds) and the corresponding 95% confidence bands of a regression of ln median municipal employment on dummy variables indicating leads and lags of a tax increase (see Table 3, specification (1)). The regression model includes year and municipalfixed effects, standard errors are clustered at the municipal level (equatic The sample consists of municipalities with at least one tax increase during the observation period.

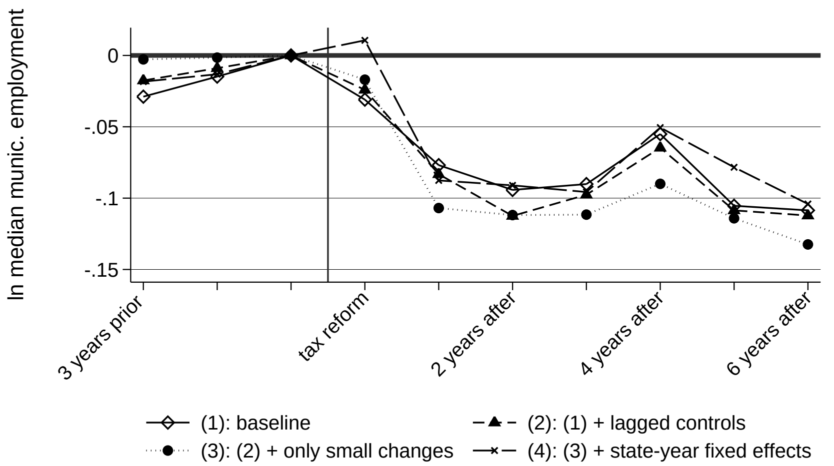
In my baseline specification, I estimate equation (7) on a sample of municipalities that experienced one or more tax increases during the observation period, excluding municipalities that experienced tax drops. Restricting the sample to municipalities with at least one tax increase is important, since these municipalities are likely to be different from those without one. Thus, I identify the effect of tax reforms on employment by using tax reform communities in no-tax reform years as the control group. Moreover, I always set $\alpha_{t-1} = 0$, in order that all coefficients can be interpreted relative to the pre-reform period.

Regression results are shown in Table 3 and presented graphically in Figures

[13] Given that almost all tax changes are increases (see Table 1), I do not have sufficient power to run the same analysis for tax decreases.

2 and 3. Estimates and 95% confidence bands of the baseline specification (1) of Table 3 are plotted in Figure 2. The figure clearly shows that employment levels are flat prior to the tax increase, which is reassuring and suggests that tax changes are exogenous. Employment levels drop after the tax reform by about 0.1 log points two years after the tax increase and remain at that level. Note that there seems to be a slight reversion four years after the reform, although the point estimate is not statistically different from $t-3$ and $t-5$. Nevertheless, the kink at $t-4$ will be further explored below.

Figure 3: Event study estimates: sensitivity



Source: LIAB. Notes: The figure plots the coefficients of a various regressions of ln median municipal employment on dummy variables indicating leads and lags of a tax increase. The regression model includes year and municipal fixed effects (equation (7)). The different lines correspond to the specifications of Table 3 (cf. legend). The sample consists of municipalities with at least one tax increase during the observation period.

Table 3 also presents further tests on the robustness of the event study design. The corresponding point estimates are plotted in Figure 3, together with the baseline coefficients. In specifications (2), I add pre-determined, potentially confounding municipal controls of period $t-2$ (log median wages, log municipal population, log municipal expenses and log county GDP to the regression model). Results do not change.[14] In specification (3), I additionally include dummies indicating a large tax increase to the model. I define a large increase as being larger than the average tax increase in my sample, which is 20 points or an increase of the EMTR by 1.3%. On the one hand, large tax chances should have a larger employment effect. On the other hand, large changes are less likely to be exogenous. While I find that none of the newly added coefficients is statistically significant, their signs suggest that the negative employment effect is stronger for *small* rather than large tax changes (see the solid circles in 3 for the coefficients for small increases). An interpretation

[14] This is also the case when I add controls with no or only one lag to the specification.

Table 3: Effect on ln median municipal employees: event study estimates

Model	(1)	(2)	(3)	(4)
tax increase$_{t+3}$	-0.029	-0.018	-0.003	-0.018
	(0.036)	(0.041)	(0.048)	(0.050)
tax increase$_{t+2}$	-0.015	-0.009	-0.002	-0.013
	(0.035)	(0.041)	(0.047)	(0.047)
tax increase$_{t}$	-0.031	-0.024	-0.017	0.011
	(0.034)	(0.038)	(0.043)	(0.045)
tax increase$_{t-1}$	-0.077**	-0.083**	-0.107**	-0.088*
	(0.035)	(0.040)	(0.046)	(0.049)
tax increase$_{t-2}$	-0.094**	-0.112***	-0.112**	-0.091*
	(0.038)	(0.042)	(0.046)	(0.050)
tax increase$_{t-3}$	-0.090**	-0.098**	-0.112**	-0.096*
	(0.038)	(0.042)	(0.047)	(0.051)
tax increase$_{t-4}$	-0.055	-0.065	-0.090**	-0.051
	(0.037)	(0.041)	(0.045)	(0.049)
tax increase$_{t-5}$	-0.105***	-0.109***	-0.114***	-0.078*
	(0.036)	(0.039)	(0.043)	(0.047)
tax increase$_{t-6}$	-0.109***	-0.112***	-0.132***	-0.104**
	(0.035)	(0.038)	(0.041)	(0.044)
ln munic. median wage$_{t-2}$		0.360***	0.359***	0.345***
		(0.108)	(0.109)	(0.109)
ln munic. population$_{t-2}$		-1.103	-1.186*	-0.129
		(0.685)	(0.687)	(0.758)
ln munic. expenses$_{t-2}$		0.024	0.024	0.020
		(0.064)	(0.065)	(0.070)
ln county GDP$_{t-2}$		0.487	0.512	0.183
		(0.386)	(0.385)	(0.405)
big tax increase$_{t+3}$			-0.059	-0.030
			(0.075)	(0.079)
big tax increase$_{t+2}$			-0.030	-0.027
			(0.110)	(0.111)
big tax increase$_{t}$			-0.022	-0.023
			(0.094)	(0.094)
large tax increase$_{t-1}$			0.144	0.134
			(0.091)	(0.091)
large tax increase$_{t-2}$			0.015	0.006
			(0.098)	(0.099)
large tax increase$_{t-3}$			0.090	0.086
			(0.095)	(0.096)
large tax increase$_{t-4}$			0.138	0.139
			(0.093)	(0.094)
large tax increase$_{t-5}$			0.049	0.047
			(0.080)	(0.082)
large tax increase$_{t-6}$			0.112	0.124
			(0.079)	(0.080)
year FE	yes	yes	yes	
state-year FE				yes
Adjusted R^2	0.004	0.012	0.012	0.016
Observations	9792	7458	7458	7458
Groups	2275	1757	1757	1757
Clusters	2275	1757	1757	1757

Source: LIAB. *Notes:* Dependent variable: ln median municipal employees. Sample: All municipalities with at least one tax increase from 1994 to 2012. All specifications include municipal fixed effects. Standard errors (in parentheses) are clustered at the municipal level. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***).

of this result is that endogeneity could bias my estimates towards zero. In the last specification, I estimate a richer model by replacing the year fixed effects, μ_t, with state-year fixed effects. While standard errors increase slightly, point estimates are hardly affected.

Another issue that needs to be discussed in the context of such a difference-in-difference research design are potential problems due to the serial correlation of the dependent and policy variable (cf. Bertrand et al., 2004). In my baseline specification, I cluster standard errors at the municipal level. I follow the suggestion by Angrist and Pischke (2009) and cluster standard errors at a higher level. The natural candidate in the context of my study is the labor market, which still yields a sufficiently large number of clusters (258). I find that standard errors are almost identical when clustering at this higher level (not reported).

5.2 Parametric results

The model. In order to quantify the employment effect and test for heterogeneous effects, I move to the establishment level and estimate a parametric model. Consider an establishment i in municipality m, state s and year t. Following the theoretical model, I regress log employment, $\ln L_{ims,t}$, on the log of the local tax rate in municipality m. Using the insights on the timing of the effect obtained from the event study conducted above, which demonstrated that employment effects materialize after two years, I use the second lag of the local tax rate as my main explanatory variable: $\ln \tau_{m,t-2}$.[15]

Furthermore, I add establishment fixed effects, μ_i, to the model. In most cases, these establishment fixed effects also account for municipal effect, since only about 200 plants in my sample change municipalities. Potentially, such a change in location could be due changes in LBT rates, which would be the most extreme form of employment reaction.[16] However, given that tax rate differentials between municipalities are rather small (other than in an international context), there are good reasons to believe that the extensive employment effect is negligible when looking at the German LBT. Nevertheless, I deal with location-changing establishments by assigning them the tax changes that they would have experienced if they had not moved and thus estimate the Intention-to-Treat effect of municipal tax changes.

[15] I experimented with different lags, but the results were hardly affected – see Table A.1 in the Appendix.

[16] Hence, my estimated intensive employment effects are conservative with respect to the total employment effect.

This implies that my establishment fixed effects also account for municipal fixed effects. Hence, I use the within-municipality variation in tax rates over time to identify the employment effect, while accounting for time-invariant confounders at the establishment and municipal level.[17]

In order to control for certain shocks, I include time fixed effects in the model. However, adding simple year dummies might not be sufficient, since local shocks may affect both establishments' employment levels and local business taxes. Therefore, I include state-year fixed effects, μ_{st}, in the baseline specification, which account for shocks such as municipal election years, which vary at the state level and have recently been shown to affect LBT rates (Foremny and Riedel, 2014). My regression model reads:

$$\ln L_{ims,t} = \alpha \ln \tau_{m,t-2} + \mu_i + \mu_{st} + \varepsilon_{ims,t}. \tag{8}$$

Since controlling for local shocks is crucial for identification of the effects, I implement two further sensitivity checks to ascertain whether my estimates are affected. First, I add controls for the local business cycle to my equation (8), specifically adding the local GDP, municipal expenses, the average wage and the neighboring municipalities' average local tax rates (all of period $t-2$). Second, I add 2,838 labor market-year fixed effects to the baseline model.

Standard errors, $\varepsilon_{ims,t}$, are clustered at labor market level instead of the municipal-year level, following the suggestion by Angrist and Pischke (2009) to overcome serial correlation problems. Again, I test the sensitivity of my results with respect to the level of clustering and find that standard errors and inference are hardly affected (see Table A.2 in the Appendix.)

Baseline results. Table 4 shows the baseline results. In specification (1), I estimate equation (8) on the sample of liable corporate plants, excluding any control variables. I find a significant, negative effect of -0.198. To ease interpretation, I transform the coefficient into an employment elasticity with respect to the effective (statutory) marginal tax rate (EMTR). This measure is reported at the bottom of Table 4. For specification (1), I find that an increase of the EMTR by 1% leads to a decrease in employment of 0.8%.[18] Additionally, I report an money metric measure,

[17] As sensitivity checks, I estimate the model (i) excluding location-changing plants and (ii) assigning the location-changing plants the observed tax rate and controlling separately for establishment and municipal fixed effects by applying the spell fixed effects estimator suggested by Andrews et al. (2006). The results did not change.

[18] I estimate a similar elasticities when using a direct measure of the effective marginal tax rate as my regressor.

which is defined as the reaction of the total wage bill – keeping wages constant – to a 1 euro increase in tax liabilities over two years. For the first model the money metric is -20 cents.[19] Note that I purely focus on the extensive margin, and thus on employment in heads. I also tested for effects at the intensive margin using information on full-time working hours, finding that effects are exclusively driven by employment responses (see Table A.4 in the Appendix).

Table 4: Effect on ln employees: baseline estimates

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln local tax rate$_{t-2}$	-0.198**	-0.259***	-0.215**	-0.027	-0.246***	-0.263***			
	(0.083)	(0.100)	(0.085)	(0.085)	(0.075)	(0.101)			
x industrial sector							-0.289***		
							(0.089)		
x service sector							0.138		
							(0.149)		
x corporate								-0.198**	
								(0.084)	
x non-corporate								0.132	
								(0.094)	
x liable firm									-0.210**
									(0.082)
x non-liable firm (placebo)									-0.000
									(0.094)
ln industry wage$_{t-2}$		-0.329***							
		(0.079)							
ln munic. population$_{t-2}$		-0.001							
		(0.177)							
ln munic. expenses$_{t-2}$		0.038***							
		(0.014)							
ln county GDP$_{t-2}$		0.069							
		(0.062)							
ln mean neighbors' tax rates$_{t-2}$			0.172						
			(0.333)						
firm (and munic.) FE	yes	yes	yes		yes	yes	yes	yes	yes
state-year FE	yes	yes	yes	yes			yes	yes	yes
year FE					yes				
labor market-year FE						yes			
Adjusted R^2	0.035	0.051	0.031	0.058	0.028	0.053	0.042	0.035	0.045
Observations	46599	24557	42906	46599	46599	46599	46599	70531	89320
Groups	13680	6927	12626	13680	13680	13680	13680	21094	25077
Clusters	258	258	251	258	258	258	258	258	258
Employment elasticity	-0.80	-0.95	-0.86	-0.11	-0.98	-1.05			
Money metric (in euros)	-0.18	-0.26	-0.19	-0.02	-0.22	-0.24			

Source: LIAB. *Notes:* Dependent variable: ln employees. The baseline sample in specification (1) to (7) consists of corporate liable firms, in specification (8) non-corporate liable firms are added to the baseline sample, in specification (9) non-liable firms are added to the baseline sample. Standard errors (in parentheses) are clustered at labor market region. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***). The money metric measure indicates the euro change of the total wage bill for given wages in response to a one euro increase in the total tax bill.

In model (2), I add pre-determined control variables of period $t-2$ at the establishment, municipality and county level to the equation.[20] This is an important test for the exogeneity of treatment, which is crucial for identification. Specifically,

[19] I obtain similar results when including the local tax rate in levels instead of logs - see Table A.3 in the Appendix.

[20] As I do not observe municipal expenses and county GDP prior to 1998, the number of observation declines.

I control for the log wage at the industry level, municipal population, municipal expenses and log county GDP.[21] The estimated employment effect is even larger than in the baseline specification with a money metric measure of 26 cents. In specification (3), I add a term capturing the average local tax rate of the neighboring municipalities to account for tax competition, since a municipality might react to tax rate changes in surrounding municipalities. Interestingly, while the coefficient on the own tax rate is hardly affected, the neighbors' average tax rate has a positive coefficient of similar absolute size (albeit insignificant). This is a first hint at regional labor mobility, which is further analyzed in Section 5.3.

In specification (4), I re-estimate the baseline model (1), but do not include establishment fixed effects. The point estimate moves towards zero, which indicates the importance of controlling for time-invariant establishment and municipal confounders. Specifications (5) and (6) assess the sensitivity of my estimates to regional shocks and thus provide another important tests of my identification strategy. The baseline model includes state-year fixed effects, thus accounting for annual shocks affecting both municipal tax rates and employment levels at the state level. In specification (5), I replace these state-year fixed effects by simple year fixed effects, ignoring potentially endogenous shocks at the state level. Conversely, in specification (6), I control for local shock at a more disaggregated level by adding labor market-year fixed effects. In both cases, employment effects increase slightly.

Next, I test for sectoral difference in the employment effect. I interact the local tax rate of period $t - 2$ with dummy variables indicating whether an establishment is in the industrial (manufacturing, construction, transportation) or service sector. Interestingly, I find that the negative employment effect seems to be purely driven by the industrial sector (specification (7)). One potential explanation is that service goods are less tradable and thus employers can adjust output prices more easily and shift the tax burden onto consumers. While this channel would be potentially interesting to study, it is impossible due to a lack of regional price level panel data for Germany. Given that I find no effect for service sector establishments, I narrow down my sample to industrial sector plants when testing for heterogeneous effects in the next subsection.

In specification (8), I include non-corporate establishments in my estimation sample. As discussed above, non-corporate plants are on average much smaller than corporate ones (see Table 2) and the tax treatment of the two legal types is

[21] Using the local unemployment rate instead of the GDP yields similar results but is potentially problematic due to endogeneity concerns.

quite different (cf. Section 2). Therefore, I have excluded these plants from the baseline sample. In line with Harju and Kosonen (2013), I find no overall effect of the tax rate on employment in non-corporate establishment. When testing for heterogeneous effects by establishment size, I find that larger non-corporate plants show a negative (yet insignificant) coefficient, which is in line with the results shown and discussed below (see Table 5).

Last, I provide a further identification test, exploiting the institutional feature that not all establishments are liable to the local business tax in Germany. There are exemptions for certain firm types, e.g. for plants in the public and in the agricultural sector. I conduct a placebo test by including these non-liable plants in my sample. Reassuringly, specification (9) shows a precisely estimated zero effect of the local tax rate on employment in non-liable establishments.

Heterogeneous effects. In the following, I check for heterogeneous effects in terms of both worker and plant characteristics. Among the broadly classified industrial plants, I first test for heterogeneous effects using a finer sectoral classification, finding lower and insignificant employment effects in plants producing consumption goods and in the transportation sector. In contrast, the effect is strong and highly significant in the metalworking and chemical industry, which mainly produces for the world market and thus cannot adjust output prices as easily.

Next, I differentiate by plant size and define small, medium, large and very large establishments by quartiles of output.[22] This distinction is interesting given recent evidence that differently sized firms face difference tax burdens (Gebhardt and Siemers, 2011; OECD, 2013). In particular, smaller firms are found to face dis-proportionally low tax burdens. Specification (2) of Table 5 is in line with these findings, given that only large and very large establishments show a negative employment effect of business taxes. In specification (3), I differentiate between small (up to 5,000 inhabitants), medium (5,000 to 25,000), large (25,000 to 100,000) and very large municipalities (above 100,000), finding no effect in cities with more than 100,000 inhabitants and only significantly negative effect in medium-sized towns. Note that small and medium municipalities account for about 90% of all municipalities.

Next, in specification (4), I construct a measure of relative size by calculating

[22] Median output in each quartile is 180,000, 981,000, 5 million and 47 million euros, respectively. I also used the distribution of employees to split establishments into the four groups and found qualitatively similar results. However, as the number of employees is my dependent variable, I prefer the results based upon the output split.

the number of employees relative to the municipal population. I define a plant as relatively large if the number of employees is larger than 1% of the municipality's population. The results show that only relatively small establishments exhibit a negative employment effect of business taxes. This suggests that locally influential establishments do not react as strongly to business tax changes. One reason for this finding could be that these relatively large establishments might have the power to influence the setting of the tax rate in the city council. In line with the results from the event study and baseline table, this finding suggests that potential endogeneity issues would bias my estimates towards zero and thus my findings should be seen as a lower bound.

In model (5), I test for differences between single-plant firms and establishments that are part of a multi-plant firm. In general, it should be easier for multi-plant firms with a presence in several municipalities to shift employees to low tax jurisdictions. Therefore, one would expect a higher effect for these plants, which is indeed verified by the data. However, the effect is also present for single-plant firms.

I also test for the different effects by East/West Germany as well as by profitability, but do not find statistically different results.

Table 5: Effect on ln employees: heterogeneous establishment effects

Model	(1)	(2)	(3)	(4)	(5)
by	industry	plant size	city size	rel. plant size	firm structure
ln local tax rate$_{t-2}$ x ...					
industry: metalworking and chemicals	-0.345***				
	(0.129)				
industry: consumption goods	-0.035				
	(0.225)				
industry: food	-0.447*				
	(0.260)				
industry: construction	-0.414*				
	(0.213)				
industry: traffic	-0.106				
	(0.250)				
abs. plant size: small		0.157			
		(0.224)			
abs. plant size: medium		-0.087			
		(0.144)			
abs. plant size: large		-0.402***			
		(0.118)			
abs. plant size: very large		-0.451***			
		(0.103)			
municipality size: small			-0.286		
			(0.205)		
municipality size: medium			-0.344**		
			(0.146)		
municipality size: large			-0.235		
			(0.192)		
municipality size: very large			-0.050		
			(0.347)		
rel. plant to mun. size: small				-0.292**	
				(0.140)	
rel. plant to mun. size: large				-0.122	
				(0.203)	
establishment type: multi-plant					-0.335***
					(0.106)
establishment type: single-plant					-0.268***
					(0.099)
Adjusted R^2	0.098	0.141	0.056	0.100	0.049
Observations	31652	23825	31652	31652	31507
Groups	8710	6206	8710	8710	8688
Clusters	258	258	258	258	258

Source: LIAB. *Notes:* Dependent variable: ln employees. Sample: industrial plants of baseline sample. All specifications include plant and municipal fixed effects as well as state-year fixed effects. Standard errors (in parentheses) are clustered at labor market region. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***). Plant size defined as quartiles of annual output: small, medium, large and very large plants with median output of 180,000, 981,000, 5 million and 47 million euros, respectively. Municipality sizes are: small up to 5,000 inhabitants), medium (5,000 to 25,000), large (25,000 to 100,000) and very large municipalities (above 100,000). Plants are large relative to municipal size if the number of employees is larger than 1% of the municipality's population.

Next, I test whether employment elasticities differ for different worker groups. Making use of the administrative employee part of LIAB, I obtain worker shares and calculate the number of employees for each worker group, before subsequently estimating the baseline model for each group separately. Table 6 shows that estimates by skill show an inversely U-shaped pattern, with strongest employment reactions to tax increase for high and low-skilled workers. This is in line with evidence on own-wage labor demand elasticities by skill estimated on the same data (Peichl and Siegloch, 2012). Moreover, I find that only full-time employment significantly reacts to local tax changes. This can be rationalized with a model of labor mobility and certain fixed costs of changing jobs. When differentiating between male and female employment, I find a somewhat larger response for male employment, which could also be related to the aforementioned full-time/part-time difference. Interestingly, Table 6 also shows that there is no negative employment effect for workers with low firm-specific tenure, while no clear age pattern is observable.

Table 6: Effect on ln employees: heterogeneous worker groups

Employee type	$\hat{\beta}$: ln local tax rate$_{t-2}$	s.e.	Adjusted R^2	Observations
high-skilled	-0.392**	0.153	0.020	19581
medium-skilled	-0.185*	0.099	0.032	31400
low-skilled	-0.467***	0.168	0.049	21873
full-time	-0.304***	0.088	0.045	31644
part-time	0.131	0.338	0.022	15762
female	-0.208*	0.113	0.026	28067
male	-0.284***	0.091	0.037	31287
blue-collar	-0.304***	0.091	0.046	30868
white-collar	-0.238*	0.127	0.011	28788
low tenure	0.015	0.216	0.086	30408
medium tenure	-0.546***	0.194	0.092	26922
high tenure	-0.550**	0.244	0.478	16402
young	-0.335*	0.184	0.081	28007
mid-aged	-0.255***	0.082	0.059	31169
old	-0.384**	0.149	0.094	28745

Source: LIAB. *Notes:* Dependent variable: ln employees of specific worker group. Sample: industrial plants of baseline sample. All specifications include firm and municipal fixed effects as well as state-year fixed effects. Sample Standard errors are clustered at labor market region. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***). Tenure groups are defined by terciles of tenure distribution, age groups are: young (16-30), mid-aged (30-50), old (51-64).

5.3 Testing the model mechanisms

In this subsection, I shed some light on the underlying mechanisms of the theoretical model presented in Section 3. First, I investigate the channels of the employment effect, before testing for intra-regional labor mobility.

Investment and output effect. The theoretical model shows that the negative employment effect goes through reduced investment and eventually leads to a reduction in output. I test this channel by replacing the left-hand side variable of regression equation (8), i.e. *ln* employees by (i) *ln* total investments, (ii) *ln* net investments (if positive) and (iii) *ln* output. In terms of heterogeneous effects, the model is estimated on the baseline sample narrowed down to industrial establishments. Moreover, I only included establishments, for which I observe investment, net investment and output.

The results presented in Table 7 are in line with the theoretical model. First, I show that employment effects are stronger for this subsample.[23] Specifications (4) to (9) show that establishments reduce net investment strongly and quickly as a response to higher LTB rates. This translates into lower total investments after two years, as well as a significantly lower output.

Table 7: Effects on ln employees, ln (net) investments and ln output

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep. var.	ln employees			ln tot invest			ln net invest			ln output		
ln local tax rate$_t$	-0.414**			-0.678			-1.091*			-0.360		
	(0.163)			(0.482)			(0.574)			(0.230)		
ln local tax rate$_{t-1}$		-0.456***			-0.653			-1.019**			-0.342**	
		(0.108)			(0.451)			(0.510)			(0.141)	
ln local tax rate$_{t-2}$			-0.441***			-0.732**			-1.635***			-0.277**
			(0.106)			(0.356)			(0.576)			(0.116)
Adjusted R^2	0.036	0.037	0.037	0.059	0.059	0.059	0.035	0.03 5	0.036	0.387	0.387	0.387
Observations	17823	17823	17823	17823	17823	17823	10970	10970	10970	17823	17823	17823
Groups	5317	5317	5317	5317	5317	5317	4088	4088	4088	5317	5317	5317
Clusters	258	258	258	258	258	258	255	255	255	258	258	258

Source: LIAB. *Notes:* Dependent variables as indicated above. Sample: industrial plants of baseline sample, where annual investments and output are observed. All specifications include firm (and municipal) fixed effects as well as state-year fixed effects. Standard errors (in parentheses) are clustered at labor market region. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***).

Intra-regional mobility. One mechanism that could explain sticky wages and seems relevant in the context of business taxation at a very local level is labor mobility. In order to test for intra-regional worker mobility, I estimate a model where the log net average employment in region r and year t – *ignoring the employment in municipality* m – is my dependent variable: $\ln(\overline{L}_{-m,r,t})$. Region r can be either the county or the labor market, $r \in \{c, l\}$. The independent variable of interest is the log average employment in municipality m, region r at time t, $\ln(L_{m,r,t})$. I additionally control for productivity and budgetary variables at the regional level net of the contribution of municipality m: log average output, log average investment, log average local tax rate and log average municipal expenses. These variables are summarized in vector $\overline{\mathbf{R}}'_{-m,r,t}$. To deal with the endogeneity between municipal

[23] Note that while the notation suggests an instantaneous adjustment, tax changes in period t are normally known by the end of year $t-1$.

and regional employment, I add region-year fixed effects to my model (denoted by $\mu_{r,t}$), which account for any unobserved local shock affecting both the left-hand side variable and the regressor of interest. Note that these dummy variables also account for regional unemployment, GDP and population size, and thus the model identifies the within-region-mobility for a given population, productivity and for given unemployment levels. Adding municipality fixed effects μ_m, my model reads

$$\ln \overline{L}_{-m,r,t} = \alpha \ln L_{m,r,t} + \boldsymbol{\beta}\overline{\mathbf{R}}'_{-m,r,t} + \mu_{r,t} + \mu_m + \varepsilon_{m,r,t}. \tag{9}$$

The results are presented in Table 8 and confirm the assumption of intra-regional labor mobility. Specification (1) shows that a decrease in municipality m's employment by 1% leads to a significant increase in the county's average regional employment (net of municipality m's contribution) of 0.08%. The point estimates slightly declines when the relevant region is defined to be the labor market, see specification (2).

Table 8: Effect on ln net mean regional employment

Model	(1)	(2)
Regional level	county	labor market
log municipal employees	-0.076***	-0.050***
	(0.005)	(0.005)
log regional investment	0.030**	0.048***
	(0.015)	(0.018)
log regional output	0.101***	0.120***
	(0.022)	(0.024)
log regional collection rate	0.115	-0.396
	(0.742)	(0.976)
log regional expenses	0.236	0.173
	(0.149)	(0.157)
Adjusted R^2	0.927	0.937
Observations	13942	16904
Groups	3963	4248
Clusters	231	233

Source: LIAB. *Notes:* Dependent variable: log mean regional employment net of the municiapilities' m contribution to the mean. All specifications include municipal as well as region (i.e. county or labor market)-year fixed effects. Standard errors (in parentheses) are clustered at respective regional level. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***).

6 Conclusions

This paper analyzes how local business taxes affect employment. A simple model of a firm shows a negative employment effect of business taxes, going through decreased investments under the assumption that labor is mobile across jurisdictions. I empirically test my theoretical predictions by exploiting the institutional setting of the local business tax, whose rates are set autarkically by the 11,441 German municipalities each year.

Relying on rich administrative linked employer-employee panel data, I provide non-parametric and parametric evidence of a negative employment effect of local business taxation. I estimate an employment elasticity with respect to the effective statutory tax rate of -0.8 after two years. Translated into a money metric measure, this implies that a one euro increase in the company's tax bill yields a decrease in the total wage bill of 20 cents after two years for given average wages. In line with my theoretical model, I show that the negative employment effect goes through reduced (net) investment, leading to lower output. Moreover, I provide evidence supporting the assumption of regional labor mobility.

Overall, I provide the first comprehensive estimates of the business tax effect on employment. Normally, the effects of corporate taxation are studied in an international context, where labor is arguably rather immobile. While this implies that my results stemming from local business taxation cannot be readily generalized to the international arena, they support existing and long-standing theoretical arguments suggesting that the mobility of production factors is crucial when analyzing the real effects of business taxation. If a production factor is mobile and the jurisdiction is small relative to the whole economy under study, local factor prices should not be affected but factor inputs will respond to the tax and flee the high-tax jurisdiction (Bradford, 1978). This general lesson is true for both the national and the international context. With labor mobility increasing over time – especially within the European Union – my findings imply that business taxes may not be shifted onto wages. In fact, if capital *and* labor are mobile, consumers or firm owners might eventually bear a larger burden of business taxes than commonly thought.

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A Appendix

Table A.1: Effect on ln employees: timing

Model	(1)	(2)	(3)	(4)	(5)	(6)
ln local tax rate$_{t-2}$						-0.064
						(0.076)
ln local tax rate$_{t-1}$						-0.046
						(0.073)
ln local tax rate$_t$	-0.158				-0.051	-0.003
	(0.101)				(0.093)	(0.077)
ln local tax rate$_{t-1}$		-0.223**			-0.127**	-0.127**
		(0.086)			(0.053)	(0.052)
ln local tax rate$_{t-2}$			-0.198**		-0.087	-0.089
			(0.083)		(0.066)	(0.066)
log collection rate$_{t-3}$				-0.148	-0.056	-0.054
				(0.096)	(0.093)	(0.093)
Adjusted R^2	0.035	0.035	0.035	0.035	0.035	0.035
Observations	46599	46599	46599	46599	46599	46599
Groups	13680	13680	13680	13680	13680	13680
Clusters	258	258	258	258	258	258
Employment elasticity	-0.63	-0.89	-0.80	-0.59	-1.28	-1.10
Euro incidence	-0.43	-0.30	-0.18	-0.10	-0.22	-0.18
Long-term effect	-0.16	-0.22	-0.20	-0.15	-0.32	-0.27

Source: LIAB. *Notes:* Dependent variable: ln employees. Sample: baseline. All specifications include firm and municipal fixed effects as well as state-year fixed effects. Standard errors (in parentheses) are clustered at labor market region. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***).

Table A.2: Effect on ln employees: clustering

Model	(1)	(2)	(3)
Cluster level	labor market	municipality-year	municipality
ln collection rate$_{t-2}$	-0.198**	-0.198***	-0.198**
	(0.083)	(0.055)	(0.083)
Adjusted R^2	0.035	0.035	0.035
Observations	46599	46599	46599
Groups	13680	13680	13680
Clusters	258	17732	3023

Source: LIAB. *Notes:* Dependent variable: ln employees. Sample: baseline. All specifications include firm and municipal fixed effects as well as state-year fixed effects. Standard errors (in parentheses) are clustered as indicated. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***).

Table A.3: Effect on employees: level vs. log

Model	(1)	(2)
collection rate$_{t-2}$	-0.001**	
	(0.000)	
ln collection rate$_{t-2}$		-0.198**
		(0.083)
Adjusted R^2	0.035	0.035
Observations	46599	46599
Groups	13680	13680
Clusters	258	258
Employment elasticity	-0.76	-0.80
Euro incidence	-0.17	-0.18

Source: LIAB. *Notes:* Dependent variable: level/ln employees. Sample: baseline. All specifications include firm and municipal fixed effects as well as state-year fixed effects. Standard errors (in parentheses) are clustered at labor market region. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***).

Table A.4: Effects on ln employees and ln total hours

Model	(1)	(2)	(3)	(4)
Dependent variable	ln employees		ln total hours	
ln collection rate$_{t-2}$	-0.198**	-0.198**	-0.193**	0.006
	(0.083)	(0.083)	(0.083)	(0.009)
log fulltime hours		-0.018		
		(0.106)		
log employees				1.000***
				(0.001)
Adjusted R^2	0.035	0.035	0.034	0.993
Observations	46599	46599	46599	46599
Groups	13680	13680	13680	13680
Clusters	258	258	258	258

Source: LIAB. *Notes:* Dependent variable: ln employees or ln total hours. Sample: baseline. All specifications include firm and municipal fixed effects as well as state-year fixed effects. Standard errors (in parentheses) are clustered at labor market region. Significance levels are 0.1 (*), 0.05 (**), and 0.01 (***).