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- ▶ **How Do Firms Respond to Place-Based Tax Incentives?**
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How Do Firms Respond to Place-Based Tax Incentives?*

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Abstract

In this paper, we evaluate the effects of payroll tax changes on firm behavior, by exploiting a unique policy setting in Norway, where a system of geographically differentiated payroll taxes was suddenly abolished due to an EU regulation. We find that firms are only partially able to shift the increased costs from higher payroll tax rates onto workers' wages. Instead, firms respond to the tax increase primarily by reducing employment. The drop in employment following the tax reform is particularly pronounced in labor intensive firms—which experience a larger windfall loss due to the tax reform than non-labor intensive firms—and in multi-establishment firms—which respond to the payroll tax increase in part by reducing the number of establishments per firm. Overall, our findings point to liquidity effects whereby a sudden and largely unexpected payroll tax increase aggravates firms' liquidity constraints, forcing them to cut employment to bring down costs.

Keywords: Payroll taxes, regional tax incentive, firm behavior, labor demand

JEL Codes: D22, H25, H32, J18, J23

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1 Introduction

Payroll taxes levied on firms constitute about 15% of total tax revenue in OECD countries¹. As payroll taxes are proportional to workers' earnings, they serve as an additional labor cost for firms, beyond the gross wages paid to employees. Some policy makers therefore argue that lowering payroll taxes, by bringing down firms' labor costs, would boost job creation and raise overall employment. Opponents, however, argue that lowering (raising) payroll taxes would hardly have any impact on employment, as firms may pass the changed tax burden onto the workers through raising (lowering) their wages.

In this paper, we shed new light on this important debate, by exploiting a unique policy setting in Norway where a system of geographically differentiated payroll taxes was suddenly abolished. In Norway, firms in more remote areas of the country generally face lower payroll tax rates than firms in the urban centers, such as Oslo. The motivation behind such regionally differentiated payroll tax rates is to stimulate employment and business activity, and to avoid depopulation of sparsely populated areas of the country. In 1999, however, the European Free Trade Association Surveillance Authority (ESA) ruled that the Norwegian system of geographically differentiated payroll tax rates was not in compliance with the European Union (EU) trade regulations. The result was a tax rate harmonization reform that took place between 2004 and 2006. The gradual harmonization created (arguably) exogenous variation in the payroll tax rates faced by firms in different regions over time, since the reform was adopted and implemented independently of the local labor market developments. We take advantage of this setting to provide an in-depth analysis of how firms adjust to the abolition of a regional tax incentive.

Our identification strategy exploits the fact that relevant tax rates are determined by the location of the worker rather than that of the firm. In particular, depending on the pre-reform composition of their employees, different firms are differentially exposed to the tax changes induced by the reform: whereas some firms experienced a sudden and unexpected windfall loss of up to 6% of their total wage bill, other firms saw no change in their total wage bill. As firms mostly hire workers from within their local area, firms that experienced larger windfall losses also typically faced a higher marginal cost of hiring new workers. Our estimates capture the combined effect of the windfall loss, and the increased marginal cost of hiring new workers.

Alongside the tax reform, a national-level subsidy scheme was implemented to facilitate firms' transitions to paying higher tax rates. In practice, the subsidy scheme rendered small

¹ Tax Foundation, p. 8: <https://files.taxfoundation.org/20170830115300/Tax-Foundation-FF557.pdf>

firms (with a wage bill below the maximum subsidy allowance) entirely unaffected by the reform, and we exploit this to conduct a placebo analysis. Interestingly, in 2007 the system of geographically differentiated payroll taxes was re-introduced after an appeal by Norway on ESA's ruling. This setting thus provides an opportunity to assess whether firms' adjustments to the tax increase is reversed once the pre-reform tax incentives are restored.

Our key finding is that firms affected by the 2004 reform respond to the payroll tax increase primarily by reducing employment, and, in consequence, sales and value added. Average firm wages, in contrast, decline only moderately in response to the tax increase. The small average wage response is partly masked, however, by compositional changes of workers in downsizing affected firms. When estimating regressions at the worker (as opposed to the firm) level, and including worker fixed effects to eliminate any bias from compositional changes, we find statistically significant evidence for partial wage shifting: a one percent increase in the payroll tax rate reduces workers' wages by about 0.6%.

We also find that multi-establishment firms experience a particularly large decline in employment, in part because they close down existing establishments, and are less likely to open up new establishments. Furthermore, we find that the drop in employment is especially pronounced in labor-intensive industries where firms, due to the high labor costs as a share of total costs, experience a relatively larger windfall loss than their counterparts in capital-intensive industries. When looking at the subsequent decrease in payroll taxes in 2007, we find that the negative employment effects induced by the 2004 reform are not reversed.

Overall, our results suggest that firms are only partially able to shift the burden of higher payroll taxes onto workers' wages, at least in the context of Norway. Instead, firms' primary means of adjustments to the tax hike (and the resulting windfall loss) appears to be to reduce employment. These results may therefore suggest that the regionally differentiated payroll tax rates that used to be in place prior to 2004 were indeed an effective policy tool to stimulate employment in remote areas of Norway.

Our findings highlight the importance of considering context-specific institutional features when evaluating the incidence of payroll taxes. In particular, the labor market institutions in Norway are characterized by a high degree of unionization and centralized wage bargaining, which may have limited firms' ability to make adjustments through wage cuts. This implies that in contexts where wage setting is less rigid, we may find a greater tax incidence on workers (as opposed to firms) than what we observe in Norway. Another key implication

of our study is that even temporary tax increases may have long-lasting employment effects.² This could be because a considerable share of the overall employment drop in (multi-establishment) firms is through establishment exits, which might be difficult to reverse.

This paper can be related to at least two strands of the literature. First, we add to the literature evaluating place-based policies (aimed at reducing regional inequalities) that, despite the prevalence of such programs, is still relatively scarce (Bartik, 1991). There is, however, a small but growing literature evaluating the impacts of regional payroll tax decreases on employment and wages. These studies tend to find small or no employment effects following decreases in payroll tax rates, together with a significant increase in wages paid to workers; see, for example, Bohm and Lind (1993) and Bennmarker, Mellander and Öckert (2009) for Sweden; Korkeämäki and Uusitalo (2009) for Finland; Johansen and Klette (1997), Stokke (2015) and Dale-Olsen (2017) for Norway; and Cruces, Galiani and Kidyba (2010) for Argentina.³

Our study departs from this literature in two main ways. First, we conduct our analysis at the level of the *firm*, as opposed to the *region*, taking advantage of the fact that firms—even in the same region—could experience different tax hikes. In this way, our firm-level approach complements the existing, region-level studies, by painting a more complete picture of the various channels through which labor markets adjust to tax changes. Second, we focus on payroll tax *increases* rather than *decreases*. The employment effects of payroll tax increases and decreases may be asymmetric; for example, if a high degree of unionization prevents firms from cutting wages in response to a tax increase, but not from raising wages in response to a tax cut. Moreover, the largely unexpected and sudden increase in the payroll tax rate, as in our context, implied a large windfall loss for some firms, and may have rendered them cash-constrained, leaving them with only a few options for adjustments in the short run.

This paper also relates to a number of recent papers that investigate the impact of windfall gains or losses on firms' employment. In a paper closest to ours, Saez, Schoefer and Seim (2017) show that in Sweden, firms with a larger share of young workers expand employment relative to firms with an older workforce in response to a payroll tax cut targeted

² This echoes the findings of Benzarti, Carloni, Harju and Kosonen (2017) on price responses to the value-added taxes in Europe.

³ A number of studies further use micro data and reform-induced changes in *national* payroll taxes levied on firms, but for particular groups of workers. Some of these papers find that the incidence is mainly on the workers (Murphy, 2007; Anderson and Meyer, 1997; 2000; Gruber, 1997), while others conclude that the incidence is only partly on workers (Kugler and Kugler, 2009; Saez, Matsaganis, Tsakoglou, 2012; Saez, Schoefer and Seim, 2017; Lehmann, Marcial and Rioux, 2013).

at young workers. In related work, Melcangi (2018) shows that an unexpected windfall gain due to a cut in *business rates* in the UK (a tax based on a periodically estimated value of the property occupied by the firm) induces firms to hire more workers. In line with this evidence, Schoefer (2016) likewise reports strong firm employment responses to windfall shocks. All three studies find larger employment adjustments to windfall shocks in highly leveraged and credit-constrained firms. Our paper contributes to this literature by exploiting a compelling research design based on externally imposed changes to payroll taxes, and by investigating a sharp and sudden windfall *loss*, as opposed to the windfall *gain* studied in Saez, Schoefer and Seim (2017). It is also important to highlight that our research design uncovers, similar to Saez, Schoefer and Seim (2017), the combined effect of windfall shocks and changes in the marginal cost of hiring new workers, rather than the pure windfall effect identified in Melcangi (2018) and Schoefer (2016).

The paper proceeds as follows. Section 2 explains the policy setting that motivates our empirical strategy. In Section 3 we formalize our empirical strategy, and in Section 4 we present the data. Section 5 starts by presenting results from an event study, demonstrating that “treated” and “control” firms indeed experienced similar developments in employment and wages prior to the reform. Next, we present our main results, and contrast them with the results from a set of “placebo” estimations. Section 6 investigates the mechanisms behind the findings of large employment effects, and Section 7 analyzes the wage and employment effects of the subsequent 2007 payroll tax decrease. Finally, Section 8 concludes with a discussion of our findings.

2 Institutional Setting and Data

2.1 The Payroll Tax Harmonization Reform

Norway runs a generous social security system to finance pension benefits and health insurance, as well as unemployment, disability and welfare benefits. The system is largely financed through payroll taxes, and while employees contribute 8.2% of their gross pay to the scheme, regardless of where they reside, employers’ contributions are geographically differentiated. Even though some employers pay significantly more into the system than others, all employees draw the same benefits from the scheme. The motivation behind geographically differentiated payroll taxes is to stimulate employment in more remote areas of the country. Until 2006, the country was divided into five tax zones, with payroll tax rates ranging from

14.1% in the central areas to 0% in the northernmost regions (see Panel (a) of Figure A1 in the Appendix). The relevant tax rates faced by a firm was determined by the locations of the workers rather than the location of the firm. This meant that firms located in the same tax zone could face different average tax rates depending on the residency locations of their workers. Even workers within the same firm could be subject to different payroll tax rates if they lived in different tax zones.

In 1999, the European Free Trade Association Surveillance Authority (ESA) ruled that the Norwegian system of geographically differentiated tax rates was not in compliance with trade regulations agreed on by the EU, and the European Economic Area (EEA) countries including Norway, Iceland and Lichtenstein. Norway contested the ruling, arguing that the differentiated tax rates (with only minor changes for certain industries) should be considered as *direct transport aid* in line with EU-EEA legislation. ESA approved the proposal, and Norway was allowed to keep the system until 2003. In September 2002, however, ESA sent a letter to Norwegian authorities requiring that the system had to be changed, and Norway was asked to propose a change by March 25th 2003 that was to be implemented by January 1st 2004.⁴ As a result, a tax rate harmonization was imposed between 2004 and 2006. The resulting payroll tax changes in the different zones are illustrated in Figure 1. Zone 5 (the northernmost region) was allowed to keep its zero payroll tax rate. Zone 1 (central areas) was likewise unaffected, and the payroll tax rate remained constant at 14.1%. In zone 2 the harmonization took place immediately in 2004, raising the tax rate from 10.6% in 2003 to 14.1% in 2004, while the harmonization was more gradual in zones 3 and 4, raising the payroll tax rate by 5.7 and 6.6 percentage points over a three-year period. In 2007, another ESA ruling allowed Norway to re-introduce the system of differentiated payroll taxes (after an appeal case), and tax rates were reduced to their pre-2004 levels.⁵

[Figure 1]

The externally imposed harmonization provides an ideal setting to study firm adjustments to payroll taxes, since the changes in the average payroll tax rate faced by firms

⁴ Norway's reply to ESA, 25.03.2003: State aid. Differentiated social security contributions in Norway. <https://www.regjeringen.no/no/dokumenter/state-aid-differentiated-social-security-4/id91117/>

⁵ Several other changes to the payroll tax system was made in 2007. First, the statutory tax rate faced by firms were to depend on the location of the firm, as opposed to the location of the workers. Second, some of the municipalities in zone 1 and 4 were classified under two new tax zones: 1a and 4a. Third, there were some changes to the sector exemptions from the system.

were imposed by ESA, and are therefore likely to be independent of the local labor market business cycles. Anticipatory adjustments to the 2003 tax reform are possible, as firms knew as of September 2002 that some changes would have to be made. The extent and timing of the changes was however not laid out until March 2003. Anticipation effects of the restoration of the differentiated system in 2007 on the other hand, are less likely, as the restoration of the system in 2007 was still under negotiation in the summer of 2006 (Aftenposten, 10.02.2006).

At the same time as complying with the EU ruling of a tax harmonization, the Norwegian government implemented a subsidy scheme to ease the burden (especially on small firms) of the higher payroll taxes introduced in 2004. In particular, firms (in most sectors) could pay the pre-reform (2003) payroll tax rate (τ_t^l) for the wage bill up to a cap, after which firms would pay the contemporary statutory tax rate (τ_t^o) for the remaining wage bill (τ_t^o and τ_t^l are reported in Table A1 in the Appendix). It is important to emphasize that the subsidy is computed at the level of the *firm* (as opposed to the *establishment*); the wage bill therefore refers to the firm's total wage bill across all establishments. The cap was set such that firms were given a maximum tax relief (subsidy) of 270,000 NOK (38,136 USD) per year.⁶ Accordingly, the actual subsidy received by a firm varied over time (as the harmonization proceeded), and depended on the worker composition of the firm. Specifically, the subsidy for firm j in year t is given by:

$$S_{j,t} = \min \left(\sum_{i=1}^{N_{j,t}} w_{i,t} \times (\tau_{i,t}^o - \tau_{i,t}^l), \bar{S} \right), \quad (1)$$

where $w_{i,t}$ is the total earnings of worker i employed at this firm in year t (across all establishments of the firm), $N_{j,t}$ is the number of workers in firm j (across all establishments) in year t , and \bar{S} is the maximum subsidy. This means that firms below a certain size were unaffected by the tax reform (assuming no immediate spillover effects), even if they experienced an increase in the average statutory tax rate.

2.2 Wage setting and Firing Costs in Norway

The system of wage bargaining in Norway is characterized by centralized bargaining and a high degree of unionization. In 2014, 52% Norwegian workers were members of a trade union,

⁶ All monetary amounts in this paper are converted to USD using the average exchange rate for 2003 where 1 USD = 7.08 NOK.

and close to 70% of workers in the private sector were employed in firms that were members of an employer federation (FAFO, 2014). Even though only firms that belong to an employer federation are legally required to pay union wages, non-member firms often do so as well. The guiding idea behind the wage bargaining system is that the outcome of wage negotiations in the sectors exposed to foreign competition should set the norm for wage growth also in other sectors of the economy. In this way, overall wage growth is linked to productivity growth in the exposed sectors.

In practice, the main federation of trade unions (*Landsorganisasjonen i Norge*) and the main private sector employee federation (*Næringslivets Hovedorganisasjon*) bargain over wages in the manufacturing sector, based on a common assessment of the economic situation produced by a committee with broad representation. This centralized wage bargaining typically determines a minimum wage increase, while leaving some room for local negotiations of supplementary wage increases at the firm level. The local negotiations are supposed to take into account a firm's profitability, productivity, expectations for the future and ability to compete (NOU 2013:13). Despite the manufacturing sector being quite small in Norway, the outcome of the centralized negotiations in this sector has usually served as an effective norm for wage growth both in other private sectors and in the public sector (Kahn, 1998; Gjelsvik, Nymoen and Sparrman, 2015). While there is some room for wage negotiations at the firm level, wage setting is more centralized in Norway than in most other comparable countries (OECD, 2016).

Similarly, employment relationships are relatively rigid in Norway.⁷ The termination of employment contracts of private sector employees is regulated by the Norwegian Working Environment Act. To terminate a contract, employers must have reasonable grounds, such as firm downsizing (Tekna, 2015).

3 Empirical Strategy

The main challenge to evaluating place-based tax incentives is that the policy is usually implemented in response to the local economic conditions. This makes it difficult to find a comparable control group to construct a counterfactual outcome – i.e., the outcome in the absence of the place-based policy – for the affected regions. We overcome this challenge by

⁷ In a cross-country comparison of “firing rigidities” conducted by the World Bank, Norway scores 40 on an index from 0-100. For comparison, the US has a score of 0, France a score of 40 and the UK a score of 10 (World Bank, 2006).

exploiting a setting where the existing place-based policy was suddenly abolished due to an ESA ruling, together with the fact that the relevant tax rates are determined by the location of the worker rather than that of the firm. There are two reasons why firms employ workers from different locations. First, firms may have establishments in different tax zones. Second, even within establishments, workers may come from different tax zones, in particular if the establishment is located close to the tax zone border. Our identification strategy compares changes in firm outcomes before and after the abolition of geographically differentiated payroll taxes between firms that are differentially exposed to the policy. In addition, due to the subsidy scheme in place, small firms remained entirely unaffected by the reform, rendering small firms suitable for a placebo analysis.

We first explain in detail how we make use of the variation in statutory tax rates (Section 3.1), and next, how the subsidy scheme rendered small firms unaffected by the tax reform (Section 3.2).

3.1 Changes in the Statutory Tax Rate

We start out by constructing a measure of the increase in the statutory tax rate faced by a firm (ignoring the subsidy scheme), for each of the post-reform years 2004-2006, based on the tax zones of residency of the workers employed in the firm in the pre-reform year (2003). Since we fix a firm's worker compositions to the pre-reform year, the variation in our exposure measure is driven by changes in the statutory payroll tax rates, and not by potentially endogenous changes in the worker composition of a firm. Our findings are robust to choosing earlier pre-reform years (see panel (E) of Table 3 and Figure 4). The *predicted average statutory tax rate* (hereby “statutory tax rate”) faced by firm j in year t , based on its 2003 worker composition, is given by:

$$\hat{\tau}_{j,t} = \sum_{i=1}^{N_{j,t=2003}} \omega_{i,t=2003} \times \tau_{z(i),t}, \quad (2)$$

where $N_{j,t=2003}$ denotes the total number of workers employed at firm j in year 2003 while $\tau_{z(i),t}$ denotes the statutory tax rate in year t of the zone that worker i resided in 2003. The time-varying, worker-specific payroll tax rate is weighted by $\omega_{i,t=2003}$, worker i 's share in the firm's total wage bill in 2003. Not surprisingly, the statutory tax rate is strongly correlated with where the firm's headquarter is located since firms primarily employ workers who reside in the same

tax zone as the firm’s headquarter. However, the location of the worker does not coincide with the location of the firm in all cases. In 2003, for instance, 42% of firms hired at least one worker living in a different tax zone than where the firm’s headquarter is located. Overall, 95.7% of the variation in the differential change in the statutory tax rate across firms is between tax zones, and 4.3% is within tax zones. Based on the statutory tax rate of firm j in year t (given by equation (2)), we then construct a measure of the firm’s overall exposure to the tax harmonization policy as follows:

$$\Delta\hat{\tau}_j = \hat{\tau}_{j,t=2006} - \hat{\tau}_{j,t=2003} \quad (3)$$

In parts of the analysis, we split firms into two groups based on their overall exposure:

$$ST_j = \begin{cases} 1 & \text{if } \Delta\hat{\tau}_j \geq 4 \text{ pp.} \\ 0 & \text{if } \Delta\hat{\tau}_j < 4 \text{ pp.} \end{cases} \quad (4)$$

We designate firms with $ST_j = 1$ as “statutory treated” and those with $ST_j = 0$ as “statutory controls”. The cut-off of four percentage points is arbitrary, and is chosen to ensure that the statutory treated firms experienced a significant tax increase. The key conclusions of our paper do not hinge on the specific cut-off chosen.

Panels (b) and (c) of Figure A1 in the Appendix show the geographical distribution of statutory treated firms. While firms that experienced some change in payroll taxes can be found in all parts of Norway (panel (b)), the statutory treated firms are mostly located in tax zones 2, 3 and 4 that were most affected by the tax harmonization policy (panel (c)).

3.2 Predicted Windfall Loss and Unaffected Firms

Because of the subsidy scheme described in Section 2.1., not all firms are affected by the tax reform, even if they experienced an increase in the predicted statutory tax rate. As shown in equation (1), the actual subsidy firms receive in a post-reform year depends on the firm’s current wage bill—which may be affected by the tax reform. To compute the firm’s predicted windfall loss (as a share of their 2003 wage bill), we first predict the subsidy that a firm would

receive based on the firm's pre-reform (2003) wage bill.⁸ The predicted windfall loss (hereby “windfall loss”) in 2006 as a share of 2003 wage bill is then given by:

$$\widehat{WL}_j = \Delta\widehat{\tau}_j - (\widehat{S}_{j,t=2006} / \sum_{i=1}^{N_{j,t=2003}} w_{i,t=2003}), \quad (5)$$

where $\Delta\widehat{\tau}_j$ is the change in statutory tax rate from 2003 to 2006 (given by (3)), $\widehat{S}_{j,t=2006}$ is the predicted subsidy the firm receive in 2006, and $\sum_{i=1}^{N_{j,t=2003}} w_{i,t=2003}$ is the firm's total wage bill prior to the reform (in 2003).

Panel (a) of Figure 2 shows the 2003-2006 changes in the statutory tax rates (equation (3)) for statutory treated firms—i.e., firms that experience an increase in the statutory tax rate of at least four percentage points, and statutory control firms, respectively. On average, statutory treated firms experience an increase in the statutory tax rate of 6.2 percentage points, while statutory control firms on average experienced an increase in the statutory tax rates of 0.4 percentage points.

Panel (b) shows the windfall loss of firms in 2006 (relative to 2003). Firms with an annual wage bill of less than 4,100,000 NOK (around 580,000 USD) in 2003 are not affected by the tax increase (assuming their work force remains unchanged). In the figure, the vertical line indicates the cut-off wage bill below which firms are unaffected. From here on, we denote firms with 2003 wage bills below the cutoff as “small” firms, and those above the cutoff as “large” firms. On average, large, statutory treated firms experience a windfall loss of 2.3 percent, while large, statutory control firms on average experienced a windfall loss of 0.1 percent.

[Figure 2]

3.3 Event Study and Baseline Regression Equation

We start our empirical analysis by conducting an event study that compares (relative to the pre-reform year 2003) employment and wages in large, statutory treated firms and large, statutory control firms) in the years prior to, and following the tax reform. The event study allows us to assess whether the two types of firms experienced similar time trends prior to the 2003 reform,

⁸ That is, $\widehat{S}_{j,t} = \min\left(\sum_{i=1}^{N_{j,t=2003}} w_{i,t=2003} \times (\tau_{i,t}^o - \tau_{i,t}^l), \bar{S}\right)$.

but diverge afterwards. This further allows us to trace out the dynamic effects of the payroll tax increases on firm outcomes.

In a next step, we exploit the variation in the statutory tax rates over time and across firms more fully, and estimate the following regression on the sample of large firms:

$$\ln(y_{j,t}) = \beta \ln(1 + \hat{\tau}_{j,t}) + \rho_t + \delta_j + \varepsilon_{j,t}, \quad (6)$$

where $y_{j,t}$ is the outcome variable of interest (such as employment and wages) in firm j in year t ; $\hat{\tau}_{j,t}$ is the statutory tax rate based on the firm's worker composition in 2003, as defined in equation (2); ρ_t and δ_j denote year- and firm fixed effects, respectively, and $\varepsilon_{j,t}$ is an error term. The parameter of interest, β , measures the impact of a one percent increase in one plus the firms' statutory tax rate (approximately one percentage point) on the outcome of interest.⁹ This parameter captures the combined effect of the windfall loss from incumbent workers, and the marginal cost increase from hiring new workers.

It should be noted that we use firm, rather than establishment, as the unit of analysis since the subsidy scheme explained in Section 2.1 was enforced at the firm level. We weight the regressions by the number of employees in the firm in 2003, and cluster standard errors at the level of the firm's municipality.¹⁰

We finally conduct a placebo event study, and run a set of placebo regressions on the sample of small firms that, because of the subsidy scheme, were de facto unaffected by the tax reform, even though their statutory tax rate increased. An absence of any effects of the tax reform on small firms provides reassurance that the treatment effects for large firms are indeed caused by the tax reform, and not by differential macroeconomic conditions in different regions of the country.

4 Data

Our analyses make use of several sources of administrative register data, provided by Statistics Norway that can be linked through unique firm, establishment and worker identifiers. The main data source is the linked employer-employee register that include information on all firms, establishments and workers covered by the social security system in Norway, for the period

⁹ In this regression, with log wages as outcome variable, a coefficient of $\beta = 1$ imply full tax incidence on workers.

¹⁰ The firms are located in 422 different municipalities.

1999 to 2009. The data include information on the number of days a worker worked during the year, her wage, the dates when she started and stopped working for a particular establishment, the establishment and firm identification number, as well as the firm's and establishment's location (municipality) and sector affiliation. We match these data to data on worker demographics, including education, labor market experience, age, gender and country of origin. We further make use of a longitudinal database with information on workers' municipality of residence.

In our baseline sample, we aggregate the worker-level data to the level of the firm, and create a balanced sample of all private-sector firms with at least two employees every year over the years 2000-2006.¹¹ Restricting the sample to firms that exist over the entire investigation period could possibly bias our findings if the tax reform affected firm survival. We investigate this in Section 5.3, and find the impact of increases in the statutory payroll tax on firm survival to be close to zero.

Table 1 presents descriptive statistics on the balanced sample of 43,561 firms. There are 4,887 statutory treated firms, which together employ 59,565 workers. Out of the 4,887 statutory treated firms, 954 are large, and hence experienced both an increase in the statutory tax rate and a consequent windfall loss, whereas 3,933 firms are small, and hence experienced an increase in the statutory tax rate only. The 954 large firms make up 56% of total employment among the statutory treated firms. There are 38,674 statutory control firms, of which 9,822 are large and 28,852 are small. The statutory control firms together employ 550,874 workers, out of which the large statutory control firms employ 67%.

Large statutory treated firms are somewhat larger than large statutory control firms, and are more likely to be in agriculture/oil/mining, manufacturing and construction, and are less likely to be in wholesale and retail and finance/insurance/property management. Differences between small statutory treated and statutory control firms are smaller. It should be noted that our empirical approach accounts for any time-constant differences between statutory treated and statutory control firms through the inclusion of firm fixed effects. The event study provides visual evidence that, despite these differences in the industry structure and firm size between large statutory treated and control firms, the two types of firms experienced similar trends in

¹¹ We drop firms with missing information on municipality, and we further exclude firms in the 99th percentile of the firm size distribution (measured by number of employees). Private sector firms include the following organizational forms: general partnership, general partnership with shared liability, limited companies, public limited company, limited liability companies, sole proprietorship and Norwegian division of foreign business enterprise.

firm outcomes prior to the 2003 tax reform. Additionally, we show that our results are robust to allowing for fully flexible industry-specific time trends.

[Table 1]

5 Results

5.1 Event Study

We start our empirical analysis with an event study that compares, relative to the pre-reform year 2003, employment (head counts), wages (per day worked), revenues and value added in large statutory treated firms (i.e., large firms primarily located in more remote areas that experienced a windfall loss; “treated” firms), and large statutory control firms (i.e., large firms primarily located in central areas that saw no increase in their statutory tax rate and hence experienced no windfall loss; “control” firms). The results are presented in Figure 3a, and show that firm outcomes evolved similarly in the two type of firms in the years prior to the reform. After the reform, however, employment sharply declines in treated firms relative to control firms (panel (a)). Firm wages also grow at a slightly lower rate in treated relative to control firms in the post-reform years—although the difference is not statistically significant at conventional levels (panel (b)). Firm revenues and value added likewise diverge (with a one-year lag) between treated and control firms in the years following the tax increase (panels (c) and (d)).

Panels (e) and (h) of Figure 3b show the corresponding series for small firms that, according to their worker composition in 2003, are (almost) unaffected by the reform, regardless of where they are located. While we see a large drop in employment, revenues and value added among large statutory treated firms relative to large statutory control firms after the tax reform, firm outcomes in small statutory treated and statutory control firms evolve at similar rates both before and after the reform. This provides reassurance that the drop in firm outcomes in large treated firms is indeed caused by the tax reform, and not by differential macroeconomic conditions in remote and central regions. The findings for small firms further suggest that spillover effects from large statutory treated to small statutory treated firms are not large.

[Figure 3a and Figure 3b]

5.2 Regression Results

Baseline Results We next exploit the variation in the statutory tax rates over time and across workers more fully, by estimating equation (6) separately for large and small (placebo) firms. We report the estimated coefficients Table 2. The results in panel (A) confirm the findings from the event study. Increases in the statutory tax rate strongly reduces employment in large firms (columns (1) and (2)), but not in small firms (columns (3) and (4)). The estimate for large firms in column (1) imply that a one percentage point increase in the statutory tax rate reduces employment—measured as the head count of workers—by about 1.9%. Estimates are similar when we use man-days as the dependent employment variable (column (2)), suggesting that firms adjust employment almost entirely on the extensive margin.

The findings in panel (B) further highlight that, in line with our findings from the event study, the drop in employment is accompanied by a drop in revenues and value added: a one percentage point increase in the statutory tax rate leads to approximately a 1.6% drop in revenues and a 1.9% drop in value added.

The findings in panel (C) show that the payroll tax increases lead to a modest (and imprecisely estimated) drop in average firm daily wages (column (9)). However, this small wage response may be masked by compositional changes of workers in affected firms. To eliminate this type of bias, we next estimate equation (6) at the worker level, and include worker fixed effects in the regression. The estimate doubles in size, suggesting that the quality of workers improves as employment declines in treated firms in response to the payroll tax increase. The estimate points to partial wage shifting: a one percentage point increase in the statutory payroll tax leads to approximately a 0.7% decline in workers' daily wage rate.

In line with the findings from the event study in Figure 3a and b, changes in the statutory tax rate have no impact on employment, revenues, value added and wages in small firms who were effectively unaffected by the reform (columns (3) , (4), (7), (8), (11) and (12) of Table 2).

[Table 2]

Robustness Checks Table 1 revealed some differences between large statutory treated and control firms in industry affiliation. To rule out that the drop in employment in treated firms relative to control firms after the tax reform simply reflect differential macroeconomic trends across industries, our first robustness check allows for fully flexible industry-specific time trends (panel (A) of Table 3). This has little effects on our estimates.

Second, the tax reform was implemented the same year as the 2004 expansion of the EU, and we might therefore worry that the inflow of labor from Eastern Europe affected treated and control firms differently.¹² To assess this, we restrict the sample to Norwegian-born workers (panel (B) of Table 3). The results from this robustness exercise are once again very similar to the baseline results.

Third, ESA allowed Norway to keep a zero tax rate in zone 5, the most remote and sparsely populated region. Results are not sensitive to excluding firms located in tax zone 5 (panel (C) of Table 3).

Fourth, there was a steady increase in the oil price between 2003 and 2006. To ensure that this increase does not bias our estimates, we next exclude two municipalities (Hordaland and Rogaland), which together employ 60% of all workers in the oil sector. Results are not sensitive to this sample restriction (panel (D) of Table 3).

[Table 3]

Finally, our results so far compute the firm's average statutory tax rate based on its 2003 workforce composition—before the tax change came into effect (2004), but after ESA ultimately required Norway to change its regionally differentiated payroll tax system (2002). Our findings are robust to calculating the firm's average statutory tax rate, and defining firm size, based on its 2001 workforce composition and wage bill (panel (E) of Table 3). Figure 4 further points to some anticipation effects, as employment started to decline in treated relative to control firms in 2002, after the policy was announced but before it came into effect.

[Figure 4]

5.3 Firm Survival

The analysis so far is based on a balanced sample of firms that operate all years between 2000 and 2006. The tax reform, however, may have affected the probability of firm survival. To investigate this, we create an unbalanced sample of firms that operate (with at least two workers) in 2003. As in our main sample, we drop firms in the 99th percentile of the firm size distribution. This gives an unbalanced sample of 14,677 large firms, of which 1,270 are

¹² From 2003-2006, the share of workers from “new EU” countries increased from 0.005 to 0.012 in large statutory control firms, and from 0.002 to 0.005 in large statutory treated firms.

statutory treated firms that experienced a windfall loss, and 13,407 are statutory control firms that did not experience an increase in the statutory tax rate, and hence experienced no windfall loss.

Panel (a) of Figure 5 shows the share of firms that are operating for each of the years 1999 to 2006, separately for large statutory treated and large statutory control firms. In each year prior to the tax reform, control firms are on average less likely to operate than treated firms. This might be explained by control firm on average being younger than treated firms; as of 2003, 5% (75%) of the control firms have existed for one (at least six) years, compared to 4 (78%) of treated firms¹³ Following Saez, Schoefer, and Seim (2017), we re-weight the group of control firms to match the age distribution in the group of treated firms, using DFL-weighting as developed by DiNardo, Fortin, and Lemieux (1996). The DFL weights are given by the following equation:

$$DFL(age_j) = \frac{\widehat{Pr}(ST_j = 1 | age_{j,t=2003}) / \widehat{Pr}(ST_j=1)}{\widehat{Pr}(ST_j = 0 | age_{j,t=2003}) / \widehat{Pr}(ST_j=0)} \quad (7)$$

where ST_j is the treatment indicator defined by equation (4) and $age_{j,t=2003}$ is a variable for firm age in year t . As shown in panel (b) of Figure 5, once DFL-weighted by firm age, the statutory treated and control firms seem comparable in term of firm survival (based on the pre-reform survival shares), and we conclude that the payroll tax increase has no differential effect on the survival of treated versus control firms.

[Figure 5]

5.4 Firm Heterogeneity

Which type of firms respond particularly strongly to payroll tax increases? Next, we investigate whether payroll tax increases differentially affect firms in labor vs non-labor intensive firms, and single vs multi-establishment firms.

¹³ We can only observe whether firms are up to six years old. The age variable therefore takes on six values where the highest value means that firm is aged six years or more.

Labor Intensive vs. Non-labor Intensive Firms Figure 6 and Table 4 show that firms in labor intensive sectors reduce employment more strongly in response to the payroll tax increase than firms in non-labor intensive sectors.¹⁴ This is in line with the hypothesis that the payroll tax increase causes a larger windfall loss in labor intensive than in non-labor intensive firms, as labor costs make up a larger share of their total costs. In our sample, 55% of the large firms were labor intensive in 2003; these firms employed 50% of all workers in large firms in that year. The figure shows results from an event study that traces out (relative to 2003) employment and wages in labor intensive (panels (a) and (b)) and non-labor intensive (panels (c) and (d)), treated and control firms, before and after the payroll tax change. Whereas employment evolved similarly in the treated and control firms before the tax increase, it starts to diverge after the tax increase in both sectors. The drop in employment in response to the tax increase is considerably larger in the labor intensive than in the non-labor intensive sector (17% vs 5% three years after the tax reform). Figure 6 further points to only a moderate and statistically insignificant decline in average firm wages following the payroll tax increase in both labor and non-labor intensive sectors.

The corresponding regression results, based on equation (6), that exploit the full variation across firms and over time in payroll tax rates, can be found in Table 4. In line with the findings from the event-study, payroll tax increases have a larger effect on employment in labor intensive compared to non-labor intensive sectors: a one percentage point increase in the statutory payroll tax rate reduces employment by about 1.2% in non-labor intensive sectors, and by between 2.9% (workers) and 3.0% (days) in labor intensive sectors (panel (A)). The regression results further point to a stronger wage response in non-labor than labor intensive sectors. Focusing on the regression estimates that include worker fixed effects to account for any compositional changes of workers, a one percentage point increase in the statutory payroll tax rate lowers wages by approximately 0.49% in labor intensive sectors (column (6)), and by 0.86% in non-labor intensive sectors (column (8)).

Overall, the findings support the hypothesis that the large drop in employment in firms affected by the policy reform is (at least in part) driven by the sharp and largely unexpected

¹⁴ We use the definition of labor intensive sectors from a governmental report (St.mld. nr. 41, 1998). The labor intensive sectors are: Manufacture of food and fish products; manufacture of wood and wood products; graphic production; manufacture of ceramic products; manufacture of basic metal and fabricated metal products; manufacture of machinery and equipment; manufacture of electrical and optical equipment; transport; other industry production; wholesale; construction; hotels and restaurants and business activities.

windfall loss—which is larger in labor intensive than non-labor intensive sectors—and not only by the increase in the marginal cost of new hires—which is common for the two sectors.

[Figure 6]

[Table 4]

Single Establishment vs. Multiple Establishment Firms Figure 7 and Table 5 show that the employment drop following the tax reform is more pronounced in multi-establishment than in single-establishment firms. In our sample, 17% of the large firms are multi-establishment firms in 2003; these firms employ 27% of all workers in large firms in that year. The number of establishments per multi-establishment firm ranges from 2 to 45, with an average of 3.8. The figure compares, in an event study, employment and wages in large statutory treated and control firms, separately for single-establishment firms (panels (a) and (b)) and multiple-establishment firms (panels (c) and (d)). In both single- and multi-establishment firms, employment grows at a roughly similar rate prior to the 2003 tax reform. In contrast, three years after the tax reform, employment declines in treated relative to control firms by 17% in multi-establishment firms, but by only half as much (8%) in single-establishment firms. The employment adjustment is immediate in multi-establishment firms, but more gradual in single-establishment firms. At the same time, there is some evidence that single-establishment firms—but not multiple-establishment firms—responded to the tax reform by reducing wages.

Regression results reported in Table 5 confirm the findings from the event study. A one percentage point increase in the payroll tax rate reduces employment approximately by between 1% (workers) and 1.1% (days) in single-establishment firms, and by nearly four times as much (about 4.3%) in multi-establishment firms (panel (A) of Table 5). On the other hand, wages decline by 0.9% (conditional on worker fixed effects) in response to a 1% increase in the payroll tax rate in single establishment firms, and by only 0.5% in multi-establishment firms (panel (B); columns (6) and (8)).

[Figure 7]

[Table 5]

6 Adjustment Mechanisms

How do firms adjust their employment? And which factors can account for the particularly large drop in employment among multi-establishment firms following the tax reform? One important channel through which multi-establishment (but not single-establishment firms) may adjust employment is reducing the number of establishments in the firm, either through increased establishment exit or through reduced establishment entry. Specifically, the subsidy scheme that rendered small firms unaffected by the reform gives firms an incentive to move part of their work force (or entire establishments) to a new firm, in order to receive another subsidy, and thereby essentially circumvent the tax increase. We call this “strategic exits”. Next, we provide evidence that a significant part of the overall employment drop in multi-establishment firms, in response to the tax reform, can be accounted for by a reduction in the number of establishments, in part because of strategic exits.

6.1 The Number of Establishments in Multi-Establishment Firms

We begin by conducting an event study that compares (relative to 2003) the number of establishments per firm in large statutory treated, multi-establishment firms, and large statutory control, multi-establishment firms in the years before and after the tax reform (Figure 8). Panel (a) of the figure illustrates that the number of establishments per firm evolved similarly in treated and control firms prior to the 2003 tax reform. Immediately after the reform, however, the number of establishments per firm declines in treated firms, but increases in control firms. Three years after the tax reform in 2006, there are 12% fewer establishments in treated relative to control firms.

To further understand the contribution of establishment exit and entry to the overall tax-induced employment drop among multi-establishment firms, we estimate the following difference-in-differences (event study) regression equation for the sample of large multi-establishment firms:

$$y_{j,t} = \rho_t + \lambda ST_j + \sum_{\kappa \neq 2003} \gamma_\kappa ST_j \cdot I(t = \kappa) + v_{j,t}, \quad (8)$$

where ρ_t is a vector of year dummy parameters, ST_j is the treatment indicator equal to one if the firm experienced an increase in the statutory tax rate of at least four percent (equation (4)),

and $I(t = \kappa)$ is an indicator variable equal to one for the year $t = \kappa$. We weight regressions by the number of workers in the firm in 2003, and cluster standard errors at the level of the municipality of the firm. In panel (b) of Figure 8, we plot the estimated coefficients $\hat{\gamma}_\kappa$ (for $\kappa = 2000 - 2006$) from this regression where the dependent variable is the number of establishments per firm, scaled by the number of establishments in the firm in 2003 ($\frac{estab_t}{estab_{t=2003}}$). The coefficients measure the percentage change in the number of establishments between year t and the pre-reform year 2003 in treated relative to control firms, and correspond to the difference between the dashed and solid lines in panel (a). As implied by panel (a), there is a drop in the number of establishments in treated relative to control firms immediately after the tax reform.

[Figure 8]

6.2 Decomposing Employment Reductions in Multi- and Single Establishment Firms

How much of the overall employment reduction in multi-establishment firms can be accounted for by establishment exits and entry, compared to employment changes in continuing establishments? To address this question, we start with the identity that the change in firm employment between year t and 2003, $E_t - E_{2003}$, equals the difference between the number of workers who joined the firm because of establishment entry, and the number of workers who left the firm because of establishment exit between 2003 and t ; plus the difference between the number of new hires and separations in continuing establishments in the firm between 2003 and t :

$$\underbrace{\frac{E_t - E_{2003}}{E_{2003}}}_{\text{Total change in employment}} = \underbrace{\frac{\text{workers_estab_entry}_t}{E_{2003}} - \frac{\text{workers_estab_exit}_t}{E_{2003}}}_{\text{extensive margin adjustment}} + \underbrace{\frac{\text{workers_hire_cont}_t}{E_{2003}} - \frac{\text{workers_sep_cont}_t}{E_{2003}}}_{\text{intensive margin adjustment}} \quad (9)$$

We then estimate regression equation (8) using the five variables from equation (9) (i.e., the total change in employment, employment changes due to establishment entry and exit (“extensive margin” adjustments) and hiring and separations within continuing establishments (“intensive margin” adjustments)) as dependent variables. Panel (a) of Figure 9 contrasts the overall tax-induced employment reduction with the employment reductions due to extensive

margin adjustments, while panel (b) decomposes the employment drop in continuing establishments into reduced hiring and increased separations. Nearly half of the tax-induced employment decline in multi-establishment firms is accounted for by extensive margin adjustments, through both an increase in establishment exit (the green and pink parts) and a reduction in establishment entry (the blue part). About one quarter of the worker reductions driven by establishment exits are due to strategic exits, where the firm moves at least 60% of an establishment's workforce to a new firm (the green part in panel (a) of the figure). This finding is consistent with the idea that firms strategically restructure in order to qualify for another annual tax subsidy, and to thereby avoid the increased tax rates. Panel (b) of Figure 9 further shows that in multi-establishment firms, the tax-induced reduction in employment in continuing establishments is entirely driven by reduced hiring.

Not surprisingly, in single-establishment firms, the tax-induced employment drop is nearly fully accounted for by intensive margin adjustments (there are slightly fewer establishment entries in single-establishment treated than control firms). Unlike continuing establishments in multi-establishment firms, continuing single-establishment firms adjust employment through both reduced hiring and increased separations.

To summarize, multi-establishment firms respond to the tax increase in a somewhat extreme way. Whereas wages in these firms barely decline, employment sharply drops—partly due to reduced establishment entry and increased establishment exits. Single-establishment firms, in contrast, respond to the tax increase both through a reduction in wages and, compared to multi-establishment firms, a more moderate drop in employment—which is driven by both increased separations and reduced hiring. One possible explanation for the divergent channels of adjustment in multi- and single-establishment firms is the presence of fixed costs of adjusting wages and laying off workers (for example due to resistance by trade unions), which multi-establishment firms, unlike single-establishment firms, find optimal not to pay as they have an additional margin of adjustment—the closure (or non-opening) of establishments.

[Figure 9]

7 Subsequent Tax Decrease

In 2007, the system of geographically differentiated taxes was re-introduced (with some adjustments), and most of the large statutory treated firms went back to paying a lower tax rate. This tax decline was (probably) a surprise for Norwegian firms, as the details of restoration of

the geographically differentiated tax were unclear as late as six months before the changes were implemented. Between 2006 and 2007, the large treated firms in our sample experienced a decrease in the statutory tax rate of 5.8 percentage points on average, compared to 0.25 percentage points among large control firms. To assess whether this led large statutory treated firms to bounce back and grow relative to large statutory control firms after 2007, we follow the large statutory treated and control firms not only until 2006 (as in our baseline results), but until 2009. The results are presented in Figure 10, and suggests that the employment drop in treated firms was not reversed after the statutory tax rates were decreased in 2007. These results should however, be interpreted with some caution. First, Figure 10 defines treatment based on the firm's exposure to the increase in the statutory tax rate in 2003 (using the firm's 2003 workforce composition), but we look at outcome variables measured a long time after 2003. Second, the financial crisis occurred just after the reversal of the tax reform, and treated and control firms might have been differentially affected. Nevertheless, the figure points to the possibility that even temporary tax increases may lead to long-lasting employment reductions in affected firms. In our context, this could be because part of the overall employment drop in (multi-establishment) treated firms is through establishment exits (in part to avoid the tax increase), which might be difficult to reverse.

[Figure 10]

8 Conclusion

This paper evaluates how firms respond to a place-based tax incentive, by exploiting a unique policy setting in Norway, where a system of geographically differentiated payroll taxes was suddenly abolished. In particular, we exploit an EU (ESA) regulation that required Norway to harmonize its payroll tax rates across regions between 2004 and 2006, which was then adopted and implemented independently of the local labor market developments, thereby creating exogenous variation in the payroll tax rates that firms in different regions faced over time.

Our key finding is that firms do not fully shift the burden of payroll tax increases onto workers, through lowering their wages. Instead, firms respond to the tax increase primarily by reducing employment. The low tax incidence on workers may be related to the high degree of unionization and centralized wage bargaining in Norway, which limits firms' ability to make adjustments through wage cuts. In particular, in each of the three years after the reform (2004-2006), the outcome of the centralized bargaining between the main federation of trade unions

and the main private sector employee federation implied a wage growth for industry workers of more than 3%, very similar in magnitude to the average wage growth observed in our sample over that period. These outcomes might have made it difficult for firms to fully cut wages in response to the local payroll tax increases, leading instead to a sizable reduction in employment.

Examining heterogeneity across firm types, we find that the drop in employment is particularly pronounced among multi-establishment (as opposed to single-establishment) firms, which adjust employment in part by reducing the number of establishments per firm. We also find that the employment effect is larger for firms in labor-intensive industries. Both of these findings are consistent with the fact that the increase in the statutory tax rate not only increases the marginal cost of hiring new workers, but also cause differential windfall shocks for different firms depending on the composition and size of their incumbent workforce (and hence their total wage bill). If firms' liquidity situation worsens due to the windfall shock, and if wages are not fully downward flexible (as is the case in Norway), then firms may be forced to cut employment to bring down costs.

In the face of large and persistent inequality in economic opportunities across regions (Chetty, Hendren, Kline, and Saez 2014), the evaluation of place-based policies is becoming increasingly important (see, e.g., Ham, Imrohoroglu, and Song 2011; Busso, Jesse, and Kline 2013; and Kline and Moretti 2013). In this paper, we focus on the case of geographically differentiated payroll tax rates, a policy tool that has been widely used in Nordic countries to reduce regional disparities in labor market opportunities. In our analysis of Norwegian firms' responses to regional payroll tax hikes, we uncover large employment responses with limited effects on wages. In addition, we document a variety of channels through which firms respond to changes in regional tax incentives, including establishment entries and exits, as well as strategic establishment exits. These results indicate that regionally differentiated payroll tax rates may indeed have been effective in stimulating employment in remote regions of Norway.

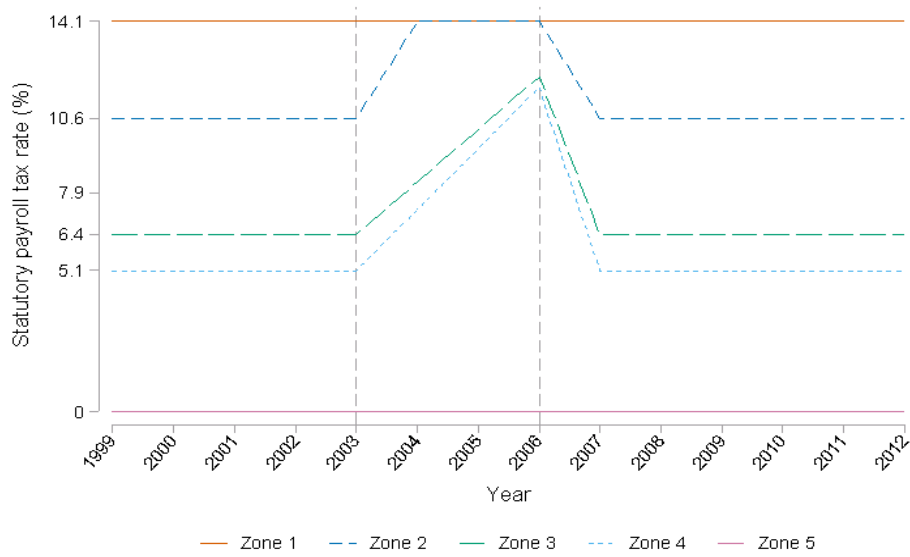
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FIGURE 1: Statutory Payroll Tax Rate by Tax Zones (Zones 1 to 5)

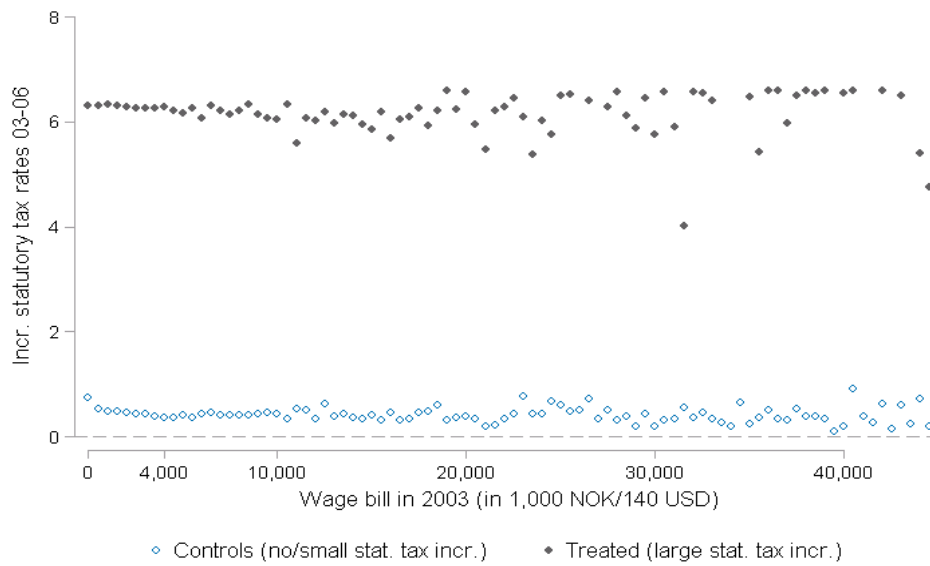


Notes: The table provides an overview of the changes in the statutory payroll tax rates (by tax zone) in Norway imposed by the EFTA Surveillance Authority (ESA). In zones 1 and 5, the tax rates remained unchanged at 14.1% and 0%, respectively. In zone 2 the payroll tax rate increased from 10.6% in 2003 to 14.1% in 2004, and in zones 3 and 4, the tax rates increased by 5.7 and 6.6 percentage points from 2003 to 2006 (see also Table A1 in the Appendix). In 2007 the geographically differentiated system was re-introduced, after an appeal by Norway on ESA’s ruling.

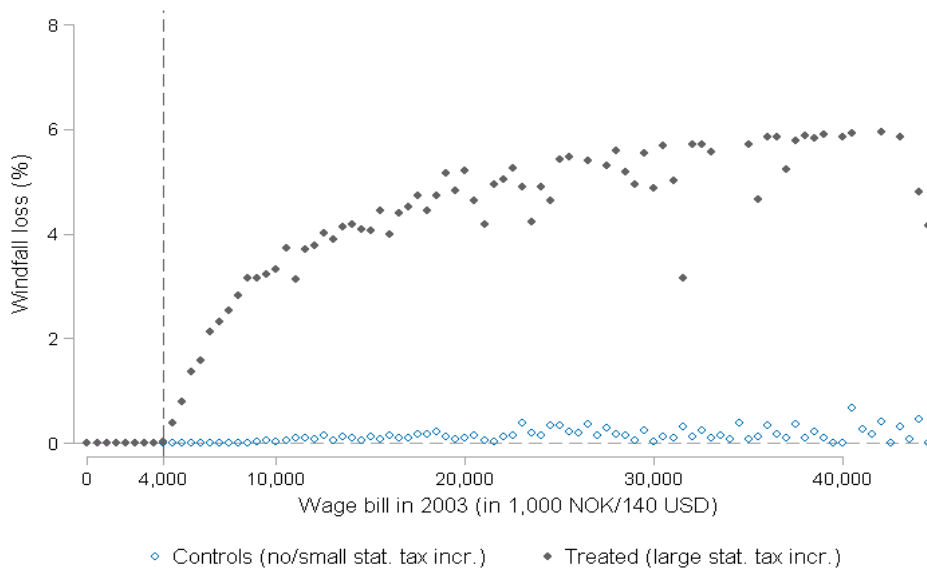
Data sources: The Norwegian Tax Authorities.

FIGURE 2: Average Tax Increase and Windfall Loss from 2003 to 2006 over Firm Size

(a) Increase in Statutory Tax Rate 03-06 over Wage Bill: Statutory Treated and Statutory Control Firms



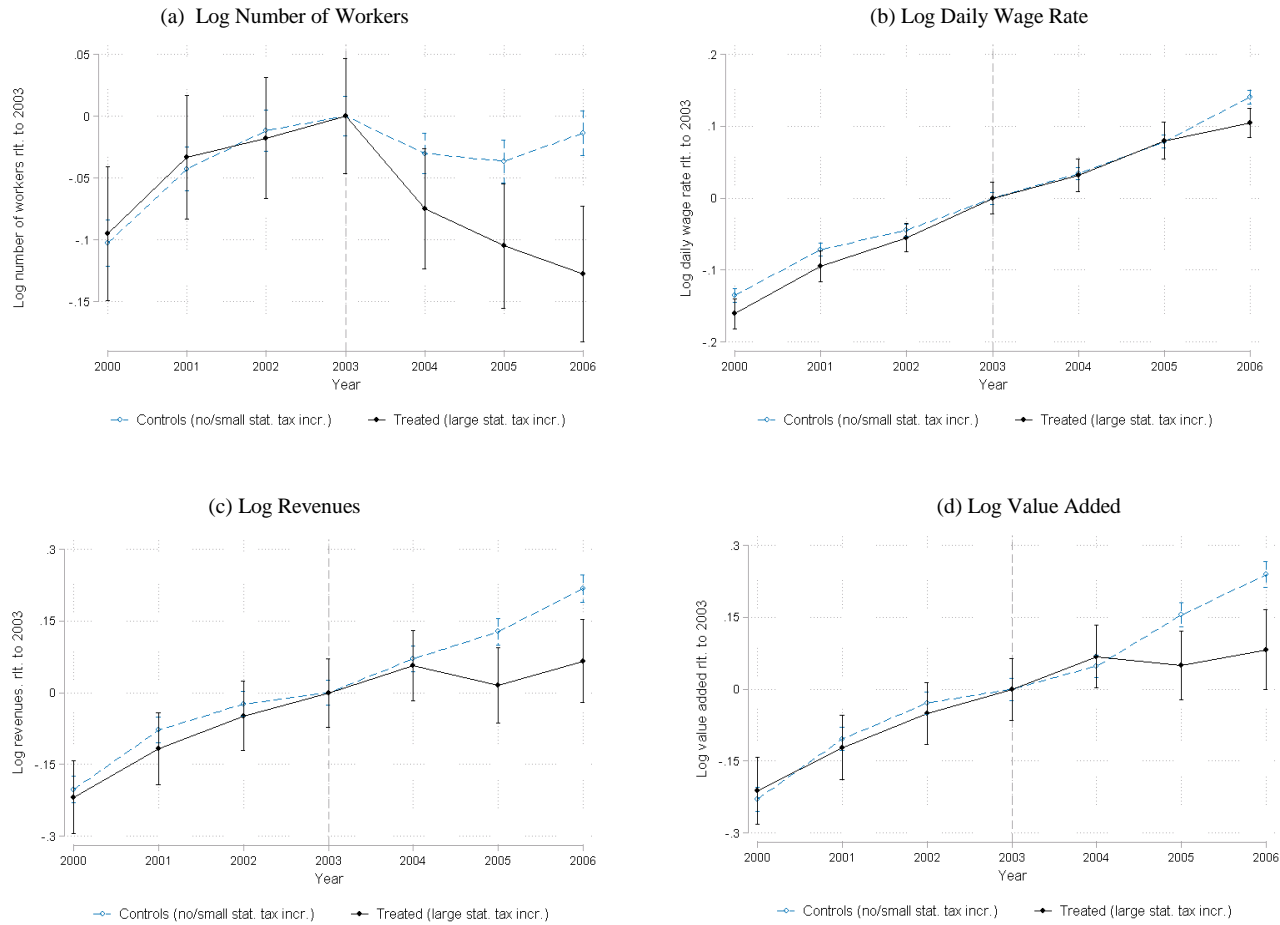
(b) Windfall Loss in 2006 over Wage Bill: Statutory Treated and Statutory Control Firms



Notes: The figure plots firms' expected average statutory tax increases from 2003 to 2006 (panel (a)), and windfall loss in 2006 relative to 2003 (panel (b)) against their 2003 wage bills for statutory treated firms and statutory control firms. Statutory treated and control firms are firms that experienced an increase in their statutory payroll tax rate of at least four/less than four percentage points, respectively (see Section 3.1 and equation (4)). The figure shows that statutory treated firms with an annual wage bill of less than 4,100,000 NOK (580,000 USD) in 2003 were not affected by the tax increase (assuming their work force remained unchanged). Balanced sample of 43,561 firms, of which 4,887 are statutory treated and 38,674 are statutory control firms.

Data sources: Norwegian register data made available by Statistics Norway.

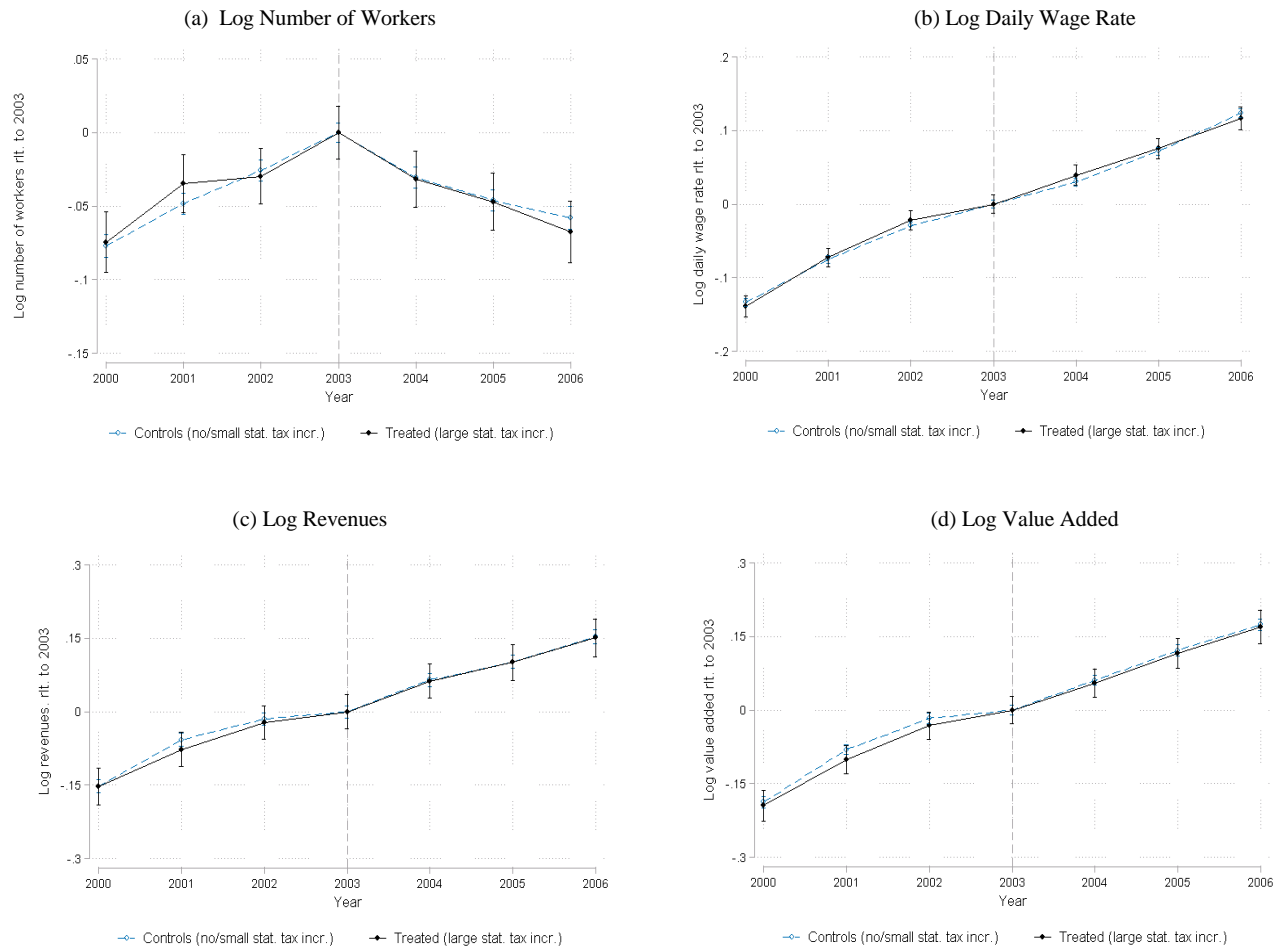
FIGURE 3a: Employment, Wages, Revenues and Value Added over Time: Large Firms



Notes: The figures show the evolution (relative to 2003) of the average number of workers in the firm (panel (a)), average firm daily wages (panel (b)), average firm revenue (panel (c)), and average firm value added (revenues minus cost of intermediates, panel (d)) separately for large statutory treated and statutory control firms (i.e., firms with an annual wage bill of at least 4,100,000 NOK in 2003 which experienced an increase in the statutory payroll tax rate of at least/less than 4 percentage points). All outcome variables are in logs. Means are weighted by the number of employees in the firm in 2003. Balanced sample of 10,776 large firms, of which 954 are statutory treated and 9,822 are statutory control firms. The vertical line indicates the point in time when the increases in the payroll tax rates came into effect.

Data sources: Norwegian register data made available by Statistics Norway.

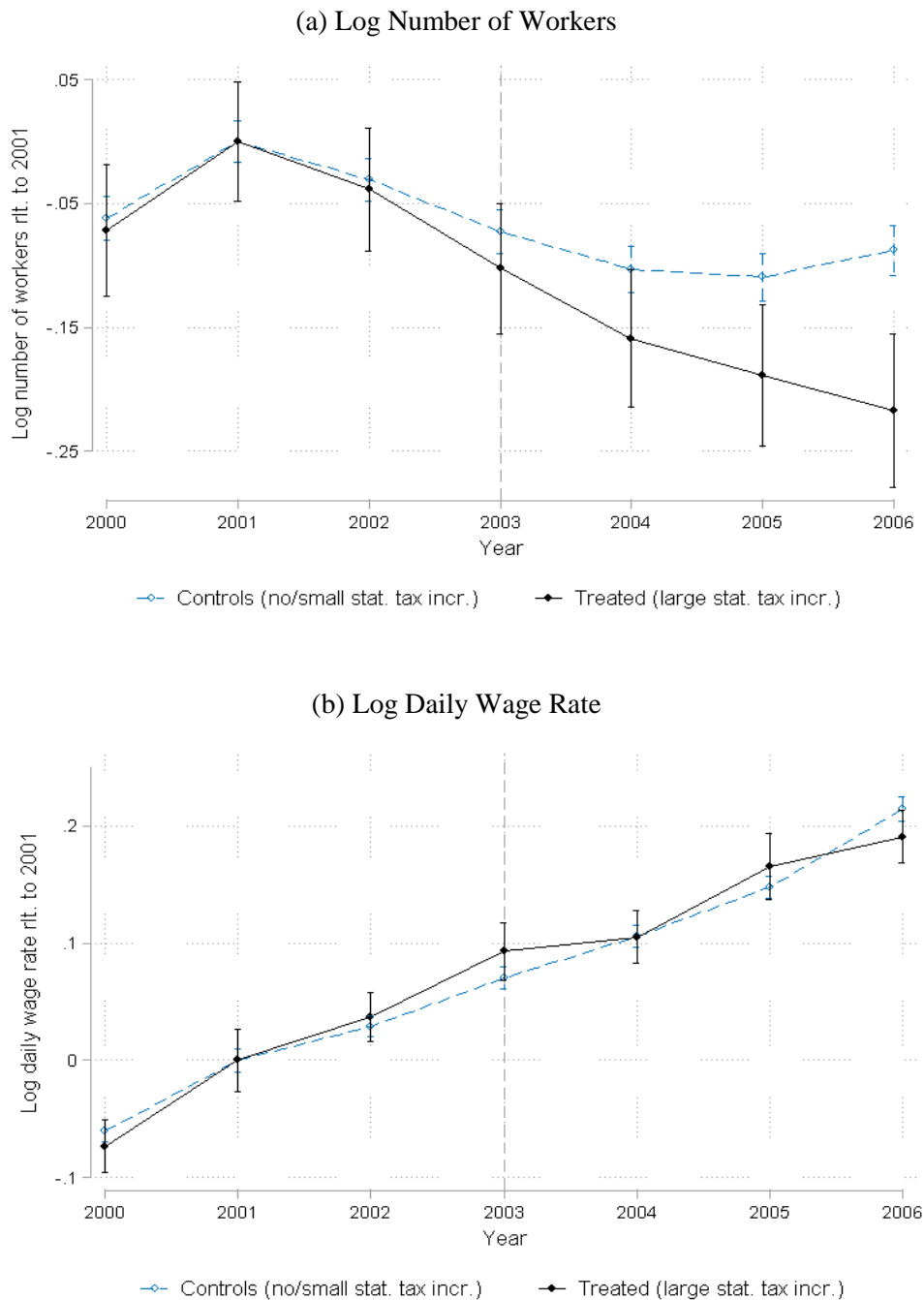
FIGURE 3b: Employment, Wages, Revenues and Value Added over Time: Small Firms (Placebo)



Notes: The figures show the evolution (relative to 2003) of the average number of workers in the firm (panel (a)), average firm daily wages (panel (b)), average firm revenue (panel (c)), and average firm value added (panel (d)) separately for small statutory treated and statutory control firms that were, due to the subsidy scheme, unaffected by the tax reform. All outcomes are in logs. Means are weighted by the number of employees in the firm in 2003. Balanced sample of 32,785 small firms, of which 3,933 are statutory treated and 28,852 are statutory control firms. The vertical line indicates the point in time when the increases in the payroll tax rates came into effect.

Data sources: Norwegian register data made available by Statistics Norway.

FIGURE 4: Employment, and Wages over Time - Anticipation Effects (Base Year 2001)

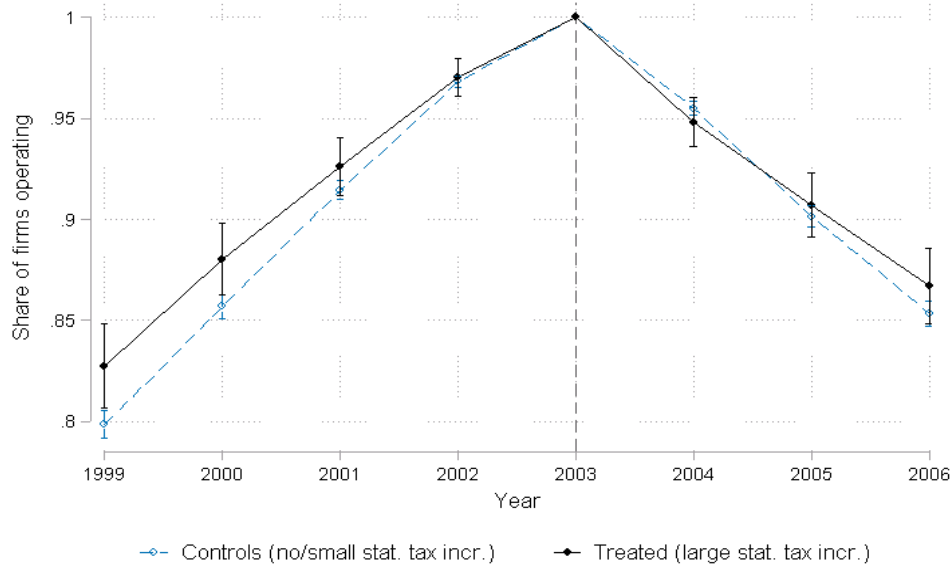


Notes: The figures show the evolution (relative to 2001) of the average number of workers in the firm (panel (a)) and the average firm daily wage (panel (b)) separately for large treated and control firms, where we use firms' worker compositions and wage bills in 2001 to select large firms, and split them into treated and control firms. All outcomes are in logs. Means are weighted by the number of employees in the firm in 2003. Balanced sample of 9,663 large firms, of which 855 are statutory treated and 8,808 are statutory control firms. The vertical line indicates the point in time when the increases in the payroll tax rates came into effect.

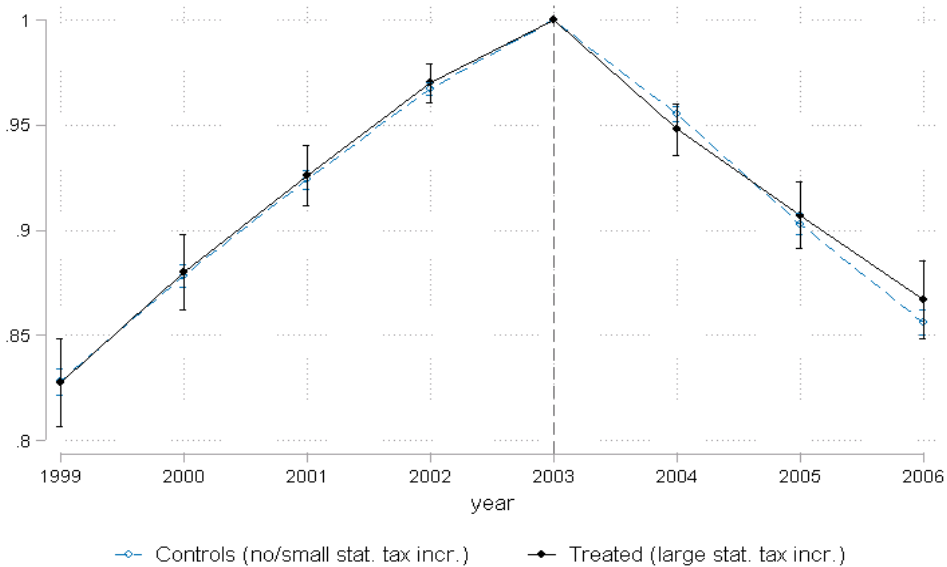
Data sources: Norwegian register data made available by Statistics Norway.

FIGURE 5: Firm Survival

(a) Share of Firms Operating

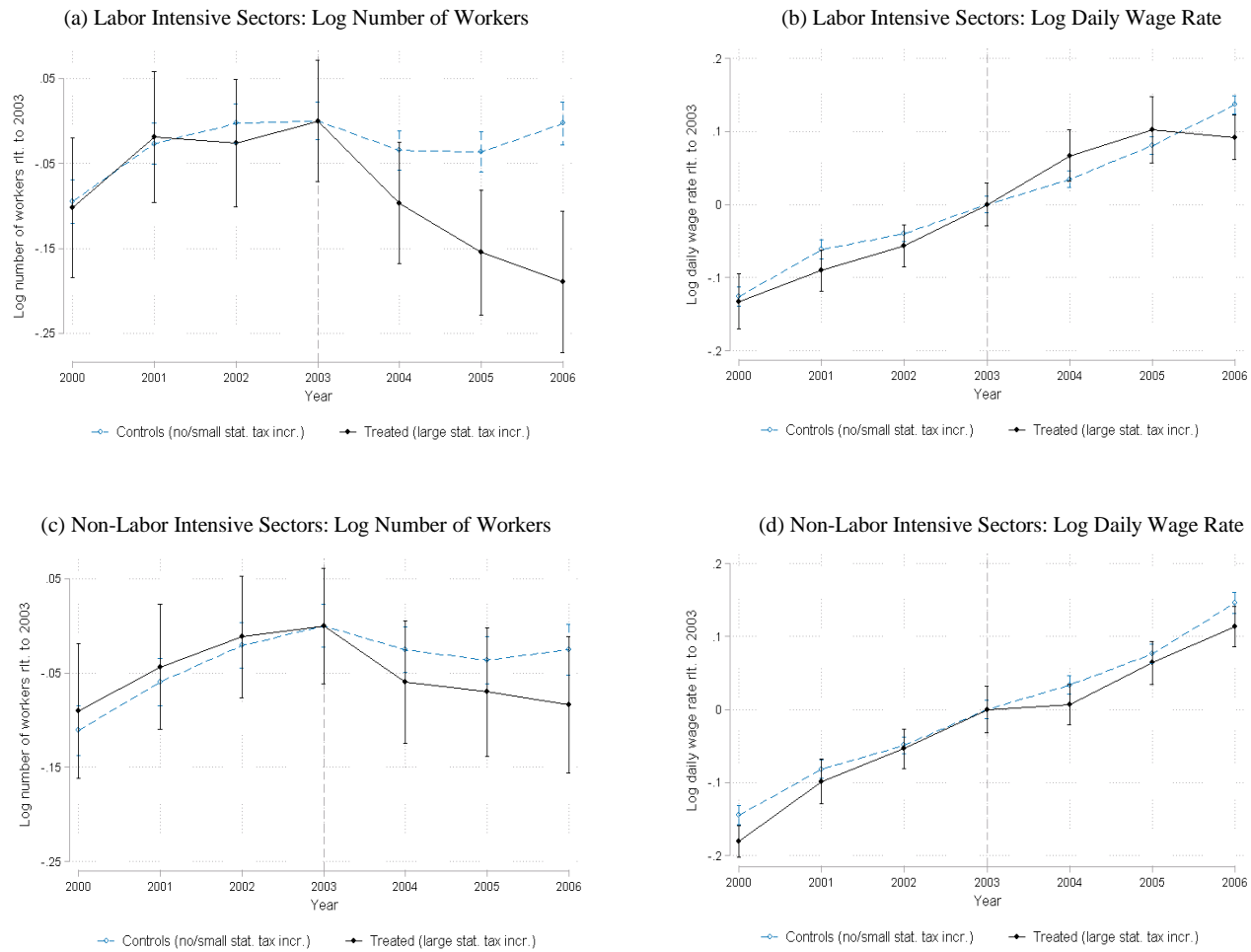


(b) Share of Firms Operating, DFL-Re-Weighted



Notes: The figure shows the share of firms operating (with at least two workers) in 2003 that operate between the years 1999 and 2006, separately for large statutory treated and control firms (i.e., firms with an annual wage bill of at least 4,100,000 NOK in 2003 which experienced an increase in the statutory payroll tax rate of at least/less than 4 percentage points). In panel (b), the group of control firms has been re-weighted to match the distribution of firm age in the group of treated firms (using the DFL weight given by equation (7)). Corresponding estimates are reported in Table A2 in the Appendix. Unbalanced sample of 14,677 large firms, where 1,270 are treated and 13,407 are not treated. Data sources: Norwegian register data made available by Statistics Norway.

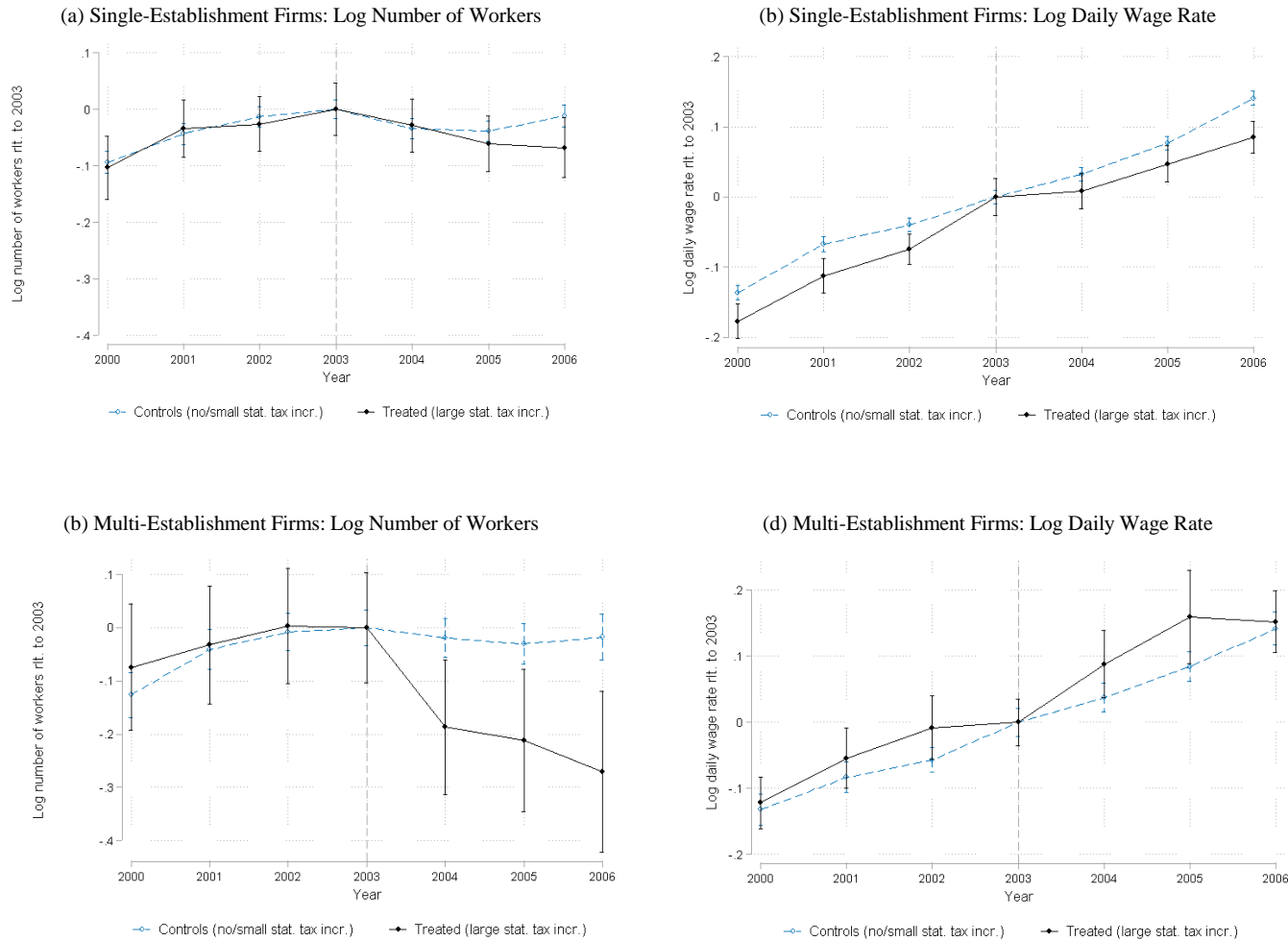
FIGURE 6: Employment and Wages over Time - Labor Intensive vs Non-Labor Intensive Sectors



Notes: The figures show the evolution (relative to 2003) of the average number of workers in the firm (panels (a) and (c)) and the average firm daily wage (panels (b) and (d)) in large treated and control firms (i.e., firms with an annual wage bill of at least 4,100,000 NOK in 2003 which experienced an increase in the statutory payroll tax rate of at least/less than 4 percentage points), separately for firms in labor-intensive and non-labor intensive sectors (defined by the firm's sector affiliation in 2003). All outcome variables are in logs. Means are weighted by the number of employees in the firm in 2003.

Data sources: Norwegian register data made available by Statistics Norway.

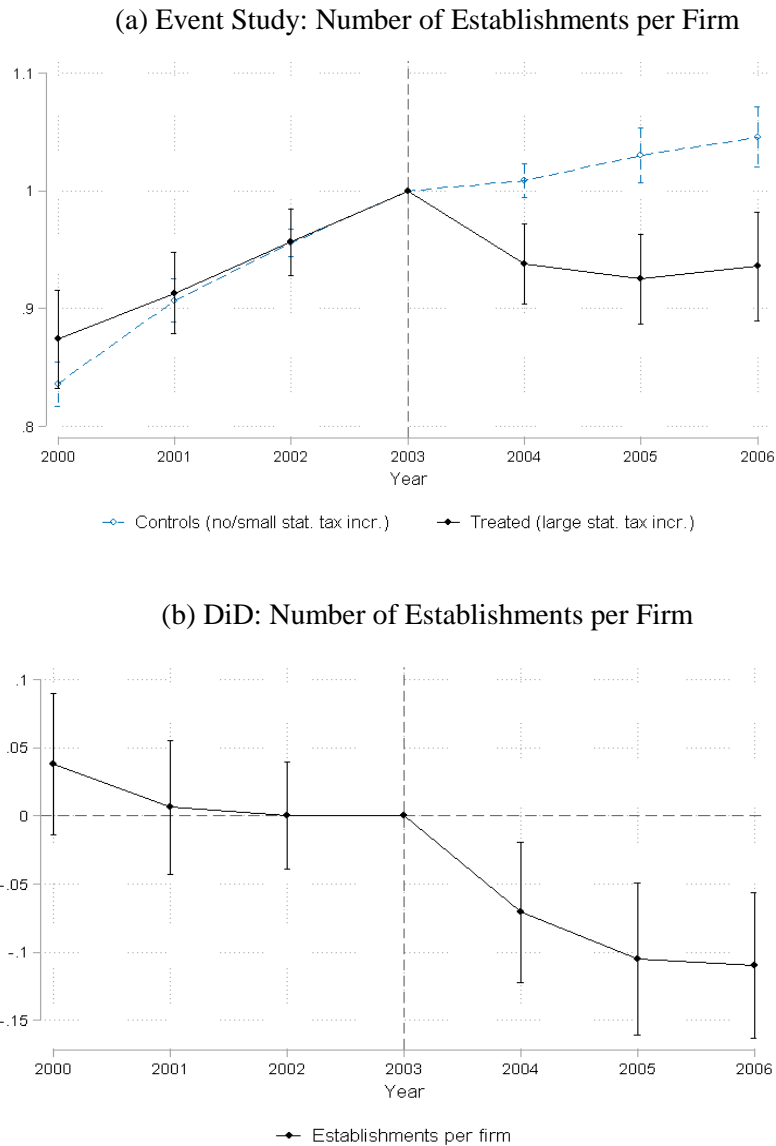
FIGURE 7: Employment and Wages Over Time – Single- vs Multi-Establishment Firms



Notes: The figures show the evolution (relative to 2003) of the average number of workers in the firm (panels (a) and (c)) and the average firm daily wage (panels (b) and (d)) in large treated and control firms (i.e., firms with an annual wage bill of at least 4,100,000 NOK in 2003 which experienced an increase in the statutory payroll tax rate of at least/less than 4 percentage points), separately for single- and multi-establishment firms (defined by the firm's status in 2003). All outcome variables are in logs. Means are weighted by the number of employees in the firm in 2003.

Data sources: Norwegian register data made available by Statistics Norway.

FIGURE 8: Number of Establishments in Multi-Establishment Firms

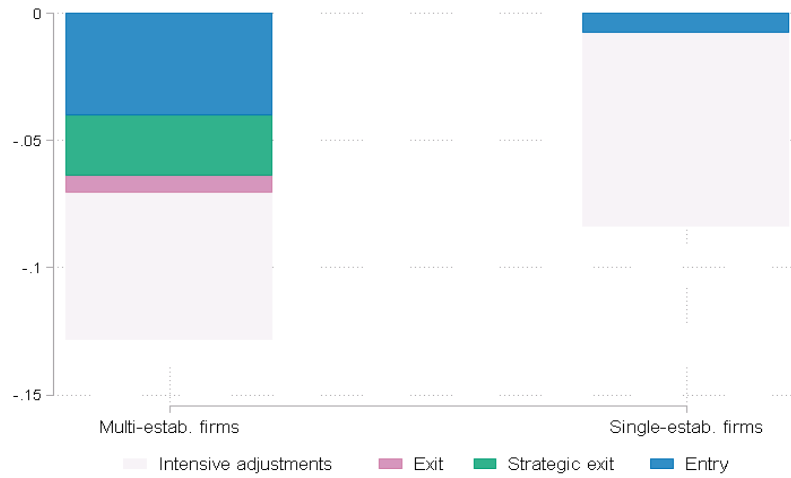


Notes: Panel (a) of the figure shows the evolution of the average number of establishments per firm, scaled by the number of establishments in 2003 for large treated and control multi-establishment firms (i.e., for firms with more than one establishment, and with an annual wage bill of at least 4,100,000 NOK in 2003 which experienced an increase in the statutory payroll tax rate of at least/less than 4 percentage points). Means are weighted by the number of employees in the firm in 2003. Panel (b) shows the estimated coefficients and standard errors on interacted year and treatment fixed effects in the regression of the number of establishments per firm (scaled by the number of establishments in 2003) on year and treatment fixed effects, as well as their interactions. The regression is weighted by the number of workers in the firm in 2003, and standard errors are clustered at the level of the municipality of the firm. Balanced sample of 1,788 large multi-plant firms, of which 180 are statutory treated and 1,608 are statutory control firms.

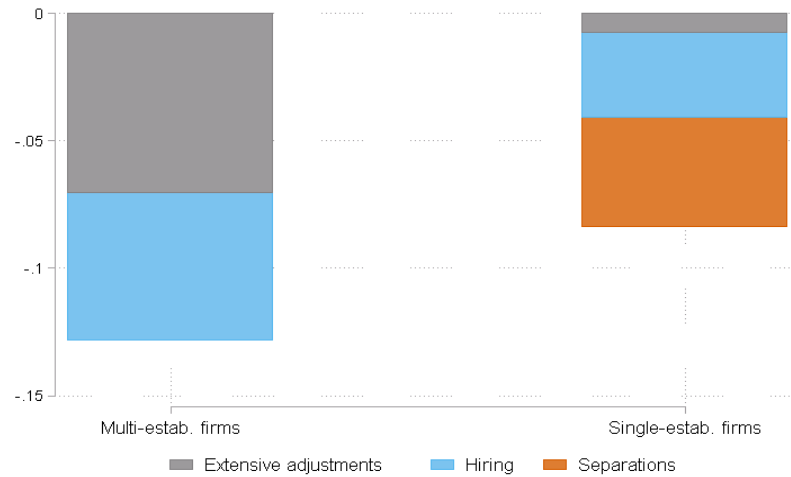
Data sources: Norwegian register data made available by Statistics Norway.

FIGURE 9: Decomposing Employment Reductions

(a) Extensive Margin Adjustments: Plant Exit, Strategic Exit and Entry

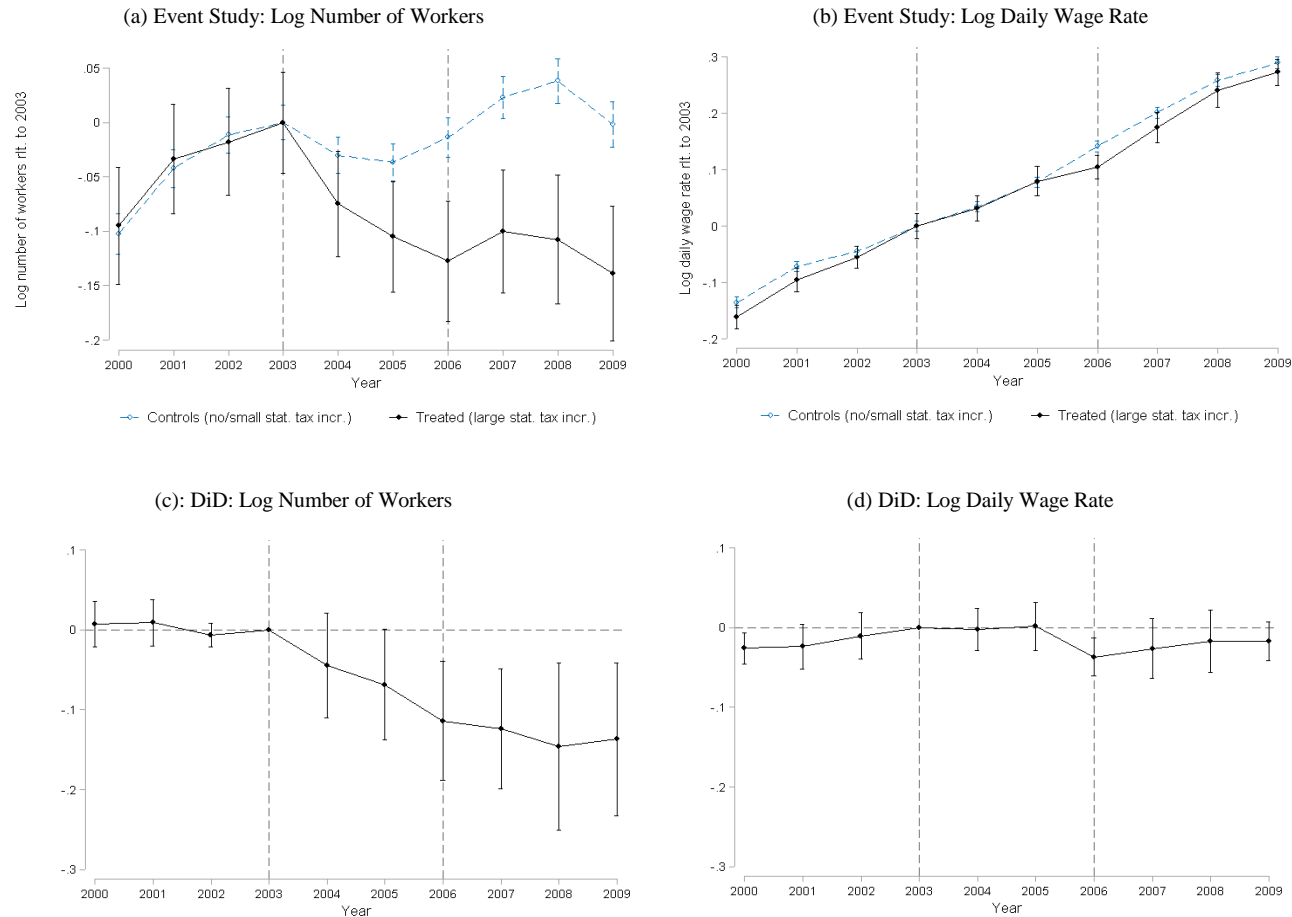


(b) Intensive Margin Adjustments: Hiring and Separations



Notes: Panel (a) decomposes the employment reductions in large statutory treated firms (relative to large statutory control firms), caused by the payroll tax increase, into intensive margin and different types of extensive margin adjustments (establishment exit, strategic exit and reduced establishment entry), separately for multi- and single-establishment firms. Panel (b) decomposes the employment reductions in large statutory treated firms (relative to large statutory control firms), caused by the payroll tax increase, into extensive and different types of intensive adjustments (hiring and separations), once again separately for multi- and single-establishment firms. Decomposed effects are the estimated coefficients on interacted year and treatment fixed effects in the regressions of six different outcome variables on year and treatment fixed effects as well as their interactions. The outcome variables are: the total change in employment, employment changes due to establishment entry and exit (extensive margin adjustments) and hiring and separations within continuing establishments (intensive margin adjustments)). All outcomes variables are scaled and regressions are weighted by the number of workers in the firm in 2003. Balanced sample of large firms. Data sources: Norwegian register data made available by Statistics Norway.

FIGURE 10: Firm Outcomes over Time - Subsequent 2006 Tax Decrease



Notes: Panels (a) and (b) compare the evolution (relative to 2003) of the average number of workers in the firm, and the average daily wage rate in the firm in large treated and control firms (i.e., firms with an annual wage bill of at least 4,100,000 NOK in 2003 which experienced an increase in the statutory payroll tax rate of at least/less than 4 percentage points). Means are weighted by the number of employees in the firm in 2003. Panels (c) and (d) show the estimated coefficients and standard errors on interacted year and treatment fixed effects in the regressions of the same outcome variables as in panels (a) and (b) on year and treatment fixed effects, as well as their interactions. The regressions are weighted by the number of workers in the firm in 2003, and standard errors are clustered at the level of the municipality of the firm. The two vertical lines indicate the points in time when the increases in the payroll tax rates came into effect, and when they were in turn abolished. Balanced sample (for 2000-2006) of 10,776 large firms, of which 954 are statutory treated and 9,822 are statutory control firms.

Data sources: Norwegian register data made available by Statistics Norway.

TABLE 1: Descriptive Statistics

	<u>Treated (large stat. tax incr.)</u>		<u>Control (zero/small stat. tax incr.)</u>	
	Large	Small	Large	Small
Daily wages	1,043	722	1,218	801
Workers	35.0	6.7	37.4	6.4
Days	11,842	2,257	12,678	2,167
Statutory tax rate 2003	0.055	0.055	0.134	0.133
Change in stat. tax rate 03-06	0.062	0.063	0.004	0.005
Windfall loss 2006, rlt. to 2003	0.024	-0.000	0.001	0.000
<i>Industries</i>				
Agriculture/oil/mining	0.057	0.044	0.021	0.031
Manufacturing	0.208	0.093	0.196	0.098
Construction	0.176	0.126	0.134	0.125
Wholesale and retail	0.214	0.360	0.278	0.355
Hotel/restaurants/catering	0.050	0.054	0.044	0.039
Transport	0.089	0.090	0.066	0.073
Finance/insurance/property mng.	0.102	0.121	0.173	0.156
Health	0.059	0.062	0.039	0.065
Other	0.046	0.051	0.049	0.058
Number of firms	954	3,933	9,822	28,852

Notes: The table shows descriptive statistics for the balanced sample of 43,561 firms with at least two employees in each year 2000-2006. The sample is first split into two groups by treatment status (firms that experienced an increase in their statutory payroll tax rate of at least four/less than four percentage points; see Section 3.1 and equation (4)). The sample is then further split into two groups by size (firms with an annual wage bill of less than/at least 4,100,000 NOK which were effectively unaffected/affected by the policy reform, as shown in Figure (2)). All variables are measured in 2003. Monetary amounts are given in NOK (1 USD = 7.08 NOK in 2003).

Data sources: Norwegian register data made available by Statistics Norway.

TABLE 2: Results from Regressions of Employment, Revenues, Value Added and Wages on the Statutory tax rate

	<u>Large firms</u>		<u>Small firms (placebo)</u>	
<i>(A) Employment</i>				
	(1)	(2)	(3)	(4)
	Workers	Days	Workers	Days
Statutory tax rate	-1.861*** (0.522)	-1.983*** (0.508)	-0.318* (0.163)	-0.265 (0.168)
Observations	75,432	75,432	229,495	229,495
<i>(B) Income</i>				
	(5)	(6)	(7)	(8)
	Revenues	Value added	Revenues	Value added
Statutory tax rate	-1.623*** (0.554)	-1.900*** (0.674)	0.111 (0.256)	0.125 (0.258)
Observations	60,368	60,368	146,139	146,139
<i>(C) Wages</i>				
	(9)	(10)	(11)	(12)
	Daily wage rate (Firm level)	Daily wage rate (Worker FEs)	Daily wage rate (Firm level)	Daily wage rate (Worker FEs)
Statutory tax rate	-0.331* (0.183)	-0.738*** (0.158)	-0.140 (0.097)	-0.006 (0.123)
Observations	75,432	2,509,187	229,495	1,261,858

Notes: Panel (A) shows effects of a one percent increase in the statutory pay roll tax rate on employment, obtained from regressing the log number of workers (head count) and log man days in the firm on $\log(1+\text{statutory tax rate})$ (see equation (2) for a definition of the firm's statutory tax rate). Results are reported separately for balanced samples of large (affected) and small (placebo) firms. Panel (B) shows results on firm income, and are obtained from regressing log revenues and log value added (revenues minus cost of intermediates), respectively, on $\log(1+\text{statutory tax rate})$ (statutory tax rate defined in equation 2). Results are reported separately for balanced samples of large (affected) and small (placebo) firms for whom balance sheet data are available (limited liability companies). In both Panels A and B, the regressions control for year and firm fixed effects, and are weighted by the number of workers in the firm in 2003. Panel (C) shows wage effects, and are obtained from regressing the log daily wage rate on $\log(1+\text{statutory tax rate})$. Results reported in columns (9) and (11) are obtained from regressions estimated at the firm level that control for year and firm fixed effects, and are weighted by the number of workers in the firm in 2003. Results reported in columns (10) and (12) are obtained from regressions estimated at the worker level that further include year, firm zone and worker fixed effects. Standard errors are clustered at the level of the municipality of the firm.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Data sources: Norwegian register data made available by Statistics Norway.

TABLE 3: Robustness Checks - Results from Alternative Specifications of the Regressions of Employment, Revenues, Value Added and Wages on the Statutory Tax Rate

	(1)	(2)	(3)	(4)	(5)
	Employment	Revenues	Value added	Daily Wage Rate (Firm level)	Daily Wage Rate (Worker FEs)
<i>(A) Sector-specific time trends</i>					
Statutory tax rate	-1.576*** (0.525)	-1.583*** (0.566)	-1.969*** (0.635)	-0.357** (0.179)	-0.738*** (0.158)
Observations	75,432	60,368	60,368	75,432	2,509,187
<i>(B) Norwegian-born workers</i>					
Statutory tax rate	-1.654*** (0.507)	N/A	N/A	-0.232 (0.202)	-0.695*** (0.149)
Observations	75,371			75,371	2,190,366
<i>(C) Excluding firms in zone 5</i>					
Statutory tax rate	-1.870*** (0.523)	-1.614*** (0.558)	-1.889*** (0.679)	-0.316* (0.183)	-0.764*** (0.160)
Observations	74,281	59,490	59,490	74,281	2,475,218
<i>(D) Excluding two "oil" municipalities</i>					
Statutory tax rate	-1.403** (0.555)	-1.440** (0.556)	-1.747*** (0.671)	-0.272 (0.184)	-0.496*** (0.155)
Observations	62,124	49,293	49,293	62,124	2,069,336
<i>(E) 2001 worker composition</i>					
Statutory tax rate	-1.105*** (0.344)	-1.443** (0.578)	-1.551** (0.689)	-0.353*** (0.117)	-0.758*** (0.148)
Observations	304,962	54,208	54,208	304,962	2,414,373

Notes: The table shows results for a number of robustness checks estimated for the following outcome variables: number of workers (head count), revenues, value added (revenues minus costs of intermediates) and daily wage rate. All outcome variables are in logs. Panel (A) shows results when sector-specific time trends (fully interacted sector and year dummy variables) are included in the regression; panel (B) shows results for Norwegian-born workers in the firm; panel (C) shows results when excluding firms located in the most remote tax zone 5 that was unaffected by the payroll tax reform; panel (D) shows results when excluding firms located in two municipalities, Hordaland and Rogaland, where the oil activity is concentrated; panel (E) shows results when the firms' worker composition and wage bills in 2001 (rather than 2003) is used to construct the firm's statutory payroll tax rate. The results reported in columns (1) to (4) are obtained from firm-level regressions of the outcome variables on $\log(1+\text{statutory tax rate})$ (statutory tax rate defined in equation 2). Regressions include year and firm fixed effects. The regressions in panels (A)-(D) are weighted by the number of workers in the firm in 2003, and the regressions in panel (E) are weighted by the number of workers in the firm in 2001. The results reported in column (5) are obtained from worker-level regressions of the worker's daily wage (in logs) on $\log(1+\text{statutory tax rate})$. The regressions further include year, firm tax zone and worker fixed effects. Standard errors are clustered at the level of the municipality of the firm.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Data sources: Norwegian register data made available by Statistics Norway.

TABLE 4: Regression Results: Labor Intensive and non-Labor Intensive Firms

	<u>Labor-Intensive Firms</u>		<u>Non-Labor-Intensive Firms</u>	
<i>(A) Employment</i>				
	(1)	(2)	(3)	(4)
	Workers	Days	Workers	Days
Statutory tax rate	-2.863*** (1.064)	-3.042*** (1.083)	-1.231* (0.643)	-1.269** (0.612)
Observations	41,125	41,125	34,307	34,307
<i>(B) Wages</i>				
	(5)	(6)	(7)	(8)
	Daily wage rate (Firm level)	Daily wage rate (Worker FEs)	Daily wage rate (Firm level)	Daily wage rate (Worker FEs)
Statutory tax rate	-0.081 (0.322)	-0.486*** (0.181)	-0.592** (0.260)	-0.861*** (0.186)
Observations	41,125	1,257,580	34,307	1,251,607

Notes: The table reports the effects of a one percent increase in the statutory payroll tax rate on employment (panel (A)) and wages (panel (B)) separately for firms in labor-intensive and non-labor intensive sectors. Results are reported for a balanced sample of large firms and are obtained from regressing the log number of workers (head count, columns (1) and (3)), log man days (columns (2) and (4)), and the log daily wage rate (columns (5) to (8)) on $\log(1+\text{statutory tax rate})$ (statutory tax rate defined in equation 2). Regressions in columns (1) to (5) and column (7) are estimated at the firm level, control for year and firm fixed effects, and are weighted by the number of workers in the firm in 2003. Results reported in columns (6) and (8) are estimated at the worker level, and further include year, firm zone and worker fixed effects. Standard errors are clustered at the level of the municipality of the firm.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Data sources: Norwegian register data made available by Statistics Norway.

TABLE 5: Regression Results: Large, Single- and Multi-Establishment Firms

	<u>Single-establishment Firms</u>		<u>Multi-Establishment Firms</u>	
<i>(A) Employment</i>				
	(1)	(2)	(3)	(4)
	Workers	Days	Workers	Days
Statutory tax rate	-0.962** (0.425)	-1.130*** (0.418)	-4.327*** (1.535)	-4.317*** (1.489)
Observations	62,916	62,916	12,516	12,516
<i>(B) Daily Wage Rate</i>				
	(5)	(6)	(7)	(8)
	Daily wage rate	Daily wage rate	Daily wage rate	Daily wage rate
	(Firm level)	(Worker FEs)	(Firm level)	(Worker FEs)
Statutory tax rate	-0.403** (0.198)	-0.893*** (0.160)	-0.147 (0.493)	-0.445* (0.249)
Observations	62,916	1,810,581	12,516	698,606

Notes: The table reports the effects of a one percent increase in the statutory payroll tax rate on employment (panel (A)) and wages (panel (B)) separately for multi-establishment and single-establishment firms. Results are reported for a balanced sample of large firms, and are obtained from regressing the log number of workers (head count, columns (1) and (3)), log man days (columns (2) and (4)), and the log daily wage rate (columns (5) to (8)) on $\log(1+\text{statutory tax rate})$ (statutory tax rate defined in equation 2). Regressions in columns (1) to (5) and column (7) are estimated at the firm level, control for year and firm fixed effects, and are weighted by the number of workers in the firm in 2003. Results reported in columns (6) and (8) are estimated at the worker level, and further include year, firm zone and worker fixed effects. Standard errors are clustered at the level of the municipality of the firm.

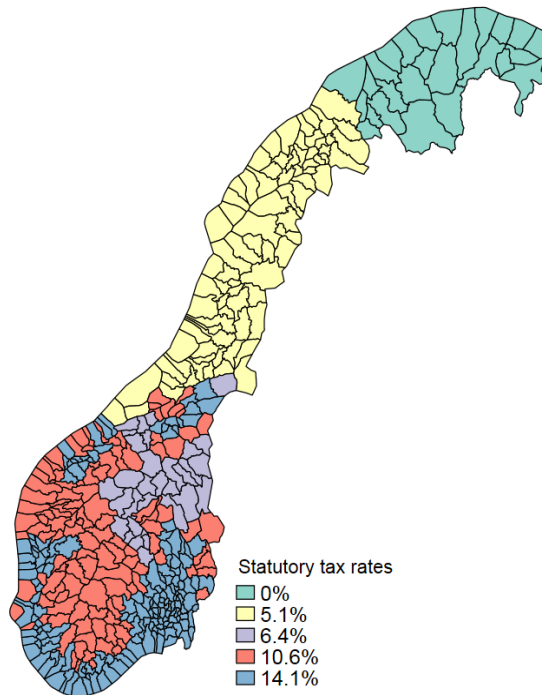
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Data sources: Norwegian register data made available by Statistics Norway.

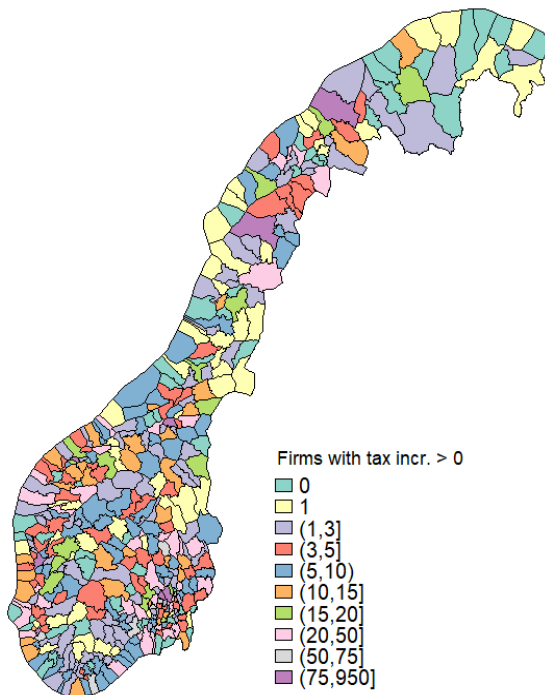
Appendix

Figure A1: Geographical Distribution of Statutory Tax Rates and Treated Firms

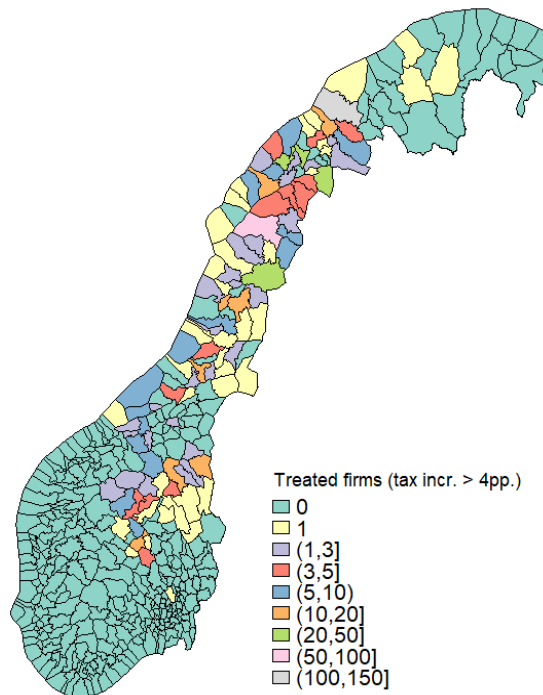
(a): Statutory Tax Rates, 2003 (Pre-Reform)



(b): Firms with Tax Increase > 0



(c): Firms with Tax Increase \geq 4pp.



Notes: Panel (a) shows the geographical distribution of statutory payroll tax rates in Norway in 2003, prior to the tax reform. Panel (b) shows the number of firms that experienced a positive payroll tax increase between 2003 and 2006 across municipalities, while panel (c) shows the number of large treated firms (i.e., firms with an annual wage bill of at least 4,100,000 NOK in 2003 that experienced an increase in the statutory payroll tax rate of at least 4 percentage points between 2003 and 2006) across municipalities.

Data sources: Norwegian register data made available by Statistics Norway.

TABLE A1: Statutory Payroll Tax Rates, 2000-2009, Zones 1 to 5

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
2000	14.1	10.6	6.4	5.1	0
2001	14.1	10.6	6.4	5.1	0
2002	14.1	10.6	6.4	5.1	0
2003	14.1	10.6	6.4	5.1	0
2004	14.1	14.1	8.3	7.3	0
2005	14.1	14.1	10.2	9.5	0
2006	14.1	14.1	12.1	11.7	0
2007	14.1	10.6	6.4	5.1	0
2008	14.1	10.6	6.4	5.1	0
2009	14.1	10.6	6.4	5.1	0

Notes: The table shows the statutory payroll tax rates by tax zone (zones 1 to 5) and over time.

Data sources: The Norwegian Tax Authorities.

TABLE A2: Firm Survival

	(1)	(2)	(3)
	No controls	Firm Age FEs	DFL-reweighted
2000.year#1.Treated	0.029*** (0.009)		0.002 (0.008)
2001.year#1.Treated	0.013* (0.007)		0.002 (0.007)
2002.year#1.Treated	0.002 (0.006)		0.003 (0.005)
2004.year#1.Treated	-0.008 (0.010)	-0.001 (0.006)	-0.007 (0.006)
2005.year#1.Treated	0.003 (0.014)	0.000 (0.006)	0.004 (0.009)
2006.year#1.Treated	0.010 (0.015)	0.001 (0.006)	0.011 (0.010)
Observations	117,368	58,684	117,368

Note: The table reports the effects of payroll tax rates on firm survival, using a difference-in-difference design. Estimates are obtained from a regression of an indicator variable equal to 1 if the firm exists in that year on year fixed effects, a treatment indicator equal to 1 if the firm experienced an increase in its statutory payroll tax rate of at least 4 percentage points, interactions between the two variables, without (column (1)) and with (column (2)) controls for firm age. The regressions in column (1) and (2) are weighted by the number of employees in the firm in 2003, while in column (3), the control group is re-weighted to match the firm age distribution in the group of treated firms (using the DFL weight given by equation (8)). Results refer to an unbalanced sample of 14,677 large firms, where 1,270 are treated and 13,407 are not treated. Standard errors are clustered at the level of the municipality of the firm.

*** p<0.01, ** p<0.05, * p<0.1

Data sources: Norwegian register data made available by Statistics Norway.