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# ABSTRACT

## Are Firms Willing to Pay Lower Wages? A Quasi-Experiment on Subminimum Wage Policy*

We examine a subminimum wage policy in the Finnish retail trade sector during 1993–1998 that allowed firms to pay subminimum wages to newly hired workers under the age of 25. This quasi-experiment enables us to compare wages for new hires in retail trade with those in similar industries. Despite the ongoing recession, the policy was adopted by firms sparingly, with most eligible workers being hired at the standard minimum wage. We propose that wage norm at the standard minimum wage creating indirect costs for firms paying subminimum wage would be the mechanism why the take-up of subminimum wage by firms remained low. We provide empirical evidence supporting this mechanism, most notably the excess mass at the standard minimum wage in the wage distribution of eligible workers. Many firms that paid the subminimum wage also reverted back to paying the standard minimum wages for subsequent hires.

**JEL Classification:** J31, J38, D22

**Keywords:** minimum wages, subminimum wage, wage determination, fairness, employment, firms

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# 1 Introduction

The employment prospects of vulnerable groups, particularly inexperienced young workers and migrants, are often considered to be constrained by high minimum wages. A popular policy solution is to allow firms to pay *lower* than the standard minimum wages for these workers. Such policies, in place in many countries including the UK and the US (see Table 2 in Adema et al. (2019)), are usually targeted at relatively unskilled workers who are entering the labor market. These schemes are often referred to as subminimum wages. Their main objective is to facilitate the entry into the labor market and improve the chances of finding employment both during the period of eligibility for the subminimum wage and after losing eligibility.

However, any such positive effects on employment hinge crucially on how firms respond to subminimum wage policies in their wage setting, as these policies do not force firms to pay lower wages rather than allow for it. Based on prior research it is unclear whether firms would even utilize subminimum wages when they are available. Furthermore, the evidence on the employment effects of subminimum wage policies remains inconclusive (Dube and Lindner (2024), p. 48). Especially empirical evidence on the determinants of firm-level wage-setting mechanisms is scarce (e.g., Jardim et al. (2022), Kreiner et al. (2020) and Umkehrer and Vom Berge (2020)). As a result, the questions that remain unanswered are to what extent firms are willing to adopt subminimum wage policies, and what are the key mechanisms determining this.

We revisit these questions by analyzing a subminimum wage policy experiment allowing us to compare the industry where the experiment took place with similar industries without the experiment. The subminimum wage was introduced in the Finnish retail trade sector in 1993-1998. The standard minimum wage of newly hired workers of younger than 25 years of age was cut to 80% of the previous level, the subminimum wage in this study.[1] We analyze the effects using comprehensive population-level administrative data. Our findings show that only a small fraction of firms took up the subminimum wage.

[1] In Finland, the minimum wage is the lowest wage set by collective agreements for specific occupations.

Instead, most firms hired eligible workers with the standard minimum rather than the subminimum wage. We present evidence supporting wage norms as an explanation for the low take-up rate.

The subminimum wage policy-experiment allows for quasi-experimental analysis due to the industry-level set-up. We utilize two complementary approaches and data sets in our empirical analysis. First, we compare the changes in average annual earnings of eligible new hires to the retail trade industry in the treatment group with a matched control group from new hires in a set of control industries resembling retail trade. We apply this research design using administrative employer-employee data that contain information on annual earnings and complete work history of each worker in Finland linked with firms containing their background characteristics such as their itemized accounts, industry, and geographical location. Based on these data, we present a detailed analysis of the effects of the subminimum wage policy on earnings and employment, highlighting how firm and individual characteristics are related to these outcomes.

Second, for a large subsample of workers, we also observe the hourly wage of each employee linked with the employer-employee data. Using these data we construct the distribution of actual hourly wages relative to the standard minimum wage. These data are also informative about the mechanisms as they allow us to study at the firm and worksite level hourly wages paid to each worker. Using these data we are able to observe whether new eligible hires are paid the standard minimum wage or subminimum wage. We are able to follow firms over time in these data, and thus determine whether a firm or establishment uses the subminimum wage or standard minimum wage in consequent hires of eligible individuals.

We establish parallel time trends between the treatment and control groups before the experiment took place in 1993. As our main result, we find that the take-up of the policy was very limited; the average reductions in both annual earnings and hourly wages were less than 5% in the eligible treatment group relative to the control group, whereas the reduction would have been closer to 20% if all new hires were paid the subminimum wage. A closer examination of the hourly wage each individual receives confirms that the

average effect is driven by only a small fraction of eligible newly hired workers receiving the subminimum wage, while a much larger fraction are receiving the standard minimum wage.[2] Moreover, we show that the earnings of the treatment group rebounds to the pre-policy trend after the experiment ends in 1998. The result is intriguing because firms paid the eligible new hires the standard minimum wage even when they were allowed to pay only 80% of that to them.

The low take-up of subminimum wage in retail trade firms implies that the policy experiment was not successful in meeting the main policy goal of improving employment prospects of the young and inexperienced workforce. Consistent with this, we find no clear differences in overall employment between the eligible retail trade workers and the control group over the period of the subminimum wage policy. Interestingly, however, we find weak substitution effects; the fraction of eligible workers relative to all new hires increased slightly. Nevertheless, this result is modest in size and only marginally statistically significant.

We then conduct an in-depth examination of the mechanisms explaining the low take-up of the subminimum wage policy by firms. We organize our results using a simple conceptual framework, wherein wage norms impose constraints for the wage setting of firms following the results of Falk et al. (2006) and Quach (2024). The central idea is that firms face indirect costs when wages are set below the standard minimum wage, which constitutes the prevailing wage norm. Otherwise firms follow normal profit maximizing and wage setting behavior. At a deeper level the indirect costs could arise, for example, through fairness considerations, paying lower wages for some workers than others would seem unfair, as for example Akerlof and Yellen (1990) highlight.

These assumptions lead to a threshold in the profit function of firms at the standard minimum wage, which in turn leads firms to opt to hire at the standard minimum wage even when a lower subminimum wage is available. Consequently, there would be an excess mass in the wage distribution at the standard minimum wage, because all the firms that could pay lower wages prefer to locate at the minimum wage to avoid the indirect costs.

[2]This also implies that the average effect on earnings is driven by lower hourly wages, not due to the reduction in annual working time.

Thus, the shape of the wage distribution serves as a test for assessing whether the wage norm mechanism seems to hold. To simplify, consider two types of firms: those operating without a wage norm and those following it. The resulting empirical wage distribution would under this scenario show what fraction of firms belong to each firm-type by whether there is excess mass at the standard minimum or subminimum wage.

Alternative explanations for the low take-up of the subminimum wage are that labor markets are tight and due to fierce competition in labor markets firms would not pay low wages in order to be able to hire eligible individuals. In a more nuanced story workers are heterogeneous in productivity and firms would prefer to hire the workers that are more productive, which would require offering wages higher than the subminimum wage. It is important to note that this mechanism does not offer a specific reason for firms to pay exactly the standard minimum wage.

We conduct several empirical tests that could either support the wage norm or the alternative explanations for the low take-up of the subminimum wage. The first result is the empirical distribution of hourly wages of the eligible new hires during the policy experiment. For these individuals the only actual constraint is the subminimum wage. However, we observe a large excess mass at the standard minimum wage and significantly smaller mass at the subminimum wage. This distribution is consistent with most firms facing a wage norm at the standard minimum wage (the second firm-type) and a smaller fraction not facing the wage norm and thus would be of the first firm-type. We also assert that the significant mass precisely at the standard minimum wage cannot be explained by alternative explanations such as paying for productivity.

We also find that among firms that paid the subminimum wage at least once, the majority (59%) reverted to paying the standard minimum wage for subsequent hires of eligible workers. This is consistent with these firms trying out the subminimum wage and then learning about indirect costs associated with it. Moreover, different establishments of the same firm seem to have simultaneously offered the subminimum and standard minimum wages for eligible recruits. This result is not consistent with the idea that firms would have uniform wage policies as an explanation for the low take-up.

We run a contest between different individual characteristics and establishment fixed effects to identify which are explaining most of the variation in whether or not an eligible new hire received the subminimum wage. The establishment fixed effects explain by far most of the variation indicating that whether or not to pay the subminimum wage is ultimately the decision by the firm. Among various individual characteristics, young and less educated individuals are more likely to receive subminimum wages. This would be consistent with under 20 years olds and less educated having less binding wage norm at the standard minimum wage.

The productivity of workers can be measured both by their earnings prior to first job eligible for the subminimum wage, and in the 18 years of data after that. In both of these measurements those who were hired at the subminimum wage do not differ from those that were hired at the standard minimum wage. This observation does not support the mechanism that when hiring at the subminimum wage firms would get less productive workers than when hiring at a higher wage.

We test which kind of firm characteristics are associated with paying the subminimum wage to eligible new hires. We test several characteristics first individually and then run a contest between them. The only characteristics that have explanatory power in that contest is pre-reform earnings dispersion among workers that would be eligible for the subminimum wage during the policy experiment. This means that firms that pay very different wages to very similar workers are the ones that predominantly take-up the subminimum wage. The other firm characteristics include firm size, productivity and financial distress. This result is at least consistent with the conclusion that indirect costs could arise through fairness considerations. Firms that have demonstrated to tolerate more heterogeneity in wages are likely the ones that do not face such severe indirect costs from fairness considerations or do not care about them.

At the time when the subminimum wage policy experiment started in 1993, Finland was in a deep recession. This meant both that youth employment dipped to a very low level and that many firms were financially distressed. Youth unemployment was in double digits. In this environment firms had plenty of available youth workforce to hire,

and many firms were in desperate need to cut their operating costs. Both factors should contribute to a higher take-up of the subminimum wage policy compared to normal economic conditions. Thus, the observed low take-up is an intriguing finding in our context. The macroeconomic conditions also work against the mechanism explaining the low take-up through firms not being able to hire productive workers with the subminimum wage.

Taken all our results together, they are consistent with the low take-up of the subminimum wage being explained by wage norms creating indirect costs. The key evidence supporting this is the excess mass in the wage distribution of the eligible workers at the standard minimum wage. Firms trying out the subminimum wage and switching back to the standard minimum wage along with our other results highlighted above also support the indirect costs story. The indirect costs could arise from fairness considerations, and our earnings dispersion result is consistent with that. Firms having high earnings dispersion could be less worried about fairness considerations than other firms in retail trade. At the same time, our additional results do not support several alternative hypotheses related to the low take-up being explained by highly competitive labor markets.

We contribute to research on subminimum wages by providing evidence on firm-level mechanisms that could explain the wage incidence findings reported in the earlier literature (Böckerman and Uusitalo 2009, Boockmann et al. 2013, Umkehrer and Vom Berge 2020, Georgiadis et al. 2020, Kreiner et al. 2020). This is valuable given that earlier research has arrived at inconclusive results (Dube and Lindner (2024), p. 48). Notably, Kreiner et al. (2020) find that a nationwide subminimum wage for those under 18 years old in Denmark creates a large decline in earnings as well as a large reduction in employment once employees reach the age threshold. This result is consistent witht the wage norms story, because the nationwide and long-existing subminimum wage in Denmark could have become a wage norm. The other cited studies find much more modest average effects on wages and earnings aligning our findings but crucially leave unanswered whether the low incidence on wages is due to the fact that firms are not able to use the subminimum wage policies or unwilling to do so. Moreover, survey evidence from the US

indicates that subminimum wages are not utilized to a large extent (Katz and Krueger 1992) also being consistent with our findings.

Moreover, we employ event study analyses to examine whether the subminimum wage had spillover effects on the wages of ineligible employees in firms that hired eligible workers. We do not find systematic evidence of spillovers in contrast to findings of Saez et al. (2019) from young-worker specific payroll tax reductions in Sweden. The difference between the payroll tax reduction and subminimum wages is that the payroll tax reduction benefits firms even in the absence of any active change in wages, but to benefit from a subminimum wage firms must use that wage in hiring.

This paper is structured as follows. Section 2 outlines the relevant institutions and macroeconomic conditions surrounding the subminimum wage policy. Section 3 describes the data and our identification strategy. Sections 4 and 5 report the effects of the policy experiment, focusing on the differences in subminimum wage adoption among employers. In Section 5.1, we present a conceptual framework that highlights mechanisms key to understanding the low take-up of the policy. Our results are presented in Section 5.2. Section 6 offers concluding remarks. Additional results and robustness checks are presented in the Appendix material.

# 2 Institutional background

*Finnish labor market.*—Wage bargaining in Finland is characterized with a high degree of co-ordination between the central trade unions and employer confederations. A high fraction of the labor force is organized. Moreover, the industry-specific collective agreements are universally binding also for non-union members in most industries, where the union contract is considered to be "representative". The union density in Finland was approximately 70% during the early 1990s (Böckerman and Uusitalo 2006). Consequently, the coverage of collective labor agreements in Finland was among the highest in OECD countries during the period we focus on (Nickell and Layard 1999).

Minimum wages are determined in Finland in each industry in the collective labor

market contracts between the unions and the employer organizations. The union contracts specify task-specific minimum wages, meaning that minimum wages vary by tenure groups and regions. Incomplete compliance is not a major issue in Finland, because the unions have sufficiently strong bargaining power to enforce minimum wage regulations. This applies also in the service industries, where the union density is lower than in the manufacturing sector.

*Macroeconomic environment.*—There was an unprecedented and deep recession leading to a significant reduction in aggregate economic activity in Finland during the early 1990s (see Honkapohja and Koskela (1999) for "a tale of bad luck and bad policies"). Output fell by 14 percent in the years 1990–1993. The unemployment rate increased in three years (1991–1993) to almost 20% from an average of around 5% during the 1980s. Among the young workers (19–24 years olds), the unemployment rate reached almost 40%. In retail trade, the industry we focus on, firm revenues were roughly cut in half in the early 1990s relative to the end of 1980s. Figure A2 illustrates the severity of the macroeconomic conditions.

*Subminimum wage policy experiment.*—The deep recession of the early 1990s led to substantial economic and political pressures to improve flexibility in wage formation. As a result, in the spring of 1993, the ruling center-right government proposed a bill that would have made it possible to pay under 25 years old workers wages lower than the prevailing industry-specific minimum wages (Böckerman and Uusitalo 2009). The aim was to support youth employment. However, this proposal was later withdrawn due to pressure from labor market parties with the commitment that this matter would be handled outside the parliamentary legislative process. Trade unions representing retail trade and hospitality industries made agreements with employer confederations in June 1993 that allowed firms to pay a subminimum wage to young newly hired workers under 25 years of age. Moreover, an eligibility rule was that the newly hired individual did not have any prior work experience in the same industry. These agreements largely followed the initial government proposal.

*Retail trade.*—Our analysis focuses on the retail trade industry that was the largest

sector where the subminimum wage for young newly hired workers was agreed upon. Retail trade is also one of the prominent low-wage industries in Finland and it employs a much larger than average share of young workers. Moreover, retail trade firms were hit hard during the economic recession creating a strong financial incentive for firms to pay the subminimum wage for the eligible new hires.

In the retail trade sector the labor union and the employer's association reached an agreement on youth subminimum wages in early June 1993. This agreement took effect on June 15$^{\text{th}}$ 1993 and was planned to last for two years. However, in 1995 the agreement was extended to be in effect until February 28$^{\text{th}}$ 1998. The minimum wages of inexperienced workers younger than 25 years were reduced to 80 percent of the lowest task- and region-specific tariffs for the first 8 months of their employment.[3] The agreement also lowered the minimum wages of trainees and summer workers but our analysis excludes these groups as they represent very temporary jobs and are only a small fraction of all employees in the data. The agreement did not affect the terms of employment of those workers who were already employed in the firm. See Figure A1 (Appendix material) for a graphical illustration of the policy experiment.

# 3 Data and empirical approach

In this section, we present data and methods that we use to identify the causal effect of subminimum wages on earnings, wages, and employment. The main aim of our analysis is to use administrative data to understand the differences in the take-up of a subminimum wage policy between firms.

*Linked employer-employee data.*—We utilize comprehensive Finnish administrative data. The core data are linked between employers and employees, and cover all firms and full population of employees in Finland. The data are in panel form, implying that we can follow the same firms and/or employees over time. However, as our main interest lies in the new young recruits, we rely on repeated cross-sections for employees. The underlying

[3]The agreement in the retail trade sector stated that under 25 years old workers who are either graduating from a vocational school or from higher education or who have no vocational training and have less than one year of occupation-related work experience were eligible to the subminimum wage.

panel structure allows us to analyze the take-up of the policy by firms over time, and we can also examine what happened to the individuals after the year of eligibility. The years we utilize in this study are 1989-2002.

The firm-side information includes the specific industry the firm is in, the number of employees, annual sales, and other accounting variables. Importantly, we observe when each worker started or ended working for a particular firm. We observe for employees their annual earnings, educational attainment and age, among other things. Due to the panel structure of the data, we can construct work histories for each employee, which is important given that only those who had no previous work history in the retail trade industry were eligible to receive a subminimum wage.

Moreover, we are able to link other information to our core dataset. The most important one is information on hourly wages for a large subsample of workers. These data are from the firms that are members of Confederation of Finnish Industries. All major retail trade chains and most of the large independent retailers are members of the employers' confederation. The main advantage of these data is that they originate directly from firms' payroll records, and provide very precise measures for wages, but the disadvantage is the smaller sample size than in the core data.

We also link to these data agreed wages from binding collective labor agreements in retail trade and our control industries. Collective agreements stipulate the standard minimum and subminimum wages for each worker based on their industry, work task, and job tenure. This information combined with the variables in the core data also allow us to evaluate accurately who exactly are eligible for the subminimum wage.

In our estimations using the entire employee and firm populations, the main dependent variable is log annual labor earnings of those fulfilling the full-time employment condition. We use the full-time employment condition to minimize the variation in annual earnings arising from the variation in working time rather than wages. The condition is defined as having at least 60% of earnings that would accrue by working 12 months with a minimum wage. In retail trade the annual earnings when working full-time with a minimum wage was 10,800 euros in 1993, and thus the working condition threshold is having earnings

of at least 6,360 euros per year. The main outcome variable excludes those who have earnings less than this threshold. We have confirmed that our results are not sensitive to using this exact threshold.

*Treatment and control groups.*—We define as the treatment group those who are eligible for receiving the subminimum wage in the Finnish retail trade industry. These are the workers under the age of 25 years old who do not have prior work history in the industry. The control group comprises individuals meeting the same age and work history criteria but who work in different industries. The selection of control industries is motivated by finding sectors that evolved similarly to retail trade in terms of youth earnings and employment. Having the control group from individuals hired to different industries rather than from firms in retail trade avoids spillover effects from contaminating the analysis. The industries and the number of observations by industry are documented in Table A1, while Figure A9 in Appendix shows the number of young new hires over time.

To gain better balance between the treatment and control groups, we prune observations from the data using coarsened exact matching (Iacus et al. 2012, hereafter CEM). We conduct matching using observations over the period 1989-1992, and as we analyze repeated cross-sections, we extend these matching weights for the full period 1989-2002 based on observable characteristics of each cross-section.[4] Restricting the matching period to 1989-1991, 1989-1990 or 1989 produces results that are almost identical to our main results. Requiring the same number of treated and control individuals within all strata in CEM or using nearest neighbour matching produces qualitatively similar results although with differences between eligible and control individuals in the pre-treatment period.

*Empirical specifications and identification.*—We estimate the effects of subminimum wage policy on the outcomes first by utilizing an event-study design comparing over time

[4]We match using years, age, time from graduation, highest degree, and earnings in the four pre-treatment cross-sections (1989-1992). We extend the weights to subsequent cross-sections (1993-2002) using industry codes, age, time from graduation, and highest degree. Some low-wage industries, such as construction, predominantly hire males, whereas some industries, including retail trade, have a high share of female workers. Thus, matching on gender would reduce the sample size substantially, and we refrained from doing so. We have confirmed that our findings hold with the smaller sample after including gender as an additional matching variable.

the treatment and control groups described above. This analysis is based on the following regression equation:

$$y_{it} = \alpha + \sum_t \phi_t Year_t + \delta Treat_i + \sum_k \beta_k Treat_i Year_k + \epsilon_{it} \quad (1)$$

where $y_{it}$ is the outcome for individual $i$ at time $t$. $\alpha$ is constant, $\delta$ is the treatment group indicator, and $\phi_t$ are the year indicators, where we omit $t-1$, that is, the year 1992 indicator from the estimation. $\beta_k$ identifies the main effects of interest, i.e., the difference between the treated and control groups for each year. $\epsilon_{it}$ is the residual error term.

The main identification assumptions are that the control group represents the treatment group in the absence of the reform and that the policy experiment is exogenous from the point of view of the firms and workers. Also, the control group should not be affected by the policy. Moreover, the policy should be exogenous to economic conditions.

We evaluate the first assumption by examining whether the pre-reform trends are parallel. The second assumption is fulfilled by the fact that the reform was negotiated at a higher industry level with the support from the government. Thus, the policy experiment took place regardless of actions or opinions of individual firm or worker. By having one industry treated and taking control group from unaffected industries should avoid the potential problem that the control group would be treated. The fourth assumption is more difficult to defend in principle, because the social partners negotiated the policy. Notably, the fact that the employer confederation was a partner of the negotiations that led to the agreement should work in favor of increasing the take-up of the policy.

Additionally to the average effect of the policy, we are interested in the effects among specific subgroups of the affected firms. To estimate these, we run difference-in-differences regressions, where we interact the firm characteristics of interest with the DiD variable. Formally, we run regressions of the following structure:

$$y_{it} = \alpha + \zeta After_t + \delta Treat_i + \gamma Treat_i After_t + \sum_g \eta_g FirmC_g Treat_i After_t + \sum_t \phi_t Year_t + \sum_g \sum_t \theta_{gt} FirmC_g Year_t + \varepsilon_{it} \quad (2)$$

where $y_{it}$ is the outcome for individual $i$ at time $t$. $\alpha$ is constant, $\delta$ is the treatment group indicator, and $\phi_t$ are the year indicators. Because the policy experiment was introduced in the middle of 1993 and it ended in the middle of 1998, we use years 1994–1997 as the $After$ period. $\gamma$ identifies the main effect of being eligible for the subminimum wage on the outcome of interest. We additionally include interactions with the treatment effect and firm characteristics $FirmC$. $\eta_g$ coefficients identify the effects of these interaction terms. $\theta_{gt}$ capture flexibly the time effect across examined firm groups common to both treatment and control groups. $\epsilon_{it}$ is the residual error term.

We do not consider the concerns raised in the recent literature regarding two-way fixed effects estimation to be relevant to our analysis. First, we employ a more traditional DiD approach with a single reform. Second, we use repeated cross-sections, where each individual is eligible only once as an inexperienced worker.

*Using hourly wages data to characterize workers and firms.*—For a subsample of workers and firms, we have data on hourly wages, which we use to calculate wages relative to occupation- and region-specific minimum wages gathered from collective labor agreements. First, we make use of these data to examine how the subminimum wage policy affects the wage distribution of young inexperienced new hires. We classify individuals who receive wages at least 10% below the regular minimum wage as those who were paid a subminimum wage. Then, we use this information to categorize firms into different groups: those that paid the subminimum wage every year once they adopted the policy, those that never paid the subminimum wage, and those that experimented with the subminimum wage but chose to reverted back to hire eligible individuals solely at a regular minimum wage or higher.

We can also link workers with their work-sites. This is useful for two reasons. First,

since many firms consist of several work-sites, we get more observations to investigate the behavior of managers. Second, decisions at the work-site level relate to the question whether managers make independent decisions across work-sites within firm. To further understand the underlying mechanisms, we examine whether firms implemented hiring policies in a top-down fashion or if individual work-sites had discretion in their wage setting.

# 4 Incomplete take-up

In this section, we present the main effects of the policy experiment highlighting the incomplete take-up. We first provide descriptive evidence of the treatment and control industries. Then we provide our estimates of the income and employment effects of the subminimum wage policy experiment. As explained above, the treatment group comprises of the eligible workers, i.e., those under 25 years of age who start a new job in the retail trade industry and do not have prior work history in the industry. The control group consists of individuals who meet the same age and work history criteria but who work in different industries. We analyze the development of these groups for different outcomes before and after the period when the subminimum wage policy was implemented, i.e., over the period 1993–1998.

*Descriptive patterns.*—Table 1 presents the key summary statistics from the data discussed above for both employees and employers. In the linked employer-employee data we have approximately 25,900 individuals who meet the above-specified eligibility criteria over the period 1989-1992. During the full calendar years of the subminimum wage policy 1994-1997, we observe 11,700 eligible individuals. For the control group, the respective numbers are 48,200 and 27,200. Table 1 and Figure A3 in Appendix show that, on average, the two groups experienced similar changes in earnings, while the control group individuals earned on average 10–15% more throughout the observation period. Figure A3 already reveals in raw data that the average earnings trajectories of the eligible individuals fall behind the control group during the policy experiment.

Although the earnings development between the two groups is very similar before the policy experiment took place, retail trade and control industries differ on average in some characteristics. The control group individuals not only earn more, but are also slightly older and more likely to be male. Utilizing matching, see Section 3 for details, we gain a much better balance between the groups, although some differences still exist, in particular gender-wise and between firms. The control firms are larger, employ fewer young new hires relative to all employees and have a slightly lower share of permanent workers. A more detailed depiction of differences in earnings, age and firm size are presented in Figures A4, A5 and A6 in Appendix.

We argue that after matching the control and treatment groups nevertheless resemble each other especially well regarding the key economic assumption of having similar time trends in the absence of the treatment. Achieving parallel pre-trends is not a necessity given the rapidly declining labor market situation in Finland, due to the deep economic recession starting from 1990. We also test the robustness of the pre-trends in matching by having as the only matching year 1989, such that we are not matching on the trends or very close to treatment starting in 1993. This robustness check yields similar results than our baseline estimates.

*Main effects of the policy.*—The top panel of Figure 1 shows the development of log earnings in the matched treatment and control groups. We find evidence for the parallel pre-trends assumption between the groups before the policy experiment in 1993.[5] Moreover, the figure reveals that the earnings of eligible new hires in the retail trade industry decrease during the reform period from their previous trend, likely showing that the subminimum wage policy had a small effect on earnings. The average earnings trajectory of the treatment group sharply increases to catch up with the pre-reform trend represented by the control group when the policy ended in 1998.

The bottom panel of Figure 1 shows the results of the event-study specification based on equation (1), that is, the difference between the treatment and control groups. These estimates reveal the quantitative magnitude of the effect. In the figure, the estimated

[5]As already discussed, we find parallel pre-trends also when we match only in 1989.

effect is between −2.6% and −5% during the full reform years 1994-1997. The DiD estimate shown in Table 2 is −4.1% (−4.6% if we exclude age and education fixed effects from the estimated model). Given that the subminimum wage was 80% of the otherwise prevailing minimum wage and that we are analyzing the development of earnings of those strictly eligible, the estimated modest (average) reduction in earnings implies that only approximately one fifth of those in the eligible group actually received the subminimum wage during the policy.[6] This finding highlights that the take-up of the subminimum wage was notably incomplete in retail trade firms.

Our results do not crucially hinge on the chosen matching approach. In Figure A7, we show our event study estimates on annual earnings using two alternative ways of matching: CEM using only the year 1989 and nearest neighbor matching using the years 1989-1992. Using only the year 1989 as the matching year is nearly identical to our baseline specification (CEM over the years 1989-1992), indicating that finding parallel pre-trends was not driven by matching on the trends. The nearest neighbor matching yields smaller estimates on earnings but also some differences in pre-trends between eligible and control individuals. Moreover, we also show the event study results without matching, which yields worse pre-trends. Without matching or with nearest neighbor matching we detect a similar pattern of declining earnings only in the reform years as in our main results, but the effect is quantitatively smaller and there are some differences in pre-trends between the groups, although these differences are not statistically significant. To summarize, our main results are not qualitatively sensitive to the technical details of the matching procedure. However, we argue that using the CEM matching for our main results is the best strategy to address the pre-existing differences between the control and treatment groups.

The small reduction in average earnings could in principle reflect other changes than reduction in hourly wages. To more closely investigate this, we turn to the hourly wage data. For each worker, we calculate the task-specific minimum wage he or she is entitled to as stipulated in collective labor agreements, and take the log difference between the

[6]The average earnings result is consistent with an earlier analysis of the experiment (Böckerman and Uusitalo 2009).

actual hourly wage and the minimum wage. When receiving the subminimum wage, this difference is negative. To validate that the negative observations are arising from receiving the subminimum wage, we also show the same metric before the policy experiment in retail trade and for workers in the control industries meeting the age and experience eligibility criteria.

Figure 2 shows the distributions of the differences between received wage and the standard minimum wage before (1989-1992) and during (1994-1997) the subminimum wage policy for the treatment group in Panel A and for the largest sector, construction, in the control group in Panel B. Both illustrations focus on young new hires without prior work experience in the sector, thus meeting the age and experience eligibility criteria. In the wage distribution of the treatment group during the policy experiment, there is a concentration of mass close to the subminimum wage threshold, i.e., at -0.2 log points. This mass reveals the impact of the policy on actual wages; these are the workers that were paid the subminimum wage. At the same time, evidently, a much larger fraction of eligible workers who were hired during the policy experiment received the standard minimum wage. Based on these results, we conclude that the take-up of the subminimum wage in firms was far from complete. Notably, some firms paid the subminimum wage while in most cases the eligible workers received instead the standard minimum wage.

There is no excess mass at the negative side in the wage distribution in the pre-policy period 1989-1992 in retail trade. Moreover, no excess mass cannot be detected during the policy period among construction workers serving here as a control group: new hires are not paid the subminimum wage.

We also re-run the event study analysis using hourly wages. Figure A8, in Appendix, reveals that we obtain evidence for parallel pre-trends, and that there was an average effect of approximately $-5\%$ in this smaller sample that is similar to our main estimates on earnings based on the larger data.

We find no significant effects on overall employment in the eligible group. The number of young, first-year recruits plummeted in both the retail trade industry and the control sectors during the deep recession, see Figure A9 in Appendix, but no clear differences in

response to the subminimum wage policy can be detected. This result is not surprising, given the low take-up of the policy in firms. We find no significant effects on worker separations, either, see Figure A10 in Appendix. However, these estimates are very imprecise, indicating that we cannot rule out large positive or negative effects.

Interestingly, we find some weak evidence for composition effects. The share of eligible new hires out of all new hires slightly increased in the retail trade firms in comparison to the control firms. Figure 3 shows the shares relative to 1992 based on an event study set-up while Figure A14 in Appendix shows the raw evolution over time. During 1989–1992 the share of the would be eligible hires was approximately 2–3 percentage points higher in the retail trade industry, whereas in 1995–1997 the difference rose to roughly 5 percentage points. After the subminimum wage experiment was abolished, the difference returned to its pre-experiment level. These results are fairly imprecise. Thus, even though we cannot find positive (average) employment effects of the policy, there is weak evidence that retail trade firms employed a few more eligible workers at the expense of individuals not eligible for the subminimum wage.

*Spillover effects of the policy.* In a similar vein to Saez et al. (2019) that analyze payroll taxes, we analyze how the subminimum wage policy affects ineligible workers in firms hiring eligible workers. These workers were not eligible for receiving the subminimum wage, because they were either 25 years old or older or had some work experience in the industry, both violating the eligibility criteria. The idea here is that although the spillover groups cannot receive the subminimum wage, they could still receive a wage that is lower than in a counterfactual state as a response to the eligible new hires receiving the subminimum wage.

In Figure 4, we show the effect on earnings in the potential spillover groups. Among both under-25 and over-25-year-old experienced new hires, the average earnings of retail trade workers fall behind those of comparable workers in other industries. We find support for parallel pre-trends, but as the effect persists beyond the subminimum wage experiment particularly for the older individuals, we interpret the findings with considerable caution. In fact, this small effect could be just created by a gradual change in trends across

industries. This worry does not apply to our main result in upper left panel as there earnings revert sharply back to the same level as in the control group when the policy period ends.

# 5 Mechanisms behind the incomplete take-up

In this section, we first present a simple conceptual framework that is helpful for understanding the low take-up of the subminimum wage among firms that hire eligible workers. After that we provide empirical evidence supporting the conceptual framework.

## 5.1 Conceptual framework

Overall, our results indicated that firms hire workers eligible for the subminimum wage but opt to pay them the standard minimum wage instead. Given that the subminimum wage would result in lower wage bill for firms than using the standard minimum wage, the result needs a mechanism explanation. Here, we argue that the indirect costs associated with using the subminimum wage outweigh the direct savings in labor costs, which would explain the low take-up. These indirect costs can be either anticipated (employers do not pay subminimum wages at all) or discovered (employers pay subminimum wages but later revert back to paying standard minimum wages or higher after encountering indirect costs associated with subminimum wages).

Falk et al. (2006) and Quach (2024) find that one plausible source for the indirect costs are wage norms. Both cited papers found that establishing a minimum wage or wage rule at a certain level may create a wage norm, below which firms are reluctant to set their wages. The evidence from the two cited papers shows that even after a wage rule that becomes the new wage norm is imposed and subsequently removed, firms continue to follow the wage rule. In our setting the standard minimum wage has been in place for a long time and has arguably established itself as a wage norm. If this is the case, the subminimum wage creates indirect costs, because it is set below the standard minimum wage.

The literature also offers related explanations for why firms deviate from minimum or strictly competitive wages in their wage-setting practices. The canonical efficiency wage model presented by Shapiro and Stiglitz (1984) is a well-known example. In this model employers pay more than the "going wage" in order to promote longer-lasting employment relationships by inducing the workers not to shirk. One specific reason for not opting to pay the lowest possible wage is proposed by Akerlof and Yellen (1990), who argue that minimum wage levels or wage floors influence workers' perception of a fair wage. Paying a wage below a fair wage would incur costs for employers. These mechanisms are consistent or more detailed reasons for wage norms that we described above, but do not necessary incur a strict threshold below which firms would face indirect costs, such as in the wage norms mechanism.

Formally, we follow Manning (2011) to conceptualize labor demand under some degree of imperfect competition. We assume that firms employ $N$ new workers, who are eligible for the subminimum wage. Firms have a revenue function $f(N)$, choose wages $w$ and face hiring costs $h$. We assume that new workers are employed to perform routine tasks in retail trade and wage has only a negligible effect on workers' productivity and firms' revenue function $f(N)$. We hold the recruitment intensity as constant, because we are interested in understanding wage setting under the subminimum wage policy.

We formalize the effect of indirect costs on wage setting, by assuming that a fixed cost $c$ arises if the wage is set below the wage norm, the standard minimum wage in this case. Firms maximize their profits by choosing wages $w$. The objective function of the firm then becomes:

$$\pi = \begin{cases} f(N) - wN - h, & \text{if wage} \geq \text{standard minimum wage} \\ f(N) - wN - h - c, & \text{if wage} < \text{standard minimum wage} \end{cases} \tag{3}$$

A simulation of Equation (3) presented in Figure 5 illustrates the resulting shape of the profit function as a function of the offered wage under these assumptions. In this exercise we consider a situation where the standard minimum wage is eight euros, and a subminimum wage of seven euros is introduced. If we assume that firm behavior is

characterized by the upper part in equation (3) also when paying the subminimum wage, that is, no indirect costs materialize when paying the subminimum wage, employers would hire eligible individuals at the subminimum wage. Firms would then also receive higher profits due to the reduced wage bill (dashed line). Instead, if we assume that firm behavior is characterized by the lower part in equation (3), firms would prefer to hire eligible workers with the standard minimum wage. This is because the indirect costs $c$ associated with the subminimum wage would result in lower profits compared to paying the standard minimum wage. This conclusion is based on the assumption that the indirect costs exceed the direct cost savings achieved by paying the subminimum wage.

In summary, this simple theoretical framework is capable of explaining the low take-up of the subminimum wage through indirect costs that are associated with the subminimum wage. Of course, the low take-up is consistent with other theoretical explanations as well. These include that in competitive labor markets firms would not be able to hire with subminimum wage, or that they would not be able to hire as productive workers as with a higher wage. The next subsection presents empirical evidence supporting our theory over these alternative explanations.

## 5.2 Empirical support for mechanisms explaining the incomplete take-up

*Shape of wage distribution.* Our first empirical support for the wage-norm model is the shape of the wage distribution of the eligible new hires during the policy that we replicate in Figure 6. In the absence of a subminimum wage, we often observe an excess mass of workers at a minimum wage, as is the case in our setting for the pre-policy period and control groups in Figure 2. When the standard minimum wage is binding, we would explain the excess mass by it. We would also assume that a counterfactual distribution in the absence of a minimum wage would not exhibit excess mass at the minimum wage.

In contrast, our main result replicated in Figure 6 shows that there is a significant excess mass at the standard minimum wage for eligible new hires during the policy period. For these individuals the actual constraint is the 20% lower subminimum wage. To

illustrate the importance of different mechanisms, Figure 6 draws three different lines corresponding to how the distribution would look like according to different hypotheses. The dashed line corresponds to all firms that take the subminimum wage as the threshold, the solid line to having a wage norm at the standard minimum wage, and the dotted line to preferring to hire more productive workers with a higher wage. Clearly, most of the distribution follows the solid line, giving considerable support for the hypothesis that there is a prevailing wage norm at the standard minimum wage. Otherwise, the excess mass at a point without a binding policy threshold is difficult to explain.

The dotted line presents a wider wage distribution without a distinct excess mass point, corresponding to the mechanism that firms would prefer to hire more productive workers, which could explain the low take-up of the subminimum wage. This wage distribution is depicted as a wider distribution without distinct points of excess mass, as firms, according to this mechanism, do not have an incentive to cluster their wage offers at any specific point.

*Firms paying the subminimum wages reverted back to standard minimum wage.* To provide additional evidence suggesting that paying the subminimum wage incurs indirect costs for firms, we leverage the panel data available for a sample of firms. We examine whether the firms that pay the subminimum wage at least once do so in the future, or revert back to using the standard minimum wage for the eligible new hires. Figure 7 shows that 59% of firms that paid the subminimum wage once later predominantly reverted back to paying the standard minimum wage, despite continuing to hire individuals eligible for the subminimum wage. A smaller proportion of firms consistently pay the subminimum wage each year, while a larger share never pays the subminimum wage.

The high share of switchers is supporting the indirect cost explanation in an important way, as it suggests that the switchers did not find the subminimum wage optimal for their purposes. Not finding the subminimum wage optimal strongly suggests that indirect costs associated with it surpass the direct cost savings from paying the lower subminimum wage. It is also noteworthy that the switchers are learning *ex post* about the indirect costs. A larger fraction of firms never pay subminimum wages, which is consistent with

them finding the indirect costs large *ex ante*.

Moreover, the switchers do not give support for the explanation that the subminimum wage policy was not salient as an explanation for the low take-up. Clearly many firms were aware of the policy, as revealed by their experimentation of it. Our finding aligns with Katz and Krueger (1992, p. 10), who argue that informing managers about subminimum wages "appears to have had no discernible effect on their restaurants' propensity to use the subminimum".

*Do firms implement uniform wage policies?* Another consideration is that firms could find it optimal to implement uniform wage policies, that is, all new hires that fit the same profile will get the same wage. This could be administratively easier, and could be a potential explanation for the low take-up of the subminimum wage as the subminimum for some and the standard minimum for others would deviate from the uniform wage policy. However, in Figure 8, we plot the share of plants (or work-sites), by firms, that paid subminimum wages to at least one new hire between 1994 and 1997. We find that in 20% of firms, some individual plants paid subminimum wages, while other plants within the same firm did not (Panel A). Roughly 60% of the firms are such that none of the plants paid subminimum wages and the remaining approximately 20% of the firms were such that all plants paid subminimum wages. This pattern is even more pronounced when we concentrate only on those firms that paid subminimum wages: less than a quarter of the firms are such that all of the plants paid subminimum wages (Panel B). This result does not support the existence of a firm-wide uniform wage policy.

*What kind of firms used the subminimum wage?* In Figure 2 we observe that some firms pay the subminimum wage while others pay the standard minimum wage to eligible new hires. We next utilize these differences and examine what kind of firms are using the subminimum wage more often than others. To maximize the sample size, we rely on earnings data rather than hourly wage data. We utilize our main DiD estimate, and interact this with different firm characteristics.[7] We consider the following firm characteristics: 1) earnings dispersion among new hires before the policy,[8] 2) firm size

[7]The estimation equation is (2) in Section 3.

[8]We cross-checked with payroll data to confirm that variation in earnings originates from wages

defined as the total number of employees before the policy, 3) productivity defined as revenue divided by the total number of employees, and 4) debt-to-equity ratio during the policy. We scale all firm-level characteristics to $[0, 1]$ interval for comparability. We study each characteristic in isolation and also include them all in the same regression.[9]

We report the findings of this analysis in Table 2.[10] These results show that in isolation from other firm characteristics, the earnings dispersion in column (3) and the number of employees in column (4) produce a statistically significant and negative coefficient indicating that higher pre-policy earnings dispersion or larger firm size leads firms to use the subminimum wage more often. However, when combining all the interactions in the same regression in column (7), only the earnings dispersion remains statistically significant. Figure 9 confirms using split-sample event-study that both high and low earnings dispersion firms are on flat pre-trend with the control firms and that the decline in earnings is larger among firms that have higher earnings dispersion during the pre-policy period. Other included firm characteristics do not produce statistically significant coefficients.

Consequently, the key result in Table 2 is that the dominating firm-characteristic associated with the use of the subminimum wage is that a firm has a high earnings dispersion. This finding is consistent with our indirect costs hypothesis, as firms that tolerate greater wage heterogeneity could also be firms that do not face as much indirect costs from paying lower wages to some workers than others. The earnings dispersion result also suggests a source for the indirect costs, which is fairness considerations. Fairness considerations can create indirect costs when it is considered as unfair if some workers receive a lower wage than others, as Akerlof and Yellen (1990) posit.

It is also important to consider the other firm characteristics analyzed in Table 2, which do not have any explanatory power in determining whether firms paid the subminimum wage. The finding that larger firms are not associated with the utilization of

rather than from working time.

[9]Narrowing our sample to firms that we can observe during 1989-1992 and for which we observe all the included firm characteristics reduces the sample size from 60,366 to 38,443 individuals in 3,136 firms.

[10]Because the inclusion of firm characteristics from Column 2 onward restricts the analysis to continuing firms only, the larger main effect in Column 2 compared to Column 1 reveals that the take-up of the policy was higher among the continuing firms.

the subminimum wage policy (after controlling for earnings dispersion) is inconsistent with the salience hypothesis, as larger firms are generally better equipped to track policy changes compared to smaller firms. Larger firms are also expected to have more standard wage policies, while smaller firms could engage in more personal negotiations when hiring new workers. Also the finding that financially distressed firms are not associated with paying the subminimum wage is intriguing, as it suggests that direct cost savings are not that important determining the take-up of the subminimum wage.

To extend this analysis, Table A2 (Appendix) incorporates additional firm-level characteristics interacted with the DiD variable. Again, the earnings dispersion among new hires is the only characteristic that is statistically significant when running a contest of all characteristics in the same specification.

*What kind of individuals received the subminimum wage?* We next study what kind of individuals mostly received the subminimum wage. We first examine the importance of the age of new hires in Figure 10. Panels A and B show the wage distributions splitting the sample to younger and older eligible new hires. Panel A clearly shows that the subminimum wage was predominantly received by new hires aged 15 to 20, in contrast to those aged 21 to 24. Panel C shows the log difference between the actual wage and the standard minimum wage by age in years of the new hires. This metric is negative if the actual wage is below the standard minimum wage. The coefficient is around -0.1 for 17 years olds and then steadily increases by age up until when the new hire is 21 years old. The coefficient reaches zero by age 20. This latter analysis confirms that whenever firms utilize subminimum wages, they do so more often when they hire under 20 year old workers. This result is consistent with the indirect costs explanation, suggesting that these costs are less severe when hiring younger new workers.

Table 3 presents the results from partial $R^2$ analysis to identify which individual-level characteristics explain receiving the subminimum wage. This analysis also includes establishment fixed-effects that capture by far the most explanatory power, indicating that paying the subminimum wage is essentially the decision of the firm or establishment. Among the individual-level characteristics, age has the highest explanatory power.

Education shows up as having the second highest partial $R^2$ among individual-level characteristics. This may be somewhat correlated with age, but it indicates that new hires with lower educational attainment are more likely to receive subminimum wages. Gender, first language or work history do not seem to explain almost any of the variation in receiving the subminimum wage.

*Are the workers receiving the subminimum wages less productive?* We also analyzed the characteristics of individuals hired at the subminimum wage utilizing the panel structure of our data. Figure 11 presents the distribution of both past (Panel A) and future (Panel B) earnings of those eligible individuals who were hired at the subminimum wage and those who could have been hired at the subminimum wage but were instead hired at the standard minimum wage. The future earnings are accrued over the 18-year period we observe after being hired during the policy period. The main result from both distributional comparisons is that they are very much overlapping. Thus, based on this observable characteristic, those hired at subminimum wage do not appear any different from those hired at the standard minimum wage. This result does not support the idea that firms prefer to hire more productive workers and, therefore, opt to use the standard minimum wage instead of the subminimum wage, which could explain the low take-up of the policy.

*Macroeconomic environment.* The finding of a low take-up of the subminimum wage policy is especially intriguing in our setting given the macroeconomic conditions of the Finnish economy at the time of the policy implementation in 1993. Finland was in a major recession from 1990 until at least 1994 followed by a slow recovery. As described in Section 2 and summarized in Figure A2 in Appendix, the youth unemployment rate was in double digits. This is particularly informative for the mechanisms explaining the low take-up. With high unemployment among the eligible population, firms likely did not have any difficulties in finding available young individuals to hire with the subminimum wage.

Also, eligible individuals had strong incentives to accept a job with the subminimum wage, as income with the subminimum wage was clearly higher than with unemployment

benefits, as we show in Figure A11. Moreover, many firms were financially distressed, and thus arguably had stronger incentives than during normal macroeconomic conditions to reduce their wage bill by utilizing the subminimum wage. Appendix Figure A2 shows that the revenue of retail trade firms was stalling. Even more strikingly, Appendix Table A3 shows that the number of filed bankruptcy applications skyrocketed at the time of the policy experiment and the share of retail trade firms with more debt than equity was at an unexceptionally high level.[11] In short, the macroeconomic conditions at the time of the policy suggest that mechanisms such as firms struggling to find productive workers in tight labor markets or having excess profits that diminished their incentive to minimize payroll costs through subminimum wages are unlikely explanations for the low take-up of the policy.

In order to understand how much firms would have saved in terms of payroll costs we present back-of-the-envelope calculations based on comparing hiring individuals with the subminimum wage and standard minimum wage. Figure A13 in Appendix illustrates that the reduction in labor costs would have been significant: approximately 3% relative to the wage bill if half of new employees had been paid a subminimum wage, and 2% if the subminimum wage was paid to a quarter of the new hires. These potential cost savings are also stable across different firm sizes. This suggests that the costs associated with hiring at a subminimum wage must surpass the direct cost savings in the wage bill, at least for firms that experimented with the subminimum and then reverted back to the standard minimum wage.

*What happened to the take-up of subminimum wage when macroeconomic conditions started to improve?* The dynamics of the take-up of the subminimum wage while economic conditions in Finland were improving sheds additional light on the mechanisms. First, the mass on the negative side in Figure 2 implies that 17% of the eligible retail trade workers received the subminimum wage in 1994-1997. This share increased from 11% in 1994 to 17% in 1995 and further to 23% in 1996 and 1997 (see Figure A12 in Appendix). Simultaneously, youth employment gradually improved over this period, as illustrated in

[11] Otherwise the economy was doing equally poor, but we do not have data on the other indicators.

Figure A2. These dynamics work opposite of the mechanism explaining the low take-up with the idea that in tight labor markets firms avoid paying too low wages to attract more productive workers. Instead, the observed dynamics are more consistent with the idea that when more and more firms pay subminimum wages, the wage norm creating indirect costs at the standard minimum wage becomes less binding over time, with almost four fifths of firms still not choosing to utilize the subminimum wage.

*Summary of empirical patterns.* To provide a summary of this section, we consider here all the empirical evidence presented in this section together. Different pieces of evidence build a picture of non-perfectly competitive labor markets where firms' wage-setting practices determine the wages of young new hires, but that wage setting is suggestively constrained by prevailing wage norms creating indirect costs. The key evidence supporting this is the excess mass at the standard minimum wage for eligible new hires, that is, individuals to whom the firm could have paid only 80% of that in the form of the subminimum wage.

The fact that firms experiment with the subminimum wage but then revert back to standard minimum wage suggests that these firms were aware of the subminimum wage policy, and that they learned of indirect costs *ex post* when they experimented with the subminimum wage. This pattern together with the fact that different worksites of the same firm use different wage policies suggest that firm-level uniform wage policies are not the explanation for the low take-up. Examining what kind of individuals receive the subminimum wage together with establishment fixed effects shows that it is the fixed effects that capture most of the explanatory power. Employees who received subminimum wage do not turn out to be less productive than those who received the standard minimum wage measured as either past or future earnings. Additionally, the notably weak macroeconomic conditions or the increasing dynamics of take-up over time do not give support to the idea that tight labor markets and firms choosing to attract more productive workers would explain the low take-up.

In short, our evidence supports the explanation that prevailing wage norm at the standard minimum wage creates indirect costs for firms if they choose to offer wages

below this level. The fact that firms with higher earnings dispersion were primarily the ones adopting the subminimum wage policy provides an indication of where from such indirect costs might originate. This result suggests that fairness considerations could significantly contribute to these costs, as it may be perceived as unfair if some workers receive lower wages than others.

# 6 Conclusions

We study a nationwide subminimum wage policy experiment for young workers in the Finnish retail trade industry. The objective of the policy experiment was to ease the entry of young inexperienced workers into the labor market. Our primary interest lies in understanding the factors that influence the adoption of this policy by retail trade firms. Using nationwide linked employer-employee data on wages at the individual level and firm characteristics combined with information on collective labor agreements, we establish two main results.

First, only a small fraction of firms took up the subminimum wage. Instead, we show that a large fraction of the workers eligible for the subminimum wage were hired at the standard minimum wage relative to those hired at the subminimum wage. We do not observe positive employment effects, consistent with small wage effects.

Second, we analyze the mechanisms that could explain the low take-up of the subminimum wage. We propose wage norms that create indirect costs as a prominent mechanism. The empirical wage distribution of eligible workers supports this mechanism, because consistent with a wage norm at the standard minimum wage we observe a large excess mass of workers at that wage. For these eligible workers the only actual policy threshold is the subminimum wage. We show that alternative mechanisms, such as firms preferring to hire more productive workers cannot explain this excess mass at the standard minimum wage. We also present evidence that out of those firms that did use the subminimum wage once, a majority reverted back to using the standard minimum wage in subsequent hires of eligible individuals. Moreover, the take-up of the policy was low despite the severe

financial difficulties faced by retail trade firms and high youth unemployment during the major economic depression of the early 1990s.

In conclusion, when wage norms or other features outside of the straightforward profit maximization of firms characterize the wage setting practices of firms, subminimum wage policies may turn out to be ineffective in meeting their policy goals. Our findings highlight the importance of policy design, suggesting that targeted subminimum wage policies experience limited uptake due to prevailing wage norms.

# References


Adema, J., Giesing, Y., Schönauer, A. and Stitteneder, T.: 2019, Minimum wages across countries, *ifo DICE Report* **16**(4), 55–63.

Akerlof, G. A. and Yellen, J. L.: 1990, The fair wage-effort hypothesis and unemployment, *The Quarterly Journal of Economics* **105**(2), 255–283.

Azen, R. and Budescu, D. V.: 2003, The dominance analysis approach for comparing predictors in multiple regression, *Psychological Methods* **8**(2), 129.

Böckerman, P. and Uusitalo, R.: 2006, Erosion of the Ghent system and union membership decline: Lessons from Finland, *British Journal of Industrial Relations* **44**(2), 283–303.

Böckerman, P. and Uusitalo, R.: 2009, Minimum wages and youth employment: Evidence from the Finnish retail trade sector, *British Journal of Industrial Relations* **47**(2), 388–405.

Boockmann, B., Krumm, R., Neumann, M. and Rattenhuber, P.: 2013, Turning the switch: An evaluation of the minimum wage in the German electrical trade using repeated natural experiments, *German Economic Review* **14**(3), 316–348.

Dube, A. and Lindner, A. S.: 2024, Minimum wages in the 21st century, *Working Paper No. 32878*, National Bureau of Economic Research.

Falk, A., Fehr, E. and Zehnder, C.: 2006, Fairness perceptions and reservation wages—the behavioral effects of minimum wage laws, *The Quarterly Journal of Economics* **121**(4), 1347–1381.

Georgiadis, A., Kaplanis, I. and Monastiriotis, V.: 2020, Minimum wages and firm employment: Evidence from a minimum wage reduction in Greece, *Economics Letters* **193**, 109255.

Honkapohja, S. and Koskela, E.: 1999, The economic crisis of the 1990s in Finland, *Economic Policy* **14**(29), 400–436.

Iacus, S. M., King, G. and Porro, G.: 2012, Causal inference without balance checking: Coarsened exact matching, *Political Analysis* **20**(1), 1–24.

Jardim, E., Long, M. C., Plotnick, R., Van Inwegen, E., Vigdor, J. and Wething, H.: 2022, Minimum-wage increases and low-wage employment: Evidence from Seattle, *American Economic Journal: Economic Policy* **14**(2), 263–314.

Katz, L. F. and Krueger, A. B.: 1992, The effect of the minimum wage on the fast-food industry, *ILR Review* **46**(1), 6–21.

Kreiner, C. T., Reck, D. and Skov, P. E.: 2020, Do lower minimum wages for young workers raise their employment? Evidence from a Danish discontinuity, *Review of Economics and Statistics* **102**(2), 339–354.

Manning, A.: 2011, Imperfect competition in the labor market, *Handbook of Labor Economics*, Vol. 4, Elsevier, pp. 973–1041.

Nickell, S. and Layard, R.: 1999, Labor market institutions and economic performance, *Handbook of Labor Economics*, Vol. 3, Elsevier, pp. 3029–3084.

Quach, S.: 2024, Wage hysteresis and entitlement effects: The persistent impact of a temporary overtime policy, *Available at SSRN 4771988* .

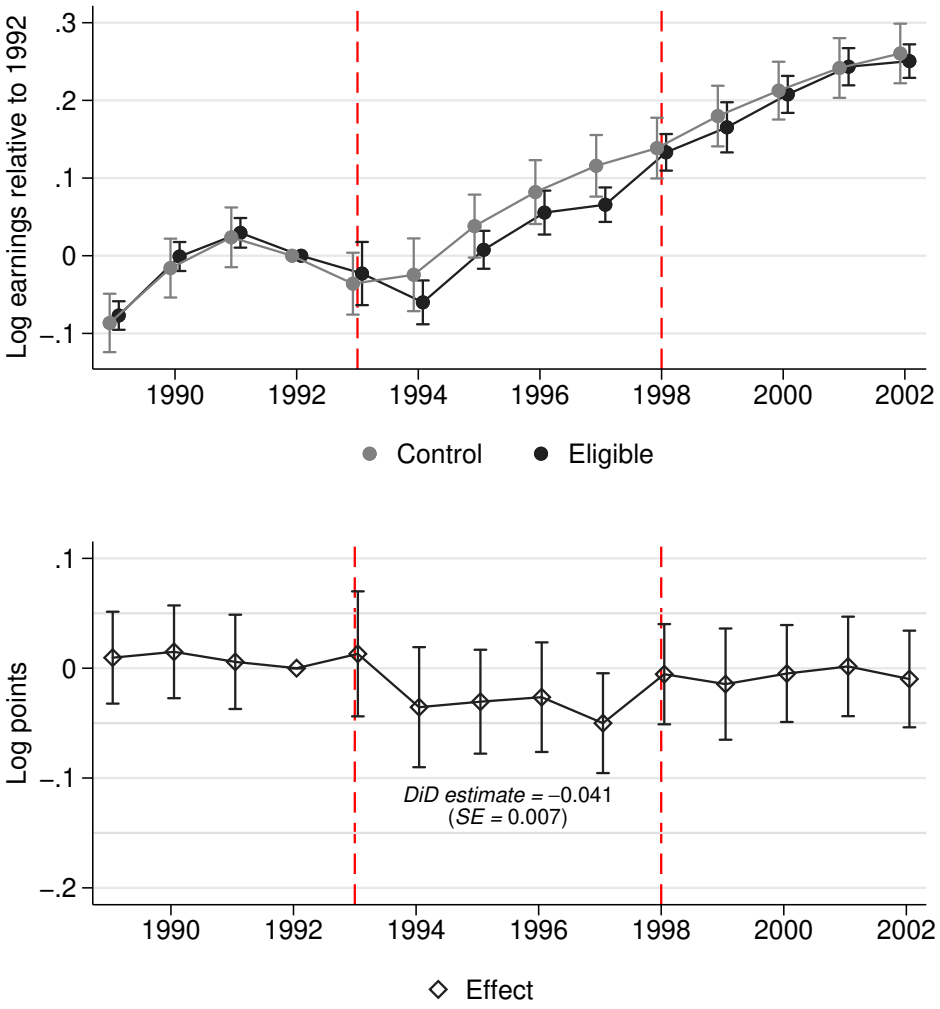
Saez, E., Schoefer, B. and Seim, D.: 2019, Payroll taxes, firm behavior, and rent sharing: Evidence from a young workers' tax cut in Sweden, *The American Economic Review* **109**(5), 1717–63.

Shapiro, C. and Stiglitz, J. E.: 1984, Equilibrium unemployment as a worker discipline device, *The American Economic Review* **74**(3), 433–444.

Umkehrer, M. and Vom Berge, P.: 2020, Evaluating the minimum-wage exemption of the long-term unemployed in Germany, *ILR Review* **73**(5), 1095–1118.

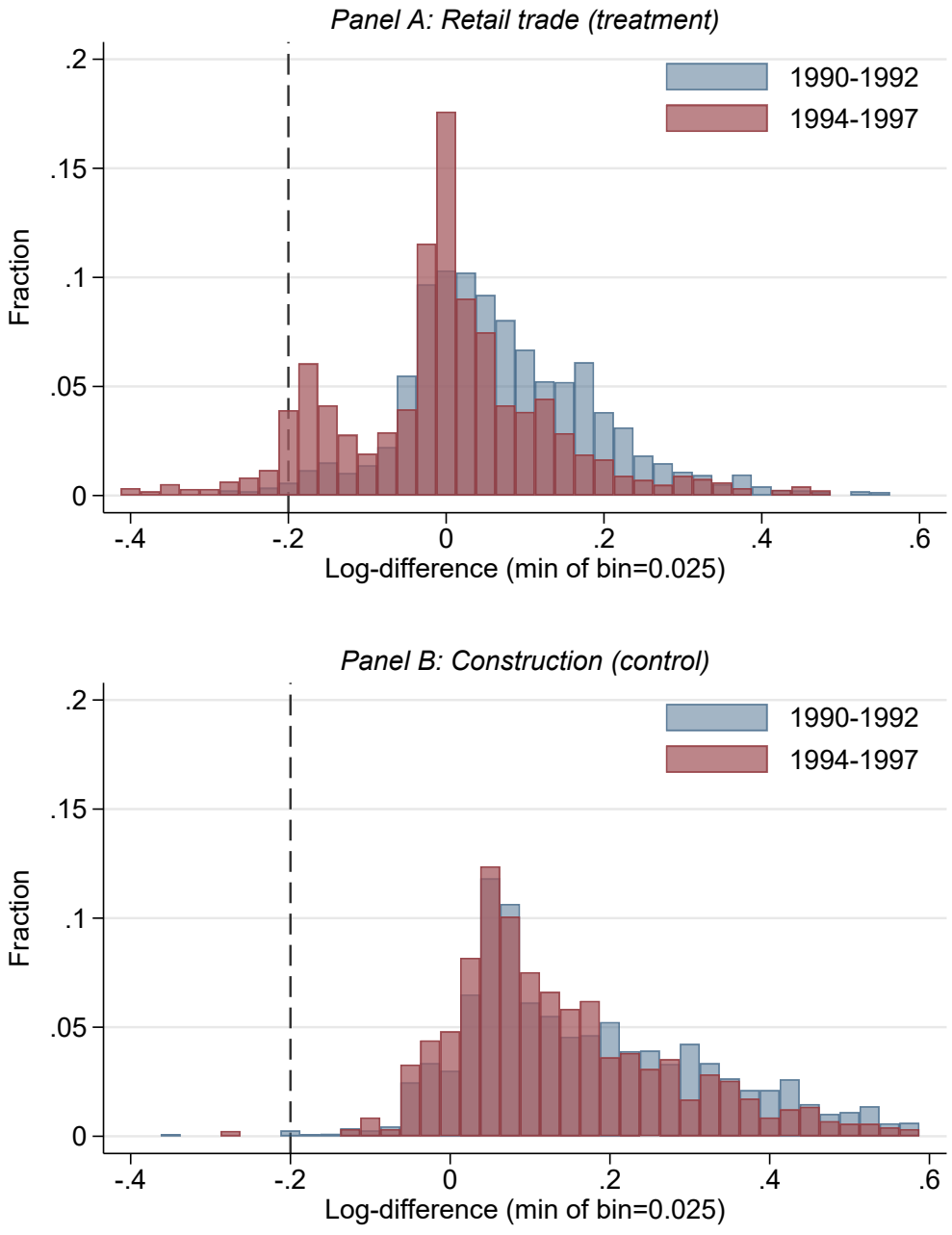
# Figures

**Figure 1:** Annual earnings in the treatment and control groups



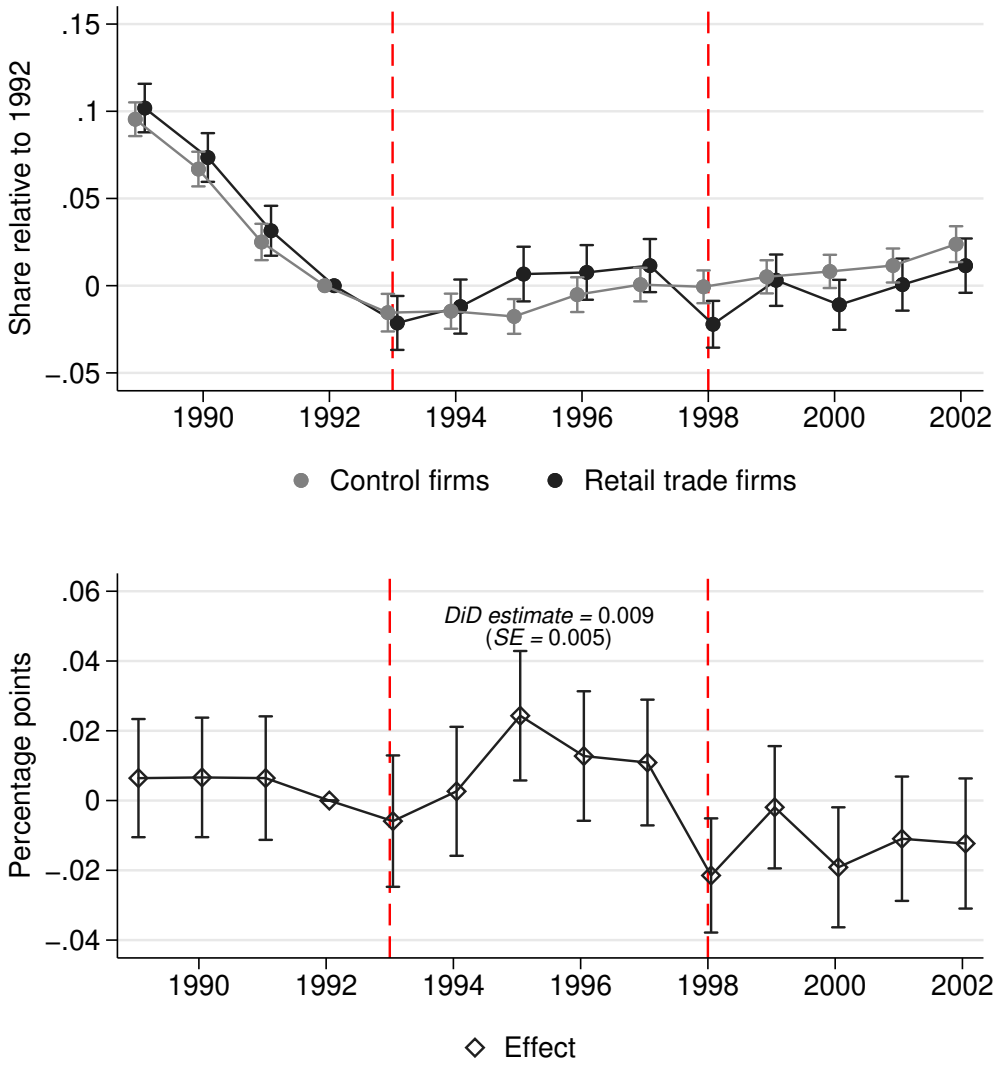

*Notes:* The graph shows the development of annual labor earnings in the treatment and control groups separately, and an event-study style difference between the groups over time. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The control group consists of individuals who meet the same criteria but work in different industries. For details on the control industries, see Table A1. The groups are matched using coarsened exact matching over the period 1989-1992. We match using years, age, time from graduation, highest degree, and earnings in the four pre-treatment cross-sections (1989-1992). We extend the weights to subsequent cross-sections (1993-2002) using industry codes, age, time from graduation, and highest degree. Standard errors are clustered at the establishment level. The earnings of individuals in the treatment industry fall behind of the control group during the subminimum wage policy.

**Figure 2:** Actual hourly wages relative to minimum wage in the treatment and control groups



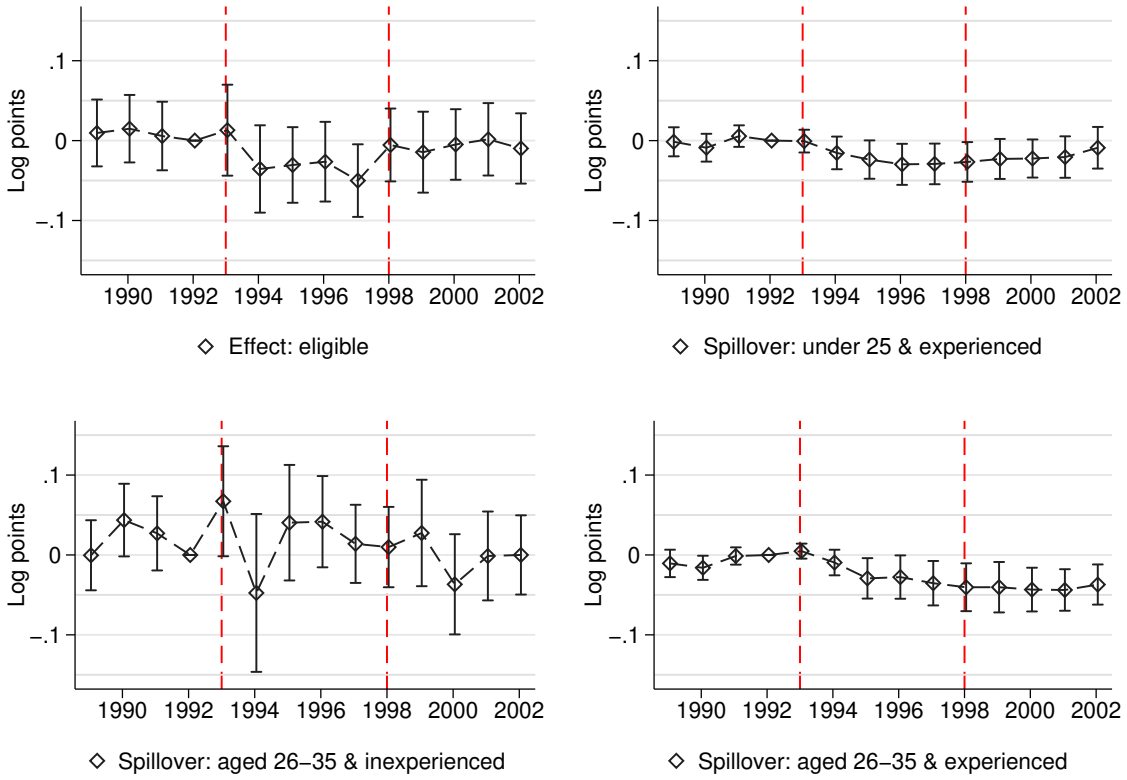

*Notes:* The graph shows the log difference between the paid hourly wage and minimum wage before and during the subminimum wage policy for the workers that meet the eligibility criteria (new hires under the age of 25 who have no prior experience in the industry they were hired in). Panel A shows the distributions in the retail trade (treatment) industry. Panel B shows the distributions for the construction industry, which is the largest industry in the control group. There is a large excess mass at the standard minimum wage and a smaller excess mass at the subminimum wage in the treatment industry during the subminimum wage policy.

**Figure 3:** Share of young inexperienced hires to all new hires in the treatment and control groups



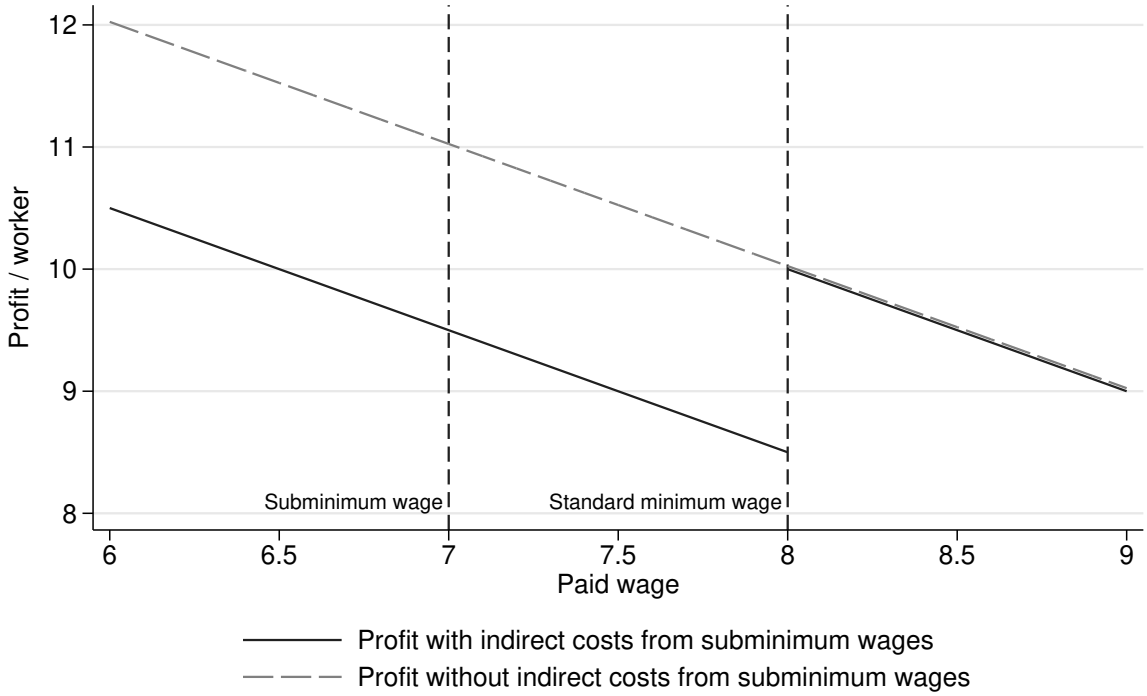

*Notes:* The graph shows the development of the share of those who meet the eligibility criteria (under 25 years old and no prior work experience from the industry) per all new workers in the treatment and control groups separately, and an event-study style difference between the groups over time. For details on the control industries, see Table A1. Standard errors are clustered at the establishment level. There is a slight increase in the share of young, inexperienced hires among all new hires in the treatment industry compared to the control group during the subminimum wage policy period.

**Figure 4:** Annual earnings in the treatment and spillover groups



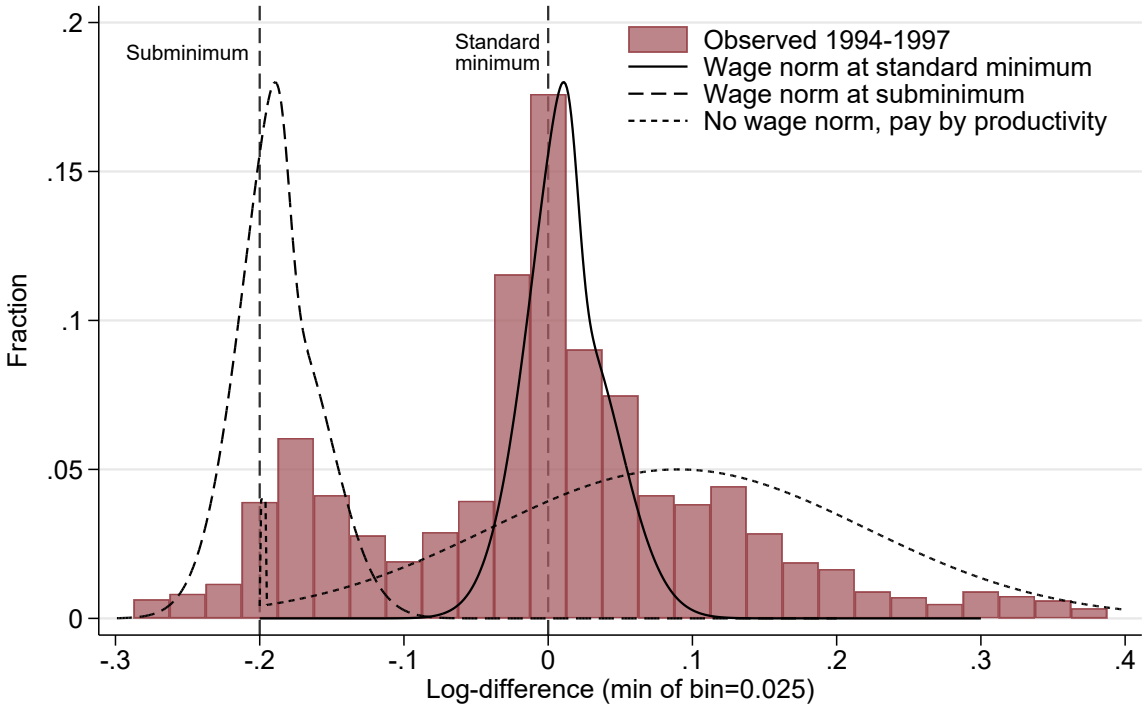

*Notes:* The graph shows the event-study style difference of annual labor earnings between the eligible and control groups, and spillover and control groups. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The three spillover groups consist of new hires, who are either too old or too experienced to be eligible. The control group consists of individuals who meet the same criteria, respectively for all four cases, but work in different industries. For details on the control industries, see Table A1. The groups are matched using coarsened exact matching over the period 1989-1992. We match using years, age, time from graduation, highest degree, and earnings in the four pre-treatment cross-sections (1989-1992). We extend the weights to subsequent cross-sections (1993-2002) using industry codes, age, time from graduation, and highest degree. Standard errors are clustered at the establishment level. The subminimum wage policy seemed to have no spillover effects.

**Figure 5:** Simulation of firm profits based on a simple conceptual framework



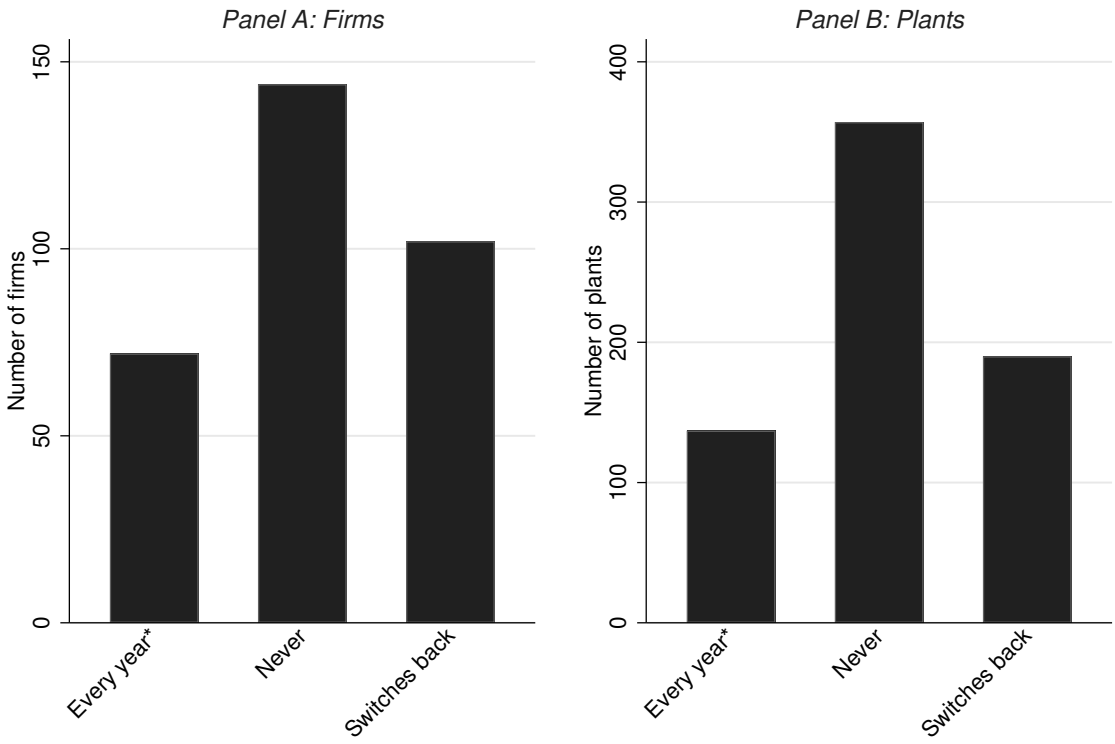

*Notes:* The graph shows profits per worker in two cases. First in dashed, with wage setting affecting only direct labor costs, equation (3). Second in solid, with wage setting affecting both direct labor costs and the expected duration of a newly-filled job, equation (3). In the simulations, $N$ is normalized to one, $f(N) = 20$, $h = 2$, and $c = 1.5$ when $w < 8$ (the minimum wage). The graph illustrates that, in a simple conceptual framework, firms' profits depend on whether there are indirect costs from subminimum wages.

**Figure 6:** Hypothetical effect of the subminimum wage policy on wage distribution



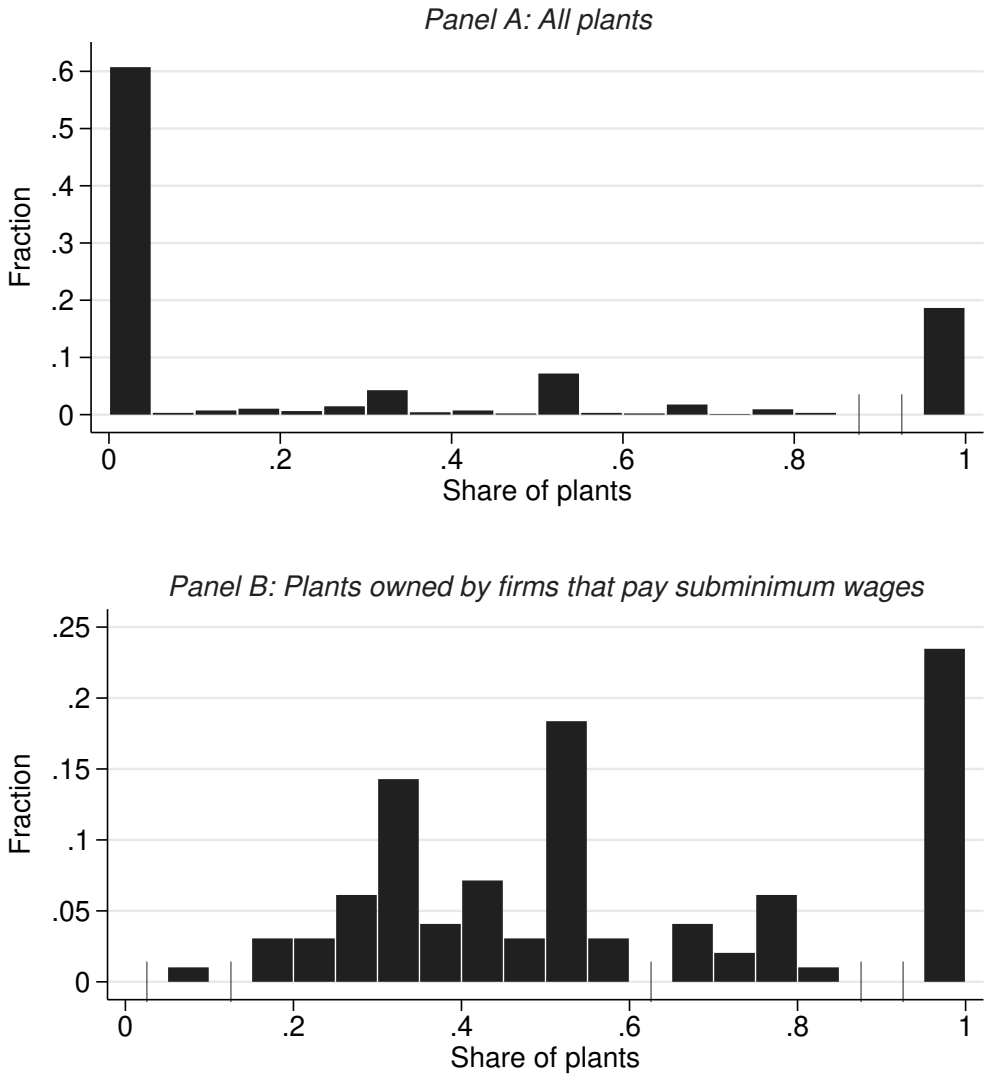

*Notes:* The observed wage distribution during the years of the subminimum wage policy (red bars of Panel A in Figure 2) is contrasted with two hypothetical scenarios of wage norms. First, in solid, the wage norm is at the standard minimum wage. Second, in dashed, the wage norm moves with the introduction of a subminimum wage. The graph illustrates how wage norms may relate to the shape of the wage distribution.

**Figure 7:** Number of firms and plants by how they pay subminimum wages



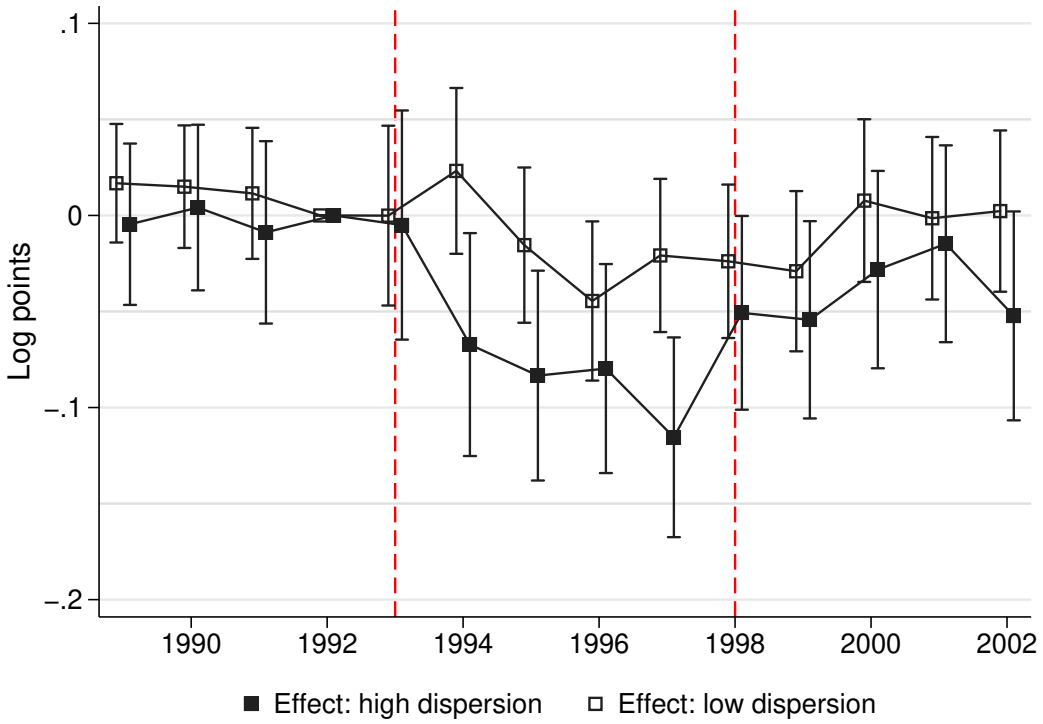

*Notes:* The graph shows the number of firms and locations of business, or plants, that paid subminimum wages every year after adopting the policy for the first time, that never paid subminimum wages and that experimented with paying subminimum wages but returned back to paying standard minimum wages or higher to eligible individuals. We define a subminimum wage as wage at least 10% below the standard minimum wage. The analysis covers firms and plants that hired eligible individuals in at least two years during the subminimum wage policy experiment. We also exclude firms and plants that paid subminimum wages in the last year they hired an eligible individual during the policy was in place meaning that they had a chance to experiment and switch back. A majority of firms and establishments who paid subminimum wages subsequently reverted back to paying only standard minimum wages.

**Figure 8:** Share of plants that paid subminimum wages over the years 1994–1997



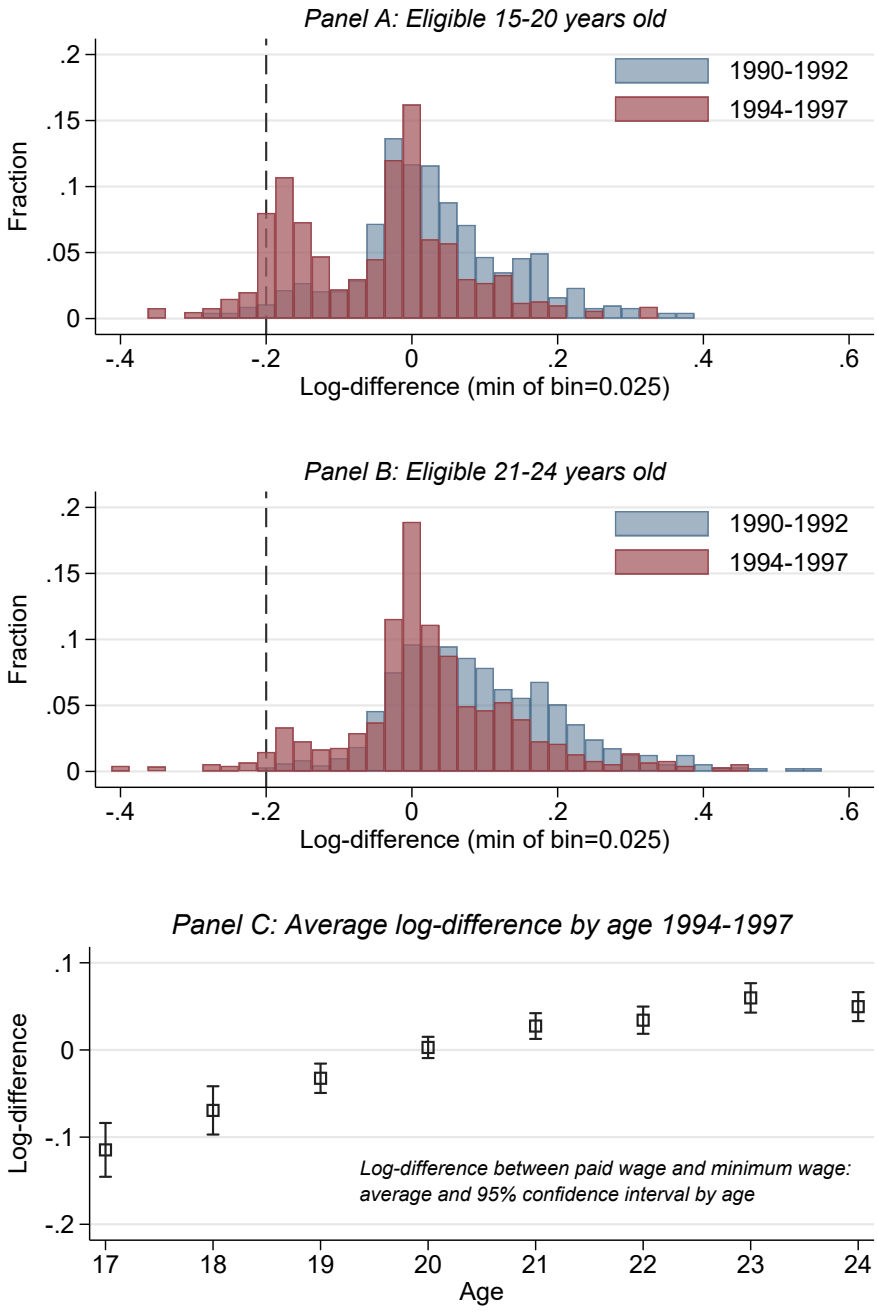

*Notes:* The graph shows the share of locations of business, or plants, that paid subminimum wages over the period 1994–1997. We define a subminimum wage as wage at least 10% below the standard minimum wage. The top panel shows the shares among all firms, whereas the bottom panel is restricted to plants owned by firms that paid subminimum wages. Less than a quarter of the multi-establishments firms that paid subminimum wages are such that all of the establishments paid subminimum wages.

**Figure 9:** Differences of log earnings between the treatment and control groups, firms divided into two groups by the dispersion of earnings among all new hires before the subminimum wage experiment took place



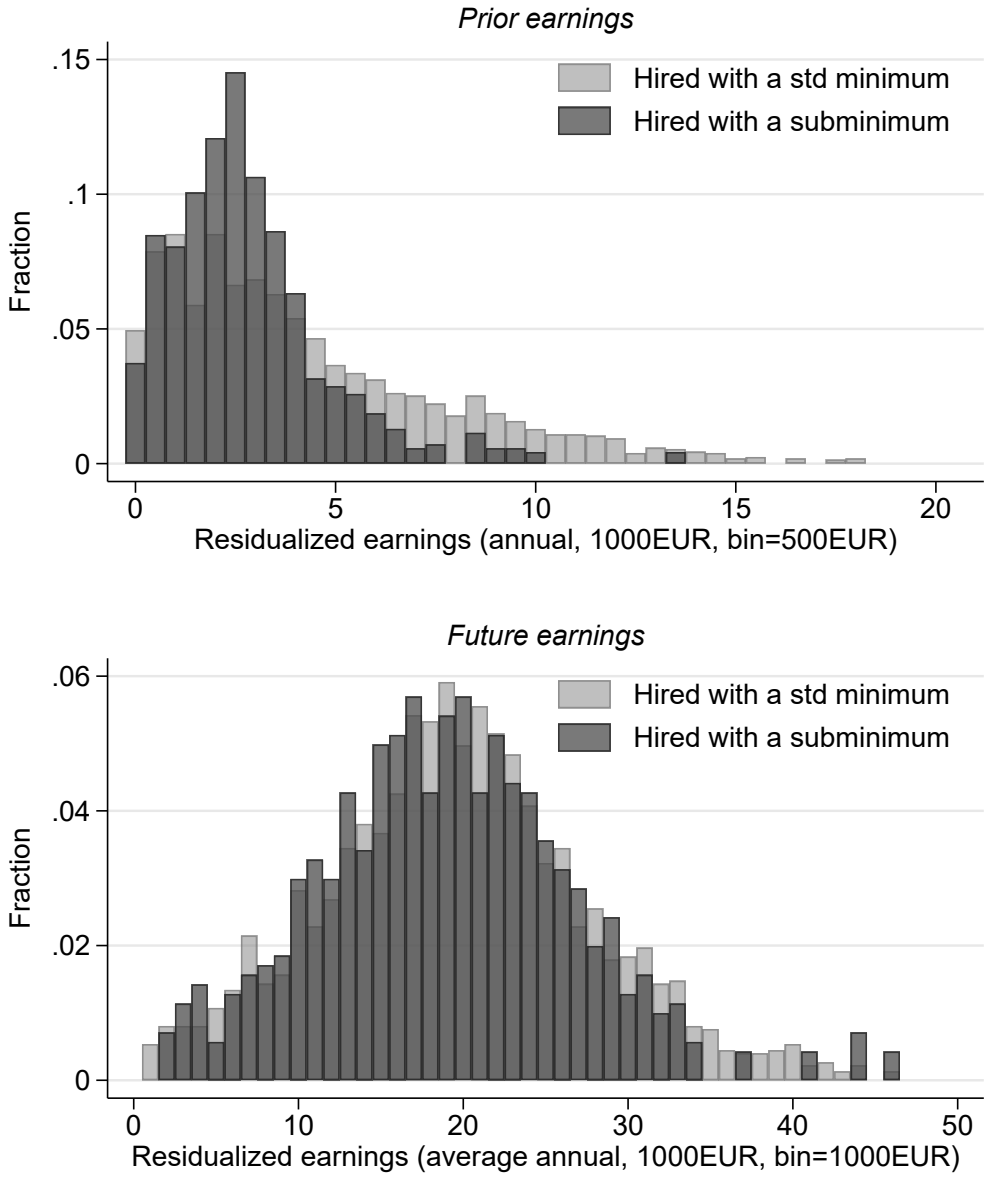

*Notes:* Dispersion is defined as the within-firm standard deviation of annual labor earnings in logs between 1989 and 1992. The sample is split in half in terms of the number of individuals within treatment and control groups separately. In the retail trade (treatment) sector, the cut-off between high and low income dispersion is 0.37 log points. In the control group, the cut-off is 0.41. The graph shows the event-study style difference of log earnings between the treatment and control groups over time. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The control group consists of individuals who meet the same criteria but work in different industries. For details on the control industries, see Table A1. The groups are matched using coarsened exact matching over the period 1989-1992. We match using years, age, time from graduation, highest degree, and earnings in the four pre-treatment cross-sections (1989-1992). We extend the weights to subsequent cross-sections (1993-2002) using industry codes, age, time from graduation, and highest degree. Standard errors are clustered at the establishment level. The effect of the subminimum wage policy on earnings is larger in firms where the dispersion of earnings among all new hires (before the subminimum wage experiment took place) was large.

**Figure 10:** Wage distributions divided by age of new hires and actual hourly wages relative to minimum wage by age




*Notes:* Panel A shows the wage distribution relative to the standard minimum wage among 15-20 years old new hires and panel B shows the same for 21-24 years old new hires. Panel C shows the log difference between the paid hourly wage and minimum wage before and during the subminimum wage policy for the eligible individuals divided into two groups by age, and the average log difference by age. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The excess mass at the subminimum wage is larger for workers aged 15-20 than those aged 21-24.

**Figure 11:** Earnings before and after being hired with subminimum or standard minimum wage




*Notes:* Prior earnings are the annual earnings in the year before being hired in the retail trade sector as an individual eligible for the subminimum wage. Future earnings are calculated over the 18 years following the year when eligible for the subminimum. Both earnings are residualized with gender, and year and age (when eligible) fixed effects. Individuals are defined as hired with a standard minimum wage if their actual wage was between -5 and 10% of the standard minimum wage, and as hired with a subminimum wage if their actual wage was between -30 and -10% of the standard minimum wage. The prior or future earnings of the young inexperienced workers hired with a subminimum wage or a standard minimum wage are similar.

# Tables

**Table 1:** Descriptive statistics: sample means

| | Before matching | | After matching | | Data on hourly wages | |
|---|---|---|---|---|---|---|
| | Treatment | Control | Treatment | Control | Treatment | Control |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Panel A: individuals, 1989–1992 | | | | | | |
| Observations | 25,869 | 48,161 | 14,924 | 28,428 | 4,243 | 6,558 |
| Age | 20.0 | 21.1 | 21.2 | 21.4 | 20.4 | 21.2 |
| Female | 0.63 | 0.30 | 0.63 | 0.28 | 0.70 | 0.29 |
| Education: secondary or higher | 0.52 | 0.64 | 0.68 | 0.69 | 0.60 | 0.68 |
| Education: bachelor or higher | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annual earnings | 7,515 | 9,912 | 10,338 | 11,650 | 9,088 | 11,210 |
| Hourly wage | | | | | 5.8 | 6.5 |
| Panel B: individuals, 1994–1997 | | | | | | |
| Observations | 11,711 | 27,208 | 5,408 | 12,669 | 3,434 | 6,481 |
| Age | 20.8 | 21.3 | 21.7 | 21.7 | 20.7 | 21.4 |
| Female | 0.61 | 0.28 | 0.61 | 0.27 | 0.66 | 0.27 |
| Education: secondary or higher | 0.72 | 0.75 | 0.83 | 0.80 | 0.74 | 0.80 |
| Education: bachelor or higher | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 |
| Annual earnings | 7,432 | 9,540 | 10,781 | 12,311 | 8,090 | 10,872 |
| Hourly wage | | | | | 6.3 | 7.2 |
| Panel C: firms, 1989–1992 | | | | | | |
| Observations | 9,946 | 14,252 | 6,888 | 11,522 | 1,298 | 1,532 |
| Number of all employees | 32.2 | 45.0 | 41.8 | 52.5 | 130.4 | 186.7 |
| Number of new employees | 6.0 | 10.3 | 8.1 | 12.2 | 19.3 | 30.8 |
| Number of young inexp. new hires (eligible) | 1.6 | 2.0 | 2.3 | 2.5 | 4.0 | 4.8 |
| Eligible / all employees | 0.18 | 0.19 | 0.25 | 0.23 | 0.10 | 0.08 |
| Eligible / new employees | 0.51 | 0.45 | 0.61 | 0.51 | 0.41 | 0.32 |
| Revenue (EUR) | 1,451,519 | 2,405,968 | 1,602,392 | 2,720,629 | 3,664,658 | 8,520,864 |
| Median log annual income of all employees | 9.20 | 9.46 | 9.30 | 9.54 | 9.37 | 9.72 |
| Median log annual income of new employees | 9.27 | 9.42 | 9.25 | 9.41 | 9.33 | 9.54 |
| Median log annual income of young inexp. new hires | 9.18 | 9.29 | 9.19 | 9.29 | 9.24 | 9.35 |
| Share of permanent employees | 0.58 | 0.54 | 0.58 | 0.54 | 0.65 | 0.65 |
| Panel D: firms, 1994–1997 | | | | | | |
| Observations | 5,561 | 9,636 | 2,922 | 6,263 | 997 | 1,236 |
| Number of all employees | 40.5 | 49.6 | 67.0 | 69.4 | 162.5 | 248.3 |
| Number of new employees | 6.1 | 9.3 | 10.5 | 13.3 | 19.3 | 39.3 |
| Number of young inexp. new hires (eligible) | 1.1 | 1.4 | 2.0 | 2.1 | 2.9 | 4.5 |
| Eligible / all employees | 0.12 | 0.14 | 0.22 | 0.22 | 0.06 | 0.06 |
| Eligible / new employees | 0.47 | 0.41 | 0.63 | 0.52 | 0.34 | 0.26 |
| Revenue (EUR) | 2,334,721 | 2,850,743 | 2,954,247 | 3,792,004 | 5,514,808 | 12,700,356 |
| Median log annual income of all employees | 9.24 | 9.39 | 9.39 | 9.54 | 9.47 | 9.78 |
| Median log annual income of new employees | 9.33 | 9.46 | 9.31 | 9.44 | 9.36 | 9.55 |
| Median log annual income of young inexp. new hires | 9.23 | 9.33 | 9.23 | 9.33 | 9.24 | 9.38 |
| Share of permanent employees | 0.60 | 0.52 | 0.61 | 0.53 | 0.69 | 0.67 |

*Notes:* The table shows the mean values for each variable in the treatment (retail trade) and control groups before and after implementing the matching procedure, and in the sample for which we have data on hourly wages. Panels A and B, respectively, show individual-level statistics before (1989–1992) and during (1994–1997) the subminimum wage policy. Similarly, Panels C and D show the statistics for the firm population.

**Table 2:** Difference-in-differences regression on the effect of subminimum wage policy on earnings, accounting for four firm characteristics

| | *Dependent variable: Log earnings* | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| DiD | -0.041*** | -0.054*** | 0.483*** | -0.012 | -0.025 | 0.008 | 0.467*** |
| | (0.007) | (0.009) | (0.106) | (0.021) | (0.046) | (0.068) | (0.134) |
| DiD * Earnings dispersion | | | -0.631*** | | | | -0.519*** |
| | | | (0.128) | | | | (0.132) |
| DiD * Number of employees | | | | -0.076** | | | -0.043 |
| | | | | (0.037) | | | (0.047) |
| DiD * Productivity | | | | | -0.046 | | -0.063 |
| | | | | | (0.069) | | (0.094) |
| DiD * Indebtedness | | | | | | -0.132 | -0.028 |
| | | | | | | (0.157) | (0.141) |
| Treat | -0.074*** | -0.073*** | -0.071*** | -0.073*** | -0.072*** | -0.073*** | -0.060*** |
| | (0.005) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.005) |
| After | 0.167*** | 0.173*** | -0.604*** | 0.137*** | 0.149*** | 0.082 | -0.670*** |
| | (0.007) | (0.009) | (0.129) | (0.020) | (0.051) | (0.096) | (0.160) |
| Constant | 8.802*** | 8.781*** | 8.686*** | 8.767*** | 8.761*** | 8.747*** | 8.631*** |
| | (0.029) | (0.039) | (0.071) | (0.040) | (0.045) | (0.041) | (0.086) |
| Observations | 60,366 | 38,443 | 38,443 | 38,443 | 38,443 | 38,443 | 38,443 |
| R-squared | 0.195 | 0.198 | 0.202 | 0.201 | 0.198 | 0.199 | 0.207 |

*Notes:* Models are based on equation (2). *After* corresponds to 1994-1997 meaning that the full reform years are evaluated. The groups are matched using coarsened exact matching over the period 1989-1992. We match using years, age, time from graduation, highest degree, and earnings in the four pre-treatment cross-sections (1989-1992). We extend the weights to subsequent cross-sections (1993-2002) using industry codes, age, time from graduation, and highest degree. Standard errors are clustered at the establishment level. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Year, age and education fixed effects are included. All firm characteristics are scaled to have a minimum 0 and maximum 1. Earnings dispersion is defined as the within-firm standard deviation of annual labor earnings in logs between 1989 and 1992. Similarly, the total number of employees and productivity (total revenue divided by the total number of employees) is calculated as an average over the years 1989–1992. Data on indebtedness, measured as the relative debt-to-equity ratio, is calculated using the years 1994–1997 (detailed data on firms' balance sheets starts in 1994).

**Table 3:** Receiving the subminimum wage: The relative importance of various individual level characteristics

| Total $R^2$ of the model = 0.6148 | | | |
|---|---|---|---|
| Predictor | Dominance statistic (partial $R^2$) | Standardized dominance statistic (share of total $R^2$) | Ranking |
| Age FE | 0.0575 | 0.0935 | 2 |
| Female | 0.0003 | 0.0005 | 12 |
| Nationality FE | 0.0020 | 0.0032 | 8 |
| Language FE | 0.0016 | 0.0026 | 9 |
| Location FE | 0.0512 | 0.0832 | 3 |
| Education FE | 0.0471 | 0.0767 | 4 |
| Annual earnings | 0.0181 | 0.0294 | 5 |
| Number of work spells | 0.0051 | 0.0083 | 7 |
| Number of unemployment spells | 0.0012 | 0.0020 | 10 |
| Establishment size | 0.0010 | 0.0017 | 11 |
| Establishment FE | 0.4190 | 0.6815 | 1 |
| Year FE | 0.0107 | 0.0174 | 6 |

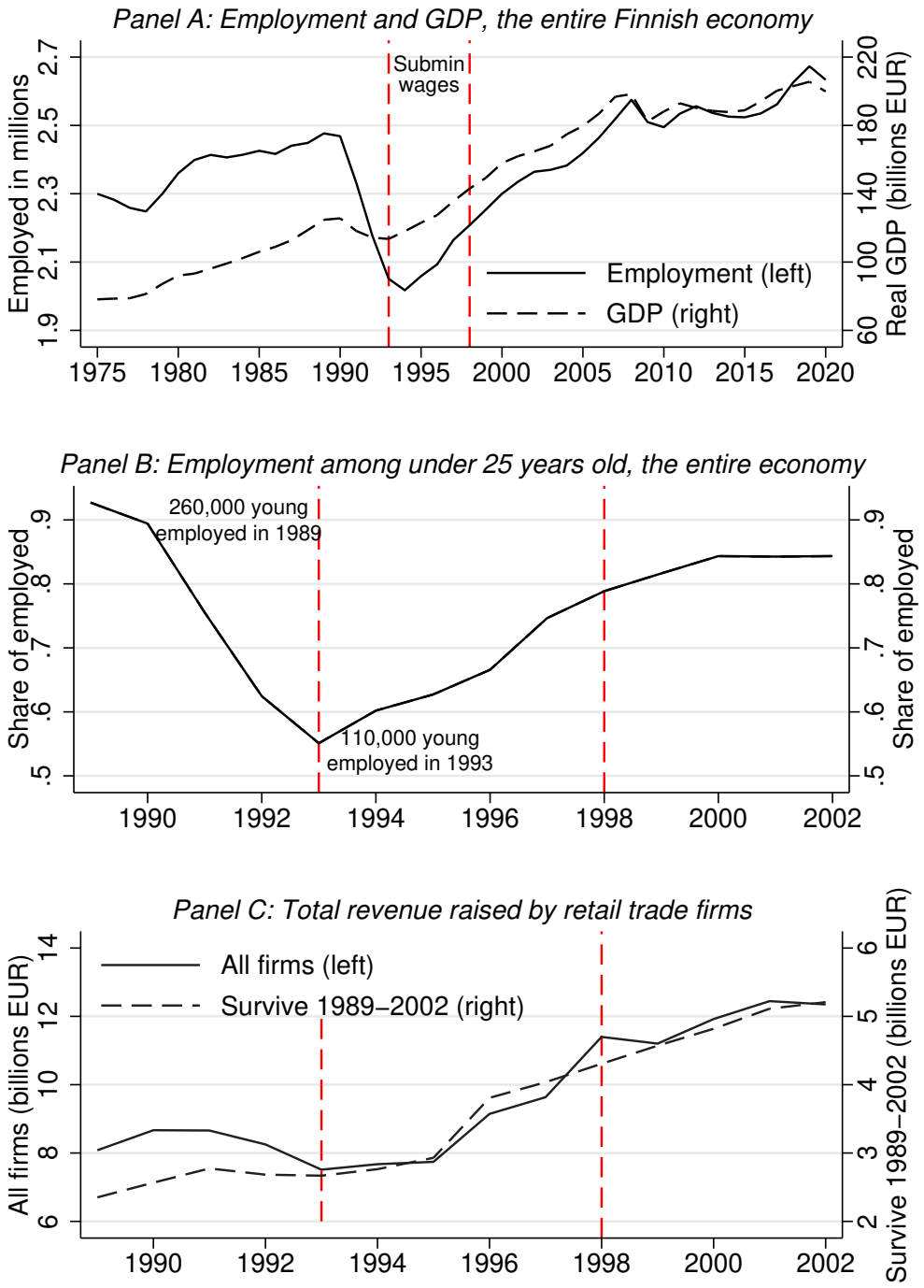
*Notes:* Table presents the estimates of the proportion of the variance of the probability of receiving the subminimum wage that is explained by each predictor, estimated following the methods by Azen and Budescu (2003). The estimates are based on a sample of those individuals who were eligible for the subminimum in the retail trade sector in 1993-1998. Dependent variable receives a value of 1 if an individual received a wage that was 10-30% lower than the standard minimum and 0 if they got a wage that was higher than 0.9 $\times$ the standard minimum. Out of the predictors, age and gender are self-explanatory. Nationality refers to Finnish nationality or the nationality one has when migrating to Finland, language to the mother tongue, location to the municipality where individual lived one prior to being eligible for the subminimum ($t-1$), education to the 3-digit code of the highest degree at $t-1$ and annual earnings to the total labor earnings at $t-1$. Number of work and unemployment spells are also measured at $t-1$. The results are based on 4095 regressions including each predictor individually, all of them together, and every combination between them, which are used to compare the contribution of each predictor to the total $R^2$ of the full model. The ranking variable ranks the relevance of each predictor by their share of the total $R^2$.

# Appendix

**Figure A1:** An illustration of the subminimum wage policy

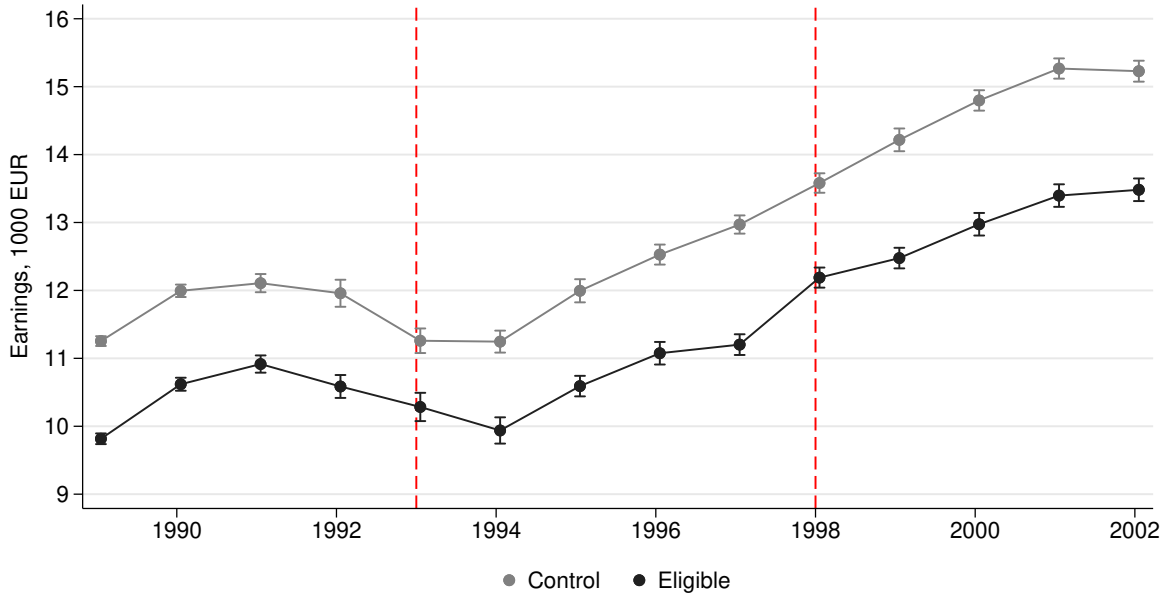

*Notes:* The solid line describes the development of the statutory minimum wage over time in euros in the Helsinki metropolitan area. The dashed line indicates the extent to which the lowest possible wages were affected by the subminimum wage policy experiment, which was set at 80% of the standard minimum wage. The calculations are based on collectively agreed wages.

**Figure A2:** Employment, GDP and firm revenues in Finland



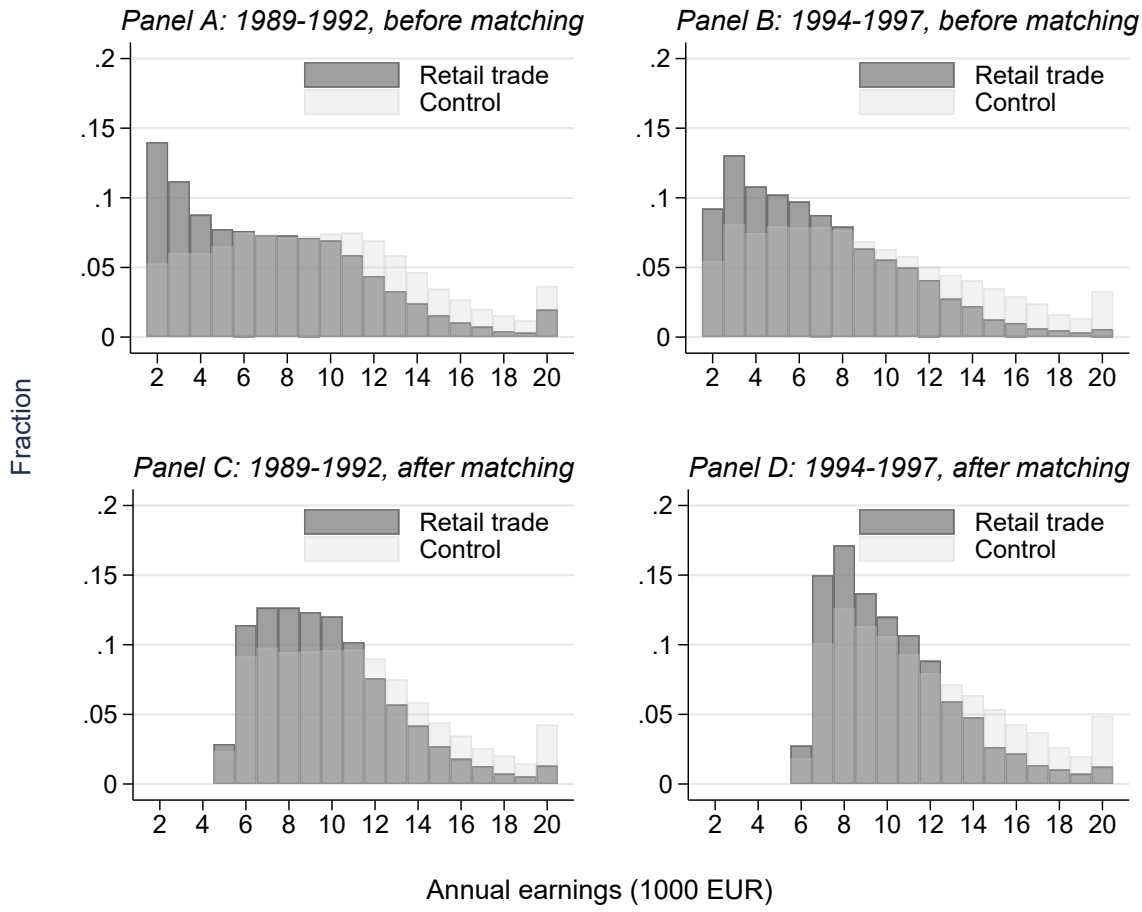

*Notes:* Share of employed among 19–24 year olds is defined as (Employed)/(Employed + Unemployed). The figure shows that GDP, employment and the revenue of retail trade firms plummeted during the recession.

**Figure A3:** Average annual labor earnings in euros in the retail trade and control industries



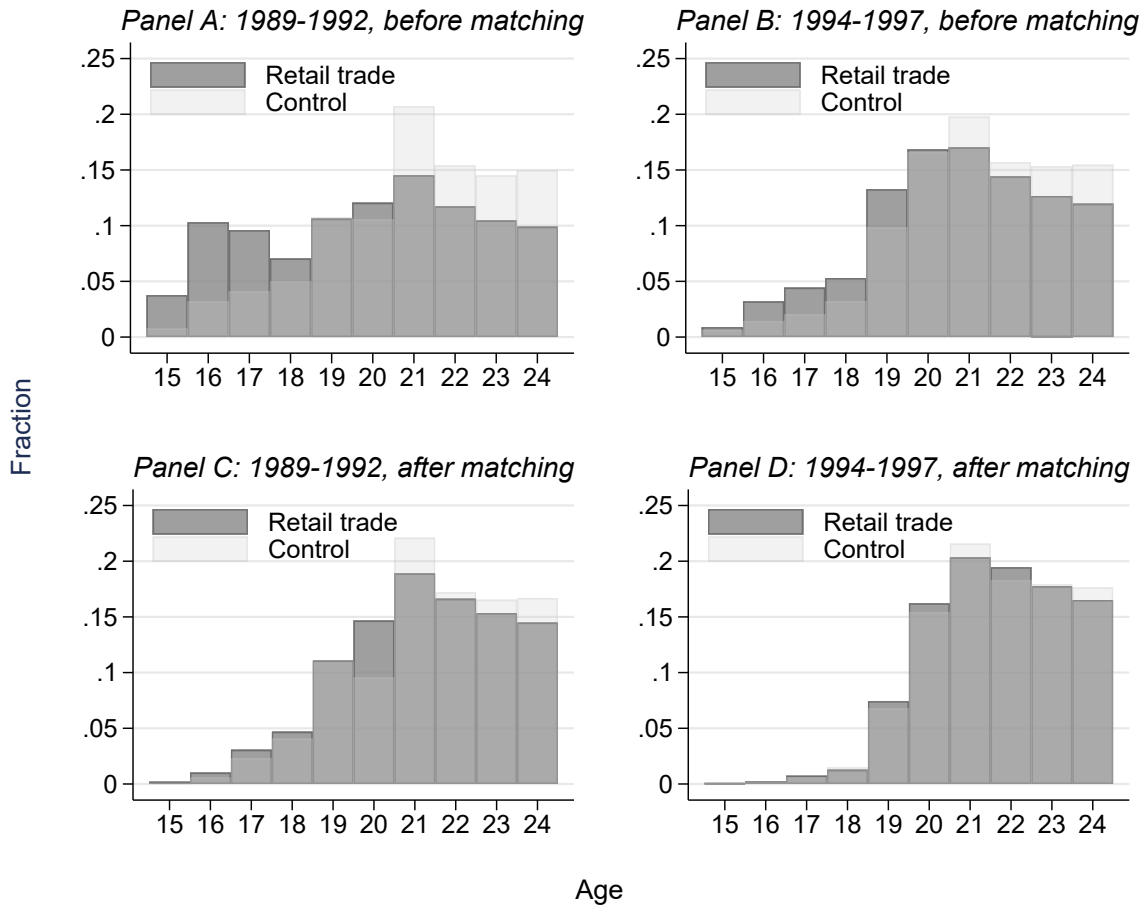

*Notes:* The graph shows the development of average annual labor earnings by year in the treatment and control groups separately. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The control group consists of individuals who meet the same criteria but work in different industries. For details on the control industries, see Table A1.

**Figure A4:** Earnings in the retail trade and control industries before and after matching



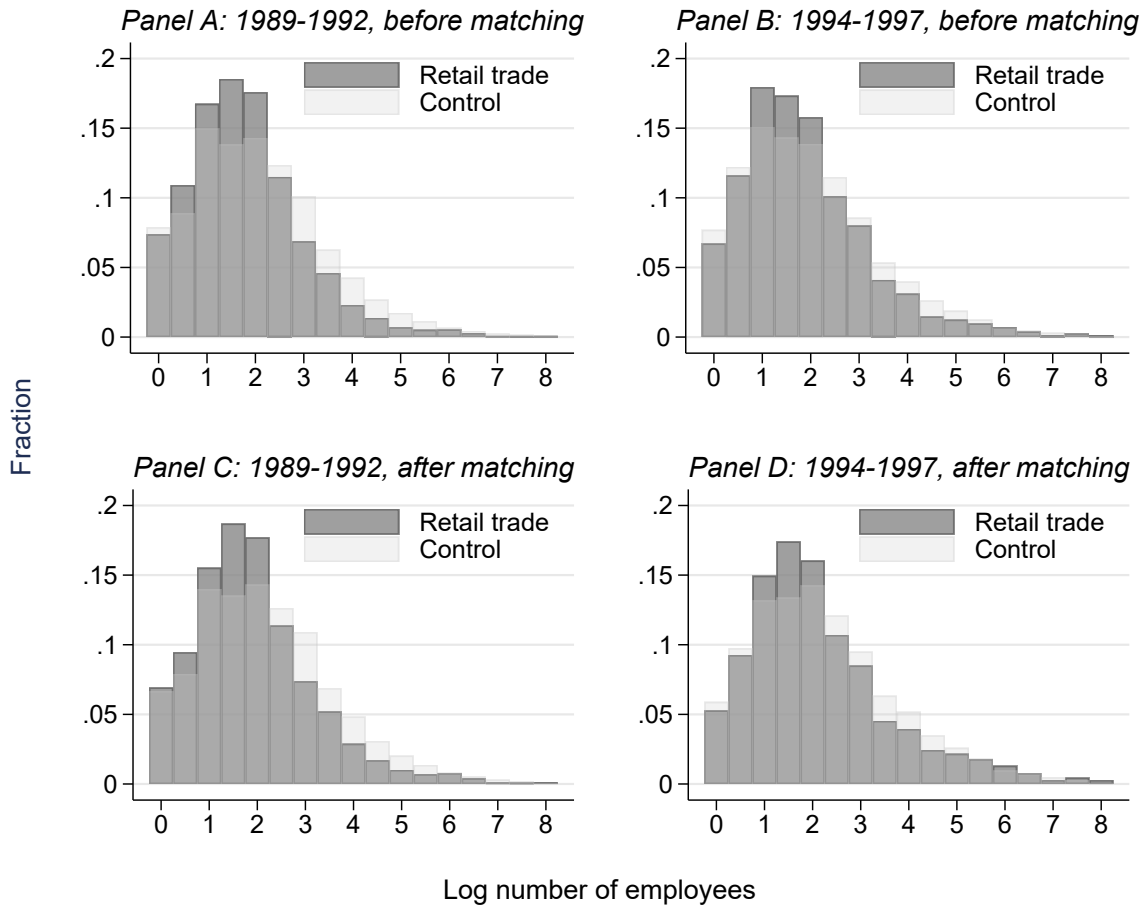

*Notes:* The figure shows the distribution of annual earnings in the treatment (retail trade) and control groups before and after implementing the matching procedure.

**Figure A5:** Age in the retail trade and control industries before and after matching



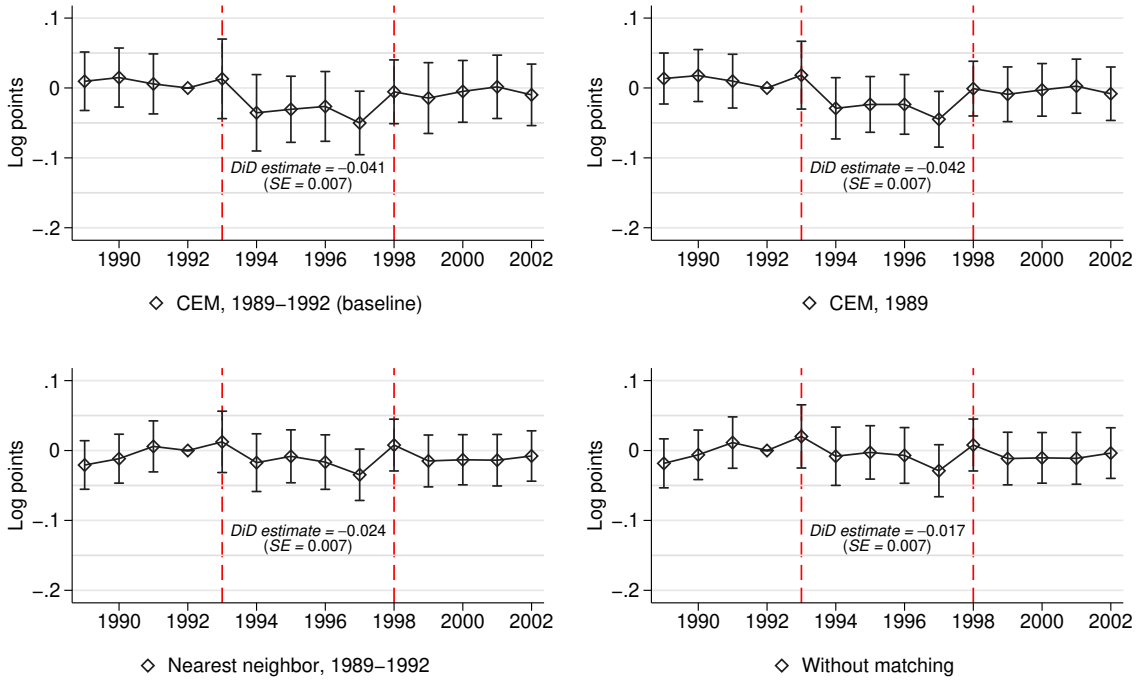

*Notes:* The figure shows the distribution of age in the treatment (retail trade) and control groups before and after implementing the matching procedure.

**Figure A6:** Firm size in the retail trade and control industries before and after matching



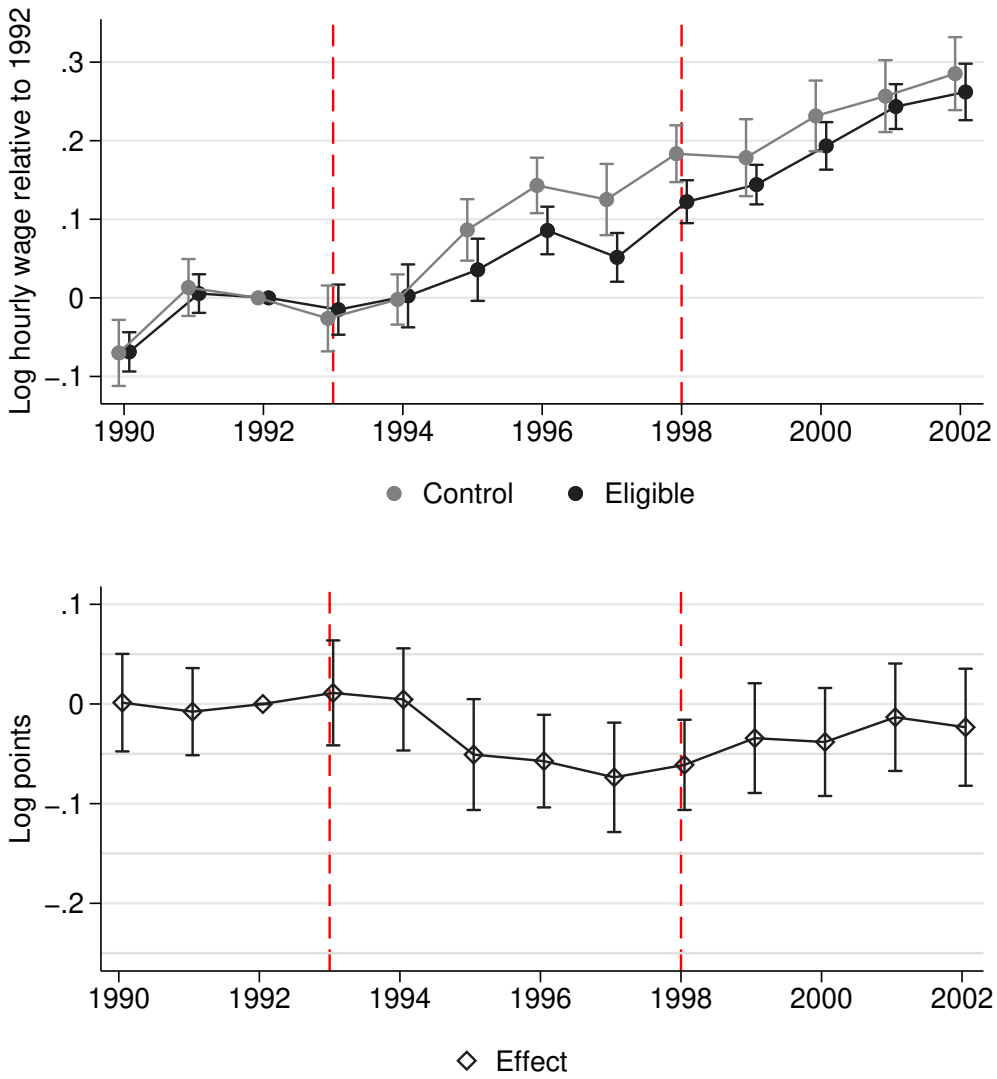

*Notes:* The figure shows the distribution of log number of employees in the treatment (retail trade) and control groups before and after implementing the matching procedure.

**Figure A7:** Annual earnings in the treatment and control groups using different matching approaches



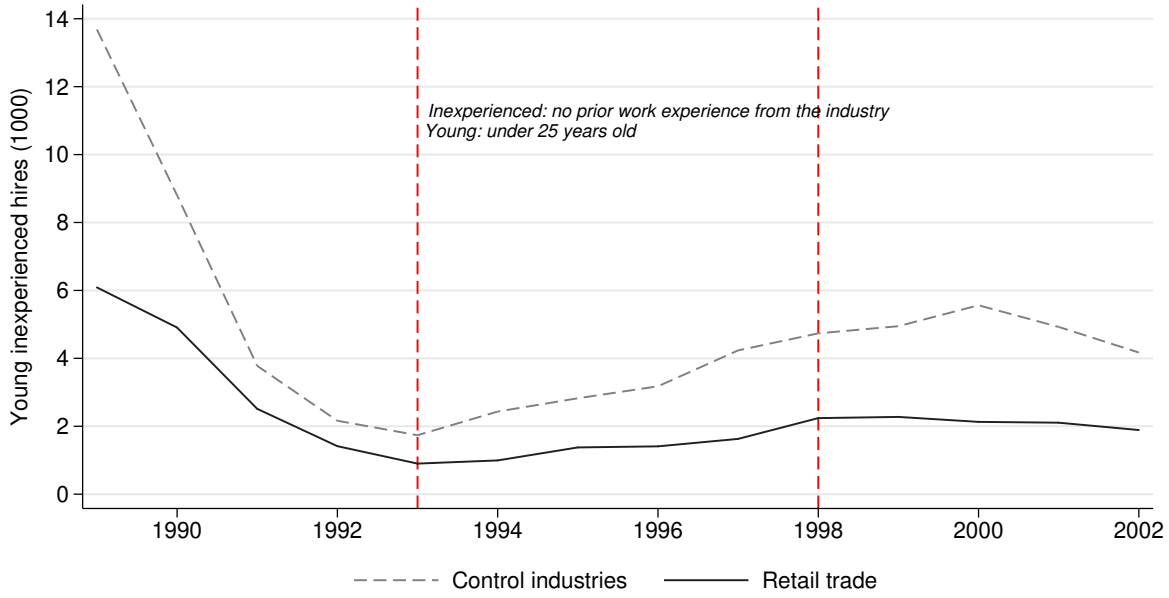

*Notes:* The graph shows the event-study style difference of annual labor earnings between the eligible and control groups using different matching approaches. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The control group consists of individuals who meet the same criteria but work in different industries. For details on the control industries, see Table A1. In the top-left panel, the groups are matched using coarsened exact matching over the period 1989-1992. In the top-right panel, coarsened exact matching is implemented using 1989 only. The bottom-left panel shows results with nearest neighbor matching. The bottom-right panel shows results without any matching. Standard errors are clustered at the establishment level. In all matching specifications, we use years (if 1989-1992), age, time from graduation, highest degree, and earnings based on pre-treatment data. We extend the weights to subsequent cross-sections (1993-2002) using industry codes, age, time from graduation, and highest degree.

**Figure A8:** Hourly wages in the treatment and control groups



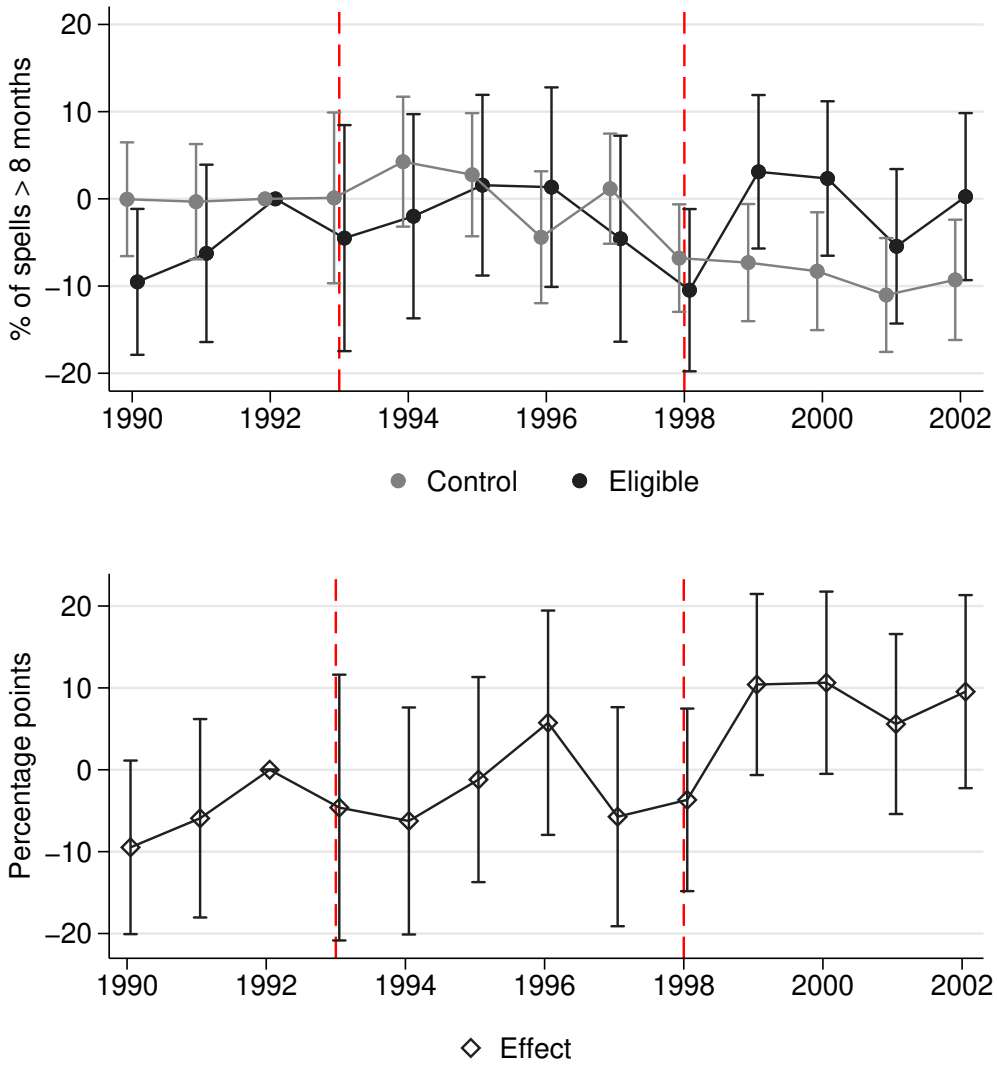

*Notes:* The graph shows the development of hourly wages in the treatment and control groups separately, and an event-study style difference between the groups over time. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The control group consists of individuals who meet the same criteria but work in different industries. For details on the control industries, see Table A1. The groups are matched using coarsened exact matching over the period 1990-1992. We match using years, age, time from graduation, highest degree, and earnings in the four pre-treatment cross-sections (1989-1992). We extend the weights to subsequent cross-sections (1993-2002) using industry codes, age, time from graduation, and highest degree. Standard errors are clustered at the establishment level.

**Figure A9:** Number of young inexperienced hires in the retail trade and control industries



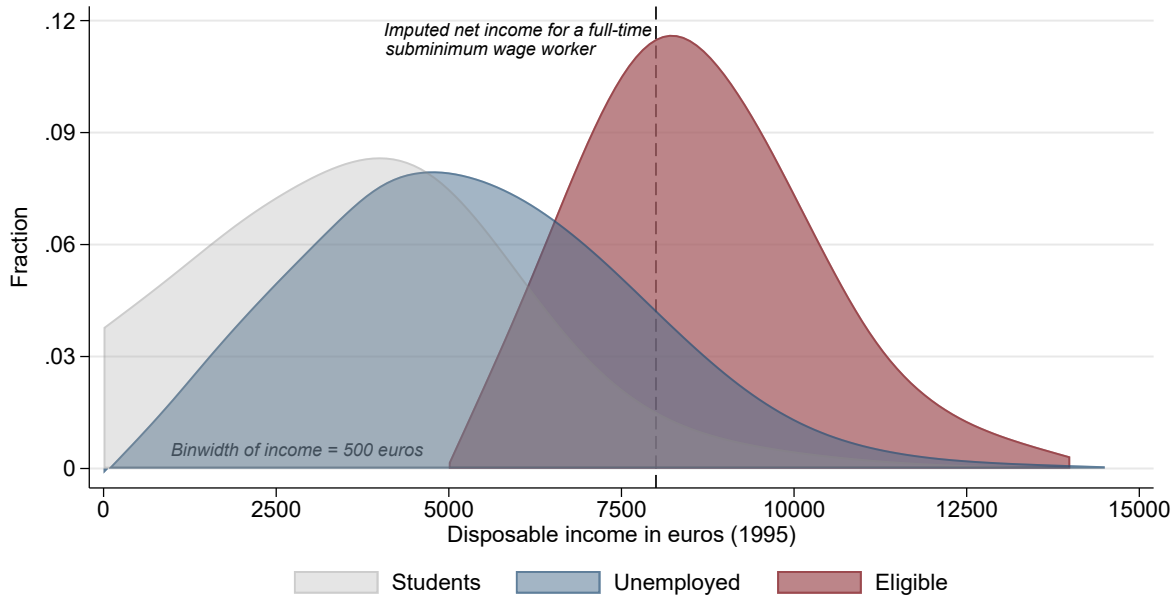

*Notes:* The graph shows the number of individuals by year in the treatment and control groups separately. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The control group consists of individuals who meet the same criteria but work in different industries. For details on the control industries, see Table A1.

**Figure A10:** Share of employment spells longer than 8 months in the treatment and control groups



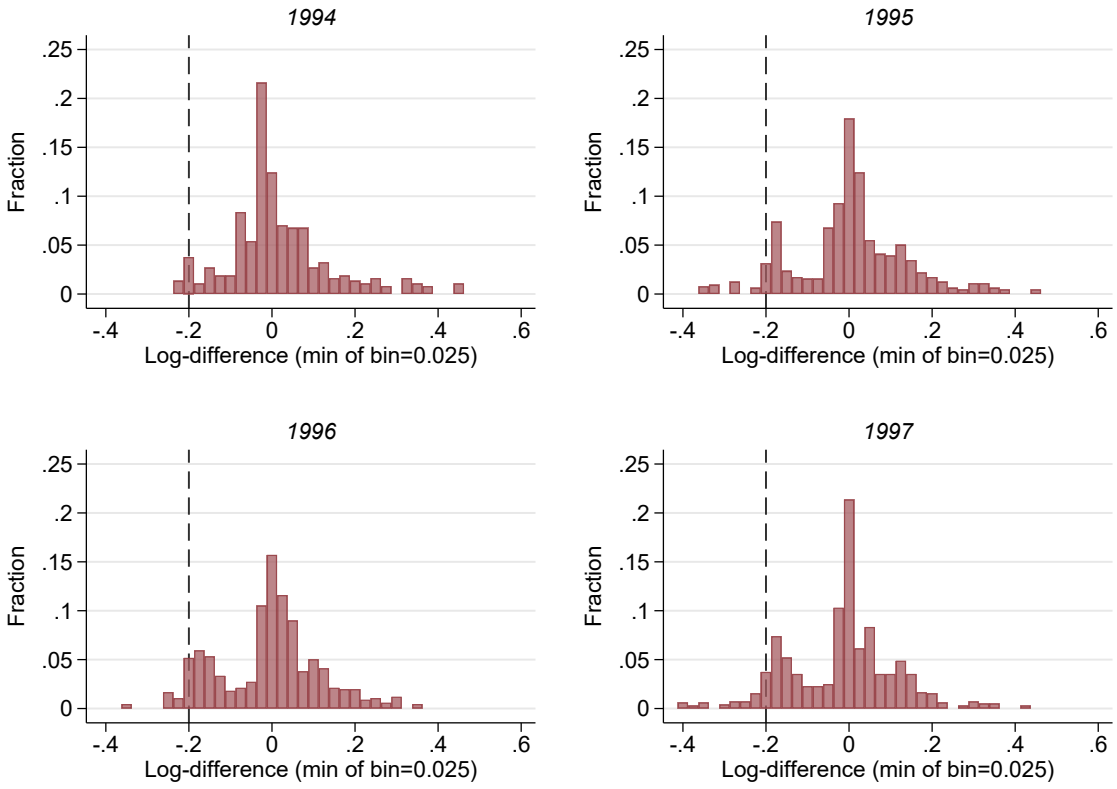

*Notes:* The graph shows the development of the share of employment spells longer than eight months in the treatment and control groups separately, and an event-study style difference between the groups over time. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry. The control group consists of individuals who meet the same criteria but work in different industries. For details on the control industries, see Table A1. Retail trade firms were allowed to pay subminimum wages for eligible individuals for the first eight months of the employment spell. In 1992, 32% of the employment spells of young inexperienced new hires lasted longer than eight months in retail trade. In the control industries, the corresponding share was 55%. The groups are matched using coarsened exact matching over the period 1989-1992. We match using years, age, time from graduation, highest degree, and earnings in the four pre-treatment cross-sections (1989-1992). We extend the weights to subsequent cross-sections (1993-2002) using industry codes, age, time from graduation, and highest degree. Standard errors are clustered at the establishment level. We find no evidence that the subminimum wage policy affected the length of employment spells.

**Figure A11:** Disposable income among eligible, young unemployed and students in 1995



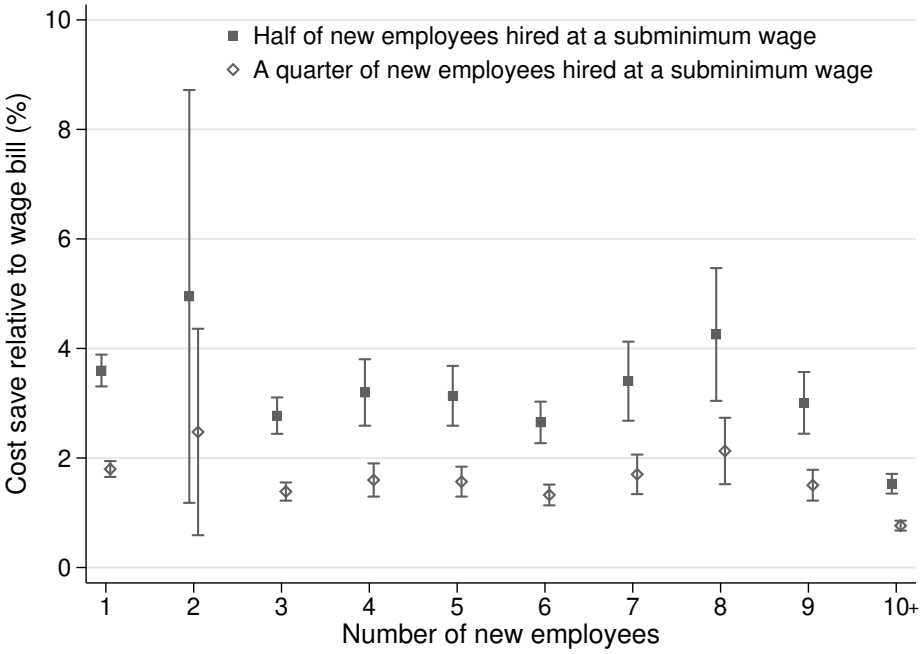

*Notes:* Eligible individuals are under 25 years old new hires who worked in retail trade and had no prior experience from the industry. Imputed net income is calculated using a 30% tax rate and assuming that the individuals would receive no benefits. Individuals are classified as unemployed, if they were out of job more than 183 days a year, and as students, if they were registered as students and had completed a secondary degree. Unemployed and students are under 25 years old. The graph illustrates that individuals had incentives to work at the subminimum wage relative to being students or unemployed.

**Figure A12:** Actual hourly wages relative to minimum wage in the treatment group by year




*Notes:* The graph shows the log difference between the paid hourly wage and minimum wage before and during the subminimum wage policy for the workers that meet the eligibility criteria (new hires under the age of 25 who have no prior experience in the industry they were hired in), year by year. The use of the subminimum wage policy increases over time.

**Figure A13:** Short-run reduction in costs from adopting the subminimum wage policy

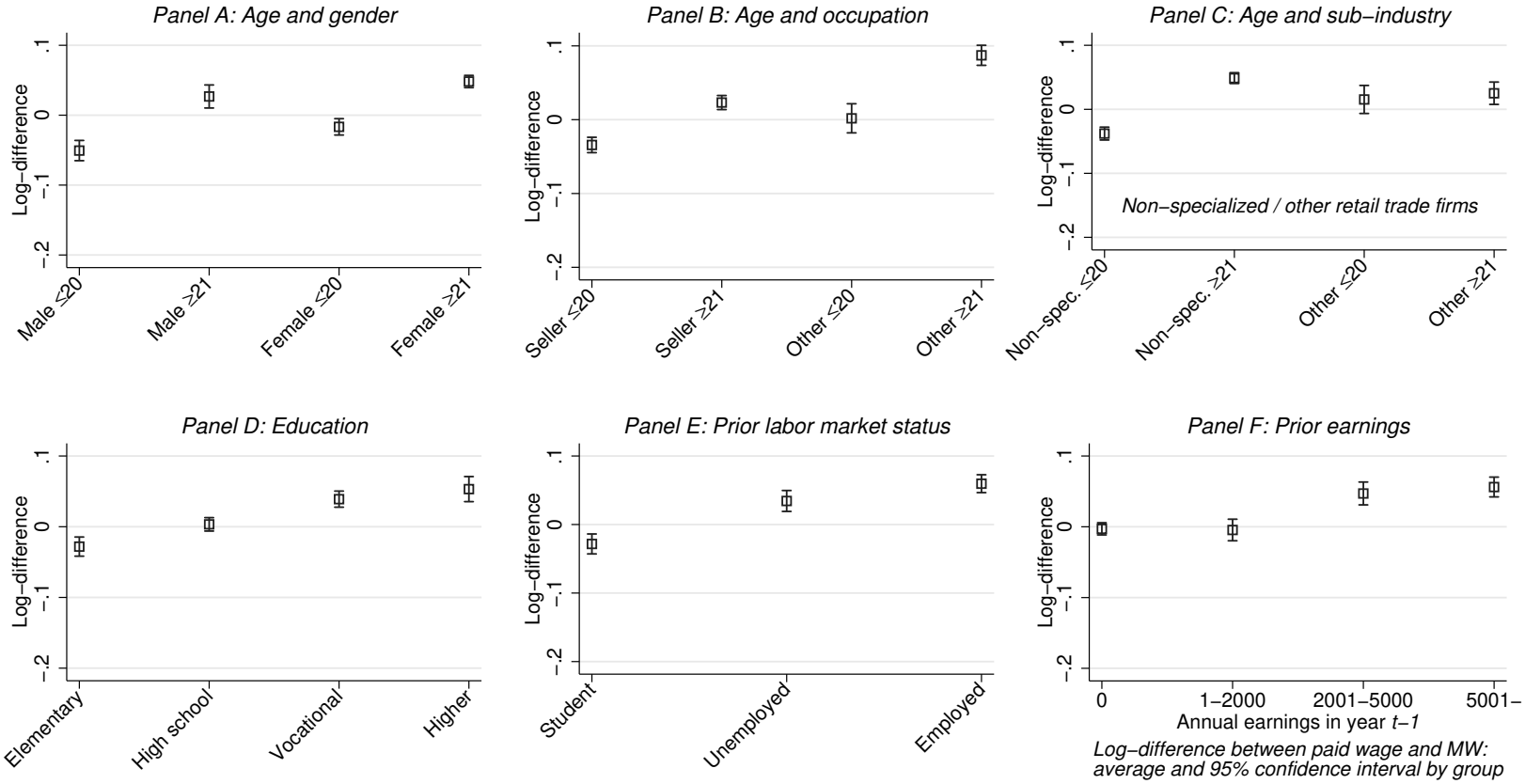



*Notes:* The graph shows the direct cost savings from adopting the subminimum wage policy expressed relative to the entire wage bill and the number of new hires. Two scenarios are presented: a half or a quarter of new employees are hired at the subminimum wage, which is 80% of the standard minimum wage. The estimates illustrate that adopting the subminimum wage policy reduces direct costs substantially.

**Figure A14:** Share of young inexperienced hires to all new hires in levels in the treatment and control groups


*Notes:* The graph shows the share of under 25 years old new hires with no prior experience in a given industry of all new hires by year in the treatment and control groups separately. For details on the control industries, see Table A1.

**Figure A15:** Log difference between actual hourly wage and minimum wage in the treatment group by individual-level characteristics over 1994–1997




*Notes:* The graph shows the average log difference between the paid hourly wage and minimum wage during the subminimum wage policy for the eligible individuals by six individual-level characteristics. The eligible group consists of new hires under the age of 25 who have no prior experience in the retail trade industry.

**Table A1:** Control industries

| | Number of under 25 years old new recruits with no prior experience from the industry | |
|---|---|---|
| Industry | 1989–1992 | 1993–1998 |
| Food processing | 5,240 | 4,288 |
| Construction (housing) | 6,948 | 2,568 |
| Construction (land & water) | 192 | 162 |
| Construction (specialized) | 6,559 | 4,088 |
| Aerial transportation | 828 | 424 |
| Storage / transportation support | 1,591 | 1,529 |
| Publishing | 1,328 | 669 |
| Production of movies and TV | 591 | 334 |
| Telecommunication | 544 | 767 |
| Information services | 45 | 76 |
| Marketing | 626 | 591 |
| Other specialized business services | 493 | 399 |
| Renting and leasing | 507 | 321 |
| Employment services | 749 | 1,174 |
| Security | 951 | 1,057 |
| Other personal services | 1,236 | 696 |
| Total control | 28,428 | 19,143 |
| Retail trade (treatment) | 14,924 | 8,549 |

*Notes:* The classification of industries follows the 2008 classification by Statistics Finland. Sample: after implementing matching.

**Table A2:** Difference-in-differences regression on the effect of subminimum wage policy on earnings, accounting for eight different firm characteristics

| | *Dependent variable: Log earnings* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| DiD | -0.041*** | -0.060*** | 0.487*** | -0.024 | 0.003 | -0.029 | -0.055*** | -0.006 | -0.158*** | -0.051 | 0.453** |
| | (0.007) | (0.010) | (0.164) | (0.025) | (0.047) | (0.074) | (0.013) | (0.055) | (0.032) | (0.034) | (0.185) |
| DiD * Earnings dispersion | | | -0.616*** | | | | | | | | -0.504*** |
| | | | (0.190) | | | | | | | | (0.174) |
| DiD * Number of employees | | | | -0.059 | | | | | | | -0.044 |
| | | | | (0.042) | | | | | | | (0.057) |
| DiD * Productivity | | | | | -0.092 | | | | | | -0.082 |
| | | | | | (0.068) | | | | | | (0.098) |
| DiD * Indebtedness | | | | | | -0.055 | | | | | -0.023 |
| | | | | | | (0.171) | | | | | (0.150) |
| DiD * Large city | | | | | | | 0.002 | | | | 0.023 |
| | | | | | | | (0.017) | | | | (0.018) |
| DiD * Median age of eligible | | | | | | | | -0.071 | | | -0.001 |
| | | | | | | | | (0.071) | | | (0.066) |
| DiD * Eligible / all new hires | | | | | | | | | 0.141*** | | 0.024 |
| | | | | | | | | | (0.048) | | (0.064) |
| DiD * Median income | | | | | | | | | | -0.122 | -0.088 |
| | | | | | | | | | | (0.087) | (0.105) |
| Treat | -0.074*** | -0.073*** | -0.071*** | -0.072*** | -0.071*** | -0.073*** | -0.067*** | -0.071*** | -0.068*** | -0.009* | -0.009* |
| | (0.005) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) | (0.005) | (0.005) |
| After | 0.167*** | 0.176*** | -0.909*** | 0.131*** | 0.129** | 0.082 | 0.165*** | 0.183*** | 0.182*** | 0.325*** | -1.044*** |
| | (0.007) | (0.010) | (0.223) | (0.024) | (0.051) | (0.104) | (0.012) | (0.057) | (0.033) | (0.031) | (0.231) |
| Constant | 8.802*** | 8.765*** | 8.679*** | 8.748*** | 8.744*** | 8.731*** | 8.719*** | 8.718*** | 8.865*** | 8.440*** | 8.751*** |
| | (0.029) | (0.040) | (0.072) | (0.040) | (0.046) | (0.042) | (0.041) | (0.045) | (0.044) | (0.042) | (0.098) |
| Observations | 60,366 | 36,699 | 36,699 | 36,699 | 36,699 | 36,699 | 36,699 | 36,699 | 36,699 | 36,699 | 36,699 |
| R-squared | 0.195 | 0.200 | 0.203 | 0.203 | 0.200 | 0.201 | 0.200 | 0.201 | 0.204 | 0.253 | 0.269 |

*Notes:* Models are based on equation (2). *After* corresponds to 1994-1997 meaning that the full reform years are evaluated. Standard errors are clustered at the establishment level. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Year, age and education fixed effects included. All firm characteristics are scaled to have a minimum 0 and maximum 1. Earnings dispersion is defined as the within-firm standard deviation of annual labor earnings in logs between 1989 and 1992. Similarly, the total number of employees and productivity (total revenue divided by the total number of employees) is calculated as an average over the years 1989–1992. Data on indebtedness, measured as the relative debt-to-equity ratio, is calculated using the years 1994–1997 (detailed data on firms' balance sheets starts in 1994). We define firm to be operating in a large city if it had any employees in the Helsinki metropolitan area (Helsinki, Espoo, Vantaa, Kauniainen), Tampere (the second most populous urban area in Finland) or Turku (the third most populous urban area) in 1989–1992. Median age of the young inexperienced workers, the share of young inexperienced hires to all new hires and the median income among all employees are measured over the years 1989–1992.

**Table A3:** Bankruptcies and debt / equity in retail trade

| | Bankruptcy applications filed | Share with debt > equity |
|---|---|---|
| 1989 | 346 | |
| 1990 | 413 | |
| 1991 | 826 | |
| 1992 | 980 | |
| 1993 | 919 | |
| 1994 | 779 | 87.7% |
| 1995 | 620 | 85.0% |
| 1996 | 502 | 81.6% |
| 1997 | 420 | 76.0% |
| 1998 | 314 | 72.1% |
| 1999 | 249 | 68.4% |
| 2000 | 264 | 65.5% |
| 2001 | 251 | 63.2% |
| 2002 | 219 | 60.3% |

*Notes:* Bankruptcy applications by retail trade firms. Debt includes both current and non-current creditors, and the sample consists of 8,566 firms that we observe in all years throughout 1994-2002. We do not have detailed data on firms' balance sheets before 1994.