The Labor Market Effects of Corporate Taxation: Evidence from Germany*

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Abstract

How does corporate taxation influence labor market outcomes? Using linked German employer-employee data and variation from a locally determined corporate income tax, I leverage a triple difference strategy to evaluate labor market outcomes for establishments and individuals. I find that a one percentage point corporate tax increase induces treated establishments responsible for paying the tax to contemporaneously reduce employment by 1% relative to untreated establishments, but has no immediate effect on individual wages. Over a three year period, employment continues to fall while wages remain stagnant. Testing for heterogeneous effects, I find that the wage rigidity persists across establishments operating under a union contract and decentralized establishments without any collective bargaining agreement. Finally, I show that the negative employment impacts are larger for small and medium size establishments, suggesting that the effects of corporate taxation appear strongest among credit-constrained establishments.

Keywords: corporate taxation, wage rigidity, heterogeneous effects

JEL Codes: E22, H22, H25, H32, J31

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1 Introduction

Economists have long debated the real effects of corporate taxation on economic growth, as well as the distributional consequences of whether firm owners bear most of its tax burden, or pass it onto workers through lower wages and fewer employment opportunities. Analyzing the effects of corporate taxation is of paramount importance, especially in the wake of the recently enacted United States Tax Cuts and Jobs Act of 2018 (TCJA), and in the midst of ongoing discussions of implementing a Common Consolidated Corporate Tax Base (CCCTB) in the European Union. Understanding the effects of corporate taxation directs economists, policymakers, and citizens toward an answer of whether the corporate income tax provides revenue that buffers the most indigent citizens against harsh poverty, or if it instead aggravates the poor in the form of less income, fewer opportunities, and greater inequality. Starting from the seminal work of Harberger (1962), traditional views of incidence argue that more mobile factor will bear less of a burden; however, previous empirical estimates of labor and capital mobility have been limited by insufficient policy variation, limited microdata availability, and the difficulty of identifying plausibly exogenous variation in corporate tax policy that does not correlate with local conditions or alternative policies.

This paper causally estimates the effects of corporate taxation on employment and wages by exploiting extensive local corporate tax variation in Germany. Each of the roughly 12,000 municipalities in Germany sets its own local corporate tax rate, known as the German Trade Tax. The Trade Tax varies widely across municipalities and over time: there have been 24,000 changes in the Trade Tax over the 2000-2012 period. Furthermore, the Trade Tax is a sector-specific tax that only bills two-thirds of the businesses in the economy that participate within a "covered sector," which consists primarily of businesses in manufacturing, wholesale and retail trade, and specialized private services. As a result, businesses in the "uncovered" sector that are not responsible for paying the Trade Tax bill provide an attractive control group for comparing outcomes over time. I link these Trade Tax rates to a representative linked employer-employee panel, which enables me to classify the covered and uncovered

sectors and subsequently track labor market responses to tax changes over time.

To achieve identification, I leverage a triple difference strategy to estimate the contemporaneous and dynamic effects of changes in local corporate tax rates on labor market outcomes. The "double" difference component exploits the rich cross-sectional variation in Trade Tax rates to compare economic outcomes across areas over time to tackle the challenge of limited tax policy variation. Furthermore, the "triple" difference component compares outcomes in the covered sector *relative* to the trajectory of economic activity in the uncovered sector, which effectively serves as a "control" group that does not pay the statutory Trade Tax bill but does face the same local economic conditions and alternative policy reforms as the "treated" covered sector. This triple difference research design enables me to convincingly attribute the economic responses to corporate tax rate changes rather than to other biasing forces. Using this variation within an area in a particular year, I estimate local projection regressions over sequential annual horizons to assess the dynamic effects of corporate tax rate changes on establishment and individual outcomes.

I find that higher corporate taxation has strong negative effects on total employment, inducing establishments to reduce employment by 1% in the short-run, and by 4.5% over a three-year period. In stark contrast, I find that corporate taxation has no significant effect on individual wages in the short-run or over time. After documenting the robustness of these results, I exploit the detailed microdata to explore potential heterogeneity that may unpack the mechanisms driving these labor market effects. Investigating the role of labor market frictions, I show that the employment effects are similarly negative for both unionized and decentralized establishments over time, while the wage results do not differ significantly from zero for workers at either type of establishment. Finally, I explore the role of financial frictions in driving the overall results by testing for heterogeneous effects by establishment size, which inversely serves as a proxy for credit constraints. I find that higher corporate taxation induces small and medium sized establishments to reduce full-time employment by significantly more than the larger establishments in the sample, though none of the size

groups appears to significantly adjust wages.

This paper contributes to a recent surge in the use of microdata to study the effects of taxation on business and individual outcomes. Specifically, this paper joins a series of papers utilizing the variation in the German Trade Tax to study the impact on wages (Fuest et al. 2018, Bauer et al. 2012), and employment (Siegloch 2014), though none of the previous studies links the two outcomes directly. Empirically, this paper also relates to an analogous literature studying the effects of U.S. state corporate tax changes on economic activity, including Suárez Serrato and Zidar (2016); Giroud and Rauh (2019); and Ljungqvist and Smolyansky (2014).

Furthermore, this paper joins a literature that investigates the properties of German wage-setting institutions, as well as the possible impacts of wage rigidities on labor market outcomes. Dustmann et al. (2009), Card et al. (2013) and Dustmann et al. (2014) specifically study the impacts of the German labor market setting on wage inequality. Moreover, Schmitt-Grohé and Uribe (2016), Daly and Hobijn (2014), and Chodorow-Reich and Wieland (2199) emphasize the effects of nominal wage rigidity in influencing labor market decisions and reallocation.

Finally, this paper joins a body of work that considers the role of financial frictions in influencing business outcomes. Fazzari et al. (1988) provides a classical study of the role of credit constraints in influencing "excess sensitivity" to cash flow. Gertler and Gilchrist (1994) initiate the use of firm size as a proxy for financial frictions. Finally, Chodorow-Reich (2014), Schoefer (2015), and Melcangi (2018) provide recent empirical contributions documenting how imperfect capital markets can influence employment outcomes.

The remainder of the paper is structured as follows. Section 2 discusses key aspects of the German local corporate tax setting and the linked employer-employee data used to assess labor market outcomes. Section 3 proposes a simple framework to illustrate how a tax on corporate capital may pass onto labor markets. Section 4 details the identification strategy to estimate contemporaneous and dynamic effects of taxation. Section 5 discusses the main

results, while Section 6 looks deeper into the mechanisms driving the key effects. Finally, Section 7 concludes.

2 Institutional Setting and Data

2.1 German Trade Tax Structure

The German constitution divides governmental authority between three levels: the federal level, the state level, and the municipal level. While the federal government and the 16 state governments work together to administer the country's primary executive and legislative activity, each of the roughly 12,000 German municipalities has its own local governmental body that administers social assistance programs, fosters cultural activities, and provides public utilities to its residents. Each municipal government primarily derives revenue from setting its own local corporate tax rate, known as the German Trade Tax. All eligible establishments residing in a particular municipality are responsible for paying the Trade Tax to their local municipal government. The Trade Tax bill for firms operating in multiple municipalities is apportioned based on the relative wage bill share that the firm pays to employees in each municipality. Municipalities can only adjust the Trade Tax rate: the tax base is determined by the federal government. In general, the wage bill is fully deductible from Trade Tax responsibility, but capital costs are not tax-deductible, implying that Trade Tax is not a pure profit tax, but instead serves effectively as a tax on capital.

Critically for my research design, the Trade Tax is a sector-specific tax. The primary industries responsible for paying the Trade Tax, which I refer to as the "covered sector," consist of manufacturing, construction, wholesale and retail, transportation, and certain services such as financial or real estate activity. The "uncovered" sector are businesses in industries that are not responsible for paying the statutory Trade Tax. The uncovered sector includes agriculture, forestry, fishing, education, health and human services, legal services, and accounting services. Overall, roughly two-thirds of German establishments are in the

covered sector.

Table 1 provides summary statistics of the Trade Tax. Over the years 2000-2012, the average Trade Tax rate across municipalities was 15%, the same level as the federal corporate tax rate from 2008 onwards. Figure 1A shows that there is substantial variation in the Trade Tax rate and changes across Germany. In particular, the large city states, i.e. Hamberg and Berlin, and municipalities in North Rhine Westphalia have particularly high Trade Tax rates. However, since I use panel data for my key analysis, I identify off of Trade Tax changes rather than Trade Tax levels. Figure 1B shows the total percentage change in the Trade Tax across municipalities from 2000-2012, showing that the overall variation differs substantially across Germany.

In 2004, the federal government instituted a minimum Trade Tax rate of 10%, though it ranged as high as 45% in the full sample of German municipalities. Before 2008, vast majority of Trade Tax changes were increases. However, in 2008, the federal government reduced the minimum Trade Tax rate to 7%, inducing a substantial tax decrease across practically every municipality in the country. Therefore, Figure 2 shows that the Trade Tax provides a particularly attractive setting to study changes in corporate tax rates as it provides a wide distribution of 24,000 rate changes, split almost evenly between increases and decreases. The average Trade Tax increase is 1% while the average Trade Tax decrease is 2% in the sample.

Finally, Figure 3a shows the serial correlation in Trade Tax changes from 2000-2012. In general, after a 1 percentage point tax increase has occurred, the tax rate seems to fall gradually, with a half-life of roughly 7 years. Indeed, Figure 3b suggests that after 8 years the changes essentially stabilize, suggesting that overall the Trade Tax changes are relatively permanent. Thus, I interpret the estimated impulse response functions of various outcomes in subsequent sections as corresponding to relatively persistent tax changes.

2.2 Linked Employer-Employee Data

I use a linked employer-employee data provided by the German Institute for Employment Research (IAB) called the LIAB Longitudinal dataset. The LIAB is comprised of the IAB Establishment Panel, which is a 1% representative panel survey of roughly 18,000 German establishments each year. Importantly, I use the panel's rich combination of administrative employment data with its survey information detailing the organizational structure, union contract status, and industry of the each establishment to assess the effects of Trade Tax changes on a range of labor market outcomes stratifying various covariates. Importantly, I use the industry code to assign each establishment to the covered or uncovered sector for my primary research design that compares relative outcomes in these sectors across areas. One issue is that the LIAB does not contain each establishment's municipality; instead, it contains the more aggregated district that each establishment is located in. Thus, when merging Trade Tax rates to each establishment, I calculate a district-level tax rate by weighting each municipal tax rate in a district by the number of establishments in the municipality. An important limitation of the IAB Establishment panel is that the identifiers each represent an establishment rather than a firm, and it is not possible to link establishments to the same firm in the data, thereby preventing a rigorous analysis of firm reallocation or establishment relocation as conducted by Giroud and Rauh (2019).

For a select sample of the IAB Establishment Panel, the LIAB provides full employment histories of all employees who ever worked for one of these establishments between the years 2000-2012 and were covered by the German social security system. The social security notifications provide a "daily" wage that corresponds to the employee's total earnings over a notification period divided by the number of calendar days corresponding to the notification. This extensive employment history is particularly attractive because it enables me to track individual's wages both while they work both for a member of the IAB Establishment Panel and beyond in case they potentially leave in response to corporate taxation. Furthermore, the data contain detailed information on age, gender, and education level that enable me to

study the potential differential responses to tax changes.

One consideration is that because the data are based on administrative social security notifications, they do not cover civil servants or self-employed workers, which account 18% of the workforce.[1] Furthermore, a small share (between 5-10%) of high-wage earner's earnings are censored as there is maximum social security contribution limit. I assign the high-wage earners this maximum level and confirm that excluding the censored individual wages does not substantially affect my primary results.

2.3 Sample Selection and Timing

For establishment-level analysis, I use the IAB Establishment Panel with available panel years between 2000-2012 to fully assess the effects of corporate tax changes on employment. For worker-level analysis, I follow Card et al. (2013) by primarily analyzing full-time employees because of the lack of data on hours worked in the LIAB, which enables me to easily scale their daily wage into monthly or annualized earnings. I deflate all real variables by the 2008 German CPI. I convert all nominal variables to real variables using the 2008 German CPI provided by the German Federal Statistical Office. Table 2 summarizes the key establishment and individual sample. 68% of the establishments and corresponding employees belong to the covered sector, implying that while the uncovered sector is smaller, it still appears large enough to serve as an appropriate control group for within-area analysis of tax changes on the covered sector. Roughly half of the establishments are bound to a collectively bargaining agreement (CBA). Most of these union contracts are negotiated at the industry-level, though 7% of the establishments are part of firm-level CBAs. A large proportion (73%) of the establishments are single-unit establishments, while 85% of the establishments in the sample have less than 250 employees. These small establishments, commonly referred to as the *Mittelstand*, have attracted special attention as they represent a substantially large proportion of German employment (61%) than similarly-sized businesses in the United States

[1] Jäeger (2016) estimates this share of the workforce not covered by social security based on data from the German Federal Statistical Office.

(43%)[2]

Finally, I comment on the timing administrative data and of Trade Tax statutes. The annual variables in the LIAB (i.e employment counts and wage data) are based on June 30 of the given reference year. Municipalities must determine the Trade Tax for a given year by May 31 of that particular year to apply. However, in practice, municipal councils determine the Trade Tax for a given year between November of the preceding year and February of the given year. Therefore, since Trade Tax rates are typically announced at least 5 months before the June 30 reference date of the LIAB data, I assess contemporaneous effects of corporate tax changes by comparing relative outcomes in the year of and the year preceding a tax change.

3 Conceptual Framework

Following the literature modeling corporate taxation (e.g. Fullerton and Metcalf 2002, Desai et al. 2008), I outline a simple framework to depict the conditions under which higher corporate taxation induces establishments to reduce employment. Suppose an establishment in a particular location with access to a neoclassical production technology $F(K, L)$ chooses optimal capital level K^* and optimal employment level L^* by maximizing profits subject to a corporate tax τ:

$$\underset{K,L}{\text{maximize}} \quad \Pi = (1-\tau)[F(K,L) - wL] - rK. \tag{1}$$

Differentiating with respect to K implies that the establishment optimally chooses capital K^* and employment L^* by setting the marginal product of capital equal to the user cost of capital:

$$F_K(K^*, L^*) = \frac{r}{1-\tau}, . \tag{2}$$

Equation 2 highlights that a higher tax rate τ effectively increases the user cost of cap-

[2] Jäeger (2016) calculates these shares using Eurostat data.

ital on the right-hand-side, which will in-turn encourage the establishment to adjust its inputs. Furthermore, differentiating with respect to L implies that the establishment sets the marginal product of labor equal to the real wage:

$$F_L(K^*, L^*) = w. \tag{3}$$

Under the condition of wage rigidity, the wage on the right-hand-side of Equation 3 is fixed. Thus, by totally differentiating Equations 2 and 3 with respect to the corporate tax rate τ under the assumption that the wage rate and capital rental rate are rigid, we can substitute an expression for $\frac{dK}{d\tau}$ into an expression for $\frac{dL}{d\tau}$ to obtain the degree to which the establishment adjusts employment with respect to the corporate tax rate:

$$\frac{dL}{d\tau} = \frac{-r \cdot F_{KL}}{(1-\tau)^2 \cdot \left[F_{KK} \cdot F_{LL} - (F_{KL})^2)\right]} < 0. \tag{4}$$

Equation 4 depicts the key insight from the corporate taxation literature: if employees productively use capital to create output for the establishment (i.e. $F_{KL} > 0$), then a higher corporate tax rate will increase the effective user cost of capital, thereby inducing establishments to reduce their capital stock. With less capital, employees are no longer as efficient in producing output, so if establishments are unable to reduce wages, they in turn will reduce their total employment count.

4 Empirical Methods: Triple Difference Strategy

4.1 Short-Run Effects of Taxation on Employment

Following the literature analyzing establishment-level outcomes (e.g. Chodorow-Reich 2014), define the change in total employment L at establishment j between years $t-1$ and $t+h$ by the symmetric growth rate:

$$g^L_{j,t-1,t+h} = \frac{L_{j,t+h} - L_{j,t-1}}{0.5[L_{j,t+h} + L_{j,t-1}]}. \tag{5}$$

The symmetric growth rate is a second-order approximation of the log-difference growth rate around 0 bounded between [-2,2] that allows for establishment entry and exit. The index h indexes the change over different annual horizons.

I assess the contemporaneous effect of a corporate tax change on employment between years $t-1$ and t (i.e. $h = 0$) by estimating the following triple difference specification:

$$g^L_{j,t-1,t} = \beta_0 \cdot I^C_j \cdot \Delta\tau_{d,t} + \mu_{d,t} + \delta_{s,C,t} + \gamma X_{j,t} + u_{j,t}, \tag{6}$$

where establishment j is located in district d in year t, and I^C_j is a dummy variable equal to 1 if the establishment is in the covered sector.[3]

The key explanatory tax variable is $\Delta\tau_{d,t} = \tau_{d,t} - \tau_{d,t-1}$, where $\tau_{d,t} \in [0,1]$ is the establishment-weighted average of the Trade Tax rates for all municipalities located in district d in year t. While the LIAB only provides establishment locations at the district-level, the establishment-weighted average provides consistent estimates on a representative sample of β due to the Conditional Expectation Function Prediction Property[4]. Therefore, β_0 represents a semi-elasticity, i.e. the percentage growth in total employment with respect to a 1% point increase in the corporate tax rate.

Identification comes from the term $\mu_{d,t}$, representing a district-year fixed effect, implying that I leverage only the variation within a district in a particular year across the "treated" covered sector and the "non-treated" uncovered sector. All primary specifications include a state-covered-year fixed effect $\delta_{s,C,t}$ that accounts for differential employment changes by the covered and uncovered sectors over time, as well as for state-administered fiscal transfers

[3] I restrict attention to establishments that never switch their covered status or reported district, which characterizes 99% of the establishments in the LIAB, thereby obviating the need for separate establishment-district fixed effects or a time subscript for the covered dummy.

[4] Hyslop and Imbens (2001) formally illustrate that using the weighted average group aggregate (here the district-level tax rate) provides consistent estimation because it optimally predicts the true regressor (i.e. the municipal-level tax rate).

across sectors. Taking differences filters out time-invariant employment determinants specific to establishments, sectors, or areas. Furthermore, while my baseline specifications contain only the previously discussed fixed effects, I subsequently augment Equation 6 with potential time-varying controls $X_{j,t}$ to ensure robustness against a series of establishment, district, and sector trends. Thus, the primary identification assumption is:

$$E\big[u_{j,t}|[I_j^C \cdot \Delta\tau_{d,t}], \mu_{d,t}, \delta_{s,C,t}, X_{j,t}\big] = 0. \tag{7}$$

Economically, Equation 7 requires that conditional on fixed effects, total employment in the covered sector *relative* to the uncovered sector follows parallel trends across areas in the absence of any tax change. In particular, the identification condition does not require that the activity in the covered and uncovered sector separately follow parallel trends, nor does it insist that the tax changes themselves are exogeneous as the district-year fixed effects effectively difference out the symmetric effects of any locally-determined policies or local conditions that influence both employment and Trade Tax changes. Instead, it requires that the Trade Tax changes are uncorrelated with other local policy instruments that specifically target the covered sector, and that relative employment in other districts provides a proper counterfactual for areas experiencing larger Trade Tax changes.

Since only certain industries are generally responsible for paying the Trade Tax, the primary threats to identification come from aggregate industry-specific shocks or idiosyncratic shocks that would place establishments on different growth trends coinciding with Trade Tax changes. To alleviate these concerns, I show that my results are robust to including industry-year fixed effects and lagged employment growth as controls in $X_{j,t}$. Furthermore, while my preferred specification includes state-covered-year fixed effects to account for the fact that the 16 German States carry out most of the fiscal redistribution in the country, I confirm that my baseline results are robust to replacing state-covered-year fixed effects with covered-year fixed effects.

4.2 Dynamic Effects of Taxation on Employment

To assess the dynamic employment effects of a persistent corporate tax change and assess pre-trends, I run a series of local projections for each horizon $H \in \{-3, -2, 0, 1, 2, 3\}$:

$$\sum_{h=0}^{H} \left[g^{L}_{j,t-1,t+h} \right] = \beta_H \cdot I^{C}_{j} \cdot \Delta\tau_{d,t} + \mu_{H,d,t} + \delta_{H,s,C,t} + \gamma_H X_{j,t} + u_{H,j,t}, \tag{8}$$

where $g^{L}_{j,t-1,t+h}$ is the symmetric employment growth rate defined by Equation 5 between periods $t-1$ and $t+h$, and the fixed effects are the same as those used for the triple difference strategy described in Section 4.1. Adding up the partial employment changes at each horizon preceding and following the pre-reform period allows me to directly estimate the path of cumulative treatment effects $\{\beta_H\}_{H=-3}^{H=3}$, where each β_H is the impulse response coefficient describing the percentage change in employment H periods after a one percentage point tax increase between years $t-1$ and t. While there has been an extensive yet inconclusive literature debating the merits of estimating dynamic treatments with local projections vs. VARs,[5] I choose to directly estimate local projections to flexibly test for potential asymmetries and ensure robustness by adding controls to $X_{e,t}$. Critically, the local projections also allow me to directly estimate β_{-2} and β_{-3} to test for pre-trends or anticipatory effects prior to the tax reform to buttress my argument that the employment effects are driven by Trade Tax changes rather than pre-existing trends or alternative policies.

4.3 Effects of Taxation on Individual Wages

In addition to assessing establishment-level outcomes, I use the linked worker data to assess the effects of corporate taxation on individual wages. Following Card et al. (2013), define the function $\mathbf{J}(i,t)$ as the unique establishment that employs worker i in year t and in turn,[6], let $d(j)$ represent the district that establishment j is located. Similar to the dynamic

[5] Plagborg-Møller and Wolf (2019) show that differences between VARs and local projections are due to extraneous restrictions on the lag structure.

[6] Less than 2% of employees have multiple jobs, so I assign a worker to the establishment that pays them their highest wage each year

establishment analyses defined in Equation 8, I assess the effects on wages by estimating the following local projection equations for horizons $H \in \{-3, -2, 0, 1, 2, 3\}$:

$$\sum_{h=0}^{H} \left[\log w_{i,t+h} - \log w_{i,t-1} \right] = \beta_H \cdot I^C_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} + \mu_{H,d,t} + \delta_{H,s,C,t} + \gamma_H X_{i,t} + u_{H,i,t}, \quad (9)$$

where the dependent variable now cumulates the log differences of wages for full-time employee i. Note that the first log difference, which estimates β_0, represents the contemporaneous effect of a tax change on wages, analogous to the contemporaneous employment analysis described by Equation 6. Similar to the establishment analysis, the triple difference strategy compares relative wages of workers in the covered and uncovered sectors who work in the same district in the year preceding a tax change to the relative wages of workers in different districts.

Critically, the the Trade Tax change that I use to assess individual i's dynamic responses is the tax change faced by his/her employer in year $t-1$, i.e. $\Delta\tau_{d(\mathbf{J}(i,t-1)),t} = \tau_{d(\mathbf{J}(i,t-1)),t} - \tau_{d(\mathbf{J}(i,t-1)),t-1}$ establishment $\mathbf{J}(i, t-1)$ located in district $d(\mathbf{J}(i, t-1))$, i.e. the establishment that employed i in the year before the tax change. As a result, in contrast to Fuest et al. (2018) who primarily analyze an establishment's median wage or contemporaneous effects on incumbent wages as long as they remain with an establishment, my focus on changes faced by an individual's employer in year $t-1$ allows me to to analyze tax-induced responses for both incumbent employees as well as workers who leave the establishment after year $t-1$ to potentially work elsewhere. Incorporating worker mobility allows me to properly determine whether relative wages initially adjust in response to taxation but then stabilize back to their initial value as predicted by the neoclassical assumption of wage equalization across sectors or areas, or whether relative wages remain consistently rigid due to various factors such as collective bargaining, institutional norms, or efficiency wages. While I assess the wages of incumbent employees and workers who leave the establishment after year $t-1$ to potentially work elsewhere, my sample does not consider new labor force entrants that join

an establishment in year t due to the inability to fully assess the pre-trends of new entrants who did not work for an IAB Establishment Panel member in each of the sample years.

5 Main Results

Table 3 shows that a higher corporate tax rate significantly reduces total employment while having no effect on individual wages in the short run. Specifically, Panel A, Column (1) shows that a 1% increase in the local corporate tax rate induces covered establishments to reduce total employment by 1% in the year of the tax change. In contrast, Panel B, Column (5) shows that higher taxation has no significant effect on wages. To rule out the possibility that municipalities change the Trade Tax in response to aggregate industry trends, Columns (3) and (7) respectively of Table 3 show that the significant drop in employment and the zero wage change are robust to accounting for industry by year fixed effects. Furthermore, Columns (4) and (8) show that the results are robust to controlling for lagged outcome growth, suggesting that pre-existing outcome trends are not driving the effects.

Figure 3 illustrates the dynamic path of labor market outcomes over time by plotting the impulse responses of total employment and individual wages. As portrayed by Figure 3, the impulse responses correspond to a corporate tax change with a half-life of 7 years. Panel A shows that relative employment in the covered sector falls substantially by 4.5% over a 3 year period following a corporate tax increase. Panel B shows that a corporate tax change has no significant effect on individual wages over the same 3-year period. Figure 3 appears to rule out a neoclassical story with perfect labor mobility: in this case, a higher corporate tax rate would induce establishments to offer lower wages initially, which in turn would encourage employees to move to the uncovered sector until wages again equalize. In contrast to this neoclassical explanation, Figure 3 suggests that establishments never offer their workers lower wages, but instead substantially reduce total employment over time. I examine the wage rigidity in greater detail in Section 6.1.

The lack of a significant tax-induced wage response differs substantially from the key result of Fuest et al. (2018), who use a difference-in-difference specification on only covered establishments to argue that a 1% tax rate reduces wages by 0.39 %. In particular, the results likely differ for two reasons. First, Fuest et al. (2018) assess a difference-in-difference design on covered establishments, which in turn relies on a claim that the Trade Tax changes are exogenous for identification. In contrast, my research design incorporates the uncovered sector as a within-area control group to filter out the effects of local conditions or other policies that may drive the results. Second, Fuest et al. (2018) primarily assess each establishment's median wage of full-time employees as the their key dependent variable. My results of lower employment and zero wage changes would imply that the median wage in covered establishments would fall if covered establishments hire fewer high-wage people relative to the uncovered sector. Indeed I do show in Section 6.2 that the smaller and medium-sized establishments that drive the total employment effects do indeed substantially reduce their full-time employment count, consistent with a compositional reduction in the median wage. Siegloch (2014) finds significant negative effects on employment two years after a tax change using a difference-in-difference specification on covered establishments analogous to that used for wages by Fuest et al. (2018), though the cumulative employment effects I find are substantially larger over several years, falling by 2.6% over a two-year period in Figure 2.

In general, my result of a 1% semi-elasticity of employment to corporate taxation is substantially larger than the results of other studies on corporate taxation. Giroud and Rauh (2019) use U.S. establishment-level data to find that a 1% higher corporate tax rate induces C-Corporations to reduce employment by 0.4%. In their study, Giroud and Rauh (2019) use only data on large multi-state firms with at least 100 employees. In contrast, the majority of establishments in my representative sample are small single-plant establishments that possibly have stronger responses to taxation, due possibly to greater wage rigidity, less working capital, or greater uncertainty. I study the heterogeneous effects on establishments

of different sizes in detail in Section 6.2 to better understand the possibility of financial frictions driving the stronger employment responses.

Furthermore, my results are possibly larger because of the IAB Establishment Panel's inability to track establishments after they drop out of the dataset. If an establishment relocates to a different municipality, it will drop out of the IAB Establishment Panel, though my analysis assigns this establishment a zero employment count upon exit. Naturally this inability to distinguish between true exit and relocation will imply a larger perceived employment effect in my analysis. However, when studying the employment effects from the perspective of a local official determining how to optimally determine the Trade Tax, the magnitude of my analysis is more relevant than considering relocation because once an establishment exits the municipality, the lower municipal government may no longer collect revenue from this establishment. Thus, my estimated employment effects are the appropriate elasticity to consider from a local policy perspective.[7]

6 Mechanisms

6.1 Assessing Imperfect Labor Markets: Union Contract Status

Having established baseline wage rigidity in the presence of corporate tax changes in Section 5, I next test for heterogeneous effects by establishment type to better understand the potential source of these wage rigidities that may influence the strong negative employment effects. Table 2 shows that roughly half of the establishments in the IAB Establishment Panel are covered by a collective bargaining agreement. However, the unionized establishments tend to be much larger than the deunionized establishments - almost 70% of the employees in the sample work for a unionized establishment. The prevalence of both decentralized and unionized establishments across sectors motivates regressions that interact a Trade Tax

[7] Suárez Serrato and Zidar (2016) make a similar point in their evaluation on the welfare of workers in a given area.

change with an establishment's union contract status to test for heterogeneous effects on establishment employment. In turn, I estimate the effect of corporate taxation on total employment with the following regressions:

$$\sum_{h=0}^{H} \left[g^{L}_{j,t-1,t+h}\right] = \beta_{H,Decentralized} \cdot \left[I^{C}_{j} \cdot \Delta\tau_{d,t} * Decentralized\right]$$
$$+ \beta_{H,Unionized} \cdot \left[I^{C}_{j} \cdot \Delta\tau_{d,t} * Unionized\right] + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{H,C,t,UnionStatus} + u_{H,j,t}. \quad (10)$$

Analogously, I test for heterogeneous effects on individual wages with the following regressions:

$$\sum_{h=0}^{H} \left[\log w_{i,t+h} - \log w_{i,t-1}\right] = \beta_{H,Decentralized} \cdot \left[I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Decentralized\right]$$
$$+\beta_{H,Unionized} \cdot \left[I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Unionized\right] + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{H,C,t,UnionStatus} + u_{H,i,t}. \quad (11)$$

Table 4 shows the contemporaneous heterogeneous effects of corporate taxation on employment and wages (i.e. $H = 0$). As expected, corporate tax changes have no immediate effect on wages for individuals working under a collective bargaining agreement, consistent with the fact that wages are typically negotiated before the tax changes occur.

When assessing the impact on wages in decentralized establishments, I note that the point estimate is negative although the estimate still does significantly differ from zero, likely due to the smaller number of employees in the panel sample who work for a deunionized establishment. Figure 4 confirms that the wages remain rigid for workers in both unionized and decentralized over a 3-year period following a tax change.

Table 4 suggests that because employers cannot pass on the burden of higher corporate taxes onto incumbent wages, they reduce employment substantially in the short-run. A 1% point corporate tax increase actually induces larger employment reductions by decentralized establishments, who reduce total employment 1.5%. Unionized establishments reduce

employment by only 0.6% in the short-run. Interestingly, Figure 4 illustrates that while employment falls significantly faster in the short-run in decentralized establishments, over a 3-year period unionized establishments ultimately catch up such that both types reduce employment by 4.5% by year 3. These patterns make sense in the context of typical German union contracts. In general, many CBAs are negotiated to last for 2 years. Furthermore, the maximum length of any fixed-term employment contracts is 2 years as well, after which an employer would be required to permanently hire an employee. Thus, employment at unionized establishments is often protected 2 years after a tax change, which would partially explain why we do not see a significant persistent drop in employment until 3 years after a corporate tax change. However, the results do not fully comport with the neoclassical intuition in Section 3, which would suggest that establishments facing a higher degree of wage rigidity (e.g. unionized establishments) would have larger employment effects in response to higher taxation.

6.2 Assessing Imperfect Capital Markets: Establishment Size

Given that labor market imperfections and wage rigidity do not appear to fully explain the substantial tax-induced employment sensitivity, I turn next to assessing the role of imperfect capital markets. As outlined in Section 3, the neoclassical model predicts that a corporate tax increase will impel all covered establishments to reduce employment due to a larger user cost of capital. However, under the assumption of perfect capital markets, the neoclassical framework suggests that establishment's organizational form or capital structure should not necessarily influence the magnitude of the employment reduction, or at the very least it remains agnostic on the scale distinction.[8]

In addition to its impact on the cost of capital, a corporate tax increase also potentially serves as a cash flow shock to establishments as they now must pay more money to the government absent significant behavioral responses. Deviating from the assumption of perfect

[8] If the neoclassical production function has constant returns to scale in labor and capital, then by definition corporate taxation should have no differential effects based on an establishment's scale decisions.

capital markets, the corporate finance literature posits that if firms must take out working capital to pre-finance employment or investment, then firms with less access to external finance, i.e. "financial frictions," would respond more significantly to cash flow shocks as these firms rely more on retained earnings to finance activity.[9] An extensive body of empirical evidience, dating back to Fazzari et al. (1988), has demonstrated that credit constraints do in fact substantially impact business outcomes. Many subsequent studies have followed Gertler and Gilchrist (1994) in using firm size as a proxy for credit constraints to study firm behavior in response to liquidity shocks, with a recent literature specifically analyzing the effects of these credit constraints on employment.[10]

Given that the decentralized establishments tend to be smaller than the unionized establishments in Germany, I following the size-proxy literature and test for heterogeneous labor market effects by establishment size. Specifically, I divide establishments into three size bin classes following the Federal Statistical Office's official classification: a "small" establishment employs 1-49 total employees, a "medium" establishment employs 50-249 total employees, and a "large" establishment employs 250 or more employees.[11] I interact the size classifications with Trade Tax changes to estimate the contemporaneous effects on employment as follows:

$$g^L_{j,t-1,t} = \beta_{0,Small} \cdot \left[I^C_j \cdot \Delta\tau_{d,t} * Small\right] + \beta_{0,Medium} \cdot \left[I^C_j \cdot \Delta\tau_{d,t} * Medium\right] + \beta_{0,Large} \cdot \left[I^C_j \cdot \Delta\tau_{d,t} * Large\right] + \mu_{d,t} + \delta_{s,C,t} + \delta_{C,t,Size} + u_{j,t}. \quad (12)$$

Similarly, I interact the size classes to estimate the contemporaneous effects on individual

[9] These frictions may result from asymmetric information on borrower health and costly verification or possible default risk from limited commitment

[10] For example, Chodorow-Reich 2014 illustrates that credit supply shocks have significantly larger effects on small and medium firms, while Melcangi 2018) shows that a revaluation of the U.K. business property tax induced stronger employment effects by smaller firms.

[11] As noted earlier, the IAB Establishment Panel represent establishments rather than firms, though I preserve consistency with the Federal Statistical Office as it reports most official business statistics by establishment rather than firm.

wages:

$$\log w_{i,t} - \log w_{i,t-1} = \beta_{0,Small} \cdot \left[I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Small \right] + \beta_{0,Medium} \cdot \left[I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Medium \right] + \beta_{0,Large} \cdot \left[I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Large \right] + \mu_{d,t} + \delta_{s,C,t} + \delta_{C,t,Size} + u_{i,t}. \quad (13)$$

Table 5 shows the contemporaneous effects of corporate tax changes on labor market outcomes. Column (1) investigates the effect on total employment, showing that higher corporate taxation induces small and medium-sized establishments to significantly reduce total employment. In contrast, large establishments do not appear to significantly alter employment in the short-run. While one may expect that smaller establishments would be more sensitive corporate taxation due to financial frictions, I find that the point estimates for small and medium-sized establishments are almost identical. Motivated by this initial evidence suggesting that the large establishments differ, but the small and medium remain similar, I adjust the dependent variable in Column (2) to look purely at the full-time employment count rather than the total employment count, which essentially removes part-time employees and trainees. Column (2) suggest again that higher corporate taxation has no immediate effect on employment at large establishments, while having significantly negative effects on small and medium-sized full-time businesses. Column (3) depicts the contemporaneous wage effects, appearing to show that higher taxation definitively has no immediate effect negative impact on wages for employees at medium and large establishments. The point estimate of the wage effect for small establishments is negative; however, again the standard error is too large to reject zero.

The contemporaneous results provide some suggestive evidence that small and medium-sized establishments differ substantially from large establishments in their employment adjustments. However, to better understand whether the differences are driven by financial frictions or slower adjustment, I combine the small and medium sized bins into an "SME"

group, and subsequently interact the two size bins with the Trade Tax changes to estimate the dynamic employment effects:

$$\sum_{h=0}^{H} \left[g^{L}_{j,t-1,t+h}\right] = \beta_{H,SME} \cdot \left[I^{C}_{j} \cdot \Delta\tau_{d,t} * SME\right]$$
$$+ \beta_{H,Large} \cdot \left[I^{C}_{j} \cdot \Delta\tau_{d,t} * Large\right] + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{H,C,t,Size} + u_{H,j,t}. \quad (14)$$

For consistency, I again assess the analogous heterogeneous effects of corporate taxation on the wages of employees at SME's and large establishments by estimating:

$$\sum_{h=0}^{H} \left[\log w_{i,t+h} - \log w_{i,t-1}\right] = \beta_{H,SME} \cdot \left[I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * SME\right]$$
$$+ \beta_{H,Large} \cdot \left[I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Large\right] + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{H,C,t,Size} + u_{H,i,t}. \quad (15)$$

Figure 7 depicts the dynamic effects of taxation on total employment count for SMEs and large establishments. Panel A shows again that the taxation significantly reduces SME total employment upon impact, after which it steadily drops by 4.7% over a three-year period. While large establishments do not initially adjust employment, they still appear to reduce total employment by 3.2$ over a three-year period, although these results are not statistically significant, likely due to the small number of large establishments in the sample. Thus, the initial effects seem to suggest that all establishments reduce employment in line with the neoclassical channel, though the size effects on total employment are similar.

While the total employment adjustment appears similar, Figure 8 illustrates substantial heterogeneity between SMEs and large establishments' adjustment of full-time employment in response to corporate taxation. Panel A depicts that SMEs consistently reduce full-time employment by 5.6% over a three-year period. In contrast, Panel B shows that large establishments reduce their full-time employment by only 1.1% over the same three-year period. though again the effect is not statistically significant. This stark difference is especially in-

teresting because it suggests that corporate taxation is especially burdensome on the most highly-paid employees at SMEs. The non-full-time component of total employment comprises part-time employees known as "marginal" employees in Germany, who earn a fixed 450 euro monthly salary, or 5,400 euros a year. Furthermore, there are also trainees who are typically are paid 20% lower salaries than entry-level full-time employees. Thus, Figure 8 suggests that higher taxation induces SMEs to primarily reduce employment of their highest wage earners, which appears consistent with the notion of financial constraints on their ability to pay these higher wages. In contrast, it seems that the large establishments primarily reduce their part-time employment and trainee counts rather than substantially adjusting their full-time employment stocks, possibly because they prefer to retain as many workers who can productively use their existing capital as long as they can afford paying them.

Finally, Figure 9 depicts that individual wages remain rigid over time at SMEs and large establishments. The incumbent wage and hiring patterns support the insight explained by Schoefer (2015) that if SMEs cannot easily reduce their wage bill in response to a higher tax bill by paying their incumbent employees lower salaries, then the higher corporate tax rate forces them to substantially reduce hiring.

7 Conclusion

This paper has documented that higher corporate taxation induces large, persistent reductions in total employment, yet has no significant effect on wages. Utilizing the extensive variation from the German Trade Tax and corresponding richness in the German labor market institutions, I show that the dynamic tax-induced patterns are similar for both unionized and decentralized establishments, suggesting that imperfect labor markets cannot fully explain the documented patterns as neoclassical intuition would suggest that institutional wage rigidity would likely suggest stronger employment effects. Having recognized that decentralized establishments tend to be smaller than unionized establishments, I further study the

effects of corporate taxation by analyzing the difference in labor responses between SMEs and large establishments. While the dynamic responses of total employment and wages are similar across SMEs and large establishments, SMEs appear to reduce full-time employment by significantly more than than the larger establishments, lending credence to the notion that these corporate tax increases produce an added burden on the most credit-constrained businesses.

From a policy perspective, this paper has important implications. While much of the discussion surrounding corporate taxation often revolves around boosting wages or investment, my results suggest that employment is an metric to consider when evaluating the effects of corporate tax policy. In particular, an extensive literature has suggested various explanations for the relatively limited employment loss during the Great Recession, known as the "German Labor Market Miracle."[12] However, this paper provides suggestive evidence that the 2008 cut in the German federal corporate tax rate and accompanying reduction in the Trade Tax minimum rate may have offset greater potential employment losses by reducing the cost of capital and injecting more cash into credit constrained establishments.

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Tables

Table 1: Summary Statistics of German Local Corporate Tax Rates, 2000-2012

A. Trade Tax Levels

Year	# of Municipalities	Mean	SD	Min	Q1	Median	Q3	Max
2000	13,835	15.97	1.95	0	15	16	17	45
2001	13,415	16.1	1.89	0	15	16	17.5	45
2002	13,207	16.19	1.9	0	15	16	17.5	45
2003	12,953	16.3	1.94	0	15	16.35	17.5	45
2004	12,395	16.46	1.86	10	15	16.5	17.5	45
2005	12,324	16.55	1.87	10	15	16.5	17.5	45
2006	12,297	16.61	1.86	10	15	16.5	17.5	45
2007	12,257	16.65	1.85	10	15.35	16.5	17.5	45
2008	12,220	11.68	1.29	7	10.85	11.55	12.25	31.5
2009	11,992	11.72	1.28	7	10.85	11.55	12.32	31.5
2010	11,441	11.83	1.27	7	10.85	11.9	12.32	31.5
2011	11,294	12.03	1.27	7	11.2	12.25	12.6	31.5
2012	11,224	12.15	1.27	7	11.2	12.25	12.95	31.5
Avg.	12,373	15	2	6	13	15	16	40

B. Trade Tax Changes

		Tax Increases				Tax Decreases			
Year	# Changes	# Inc.	Mean	Med	SD	# Dec.	Mean	Med	SD
2000	1,131	1,000	0.98	0.6	1.00	131	-1.9	-1	2.34
2001	1,536	1,382	1.01	0.5	0.94	154	-1.3	-1.1	1.23
2002	1,066	968	1.14	1	0.97	98	-2.6	-1.5	2.97
2003	1,189	1,116	1.15	1	0.84	73	-2.4	-1	3.15
2004	1,056	994	1.14	1	1.02	63	-2.0	-1	2.32
2005	1,371	1,284	1.04	1	0.82	87	-1.7	-1	1.95
2006	1,011	898	1.03	0.5	0.98	113	-1.4	-1	1.66
2007	506	413	1.03	0.75	0.89	93	-1.2	-1	1.28
2008	11,718	6	0.48	0.5	0.18	11,712	-4.9	-4.95	0.61
2009	575	442	0.93	0.7	0.72	134	-0.8	-0.665	0.75
2010	1,106	1,001	1.02	0.7	0.82	105	-0.6	-0.35	0.82
2011	2,090	2,024	1.01	0.7	0.77	66	-0.5	-0.35	0.50
2012	1,513	1,442	0.94	0.7	0.75	71	-0.6	-0.35	0.87
Avg	1,990	998	1	1	1	992	-2	-1	2

Notes: Table provides Trade Tax summary statistics for all German municipalities. Panel A summarizes Trade Tax levels set by each municipality. Panel B summarizes the implied tax changes. The Federal Government imposed a minimum rate of 10% in 2004, which it reduced to 7% in 2008. The last row calculates unweighted averages across years 2000-2012. Data Source: Trade Tax rates from 2000-2012 provided by the Federal Statistical Office.

Table 2: Summary Statistics of German Employer-Employee Sample, 2000-2012

A. Summary Statistics of Labor Market Variables Within Each Sector

		Covered Sector	Uncovered Sector	Full Sample
Establishment Sample	N	12,335	5,799	18,134
Total Employment Count	Mean	157	184	166
	Median	18	30	21
	SD	1,137	667	1,005
Employee Sample	N	114,935	52,878	167,813
Individual Monthly Wage (Euros)	Mean	3,413	2,709	3,063
	Median	3,348	2,334	3,164
	SD	1,285	1,179	1,295

B. Cross Tabulation of Establishment Shares by Establishment Type and Sector

		Covered Sector	Uncovered Sector	Full Sample
Total Share of Establishments		68%	32%	100%
Union Contract Type	Industry	27%	15%	42%
	Firm	4%	3%	7%
	None	37%	14%	51%
Organizational Structure	Single-Unit	53%	20%	73.0%
	Multi-Unit	15%	12%	27.0%
Size (Number of Employees)	1-49	44%	18%	62.0%
	50-249	14%	8%	22.0%
	250+	10%	6%	16.0%

Notes: Table provides summary statistics of the linked employer-employee LIAB sample. Table A depicts the summary statistics of establishment-level employment counts as well as the individual-level real wages of all full-time employees in the sample from 2000-2012. I calculate real wages by converting the raw nominal daily wages to real 2008 euros using the German CPI provided by the Federal Statistical Office, and then multiply the daily real wage by 30 days to obtain the monthly wage. Panel B summarizes the share of establishments in the sample that fit into each cell of a descriptor. Data Source: IAB LIAB linked employer-employee data.

Table 3: Effects of Corporate Tax Changes on Labor Market Outcomes

A. Effects of Taxation on Total Employment

	(1)	(2)	(3)	(4)
Explanatory Variables				
Corporate Tax Change $\Delta\tau_{d,t}$	-1.101***	-0.908***	-1.169***	-1.351***
	(0.347)	(0.323)	(0.344)	(0.315)
District x Year FE	Yes	Yes	Yes	Yes
State x Covered x Year FE	Yes	No	Yes	Yes
Covered x Year FE	No	Yes	No	No
Industry x Year FE	No	No	Yes	No
Lagged Employment Growth	No	No	No	Yes
Observations	141,090	141,090	141,090	108,338
Number of Districts	469	469	469	469

B. Effects of Taxation on Individual Wages

	(5)	(6)	(7)	(8)
Explanatory Variables				
Corporate Tax Change $\Delta\tau_{d(\mathbf{J}(i,t-1)),t}$	0.091	-0.099	0.130	-0.050
	(0.237)	(0.221)	(0.233)	(0.206)
District x Year FE	Yes	Yes	Yes	Yes
State x Covered x Year FE	Yes	No	Yes	Yes
Covered x Year FE	No	Yes	No	No
Industry x Year FE	No	No	Yes	No
Lagged Wage Growth	No	No	No	Yes
Observations	1,122,173	1,122,173	1,122,173	1,105,669
Number of Districts	356	356	356	356

Notes: Table 3 displays results from triple-difference regressions estimating the contemporaneous effects of corporate tax changes on labor market outcomes. Subscripts *i,j,s,d,t,* I^C index an individual, establishment, state, district, year, or covered sector indicator. $\boldsymbol{J}(i,t-1)$ is the establishment that employs *i* in year *t-1*. Panel A estimates Equation (6):

$$g^{L}_{j,t-1,t} = \beta_0 \cdot I^{C}_{j} \cdot \Delta\tau_{d,t} + \mu_{d,t} + \delta_{s,C,t} + \gamma X_{j,t} + u_{j,t}$$

where the dependent variable is the symmetric growth rate of employment from Equation (5). Panel B estimates the effects on individual wages by estimating Equation (9) with H=0:

$$\log w_{i,t} - \log w_{i,t-1} = \beta_0 \cdot I^{C}_{J(i,t-1)} \cdot \Delta\tau_{d(J(i,t-1)),t} + \mu_{d,t} + \delta_{s,C,t} + \gamma_0 X_{i,t} + u_{i,t}$$

The variable $\Delta\tau_{d,t}$is the weighted district-level tax change between years t-1 and t. Columns (1)-(4) estimate the different fixed effects and controls listed on total employment specifications; Columns (5)-(8) mirror these alternative specifications on individual wages. The sample considers available data from 2000-2012, during Germany which had 16 states and 469 different districts. Standard errors in parentheses are clustered by district. *p<0.1, **p<0.05, ***p<0.01. Data Source: IAB LIAB data merged with Trade Tax rates from the Federal Statistical Office.

Table 4: Effects of Corporate Taxation on Labor Market Outcomes by Union Status

Dependent Variable:	Total Employment Growth	Individual Wage Growth
	(1)	(2)
Explanatory Variables		
$\Delta\tau_{d,t}$* Decentralized	-1.487***	-0.378
	(0.468)	(0.525)
$\Delta\tau_{d,t}$* Unionized	-0.683*	-0.0383
	(0.369)	(0.233)
District x Year FE	Yes	Yes
State x Covered x Year FE	Yes	Yes
Covered x Year x Union Status FE	Yes	Yes
Observations	141,090	1,090,847
Number of Districts	469	354

Notes: Table 4 displays results from triple-difference regressions estimating heterogeneous contemporaneous effects of corporate tax changes by an establishment's union contract status on labor market outcomes. Subscripts *i,j,s,d,t,* I^C index an individual, establishment, state, district, year, or covered sector indicator. $\boldsymbol{J}(i,t-1)$ is the establishment that employs *i* in year *t-1*. Column (1) estimates the effect on total employment by estimating:

$$g^{L}_{j,t-1,t} = \beta_{0,\text{Decentralized}} \cdot I^{C}_{j} \cdot \Delta\tau_{d,t} * Decentralized + \beta_{0,Unionized} \cdot I^{C}_{j} \cdot \Delta\tau_{d,t} * Unionized$$
$$+\mu_{d,t} + \delta_{s,C,t} + \delta_{C,t,Union\ Status} + u_{j,t},$$

where the dependent variable $g^{L}_{j,t-1,t}$ is the symmetric growth rate of total employment. Column (2) estimates the effect on individual wages by estimating:

$$\log w_{i,t} - \log w_{i,t-1} = \beta_{0,Decentralized} \cdot I^{C}_{J(i,t-1)} \cdot \Delta\tau_{d(J(i,t-1)),t} * Decentralized$$
$$+\beta_{0,Unionized} \cdot I^{C}_{J(i,t-1)} \cdot \Delta\tau_{d(J(i,t-1)),t} * Unionized + \mu_{d,t} + \delta_{s,C,t} + \delta_{C,t,Union\ Status} + u_{i,t},$$

where the dependent variable is the log difference in incumbent individual wages. The variable $\Delta\tau_{d,t}$is the weighted district-level tax change between years t-1 and t. Half of the establishments in the sample are unionized, meaning that they have firm-level or sector-level collective bargaining agreements, while the remaining half of establishments are decentralized, meaning they are not bound to any collective bargaining agreement. The sample considers available linked employer-employee data from 2000-2012, during Germany which had 16 states and 469 different districts. Standard errors in parentheses are clustered by district. *p<0.1, **p<0.05, ***p<0.01. Data Source: IAB LIAB data merged with Trade Tax rates from the Federal Statistical Office.

Table 5: Effects of Corporate Taxation on Labor Outcomes by Establishment Size

Dependent Variable:	Total Employment Growth	Full-Time Employment Growth	Individual Wage Growth
	(1)	(2)	(3)
Explanatory Variables			
$\Delta\tau_{d,t}$ * Small	-1.192***	-1.740***	-0.284
	(0.404)	(0.580)	(0.250)
$\Delta\tau_{d,t}$ * Medium	-1.298***	-1.495***	0.235
	(0.471)	(0.562)	(0.316)
$\Delta\tau_{d,t}$ * Large	-0.048	0.488	0.093
	(0.582)	(0.656)	(0.275)
District x Year FE	Yes	Yes	Yes
State x Covered x Year FE	Yes	Yes	Yes
Covered x Year x Size FE	Yes	Yes	Yes
Observations	141,090	141,090	1,108,676
Number of Districts	469	469	354

Notes: Table 5 displays results from triple-difference regressions estimating heterogeneous contemporaneous effects of corporate tax changes by an establishment's employment size count on labor market outcomes. Subscripts *i,j,s,d,t,* I^C index an individual, establishment, state, district, year, or covered sector indicator. $\boldsymbol{J}(i,t-1)$ is the establishment that employs *i* in year *t-1*. Columns (1) and (2) assesses employment effects by estimating:

$$g^L_{j,t-1,t} = \beta_{0,Small} \cdot I^C_j \cdot \Delta\tau_{d,t} * Small + + \beta_{0,Medium} \cdot I^C_j \cdot \Delta\tau_{d,t} * Medium$$

$$+\beta_{0,Large} \cdot I^C_j \cdot \Delta\tau_{d,t} * Large + \mu_{d,t} + \delta_{s,C,t} + \delta_{C,t,Size} + u_{j,t},$$

where the dependent variable in Column (1) is the symmetric growth rate of total employment (i.e. full-time and part-time employees), and the dependent variable in Column (2) is the symmetric growth rate of only full-time employment. Column (3) estimates the effect on individual wages by estimating:

$$\log w_{i,t} - \log w_{i,t-1} = \beta_{0,Small} \cdot I^C_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Small$$

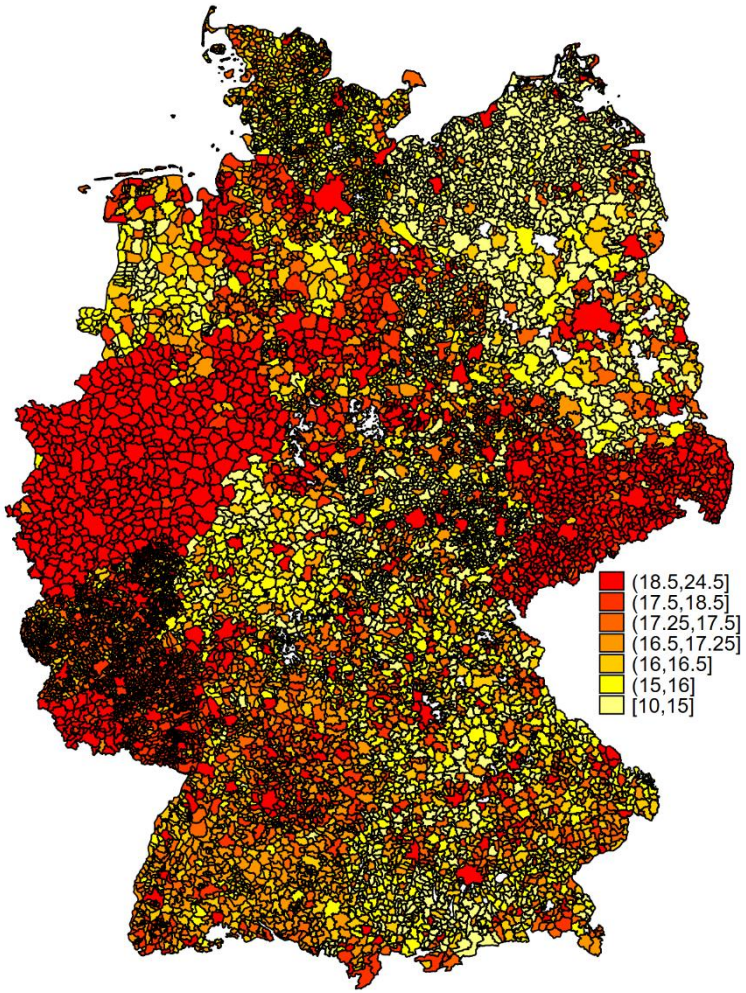
$$+\beta_{0,Medium} \cdot I^C_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Medium + \beta_{0,Large} \cdot I^C_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Large$$

$$+\mu_{d,t} + \delta_{s,C,t} + \delta_{C,t,Size} + u_{i,t},$$

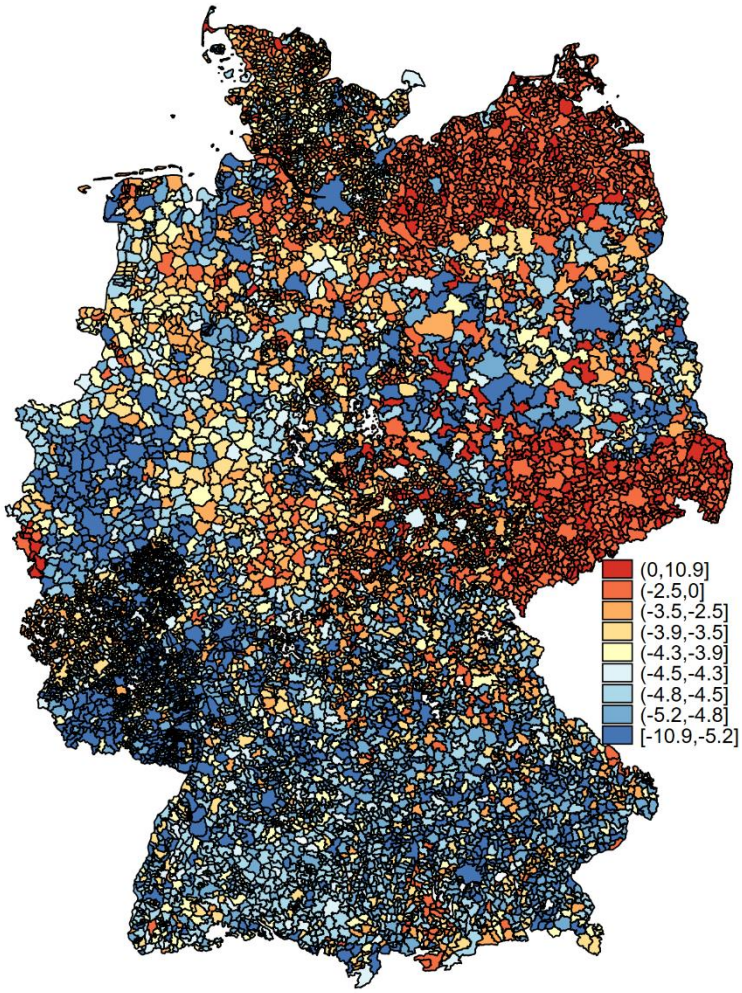
where the dependent variable is the log difference in incumbent individual wages. The variable $\Delta\tau_{d,t}$is the weighted district-level tax change between years t-1 and t. Establishments are divided into size bins of 1-49, 50-249, and 250+. The sample considers available linked employer-employee data from 2000-2012, during Germany which had 16 states and 469 different districts. Standard errors in parentheses are clustered by district. *p<0.1, **p<0.05, ***p<0.01. Data Source: IAB LIAB data merged with Trade Tax rates from the Federal Statistical Office.

Figure 1: Variation in German Local Corporate Tax Rates Across Municipalities Over Time

A. Trade Tax Rates in 2006



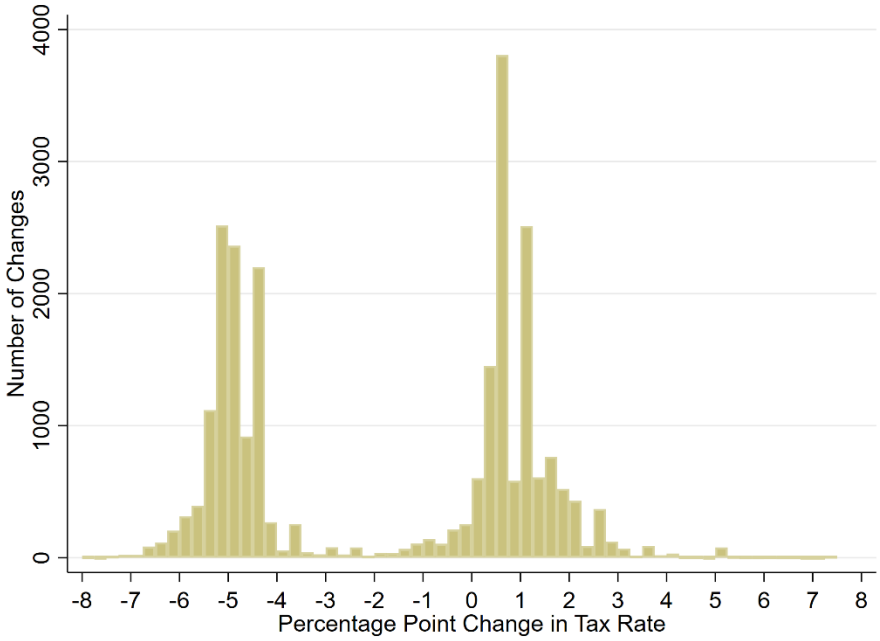
B. Total Percentage Change in Tax Rates, 2000-2012



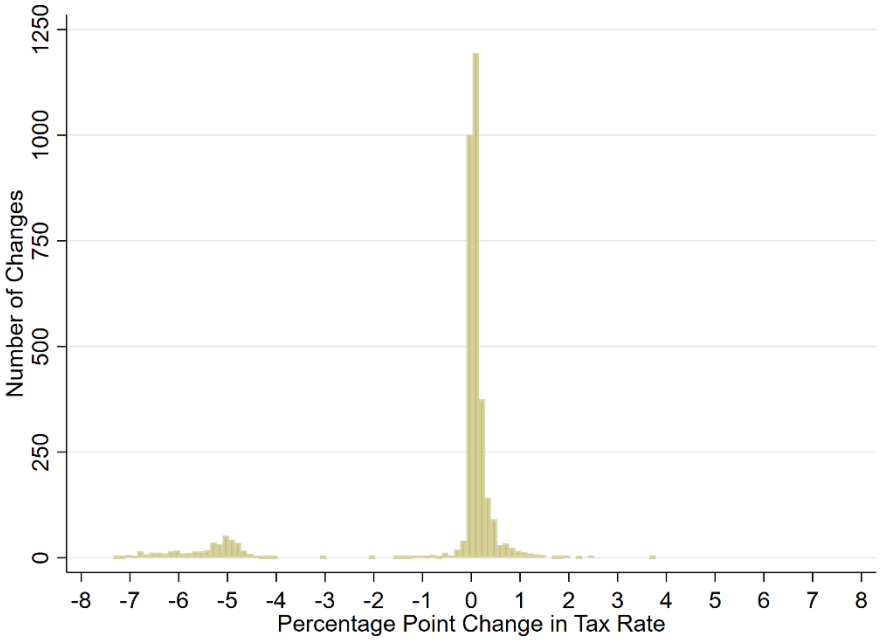
Notes: Figure illustrates cross sectional and time series variation in German Trade Tax rates. Panel A shows the Trade Tax levels in 2006 using the official German municipal borders defined as of December 31, 2006. Panel B displays the total percentage point change in the Trade Tax rate between the beginning of 2000 (or earliest year available) and 2012 using the official borders defined as of December 31, 2012. Data Source: Trade Tax rates from 2000-2012 provided by the Federal Statistical Office.

Figure 2: Distribution of Local Corporate Tax Changes, 2000-2012

A. Municipal-Level Tax Changes



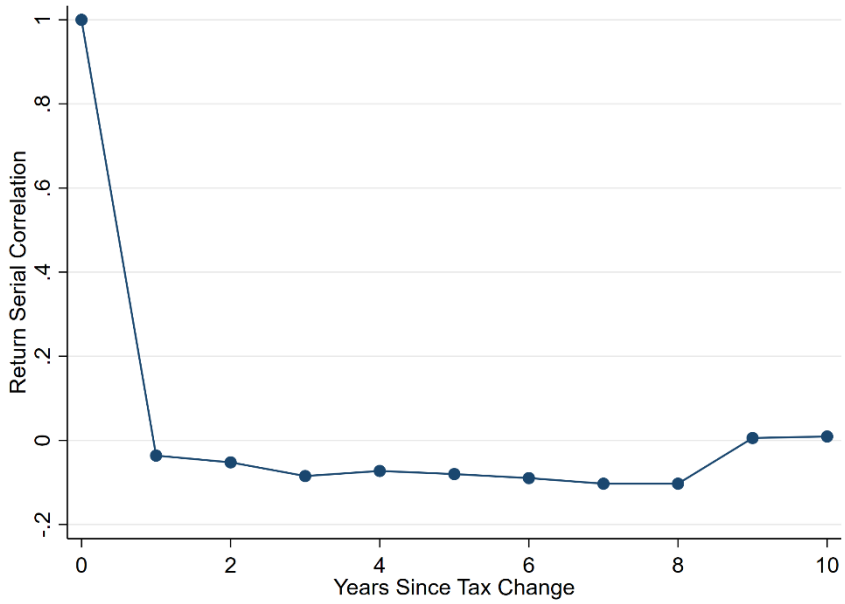
B. Weighted District-Level Tax Changes



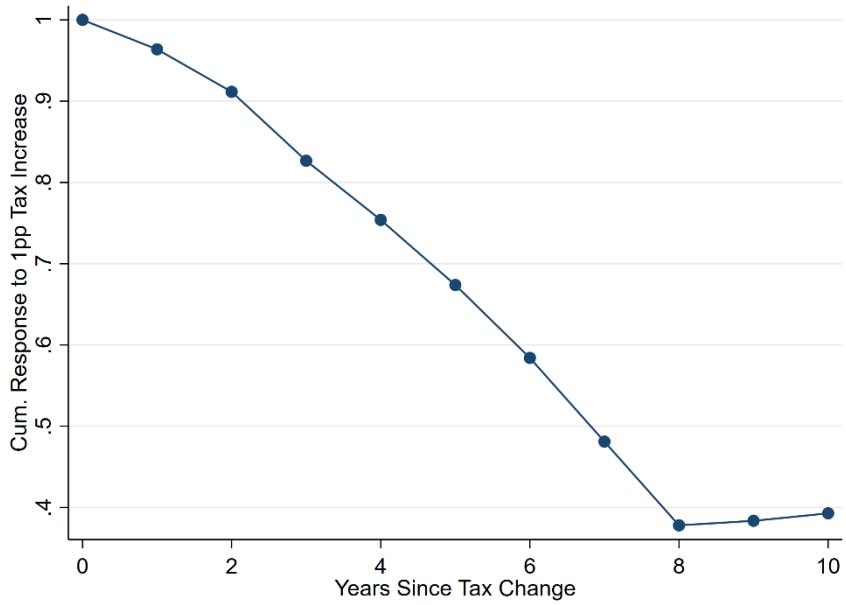
Notes: Figure illustrates the distribution of Trade Tax changes from 2000-2012. Panel A displays the municipal-level tax changes. Panel B displays implied district-level tax changes calculated by weighting each district's municipal-level changes by the number of establishments in each municipality for a given year. There are 24,306 total tax changes from 2000-2012 (12,207 increases and 12,099 decreases), implying 4,501 weighted district-level changes (3,618 increases and 883 decreases). The figure excludes 34 changes outside of the [-8%, 8%] range for visual clarity. Data Source: Trade Tax rates from 2000-2012 provided by the Federal Statistical Office; establishment counts provided by the IAB.

Figure 3: Serial Correlation and Dynamics of Local Corporate Tax Changes

A. Serial Correlation of Tax Changes



B. Cumulative Tax Change Response

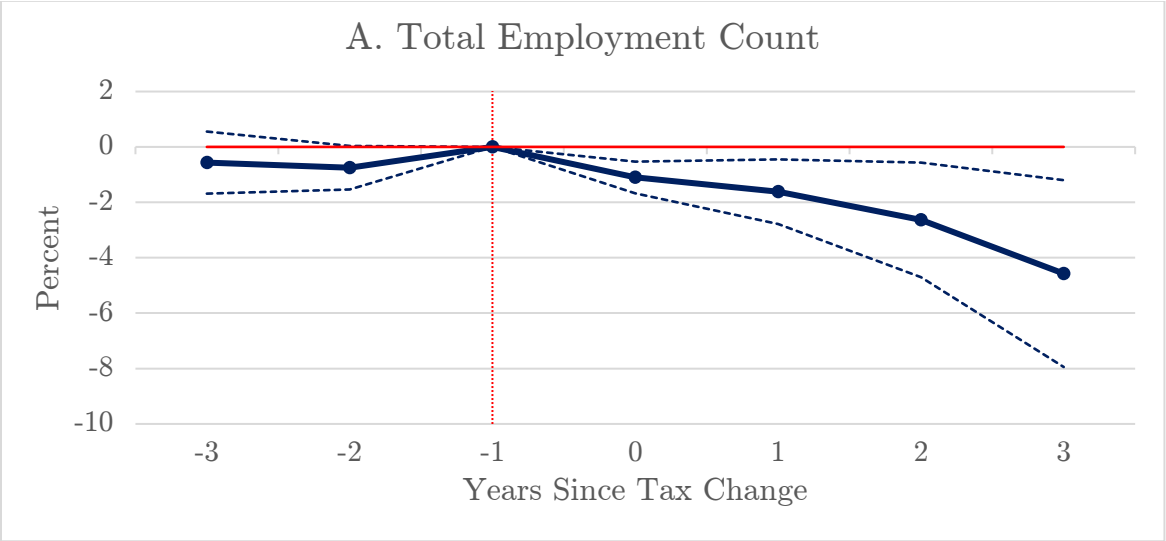


Notes: Figure illustrates the serial correlation and implied cumulative response of Trade Tax changes from 2000-2012. Panel A reports the coefficients β_h from estimating the regression:

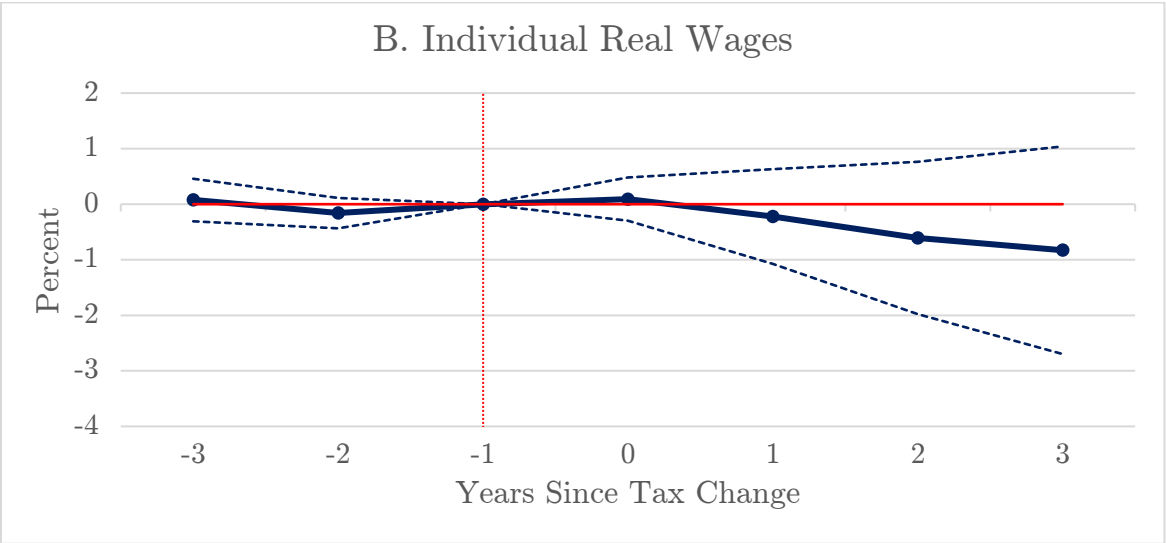
$$\tau_{m,t+h} - \tau_{m,t+h-1} = \beta_h[\tau_{m,t} - \tau_{m,t-1}] + \alpha_h + e_{m,h} \quad ,$$

where m indexes each municipality, t indexes the year. Panel B displays the cumulative coefficients $\beta_H = \sum_{h=0}^{H} \beta_h$, i.e. the sum of the coefficients from Panel A. Data Source: Trade Tax rates from 2000-2012 provided by the Federal Statistical Office.

Figure 4: Cumulative Effect of 1% Corporate Tax Increase on Labor Market Outcomes



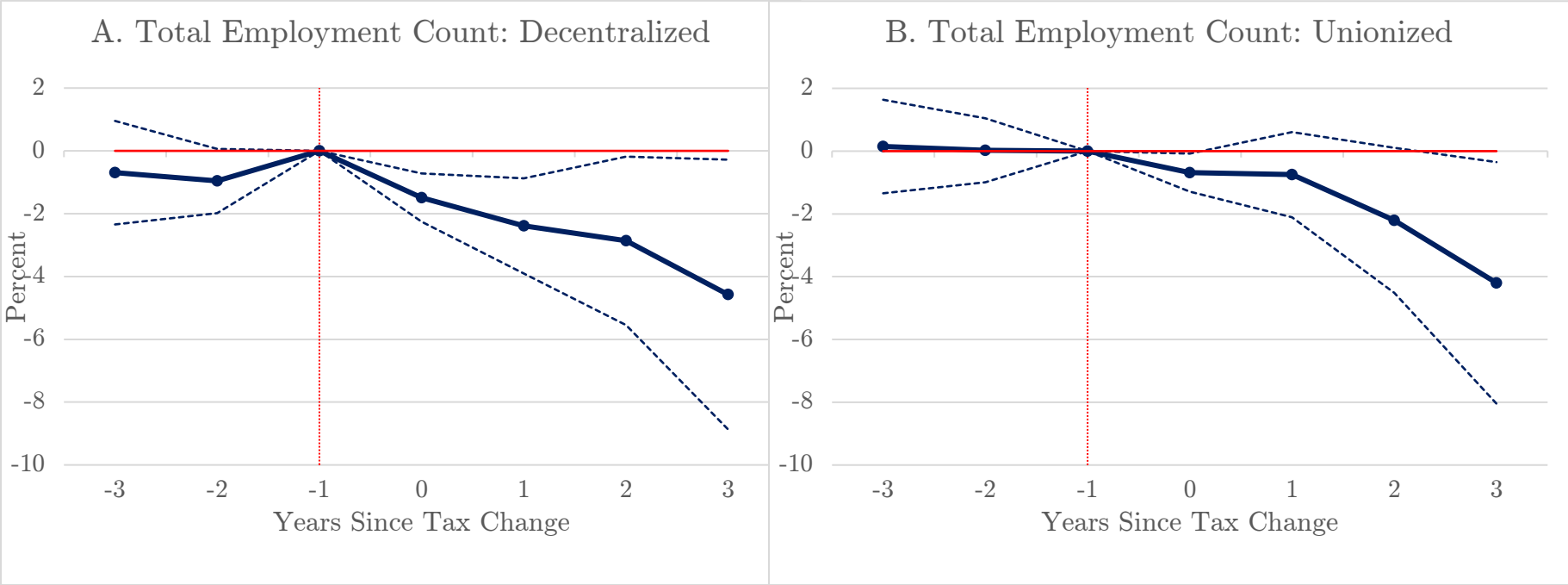
$$\sum_{h=0}^{H}\left[g^{L}_{j,t-1,t+h}\right] = \beta_H \cdot I^{C}_{j} \cdot \Delta\tau_{d,t} + \mu_{H,d,t} + \delta_{H,s,C,t} + u_{H,j,t}, \quad H = -3,-2,0,1,2,3$$



$$\sum_{h=0}^{H}\left[\log w_{i,t+h} - \log w_{i,t-1}\right] = \beta_H \cdot I^{C}_{J(i,t-1)} \cdot \Delta\tau_{d(J(i,t-1)),t} + \mu_{H,d,t} + \delta_{H,s,C,t} + u_{H,i,t},$$

Notes: Figure illustrates the effects of a 1%-point corporate tax increase on labor market outcomes by plotting the impulse response coefficients β_H from the dynamic local projection specifications described in the Empirical Methods Section. Subscripts *i,j,s,d,t,* I^C index an individual, establishment, state, district, year, or covered sector indicator. $\boldsymbol{J}(i,t-1)$ is the establishment that employs *i* in year *t-1*. *H* indexes each horizon relative to the year of the tax change. Panel A estimates Equations (8) to assess the effects on establishment-level total employment, where the dependent variable is the symmetric growth rate in Equation (6). Panel B estimates Equations (9) to assess the effects on individual wages, where the dependent variable cumulates the differences of log wages. The variable $\Delta\tau_{d,t}$is the weighted district-level tax change between years t-1 and t. The sample considers available linked employer-employee data from 2000-2012. Standard errors in parentheses are clustered by district. All specifications include district x year and state x covered x year fixed effects. 90% confidence intervals based on standard errors clustered by district are in dashes. Data Source: IAB LIAB linked employer-employee data merged with Trade Tax rates from the Federal Statistical Office.

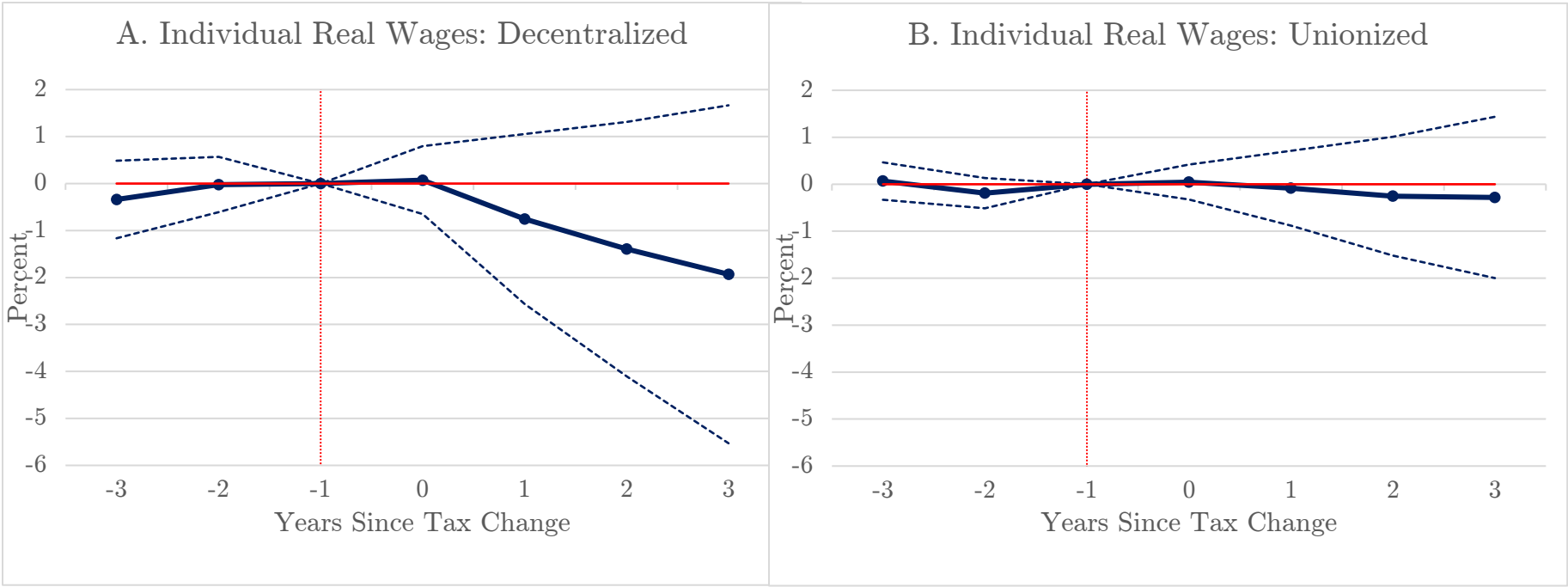
Figure 5: Heterogeneous Effects of 1% Corporate Tax Increase on Total Employment by Union Status



$$\sum_{h=0}^{H}\left[g^{L}_{j,t-1,t+h}\right] = \beta_{H,Decentralized} \cdot I^{C}_{j} \cdot \Delta\tau_{d,t} * Decentralized + \beta_{H,Unionized} \cdot I^{C}_{j} \cdot \Delta\tau_{d,t} * Unionized + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{C,t,Union\ Status} + u_{H,j,t},$$

Notes: Figure illustrates heterogeneous effects of a 1%-point corporate tax increase on total employment count by union contract status. Each figure plots the impulse response coefficients β_H from the local projection specifications listed above. Subscripts i,j,s,d,t,I^C index an individual, establishment, state (16 in sample), district (469 in sample), year, or covered sector indicator. H indexes each horizon relative to the year of the tax change. The dependent variable is the symmetric growth rate of total employment defined in Equation (6). The variable $\Delta\tau_{d,t}$is the establishment-weighted district-level tax change between years t-1 and t. Panel A displays $\beta_{H,Decentralized}$, the effects on decentralized establishments. . Panel B displays $\beta_{H,Unionized}$, the effects on unionized establishments. All specifications include district x year and state x covered x year fixed effects, and covered x year x union status fixed effects. 90% confidence intervals based on standard errors clustered by district are in dashes. Data Source: IAB LIAB linked employer-employee data merged with Trade Tax rates from the Federal Statistical Office.

Figure 6: Heterogeneous Effects of 1% Corporate Tax Increase on Individual Real Wages by Union Status

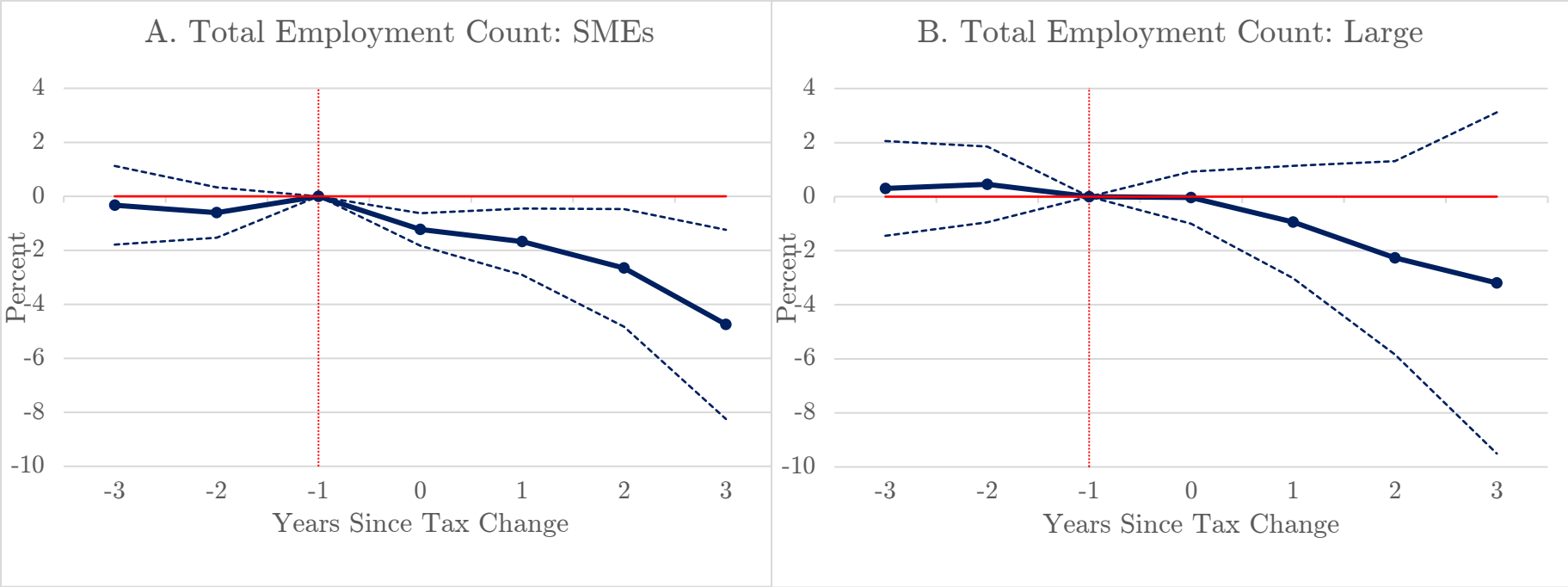


$$\sum_{h=0}^{H}\left[\log w_{i,t+h} - \log w_{i,t-1}\right] = \beta_{H,Decentralized} \cdot I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Decentralized$$

$$\beta_{H,Unionized} \cdot I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Unionized + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{C,t,Union\ Status} + u_{H,i,t},$$

Notes: Figure illustrates heterogeneous effects of a 1%-point corporate tax increase on individual real wages by union contract status. Each figure plots the impulse response coefficients β_H from the local projection specifications listed above Subscripts *i,j,s,d,t,* I^C index an individual, establishment, state (16 in sample), district (469 in sample), year, or covered sector indicator. $\boldsymbol{J}(i,t-1)$ is the establishment that employs *i* in year *t-1*. *H* indexes each horizon relative to the year of the tax change. The dependent variable is the cumulated log difference of the real wage as defined in Equation (9). The variable $\Delta\tau_{d,t}$is the establishment-weighted district-level tax change between years t-1 and t. Panel A displays $\beta_{H,Decentralized}$, the effects on workers employed by decentralized establishments. . Panel B displays $\beta_{H,Unionized}$, the effects on workers employed by unionized establishments. All specifications include district x year and state x covered x year fixed effects, and covered x year x union status fixed effects. 90% confidence intervals based on standard errors clustered by district are in dashes. Data Source: IAB LIAB linked employer-employee data merged with Trade Tax rates from the Federal Statistical Office.

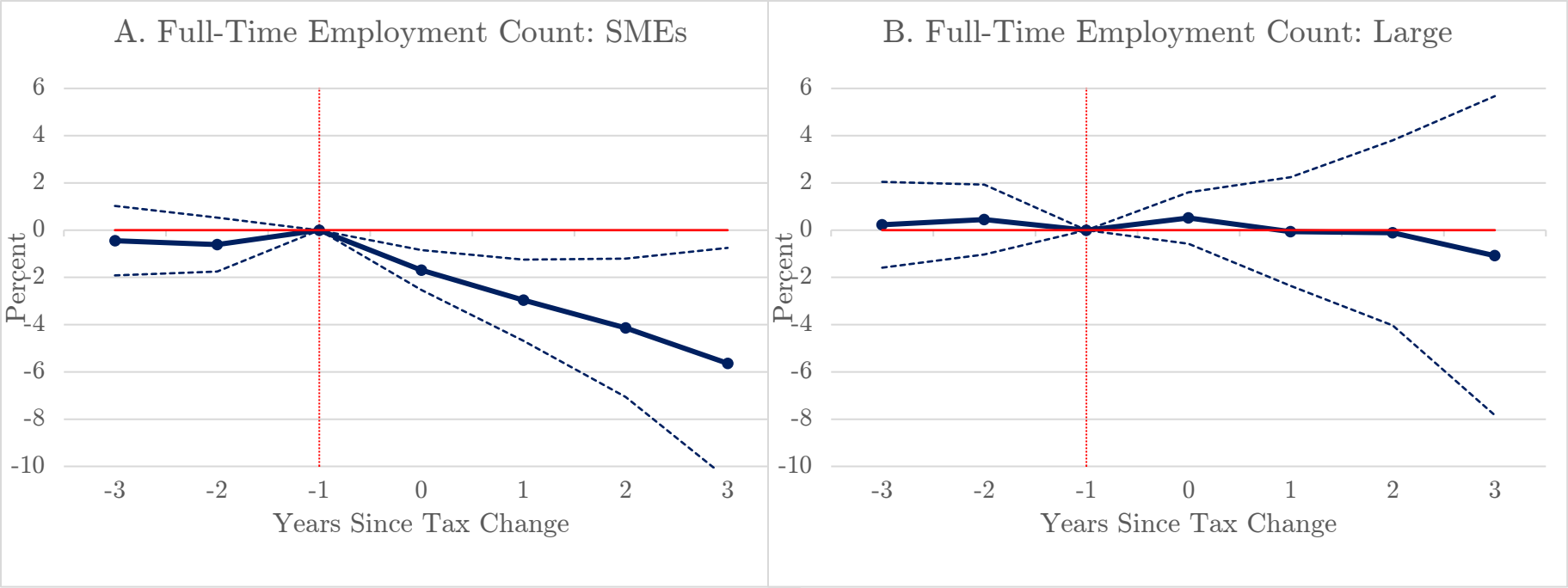
Figure 7: Heterogeneous Effects of 1% Corporate Tax Increase on Total Employment by Establishment Size



$$\sum_{h=0}^{H}\left[g^{L}_{j,t-1,t+h}\right] = \beta_{H,SME}\cdot I^{C}_{j}\cdot \Delta\tau_{d,t} * SME + \beta_{H,Large}\cdot I^{C}_{j}\cdot \Delta\tau_{d,t} * Large + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{C,t,Size} + u_{H,j,t},$$

Notes: Figure illustrates heterogeneous effects of a 1% point corporate tax increase on total employment count (i.e. including full-time, part-time, and trainees) by establishment size. Each figure plots the impulse response coefficients β_H from the local projection specifications listed above. Subscripts i,j,s,d,t,I^C index an individual, establishment, state (16 in sample), district (469 in sample), year, or covered sector indicator. The dependent variable is the symmetric growth rate of total employment defined in Equation (5). The variable $\Delta\tau_{d,t}$is the weighted district-level tax change between years t-1 and t. Panel A displays $\beta_{H,SMEs}$, the effects on small and medium establishments, measured as having 1-249 total employees. Panel B displays $\beta_{H,Large}$, the effects on large establishments, measured as having 250+ total employees. All specifications include district x year and state x covered x year fixed effects, and covered x year x size fixed effects. 90% confidence intervals based on standard errors clustered by district are in dashes. Data Source: IAB LIAB linked employer-employee data merged with Trade Tax rates from the Federal Statistical Office.

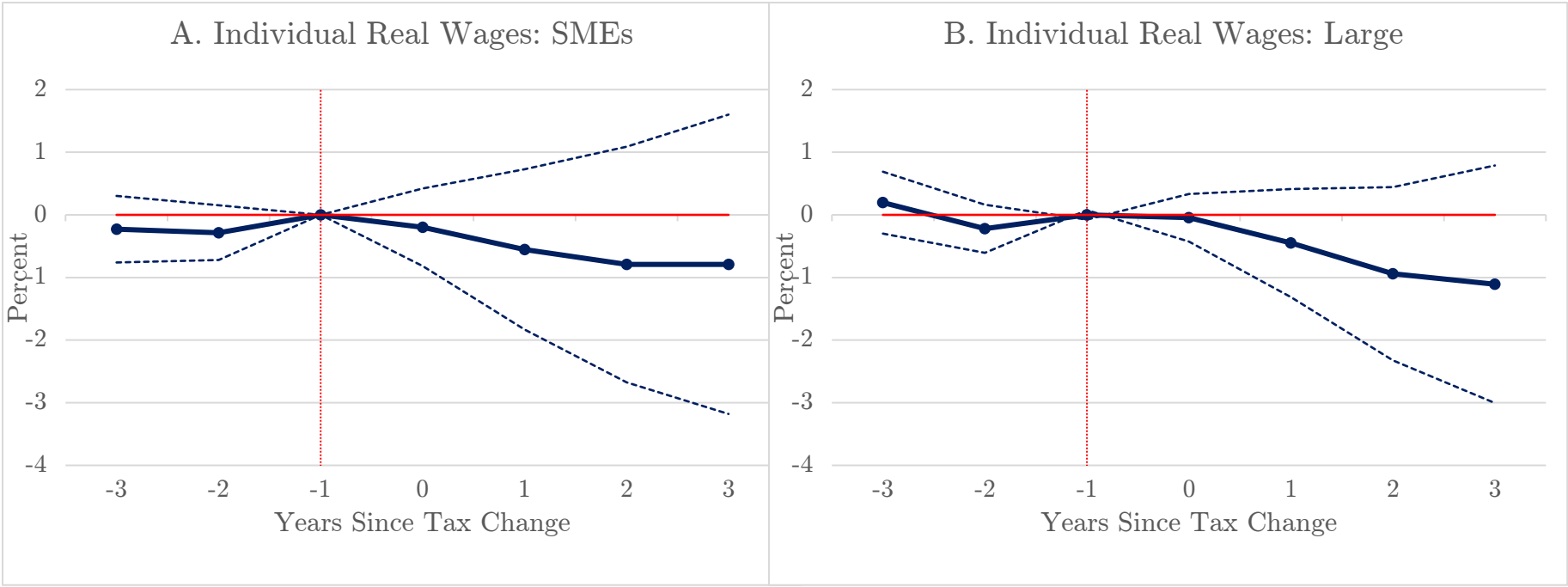
Figure 8: Heterogeneous Effects of 1% Corporate Tax Increase on Full-Time Employment by Establishment Size



$$\sum_{h=0}^{H}\left[g_{j,t-1,t+h}^{L,FT}\right] = \beta_{H,SME} \cdot I_j^C \cdot \Delta\tau_{d,t} * SME + \beta_{H,Large} \cdot I_j^C \cdot \Delta\tau_{d,t} * Large + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{C,t,Size} + u_{H,j,t},$$

Notes: Figure illustrates heterogeneous effects of a 1%-point corporate tax increase on full-time employment count by establishment size. Each figure plots the impulse response coefficients β_H from the local projection specifications listed above. Subscripts i,j,s,d,t,I^C index an individual, establishment, state (16 in sample), district (469 in sample), year, or covered sector indicator. H indexes each horizon relative to the year of the tax change. The dependent variable is the symmetric growth rate of full-time employment, defined in Equation (5) but replacing total employment with full-time employment. The variable $\Delta\tau_{d,t}$is the weighted district-level tax change between years t-1 and t. Panel A displays $\beta_{H,SMEs}$, the effects on small and medium establishments, measured as having 1-249 total employees. Panel B displays $\beta_{H,Large}$, the effects on large establishments, measured as having 250+ total employees. All specifications include district x year and state x covered x year fixed effects, and covered x year x size fixed effects. 90% confidence intervals based on standard errors clustered by district are in dashes. Data Source: IAB LIAB linked employer-employee data merged with Trade Tax rates from the Federal Statistical Office.

Figure 9: Heterogeneous Effects of 1% Corporate Tax Increase on Individual Real Wages by Establishment Size



$$\sum_{h=0}^{H}\left[\log w_{i,t+h} - \log w_{i,t-1}\right] = \beta_{H,SME} \cdot I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * SME$$

$$\beta_{H,Large} \cdot I^{C}_{\mathbf{J}(i,t-1)} \cdot \Delta\tau_{d(\mathbf{J}(i,t-1)),t} * Large + \mu_{H,d,t} + \delta_{H,s,C,t} + \delta_{C,t,Size} + u_{H,i,t},$$

Notes: Figure illustrates heterogeneous effects of a 1%-point corporate tax increase on individual real wages by union contract status. Each figure plots the impulse response coefficients β_H from the local projection specifications listed above. Subscripts *i,j,s,d,t,* I^C index an individual, establishment, state (16 in sample), district (469 in sample), year, or covered sector indicator. $\boldsymbol{J}(i,t-1)$ is the establishment that employs *i* in year *t-1*. *H* indexes each horizon relative to the year of the tax change. The dependent variable is the cumulated log difference of the real wage as defined in Equation (9). The variable $\Delta\tau_{d,t}$is the establishment-weighted district-level tax change between years t-1 and t. Panel A displays $\beta_{H,SMEs}$, the effects on workers employed by small and medium establishments, measured as having 1-249 total employees. Panel B displays $\beta_{H,Large}$, the effects on workers at large establishments, measured as having 250+ total employees. All specifications include district x year and state x covered x year fixed effects, and covered x year x size fixed effects. 90% confidence intervals based on standard errors clustered by district are in dashes. Data Source: IAB LIAB linked employer-employee data merged with Trade Tax rates from the Federal Statistical Office.