NBER WORKING PAPER SERIES

CAN PAYROLL TAX CUTS HELP FIRMS DURING RECESSIONS?

Youssef Benzarti
Jarkko Harju

Working Paper 27485
http://www.nber.org/papers/w27485

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 2020

We are grateful to Alan Auerbach, Raj Chetty, Cecile Gaubert, Teemu Lyytikäinen, Pat Kline, Emmanuel Saez, Alisa Tazhitdinova and Danny Yagan for helpful suggestions and comments. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Can Payroll Tax Cuts Help Firms During Recessions?
Youssef Benzarti and Jarkko Harju
NBER Working Paper No. 27485
July 2020
JEL No. H20,H22,H23

ABSTRACT

This paper estimates the effect of payroll tax cuts on firm activity during economic downturns. We use two regional payroll tax cuts in Finland as well as the onset of the Great Recession to estimate the effect of the recession on firms treated by the payroll tax cuts compared to a similar control group. When implemented, prior to the Great Recession, we estimate that the payroll tax cuts had limited effects on firms located in the treated regions. However, when the recession starts, some of its negative effects were substantially hampered by the previously enacted payroll tax cuts in treated firms. These effects are exacerbated for men and low-skilled employees. We also find that sales and profits in treated firms respond differently in treated firms during the recession. This shows that payroll tax cuts can make firms more resilient during downturns.

Youssef Benzarti
Department of Economics
University of California
Santa Barbara, CA 93106
and NBER
youssef.benzarti@gmail.com

Jarkko Harju
VATT Institute for Economic Research
Arkadiankatu 7
P.O.Box 1279
00101, Helsinki
Finland
jarkko.harju@vatt.fi

1 Introduction

How do payroll taxes affect firms during economic downturns? The common wisdom in public finance is that the incidence of payroll taxes is mostly borne by workers, in which case, payroll tax changes should not affect firm-level outcomes. However, recent evidence has questioned this received wisdom, by showing that some, if not all, of the incidence of payroll taxes is borne by firms and can substantially affect firm level activity.[1] This paper empirically addresses this question by estimating the effect of payroll taxes on firm activity during the Great Recession.

Our empirical strategy relies on using two regional tax cuts in Finland that were enacted several years prior to the Great Recession and were still in place throughout the entire recessionary period. These two waves of payroll tax cuts were enacted in 2003 and 2005 and were repealed in 2012, which allows us to observe the behavior of firms in the treated regions before and after the onset of the Great Recession in 2008 in Finland. The treated regions are all located in the Northern part of Finland, which is relatively poor compared to the rest of the country. However, not all Northern regions are selected into treatment, which allows us to use the remaining similar Northern regions as a control group. Using a difference-in-difference strategy, we compare firms located in regions treated with the payroll tax cuts to firms in similar control regions where payroll taxes were not changed.

First, we find that the payroll tax cuts, when enacted several years prior to the Great Recession, have very limited effects on earnings and on firm-level outcomes, implying that the savings from the lower payroll tax cuts are likely channeled into firms and likely saved since they do not appear to affect employment, earnings, sales or investment. The clearest effect of the cut in payroll taxes appears at the time of the Great Recession: here we estimate that firms located in the treatment regions exhibit a substantially different behavior than the ones in the control region. In particular, while the Great Recession caused a decrease in earnings in firms located in both control and treatment regions, these decreases are substantially

[1] See Saez et al. (2012), Saez et al. (2019), Benzarti et al. (2020) and Benzarti & Harju (2020).

smaller in the treated regions. And these effects seem to be particularly acute for low-skilled workers. Overall, the net of payroll tax wage bill is relatively higher for firms in the treated regions, consistent with them paying their employees relatively more. While the employment effects are somewhat noisier, we also find that treated firms employ relatively more workers, which could be due to either more hiring or fewer separations. In addition, treated firms also invest relatively more and realize more sales than control firms during the Great Recession. Importantly, some of these effects are long lived and tend to persist even after the payroll tax cuts are repealed in 2012. This is particularly true for the employment effects.

Our main identification assumption is that firms in the treatment regions would have behaved similarly to firms in the control region had there been no change in payroll taxes. A common test of this assumption is to ensure that trends in the control and treatment groups are parallel prior to the change in payroll taxes. Our graphical evidence is consistent with this identification assumption. We also show evidence that the control and treatment regions are very similar along many observable characteristics. This is likely due to the fact that regions were selected into treatment not because of their economic conditions but rather because of political considerations: the payroll tax cuts were targeted at Northern regions only, which are typically poorer than the rest of Finland, but among these regions, it did not affect the poorest ones. While all the treatment regions are relatively poor compared to the rest of Finland, they are not the poorest regions in the area.

Our main contribution is to shed light on the effects of payroll taxes during recessions, which is a question that had not been addressed by previous literatures. In doing so, we contribute to three main strands of literatures. First, we contribute to the tax incidence literature and in particular to the few papers that address the question of who bears the incidence of payroll taxes. Our main contribution to this literature is to assess whether the incidence of payroll taxes depends on the business cycle. This literature has mostly focused on estimating the incidence of payroll taxes without paying much attention to business cycles. While older papers have mostly estimated that workers bear the incidence of payroll taxes

(Gruber (1997)), recent results (Saez et al. (2012), Saez et al. (2019) and Benzarti & Harju (2020)) show that firms are likely to bear a substantial burden of the incidence of payroll taxes. Relatedly, Bozio et al. (2019) show that this burden crucially depends on whether payroll taxes are linked to the benefits they fund. Notably, Korkeamki & Uusitalo (2009) use the same variation from the first wave of the experiment as we do to study short-term responses and find no clear wage or employment responses.[2] Finally, Huttunen et al. (2013) finds no employment or wage responses to a very targeted payroll tax cut for the employers of older and low-wage workers in Finland.

Second, we contribute to a public finance literature that assesses whether government intervention should vary during the business cycle. While we do not address this question directly – we do not derive optimal payroll tax rates over the business cycle – we provide evidence that the effect of payroll taxes varies over the business cycle, which can help inform future research on this question. In public finance, this literature has mostly focused on the optimal provision of unemployment insurance (see Landais et al. (2018b) and Landais et al. (2018a)) and on public expenditure (Michaillat & Saez (2019)).

Relatedly, our results have implications for the effectiveness of stimulus programs. Our paper is closely related to Ku et al. (2020), who show that place-based payroll tax cuts are partially shifted to employees and have large employment effects. We complement their analysis by focusing on the effect of place-based payroll tax cuts during periods of severe economic downturns. While there are several papers showing that Value-Added Tax cuts are ineffective at stimulating firm activity as they are mostly passed through to profits (see, e.g. Benzarti & Carloni (2019); Kosonen (2015); Benzarti et al. (Forthcoming); Harju et al. (2018)), few papers have considered the stimulus effects of payroll taxes. Our findings suggest that they can have long-run effects on firm activity by increasing production, output and profits even after the cuts are repealed. They also lead to higher wages, which can also

[2] Korkeamki (2012) also studies the longer term effects of the experiments, and uses the variation from the second wave of the experiment (in his PhD dissertation) but does not consider the effects of the payroll tax cut during the Great Recession.

stimulate demand.

Finally, our results are also closely related to papers estimating the effect of place-based policies (reviewed for example in Kline & Moretti (2014) and Neumark & Simpson (2015)). In our empirical setting the payroll tax cuts were targeted to high unemployment areas and aimed at increasing employment. Our empirical findings support the view that reducing payroll tax rates in areas suffering from poor economic conditions can increase economic activity, especially during bad economic cycles.

2 Institutions and empirical setting

2.1 The Finnish Payroll Tax System

The payroll tax system in Finland is similar to that of other countries in that it funds social insurance programs including old age insurance, unemployment insurance, health insurance and other smaller programs. Both employers and employees are statutorily liable for paying a given portion of payroll taxes with a higher share for employers. The tax rate schedule is a function of several firm and employee characteristics including the age of the worker, the size of the firm, the capital intensity of the firm and other observable characteristics. The average employer-level payroll tax rate varies over time and by firm characteristics and has been higher than 20% during for the past twenty years. Appendix Table 6 shows a detailed description of the percentages by years by different firm categories.

The Finnish Payroll Tax Experiments. In this paper we use two regional and temporary payroll tax rate cut experiments as a source of exogenous variation. Talks about experimenting with payroll taxes on a set of Finnish regions started in December 2001. A proposal of temporarily repealing employer contributions to the National Pension Insurance and the National Health Insurance was brought to a vote in the Parliament in September 2002. The first wave of cuts was approved in December 2002. The payroll tax rate was

cut in January 2003 by 3 to 6 percentage points depending on firm-level characteristics (see Appendix Table 6). The tax cuts' stated goal was to experiment with lowering payroll taxes in a group of Finnish municipalities in order to assess the effects of payroll taxes on employment. With this goal in mind, twenty municipalities were first chosen among a set of relatively high unemployment municipalities. Importantly, while only poor municipalities were considered, the twenty municipalities that made it into the treatment group were not selected solely based on economic conditions. Instead, the final selection of these targeted municipalities was the result of intense political negotiations.[3] As such, some of the highest unemployment areas were not part of the experiment and there were also areas with equally high unemployment rates that were excluded from the treatment group. The experiment resulted in the removal of the national health and pension insurances portion of contributions for firms located in the twenty treated municipalities.[4] Importantly, current and future benefits were not affected by the cut in payroll taxes which applied to all employees in a given firm, as long as it was located in one of the treated regions. All private employers registered for operation in the treated municipalities were eligible for the payroll tax cut.

The law was passed with the European Union *de minimis* regulations which regulates firm subsidies in EU Member States. This meant that the agriculture, fishing and transportation sectors were excluded from the experiment.

The second wave of the experiment took place in January 2005, which included additional municipalities, mostly from the Kainuu region of Finland.[5] Firms that were located in these municipalities were subject to the same payroll tax cuts as the ones from the first wave of the experiment. There was a third wave of experimentation in 2007, which started in January

[3] Korkeamki (2012) and Korkeamki & Uusitalo (2009) provide a detailed narrative of the first wave of the experiment, which we summarize here.

[4] The target region consisted the following 20 municipalities mostly from the Lapland of Finland: Enonteki, Hailuoto, Houtskari, Inari, Ini, Kemijrvi, Kittil, Kolari, Korppoo, Muonio, Nauvo, Pelkosenniemi, Pello, Posio, Salla, Savukoski, Sodankyl, Utsjoki, Velkua and Ylitornio. However, in this paper we do not include firms located in six municipalities on the islands of the west coast of Finland due to their small size and remote location. These are: Hailuoto, Houtskari, Ini, Korppoo, Nauvo and Velkua.

[5] These municipalities were: Kajaani, Kuhmo, Hyrynsalmi, Paltamo, Puolanka, Ristijrvi, Sotkamo, Suomussalmi, Vaala and Vuolijoki.

2007. This wave added six of the most eastern municipalities. However, we do not analyze this last wave of expansion, as these areas have very few firms and its onset was too close to that of the Great Recession.

All waves of the experiment ended in December 2011. Therefore, the first wave lasted nine years and the second one six with substantial overlap with the Great Recession, which started mid-2008 in Finland. Starting from January 2012, the firm-level payroll tax rates were increased in the treatment municipalities so as to match those of the rest of the country. Appendix Table 6 shows the employers' contribution rates over time.[6]

Minimum Wages And Wage Setting. Finland does not have a government mandated minimum wage. Instead, wage bargaining occurs at the national level between employer and employee representatives, setting a wage floor that depends on several characteristics including employee tenure, industry of employment and other observable characteristics. When the central agreement is reached, the negations continue at the sector-level, usually by each industry. These negotiations set a representative wage level increase in these sectors but also a minimum wages for each job task. These wage floors are likely to affect the pass-through of payroll taxes in a similar way national minimum wages would in other countries.

Importantly, these wages apply to all workers, not only to the employees that belong to labor unions. Although collective bargaining applies to more than 90% of workers, wages can vary across firms and across employees within firms. Firms can, of course, pay higher wages but also lower wages as long as the minimum wage rules are not violated. Therefore, wages can vary considerably across firms in the same job tasks.

[6]Note that there was a 0.8 percentage point payroll tax cut that affected all firms in Finland in April 2009 and a larger cut starting in January 2010 as the firm size categories for national health and pension insurances were removed and harmonized to the lowest payroll tax rate.

2.2 Data

We use a panel dataset of firm-level tax returns, covering the universe of firms in Finland. The data are annual and contain information on every line of profits and losses at the firm level, thus allowing us to observe, for example, sales, fixed and variable costs separately, as well as number of employees, total wage sums and investments. Importantly, the dataset also includes the exact address for each firm, which is essential for assigning firms to treatment and control groups. The dataset covers the years 1999 to 2015, but some variables are missing from 1999 to 2002. However, our main outcomes of interest (payroll tax bill, number of employees, employee-level earnings, total labor costs, sales and profits) are all available from 1999 onwards.

The second dataset used in the analysis includes employer-reported wage information of all employees. These data, which link employees to firms, cover sole proprietors starting only from 2006 onwards. For this reason, we exclude them from the analysis. Note that, although there are many sole proprietors in the data, they are all very small and employ very few workers (0.5 on average in 2002) and therefore are mostly unaffected by the payroll tax changes we analyze. These individual-level data contain detailed information on earnings, socio-economic status and other important employee-level characteristics such as demographic information on the employee: age, gender, education, tenure of job contracts, etc. Overall, using unique identifiers, we are able to link the firm-level data to the employee-level data for 97% of corporations and partnerships.

2.3 Estimation Strategy

We estimate the effects of the two payroll tax reforms using a difference-in-differences estimation strategy. The main identification assumption is that, absent payroll tax changes, there would have been no change in outcomes of the treated group relative to the control group. To validate this assumption, we extensively inspect the pre-treatment trends of the outcomes of interest in Section 3.1 across treatment and control groups and show that pre-trends are

parallel. Formally, we estimate the following equation:

$$Y_{i,t} = \alpha_0 + \alpha_1 A_i + \alpha_2 (A_i * Recession_t) + \alpha_3 (A_i * Exp_{1t}) \quad (1)$$
$$+\alpha_4 (A_i * Exp_{2t}) + \gamma_i + \mu_t + \epsilon_{i,t}$$

where $Y_{i,t}$ represents the variable of interest in logs, i.e., payroll taxes paid, labor costs net of the employer portion of payroll taxes, employee-level earnings, number of employees, sales, profits, etc. A_i is equal to one if firm i is located in one of the treated municipalities and zero if it is in one of the control municipalities, which we define below. $A_i * Recession_t$ is the interaction term for firms in treatment areas in the post recession period, years 2009 to 2015. Exp_{1t} is equal to one for the first wave of the payroll tax experiments (2003 to 2011) and the second wave (2005 to 2011), and is zero otherwise. Exp_{2t} is equal to one for the post-experiment period (2012 to 2015), and zero otherwise. Firms are weighted by firm-level pre-reform labor cost levels in all specifications, using the average firm-level labor costs from 1999 to 2002. Standard errors are clustered at the municipality level, which is the source of the variation we are exploiting in this paper.

The main coefficients of interest are α_2, α_3 and α_4; α_2 identifies the effect of the payroll tax rate cuts on the post-recession years (2009 to 2015), α_3 corresponds to the effect of the tax cuts on firms at the time of the cuts (for both waves) and α_4 identifies the effect of payroll tax cuts post-Great Recession. In equation 1, μ_t represents year fixed effects, γ_i corresponds to firm fixed effects and $\epsilon_{i,t}$ is the error term.

The control group is constructed so as to include all neighboring municipalities that share a border with the targeted municipalities, but exclude the four largest cities (Rovaniemi, Oulu, Kuopio and Joensuu) close to the treatment municipalities, as these were explicitly excluded from the treatment group when designing the experiment by the Finnish Govern-

ment.[7]

Figure 1 shows the different treatment regions and the control municipalities. The control and treatment groups appear to be reasonably similar, as shown in Figure 2. This Figure plots average municipality-level outcomes of four main economic measures over time separately for the whole country, as well as for the control and treatment regions. Figure 2 shows that both treatment regions and control regions have, on average, lower employment rates and tax revenue per capita relative to all municipalities in Finland as well as higher unemployment rates and higher government subsidies. However, the treatment municipalities are very comparable to the control municipalities, consistent with the fact that assignment to treatment was not solely based on economic conditions. Municipalities in the control group have slightly higher employment rates and lower unemployment rates compared to the treatment group, but these level differences are not large. More importantly, the pre-experiment trends across groups are very similar. There are no noticeable differences in levels or trends for tax revenue (exclusive of payroll taxes) and government subsidies across the treatment and control municipalities. It is also worth emphasizing that in many control municipalities, employment rates are lower and unemployment rates higher relative to the treatment municipalities, which further suggests that economic conditions were not the main and only criteria of assignment to treatment.

3 Results

3.1 Graphical Evidence

In this section, we plot our main outcomes of interest separately for the treatment and control groups. We do this for two reasons: (1) to validate the parallel trend assumption needed

[7]The municipalities in the control area are: Ii, Iisalmi, Kaavi, Keminmaa, Kiuruvesi, Kontiolahti, Kuusamo, Krsmki, Lapinlahti, Liminka, Liperi, Maaninka, Muhos, Pielavesi, Polvijrvi, Pudasjrvi, Pyhjrvi, Pyhnt, Ranua, Siikalatva, Simo, Sonkajrvi, Taivalkoski, Tervola, Tohmajrvi, Tornio, Tuusniemi, Tyrnv, Utajrvi and Vierem.

for our difference-in-differences estimation strategy and (2) to visually assess the response of our main outcomes to the payroll tax reforms and to the Great Recession. Each figure plots the coefficients from a fixed effect regression of the outcome of interest, namely, the amount of payroll taxes, payroll costs net of taxes, number of employees and labor input in months at the firm level on year dummies weighted by pre-reform firm-level annual labor costs. For all figures we also remove the level differences between groups by indexing all groups to zero in 2002, a year before the first experiment, and thus the figures show the changes in levels relative to this year.[8] Table 1 shows the firm-level descriptive statistics by treatment and control regions in 2002.

Payroll Taxes Paid by Firms. The upper-left panel of Figure 3 plots average firm-level payroll taxes from 1999 to 2015 relative to year 2002. Both treatment and control groups exhibit parallel trends prior to the reform. We observe a decrease in average payroll taxes paid in the first year after the treatment starts for both treatment groups, in 2003 for the first treatment group and 2005 in the second one. As the payroll tax rates are reverted back to the same level to that of the control municipalities (and the rest of the country), in 2012, the response of treatment group relative to the control group appears to be larger than the response to the payroll tax cut. This asymmetry could be consistent with an increase in number of employees or an asymmetric response of wages to payroll tax cuts, which we investigate next.

Firm-level labor costs and employment. Payroll tax cuts increase incentives to hire and retain employees. To assess the effect of this incentive, we first plot firm-level labor costs net of the employer portion of payroll taxes over time in the upper-right panel of Figure 3. Wage costs includes all costs of employees (net of the employer portion of payroll taxes), a variable that is directly available in our data. Both treatment and control groups follow parallel pre-trends from 1999 to 2002, validating our empirical approach. In the

[8] Appendix Figures 8–11 show the DD estimates over time for pooled treatments for each outcome.

first treatment group there is a clear increase in labor costs right after the reform in 2003 compared to the control group. The pattern is a bit different for the second treatment group. There is a small increase already in 2005 in the second treatment area but it seems to take two years after the start of the treatment for there to be a clear increase in labor costs.

In principle, payroll tax decrease in target regions could also affect the survival rate of firms, increase entry and movement of existing firms towards the targeted municipalities. If these effects are present and large, they could also create a challenge for our empirical setting. Figures 12 and 13 in Appendix A show the number of firms entering into, exiting from and moving into the target regions. Although there seems to be rather large annual variation in these numbers, the figures suggest no systematic differences in any of these outcomes during or after the experiment period. Therefore, these observations suggests that payroll tax cuts do not affect firm births, deaths or location choices, and also that our empirical approach is not threatened by these types of responses.

In order to study the changes in employment over time, we plot the number of employees and labor input in months. Number of employees represents the number of job contracts a firm has during a given year and labor input in months represents the number of months employees' have worked at a given firm within a year. Therefore, both of these measure describe the amount of labor input used in firms. The lower-left panel of Figure 3 shows that the pre-experiment trends in the number of employees are again relatively parallel, although the pre-trend for the second treatment group is somewhat different. The number of employees slightly increases gradually after the start of the treatment periods for both treatment groups compared to the control group. The difference with the control group clearly increases after the start of the Great Recession from 2008 onward. Therefore, the level of employment is clearly increasing post-recession period among firms in the treatment municipalities compared to firms in control municipalities. The lower-right panel of Figure 3 for labor input in months shows very similar effects.

Figure 7 shows the effect of the payroll tax cuts on other firm-level outcomes, namely

sales, investments and profits. Sales follow parallel trends prior to the reform and do not appear to be responding to the payroll tax cut. There is a divergence between the control and the two treatment groups at the onset of the Great Recession. This differential response persists over time and suggests that lower payroll taxes may have helped treated firms cope better with the effects of the financial crisis. The lower-left panel of Figure 7 shows a similar pattern for investment: they follow parallel trends during the pre-treatment period and there is no change in investments during the treatment period or after the Great Recession. The lower-right panel of Figure 7 shows the response of profits: pre-reform trends are parallel and profits increase as payroll taxes are cut and remain at higher levels for the entire experiment period, and even once the payroll tax cuts are repealed. This suggests that temporary payroll tax cuts can have long lasting effects even when the payroll tax rates are brought back to their original levels.

Employee-level earning responses. Figure 4, plots average employee-level earnings at the firm level in the treatment and control groups over time. There is no change in average employee-level earnings following the payroll tax rate cuts in the treatment groups relative to the control group. This suggests that firms do not reduce employee wages after the payroll tax cuts, and thus the incidence of payroll taxes appears to be borne by firms. However, starting from 2008 onward, average earnings are higher in both treatment groups compared to the control group. Surprisingly, the gap between treatment and control groups remains even after the payroll tax rates are reverted back to the same level after 2011.

Figure 5 shows the employee-level earnings responses by gender, education and by types of job tasks. The figure shows no changes in earnings among any of the groups in the two treatment regions right after the payroll tax cut. However, starting in 2009, the earnings diverge in both treatment groups relative to the control group. The This effect is most prevalent among men, low educated (non-college) workers and employees working in lower-level and manual tasks.

Employee-level employment responses. Figure 6 shows employment responses using the same division by employee-level characteristics as we did for employee-level earnings. As is visible from these figures, the pre-payroll tax cut trends are far from perfect complicating any inference. Therefore, these results should be interpreted with caution. However, it appears that the positive employment responses are relatively larger for men, non-college educated, upper- and lower-level workers.

Next and In order to quantify all of the effects mentioned in this Section and their associated standard errors we show regression estimates using a difference-in-differences framework.

3.2 Regression results

Average responses of firm-level labor outcomes. Table 2 shows the results of estimating equation (1) on firm-level outcomes. Column (1) shows that the amount of payroll taxes decreases by 30% on average among both treatment groups right after the experiment starts relative to the control group. This confirms that firms in the treated municipalities indeed experienced a cut in their payroll tax burden. However, it seems that the level of payroll taxes is higher post-recession period, on average by 7%. This could be consistent with an asymmetric pass-through of payroll taxes to wages, possibly because of downwards wage rigidity; or an asymmetric effect of payroll taxes on employment, which could be due to high firing costs.

Column (2) shows that the experiments increased firm-level labor costs net of payroll taxes but only after the recession. This is consistent with the persistent effect on payroll taxes paid shown in Column (1). The estimates for the effect of the payroll tax cut experiments are all small and not statistically significant. Column (3) shows that the number of workers in treated firms increased by 5% during the post-recession period. Similarly, estimates for the effect of the payroll tax cut experiments are small and statistically insignificant. Column (4) also shows that the results are very similar using the number of total working months of all workers within a firm during a year as an alternative measure for labor input.

Firm-level production responses. The estimated firm-level production responses at the time of the Great Recession are larger than those triggered by the changes in payroll taxes but are very noisily estimated, making any statements about firm-level production at best suggestive, as can be seen in Table 3. The only effect we can detect with certainty is that input usage is substantially higher in the treated regions even after the payroll tax cut is repealed. This is also consistent with an increase in total labor costs as we discuss below when addressing cumulative effects.

Employee-level earnings responses. Table 4 shows the average employee-level earnings responses. Column (1) shows that the average earnings level is higher in the treated firms after the recession compared to firms in the control region. These effects are mostly driven by low-skilled workers holding non-managerial and manual jobs. This effect is not persistent and disappears once the payroll tax cut is repealed as can be seen from the cumulative effect estimates.

Effects on employment. Table 5 shows the employment responses using a classification of workers similar to that used in Table 4. The estimates in Table 5 suggest that the increase in employment is driven by higher responses among female and low-educated employees, and employees in non-manual jobs. Note, however, that few of the employment estimates are very precise.

Cumulative effects We systematically report the cumulative effects which add up the effects of the two payroll tax changes and the Great Recession. Overall, the cumulative effects appear large and significant for total labor costs net of payroll taxes and for inputs use. This is consistent with firms producing more, although we do not detect a substantial change in sales. All of the remaining cumulative effects are of small magnitude and statistically indistinguishable from zero, suggesting that the long-term consequences of the temporary payroll tax cuts for these other outcomes are negligible.

4 Conclusion

This paper estimates the effect of payroll taxes on firm activity during the Great Recession by exploiting two regional payroll tax cuts that were enacted several years prior to the start of the economic downturn. By comparing firms located in regions with lower payroll tax rates to firms in similar regions unaffected by the payroll tax cuts, our results show that temporary payroll tax cuts have very limited effects on individual-level earnings and firm-level outcomes right after their implementation. However, while the Great Recession led to a decrease in earnings in firms located in both control and treatment regions, these decreases are substantially smaller in the regions with lower payroll tax rates.

Therefore, our findings suggest that payroll tax cuts could be a way to stimulate firm activity during downturns, and could be more effective than VAT rate cuts, for example, which have been found to be relatively ineffective (see, e.g. Benzarti & Carloni (2019); Kosonen (2015); Benzarti et al. (Forthcoming); Harju et al. (2018)).

References

Benzarti, Youssef & Dorian Carloni. 2019. Who Really Benefits From Consumption Tax Cuts? Evidence From a Large VAT Cut in France. *American Economic Journal: Economic Policy* .

Benzarti, Youssef, Dorian Carloni, Jarkko Harju & Tuomas Kosonen. Forthcoming. What Goes Up May Not Come Down: Asymmetric Incidence of Value Added Taxes. *Journal of Political Economy* .

Benzarti, Youssef & Jarkko Harju. 2020. Using payroll tax variation to unpack the black box of firm-level production. *NBER Working Paper No. 26640* .

Benzarti, Youssef, Jarkko Harju & Tuomas Matikka. 2020. Does Mandating Social Insurance Affect Entrepreneurial Activity? *American Economic Review: Insights* .

Bozio, Antoine, Thomas Breda & Julien Grenet. 2019. Does tax-benefit linkage matter for the incidence of social security contributions? *Working Paper* .

Gruber, Jonathan. 1997. The incidence of payroll taxation: Evidence from chile. *Journal of Labor Economics* 15(3).

Harju, Jarkko, Tuomas Kosonen & Oskar Nordstrm-Skans. 2018. Firm types, price-setting strategies, and consumption-tax incidence. *IFAU Working Paper 2018:4* .

Huttunen, Kristiina, JukkaPirttil & RoopeUusitalo. 2013. The employment effects of low-wage subsidies. *Journal of Public Economics* 97. 49–60. doi:https://doi.org/10.1016/j.jpubeco.2012.09.007.

Kline, Patrick & Enrico Moretti. 2014. People, places, and public policy: Some simple welfare economics of local economic development programs. *Annual Review of Economics* 6. 62962. doi:10.1146/annurev-economics-080213-041024.

Korkeamki, Ossi. 2012. *Essays on labour demand and wage formation*: VATT Institute for Economic Research, Publications 60 dissertation.

Korkeamki, Ossi & Roope Uusitalo. 2009. Employment and wage effects of payroll tax cut – evidence from a regional experiment. *International Tax and Public Finance* 16. 753772.

Kosonen, Tuomas. 2015. More and cheaper haircuts after vat cut? on the efficiency and incidence of service sector consumption taxes. *Journal of Public Economics* 131(C). 87–100.

Ku, Hyejin, Uta Schönberg & Ragnhild C Schreiner. 2020. Do place-based tax incentives create jobs? *Journal of Public Economics* 104105.

Landais, Camille, Pascal Michaillat & Emmanuel Saez. 2018a. A macroeconomic approach to optimal unemployment insurance: Applications. *American Economic Journal: Economic Policy* 10(2). 182–216.

Landais, Camille, Pascal Michaillat & Emmanuel Saez. 2018b. A macroeconomic approach to optimal unemployment insurance: Theory. *American Economic Journal: Economic Policy* 10(2). 152–81.

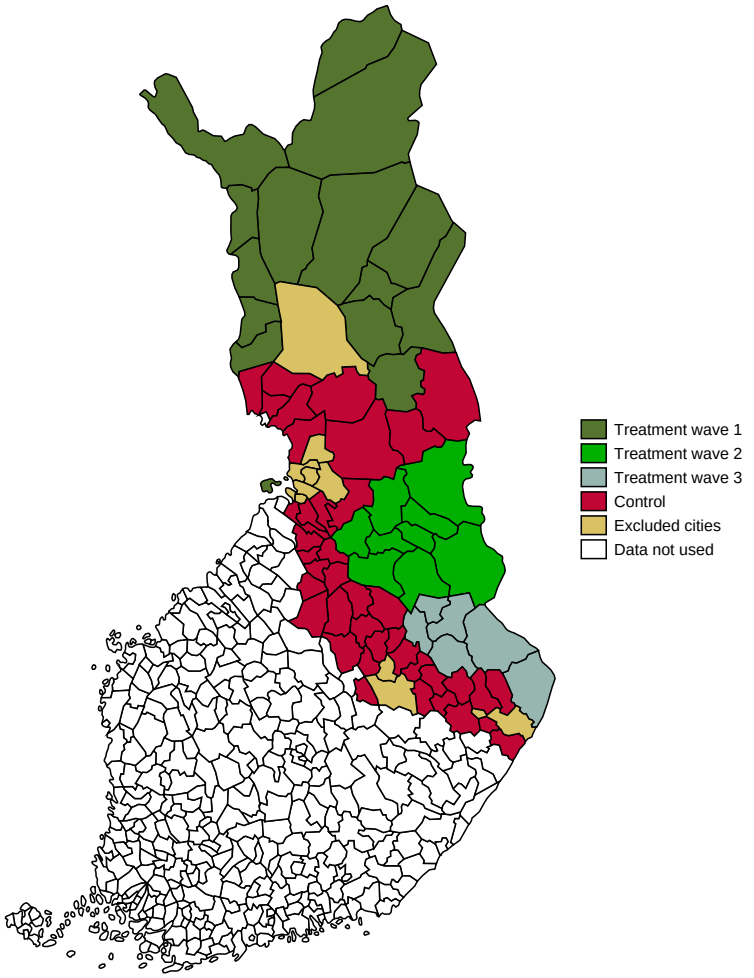
Michaillat, Pascal & Emmanuel Saez. 2019. Optimal public expenditure with inefficient unemployment. *The Review of Economic Studies* 86(3). 1301–1331.

Neumark, David & Helen Simpson. 2015. Place-based policies. *Handbook of Regional and Urban Economics* 5B. doi:http://dx.doi.org/10.1016/B978-0-444-59531-7.00018-1.

Saez, Emmanuel, Manos Matsaganis & Panos Tsakloglou. 2012. Earnings determination and taxes: evidence from a cohort-based payroll tax reform in greece. *The Quarterly Journal of Economics* 127(1). 493–533.

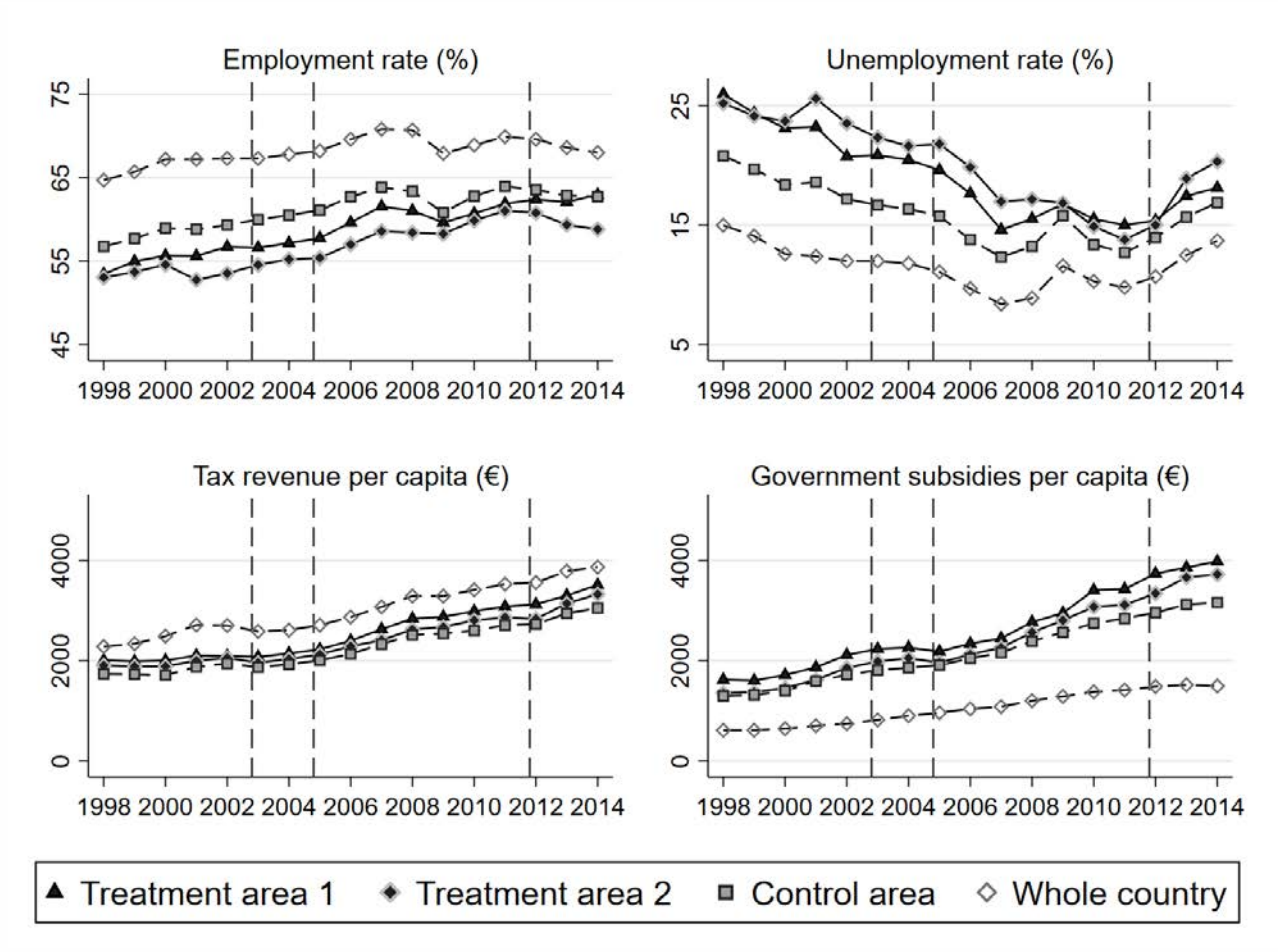
Saez, Emmanuel, Benjamin Schoefer & David Seim. 2019. Payroll taxes, firm behavior, and rent sharing: Evidence from a young workers' tax cut in sweden. *American Economic Review* 109(5). 1717–63.

Figure 1: Municipalities in the treatment and control groups



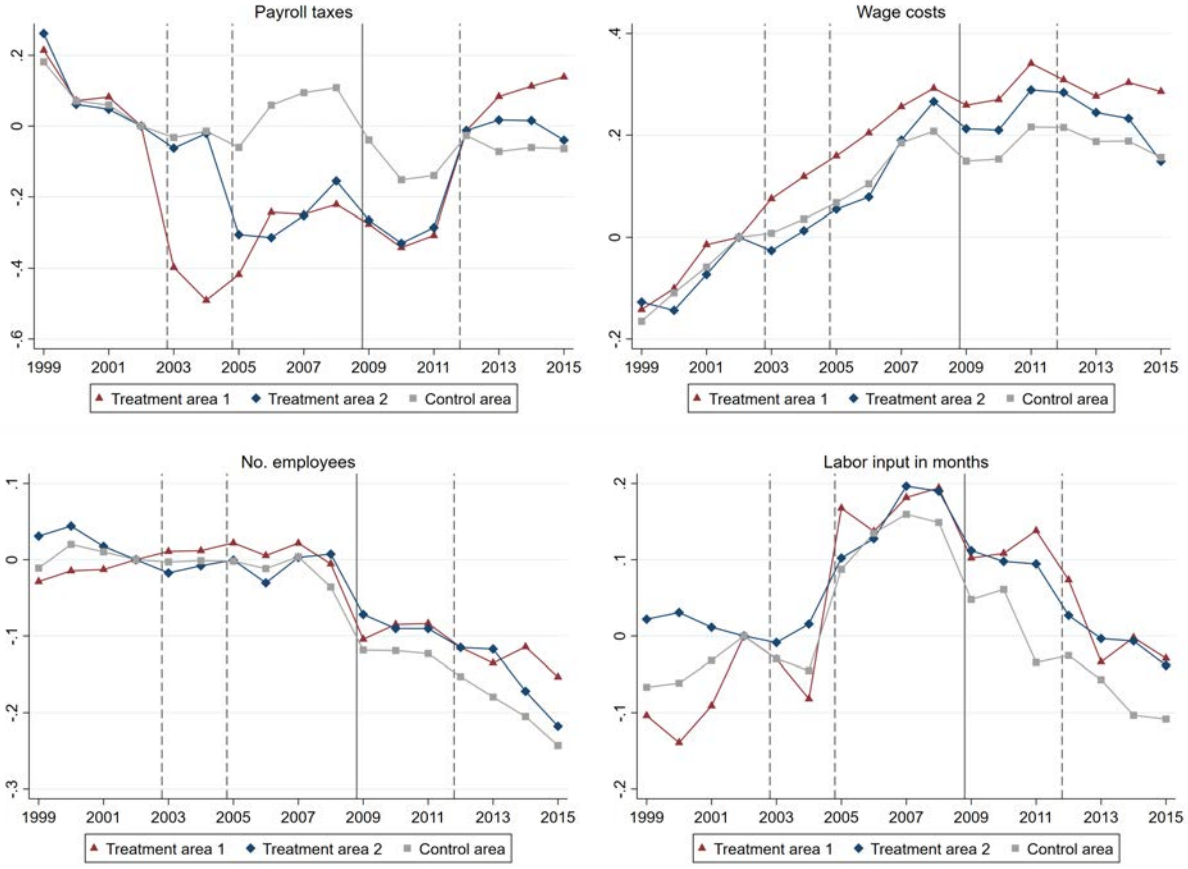
Note: This figure shows the map of Finland with the corresponding municipality borders in 2002. Colors on the map show the municipalities where the payroll tax cuts were enacted, the control municipalities, the excluded cities and the municipalities we do not include in our empirical analysis.

Figure 2: Municipality-level comparisons in the treatment and control regions and all of Finland



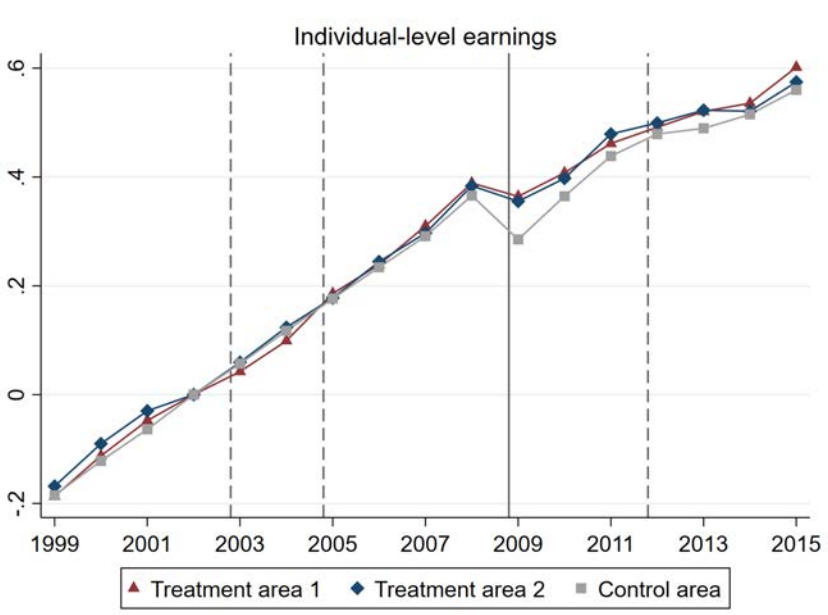
Note: These figures plot the average municipality-level outcomes of four main economic indicators over time for the whole country, the control and the treatment regions used in the empirical analysis.

Figure 3: Firm-level payroll taxes, wage costs, number of workers and labor input



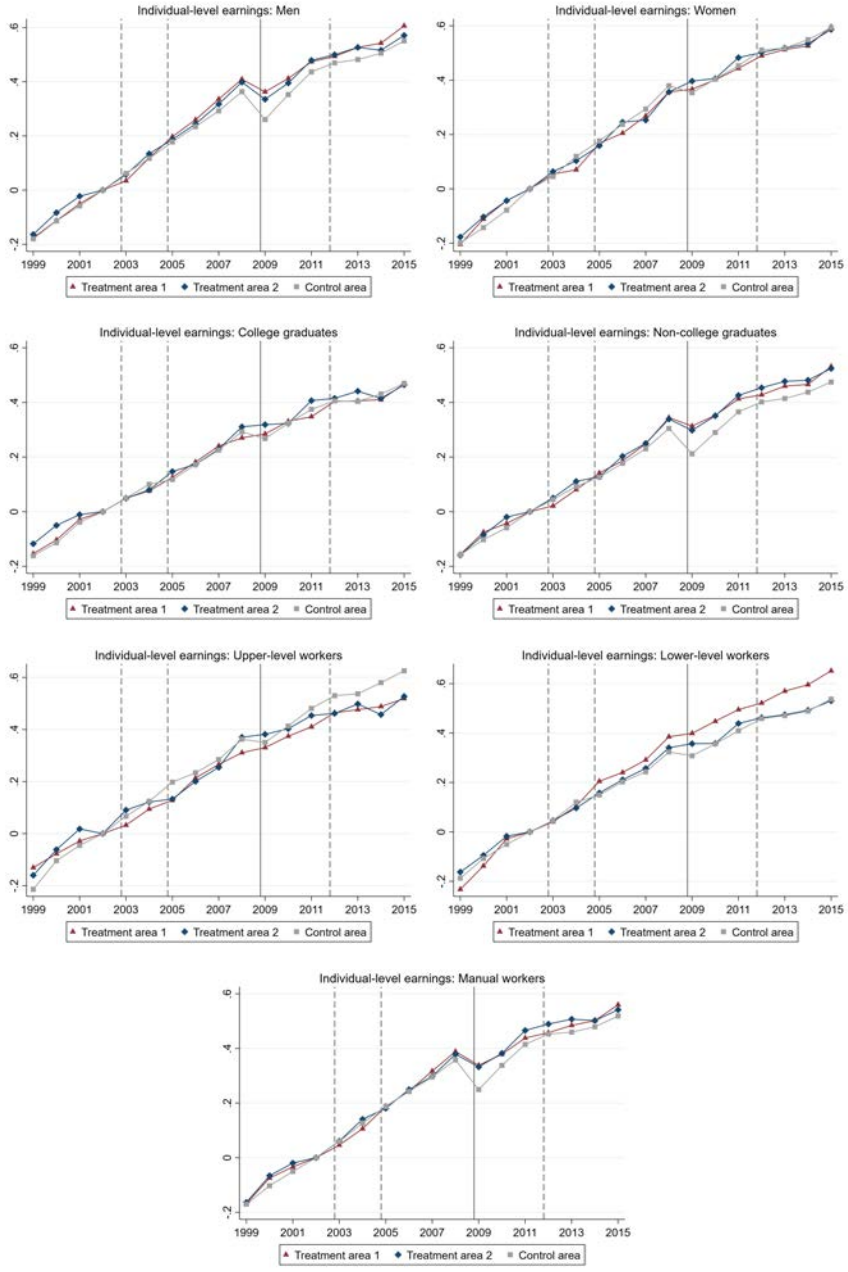
Note: These figures plot the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual sales relative to year 2002 separately for the control and treatment regions.

Figure 4: Annual employee earnings



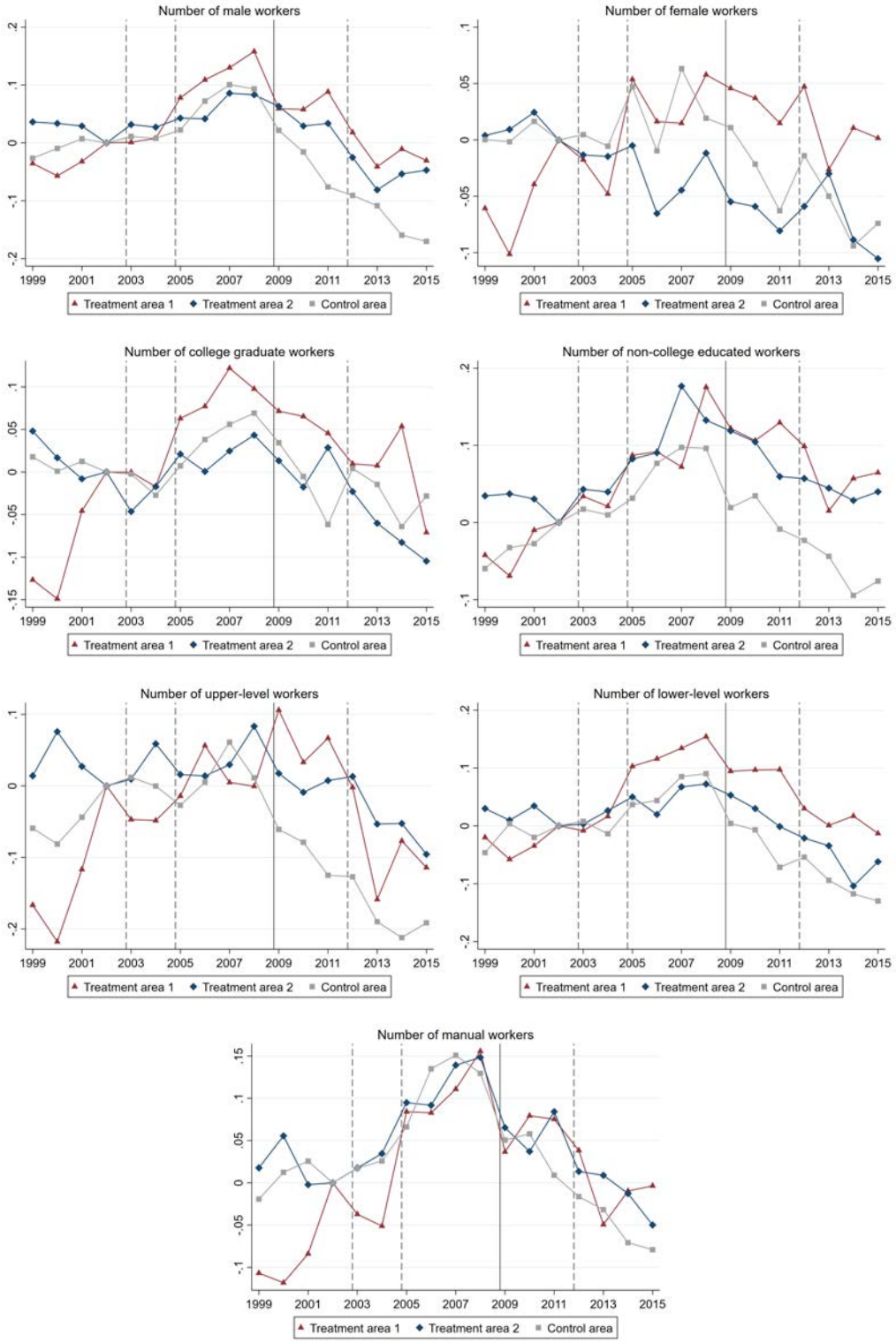
Note: This figure plots the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual sales relative to year 2002.

Figure 5: Annual earnings by worker characteristics



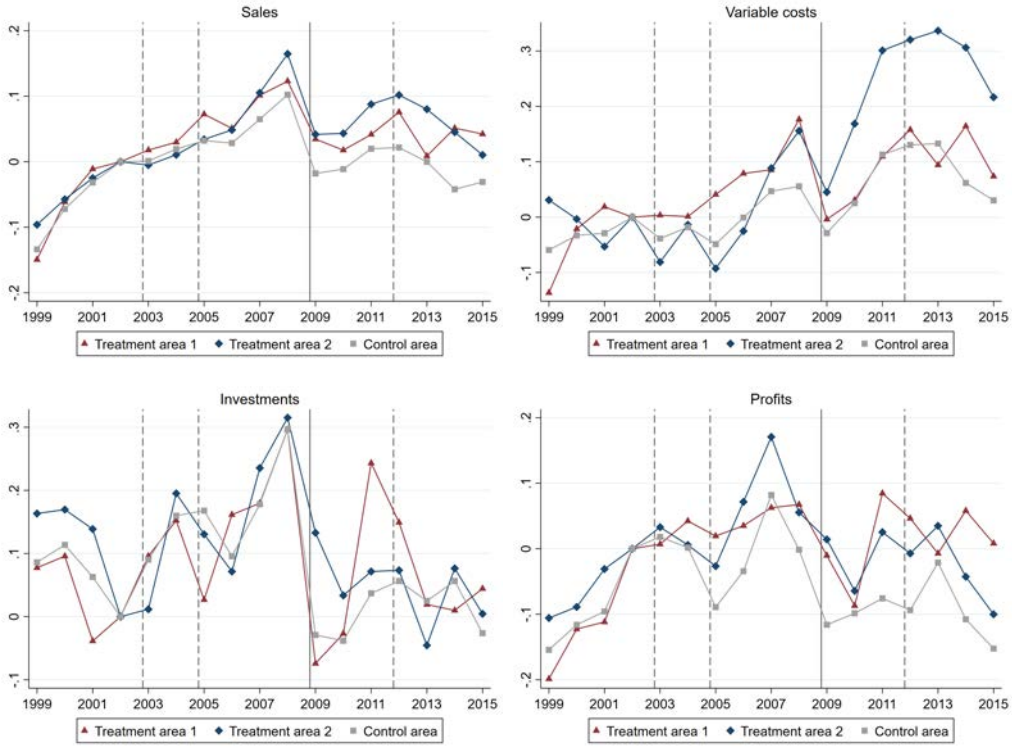
Note: These figures plot the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual sales relative to year 2002.

Figure 6: Number of employees by worker characteristics



Note: These figures plot the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual sales relative to year 2002.

Figure 7: Firm-level annual sales, inputs, investments and profits



Note: These figures plot the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual sales relative to year 2002.

Table 1: Firm-level descriptive statistics in year 2002

	VARIABLES	Payroll taxes	Labor costs	No. empl.	No. empl.	No. empl.	Average wages	Turnover	Profits
	Stats				full-time	part-time			
Experiment 1	Mean	4191	43679	3.8	.54	2.9	9518	259674	24463
	Median	1628	14873	2	0	2	7315	128870	16594
	SD	6225	68980	3.7	.82	2.7	8791	300759	28096
	N	1719	2089	2089	2089	2089	1769	1950	1727
Experiment 2	Mean	5391	56254	4.3	.7	3.1	11025	291109	27626
	Median	2329	20882	3	0	2	9071	161714	19396
	SD	7065	79600	3.8	.88	2.8	9325	309437	29940
	N	1557	1890	1890	1890	1890	1683	1767	1660
Control	Mean	5394	51614	4.1	.64	3	10422	282755	29483
	Median	2236	18167	3	0	2	8002	150820	20734
	SD	7146	77410	3.8	.85	2.8	9459	310350	30427
	N	5100	6268	6268	6268	6268	5484	5758	5346

Note: This table shows the firm-level mean, median, standard deviation and number of observations of the main outcome variables used in the empirical analysis.

Table 2: Average firm-level responses to the payroll tax experiments and to the Great Recession (weighted by firm-level labor costs)

VARIABLES	(1)	(2)	(3)	(4)
in logs	Payroll	Labor costs	Number of	Labor input
	taxes	net of payroll taxes	workers	in months
$\alpha_2(A_i * Recession_t)$	0.0671**	0.0757***	0.0500**	0.0536**
	(0.0323)	(0.0242)	(0.0240)	(0.0267)
$\alpha_3(A_i * Exp_{1t})$	-0.302***	0.0383	0.00543	0.00813
	(0.0400)	(0.0268)	(0.0383)	(0.0397)
$\alpha_4(A_i * Exp_{2t})$	-0.0841	0.00898	-0.00616	-0.00370
	(0.0541)	(0.0369)	(0.0598)	(0.0644)
Cumulative effect	-0.324	0.082	0.050	0.058
p value	<0.001	0.058	0.615	0.572
Observations	56,205	69,701	73,578	73,532
R-squared	0.052	0.010	0.060	0.030

Note: This table shows the coefficients from specification (1) with firm- and year-fixed effects. We use data from 1999 to 2015 in these estimations, Exp refers to one in years 2003 to 2011 (first treatment wave) and 2005 to 2011 (second treatment wave), Exp is two for years 2012 to 2015, and zero otherwise. A refers to a dummy equal to one if a firm is located in the treated municipalities, and zero otherwise. The standard errors in parentheses are clustered at the municipality level.

Table 3: Average firm-level responses to the payroll tax experiments and to the Great Recession (weighted by firm-level labor costs)

VARIABLES in logs	(1) Sales	(2) Input usage	(3) Investments	(4) Profits
$\alpha_2(A_i * Recession_t)$	0.0327	0.045	0.0404	-0.113
	(0.0267)	(0.054)	(0.0634)	(0.170)
$\alpha_3(A_i * Exp_{1t})$	0.00530	0.084**	0.00368	0.200
	(0.0280)	(0.033)	(0.0432)	(0.160)
$\alpha_4(A_i * Exp_{2t})$	0.00927	0.142***	-0.0284	0.382
	(0.0465)	(0.049)	(0.0835)	(0.242)
Cumulative effect	0.047	0.271	0.016	0.469
p value	0.476	<0.001	0.850	0.129
Observations	72,875	65,756	49,018	58,861
R-squared	0.006	0.007	0.008	0.012

Note: This table shows the coefficients from specification (1) with firm- and year-fixed effects. We use data from 1999 to 2015 in these estimations, Exp refers to one in years 2003 to 2011 (first treatment wave) and 2005 to 2011 (second treatment wave), Exp is two for years 2012 to 2015, and zero otherwise. A refers to a dummy equal to one if a firm is located in the treated municipalities, and zero otherwise. The standard errors in parentheses are clustered at the municipality level.

Table 4: Average employee-level responses to the payroll tax experiments and to the Great Recession

Employee earnings in logs	(1) All	(2) Male	(3) Female	(4) No college degree	(5) College degree	(6) Upper-level	(7) Lower-level	(8) Manual
$\alpha_2(A_i * Recession_t)$	0.0416***	0.0375***	0.0387***	0.0497***	0.00663	0.00264	0.0349***	0.0513***
	(0.00833)	(0.00958)	(0.0102)	(0.00994)	(0.0103)	(0.0264)	(0.00965)	(0.0104)
$\alpha_3(A_i * Exp_{1t})$	-0.0106	0.000535	-0.0343*	-0.00956	-0.00227	-0.0630**	0.00507	-0.0137
	(0.0152)	(0.0154)	(0.0195)	(0.0183)	(0.0164)	(0.0262)	(0.0142)	(0.0207)
$\alpha_4(A_i * Exp_{2t})$	-0.0366*	-0.0275	-0.0540**	-0.0355	-0.0120	-0.0984**	-0.00382	-0.0436*
	(0.0198)	(0.0209)	(0.0229)	(0.0242)	(0.0214)	(0.0390)	(0.0191)	(0.0250)
Cumulative effect	-0.006	0.011	-0.050	-0.013	-0.030	-0.167	-0.123	-0.046
p value	0.875	0.772	0.233	0.917	0.732	0.297	0.218	0.574
Observations	1,231,009	834,786	396,223	907,268	146,730	88,232	275,665	728,002
R-squared	0.059	0.066	0.047	0.078	0.048	0.071	0.056	0.057

Note: This table shows the coefficients from specification (1) with employee- and year-fixed effects. We use data from 1999 to 2015 in these estimations, Exp refers to one in years 2003 to 2011 (first treatment wave) and 2005 to 2011 (second treatment wave), Exp is two for years 2012 to 2015, and zero otherwise. A refers to a dummy equal to one if an employee works in a firm located in the treated municipalities, and zero otherwise. The standard errors in parentheses are clustered at the municipality level.

Table 5: Average firm-level employment responses to the payroll tax experiments and to the Great Recession (weighted by firm-level labor costs)

Number of workers in logs	(1) Female	(2) Male	(3) College degree	(4) No college degree	(5) Upper-level	(6) Lower-level	(7) Manual
$\alpha_2(A_i * Recession_t)$	0.0971**	0.0217	0.0401	0.0497	0.0649*	0.0339*	-0.0143
	(0.0430)	(0.0230)	(0.0272)	(0.0331)	(0.0356)	(0.0202)	(0.0353)
$\alpha_3(A_i * Exp_{1t})$	-0.0288	0.00376	-0.0287	-0.0284	-0.0650	-0.0617	-0.0279
	(0.0598)	(0.0433)	(0.0346)	(0.0525)	(0.0662)	(0.0416)	(0.0391)
$\alpha_4(A_i * Exp_{2t})$	-0.0175	-0.0372	-0.0416	-0.0340	-0.167*	-0.0958*	-0.00378
	(0.0659)	(0.0626)	(0.0497)	(0.0653)	(0.0844)	(0.0548)	(0.0549)
Cumulative effect	0.051	-0.012	-0.030	-0.013	-0.167	-0.123	-0.046
p value	0.706	0.904	0.732	0.917	0.297	0.218	0.574
Observations	45,321	64,859	34,344	66,547	25,624	44,376	49,078
R-squared	0.046	0.054	0.070	0.023	0.022	0.023	0.020

Note: This table shows the coefficients from specification (1) with firm- and year-fixed effects. We use data from 1999 to 2015 in these estimations, Exp refers to one in years 2003 to 2011 (first treatment wave) and 2005 to 2011 (second treatment wave), Exp is two for years 2012 to 2015, and zero otherwise. A refers to a dummy equal to one if a firm is located in the treated municipalities, and zero otherwise. The standard errors in parentheses are clustered at the municipality level.

Appendix A

Table 6: Social insurance contribution rates by firm categories, insurance program and years

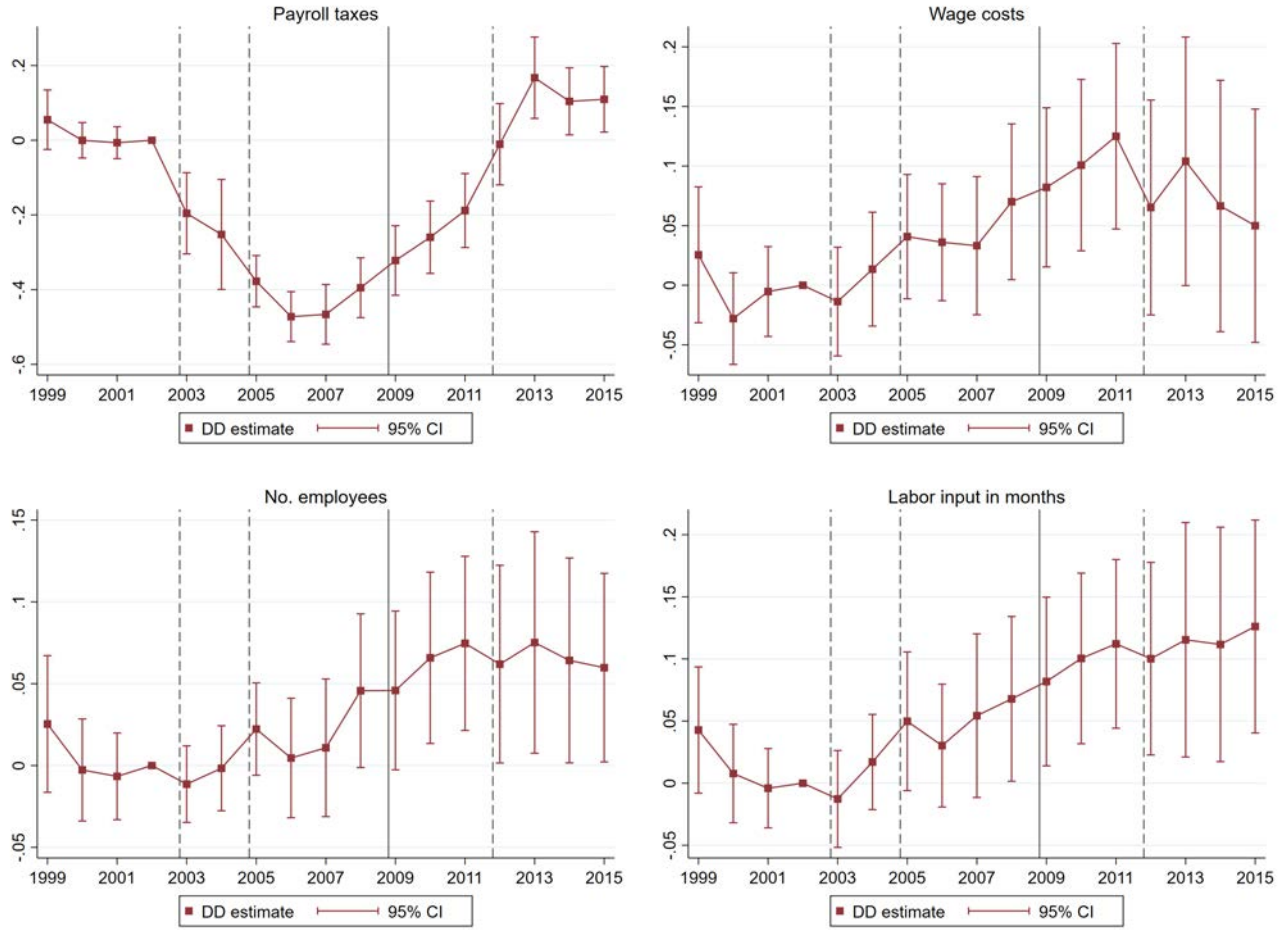
	National health and pension insurances Firm categories*			Accident insur.***	Unemployment insurances Firm categories**		Group life insur.***	Employees pensions***	Total	
Year	I	II	III		I	II			low	high
1996	4.000	5.600	6.500	1.2	1.00	4.00	0.100	16.80	23.100	28.600
1997	4.000	5.600	6.500	1.4	1.00	4.00	0.090	16.70	23.190	28.690
1998	4.000	5.600	6.500	1.4	0.90	3.90	0.080	16.80	23.180	28.680
1999	4.000	5.600	6.500	1.3	0.90	3.85	0.080	16.80	23.080	28.530
2000	4.000	5.600	6.500	1.2	0.90	3.45	0.090	16.80	22.990	28.040
7/2000	3.600	5.600	6.500	1.2	0.90	3.45	0.090	16.80	22.590	28.040
2001	3.600	5.600	6.500	1.2	0.80	3.10	0.095	16.60	22.295	27.495
2002	3.600	5.600	6.500	1.1	0.70	2.70	0.095	16.70	22.185	27.085
3/2002	2.950	5.150	6.050	1.1	0.70	2.70	0.095	16.70	21.535	26.635
2003	2.964	5.164	6.064	1.1	0.60	2.45	0.081	16.80	21.545	26.495
2004	2.964	5.164	6.064	1.1	0.60	2.50	0.080	16.80	21.544	26.544
2005	2.966	5.166	6.066	1.2	0.70	2.80	0.080	16.80	21.746	26.946
2006	2.958	5.158	6.058	1.1	0.75	2.95	0.080	16.70	21.588	26.888
2007	2.951	5.151	6.051	1.1	0.75	2.95	0.080	16.64	21.521	26.821
2008	2.771	4.971	5.871	1.0	0.70	2.90	0.080	16.80	21.351	26.651
2009	2.801	5.001	5.901	1.0	0.65	2.70	0.070	16.80	21.321	26.471
4/2009	2.000	4.201	5.101	1.0	0.65	2.70	0.070	16.80	20.520	25.601
2010	2.220	2.220	2.220	0.8	0.75	2.95	0.070	16.90	20.74	22.94
2011	2.210	2.210	2.210	1.0	0.80	3.20	0.070	17.10	21.18	23.58
2012	2.210	2.210	2.210	1.0	0.80	3.20	0.070	17.35	21.43	23.83
2013	2.040	2.040	2.040	0.9	0.80	3.15	0.070	17.35	21.16	23.51
2014	2.140	2.140	2.140	0.9	0.75	2.95	0.070	17.75	21.61	23.81
2015	2.080	2.080	2.080	0.9	0.80	3.15	0.070	18.00	21.85	24.89
2016	2.120	2.120	2.120	0.8	1.0	3.90	0.070	18.00	21.99	24.89
2017	1.080	1.080	1.080	0.8	0.8	3.30	0.070	17.95	20.70	23.20

* Refers to firm categories by wage sums and capital depreciation.

** Category I is for wages below certain wage sums threshold, e.g. 2,059,500 euro in year 2017, and category is for wages above the threshold. The threshold varies over years.

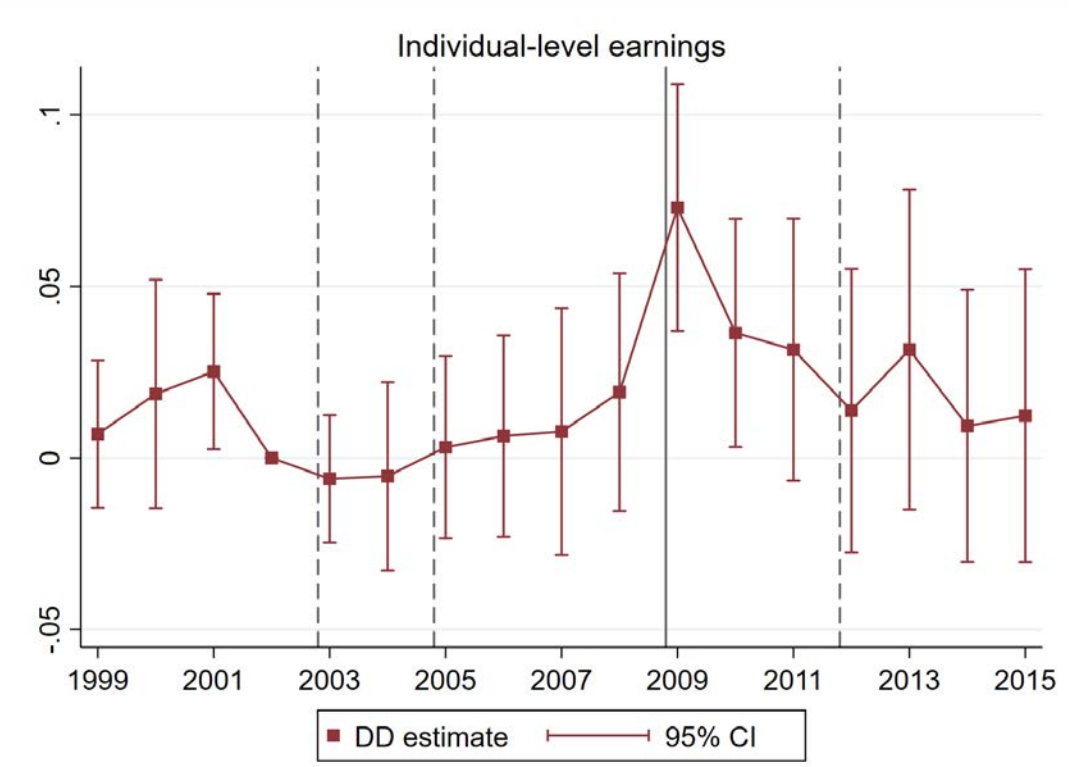
*** Represents the average values of these insurances.

Figure 8: Firm-level payroll taxes, wage costs, number of workers and labor inputs



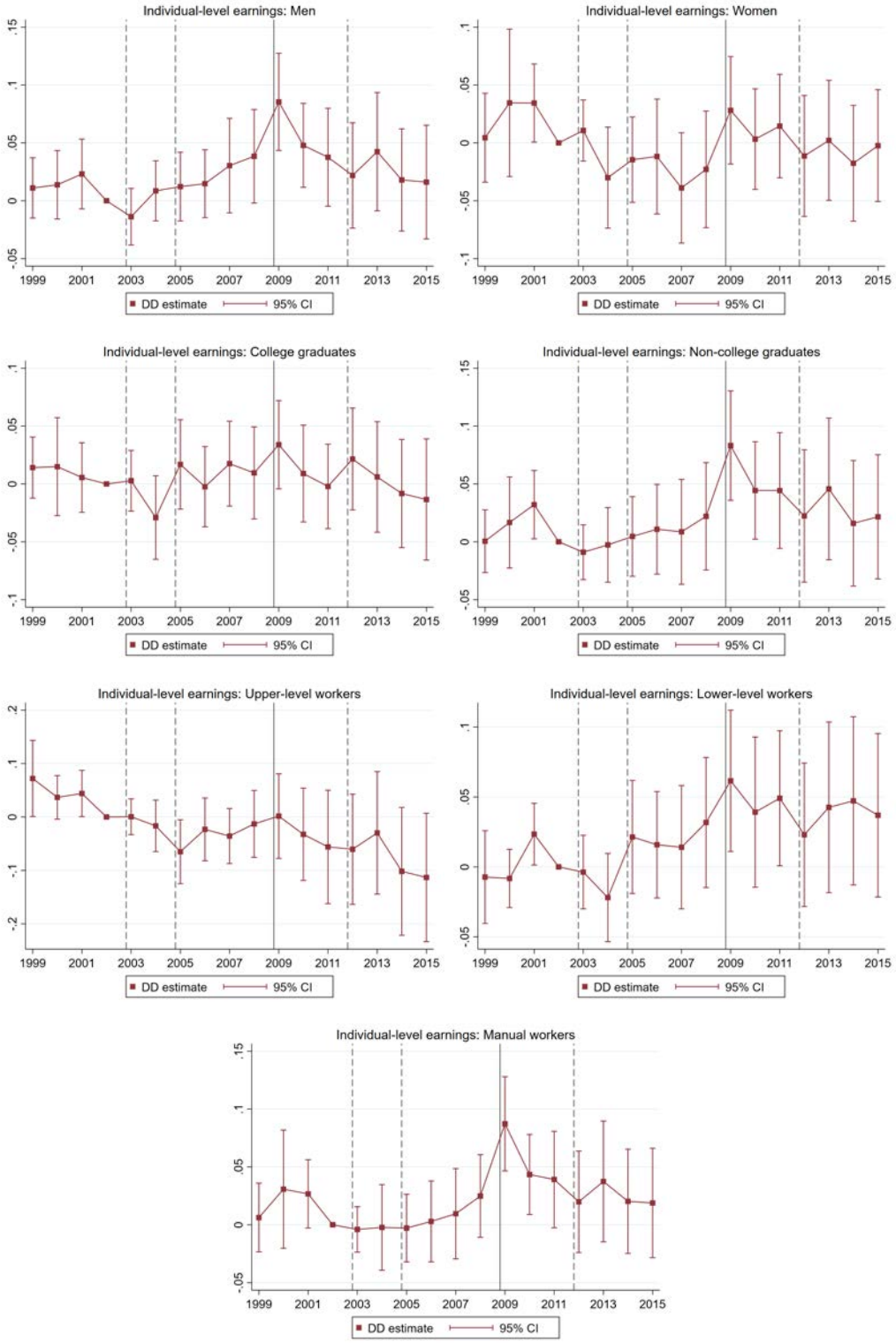
Note: These figures plot the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual labor costs relative to year 2002.

Figure 9: Annual employee earnings



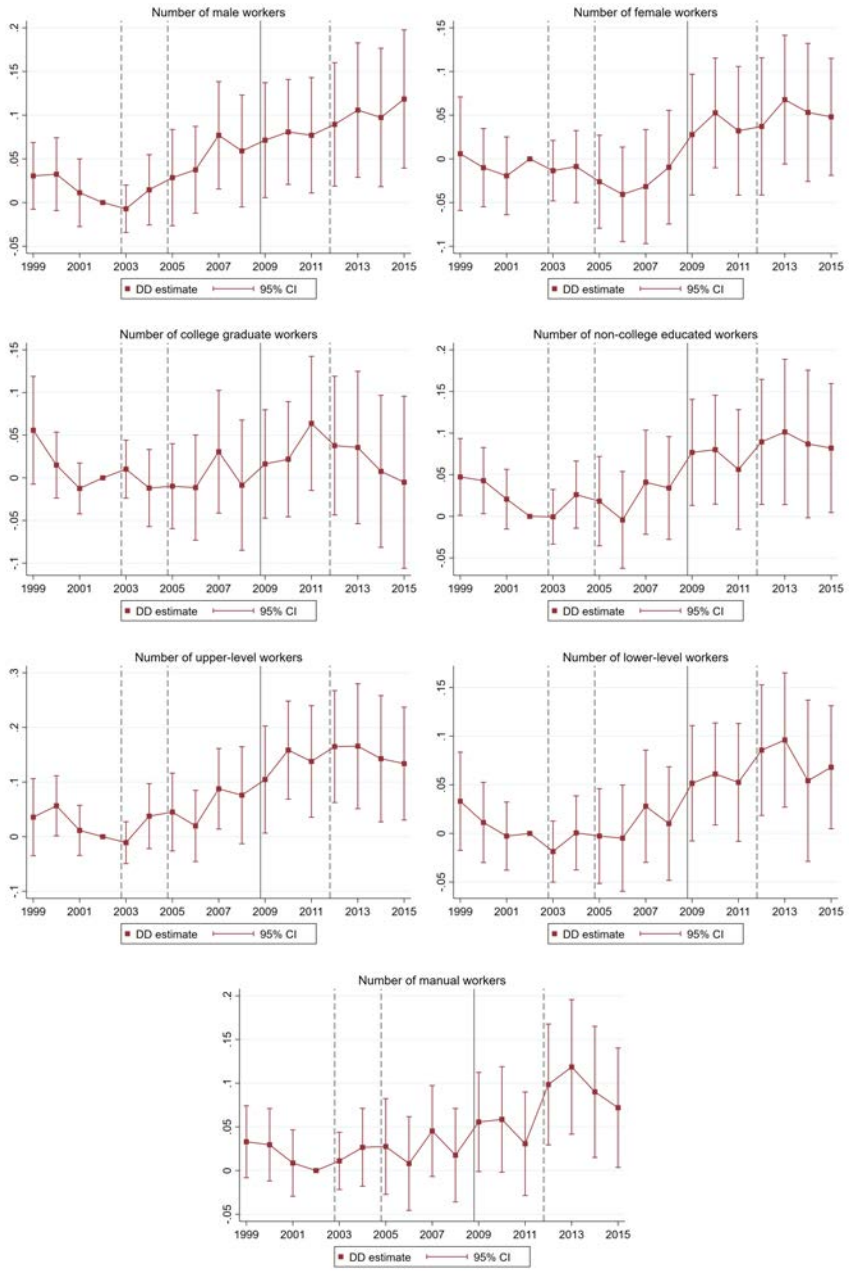
Note: This figure plots the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual labor costs relative to year 2002.

Figure 10: Annual earnings by worker characteristics



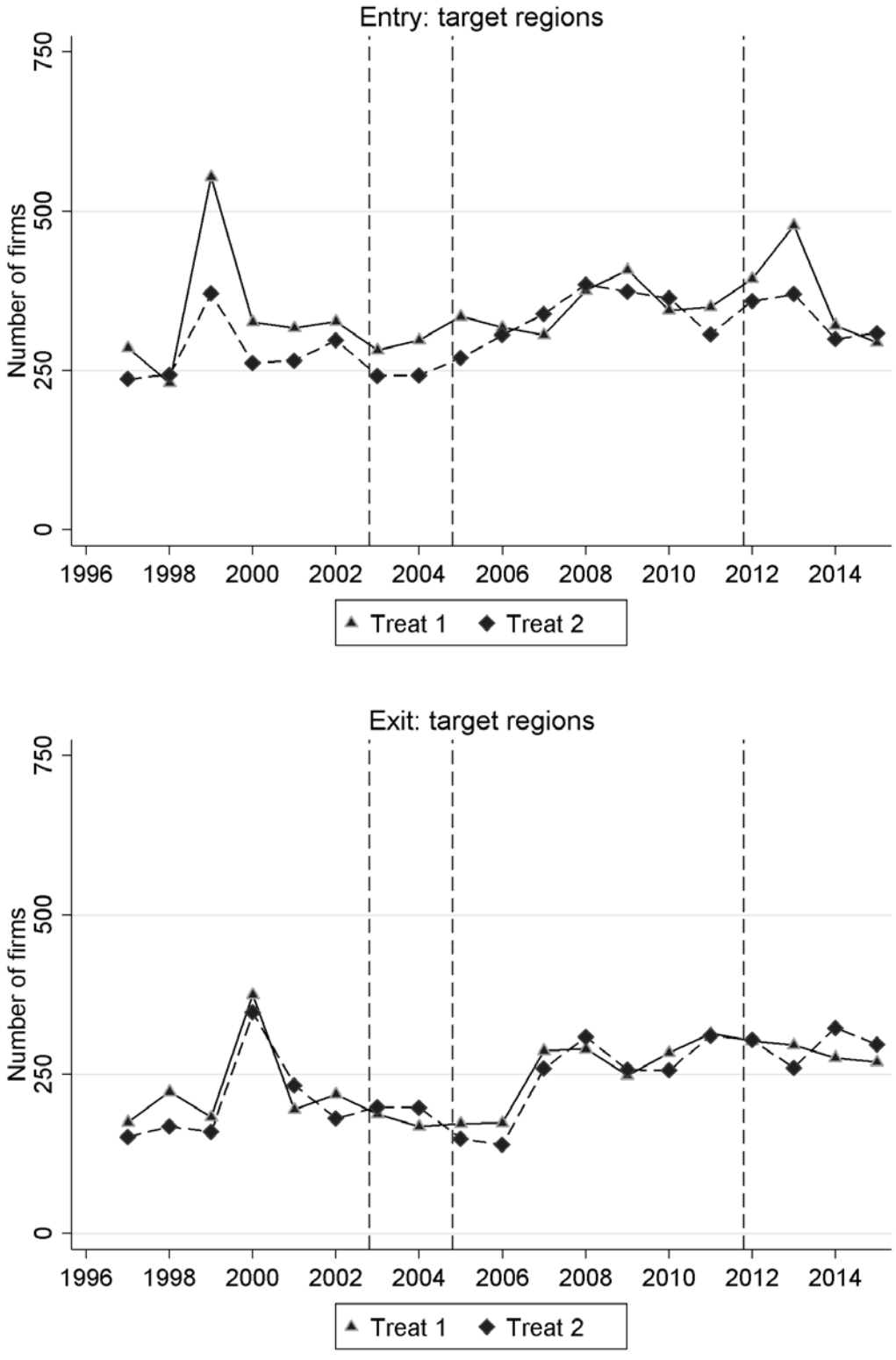
Note: These figures plot the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual labor costs relative to year 2002.

Figure 11: Number of employees by worker characteristics



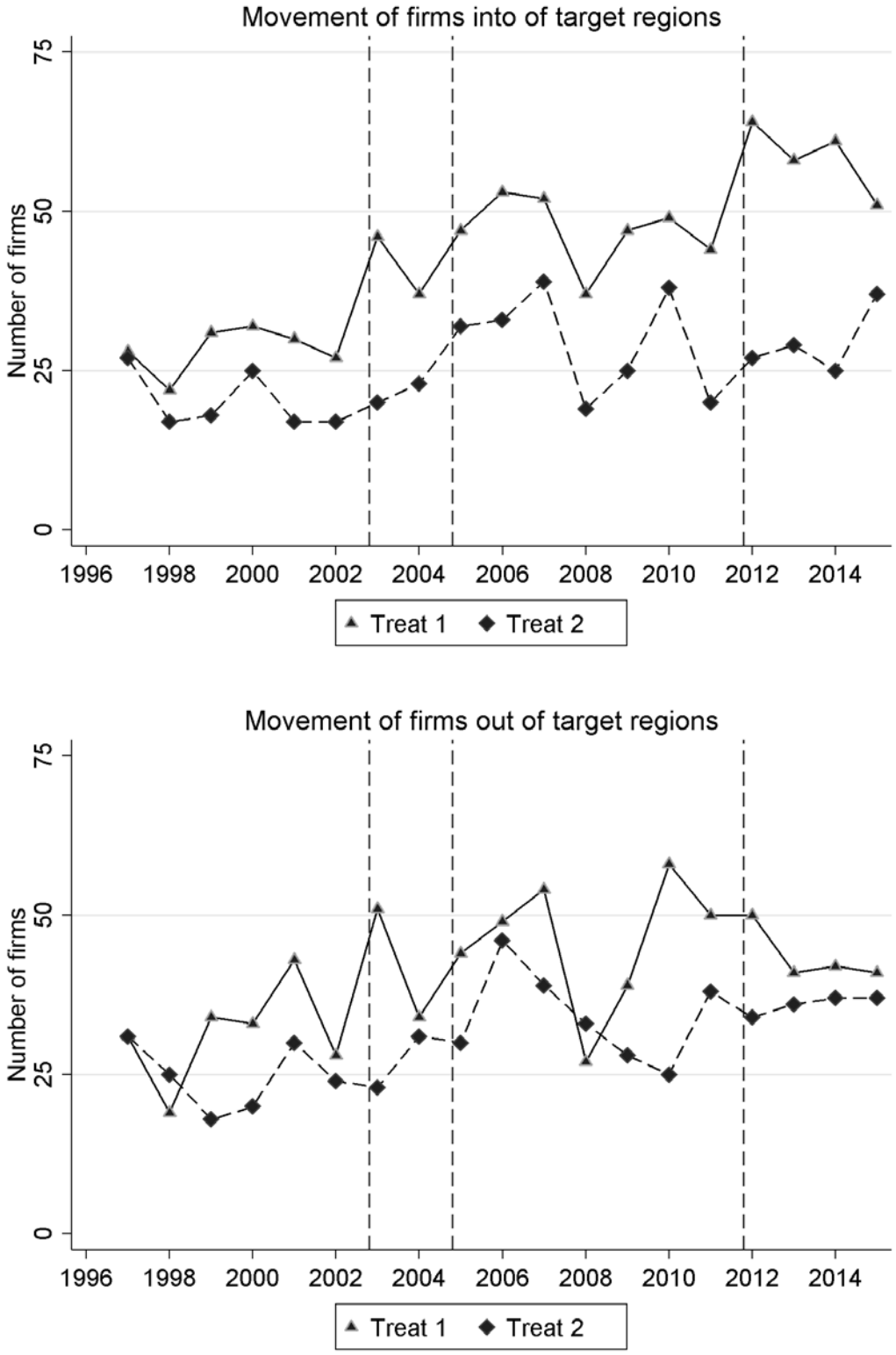
Note: These figures plot the coefficients from a regression of the outcome of interest on year dummies weighted by pre-reform firm-level annual labor costs relative to year 2002.

Figure 12: Number of firms exiting and entering the treatment municipalities



Note: These figures plot the number of new firms entering (upper panel) and exiting(lower panel) the treated municipalities by years.

Figure 13: Number of firms moving from other municipalities to the treated municipalities



Note: These figures plot the number of existing firms moving their location into (upper panel) and out of (lower panel) the treated municipalities by years.