Do higher corporate taxes reduce wages or working hours?

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Abstract

In principle, firms have two margins to reduce their labor costs in a response to higher business taxes. They can adjust wages to shift the burden of business taxation to labor (corporate tax incidence) or they can reduce their labor demand at the extensive margin (number of staff members) or at the intensive margin (number of hours per staff member). Due to data limitations, previous research on corporate tax incidence implicitly assumes a constant number of working hours per staff member and interprets reductions of wages per staff member as a reduction in hourly wages. Using the AFiD Panel Industrial Establishments of the German Federal Statistical office including information on working hours, we analyze if changes in local business tax (LBT) rates in German municipalities affect wages per hour and/or the number of hours per staff member. A wide range of empirical tests provides robust evidence that higher LBT rates in German municipalities reduce the number of working hours (labor demand), but do not reduce the wage per working hour. Further, even after accounting for alternative payroll shifting between establishments, we continue to find statistically significant and negative tax effects on working hours (labor demand), but find no empirical evidence that firms shift their tax burden on hourly wages.

Keywords: tax incidence; wages; corporate income tax; elasticity; labor demand

JEL codes: H22; H25; H26

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1. Introduction

Prior research shows that corporate income taxes have important consequences for labor markets. One line of theoretical and empirical research suggests that firms at least partially shift the burden of corporate taxes onto the wages of their employees by reducing pay (*corporate tax incidence*; Harberger 1962; Arulampalam et al. 2012). For example, Fuest et al. (2018) provide empirical evidence that about 50 percent of the burden of the German local business tax are shifted to labor. [1] Another line of research examines labor demand responses to business taxation at the *extensive* margin and documents that higher business taxes can result in firms reducing the number of workers they employ.[2] In this paper, we focus on one form of labor response that has received little attention in prior research. We investigate the effect of corporate income taxes on the number of working hours firms demand per employee (labor demand at the *intensive* margin).

Distinguishing this effect from other responses is critical because it can have very different consequences for firms, households, and society from other labor channels. For example, a pure reduction in pay per hour (corporate tax incidence) has no direct effect on the degree of labor hours put into production (e.g., Cobb and Douglas, 1943; Griliches, 1967) nor on output (although an indirect effect might result from smaller effort per hour). Instead, it represents a transfer of the income consequences of the business's tax burden to worker households. Alternatively, a reduction of working hours without an adjustment in pay per hour may reduce either labor intensity (the composition of labor versus capital as an input) or output and, thus, more directly affect production. At the household level, a reduction in pay without

[1] Theoretical predictions for the effect of corporate income taxes for employees is evaluated, for example, in Harberger (1962), Auerbach (2006), and Harberger (2008). Further, related empirical work show at least a 50 shifting of the corporate tax burder to wages (Felix and Hines 2009; Arulampalam et al. 2012; Liu and Altshuler 2013; Bauer et al. 2017; Hassett and Mathur 2015; Fuest et al. 2018). Of course, other work suggests that this magnitude may be smaller at 19 to 35 percent (Suárez-Serrato and Zidar 2016; Dwenger et al. 2017), and at least one study does not find evidence that corporate taxes are passed on to wages in line with general equilibrium predictions (e.g., Clausing 2013).

[2] Bettendorf et al., 2009; Feldmann, 2011; Zirgulis and Šarapovas, 2017; Ljungquist and Smolyanski, 2018; Mukherjee and Badola, 2023.

an adjustment to hours (corporate tax incidence) represents a transfer of the firm's tax burden to worker household income. Conversely, a reduction of working hours per employee does not necessarily reduce household income if it frees up hours that are then compensated by a second employer. Finally, from a macroeconomic perspective, labor demand adjustments are likely to have a more direct effect on unemployment rates or the rate of technological development (e.g., robotics) than a pure wage per hour adjustment. While we limit our analysis to firm establishment responses to business taxes and do not evaluate household- or macro-economic responses to these taxes, we outline these alternative consequences above just to make it clear why distinguishing this type of labor demand response from a pure wage channel is important.

To help distinguish these different effects on labor, we use high-quality administrative panel data from the German Federal Statistical Office of business establishments in the manufacturing sector (*AFiD Panel Industrial Establishments*)[3] to investigate the effect of business taxes on hourly wages and working hours per employee (*labor response at the intensive margin*). A major benefit of this administrative data is that it provides information not only on payroll and staff, the focus of much of prior research, but also on the aggregate number of working hours per year at the establishment level. This allows us to decompose the wage per staff member into the hours per staff member and the wage per working hour at the establishment level and to identify the tax effects along these two different margins.

The setting we use to investigate the questions above is the variation in local business tax (LBT) rates for Germany manufacturing establishments over the period 1999-2015. This setting is valuable for several reasons. First, as mentioned before, the AFiD Panel for Industrial Establishments provides us with unique information on working hours, staff members, and payroll costs at the establishment level, allowing us to disentangle corporate tax incidence from a labor demand response at the intensive margin. Second, due to the high number of

[3] While we discuss the AFiD panel data in detail later in the paper, see Malchin and Voshage (2009) for a thorough discussion of the panel data.

municipalities and tax rate changes, the setting provides a lot of variation in business tax rates at the cross section and over time while keeping other factors relatively homogenous (e.g., legal system). Fuest et al. (2018) have already used this setting to analyze LBT rate effects on the wage per staff member. Third, German municipalities are allowed to change LBT rates but not the LBT tax base. Thus, the setting allows for a clear identification of tax rate effects. Fourth, while the data is limited to manufacturing establishments (all those with at least 20 staff members), this is a very relevant sector for other types of labor market responses to tax rates (corporate tax incidence). Prior theory (Harberger 2006; Gravelle 2013) and empirical evidence (Fuest et al. 2018) suggests that the manufacturing sector is a critical sector for corporate tax incidence in the overall economy.

For the research design, we employ the difference-in-differences and event study approaches from Fuest et al. (2018), where the events correspond with adjustments to LBT rates both across municipalities and over time in Germany.[4] However, the German administrative data we use differs from the German administrative data used in Fuest et al. (2018). We use the AFiD panel that covers the universe of all manufacturing establishments with great than 20 employees and decomposes the wages per staff outcome into two distinct channels: hours per staff (labor demand at the intensive margin) and wages per hour worked (corporate tax incidence). Alternatively, Fuest et al. (2018) use the IAB firm panel that provides a 1 percent random sample of the establishments in all sectors (including establishments with less than 20 staff members). Their data does not offer information on working hours but does offer employee level information (e.g., skill level, whether they belong to a union), which is not available in our data.

We begin with a panel of establishment-years most similar to the analysis in Fuest et al. (2018) (1999-2008 for all legal forms) and then adapt the panel for additional restrictions in

[4] Due to data limitations, we use the logarithm of the average wage per staff and not the logarithm of the median wage as baseline measure.

our data (for availability of the hours worked) and to allow for an extension of the sample period to 1999-2015. We restrict the longer time series analysis to establishments of incorporated firms because the German Business Tax Reform 2008 changed local business tax incentives for firms with individual partners and sole proprietorships.[5]

We begin by re-estimating the analysis in Fuest et al. (2018) on the logarithm of the average wage per staff for a sample most similar to the sample in their study and are able to confirm the main findings in their paper. This also holds when we adapt the sample to require information on hours worked and when we extend the sample period for incorporated firms. Consistent with Fuest et al. (2018), the results in this analysis document lower wages per staff in response to increases in LBT rates.

We then estimate the difference-in-differences analysis and event study analysis for the two channels above to better understand how each channel contributes to the wage per employee response observed in Fuest et al. (2018). In all empirical tests, we observe that tax rate increases result in *lower* labor demand (hours worked per employee). However, we also observe that higher taxes correspond with an unexpected *increase* in the average wage per hour worked. Thus, the negative effect on wages per employee appear to be largely driven by a labor demand channel effect rather than a pure pay or incidence channel effect (wages/employee = hours/employee x wage/hour).

The unexpected finding that average wage per hour increases with LBT rates is at odds with corporate tax incidence theory. Nevertheless, it is not necessarily a contradiction to Fuest et al. (2018) as their analysis uses a different data set, their results are largely driven by small establishments with less than 10 staff members (not included in our data), and their focus is on a decomposed measure (wage per staff). A potential explanation for our unexpected finding with wages per hour worked is that firms may disproportionately reduce their low-quality (less

[5] The extended data set does not include other legal forms due to an important tax reform that substantially altered taxation for other legal forms (pass throughs and individual taxpayers) in 2008.

productive) labor demand that correspond with lower hourly wages. As a result, higher hourly wages make up a larger percent of the distribution of hours and result in a higher average wage for remaining working hours. It would also be in line with the finding of Fuest et al. (2018) that wage per staff responses to LBT rate changes are much larger for less well-paid workers (blue collar, women, underprivileged).

We confirm these findings are robust to alternative fixed effects, the addition of controls, and consideration for whether we include versus exclude a group of establishments that was not incorporated in the Fuest et al. (2018) analysis (eastern Germany establishments). Further, we confirm that the estimates with the two channels are robust to employing the dynamic two-way fixed effects estimator from de Chaisemartin and d'Hautefeuille (2024) to address recent concerns about analysis using staggered policy implementations.

As discussed above, while the AFiD data offers the advantage of observing hours worked at the establishment level, a disadvantage of this data relative to the data in Fuest et al. (2018) is that it does not contain employee-level information. As a result, we must use more indirect tests to evaluate one plausible explanation for why firms might *decrease* their labor demand but, unexpectedly, *increase* their wages per hour in response to higher LBT rates. While the analysis above focuses on the intensive margin (adjustments to the hours worked for workers employed and wages for hours worked), this additional analysis evaluates extensive margin adjustments for the overall number of hours worked by all employees in the establishment and the overall number of workers employed by the establishment. Results from this analysis are consistent with the firm replacing some full-time workers with part-time workers and the part-time workers receiving a premium with their hourly wage relative to full-time workers.

Collectively, while we observe an increase in employees and a higher wage per hour following LBT rate increases, the total number of hours worked and the average hours worked per employee are lower than they were before the LBT rate increase. Thus, collectively these

responses result in a form of labor cost savings for firms in response to tax rate increases. Of course, without access to employee-level characteristics to investigate compositional effects of LBT rates directly, we recognize that other explanations could play a role in these findings.

We perform two other sets of analysis in the paper. The first examines whether labor demand and pure pay (corporate tax incidence) responses differ when the firm has access to less costly labor response options. The second test investigates whether there is firm-level heterogeneity in the labor demand and wage per hour response to LBT rates. Prior research shows that the German LBT formula apportionment system provide evidence that the formula apportionment system for the German LBT provides incentives for firms with more than one establishment to shift their payroll cost to establishments in low-tax municipalities. Payroll shifting may include both accounting-based strategies and the strategic use of contractors from a subsidiary company (Eichfelder and Zander 2018) as well as reallocations of real labor inputs among establishments (Riedel 2010). While relocations create real effects for labor, an advantage of either type of payroll shifting response is that it does not require altering the overall wages paid per employee or overall hours worked. Thus, we expect these types of responses are less costly for firms and predict that wage per employee, hours per employee, or wage per hour are less responsive to LBT rates in firms with access to payroll shifting opportunities.

Using a difference-in-differences design, we re-examine our analysis for the three initial labor outcomes above for a subsample of firms that are not able to shift payroll (single establishment firms) and for firms with opportunities for payroll shifting (multi-establishment firms). In a second test, we then use the formula-apportionment (FA) weighted LBT rate at the firm level as the LBT measure for multi-establishment firms and thus ensure that payroll-shifting incentives (not included in the FA-adjusted measure) do not drive our results. While we continue to find statistically significant and economically relevant evidence that higher LBT rates reduces the number of working hours and increase the average wage per working hour in

all subsamples, these effects appear larger in the single establishment samples (where shifting opportunities are not available).

For the firm-level heterogeneity analysis, we consider whether three forms of firm-heterogeneity alter the LBT rate responses labor market outcomes above (wages per employee, wages per hour, and hours per employee). While observe that while one form of heterogeneity does alter the response (R&D intensity), we do not observe consistent evidence that the two other firm-level types of heterogeneity (capital intensity and productivity) play a role in these responses.

The results in this paper contribute to three streams of research. First, we contribute to a long stream of empirical literature that investigates how corporate taxes affect wages (Felix and Hines 2009; Arulampalam et al. 2012; Liu and Altshuler 2013; Suárez-Serrato and Zidar 2016; Bauer et al. 2017; Dwenger et al. 2017; Hassett and Mathur 2015; Fuest et al. 2018). Corresponding analyses generally attribute downward adjustments to wages in response to higher taxes as a transfer of the firm's tax burden to employee income. However, this takeaway requires the assumption that working hours do not change, as data on working hours is scarce. Using LBT rates across Germany and unique from the AFiD panel, we are able to disentangle tax effects on working hours (labor demand at the intensive margin) from tax effects on the wage per working our (corporate tax incidence). We only obtain empirical evidence for the first channel (labor demand), but not for the second channel (tax incidence). Our findings suggest that tax effects in existing research often attributed to corporate tax incidence might instead result, at least in part, from labor demand responses at the intensive margin.

Our findings also contribute to prior literature that investigates how business taxes influence employment (Bettendorf et al., 2009; Feldmann, 2011; Zirgulis and Šarapovas, 2017; Ljungquist and Smolyanski, 2018; Mukherjee and Badola, 2023; Criscuolo et al. 2019; Curtis et al. 2022; Bilicka et al. 2022; Souillard 2022). While this literature investigates the role of business taxes (or regulations that curb tax avoidance) on employment at the extensive margin,

the unique data in our study allows us to also consider tax effects on employment at the intensive margin. Results show that, while the number of employees actually went up as LBT rates increased, the number of working hours per employee as well as the number of aggregate working hours went down. On possible explanation for this result is that firms switched some of their full-time employees for part-time employees, which in turn increased the number of staff members, but reduced overall labor input. This finding suggests that firm labor responses to tax policy may be complex and might require consideration for labor demand responses at both the extensive and intensive margin. In addition, both types of responses might have different implications for the overall economy (e.g., inputs for firm productivity and unemployment rates).

Finally, the results in this study also contribute to the literature on formula apportionment and payroll shifting (Klassen and Shackelford 1998; Anand and Sansing 2000; Goolsbee and Maydew 2000; Gupta and Mills 2002; Martini et al. 2013; Clausing 2016; Eichfelder et al. 2018; Fuest et al. 2021). We extend this literature by showing how the availability of payroll shifting opportunities influences a firm's willingness to adjust wages per employee, wage per hour, and hours per employee in response to LBT rates. Overall, our findings suggest that firms will be less responsive with adjusting labor demand or wage per employee to LBT rates when they have the opportunity to use a less costly form of adjusting payroll to avoid taxes. This finding is important as it underscores that firms may generally prefer (less costly) accounting-based adjustments to tax policy to adjustments that have relevant consequences on their business model and their production function. Conversely, future research that examines the effect of taxes on wages should consider the role of payroll shifting when evaluating which tax measures are used.

2. Hypothesis Development and Background

2.1 Hypothesis Development

While business taxes are legally imposed on firms and their owners, an extensive economic literature evaluates the extent to which this tax burden can be shifted to other stakeholders of the firm like employees and consumers and the conditions under which is likely to be transferred to others (e.g., Harberger, 1962; Gravelle and Kotlikoff, 1989; Gravelle, 2013). Specifically, when examining the impact of business taxes on employees, prior research identifies two principal mechanisms through which the tax burden may be transferred to labor. The mechanism of *indirect incidence* builds on Harbergers' (1962) seminal work and argues that the national and international mobility of capital redirects investments from the domestic corporate sector to other sectors or other countries, when the domestic country increases the business tax rate. This reallocation reduces labor productivity and – as a consequence – wages within the domestic business sector. The second mechanism, *direct incidence*, suggests that employers and employees bargain over economic rents following tax changes. As business taxation reduces the economic rent of the employer, it also affects the bargaining process and reduces the economic rent of the employee (Arulampalam et al., 2012).

Empirical findings on the incidence of business taxation on wages are mixed. Several studies suggest economically large wage effects, with firms shifting more than half of their tax burden onto employees (e.g., Arulampalam et al., 2012; Hassett and Mathur, 2015). Fuest et al. (2018) estimate for the German LBT also suggests that about half of the burden of the average firm is shifted on labor. However, results with their heterogeneity tests suggest that this effect is mainly driven by the smallest establishments in their sample (establishments with less than 10 staff members), while subsample tests do not provide statistically significant results for larger establishments that have more than 100 employees.[6]

Documenting a wide heterogeneity of estimates, other research documents weaker effects (Clausing, 2012; Dwenger et al., 2017; Suarez-Serrato and Zidar, 2016) or statistically

[6] Recall that the data for our analysis does not allow inclusion of firms with less than 20 employees. Thus, our estimates do not reflect the role of the smallest subset of firms.

insignificant effects (Clausing, 2013; Curtis et al., 2022; Felix and Hines, 2022)[7] of business taxes on wages. Further, Knaisch and Pöschel (2024) perform a meta-regression analysis for studies examining wage responses to corporate income taxes and find evidence of publication bias in favor of papers with results supporting a wage-reducing effect from taxes. After correcting for this bias in their analysis, they no longer observe a statistically significant association between business tax rates and wages of employees on average. Despite some mixed findings in the prior literature, we state the first hypothesis in the alternative form to be consistent with the more common finding in prior literature that firms lower wages per employee in response to increases in corporate income taxes.

H1 *Firms reduce the wages per employee in response to higher LBT.*

A broader limitation within the literature that investigates the wage incidence effect with corporate income taxes is that data for this type of analysis typically only allows researchers to observe the effect on wages per employee but not on wages per working hour (i.e. accounting for what is paid for with the wage). As a result, attributing the wages per employee effect purely to tax incidence ignores an alternative labor response to tax rates that could also result in firms having lower wages per employee following tax rate increases, whereby firms may response to higher tax rates by reducing the number of hours demanded from workers. To see why, consider the following equation breaking wages per employee into two components, wages per hour worked and hours worked per employee.

$$\frac{Wages}{Employee} = \frac{Wages}{Hour} \text{ x } \frac{Hours\ Worked}{Employee} \quad (1)$$

A decrease in wages per employee could reflect a reduction in wages per hour worked (a *tax incidence* effect), a reduction in hours demanded per employee (a *labor demand* effect), or a combination of the two effects. However, each type of response has distinct consequences for firms and laborer households. For example, a labor demand effect may mean lower hours

[7] Felix and Hines in fact provide mixed evidence. While they find a significant association of union-wage premiums and state corporate income tax rates in 2000, the do not find such evidence in the year 2024.

going into production for the firm (lower productivity) while the laborer has freed up hours for part-time work serving another employer to make up missing wages. Alternatively, an incidence effect continues to retain the laborer's time contributing to the firm's production but means the laborer's household receives less for the same work. Therefore, distinguishing between these consequences is important for understanding how changes in corporate income taxes affect businesses and society.

From a theoretical perspective, if higher business taxes reduce investment or economic activity, this may also reduce demand for labor. Macroeconomic and state-level analyses show empirically that higher business taxes can reduce employment along extensive margins (Bettendorf et al., 2009; Feldmann, 2011; Zirgulis and Šarapovas, 2017; Ljungquist and Smolyanski, 2018; Mukherjee and Badola, 2023). Criscuolo et al. (2019) and Curtis et al. (2022) provide evidence that investment tax incentives could increase the number of employees. Similarly, Bilicka et al. (2022) and Souillard (2022) document that strict anti-tax-avoidance regulations may unintentionally constrain firms' labor demand. However, this literature does not consider the wage per hour (incidence) effects of these tax changes outside employment levels. Thus, the unique data we employee allows us to examine both channels along with the overall effect on wages per employee. Based on the above, we hypothesize (in the alternative form) that firms may respond to increases in corporate income tax rates through both the incidence and labor demand channels, which can contribute to the effects on wages per employee (H1).

H2 *Firms reduce the wages per working hour in response to higher LBT rates.*

H3 *Firms reduce the number of working hours per employee in response to higher LBT rates.*

Firms can respond to changes in business taxes in alternative ways, some of which may be more or less costly for the firm. The two types of responses above are considerably costly firms in terms of the potential for real effects for inputs with production (via reduced labor

demand) or making an important set of stakeholders in the firm (employees) worse off with lower pay. All else equal, we expect that firms are less likely to consider these types of responses when lower cost alternatives are available. Another plausibly lower cost, labor-related response studied in prior literature is when firms use payroll shifting to reduce their exposure to high tax rates (Riedel 2010; Eichfelder et al. 2018; Fuest et al. 2021). This form of opportunity is only available to firms that operate across multiple municipalities where they can shift their payroll away from high tax rate municipalities to low tax rate municipalities (as opposed to firms that operate only within a single municipality). This is a labor-related response because in Germany formula apportionment (the distribution of taxable income across tax jurisdictions) is based solely on what proportion of its payroll is attributed to a particular municipality and not on other factors (like sales or assets). We consider this a lower cost response to higher tax rates because it can be accomplished through two channels, which each seem to be less costly for the firm. Payroll shifting may result from either accounting-based tax avoidance strategies (e.g., by allocating payroll costs with several job sites to the job site with the lowest tax rate without having to actually shift where employees work)[8] or a reallocation of where the work is actually performed across municipalities. While the latter does involve a real adjustment to operations, a reallocation of working hours that does not change overall hours worked is arguably less extreme than an overall reduction in hours or reduction in pay for hours worked. We provide the hypothesis below (in the alternative form) based on the expectation that firms will be more likely to employ reductions in labor demand or shift incidence to laborer wages when other less costly options are not available.

H4 *The number of working hours per employee and wages per working hour are more responsive to LBT rates in single establishment firms than in multi-establishment firms.*

[8] These accounting-based tax avoidance strategies are driven by the fact that there is typically no financial report at the establishment level, which providing firms with discretion in their tax allocation declaration (German: *Zerlegungserklärung*). Eichfelder et al. (2018) discuss FA-based tax avoidance strategies and provide empirical evidence for such a type of behavior. Eichfelder and Zander (2018) provide evidence from qualitative expert interviews that confirm this formula apportionment-based type of tax avoidance.

2.2 Background on Local Business Tax (LBT) Rates in Germany

[Figure 1 about here]

[Figure 2 about here]

We focus on adjustments to local business tax rates across municipalities in Germany. In Figures 1 and 2, we provide visual representations of variation in local business tax rates in Germany similar to Fuest et al. (2018) where our first figure reports variation in the level of the LBT rate across municipalities at a single point in time (2015 in our case). The second figure reports the number of LBT rate adjustments (including tax hikes and tax cuts) over our broader sample period (1999-2015). The figures demonstrate the wide range of variation in tax rates in Germany over this period with higher rates existing in both agglomerated areas as well as in the state of North-Rhein Westfalia and Saxony Anhalt. Domestic profits of German corporations and most sole proprietorships and partnerships[9] are subject to a local business taxes (German: *Gewerbesteuer*). Local business taxes are determined as a function of two components: federal level base policies that are applied to all municipalities and local level adjustments to these base policies. While the German parliament and the Federal Council of Germany set the rules, the basic tax rate θ_t in the year t (3.5 percent as of 2025), and the assessment base (adjusted taxable income), each German municipality j has the authority to set a local business tax multiplier m_{jt} that adjusts the rate. The product of the basic rate and the LBT multiplier defines the local business tax rate τ_{jt}. Before the German Business Tax Reform 2008, the German local business tax was deductible as a business expense from its own assessment base. Thus, before GBTR 2008, the effective tax rate of the German local business tax is $\tau_{jt} = \frac{m_{jt} \cdot \theta_t}{(1+m_{jt} \cdot \theta_t)}$, with a basic rate θ_t of 5 percent. However, following the GBTR 2008, the German local business tax was no longer deductible as a business expense from its own

[9] Exceptions exist for sole proprietorships and partnerships with earnings from agriculture, forestry and learned academic professions (e.g., self-employed doctors, tax advisers, architects, engineers). These types of businesses are not taxed by the German local business tax.

assessment base and the effective LBTR became $\tau_{jt} = m_{jt} \cdot \theta_t$, with a basic rate of 3.5 percent. Since 2004, the minimum LBT multiplier that can be set by a municipality is 2.

In addition to a local business tax, German corporations pay a corporate income tax (15 percent since 2008) plus a "solidarity surcharge" (German: *Solidaritätszuschlag*) of 5.5 percent to the corporate income tax (CIT) burden (effectively 0.825 percent = 5.5% × 15%).[10] German sole proprietorships and partnerships with individual business owners pay personal income tax with a maximum marginal rate of 45 percent (since 2008) and a surcharge of 5.5 percent to the personal income tax (PIT) burden. To avoid double taxation, individuals as business owners may credit LBT tax payments against their PIT. Before 2008, the German tax law provided a lump-sum tax credit that did not depend on the LBT local tax multiplier.[11] Since 2008, the tax credit is limited to a) the LBT tax expense and b) a maximum credit with a local tax multiplier of 3.8.[12] This regulation had two consequences. First, since 2008, the effective LBT burden on corporate taxpayers is larger than for individual taxpayers. Second, for a LBT multiplier up to 3.8 (4 since 2020), the effective LBT burden or individual business owners is typically zero.

An important characteristic of the German LBT is the formula apportionment (FA) regarding the allocation of taxable income for firms with establishments in different municipalities discussed above for H4. A firm with multiple establishments allocates adjusted taxable income (and thus the tax payment) corresponding to the payroll share in a municipality. Such an formula apportionment (FA) regime becomes relevant only if a) a firm has establishments in more than one German municipality or b) a consolidated tax group has

[10] The CIT and solidarity surcharge are not captured by our LBT rate measure. However, when we run analysis on our corporate subsamples, all firms in the sample are subject to the CIT and solidarity surcharge and any changes in these tax rates are captured by year fixed effects. Given that results are generally similar when we limit the sample to incorporated firms vs. a broader sample of firms this suggests the CIT and solidarity surcharge are not driving our results. In an unreported robustness check for the full sample, we also consider legal-form year fixed effects to account for year-specific adjustments of tax rates for legal forms (i.e., CIT rates, PIT rates or solidarity surcharge).

[11] This lump-sum tax credit amounted to 9% of the adjusted LBT profit (*Gewerbeertrag*).

[12] This local tax multiplier threshold increased to 4 in 2020. However, this change occurred after our extended sample period ends in 2015.

subsidiaries in more than one municipality (group taxation regime). In these cases, the FA rules provide incentives to allocate payroll to low-tax municipalities as this decreases the weighted average tax rate of multi-establishment firms.

3. Empirical design and the data

3.1 Empirical design for analysis of H1-H3

To examine the effect of the local business tax on the wage per employee, we employ both an event study and a difference-in-differences analysis in line with Fuest et al. (2018) to examine the effect of a change in the local business tax rates on different labor outcomes. For the event study, in line with Simon (2016) and Fuest et al. (2018), we perform separate analyses for three types of events: a) an increase in the LBT rate, b) a large increase in the LBT rate, and c) a decrease in the LBT rate. A large increase is defined as an increase in the 75th percentile of positive LBT rate changes during our sample period. We report results for tax hikes as the first and by far most common type of an event (about 90% of tax rate changes are tax hikes).[13]

Equation (2) below presents the regression equation for the event study model:

$$ln(labor\ outcome_{ijt}) = \sum_{v=-4}^{5} \gamma_v D_{j,t+v} + \mu_i + \mu_j + \lambda_{st} + \varepsilon_{it} \quad (2)$$

The dependent variable $ln\ (labor\ oucome_{ijt})$ is one of three labor outcomes for establishment i located in municipality j in year t: (1) the natural log of the average annual real wage per employee,[14] (2) the natural log of the average annual wage per hour, and (3) the natural log of the average annual hours worked per employee. The explanatory variable $D_{j,t+v}$ is a dummy variable designed to identify years that are v periods before or after a tax event occurring in municipality j. The dummy variable takes the value 1 for an event (i.e., a tax hike, a large tax

[13] In unreported robustness checks, we also tested large tax hikes and tax cuts with similar results and implications.
[14] Fuest et al. (2018) use the median wage per employee. However, unlike the IAB panel data in Fuest et al. (2018), AFiD (the data we use) provides data at the establishment level but not at the employee level. As a result, we have to use the average annual wage per employee.

hike, or a tax cut) in the municipality *j* for *v* periods before or after the year *t* and 0 otherwise.[15] Our default specification uses establishment (μ_i) and municipal (μ_j) fixed effects. We also include the interaction of state and year as fixed effect ($\lambda_{s,t}$) to account for regional shocks. We consider alternative fixed effects and add controls later in the analysis for robustness. H1-H3 predict that the coefficient estimate for γ_v should be negative for all three labor outcomes for the years following a tax rate increase indicative of alternative channels to lower total wage costs for the firm.

We then perform a generalized difference-in-differences model with a staggered treatment interpreting changes in the LBT rates as exogenous shocks that could influence all three labor outcomes. In all specification we again account for establishment fixed effects, municipality fixed effects, and state-year fixed effects and consider alternative specifications for robustness.

$$ln(labor\ outcome_{ijt}) = \delta\, ln\big(1 - \tau_{jt}\big) + \mu_i + \mu_j + \lambda_{st} + \varepsilon_{it} \quad (3)$$

$ln(labor\ outcome_{ijt})$ corresponds with the same three labor outcomes discussed in equation (2). δ is interpreted as the percentage change in the labor outcome that corresponds with a one-percent change in the net-of-LBT rate.[16] Because the tax variable of interest is in a *net-of*-tax form, a *positive* (negative) δ represents a *decrease* (an increase) in the labor outcome in response to an increase in the LBT rate.[17] In the baseline regression, we do not account for any additional control variables. However, in alternative specifications, we incorporate additional control variables at the establishment level (the natural logarithm of the number of employees) and county level (the natural logarithm of GDP, the natural logarithm of unemployment rate,

[15] Following Fuest et al. (2018) and Lichter et al. (2025), we bin up event dummies at the end points of the event window.

[16] In our default analysis, we use the establishment's local business tax rate in line with Fuest et al. (2018). In later analysis for H4, we incorporate a weighted local business tax rate across the firm's establishments to evaluate a role for payroll shifting as an alternative response.

[17] Unlike the event study approach with indicator variables for an increase or decrease, the continuous form here offers an advantage in that it allows all directions of adjustments to the LBT to contribute to our estimates in the same analysis.

and the natural logarithm of the population – all at the county level).[18] H1-H3 predict that the coefficient estimate for δ should be positive for all three labor outcomes indicative of firms responding to LBT rate increases with each channel in a way that reduces overall wage costs for the firm.

3.2 Data – unique advantages, limitations, and comparisons with Fuest et al. (2018)

Our main data source is the German AFiD Panel for Industrial Establishments (German: *Amtliche Firmendaten in Deutschland – Industriebetriebe*) for the manufacturing and mining industries.[19] These industries represent about one-quarter of the gross value added of the German economy (Destatis 2015). The AFiD panel incorporates several mandatory business surveys conducted by the German Federal Statistical Office (German: *Statistisches Bundesamt*) and can be accessed by remote-data processing (Malchin and Voshage 2009). The most relevant survey for our analysis is the Monthly Report for Manufacturing and Mining Industries (German: *Monatsbericht für das verarbeitende Gewerbe und die Gewinnung von Steinen und Erden*).[20] This survey provides information on the payroll expense, the number of employees, and the aggregate number of working hours at the establishment level. Thus, for multi-establishment firms, the data provides more granular information than at the firm level alone. This is a major benefit for our analysis as LBT rates vary at the establishment level (across municipalities) and not only at the firm level. Therefore, we are able to clearly identify the relevant tax rate for each establishment as well as the formula apportionment-weighted average tax rate at the firm level in later analysis with H4.

[18] A county (German: *Kreis*) is a regional body in Germany. While for larger cities with typically more than 100,000 inhabitants, the city county is identical to the municipality (German: *kreisfreie Stadt*), there also exist rural counties (German: *Landkreis*) that can include plenty of small and medium-sized municipalities. In 2025, Germany has 106 city counties and 294 rural counties.

[19] The official title of the data is "Research Data Centres of the Federal Statistical Office and the statistical offices of the Länder, AFiD panel for the manufacturing and mining industries, 1995-2008"; see also http://www.forschungsdatenzentrum.de/bestand/afid-panel_industriebetriebe/index.asp.

[20] The German titles of the surveys are as follows: „Investitionserhebung bei Betrieben des Verarbeitenden Gewerbes sowie der Gewinnung von Steinen und Erden" and „Monatsbericht bei Betrieben des Verarbeitenden Gewerbes sowie der Gewinnung von Steinen und Erden".

The definition of establishments in the database is very close to that under German tax law. Thus, we can rule out that subsidiaries of a firm group are regarded as establishments in our data. Using the German Statistics of Tax Multipliers (German: *Statistik der Hebesätze*) and Regio-Stat information, we complement these data with LBT rates at the municipality level and information on the economic conditions at the county level (GDP per capita, population, unemployment rate). We also incorporate information from the AFiD panel for Industrial Firms (German: *AFiD Panel – Industrieunternehmen*) and from the Cost Structure Survey (German: *Kostenstrukturerhebung für das verarbeitende Gewerbe sowie die Gewinnung von Steinen und Erden*). This provides us with a unique panel of establishment data covering the period from 1999 to 2015.

AFiD provides several key advantages for our analysis. Most relevant, it includes information not only on payroll costs and the number of staff members in an establishment, but also on the number of hours worked. This is a key feature for our target to disentangle *tax incidence* from *labor demand* effects. The information at the establishment level, which is more granular than the firm level and allows us to clearly identify the relevant tax rates at the establishment level and the formula apportionment-adjusted average LBT rates at the firm level for later analysis with H4. AFiD also includes a full census of all establishments with at least 20 staff members. Hence, concerns about non-response and sample selection are not issues for our analysis. As wages in the manufacturing sectors should be more strongly affected by corporate taxation compared to other sectors (Harberger 2008; Gravelle 2013), this sector seems be especially relevant for our research question. For example, while Fuest e al. (2018) find an elasticity of the net-of-tax rate to the wage per employee of 0.388 for the full sample of many business sectors, their estimate for this elasticity is largest for the manufacturing industry with a value of 0.566. Therefore, our analysis focused on the manufacturing industry suggests that our findings might be taken as an upper bound for other German industries. An additional advantage from our data stems from the fact that the data are anonymized and available only

for political and scientific use. Hence, there should be a lower incentive for survey participants to "massage the numbers" than in public financial statements (for conforming tax avoidance in accounting data see Eichfelder et al. 2025).

Given both Fuest et al. (2018) and our study use German establishment data and some of our early, baseline tests are interpreted with comparisons to their results, it is helpful to outline some of the differences in the data used with each study's analysis. First, while Fuest et al. (2018) use the IAB establishment panel linked with information from the administrative employment register of the German Federal Employment Agency, we rely on the AFiD panel for the manufacturing sector at the establishment level (German: *Amtliche Firmendaten in Deutschland Betriebspanel*). As a consequence, our analysis uses the full sample of all German establishments with at least 20 staff members in the German manufacturing sector. By contrast, Fuest et al. (2018) use a 1 percent stratified sample of German establishments across all sectors (including establishments with less than 20 staff members) linked to a 6 percent sample of employee data. In addition, while Fuest et al. (2018) excludes most establishments in eastern Germany as a reaction to municipality mergers, we instead retain these municipalities to be able to expand our inferences more broadly but incorporate sensitivity analysis to verify that our results are robust when we exclude all eastern Germany establishments. Overall, in terms of firm representation and inferences, our data focuses on a more extensive representation of a single (but important) sector for corporate tax outcomes, and the data in Fuest et al. (2018) captures a narrower slice of a broader set of firm sectors. Both approaches complement one another by assessing how inferences in the analysis carryover to other settings.

Beyond sample composition, it is also helpful to outline differences in the types of measures that can be captured with our data versus the data in Fuest et al. (2018). A unique advantage of our data is that it provides the aggregate number of hours worked of the establishment *i* in year *t*. This enables us to disentangle tax incidence effects from labor demand effects of the local business tax. However, a key limitation with our data relative to Fuest et al.

(2018) is that our data does not provide information at the employee level. Because of this, we must use annual establishment averages (as opposed to the medians used in Fuest et al. 2018) for our labor outcomes like wage per staff. Additionally, it means that we cannot investigate the employee-specific factors examined with later analysis in Fuest et al. (2018) (e.g., for unionization, education, employee skills, gender, or age). Instead, we have to limit our later heterogeneity analysis to establishment level characteristics (e.g., R&D intensity).

3.3 Descriptive Statistics

We prepare four initial samples for our analysis that vary by the time periods analyzed, the requirement to have information on working hours, and the type of firm included (incorporated firms alone or a broader sample of both corporations and path-through entities that typically belong to individuals). Our first baseline sample is most similar to Fuest et al. (2018), where we start with a sample from 1999 to 2008 (their sample period) considering all legal forms (corporations and pass-through entities) of about 68,679 permanent establishments with at least 20 staff members in the German manufacturing sector. For this sample, we have 464,720 establishment-year observations.

We then prepare a second sample that restricts the baseline sample to observations with information available for working hours and working hours per staff member (to be able to evaluate H2 and H3). This reduces the sample to 414,066 establishment-year observations (still for 1999-2008). If we then further restrict the sample to corporations, the number of observations reduces to 258,968. Finally, we extend the observation period for this corporation sample to 1999-2015 (corporation sample, 1999-2015) increasing the number of observations to 513,507. We only include corporations in the sample extended to 2015 because of the

German Business Tax Reform 2008 (GBTR 2008) that substantially altered taxation for other business forms (pass-throughs and sole proprietorships).[21]

Table 1 documents descriptive statistics for these four different samples. All monetary values have been price-adjusted by the German Producer Price Index for Manufacturing Goods (PPI) of the German Federal Statistical Office (German: *Erzeugerpreisindex Gewerbliche Produkte*) to the year 2015. For the initial sample with available working hour information (Panel B), we find that the average establishment observations has price-adjusted wage costs per year of 6.04 million €. The average number of staff members (considering changes in employment within the year) is 140 with 183 thousand working hours. On average, an establishment generates price-adjusted sales of 38.13 million € and the capital stock (measured by fixed assets) is 9.26 million €.[22] The PPI-adjusted yearly wage cost per staff is 34.74 thousand € and the average wage cost per working hour 48.49 €. Each staff member (including part-time employees, trainees)[23] is working 1,357 hours per year or 113 hours per month on average. As the data does not include information at the employee level, we are not able to provide more detailed information on the composition of employees at the firm. The average establishment-level LBT is 15% and the average factor apportionment (FA)-weighted LBT rate at the firm level is 13 percent. In line with Riedel (2010) and Eichfelder et al. (2018), the lower rate at the firm level is consistent with the expectation that firms use payroll shifting to reduce their FA-weighted average tax rate by allocating some of their payroll to low LBT municipalities.

[Table 1 about here]

[21] Due to the GBTR 2008, the effective LBT burden became effectively zero for single entity firms and individual taxpayers as long as the LBT multiplier in a municipality was not higher than 4. Thus, LBT tax incentive after 2008 differ dramatically between establishments of individual taxpayers and establishments of corporations.

[22] The AFiD panel does not provide information on the capital stock at the firm level or the establishment level. Therefore, we use the approach of Eichfelder et al. (2023) using information from the Cost Structure Survey, the Investment Survey and the Montly Report to calculate capital stocks at the establishment level.-

[23] This includes only staff employed directly by the firm, but not self-employed freelancers or contractors that employed by another firm. The data does not provide information on the type of employment contracts (e,g., part-time workers vs. full-time workers, blue-collar workers vs. white-collar workers).

Comparisons between our baseline sample most similar to Fuest et al. (2018) (Table 1 Panel A) and our initial sample requiring available information on working hours (Table 1 Panel B) suggest that the samples are largely similar. The average establishment size is slightly smaller for the sample in Panel A, which documents a smaller number of staff members (128), lower sales (34,89 million €) and lower capital stock (8.76 million €). Further, when we limit the sample in Panel B to only incorporated firms in Panel C, the descriptive statistics are also similar. In Panel C, the average number of staff (about 156), working hours (203 thousand), wage per hour is higher (55.78 €), sales (46.82 million €), and the capital stock (10.91 million €) are slightly higher than in Panel B. However, the average wage per staff in Panel C very close to the average wage per staff in Panel B.

Table 1 Panel D reports descriptive statistics for the extended corporation sample from 1999 to 2015. In line with increasing establishment size over time, the extended corporate sample has a greater number of staff members (about 186) and working hours (249 thousand) on average than in the shorter time period sample limited to corporations (Panel C). The same holds for wages (8.6 million €), sales (55.73 million €) and capital stock (12.5 million €). However, the price-adjusted wage per staff (36.58 thousand €) and the price-adjusted wage per hour (56.04 €) are very close to Panel C.

Important for our focus on LBT rates in our analysis, we find no relevant differences in the average LBT rates at the establishment and the firm level for the different subsamples across Panels A-D of Table 1.

4. Results

4.1 Recapitulation of Fuest et al. (2018) (H1 – the effect on wages per employee)

In Table 2, we provide generalized DiD regressions in line with Fuest et al. (2018) for the logarithm of wage per staff as dependent variable (for event study results see Subsection 5.2.). While we use a similar specification as Fuest et al. (2018), our analysis differs in several ways. First, we use the AFiD panel for industrial establishments and not the IAB establishment

panel for all industrial sectors. Thus, our data does not include establishments with less than 20 employees, for which Fuest et al. (2018) fine the strongest tax effects. Second, due to data restrictions, we use the logarithm of the average wage per employee and not the logarithm of the median wage per employee as dependent variable. Third, we do not exclude municipalities with mergers in the observation period. Thus, our data includes most establishments in eastern Germany, which are typically excluded by Fuest et al. (2018).

Despite these differences in the samples, our findings in Table 2 generally confirm the results of Fuest et al. (2018) where an increase in the LBT corresponds with lower wages per employee, which is attributed to tax incidence by employees in their paper. Recall that, given we use the net-of-LTB rate form of the tax variable, a positive coefficient means a negative tax effect on the average wage per staff. The estimated elasticity in column (1) (0.445) with our manufacturing sample is slightly higher than the baseline estimate of Fuest et al. (2018) (0.388) when they include all sectors, but is smaller than their estimate for the manufacturing sector (0.556). This is also not surprising as our sample does not include establishments with less than 20 staff member, which Fuest et al. (2018) identify as the subsample that is most responsive to the LBT.

Columns (2)-(6) vary by which fixed effects are included (commuting zone fixed effects or retaining state-year fixed effects), whether controls are incorporated, and whether we include versus exclude establishments in eastern Germany.[24] In all but one column (column (2) where we exclude state-year fixed effects), we find a positive coefficient on the log net-of-LBT rate where elasticities range from 0.209 to 0.785 and are highest when establishments from eastern Germany are excluded (to be in line with the approach in Fuest et al. (2018)).

[24] When use controls from period t-2 (two years prior to the event) to mitigate concerns these may be endogenous to the tax rate change.

4.2 Analysis of wage components (H2 – wages per hour and H3 – hours per employee)

In Table 3, we next turn to our difference-in-differences analysis with equation (3) that investigates the role of two components of wages per employee in response to increases in LBT rates. We investigate the two alternative responses predicted in H2 and H3, tax incidence (wages per hour worked) and labor demand (hours per employee), respectively. Before discussing analysis for the tests of H2 and H3 in Panels B and C of Table 3, however, we first verify that the sample modifications required to investigate these two components do not alter findings for the wages per employee findings in Table 2.

To do this, we re-estimate the analysis from Table 2 using the baseline sample with the added restriction that firms have information available on hours worked in columns (1-3) of Panel A of Table 3.[25] Additionally, we re-estimate the analysis from Table 2 for the extended sample period (1999-2015) for corporations in columns (4-6) of Table 3 Panel A. Reassuringly, despite the additional information requirement for hours worked, the expansion to a broader sample period, and the limitation of firms in the extended period to corporations, we continue to observe the positive coefficient estimate across columns of Table 3 Panel A in line with Fuest et al. (2018) and our findings in Table 2. This provides reassurance that adjustments in our sample needed for our wage component analysis do not drive alternative findings in comparisons with our results and those in Fuest et al. (2018).

Before turning to a longer discussion required with Table 3 Panel B, which produces a surprising finding for the incidence channel (H2), we first evaluate Table 3 Panel C that corresponds with the labor demand channel (H3). Across all columns of Panel C, we observe evidence in support of H3 that predicts an increase in LBT will correspond with a reduction in labor demand (hours per staff). The positive coefficient estimates across all columns are statistically significant at the 1 percent level. This finding is important in its own right even

[25] This is the sample reported in Panel B of Table 2 (the descriptive statistics table).

before turning to analysis in Table 3 Panel B. This is because the results in Panel C provide the first indication that the wages per employee response observed in the prior literature on tax incidence (and Table 3 Panel A in our analysis) should not be attributed entirely to a labor incidence channel but should instead be attributed at least in part to the labor demand response by firms.

We save the results for the incidence response in Table 3 Panel B for last because the results depart from the prediction in our H2 based on prior literature with wage incidence responses to tax rates. In Panel B, where we use wages per hour rather than wages per employee, we observe that firms actually *increase* wages per hour for employees in response to higher LBTs; coefficient estimates on the net-of-LBT rate are negative and statistically significant at the 5 percent level or better. Said another way, once we use a measure of wages that accounts for the role of hours worked, we no longer see evidence of a wage incidence result in response to LBT rates.

To understand why firms might respond in the *opposite* direction from the direction predicted in H2 (in contrast to corporate incidence theory), we incorporate additional analysis in Sec. 5.1 that considers effects for extensive margins on the level of staff and total hours. The combined analysis with extensive margins (Sec. 5.1) and the intensive margins examined in Table 3 offer one plausible explanation for why firms might respond in this way. For now, we take the finding as given and consider what this means for interpretations of wages per employee in Table 3 Panel A and Table 2 and, similarly, what this could mean for analysis in prior literature using a wages per employee measure to make inferences about tax incidence.

We adapt equation (1) to illustrate different ways the components for wage per hour and hours per employee could result in a reduction in wages per employee:

$$\downarrow \frac{Wages}{Employee} = \downarrow \frac{Wages}{Hour} \text{ x } \downarrow \frac{Hours\ Worked}{Employee} \qquad (1\downarrow A)$$

$$\downarrow \frac{Wages}{Employee} = \uparrow \text{ or no } \Delta \frac{Wages}{Hour} \text{ x } \downarrow \frac{Hours\ Worked}{Employee} \qquad (1\downarrow B)$$

$$\downarrow \frac{Wages}{Employee} = \downarrow \frac{Wages}{Hour} \text{ x } \uparrow \text{ or no } \Delta \frac{Hours\ Worked}{Employee} \quad (1\downarrow C)$$

A decrease in wage per employee could reflect a reduction in both wage per hour and hours worked per employee (in line with our predictions in H1-H3). However, a decrease in wages per employee could also reflect a larger reduction in one of the above components that dominates either the absence of a change or a smaller increase by the other component. The results in Tables 2 and 3 are consistent with the explanation in (1↓B) whereby the reduction in hours worked per employee dominate an increase in wage per hour to in turn reduce overall wages per employee. Evaluating the findings across all three panels in Table 3 is important because it changes our understanding of the role of the labor demand response in the overall wages per employee findings in Table 3 Panel A. Under equation (1↓B), this suggests that even attributing the full extent of the wages per employee findings in Tables 2 and 3 Panel A to demand for worker hours likely understates the extent of the labor demand response by firms. This is because the reflection of hours per employee (Panel C) in wages per employee (Panel A) is partly offset by the opposing response with wages per hour (Panel B). Further, these results suggest using wages per employee rather than wages per hour to study the wage incidence effects of tax rates leads to incorrect inferences about wage incidence. Overall, the results in Tables 2 and 3 fill an important void in the literature by revising an understanding of the role of the incidence and labor demand channels when studying wages per employee responses to tax rates.

We report the event study (equation (2)) versions of the analysis corresponding to Table 3 Panels A-C in Figures 3-5, respectively, in line with the event study approach in Fuest et al. (2018). We present event study results for the baseline sample in the shorter period (1999-2008) and the corporate extended sample (1999-2015) in Panels A and B, respectively, for each figure. We use the year before treatment (*t-1*) as reference year to estimate the other dummy variables. The event study representations of the analysis in these figures add to the analysis in Tables 2

and 3 in two ways. First, it allows us to consider the reasonableness of the assumption with the difference-in-differences approach by offering information about whether or not labor outcomes were already likely to have been trending in the direction of the differences we observe in Tables 2 and 3 absent any tax rate change (i.e., whether or not the common trends assumption is likely to hold). While it is not possible to directly test the common trends assumption, the fact that we do not observe a statistical difference in trends for any of the three labor outcomes leading up to the tax rate change period (in Figures 3-5) suggests that the common trends assumption is likely reasonable in our setting (as it was for Fuest et al. (2018) that use a similar setting).

Further, by examining the differences in the years following the tax rate change in Figures 3-5, we are also able to consider how long it takes for firms to incorporate the response into the different labor outcomes. Consistent with the findings in Fuest et al. (2018), Figure 3 shows it generally takes some time for the effect of the tax hikes to emerge in wages per employee (e.g., we do not observe a statistically significant difference in t=0). However, at least a portion of the individual, competing channel responses (wages per hour – Figure 4 and hours per employee – Figure 5) are reflected more quickly starting in t=0. To address recent concerns with potential weighting issues that may arise with staggered difference-in-differences analysis, in our Online Appendix Figures A1-A3, we re-estimate the analysis from Figures 3-5, respectively, using the dynamic two-way fixed effects estimator in de Chaisemartin and d'Hautefeuille (2024). Different from other two-way fixed effect estimators, this estimator not only accounts for the treatment effect by an indicator variable but also allows consideration for the size of the tax rate change in the estimation (see also de Chaisemartin et al., 2024). Results with the approach are robust for the two separate channels (wages per hour and hours per employee) but the effect is more muted for wages per employee.

4.3 The role of lower cost payroll shifting opportunities for incidence and labor demand (H4)

We next evaluate whether the availability of other payroll related responses for firms alters the extent of the tax incidence and labor demand responses by these firms. As discussed in section 2.1, the other payroll response we consider is the use of payroll shifting across municipalities to lower the firm's exposure to high-tax rate municipalities in line with prior research (Riedel (2010), Eichfelder et al. (2018) and Fuest et al. (2021)). Further, as discussed in motivating H4, we expect that a payroll shifting response to be a lower cost payroll-related response for the firm. This is because it involves either only accounting-based tax avoidance strategies for where payroll is reported with no real effects for firm operations and no effect on overall firm pre-tax profits or it involves a real shifting of the location of payroll amongst the firm's establishments but not a reduction in the overall firm payroll.

We report analysis for H4 in Table 4. A payroll shifting response is only available to firms with multiple establishments as opposed to a single establishment that operates in only one municipality. Thus, we expect to observe a smaller response with more costly options (wages per hour and hours per staff) in multi-establishment firms relative to single establishment firms who do not have this alternative opportunity. Table 4 repeats the analysis from Table 3 Panels A-C but breaks out samples into single establishment firms versus multi-establishment firms. Odd columns present results for single establishment firms, and even columns present results for multi-establishment firms. We use a payroll weighted LBT rate for the multi-establishment columns to ensure the labor outcome responses in Table 4 for multi-establishment firms only capture responses for these labor outcomes that are distinct from payroll shifting. We do not use the payroll weighted LBT rates for multi-establishment firms in our earlier analysis (Tables 2 and 3) because we try to start by being consistent with the approach in Fuest et al. (2018), which does not use weighted LBT rates.

Consistent with H4, for the two separate response channels in Table 4 Panels B and C, the results generally support our prediction that wage per hour and hours per employee

responses are smaller in multi-establishment firms. However, the wage per hour and hours per employee responses still occur in multi-establishments firms and are not limited to single establishment firms.

While H4 does not make a prediction for the effect on wage per employee (Table 4 Panel A) given this does not capture a particular response channel with LBT rates, we include this panel for completeness as it is useful to evaluate how the breakout of firm type and incorporation of weighted tax rates for multi-establishment firms play into analysis based on wage per employee alone. Overall, we do not observe evidence of an adjustment to wages per employee for any of the columns in Table 4 Panel C.[26] One interpretation of this result is that, while the wages per hour and hours per staff responses occur and are distinct from the payroll shifting channel, the two competing responses do not result in a net adjustment to wages per employees after accounting for the payroll shifting response to LBT rates. Thus, the incremental, earlier (net) wages per employee results in Tables 2 and 3 Panel A might alternatively be explained by payroll shifting responses.

5. The role of extensive margins and heterogeneity tests

5.1 Extensive margins

Given that at first glance the wages per employee results for H2 work in the opposite direction of what is predicted in the literature (that firms pay *higher* wages per hour following LBT rate increases), we consider one reason firms might respond in this way combined with the reduction in labor demand response we observe for H3.

One possible explanation might involve firms replacing some full-time employees with part-time employees and the role of intensive versus extensive margins in labor demand. Note that the number of employees includes a count of both full-time and part-time workers. Thus,

[26] In Online Appendix Table A1, we re-estimate Table 2 with weighted LBT rates and similarly fail to find evidence of an adjustment to wage per staff for any of the columns. Thus, the role of the weighting is not limited to our sample in Table 3 Panel A that also requires available hours worked information.

one explanation for the combined results we observe in Panels B and C of Table 3 could be that firms may not only reduce the number of working hours along the intensive margins (within the same set of employees as before the tax rate change) but may also change the composition of the workforce to replace some full-time employees with part-time employees and compensate these employees differently per hour.[27]

Compensation per hour may be different for these part-time employees for at least two reasons. First, the firm may elect to pay an hourly premium for more productive works to help offset some of the output lost with switching from full-time to part-time employees. Further, part-time employees bear greater risk to their total income without a full-time fixed amount of hours demanded and, consequently, they may require an hourly premium to compensate for that risk. Of course, this path only represents labor cost savings for the firm if the *total* set of working hours was reduced (was not just equally offset) with the replacement of some full-time employees with part-time employees. Thus, if firms respond in this way, we should observe that not only is that average set of hours per employee lower (Table 3 Panel C) and the average wage per hour higher (Table 3 Panel B) but also that the total number of working hours for all employees should be lower.

We report analysis for the related tests in Table 5 Panels A and B. Panel A reports evaluation of the extensive margins for the average annual working hours at the establishment (across all employees). Panel B reports evaluation of the extensive margins for the average annual number of employees for the establishment (containing both full-time and part-time employees). Consistent with firms responding to higher LBT rates by replacing some full-time employees with part-time employees, we observe that firms generally employed a *greater* number of employees following LBT rate increases but the overall number of working hours across these employees was lower than before the LBT rate. While our data does not have

[27] Additionally, this could occur by switching current full-time employees to part-time status.

employee level information to directly observe whether staff were full-time or part-time, we offer the above indirect analysis as just one possible explanation for why it may reasonable that firms simultaneously decreased the hours per staff but increased the wage per hour in responses to LBT rates.

5.2 Heterogeneity tests

As discussed, an important limitation with our data is that we cannot examine heterogeneity tests in terms of employee-characteristics like unionization, education, employee skills, gender, or age that were examined in Fuest et al. (2018). Instead, we are limited to considering establishment or firm levels of heterogeneity. We consider three types of firm-level sources of heterogeneity for this analysis: R&D intensity, capital intensity, and productivity (as captured by total factor productivity).[28]

We evaluate the role of R&D intensity because we expect that labor may play a larger role in R&D intensive firms. Ex ante it could be argued that labor outcomes for R&D intensive firms may be either more or less responsive to LBT tax rates. On the one hand, these firms might be more responsive with their labor outcomes because labor choices make up a larger set of the options available to them relative to firms that predominately rely on capital. On the other hand, the unique skill or knowledge of laborers in R&D intensive firms may make firms less willing to make adjustments to labor in response to tax rates because they contribute more value to the firm.

We consider capital intensity for similar types of competing arguments as with R&D intensity above. Capital intensive firm labor outcomes might be less responsive to tax rates

[28] We consider information on R&D expenses at the firm level from the Cost Structure Survey (German: *Kostenstrukturerhebung für das Verarbeitende Gewerbe sowie die Gewinnung von Steinen und Erden*) and define R&D intensity as the logarithm of PPI-adjusted R&D expenditures per staff member. Capital intensity is the logarithm of the PPI-adjusted capital stock per staff member. Productivity is defined as total factor productivity estimated with the Wooldridge (2009) method with the logarithm of sales as output and the logarithm of wages, the logarithm of capital stock and the logarithm of material costs as inputs. For all measures, we define the "high" subsample as the establishments in the top quartile of the distribution. Thus, high R&D intensity establishments are establishment that belong to the firms in the top 25th percentile.

because labor options make up a smaller set of the options available to these firms. Conversely, capital intensive firms may be more willing to adjust labor outcomes than less capital intensive firms, even if they have fewer options for these adjustments, because labor resources are of lower priority in these firms.

Predictions for the role of the last characteristic, firm total factor productivity, are less clear. However, we include analysis with productivity because labor is an important input for production functions and how productive a firm is in applying all inputs (both labor and capital) could reasonably be expected to alter its willingness to adjust labor factors in response to tax rates.

For the heterogeneity tests, we re-estimate all three panels from Table 3 and incorporate an interaction term for each of the firm-level characteristics above.[29] Col. 1-2 (3-4) in each panel report the analysis for R&D intensity (capital intensity). Col. 5-6 report analysis for the productivity analysis. Overall, only R&D intensity seem to play a consistent role in the analysis, whereby results suggest labor outcomes for R&D intensive firms are more responsive to LBT rates. The coefficient estimates on the R&D intensity interaction terms (*Log NLBTR x R&D Intensity*) are statistically significant at the 5 percent level or better in col. 1 and 2 for all three panels and the coefficient is of the same sign as the LBT rate term. Instead, the results for interactions with capital intensity and productivity in col. 3-5 are more mixed and do not provide evidence to support a consistent role for this source of heterogeneity with responses to LBT rates.

6. Conclusion

In this paper, we investigate an additional channel through which business taxes can influence labor and evaluate how accounting for this channel alters inferences in prior literature attributed to another important labor channel (wage incidence). Specifically, using variation in

[29] As a result, this returns to using unweighted LTB rates in line with the approach in Table 3.

local business tax (LBT) rates and unique data on the working hours at German manufacturing establishments, we show that firms reduce the average hours worked per employees in response to business tax rates. Documenting this distinct labor demand channel is important because it may have different consequences for firms (e.g., in terms of production) and households (e.g., in terms of income) than a pure wage response to tax rates.

We then show that if we use a measure of wages per hour as opposed to wages per employee to distinguish a wage effect versus a labor demand effect this leads to very different inferences for the role of LBT rates with wage incidence. In particular, we observe that firms actually *increase* wages per hour in response to tax rate increases. This finding with wages per hour stands at odds with the inferences in Fuest et al. (2018) that infer a large wage incidence effect on employees following LBT rate increases. In later analysis, we provide one plausible explanation for this seemingly unexpected finding by evaluating tests with extensive margins for the total number of employees and total hours worked at the establishment. While the data with hours worked does not offer employee level information, indirect evidence with these extensive margin tests are consistent with firms reducing the number of full-time employees and engaging more part-time employees that do not fully offset the full-time employees lost. Further, the results would be consistent with part-time employees receiving an hourly premium for their hours. Of course, we recognize that other explanations may play a role given we do not have direct measures of employee characteristics to study compositional differences.

Later analysis also considers whether access to less costly payroll shifting responses with LBT rates alters a firm's willingness to respond to these tax rates with an adjustment to hours per employee or hourly wages. Consistent with this prediction, we observe that hours per employee and hourly wages are more responsive to LBT rates in firms without access to these less costly shiftingopportunities. However, once we account for payroll shifting opportunities, we no longer observe evidence of a wages per employee response with LBT rates. This could occur if a substantial portion of the wages per employee effect observed in prior literature (e.g.,

Fuest et al. 2018) is explained by payroll shifting strategies that do not alter the overall level of compensation for hours worked.

Given the results in our study introduce evidence for a new channel with labor market responses to tax rates (labor demand along intensive margins) and present a counterintuitive result for adjustments to wages per hour in response to tax rates, we hope that this motivates future research on alternative labor market dynamics with tax rate changes. For example, if researchers could integrate data with information on both hours worked and employee-level information, it would be interesting to investigate compositional shifts within firms following changes in tax rates (e.g., the proportion of part-time versus full-time hours, hours for high skill versus low skill works). This area of work is important for policymakers that have expressed concern about how workers and other key stakeholders are affected by corporate tax rates (Durante 2021).

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Figures and Tables

Figure 1: Local business tax rates in Germany, 2015

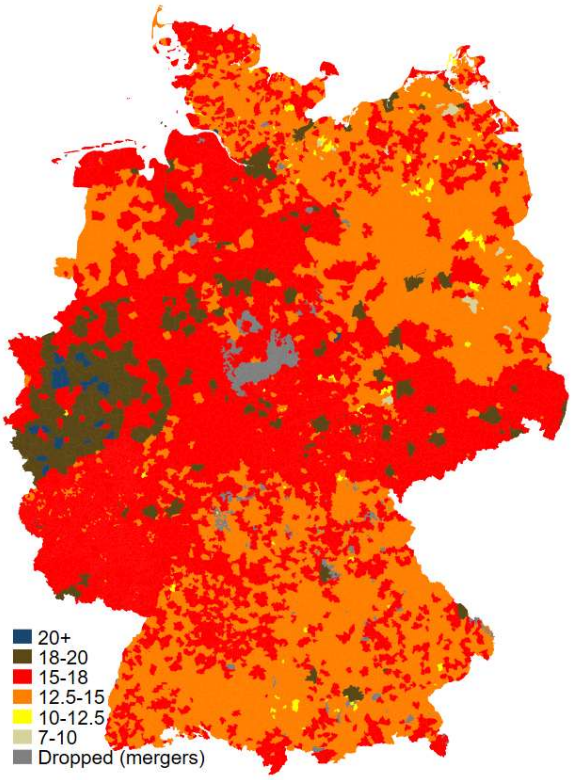


Figure 2: Local business tax rate variations, 1999-2015

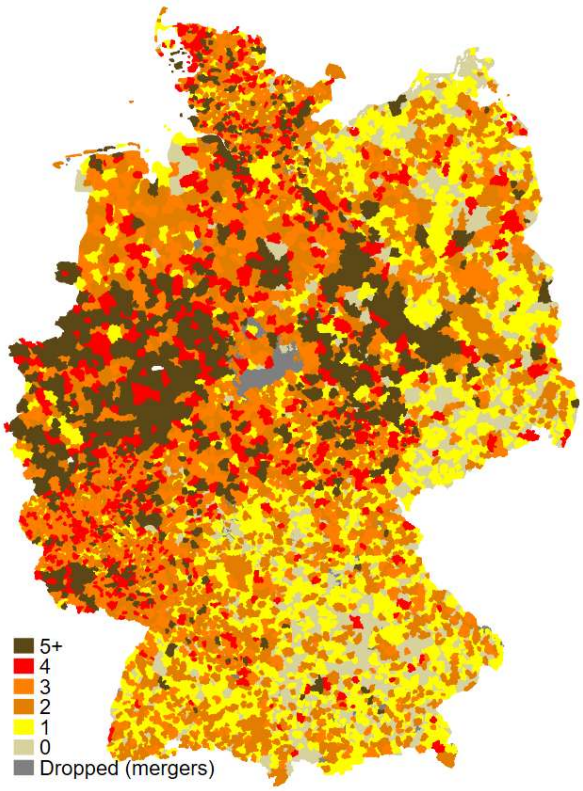
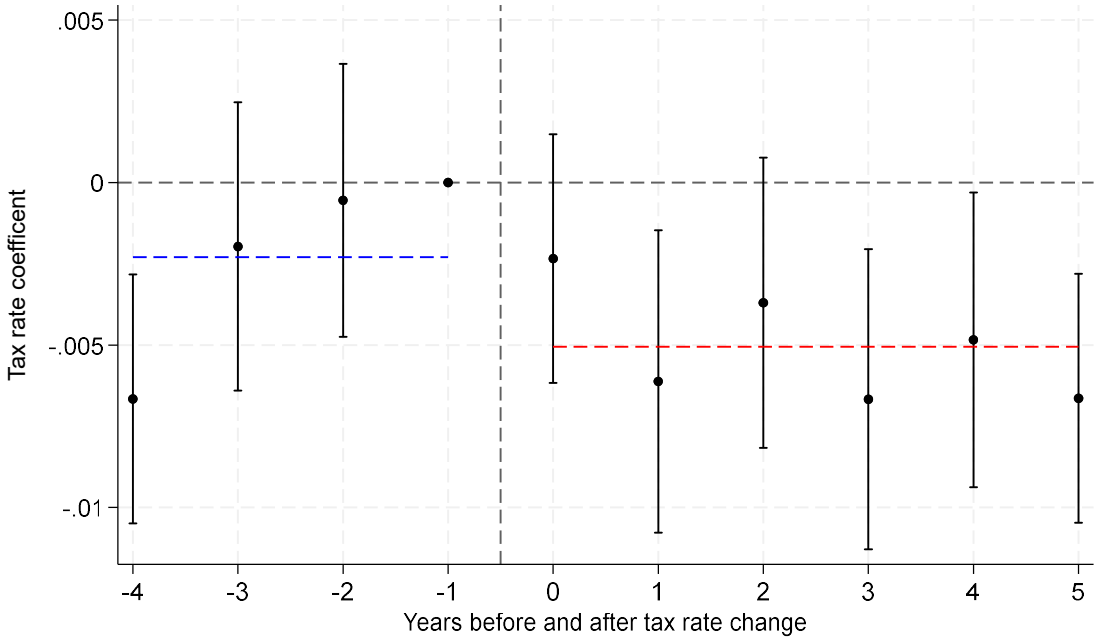


Figure 3: Logarithm of wage per staff: Event-study
Panel A: Baseline sample, 1999-2008



Panel B: Corporation sample, 1999-2015

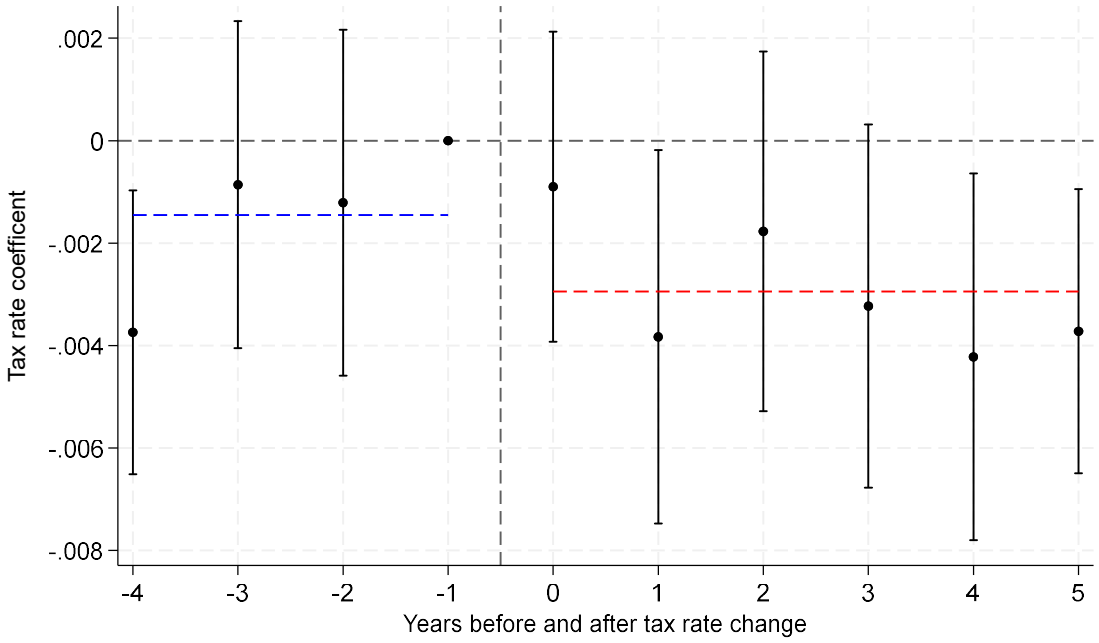
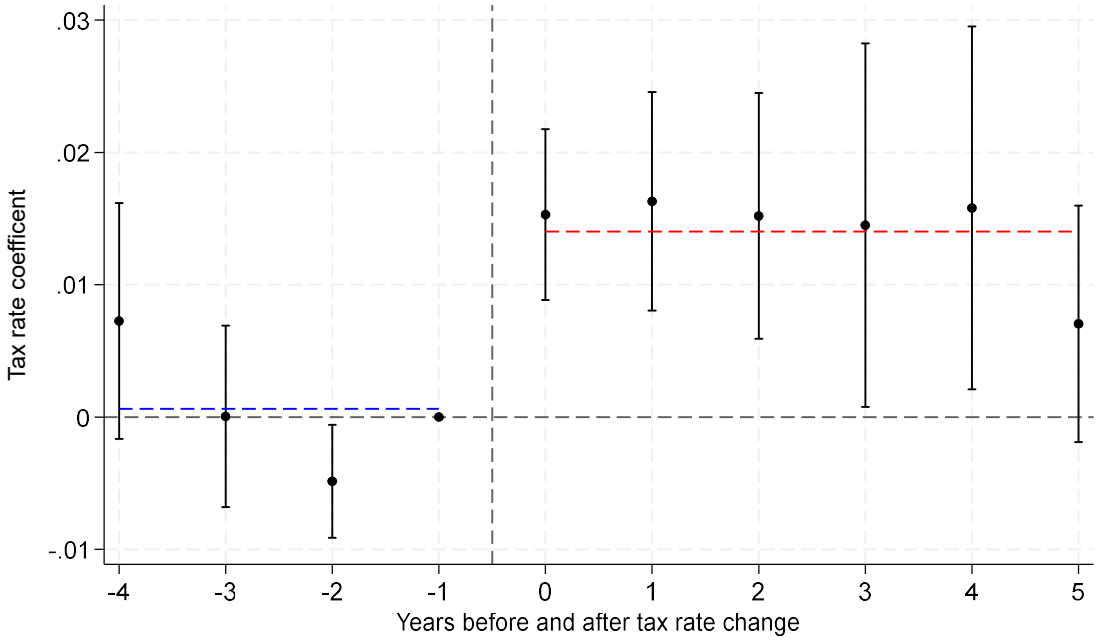


Figure 4: Logarithm of wage per hour: Event-study
Panel A: Baseline sample, 1999-2008



Panel B: Corporation sample, 1999-2015

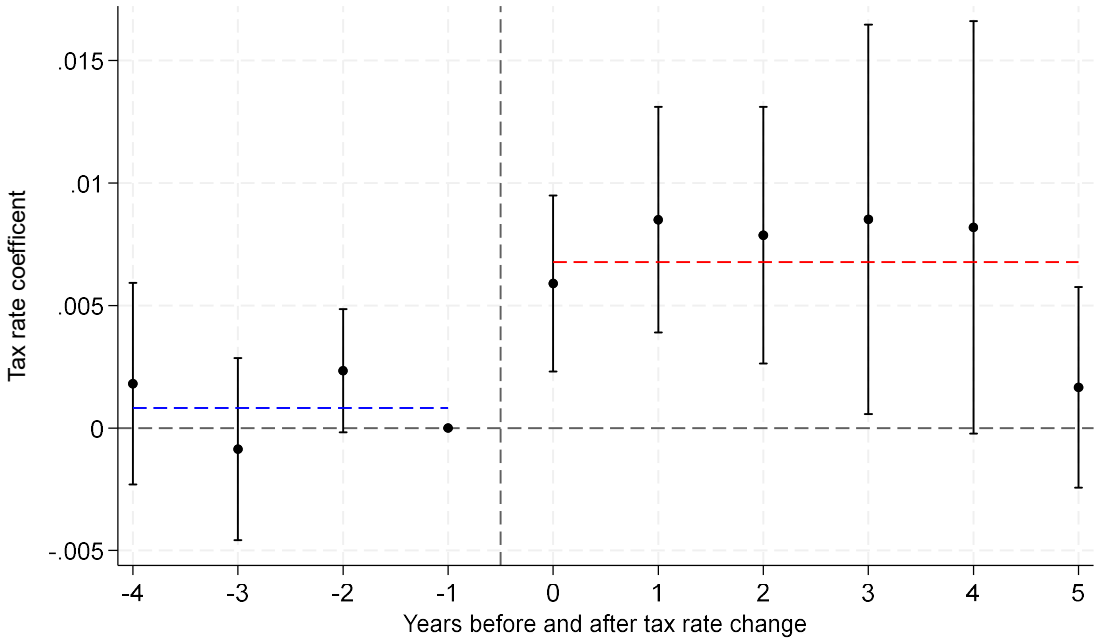
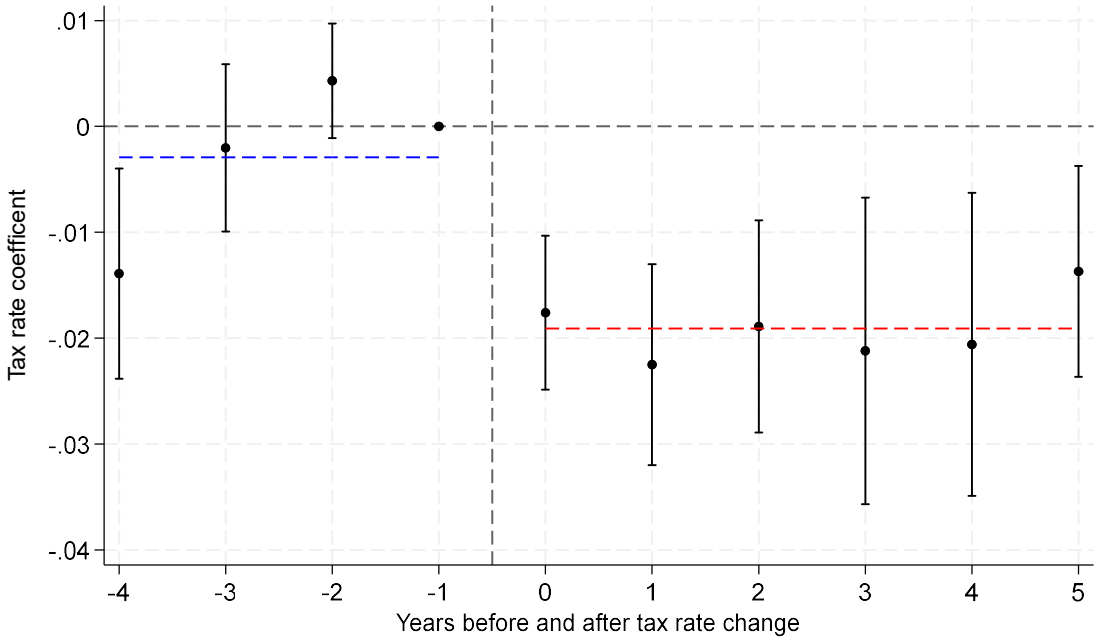


Figure 5: Logarithm of hours per staff: Event-study
Panel A: Baseline sample, 1999-2008



Panel B: Corporation sample, 1999-2015

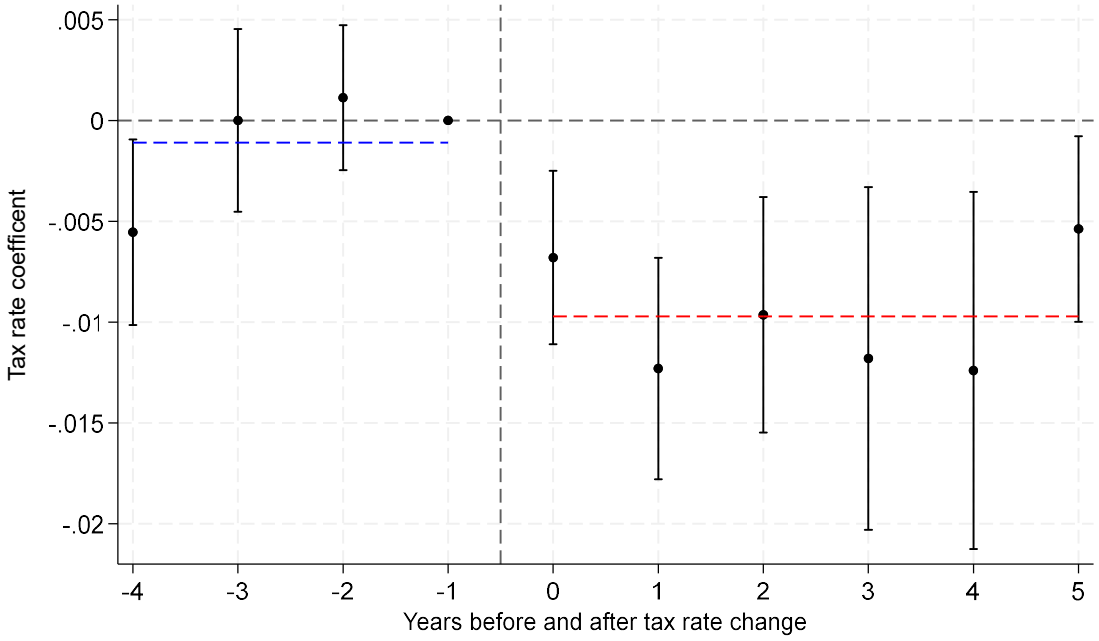


Table 1: Descriptive statistics

Variables	Obs.	Mean	St. Dev.	p25	Median	P75
Panel A: Baseline sample (1999-2008)						
Wages (Mio. €)	464,720	5.52	33.99	0.80	1.57	3.82
Working hours (in Th.)	420,951	180.43	732.16	36.39	70.94	158.18
Average staff (year)	464,720	128.67	567.40	28.50	48.83	105.83
Sales (Mio. €)	464,720	34.89	365.12	266.29	6.25	18.02
Capital stock (Mil. €)	464,720	8.76	532.18	1.21	2.80	5.80
Wage per staff (Th. €)	464,720	34.45	15.34	25.35	33.90	42.35
Wage per hour (€)	414,066	48.49	2,032.81	18.23	24.51	33.07
Hours per staff	464,720	1,334.98	475.93	1,063.78	1,409.11	1,652.25
LBT rate	464,720	0.15	0.02	0.14	0.15	0.17
Weighted LBT rate	464,720	0.13	0.02	0.12	0.13	0.14
Panel B: Sample with information on working hours (1999-2008)						
Wages (Mil. €)	414,066	6.04	35.94	0.87	1.78	4.32
Working hours (in Th)	414,066	183.42	737.85	37.65	72.56	160.73
Average staff (year)	414,066	140.04	599.79	30.00	54.83	118.17
Sales (Mio. €)	414,066	38.13	384.73	2.87	7.03	20.49
Capital stock (Mil. €)	414,066	9.26	587.22	1.30	2.90	6.00
Wage per staff (Th. €)	414,066	34.73	13.37	25.93	34.40	42.61
Wage per hour (€)	414,066	48.49	2,032.81	18.23	24.51	33.07
Hours per staff	414,066	1,357.18	447.38	1,084.63	1,417.86	1,656.64
LBT rate	414,066	0.15	0.02	0.14	0.15	0.17
Weighted LBT rate	414,066	0.13	0.02	0.12	0.13	0.14
Panel C: Corporation sample (1999-2008)						
Wages (Mil. €)	258,968	7.01	44.61	0.95	1.87	4.51
Working hours (in Th)	258,968	203.37	903.57	39.84	75.74	165.98
Average staff (year)	258,968	155.59	737.19	31.13	56.42	121.33
Sales (Mil. €)	258,968	46.62	482.26	3.12	7.35	21.50
Capital stock (Mil. €)	258,968	10.91	742.10	1.30	2.91	6.14
Wage per staff (Th. €)	258,968	35.85	13.63	26.76	35.19	43.72
Wage per hour	258,968	55.78	2,530.93	18.57	24.93	33.79
Hours per staff	258,968	1,367.56	440.68	1,099.27	1,433.70	1,666.80
LBT rate	258,968	0.15	0.02	0.14	0.15	0.17
Weighted LBT rate	258,968	0.13	0.02	0.12	0.13	0.14
Panel D: Extended corporation sample (1999-2015)						
Wages (Mil. €)	513,507	8.60	52.80	1.20	2.48	5.79
Working hours (in Th)	513,507	249.28	1,053.14	48.49	102.00	213.15
Average staff (year)	513,507	185.92	821.68	39.58	72.58	151.33
Sales (Mil. €)	513,507	55.73	557.56	3.97	9.84	28.33
Capital stock (Mil. €)	513,507	12.50	588,31	1.48	3.38	7.48
Wage per staff (Th. €)	513,507	36.58	13.81	27.41	35.75	44.36
Wage per hour	513,507	56.04	2963.09	18.96	25.42	34.13
Hours per staff	513,507	1,376.40	424.17	1,129.76	1,440.57	1,653.07
LBT rate	513,507	0.15	0.02	0.13	0.15	0.16
Weighted LBT rate	513,507	0.13	0.02	0.12	0.13	0.14

Table 1 reports descriptive statistics of establishment characteristics. Monetary values are all adjusted by the German producer price index; adjustments: Sales (Mil. €), tax rates (percentage points), capital stock Panel A reports a baseline sample for all legal forms over 1999-2008. Panel B reports the sample in Panel A limited to those with working hour data. Panel C reports Panel B limited to incorporated firms. Panel D then extends the corporate sample in Panel C to capture 1999-2015 (a longer sample period). Mil. refers to millions and Th. refers to thousands.

Table 2: Recapitulating the wages per staff findings in Fuest et al. (2018) (H1)

Dependent variable	(1) Log Wage/Staff	(2) Log Wage/Staff	(3) Log Wage/Staff	(4) Log Wage/Staff	(5) Log Wage/Staff	(6) Log Wage/Staff
Log net-of-LBT rate	**0.445*** **	**0.209**	**0.455*** **	**0.407** **	**0.359***	**0.785** **
	(0.201)	**(0.196)**	**(0.199)**	**(0.182)**	**(0.184)**	**(0.236)**
Predicted sign	+	+	+	+	+	+
Establishment, Year and Muncipality FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES		YES	YES	YES	YES
Comzone-Year FE			YES			
Establishment controls t-2				YES		
County controls t-2					YES	
No east establishments						YES
Observations	464,720	464,720	464,720	419,405	429,116	386,796
Adjusted R-squared	0.696	0.696	0.696	0.712	0.713	0.705

The baseline specification relies on Fuest et al. (2018). The 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-the local business tax rate. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; county controls include the natural logarithm of GDP, the natural logarithm of the unemployment rate, and the natural logarithm of the population; establishment controls include the logarithm of the number of employees; all control variables are lagged twice to account for endogeneity concerns.

Table 3: Analysis of wage components (H1-H3)

Panel A: Logarithm of Wage per Staff (H1 – after requiring working hour information for the sample)						
	(1)	(2)	(3)	(4)	(5)	(6)
Log net-of-LBT rate	**0.378***	**0.679*****	**0.216**	**0.649*****	**0.260****	**0.466*****
	(0.193)	**(0.222)**	**(0.219)**	**(0.272)**	**(0.127)**	**(0.146)**
Predicted sign	+	+	+	+	+	+
Sample period	1999-2008	1999-2008	1999-2008	1999-2008	1999-2015	1999-2015
Corporation sample			YES	YES	YES	YES
Establishment, Year and Muncipality FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES	YES	YES
No East establishments		YES		YES		YES
Observations	414,066	345,618	258,968	208,464	513,507	415,916
Adjusted R-squared	0.733	0.743	0.708	0.713	0.704	0.700
Panel B: Logarithm of Wage per Hour (H2 – incidence)						
	(1)	(2)	(3)	(4)	(5)	(6)
Log net-of-LBT rate	**-3.135*****	**-4.571****	**-2.829*****	**-4.519****	**-1.761*****	**-2.514****
	(0.638)	**(0.863)**	**(0.675)**	**(0.952)**	**(0.378)**	**(0.488)**
Predicted sign	+	+	+	+	+	+
Sample period	1999-2008	1999-2008	1999-2008	1999-2008	1999-2015	1999-2015
Corporation sample			YES	YES	YES	YES
Establishment, Year and Muncipality FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES	YES	YES
No East establishments		YES		YES		YES
Observations	414,066	345,618	258,968	208,464	513,507	415,916
Adjusted R-squared	0.755	0.728	0.749	0.718	0.770	0.744
Panel C: Logarithm of Hours per Staff (H3 – labor demand)						
	(1)	(2)	(3)	(4)	(5)	(6)
Log net-of-LBT rate	**3.513*****	**5.249*****	**3.045*****	**5.168*****	**2.021*****	**2.980*****
	(0.713)	**(0.946)**	**(0.757)**	**(1.048)**	**(0.414)**	**(0.523)**
Predicted sign	+	+	+	+	+	+
Sample period	1999-2008	1999-2008	1999-2008	1999-2008	1999-2015	1999-2015
Corporation sample			YES	YES	YES	YES
Establishment, Year and Muncipality FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES	YES	YES
No East establishments		YES		YES		YES
Observations	414,066	345,618	258,968	208,464	513,507	415,916
Adjusted R-squared	0.532	0.545	0.522	0.539	0.555	0.572

The dependent variable is either the logarithm of the average wage per employee (columns 1 and 2), the logarithm of the average wage per working hour (columns 3 and 4) or the average page per working hour (columns 5 and 6) of establishment *i* in year *t* . Log net-of-LBT rate is the logarithm of the net-of-the local business tax rate. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Wage components for single and multi-establishment firms with weighted LBT rates

Sample	Single Establish. 1999-2008	Multi Establish. 1999-2008	Single Establish. Corporations 1999-2015	Multi-Establish. Corporations 1999-2015
Panel A: Logarithm of Wage per Staff				
	(1)	(2)	(3)	(4)
Log firm net-of-LBT rate	**0.184**	**-0.304**	**0.219**	**-0.0323**
	(0.201)	**(0.257)**	**(0.137)**	**(0.128)**
Predicted sign	+	+	+	+
Establishment, Year and Muncipality FE	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES
Observations	320,918	93,148	393,573	119,934
Adjusted R-squared	0.747	0.707	0.695	0.742
Panel B: Logarithm of Wage per Hour				
	(1)	(2)	(3)	(4)
Log firm net-of-LBT rate	**-2.056*** **	**-1.176*** **	**-0.897*** **	**-0.561*** **
	(0.547)	**(0.348)**	**(0.298)**	**(0.170)**
Predicted sign	+	+	+	+
Establishment, Year and Muncipality FE	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES
Observations	320,918	93,148	393,573	119,934
Adjusted R-squared	0.779	0.704	0.789	0.740
Panel C_ Logarithm of Hours per Staff				
	(1)	(2)	(3)	(4)
Log firm net-of-LBT rate	**2.241*** **	**0.872*** **	**1.116*** **	**0.529*** **
	(0.597)	**(0.336)**	**(0.298)**	**(0.187)**
Predicted sign	+	+	+	+
Establishment, Year and Muncipality FE	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES
Observations	320,918	93,148	393,573	119,934
Adjusted R-squared	0.561	0.517	0.573	0.573

The dependent variable is either the logarithm of the average wage per employee (columns 1 and 2), the logarithm of the average wage per working hour (columns 3 and 4) or the average page per working hour (columns 5 and 6) of establishment *i* in year *t* . Log net-of-LBT rate is the logarithm of the net-of-the local business tax rate. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Extensive margins - analysis with working hours and staff members

Panel A: Logarithm of working hours						
	(1)	(2)	(3)	(4)	(5)	(6)
Log net-of-LBT rate	**2.689*** **	**0.3855*** **	**2.104*** **	**3.425*** **	**0.936*** **	**1.274*** **
	(0.638)	**(0.803)**	**(0.723)**	**(0.925)**	**(0.376)**	**(0.475)**
Sample period	1999-2008	1999-2008	1999-2008	1999-2008	1999-2015	1999-2015
Corporation sample			YES	YES	YES	YES
Establishment, Year and Muncipality FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES	YES	YES
No East establishments		YES		YES		YES
Observations	414,066	345,618	258,968	208,464	513,507	415,916
Adjusted R-squared	0.879	0.885	0.873	0.879	0.869	0.875
Panel B: Logarithm of staff members						
	(1)	(2)	(3)	(4)	(5)	(6)
Log net-of-LBT rate	**-0.824*** **	**-1.394*** **	**-0.941*** **	**-1.743*** **	**-1.085*** **	**-1.706*** **
	(0.299)	**(0.377)**	**(0.377)**	**(0.495)**	**(0.414)**	**(0.526)**
Sample period	1999-2008	1999-2008	1999-2008	1999-2008	1999-2015	1999-2015
Corporation sample			YES	YES	YES	YES
Establishment, Year and Muncipality FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES	YES	YES	YES	YES	YES
No East establishments		YES		YES		YES
Observations	414,066	345,618	258,968	208,464	513,507	415,916
Adjusted R-squared	0.956	0.957	0.954	0.956	0.934	0.936

In Panel A, the dependent variable is the number of working hours per year of establishment *i* in year *t* . In Panel B, the dependent variable is the average number of staff members of establishment *i* over the year *t.* Log net-of-LBT rate is the logarithm of the net-of-the local business tax rate. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

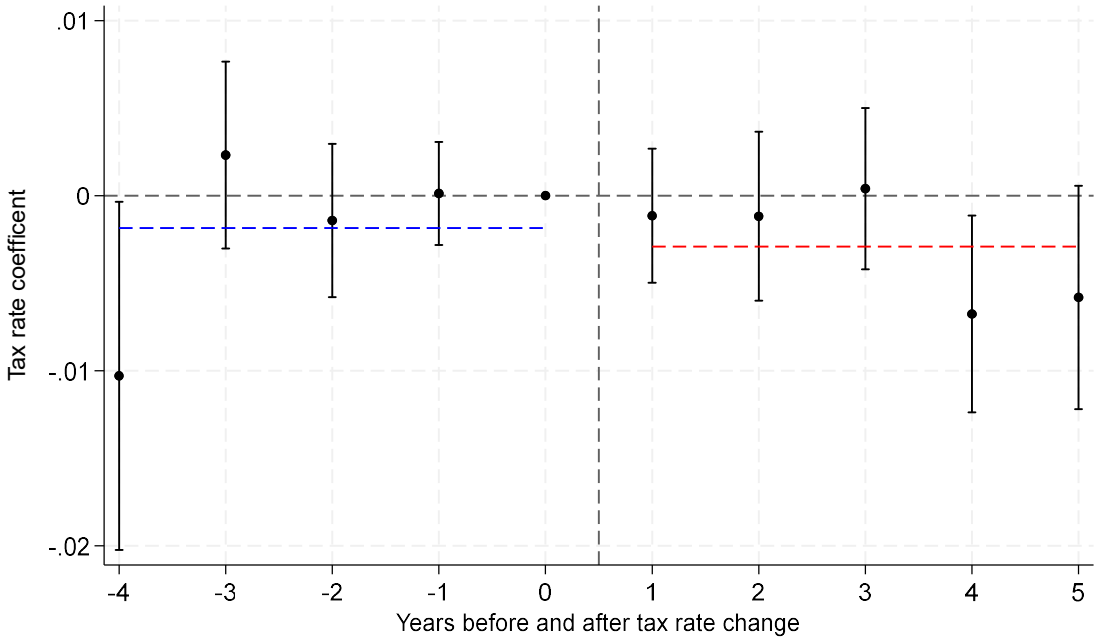
Table 6: Analysis of heterogeneity effects for wage components

Panel A: Logarithm of wage per staff						
	(3)	(4)	(5)	(6)	(7)	(8)
Log net-of-LBT rate	0.280	-0.0779	0.325*	0.113	0.321	-0.187
	(0.193)	(0.124)	(0.197)	(0.128)	(0.196)	(0.129)
Log NLBTR x R&D intensity	**1.075*** (0.193)**	**2.255*** (0.145)**				
Log NLBTR x Capital intensity			**0.239 (0.155)**	**0.763*** (0.151)**		
Log NLBTR x TFP					**0.209* (0.110)**	**1.334** (0.106)**
Sample period	1999-2008	1999-2015	1999-2008	1999-2015	1999-2008	1999-2015
Corporation sample		YES		YES		YES
Observations	414,066	513,507	414,066	513,507	414,066	513,507
Adjusted R^2	0.733	0.704	0.733	0.704	0.733	0.704
Panel B: Logarithm of wage per hour						
	(3)	(4)	(5)	(6)	(7)	(8)
Log net-of-LBT rate	-3.085***	-1.283***	-3.121***	-1.763***	-3.121***	-1.763***
	(0.610)	(0.332)	(0.643)	(0.366)	(0.643)	(0.366)
Log NLBTR x R&D Intensity	**-0.890** (0.405)**	**-3.197*** (0.535)**				
Log NLBTR x Capital Intensity			**-0.0615 (0.224)**	**0.00758 (0.288)**		
Log NLBTR x TFP					**0.252 (0.186)**	**0.696** (0.211)**
Sample period	1999-2008	1999-2015	1999-2008	1999-2015	1999-2008	1999-2015
Corporation sample		YES		YES		YES
Observations	414,066	513,507	414,066	513,507	414,066	513,507
Adjusted R^2	0.755	0.771	0.755	0.770	0.755	0.770
Panel C: Logarithm of hours per staff						
	(3)	(4)	(5)	(6)	(7)	(8)
Log net-of-LBT rate	3.333***	1.205***	3.446***	1.876***	3.525***	1.807***
	(0.688)	(0.352)	(0.715)	(0.394)	(0.697)	(0.403)
Log NLBTR x R&D Intensity	**1.965*** (0.462)**	**5.452*** (0.553)**				
Log NLBTR x Capital Intensity			**0.300 (0.258)**	**0.763*** (0.151)**		
Log NLBTR x TFP					**-0.0424 (0.206)**	**0.639*** (0.215)**
Sample period	1999-2008	1999-2015	1999-2008	1999-2015	1999-2008	1999-2015
Corporation sample		YES		YES		YES
Observations	414,066	513,507	414,066	513,507	414,066	513,507
Adjusted R^2	0.532	0.555	0.532	0.555	0.532	0.555

The dependent variable is either the logarithm of the average wage per employee (Panel A), the logarithm of the average wage per working hour (Panel B) or the average page per working hour (columns 5 and 6) of establishment *i* in year *t* . Log net-of-LBT rate is the logarithm of the net-of-the local business tax rate. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Online Appendix

Figure A1: Log of wage per staff: Two-way FE (de Chaisemartin/d´Hautefeuille, 2024)
Panel A: Full sample 1999-2008



Panel B: Corporation sample 1999-2015

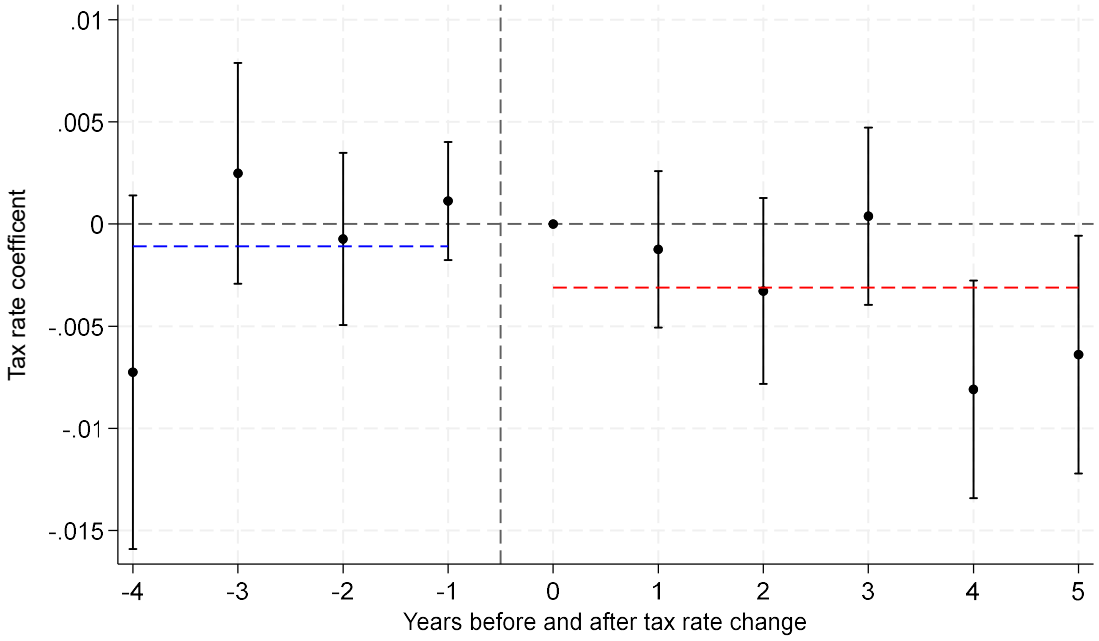
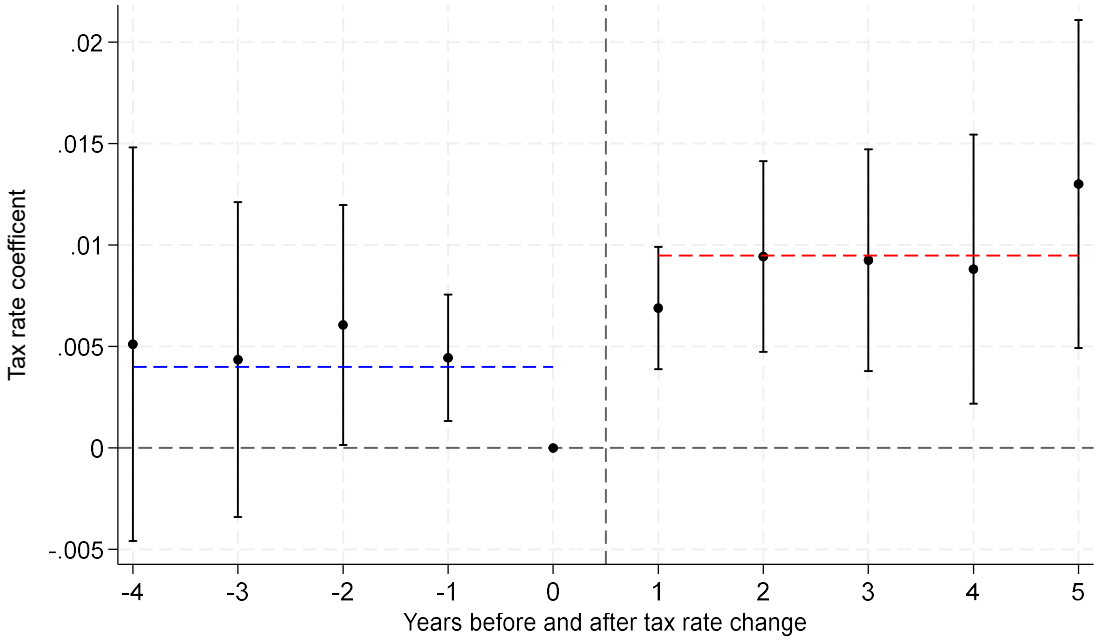


Figure A2: Log of wage per hour: Two-way FE (de Chaisemartin/d´Hautefeuille, 2024)
Panel A: Full sample 1999-2008



Panel B: Corporation sample 1999-2015

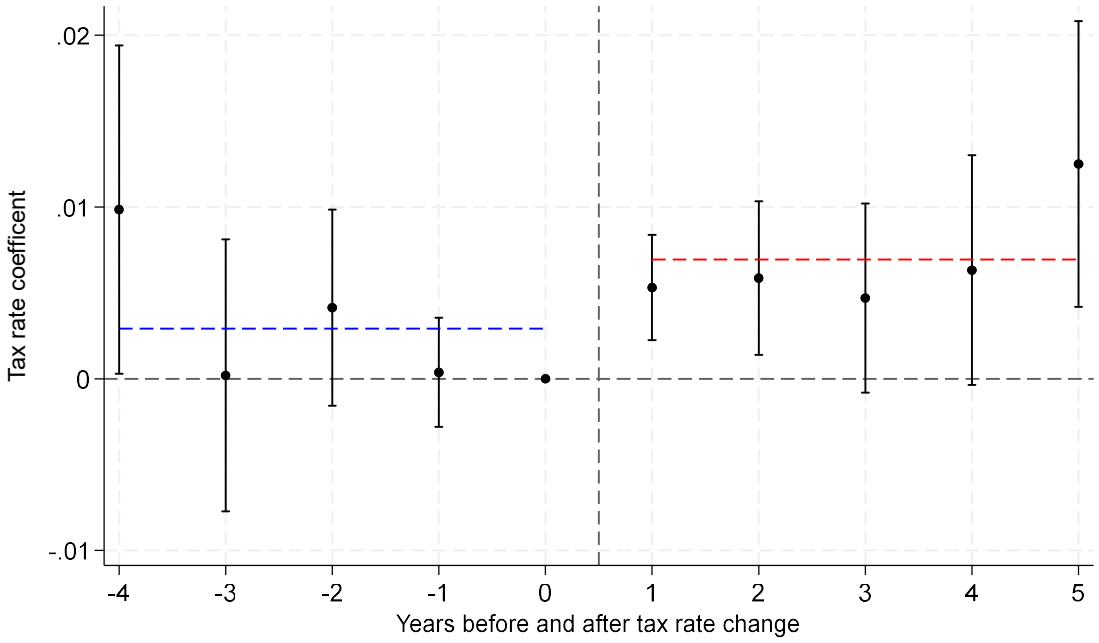
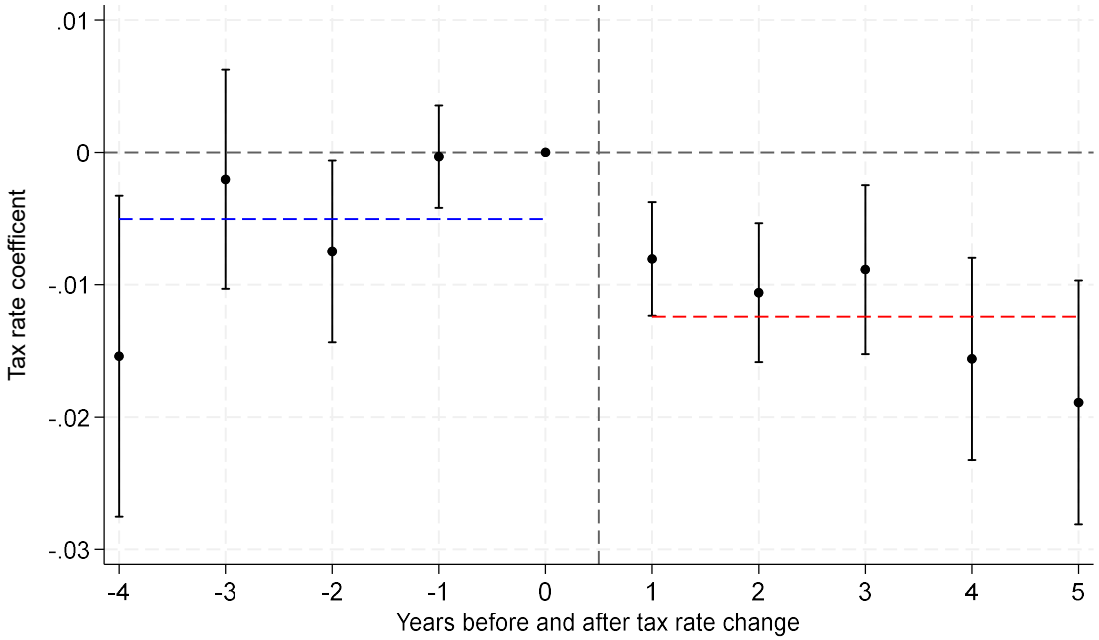


Figure A3: Log of hours per staff: Two-way FE (de Chaisemartin/d´Hautefeuille, 2024)
Panel A: Full sample 1999-2008



Panel B: Corporation sample 1999-2015

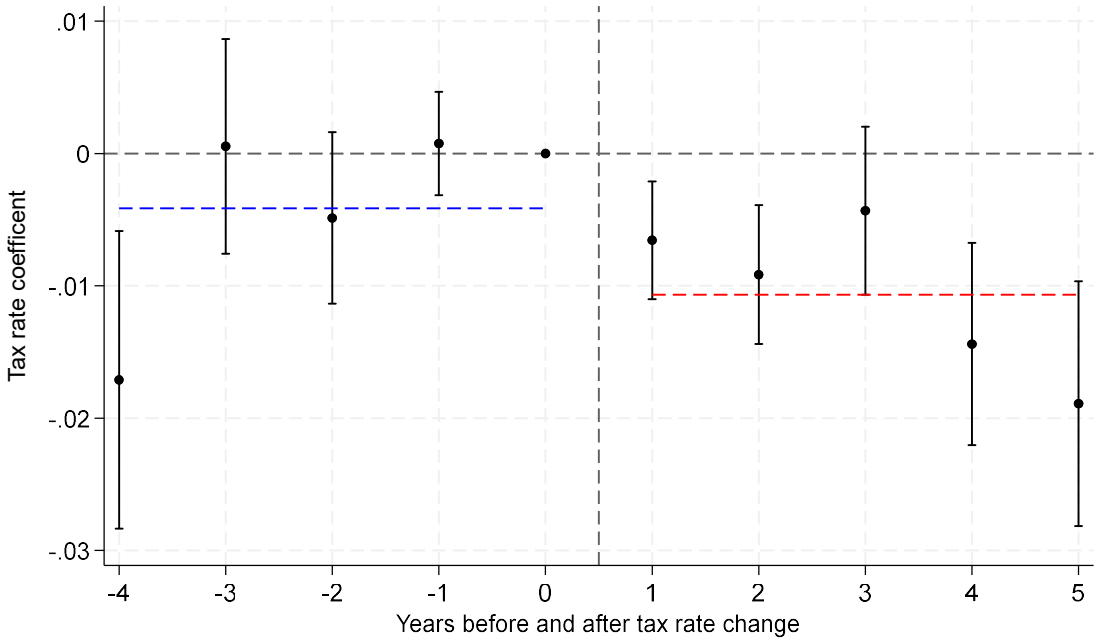


Table A1: Baseline analysis with weighted tax rates (1999-2008)

Dependent variable	(1) Log Wage/Staff	(2) Log Wage/Staff	(3) Log Wage/Staff	(4) Log Wage/Staff	(5) Log Wage/Staff	(6) Log Wage/Staff
Weighted Log net-of-LBT Rate	**0.163**	**0.116**	**0.150**	**0.270**	**0.269**	**0.192**
	(0.177)	**(0.176)**	**(0.182)**	**(0.178)**	**(0.178)**	**(0.216)**
Establishment, Year and Muncipality FE	YES	YES	YES	YES	YES	YES
State-Year FE	YES		YES	YES	YES	YES
Comzone-Year FE			YES			
Establishment controls t-2				YES		
County controls t-2					YES	
No east establishments						YES
Observations	464,720	464,720	464,720	419,405	429,116	386,796
Adjusted R-squared	0.696	0.696	0.696	0.712	0.713	0.705

The baseline specification relies on Fuest et al. (2018). The 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-the local business tax rate. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; county controls include the natural logarithm of GDP, the natural logarithm of the unemployment rate, and the natural logarithm of the population; establishment controls include the logarithm of the number of employees; all control variables are lagged twice to account for endogeneity concerns.