Minimum Wage Increases, Hours of Work, and Overtime Pay Regulation: Evidence from the Matched Current Population Survey

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Abstract

This paper examines short-run adjustments of working hours to minimum wage increases. By combining observations from the matched Current Population Survey and data regarding large-scale state-level minimum wage increases, I find negative effects on working hours. Large minimum wage increases reduce the working hours by approximately 50 minutes per week. These effects are neither identical nor monotonic across working hours. Workers who worked part-time or overtime prior to the increases are negatively affected in terms of their working hours, while full-time workers are largely unaffected. Adjustments are related to a 40-hour workweek. There is a large shift from overtime to 40-hour per week positions for those working overtime in the previous year, while part-time workers are less likely to work 40-hour per week after increases. These adjustments are consistent with the predictions from a labor demand model with a kinked labor cost schedule caused by the overtime pay regulation.

JEL Codes: J23, J33

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1 Introduction

Over the past four decades, economists have extensively studied the effects of minimum wages on the number of jobs. However, extensive margin analysis focusing on the number of jobs may provide a limited picture of the effects of minimum wages on low-wage workers. Employers may prefer to adjust working hours instead of (or together with) the number of workers, especially in the short run (Hamermesh 1993, Ch. 7). Therefore, a change in the number of jobs may misrepresent the change in labor demand.

Minimum wage earners work relatively few hours and are disproportionately likely to work part-time, but there is substantial heterogeneity within this group. Most teenagers, the group that has been most extensively studied, work in part-time jobs, while the majority of prime-age workers, a group that comprises the larger portion of minimum wage workers, work in full-time jobs. However, little research has studied whether and how minimum wage effects differ by workers' working hours. In their review of minimum wage effects on various populations, Belman et al. (2015) point out the dearth of research analyzing the differential effects on part-time and full-time workers, writing, "this is a gap in the literature where further research is likely to be productive (p.603)." This paper fills the gap by examining the minimum wage effects on part-time, full-time, and overtime workers.

In this paper, I pay particular attention to overtime pay regulation. The Fair Labor Standards Act (FLSA), the law regulating minimum wage and overtime pay, requires firms to pay at least one-and-a-half times straight rate wages for hours exceeding 40 hours per week for many minimum wage workers. Therefore, employers face a kinked labor cost schedule, which provides an economic rationale for differential effects on part-time, full-time, and overtime workers.

Specifically, I examine the short-run adjustments of labor market outcomes, especially working hours, after the minimum wage increases using observations from the matched Current Population Survey Outgoing Rotation Group (CPS-ORG hereafter) over a 15-year period (2005-2019) and focusing on large-scale state-level minimum wage changes. The results indicate that the minimum wage increases reduce the working hours of affected workers by approximately 50 minutes per week, roughly 3.3 percent of the average baseline number of work hours (implied own-wage elasticity is approximately -0.6). These effects are neither identical nor monotonic across the number of hours of work. On the one hand, the working hours of part-time and overtime workers are reduced by approximately 4.4 and 6 percent, respectively. On the other hand, full-time workers with similar wages are largely unaffected in terms of the number of working hours. These negative effects on working hours offset much of wage gain, leading to insignificant effects on weekly earnings.

Economic theory suggests that bunching is likely to arise at convex kink points (Moffitt 1990; Saez 2010; Kleven 2016). I estimate the minimum wage effects on the probability of working part-time, full-time excluding 40 hours, exact 40 hours (the kink point), and overtime. I find a large shift from overtime to 40-hour workweeks for those working overtime in the previous year. Furthermore, the transition from part-time work to a 40-hour workweek is less likely to occur when the minimum wage is increased, although full-time workers are unaffected. These findings are consistent with the predictions that arise from a kinked labor cost function.

These findings speak to several lines of the literature. First, this paper contributes to the study of the intensive margin effects of minimum wage increases. Through the lens of longitudinal data, the results of the analysis clarify how minimum wage increases affect those who are earning a minimum wage. This study also extends the literature by addressing an understudied but theory-guided dimension of heterogeneity based on the initial level of working hours. Given that minimum wage workers from various demographic groups work different numbers of hours, it provides a useful guideline for understanding and predicting the effects of minimum wage increases. Finally, it contributes to the literature on overtime work by examining the effects of wages on overtime incidence.

The remainder of the paper is organized as follows: Section 2 introduces the background and related literature. Section 3 presents a conceptual framework that shows the effect of the minimum wage increases under overtime pay regulations. Section 4 introduces the data and summary statistics. The empirical strategy is discussed in Section 5. Section 6 shows the empirical findings. Section 7 summarizes the paper and presents a simple back-of-the-envelope calculation examining the total hours lost if all states increased their minimum wages. The results suggest that even though the size of the overtime minimum wage worker population is small, their practical importance is not negligible.

2 Background and Literature Review

Enacted in 1938, the FLSA has regulated the price and quantity of labor in the U.S. by setting the minimum wage and overtime pay rules.[1] The minimum wage is perhaps the most extensively scrutinized policy in the field of labor economics.[2] The minimum wage literature has primarily been concerned with the effects of the minimum wage on the number of low wage workers, especially teeangers and workers employed in fast-food restaurants. An extensive margin analysis examining the effects on the number of workers has attracted attention in academia for two main reasons. First, this question is helpful for understanding the costs and benefits of minimum wages. Second, examining whether a minimum wage reduces employment is widely considered a means for assessing

[1] Brown and Hamermesh (2019) provide a review of economic research on the FLSA

[2] I do not attempt to review the vast body of minimum wage literature in its entirety here, and several high-quality reviews are available (e.g., Neumark and Wascher 2008, and Belman and Wolfson 2014).

so-called Neoclassical economics based on the demand curve.

As noted by Steward and Swaffield (2008, p.150.), however, economic theory predicts a reduction in labor usage, not necessarily a reduction in the number of workers. Firms may decide to adjust working hours, as well as the head count of workers. Therefore, examining only the extensive margin responses may provide a limited picture of the overall effects on labor demand.

This concern provides motivation for the studies on the intensive margin analysis of minimum wages, starting from Zavodny (2000).[3] Compared to the existing literature on the extensive margin analysis, there are far fewer studies on the intensive margin, and the evidence is mixed.[4] Similar to studies of the extensive margins, the majority of the intensive margin studies focus on specific subgroups with low wages. Studies using two-way fixed effects (TWFE, hereafter) and state-panel data to examine the intensive margin effects on teenagers have found negative effects, although Allegretto et al. (2011) find that negative effects disappear when controlling for regional heterogeneity more aggressively by adding division-specific time controls and state-specific time trends.[5] Estimates for other populations have also varied from no effects (Dube et al., 2007 for the fast-food industry, Orrenius and Zavodny, 2008 for immigrants with lower educational attainments) to large elasticities of -1 (Sabia, 2008 for single mothers with lower educational attainments and Orazem and Mattila, 2002 for retail sectors). Cengiz et al. (2019, Appendix Table A) provide the intensive margin analysis of the entire population of low wage workers, not limited to specific groups. By applying the bunching method to the CPS-ORG, they find no negative effects on the number of full-time equivalents (FTE), which can be understood as total unconditional working hours.[6]

A few other studies have used longitudinal data to examine intensive margin responses, as I do in this paper. With longitudinal data, researchers can focus on workers who are actually earning a minimum wage instead of relying on age or other demographic variables to identify the population of interest. The closest study is Neumark et al. (2004, NSW for short), which use the matched CPS-ORG (1979-1997) and report the negative effects on working hours of low-wage incumbent workers. Compared to NSW, the present paper focuses on larger minimum wage changes and uses a smaller number of wage bins for a more intuitive interpretation. I further explore another dimension of heterogeneity that results from differences in initial working hours.

[3] Belman and Wolfson (2014, Chapter 3) provide a detailed review of this subject.

[4] Although debates and disagreements continue, review papers and meta-analyses suggest that median teen employment elasticities in the literature lie in the narrow bound of [-0.2, 0]. See Wolfson and Belman (2019) and Congressional Budget Office (2019).

[5] Unconditional hours elasticity ranging from -0.2 to -0.4 (Orrenius and Zavodny, 2008; Sabia, 2009) and smaller conditional hours elasticities (from 0 to -0.1)

[6] Cengiz et al. (2019) measured the number of FTEs by the weighted sum of working hours divided by 40.

Two recent studies apply administrative panel data to this question. Gopalan et al. (forthcoming) use administrative payroll panel data and report no effects on the working hours of minimum wage workers, although they do find reductions in the number of new hires. In contrast, Jardim et al. (forthcoming) find that the minimum wage increase in Seattle reduce working hours, while it does not affect the number of jobs. While these papers focus on a single or small number of minimum wage increases, the present paper studies a broader set of minimum wage increases. My key findings, the absence of extensive margin responses accompanied by large intensive margin responses in the short run, are in line with those of Jardim et al. (forthcoming).

Although the effect on the relative share of part-time and full-time workers among the workforce has been an important topic in the literature,[7] little research has examined whether and how those who work part-time and full-time are affected differently. In a review of minimum wage effects on various populations, Belman et al. (2015) note the dearth of work on this subject, mentioning that they are aware of only one study using British data (Connonlly and Gregory, 2002). Studies on overtime workers are even scarcer, partly reflecting the fact that overtime work is not common among minimum wage workers. One notable exception is Cengiz et al. (2021), who examine the effects of minimum wage increases on the share of part-time and overtime workers. Cengiz et al. (2021) find that minimum wage increases reduce the share of part-time workers among the high-probability group identified by machine learning. This study extends the literature by explicitly considering differential effects on workers who are working different amounts of hours prior to the minimum wage increases.

This work contributes to the small body of economic studies on overtime pay regulation. Although the minimum wage literature has largely ignored the issue of overtime work, the overtime pay literature has focused on the relationship between overtime pay and minimum wages, starting from Trejo (1991). He analyzes overtime pay regulation from two perspectives: the fixed-wage (Labor Demand) model and the fixed-job (Employment Contract) model. In the former, a straight rate wage is given and fixed; hence, imposing an overtime pay premium creates a kink in the wage schedule and overtime pay discourages overtime work for everyone. The prediction based on the fixed-job model is very different. In this framework, employers and workers care about the combination of total (weekly) hours and earnings. If the government newly introduces the overtime pay or increases the premium, workers and employers can nullify its effect and maintain the same combination of hours and earnings by adjusting the straight wage rate – except when they cannot legally lower the straight wage rate, as is the case for minimum wage earners. Although they yield different predictions regarding the effects of overtime pay regulation, these two perspectives agree on the effect on the minimum wage workers: overtime pay regulation is binding for them. Hence, employers of minimum wage workers face a kinked labor cost schedule caused by the overtime pay regulation. By

[7] Card and Krueger (1995, pp.48-49.), and Dube et al. (2007) find an increase in the proportion of full-time workers. Ressler et al. (1996) report the opposite finding based on a time-series method.

using minimum wage as a source of plausibly exogenous variations in wages, this paper provides evidence of how employers adjust labor hours to wage increases when they face a kinked cost schedule.

3 Conceptual Framework

This section presents a labor demand model with a kinked labor cost adopted from the textbook model of Cahuc et al. (2014, Chapter 2). Consider a production function with a single labor input, $Y = f(L)$,[8] where L is total labor use. Define $L = N \cdot e(H)$ where N is the number of workers and $e(H)$ is the measure of efficiency per worker.[9]

Suppose that employing a worker entails a fixed cost, F. For simplicity, ignore additional fixed costs associated with full-time work (e.g. health insurance) and other fringe benefits. Let w be the given hourly wage. If workers work longer than $\bar{H}$, employers need to pay overtime premium b for additional hours. In the United States, $\bar{H} = 40$ and $b = 0.5$ The labor cost per worker is $LC(H) = F + wH + bw(H - \bar{H})\boldsymbol{I}(H > \bar{H})$.

The employer's maximization problem given wage rate is

$$\max_{N,H} \pi = pf(L) - N \cdot LC(H)$$

Define cost per efficiency, $\omega = \dfrac{LC(H)}{e(H)}$. Rewrite the firm's problem as

$$\max_{N,H} \pi = pf(L) - \omega L$$

The problem can be solved in two steps, as discussed in Cahuc et al. (2014). Firms first find H which minimizes ω, then choose optimal L^* by choosing N. The solution is

$$H^* = \begin{cases} \dfrac{\eta_H^e(H_p^*)F}{w(1-\eta_H^e(H_p^*))} & \text{if } F \leq \delta_p \\ \bar{H} & \text{if } \delta_p \leq F \leq \delta_o \\ \dfrac{(F - bw\bar{H})\eta_H^e(H_o^*)}{w(1+b)(1-\eta_H^e(H_o^*))} & \text{if } F \geq \delta_o \end{cases}$$

where $\delta_p = \dfrac{w(1-\eta_H^e(H_p^*))\bar{H}}{\eta_H^e(H_p^*)}$, $\delta_o = \dfrac{w(1+b-\eta_H^e(H_o^*))\bar{H}}{\eta_H^e(H_o^*)}$, and $\eta_H^e(\cdot)$ is the elasticity of efficiency with respect to hours and measures the productivity gain from working more hours. η_H^e should be in the [0,1] interval. $\eta_H^e = 1\ \forall H$ implies that workers and

[8] It can be understood as the short-run adjustments when capital is fixed.

[9] If $Y = L, e(H)$ can be understood as the production function in Barzel (1973). He studies the shape of the $e(H)$ function under the learning-by-doing and work fatigue. If $e(H) = H$, workers and hours are perfectly substitutable.

hours are a perfect substitute ($e(H) = H$), then there is no interior solution. Then, the optimal working hour is either $\bar{H}$ or the largest possible H. Since $\bar{H}, b$, and w are fixed parameters, main determinants of working hours are fixed costs and elasticity of efficiency. Smaller fixed costs and lower elasticities of efficiency promote the hiring of part-time workers.

What would happen if the wage is increased to $w' > w$? Suppose that the new profit level is large enough to compensate for variable costs. Then employers will continue to hire workers at least in the short run. The above equation shows that $\frac{\partial \delta_p}{\partial w} > 0$, $\frac{\partial \delta_o}{\partial w} > 0$ and $\frac{\partial H^*}{\partial w} \leq 0$. Therefore, more workers are likely to work part-time, and some of the overtime workers will move to 40-hour per week jobs. Some full-time workers may become part-time workers, but for those who are in $F \in [\delta_p(w'), \delta_o(w)]$ will not be affected.

Figure 1 illustrates some examples. I assume the isoprofit curve to be convex at least near H^*. Panel A shows the case of an overtime worker who moved to the kink point, $H = 40$. Panel B shows the case of a full-time worker whose work hours have not changed. Finally, Panel C shows the case of a part-time worker. The intuition is simple. By rotating the slope of the labor cost, the standard price effects argument works for the part-time and overtime workers. However, a larger change in wages is required to move the workers clustered at the kink point.

In summary, the model predicts negative effects on working hours for those previously working part-time and overtime, while smaller negative effects for those working full-time. The effects on the overall size of the bunching are ex ante unclear, since some full-time workers will lose their hours while overtime workers will move to the kink point.[10]

4 Data

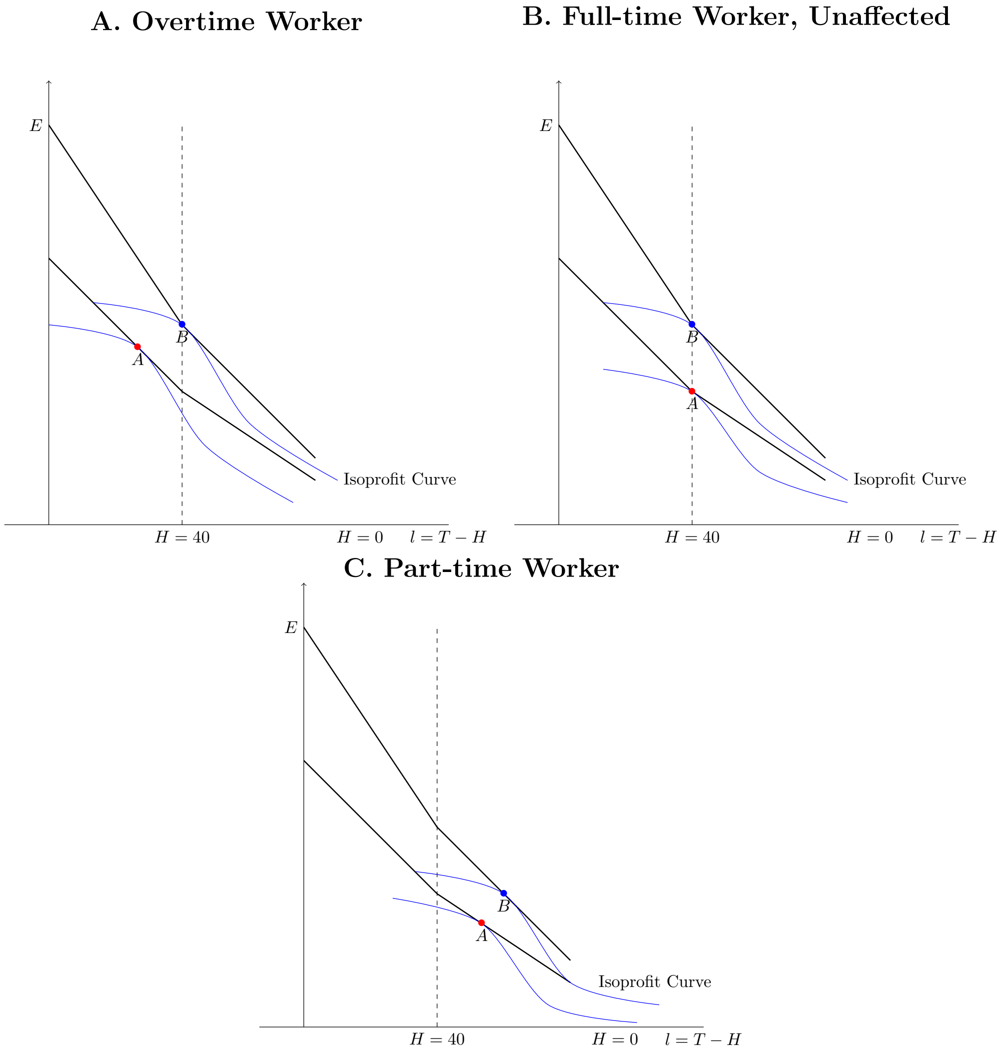
The primary source of information for this study is the CPS-ORG for the years 2005-2019, a nationally representative, large scale survey.[11] I construct a two-year panel data using the structure of the CPS-ORG.[12] The strengths of the CPS-ORG include its large

[10] Δ Bunching $= \int_{\delta_o(w)}^{\delta_o(w')} f(F)dF - \int_{\delta_p(w)}^{\delta_p(w')} f(F)dF$ where $f(F)$ is the pdf of fixed costs

[11] Changes in overtime pay regulation may change the effects of minimum wages on overtime work by altering the bindingness of overtime pay. To minimize this concern, I select a period between changes in overtime regulations; 2005 and 2020.

[12] When the respondents enter the survey, they are interviewed for the first four months, there are no interviews for the next eight months, and the respondents are interviewed again in the final four months. In the fourth and eighth interviews, the respondents are asked for more detailed information on earnings, forming the Outgoing Rotation Group.

Figure 1: Minimum Wage Increases and Working Hours with Overtime Pay Regulation



sample size and relatively precise information on hourly wages.[13] However, its short panel lengths prevent the study of longer-run changes.

I exclude workers whose hours or wages are imputed (following Cengiz et al., 2019), self-employed workers, and workers whose growth in wages or hours exceed 1000 percent (following NSW). I exclude observations whose first-year wages are lower than 50 percent of the effective minimum wage, which is the maximum of state- and federal-level minimum wages. Monthly state-level effective minimum wage data are obtained from Vaghul and Zipperer (2019).[14] I further restrict my sample to be balanced, requiring the respondents to be between 16 and 64 years of age in both interviews. State-level information is downloaded via the Bureau of Labor Statistics.[15] Inflation is adjusted by using R-CPI-U-RS.[16]

The key variables are the measures of hourly wages and hours. I use straight rate wages excluding overtime pay, tips, and commissions whenever this information is available. However, the salaried workers report only their earnings - including overtime pay, tips, and commissions - in whatever time frame is convenient for them (annual, monthly, biweekly, weekly, or others), and the CPS converts reported earnings to weekly earnings. The hourly wages of salaried workers are calculated by dividing the weekly earnings by the weekly working hours; for the working hours, I use the usual number of hours worked per week.

Based on the hourly wages, I restrict my sample to low-wage workers whose initial hourly wage was lower than the initial minimum wage plus five dollars. I divide these workers into 12 groups: four groups based on wages times three groups based on working hours in the first year. The four wage groups are roughly similar in size. The first group consists of the workers whose first-year wage is lower than the effective minimum wage plus 50 cents (in 2019 USD). Given the definition of treatment discussed in the next section, they are directly affected if treated. In the second wage group, the wage minus the minimum wage of workers is in (0.5, 2]. In the treated states, they are a mixture of directly affected (those whose hourly wage is larger than the minimum wage plus 50 cents but smaller than the new minimum) and indirectly affected by spillover effects. These two groups are the primary focus. Throughout the paper, I refer to the former as the lowest wage group (or Group 1), and the latter as the lower wage group (or Group 2). The third (Group 3) and fourth (Group 4) groups consist of workers whose first-year wages minus the minimum wage are in (2, 3.5] and (3.5, 5], respectively. Workers in these groups are still low-wage workers, but are less likely to be affected by minimum wage changes.

[13]In the CPS-ORG, the respondents are asked about their hourly earnings directly if they are paid hourly. Therefore, the hourly earnings information for them is free from the measurement errors in hours.

[14]It can be downloaded from https://github.com/benzipperer/historicalminwage/releases/tag/v1.2.0

[15]Available at https://www.bls.gov/web/laus.supp.toc.htm

[16]Available at https://www.bls.gov/cpi/research-series/r-cpi-u-rs-home.htm

I classify the workers as part-time, full-time, and overtime workers based on the usual working hours in the year they enter the survey. The overtime workers are defined as those who work more than 40 hours per week. The distinction between the part-time and the full-time workers is rather unclear. In this study, I follow the definition of the CPS and Dunn (2018) and define the part-time workers as those who work less than 35 hours per week.[17]

Table 1 presents descriptive statistics summarizing the data. Even among low-wage workers, there are substantial differences in patterns in working hours. In general, the workers with lower wages are more likely to work part-time and fewer hours, with a larger standard deviation, suggesting greater variation among them. Although approximately 60 percent of the minimum wage workers are part-time workers, only approximately 25 percent of the upper wage groups work part-time.

The low wage workers are not strongly attached to the labor market: approximately 20 percent of the workers did not work in the second year. Both higher wages and a larger number of working hours suggest that the workers are more strongly attached to the labor market. While more than 25 percent of Group 1 workers do not work in the second year, the percentage drops to approximately 17 percent for Group 4 workers. Appendix Table A1 shows that approximately 25 percent of the part-time workers do not work in the second year, while more than 90 percent of the overtime workers do.

Panel D shows the evolution of wages. Approximately half of the workers in the lowest wage group remain in minimum wage positions in the second year, and approximately 10 percent or fewer of the non-minimum wage workers become minimum wage workers in the second year. These findings are in line with those of Carrington and Fallick (2001). The minimum wage workers caught up to their counterparts in the higher wage groups. The difference in the average wage between the first and second groups shrinks from 0.168 log points to 0.071 log points, while the gap between the second and third groups is almost stable (0.134 log points to 0.116 log points).

In Appendix Table A1, I present the summary statistics by the hour group. Three features of Appendix Table A1 are worth mentioning. First, there is a strong correlation between the current working hours and the future working hours. Conditional on working, approximately three-quarters of the part-time workers continue to work part-time in the second year, and most of the full-time workers continue to work full-time. The fraction decreases for the overtime workers; nevertheless, more than half of the overtime workers work overtime in the subsequent year. Second, although most of the low-wage workers are paid hourly (85 percent), approximately half of the overtime workers are

[17] If workers worked less than 35 hours per week, the CPS asks the reason. Alternative definitions of part-time workers are possible. For instance, Cengiz et al. (2021) define part-time workers as those who work less than 30 hours per week.

Table 1: Descriptive Statistics

		Wage Group			
	All	Group 1	Group 2	Group 3	Group 4
	$\tilde{w} \leq 5^b$	$\tilde{w} \leq 0.5$	$0.5 < \tilde{w} \leq 2$	$2 < \tilde{w} \leq 3.5$	$3.5 < \tilde{w} \leq 5$
Panel A. Year 1 Economic Variables					
Log Wage (2019 USD)	2.330	2.108	2.276	2.410	2.530
	(0.197)	(0.192)	(0.104)	(0.092)	(0.091)
Paid Hourly	0.853	0.813	0.905	0.860	0.826
Weekly Hours of Work	32.404	28.195	30.832	34.189	36.479
	(12.020)	(13.272)	(11.766)	(11.083)	(10.143)
Part-time	0.426	0.603	0.497	0.350	0.248
Full-time	0.504	0.339	0.449	0.575	0.655
Overtime	0.071	0.058	0.054	0.075	0.097
Panel B. Year 2 Economic Variable					
Work in Second Year	0.812	0.747	0.795	0.837	0.870
Log Wage (2019 USD)^a	2.460	2.320	2.391	2.507	2.604
	(0.302)	(0.331)	(0.266)	(0.273)	(0.262)
Paid Hourly^a	0.827	0.822	0.870	0.821	0.792
Weekly Hours of Work^a	34.193	30.942	32.914	35.453	37.014
	(10.879)	(12.095)	(10.945)	(10.221)	(9.323)
Part-time	0.283	0.375	0.327	0.239	0.187
Full-time	0.469	0.325	0.419	0.532	0.601
Overtime	0.060	0.046	0.048	0.066	0.081
Change Industry^a	0.294	0.268	0.300	0.307	0.300
Panel C. Year 1 Demographic Variable					
Age	34.872	31.305	33.544	36.498	38.192
	(13.820)	(13.849)	(13.927)	(13.473)	(12.982)
Female	0.585	0.592	0.593	0.576	0.577
< High School	0.234	0.352	0.258	0.183	0.146
High School Graduates	0.349	0.301	0.351	0.370	0.373
Some College	0.309	0.267	0.305	0.327	0.336
College Graduates	0.088	0.063	0.072	0.098	0.118
Higher than B.A.	0.020	0.016	0.014	0.021	0.028
African American	0.125	0.113	0.127	0.131	0.129
Hispanic	0.247	0.275	0.262	0.240	0.211
Other Non-white Races	0.086	0.099	0.088	0.080	0.077
Teenagers	0.139	0.268	0.172	0.077	0.042
Panel D. Year 2 Wage Distribution					
$w^2 \leq MW^1 + 0.5^a$	0.147	0.437	0.124	0.047	0.028
$w^2 \leq MW^1 + 2^a$	0.371	0.723	0.561	0.177	0.078
$w^2 \leq MW^1 + 3.5^a$	0.590	0.827	0.777	0.561	0.213
$w^2 \leq MW^1 + 5^a$	0.764	0.880	0.864	0.747	0.574
$w^2 \leq MW^2 + 0.5^a$	0.165	0.474	0.151	0.056	0.031
Panel E. Treatment					
Experience Treatment	0.144	0.152	0.139	0.140	0.145
Experience Small-scale Increases	0.222	0.266	0.212	0.199	0.213
Experience Increase by Federal^b	0.093	0.067	0.084	0.096	0.125
Observations	91308	20465	24050	24713	22080

Variables with ^{a} are measured conditional on working in the second year. $\tilde{w} = w^1 - MW^1$, the first-year wage minus the first-year minimum wage. All the results are weighted by the CPS earnings weight (*earnwt*). The first row of the variable shows the means and the second shows the standard deviations. The standard deviations of the indicator variables are omitted. ^{b} includes both the small and large scale increases by federal one.

salaried. This finding partly reflects salaried workers who are not near-minimum wage workers but are included in this category due to the large positive measurement error in the number of hours worked. However, it may also reflect overtime pay concerns. As noted by Chung and Haider (2020), larger portions of salaried workers are not subject to overtime pay due to the FLSA structure, so employers may have an incentive to change their method of payment. Finally, the part-time workers are generally younger, and the share of the female workers is much higher for this population. Approximately one quarter of the part-time workers are teenagers, while less than 3 percent of the overtime workers are younger than 20.

5 Identification Strategy

To identify the effects of the minimum wage increases, I compare those workers whose initial labor market behaviors are similar but who experience different minimum wage evolutions. I define the relevant workers based on their initial wage, instead of using demographic or industry information. This method enables me to analyze a larger proportion of the minimum wage workers. The effects on hiring are beyond the scope of this paper.[18] Furthermore, due to the short panel length ($T = 2$) of the CPS-ORG, I could assess effects only in the short-run. This limits the analysis, but, given that working hours are adjusted more quickly (Belman and Wolfson, 2010), it may provide a reliable picture on the intensive margin responses.

During the sample period, 2005-2019, there were hundreds of nominal minimum wage increases including states that index their minimum wages to inflation. The magnitude of the nominal increases range from 4 cents to 1.95 dollars.[19] Among the numerous increases, I focus my attention on those increases that are at least 50 cents in 2019 USD and define them as 'treatments'.[20] This definition gives me 107 treatments. The definition is similar to that of Cengiz et al. (2019, 2021). The median size of the minimum wage increases of the treatment is approximately 10 percent of the previous minimum wage. The following difference-in-differences specification is used:

$$y_{ijhst} = \alpha + \sum_j \beta_j D_{st} \times \boldsymbol{I}(w^1 \in \text{Group } j) + X'_{ist}\delta + W'_{st}\eta + \Omega + \lambda_{jh} + \rho_{js} + \rho_{jt} + e_{ist} \quad (1)$$

Variables y_{ijhst} represent the labor market outcomes of individual i residing in state s at time t in wage group j and hour group h. The unit of time is month. Variable D is

[18] Several recent papers argue that new hiring is a key channel of employment adjustments. See Meer and West (2016) and Gopalan et al. (forthcoming)

[19] Increases of 4 cents were implemented in Alaska (2018), Florida(2009), Missouri(2017), and Ohio(2017) and an increase of 1.95 dollars was implemented in Arizona (2017)

[20] The minimum wage effects could be much clearer in the large-scale increases. For a detailed discussion, see Clemens and Strain (2021).

a treatment indicator that equals 1 if individual i living in state s experiences the treatments defined above in the month (t) of the second-year interview or in the preceding 11 months.[21] w^1 refers to real hourly wages in the first-year interview, and the wage group is defined based on their wages compared to the effective minimum wages. From here, all the superscripts imply the year of the interview (1 or 2).

Parameters β_js are the key parameters of interest that measure the treatment effects on the workers in wage group j. To compare those who experience large scale minimum wage changes and no changes, I additionally put indicators for federal- and small-scale state- level increases that interact with each wage group indicator in Ω.

Vector X contains a set of individual covariates including gender, a quartic in age, the categorical variables of education and race, and an indicator for metropolitan residents measured in the initial year. W is a set of state-level controls including state-level unemployment and the logs of the population, measured in the second interview year. Three sets of fixed effects - wage-group-by-hour-group fixed effects (λ_{jh}), wage-group-by-state fixed effects (ρ_{js}), and wage-group-by-time fixed effects (ρ_{jt}) - are included. By putting ρ_{js} and ρ_{jt}, β_js can be understood as parameters in the standard TWFE regression using only the observations in wage group j. Therefore, β_js are identified using variations within the wage group across treated and untreated states. Putting λ_{jh} further controls the differences in the labor market outcomes related to the differential initial labor market behaviors, hence identification is made within the groups.

This empirical strategy has several issues. The wage group is defined based on the wage relative to the minimum wage in the first year. This method is in line with studies using longitudinal data and aggregating states with different minimum wages (e.g., NSW and Lopresti and Mumford (2016)). However, the substantial variations in state-level minimum wages in recent years raise an important issue. For instance, a worker in Mississippi (which is bound by a federal minimum wage of \$7.25) earning \$7.50 in 2019 and another worker in the District of Columbia (whose minimum wage was \$14 in 2019) earning \$ 14.25 dollars per hour in 2019 are classified into the same wage group. Both the absolute value of wages and wages relative to the minimum may play a role, and if so, it is questionable whether a worker in D.C. could be an appropriate counterfactual for a worker in Mississippi and vice versa. Furthermore, the minimum wage effects could be larger when high minimum wage states are treated, which introduces the possibility of heterogeneous effects.

If both the treated and the untreated states contain a good mixture of high- and low-wage states in each period, this problem may not be a major concern. The minimum wage increases are, however, unevenly distributed over time and across states. Recent

[21] It is intended to capture the minimum wage increases between the two interviews in the CPS. Since the exact interview date is unknown, some minimum wage changes may have taken effect merely a few days prior to the first interview or after the second interview.

minimum wage increases have been led by high minimum wage states, and a large proportion of workers in the control group reside in the states that are bound by federal minimum wages. In contrast, during the periods of federal minimum wage increases (2007-2009), only a handful of high minimum wage states comprise the control group.[22]

Appendix C includes two exercises conducted to examine how different compositions of treated and control groups affect the estimates. First, I include the minimum wage increases by the federal level changes in treatments and estimate the main analysis of the paper. Second, I estimate the same equations using only observations from the years 2011-2019, a period with no federal level minimum wage increases. In the years 2011-2019, there is a stronger tendency for higher minimum wage states to further increase their own minimum wages. Appendix C shows that the adjustments become larger when the treated group includes more high minimum wage states and become smaller when federal level increases are included.

Another issue is related to the uneven distribution of the minimum wage increases and their heterogeneous effects. Equation (1) is in the TWFE framework. Recent econometric literature has shown that the parameter of interest, β_j, can be understood as a weighted sum of average treatment effects in each time t, and some weights could be negative (see, e.g., Goodman-Bacon, 2019; de Chaisemartin and d'Haultfoeuille, 2020.) Negative weights are more likely to arise when a large share of states are treated, and when some states are treated in many periods. These negative effects are likely to be an issue if the treatment effects are heterogeneous. Both concerns are relevant for this study. As shown in Appendix Figure A1, the minimum wage increases are highly clustered in the years 2007-2009 and 2016-2019. Furthermore, the former coincided with the Great Recession, the period in which the minimum wage effects could be different from other years.

To determine whether this problem affected the estimates, I use the estimator provided by de Chaisemartin and D'Haultfoeuille (2020). The key intuition of their alternative estimator is to compare outcomes of the 'joiners' and the 'stable group'.[23] Since most of the minimum wage increases are clustered in January (in the beginning of the year), - and July if federal level increases are also considered - I am able to use only a small fraction of the observations. The results using the alternative estimator are shown in Appendix E. The results are generally larger in magnitude but highly imprecise possibly due to the small sample size.

So far, I have not permitted the effects to vary across the hour groups. To examine whether the minimum wage effects are different across the initial working hours, I revise

[22]For instance, as of July 2007, the year of the federal minimum wage increases, only three states (Alaska, Minnesota, and Wisconsin) and the District of Columbia did not experience any nominal changes in minimum wages within a year.

[23]The joiners are those who start to receive the treatments or stop receiving treatments and the stable group refers to those who are treated both before and after or who are untreated in both periods

Equation (1) as follows

$$
\begin{aligned}
y_{ijhst} \quad = \quad & \alpha + \sum_j \sum_h \beta_{jh} D_{st} \times \boldsymbol{I}(w^1 \in \text{Group } j) \times \boldsymbol{I}(h^1 \in \text{Group } h) \\
& + X'_{ist}\delta + W'_{st}\eta + \Omega + \lambda_{jh} + \rho_{js} + \rho_{jt} + e_{ist}
\end{aligned}
\tag{2}
$$

Here, β_{jh} captures the effects of the large-scale increases in the effective minimum wages ("treatment") on labor market outcomes whose wage group is j and hour group is h. The conceptual framework expects the effects to be different in magnitude across hours of work, and even opposite in sign for the probability of working at the kink point. By estimating β_{jh}s, Equation (2) can examine whether aggregating everyone regardless of their working hours ignores such differential adjustments by hours.

This study focuses on the short-run changes. One potential source of misspecification is dynamic effects of minimum wage changes. Technically, it is possible to analyze using an event-study framework including lags and/or leads of minimum wage changes. However, interpreting the coefficients for the past minimum wage changes is clear only under the assumption that the past minimum wage increases do not affect their wage relative to the minimum wage *and* part-time, full-time, and overtime status in the first-year observation. Given the evidence provided by Belman and Wolfson (2010) that the employers adjust hours quickly (within a year), this assumption is restrictive. Instead of imposing stronger assumptions, I focus on the short-run effects of the minimum wage changes. However, I test whether the estimates are sensitive to the inclusion of lags and leads in Appendix D by using the event-study specification. The results are generally robust to the inclusion of leads and lags. Coefficients for the future minimum wage increases are generally close to zero and flat, suggesting parallel pre-trend. Analysis in Appendix D further confirms that intensive margin responses are completed within a year.

6 Empirical Findings

I first explore the effects of the minimum wage increases on the incumbent workers by estimating Equation (1). In Table 2, the first three columns are estimated conditional on working in both the first and second years, and the latter two columns condition just on working in the initial year. Column (1) shows that hourly wages increased by approximately 5 percent for the workers in the lowest wage group. Note that the median minimum wage increase is approximately 10 percent in treated states, which implies a wage elasticity of approximately 0.5. The estimates for the upper wage groups show positive but smaller effects on the hourly wages, suggesting small spillover effects.

Does the minimum wage affect employment outcomes? Columns (2) through (5) examine this question. Columns (2) and (3) show the intensive margin responses using

Table 2: Minimum Wage Effects across Wage Groups

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} = w^1 - MW^1 \leq 0.5)$	0.052***	-0.864**	-0.033*	0.015	-0.335
	(0.013)	(0.271)	(0.013)	(0.015)	(0.445)
$D_{st} \times I(0.5 < \tilde{w} \leq 2)$	0.031***	0.161	0.009	-0.010	-0.274
	(0.009)	(0.204)	(0.007)	(0.012)	(0.404)
$D_{st} \times I(2 < \tilde{w} \leq 3.5)$	0.024+	0.024	0.006	-0.000	0.087
	(0.014)	(0.243)	(0.009)	(0.011)	(0.357)
$D_{st} \times I(3 < \tilde{w} \leq 5)$	0.010	-0.104	0.000	-0.000	-0.067
	(0.012)	(0.231)	(0.009)	(0.008)	(0.331)
Observations	74,150	74,150	74,150	91,308	91,308
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

$\tilde{w} = w^1 - MW^1$, the initial wage minus the initial minimum wage. Each number in the cell shows β_j. All the regressions include a quartic in age, dummy for high-school graduates, some college, B.A., above B.A., African-American, Hispanic, and other nonwhite races, and metropolitan residents as the individual controls. State-month level unemployment rates and logs of the population are included. Standard errors are clustered at state level. All results are weighted using earnings weight (*earnwt*). The period unit is month.
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

two measures: usual weekly hours of work and log of weekly working hours. Conditional on working, increased wages lowered the weekly working hours. Workers in the lowest wage group lost hours by approximately 50 minutes or 3.3 percent. It suggested that employers responded to the wage shock along the intensive margin in the short run. Combining with the wage elasticity of 0.5 from the column (1), implied own-wage elasticity of working hours, the ratio of the percent change of the working hours to the percent change of the wages, is approximately -0.6. In contrast to large adjustments for the workers in the lowest wage group, there are no detectable effects on the upper wage groups. In summary, only narrowly defined near-minimum wage workers are affected, suggesting that precise information of the affected population is important. Much of the wage gain is offset by the loss in hours, leading to insignificant effects on weekly earnings.[24]

[24]The effects on the log weekly earnings (including overtime pay, tips, and commissions for both hourly paid and salaried workers) are -0.002 (se 0.017) for workers in the lowest wage group, and 0.032 (se 0.013) for those in the lower wage group. In principle, the effects on log weekly earnings should be equal to the sum of the effects on the hourly wage and weekly working hours. Estimated coefficients deviate from the simple sum of two coefficients since different measures are used for weekly earnings and hourly wages of hourly paid workers. In the CPS-ORG, hourly wages of the hourly paid workers do not include overtime pay, tips, and commissions, while weekly earnings do. These definitions suggest that the product of hourly wage and weekly working hours should be larger or equal to the reported weekly earnings. However, in data, the average of the latter is larger than that of the former for the minimum wage workers. Since the CPS converts reported earnings in whatever time frame is convenient for respondents (biweekly, monthly, quarterly, annual, etc) into weekly earnings, it may reflect the fact that minimum wage workers are weakly attached to the labor market so they are less likely to work full-year or full-month.

Table 3: Minimum Wage Effects across Wage and Hours Group

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0,35))$	0.056***	-0.995**	-0.044*	0.027+	-0.092
	(0.014)	(0.371)	(0.018)	(0.016)	(0.486)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35,40])$	0.035*	-0.160	-0.009	-0.008	-0.418
	(0.015)	(0.229)	(0.010)	(0.019)	(0.695)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.113*	-3.334***	-0.060*	0.018	-2.167+
	(0.044)	(0.883)	(0.024)	(0.027)	(1.103)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0,35))$	0.032**	-0.128	0.000	-0.006	-0.357
	(0.011)	(0.295)	(0.011)	(0.022)	(0.596)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35,40])$	0.030**	0.518+	0.019+	-0.016	-0.211
	(0.010)	(0.298)	(0.010)	(0.013)	(0.517)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	0.026	-0.173	0.006	0.003	0.036
	(0.029)	(0.979)	(0.027)	(0.033)	(1.446)
Observations	74,150	74,150	74,150	91,308	91,308
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, in other words, initial wage minus initial minimum wage. h^1 refers to working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

The minimum wage increases, however, have no effect on the number of workers, at least for the incumbent workers analyzed in this study, as is clear in Column (4) The absence of extensive margin responses for incumbent workers is consistent with recent studies (see Cengiz et al., 2019, Gopalan et al., forthcoming, and Jardim et al., forthcoming). However, it does not necessarily imply the absence of employment effects if employers prefer to adjust the size of the workforce by hiring channels rather than firing (Gopalan et al., forthcoming).

Column (5) examines the effects on hours of work, unconditional on working in the second year. It can be understood as the effects on total working hours of incumbent workers. Together with the extensive margin analysis, it does not show significant effects. In summary, Table 2 shows the intensive margin responses without extensive margins in the short run, and this finding is in line with the Seattle minimum wage increases (Jardim et al., forthcoming).

Finally, the effects on two upper wage groups are neither economically nor statistically significant, except for small and weak positive effects on the wage of the third group, as expected. In later analyzes, I only present the effects on the bottom two groups for the sake of convenience. Full tables are available in Appendix B.

Table 3 shows the disaggregated results by initial working hours, following Equation (2). Again, column (1) shows clear, positive wage effects. Wage effects were approximately 5.6 percent for part-time workers and 3.5 percent for full-time workers. Large, positive wage effects on overtime workers partly reflect a reduction in working hours.

As discussed above, a large share of overtime workers are salaried workers. Since the wage of salaried workers is calculated by dividing weekly earnings by weekly hours, a reduction in hours may create a spurious positive effect on wages.

Columns (2) and (3) show the evidence of intensive margin adjustments in the short-run. In columns (2) and (3), part-time and overtime minimum wage workers are negatively affected on hours, while full-time workers are nearly unaffected. Part-time workers lose their hours by approximately one hour or by 4.4 percent, and overtime workers lose hours by approximately 3.3 hours or 6 percent. Implied own-wage elasticity of working hours is approximately -0.8 and -0.5, respectively. The 95 percent confidence interval for the estimate for part-time or overtime workers rule out the point estimate for full-time workers. This pattern is consistent with the prediction from Section 3.

An alternative explanation for negative effects on part-time workers might be related to their lower productivity. This is in line with larger negative effects on the working hours of less experienced workers (Jardim et al., forthcoming).[25] However, this explanation is not readily applicable to the results in Table 3 for two reasons. First, the productivity story cannot explain the effects on overtime workers. They are more strongly attached to the labor market and possibly more productive than part-time and full-time workers. Second, the productivity explanation expects that lower-hour workers will be hit harder. However, further analysis in Appendix F does not support this hypothesis. In Appendix F, I divide the part-time workers into more detailed groups and estimate Equation (2). The results suggest that negative effects are almost the same in magnitude for part-time workers with different hours of work. For instance, in Appendix Table F1, those who work 20 hours per week or less lose their hours by approximately 4.9 percent, and those who work between 20 and 35 lose their hours by 4.7 percent. Therefore, differences only appear between part-time and full-time. In contrast to the productivity explanation, the kinked labor demand model fits well into the results. In Section 3, elasticity is identical for all part-time workers regardless of their initial working hours. The large difference in responses is expected to be found only from the kinked point, as shown in Table 3 and Appendix F.

Unlike columns (2) and (3), column (4) does not show any clear sign of employment effects along the extensive channel. Except for the weak positive effects on the probability of working of the part-time workers, all estimates are neither statistically significant nor economically meaningful. These estimates lead to the estimates for unconditional hours of work statistically indistinguishable from 0 in column (5), except for the overtime workers.

Full-time workers in the lower wage group are positively affected in terms of hours, although the size is small and estimates are not highly precise. They gain hours by

[25] Jardim et al., forthcoming define the less experienced workers by those whose total working hours in the three quarters prior to the increase are lower than the median.

approximately 30 minutes per week or 2 percent. Combining negative estimates on the lowest part-time workers and positive effects on the lower group full-time workers suggested the possibility of labor-labor substitution discussed by Clemens et al. (2021) and Neumark and Wascher (2011), although the evidence is not strong. Note that wage effects are larger for the lowest group workers, while productivity could be higher for the full-time workers in the lower wage group. Given the wage effects, workers who are more productive become relatively cheaper, and employers may shift hours to those workers.

The measurement issues which may affect the estimates are worth discussing. Since overtime workers may be exposed to temporary shocks to the working hours or positive, nonclassical measurement errors in working hours, one may wonder whether regression to the mean may derive the results. As shown in Appendix Table A1, a larger portion of overtime workers turn to full-time workers in the following year, consistent with the regression to the mean. However, I do not compare overtime workers with other workers, but compare overtime workers experiencing minimum wage increases with those who are not. Therefore, regression to the mean is less likely to affect the results unless minimum wage increases are not correlated to the aforementioned factors affecting working hours.[26]

So far, I have examined the effects on working hours. Although the patterns are largely consistent with the predictions, I do not examine the effects related to the kink point itself. Here, I provide more direct evidence involved with the kink by showing the effects on the probability of working a specific amount of hours, e.g., overtime or 40-hour work week. I estimate the Equation (2) by using $\boldsymbol{I}(h^2 > 40), \boldsymbol{I}(h^2 = 40), \boldsymbol{I}(h^2 \in [35, 40))$, and $\boldsymbol{I}(h^2 \in (0, 35))$ as outcome variables. The first outcome, $\boldsymbol{I}(h^2 > 40)$, can be connected to the overtime pay literature, since it estimates the effects on the overtime incidence. Table 4 shows the estimates, and Figure 2 visualizes the effects. The full table including the estimates from equation (1) is in the Appendix B.

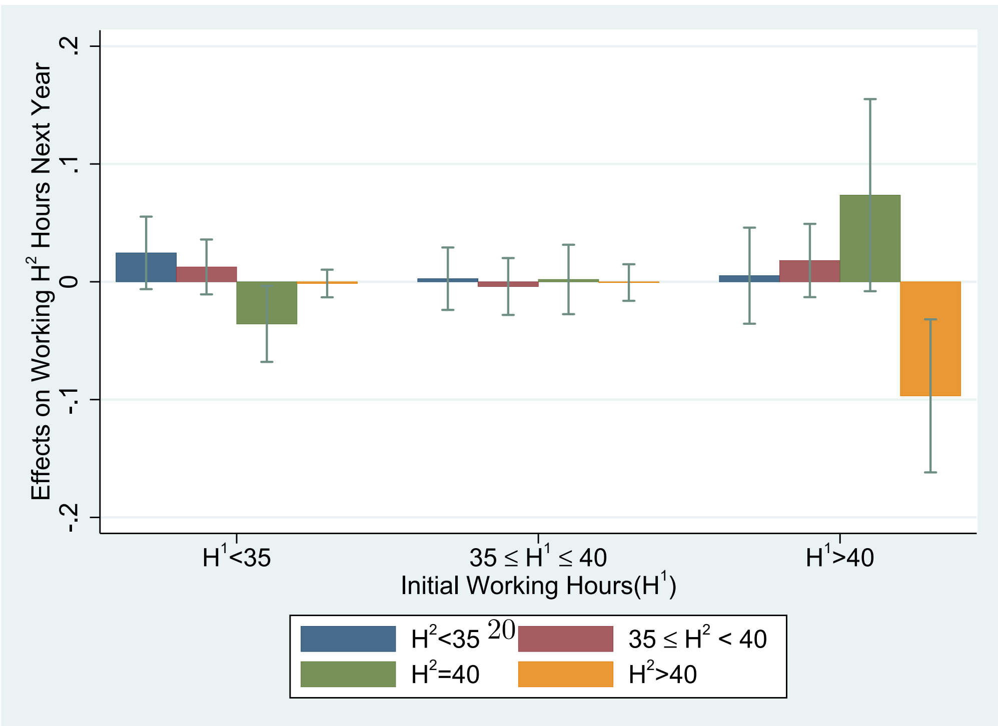
[26]Another issue is measurement error in hours which may affect the results by misclassifying salaried workers. In Appendix G, I additionally replicate the analysis using only hourly paid workers in the first year. For part-time and full-time workers, results are almost identical to those in Tables 2 and 3. However, I lose precision for overtime workers due to the smaller sample size. Note that more than half of the overtime workers are salaried workers. 95 percent confidence interval of coefficient on the minimum wage overtime workers' hours of work include both negative 3 and positive 3, and wage effects are also imprecisely estimated.

Table 4: Minimum Wage Effects on Hours-of-Work Distribution

	Work in Both Year			
	$h^2 \in (0,35)$	$h^2 \in [35,40)$	$h^2 = 40$	$h^2 > 40$
	(1)	(2)	(3)	(4)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0,35))$	0.025	0.013	-0.036*	-0.001
	(0.016)	(0.012)	(0.016)	(0.006)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35,40])$	0.003	-0.004	0.002	-0.001
	(0.014)	(0.012)	(0.015)	(0.008)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.005	0.018	0.074+	-0.097**
	(0.021)	(0.016)	(0.042)	(0.033)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0,35))$	0.011	0.012	-0.016	-0.007
	(0.016)	(0.011)	(0.017)	(0.005)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35,40])$	-0.001	0.002	-0.018	0.017+
	(0.014)	(0.015)	(0.017)	(0.010)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	0.038	-0.002	-0.097*	0.060+
	(0.026)	(0.014)	(0.038)	(0.035)
Observations	74,150	74,150	74,150	74,150
Controls	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, in other words, initial wage minus initial minimum wage. h^1 refers to working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Figure 2: The Effects on Hours-of-Work Distribution by Initial Working Hours



It shows the coefficients and 95% confidence intervals of the effects of minimum wage increases on the directly affected workers' hours-of-work distribution by workers initial working hours. H^1 and H^2 refer to the hours of work at the first and second interview, respectively. See text for details.

The results in Table 4 and Figure 2 are again consistent with the prediction. First, the probability of working 40 hours per week decreases for part-time workers by 3.6 percentage points when the minimum wage is increased. Figure 2 visually emphasizes that they are instead working a smaller number of hours. This result is consistent with the prediction of Section 3, which suggests that part-time work would be more prevalent, and some workers would move out from the kink point.

The effects on overtime workers are also consistent with the prediction. They are less likely to work overtime and shift to 40-hour per week positions. Estimates show that the probability of staying in overtime positions decreases by 9.7 percentage points, which is larger than one-fifth of the total probability of staying in overtime jobs. This result provides evidence that higher (straight-rate) wages are likely to reduce the incidence of overtime work. However, effects on becoming overtime workers for part-time or full-time workers are estimated to be zero. Since becoming an overtime worker is very uncommon for part-time and full-time workers, this result is reasonable. The prediction in Section 3 showed that larger bunching at the kink is only relevant for potential overtime workers; hence, part-time and full-time workers are not affected. This further explains the lack of evidence on the effects of the share of overtime workers in Cengiz et al. (2021).

Finally, Table 4 shows the shift from 40-hour positions to overtime from full-time and overtime workers in the lower wage group. It may suggest the labor-labor substitution toward more productive workers. However, the effects on working hours are minimal for these groups in Table 3, suggesting that the overall effects could be small.

7 Discussion and Conclusion

In this study, I explore the effects of minimum wage increases on short-run adjustments in labor market outcomes by combining longitudinal data from the CPS-ORG and 107 large-scale state-level minimum wage increases. The results show that employers adjust hours in response to minimum wage increases, and different adjustments were made for different types of workers. Part-time and overtime workers lose working hours, and negative effects on working hours offset much of wage gain. Full-time workers do not experience negative effects on hours and they also enjoy wage gains. I find that minimum wage increases and overtime pay regulation interact with each other and discourage the use of overtime workers. Affected overtime workers shift toward 40-hour per week positions, and part-time workers are more likely to stay in part-time jobs.

The analysis in this paper suggests that part-time and overtime minimum wage workers experience negative effects on their labor-market outcomes. To see how my estimates can be connected to the existing literature focusing on specific demographic subgroups, I show the portion of demographic subgroups among minimum wage part-time, full-time, and overtime workers in Table 5A, and the share of part-time, full-time, and overtime

Table 5A. Demographic Subgroup by Hours of Work

	$w^1 \leq MW + 0.5$, first year observation		
	Part-time	Full-time	Overtime
Teenager	0.403	0.070	0.028
Low-educated Prime-age Men	0.017	0.114	0.120
Low-educated Prime-age women	0.050	0.124	0.062
Low-educated Single Mothers	0.191	0.216	0.132
Low-educated Male Immigrants	0.017	0.114	0.120
Better-educated Prime-age Men	0.072	0.167	0.355
Better-educated Prime-age Women	0.185	0.277	0.206
Observations	12608	6664	1193

All results are weighted by earnings weight *earnwt*. 'Low-educated' is defined as those whose education level is lower than a high-school diploma, and 'Better-educated' is defined as those who have a high-school diploma or higher educational attainment (including some college, B.A., and advanced degree). Prime-age is 25-55. Immigrants are defined as those whose place of birth is uot United States.

Table 5B. Hours of Work by Demographic Subgroup

	$w^1 \leq MW + 0.5$, first year observation							
	Whole	Teenagers	Low-educated				Better-educated	
			Prime-age Men	Prime-age Women	Single Mothers	Male Immigrants	Prime-age Men	Prime-age Women
Part-time	0.603	0.905	0.187	0.398	0.610	0.186	0.358	0.513
Full-time	0.339	0.089	0.689	0.554	0.355	0.689	0.470	0.432
Overtime	0.058	0.006	0.124	0.048	0.035	0.125	0.171	0.055
Observations	20465	5856	959	1455	2032	934	2456	4681

See notes for Table 5A

workers among selected groups in Table 5B. Only the first-year observations of the lowest wage group workers were used.

On the one hand, negative effects on the part-time workers suggest that teenagers and single mothers might be the most vulnerable to the minimum wage increases. Teenagers have been the most extensively studied in the literature, but analysis suggests that they are not representative of minimum wage workers. Rather, they are the group most concentrated in part-time jobs, so they might be the most likely to be negatively affected in terms of working hours. Hence, focusing on teenagers may provide a biased view, given the differential effects of minimum wages depending on the hours of work. Another group among whom part-time work is prevalent is single mothers; this suggests that they may be negatively affected as well.

On the other hand, negative effects on the working hours of overtime workers point to a very different group to be affected by the minimum wages. Prime-age men make up nearly half of the minimum wage overtime workers. Although most prime-age men are full-time workers, there may exist a small minority experiencing large negative effects on their working hours.

Then how many workers would be affected? I use the simple back-of-the-envelope-calculation to see how many workers would be affected, and how many hours would be reduced. According to the BLS minimum wage report, in 2018, the number of hourly paid workers whose hourly earnings are at or below the federal minimum wage is approximately 1.7 million (Bureau of Labor Statistics 2019). 885,000 of them were part-time workers and 50,000 worked overtime. However, this calculation substantially underestimates the number of affected workers for two reasons: first, in 2018, 29 states and the District of Columbia had their own minimum wage higher than the federal; second, hourly paid workers made up only a small fraction of minimum wage overtime workers.

I calculate the fraction of hourly paid workers whose hourly earning is at or below federal minimum wage using first-year observations of the lowest wage group workers in 2018. In my sample, only around 16 percent of part-time workers and 6 percent of overtime workers in the lowest wage group were hourly paid workers at or below the federal minimum wage. Using these percentages, I estimate the number of the part-time and overtime workers in the lowest wage group to be roughly 5.5 million and 800,000, respectively. Appendix Table A1 showed that 75 percent of part-time workers and 90 percent of overtime workers continued to work in the following year.

Combining the above information with estimates in Table 3, a back-of-the-envelope calculation suggests that if all states increase their minimum wage by 10 percent (approximately the median of the size of increases in the data), the sum of hours lost would be approximately 4 million hours per week ($5.5 \times 0.75 \times 1$) for the part-time workers, and slightly more than 2 million hours per week ($0.8 \times 0.9 \times 3.3$) for overtime workers. In summary, although the number of the overtime minimum-wage workers is relatively small, their importance is non-negligible because each overtime worker loses a relatively large number of hours if subjected to a minimum wage increase.

Overall, the results in this paper suggest that economists need to more broadly consider the effects of the minimum wages on various economic outcomes, rather than focusing on the change in the head count of workers. Economists have widely considered that testing whether the minimum wage reduces the number of jobs is testing neoclassical economics itself. However, when firms can change output prices and other nonwage aspects of jobs (including working hours and overtime benefits discussed in this paper), minimum wage does not necessarily reduce the number of jobs. Recently, Clemens (2021) points out that "margins including nonwage job attributes can have first-order implications for analyses of minimum wages (p.52.)" and review the small body of economic literature on other margins, including output prices, noncash compensations and other job attributes. This paper is in line with Clemens (2021)'s argument and suggests that minimum wage literature needs to expand the scope of outcomes of interest to a variety of aspects of jobs.

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Online Appendix

A. Data Appendix

A1. Matching CPS-ORG

The standard way to construct longitudinal data using the CPS-ORG is to rely on household identifier variables (*hhid*, *hhnum*, and *lineno*) together with the month of the interview (*intmonth*) and state information to match first- and second-year observations. See Madrian and Lefgren (1999) for a detailed discussion. However, this set of variables generally creates multiple matches since the combination cannot uniquely identify each observation in the data set. From 2004 Q2, however, researchers can uniquely identify each observation by adding additional information from *hrhhid2*, another household identifier, to the enumerated variables. By using additional information, approximately 78 percent of the raw data was matched. Because of the age restriction, approximately 4 percent of the sample was dropped. Among the matched, an additional 3 percent is dropped since the changes in age are too large or small (larger than 2 or smaller than 0) or the reported sex varies. Approximately 72 percent of observations in raw data survive the criteria. I use observations who enter the interview from 2005 to 2018, and the second-year sample consists of observations from 2006 to 2019.

A2. Additional Summary Statistics

Table A1 shows the summary statistics by the hour group. The key features are discussed above. All four wage groups are aggregated for Table A1.

Table A1: Summary Statistics by Working Hours

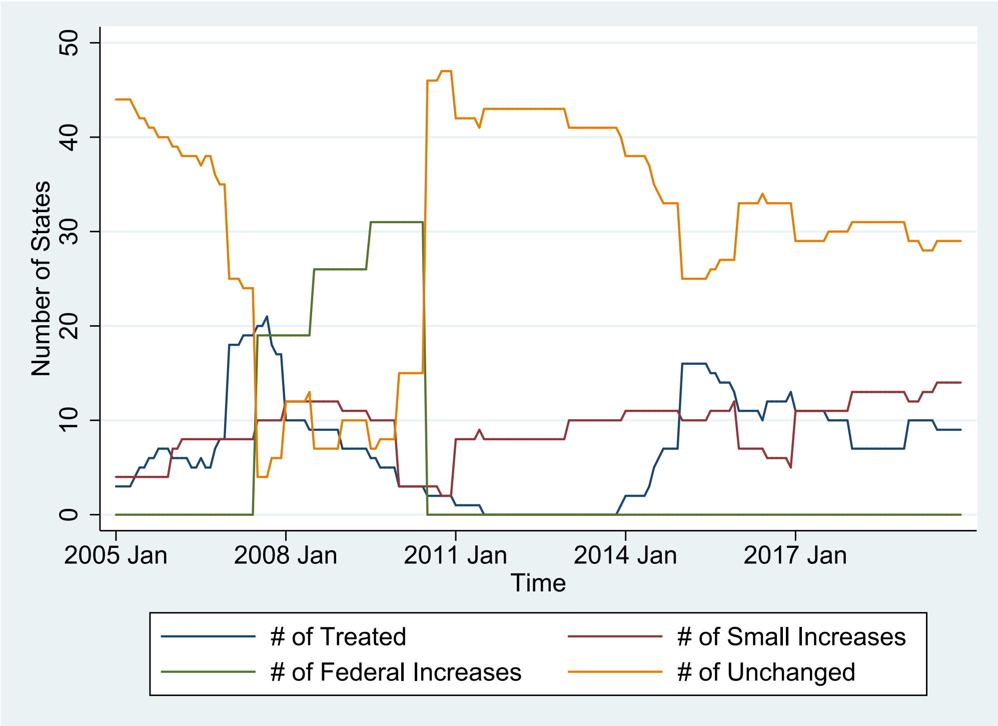
	Hours Group		
	Part-time	Full-time	Overtime
Panel A. Year 1 Economic Variable			
Log Wage (2019 USD)	2.280	2.370	2.347
	(0.194)	(0.186)	(0.231)
Paid Hourly	0.932	0.834	0.513
Panel B. Year 2 Economic Variable			
Work in the Second Year	0.744	0.856	0.902
Log Wage (2019 USD)^a	2.388	2.494	2.586
	(0.278)	(0.290)	(0.397)
Paid Hourly^a	0.903	0.815	0.534
Part-time	0.544	0.096	0.043
Full-time	0.188	0.719	0.373
Overtime	0.012	0.041	0.487
Panel C. Year 1 Demographic Variable			
Age	31.151	37.482	38.679
	(14.417)	(12.734)	(12.192)
Female	0.652	0.556	0.387
< High School	0.260	0.219	0.191
High School Graduates	0.286	0.403	0.345
Some College	0.356	0.277	0.257
College Graduates	0.083	0.084	0.140
Above B.A.	0.015	0.017	0.066
African American	0.112	0.141	0.088
Hispanic	0.176	0.309	0.238
Other	0.083	0.087	0.093
Teenager	0.275	0.041	0.023
Panel D. Wage Group			
Wage Group 1	0.334	0.158	0.194
Wage Group 2	0.313	0.239	0.204
Wage Group 3	0.219	0.304	0.285
Wage Group 4	0.134	0.298	0.317
Observations	39731	45125	6452

See note for Table 1. Variables with ^{a} are measured conditional on working in the second year.

A3. Number of Treated and Control States Each Year

The minimum wage increases are unevenly distributed over time and across states. Figure A1 shows the number of states who experience treatment, small-scale state-level increases, federal-level increases within a year as well as those whose minimum wages have remained unchanged by each month from 2005 January to 2019 December. The

Figure A1. Number of States Experiencing the Treatments



Number of states that experienced treatments, small-scale state-level increases, and federal increases within a year. The orange line shows the number of states whose minimum wage emained unchanged within a year.

figure shows that the minimum wage increases are highly concentrated on two periods: 2007-2010 and 2015-2019. The first era coincides with the Great Recession and federal level increases in 2007, 2008, and 2009. The major driving force of the second period is the state-level changes.

B. Full Tables

This section shows the full versions of Table 3 and 5. Most of the estimates for two upper wage groups are statistically indistinguishable from zero and small in magnitude.

Table B1. Full Version of Table 3

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0, 35))$	0.056***	-0.995**	-0.044*	0.027+	-0.092
	(0.014)	(0.371)	(0.018)	(0.016)	(0.486)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35, 40])$	0.035*	-0.160	-0.009	-0.008	-0.418
	(0.015)	(0.229)	(0.010)	(0.019)	(0.695)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.113*	-3.334***	-0.060*	0.018	-2.167+
	(0.044)	(0.883)	(0.024)	(0.027)	(1.103)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0, 35))$	0.032**	-0.128	0.000	-0.006	-0.357
	(0.011)	(0.295)	(0.011)	(0.022)	(0.596)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35, 40])$	0.030**	0.518+	0.019+	-0.016	-0.211
	(0.010)	(0.298)	(0.010)	(0.013)	(0.517)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	0.026	-0.173	0.006	0.003	0.036
	(0.029)	(0.979)	(0.027)	(0.033)	(1.446)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in (0, 35))$	0.029*	0.152	0.019	-0.010	-0.125
	(0.015)	(0.348)	(0.015)	(0.016)	(0.481)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [35, 40])$	0.030+	-0.129	-0.002	0.008	0.208
	(0.016)	(0.283)	(0.011)	(0.011)	(0.402)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 > 40)$	-0.040	0.561	0.005	-0.004	0.330
	(0.027)	(0.883)	(0.018)	(0.017)	(1.125)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in (0, 35))$	0.002	-0.103	-0.003	-0.015	-0.374
	(0.010)	(0.449)	(0.021)	(0.014)	(0.445)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [35, 40])$	0.006	0.012	0.003	0.006	0.159
	(0.013)	(0.197)	(0.007)	(0.009)	(0.415)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 > 40)$	0.066*	-0.882	-0.006	0.007	-0.643
	(0.033)	(0.697)	(0.015)	(0.019)	(1.249)
Observations	74,150	74,150	74,150	91,308	91,308
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table B2. Full Version of Table 5

	Work in Both Year			
	$h^2 \in (0, 35)$	$h^2 \in [35, 40)$	$h^2 = 40$	$h^2 > 40$
	(1)	(2)	(3)	(4)
Panel A. Across Wage and Hours Group				
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0, 35))$	0.025	0.013	-0.036*	-0.001
	(0.016)	(0.012)	(0.016)	(0.006)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35, 40])$	0.003	-0.004	0.002	-0.001
	(0.014)	(0.012)	(0.015)	(0.008)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.005	0.018	0.074+	-0.097**
	(0.021)	(0.016)	(0.042)	(0.033)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0, 35))$	0.011	0.012	-0.016	-0.007
	(0.016)	(0.011)	(0.017)	(0.005)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35, 40])$	-0.001	0.002	-0.018	0.017+
	(0.014)	(0.015)	(0.017)	(0.010)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	0.038	-0.002	-0.097*	0.060+
	(0.026)	(0.014)	(0.038)	(0.035)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in (0, 35))$	0.014	-0.012	0.004	-0.005
	(0.016)	(0.012)	(0.013)	(0.005)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [35, 40])$	0.007	-0.006	0.011	-0.012*
	(0.013)	(0.011)	(0.018)	(0.006)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 > 40)$	0.008	0.011	-0.032	0.013
	(0.015)	(0.009)	(0.036)	(0.029)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in (0, 35))$	-0.013	-0.001	0.017	-0.004
	(0.024)	(0.016)	(0.018)	(0.009)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [35, 40])$	-0.007	0.006	0.006	-0.005
	(0.010)	(0.008)	(0.019)	(0.010)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 > 40)$	-0.020+	-0.010	0.098*	-0.069+
	(0.011)	(0.014)	(0.044)	(0.035)
Panel B. Across Wage Group				
$D_{st} \times I(\tilde{w} = w^1 - MW^1 \leq 0.5)$	0.015	0.007	-0.014	-0.008
	(0.012)	(0.011)	(0.013)	(0.006)
$D_{st} \times I(0.5 < \tilde{w} \leq 2)$	0.007	0.007	-0.022	0.008
	(0.010)	(0.010)	(0.013)	(0.006)
$D_{st} \times I(2 < \tilde{w} \leq 3.5)$	0.009	-0.007	0.005	-0.008
	(0.010)	(0.008)	(0.011)	(0.005)
$D_{st} \times I(3.5 < \tilde{w} \leq 5)$	-0.010	0.003	0.018	-0.011
	(0.009)	(0.008)	(0.016)	(0.010)
Observations	74,150	74,150	74,150	74,150
Controls	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

C. Alternative Treatment Definitions

This section explores how the estimates are affected by using an alternative definition of the treatments and different time periods. The goal of these exercises is to understand the relationship between the estimated effects and the different composition of the treated groups and the role of initial minimum wages.

Tables C1 and C2 replicate Tabless 2 and 3 with the treatments defined as an increase in effective minimum wages exceeding 50 cents in 2019 USD including federal minimum wages. Unlike the analysis in the body, the treatments include both state- and federal level changes.

The results in Tables C1 and C2 are largely similar to those in Table 2 and 3, but the negative estimates on the working hours decreased in absolute terms. Several factors may play a role. First, the wage effects in Column (1) are smaller with the alternative definition. This finding may reflect the gap in the initial wage that is not fully controlled by the group-by-state fixed effects. Additionally, the state-level changes may have larger wage effects. If the underlying wage effects are smaller, it is not surprising to see smaller effects on the hours. Second, compared to Tables 2 and 3, the treatment groups in Tables C1 and C2 have more states with lower initial minimum wages. If the absolute wage level, together with wage relative to minimum, plays a role, it may explain the patterns in Tables C1 and C2.

Table C1. Replication of Table 2, Using Federal and State Increases as the Treatments

	Work in Both Years			Work in First Year	
	Log Wage (1)	Hours of Work (2)	Log Hour (3)	Work (4)	Hours of Work (5)
$D_{st} \times I(\tilde{w} = w^1 - MW^1 \leq 0.5)$	0.040**	-0.481+	-0.018+	0.010	-0.090
	(0.012)	(0.242)	(0.010)	(0.011)	(0.374)
$D_{st} \times I(0.5 < \tilde{w} \leq 2)$	0.014+	-0.085	0.001	-0.008	-0.335
	(0.007)	(0.167)	(0.006)	(0.010)	(0.293)
$D_{st} \times I(2 < \tilde{w} \leq 3.5)$	0.007	-0.103	-0.001	-0.005	-0.280
	(0.011)	(0.208)	(0.009)	(0.010)	(0.350)
$D_{st} \times I(3 < \tilde{w} \leq 5)$	0.003	-0.094	-0.002	0.000	-0.045
	(0.010)	(0.164)	(0.007)	(0.007)	(0.300)
Observations	74,150	74,150	74,150	91,308	91,308
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table C2. Replication of Table 3, Using Federal and State Increases as the Treatments

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0, 35))$	0.040**	-0.807*	-0.032*	0.011	-0.271
	(0.013)	(0.332)	(0.015)	(0.012)	(0.414)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35, 40])$	0.032*	0.179	0.002	0.004	0.124
	(0.014)	(0.212)	(0.009)	(0.016)	(0.553)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.080+	-1.321	-0.019	0.039	0.497
	(0.047)	(1.407)	(0.030)	(0.028)	(1.600)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0, 35))$	0.012	-0.490+	-0.017	-0.008	-0.560
	(0.009)	(0.279)	(0.011)	(0.018)	(0.513)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35, 40])$	0.013	0.388+	0.019+	-0.012	-0.237
	(0.009)	(0.218)	(0.010)	(0.010)	(0.391)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	0.032	-0.461	-0.001	0.036	1.085
	(0.027)	(0.893)	(0.024)	(0.030)	(1.571)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in (0, 35))$	0.006	0.054	0.008	-0.004	0.039
	(0.013)	(0.314)	(0.016)	(0.015)	(0.454)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [35, 40])$	0.011	-0.238	-0.006	0.003	-0.139
	(0.013)	(0.211)	(0.008)	(0.010)	(0.377)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 > 40)$	-0.013	0.234	-0.002	-0.062*	-2.878+
	(0.023)	(0.693)	(0.015)	(0.027)	(1.454)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in (0, 35))$	-0.006	0.002	-0.003	-0.015	-0.230
	(0.009)	(0.346)	(0.017)	(0.011)	(0.380)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [35, 40])$	0.003	-0.014	0.001	0.005	0.070
	(0.010)	(0.148)	(0.006)	(0.008)	(0.348)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 > 40)$	0.030	-0.871	-0.012	0.016	-0.289
	(0.030)	(0.591)	(0.013)	(0.016)	(1.067)
Observations	74,150	74,150	74,150	91,308	91,308
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

In Table C3 and C4, I additionally estimated Equations (1) and (2) using observations from years 2011-2019. That period saw no federal minimum wage increases. Further, the average minimum wages of the treated states before the treatment are higher during this time period.[27] These results show that negative effects on the working hours are strengthened, and the wage effects are much clearer.

By comparing the patterns in Tables 2, 3, C1, C2, C3, and C4, we can learn that the negative effects on the working hours are larger when the high-minimum wage states are treated. If the high-minimum wage states are treated, their new minimum could be binding for more workers, and it may cause larger negative effects on the working hours. Table C1 shows that when the treated group contained a treatment for low-wage states bound by federal minimum wages, the negative effects on hours are rather modest, and the wage gains far exceed loss in hours. However, when the states with higher minimum

[27]The unweighted average real minimum wage of the treated states one month before the increase is \$9.32 for the state-level treatment during the years 2005-2019, \$8.96 for the state- and federal increases during the years 2005-2019, and \$10.26 for the state-level increases during the years 2011-2019.

wages further increase their minimum, as many states recently do, the loss in working hours could offset wage gains, raising a question of whether increasing the minimum wage could boost the earnings of the low-wage workers.

Table C3. Replication of Table 2, Years 2011-2019

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} \leq 0.5)$	0.062***	-1.590***	-0.061**	0.004	-1.240*
	(0.017)	(0.379)	(0.018)	(0.018)	(0.468)
$D_{st} \times I(0.5 < \tilde{w} \leq 2)$	0.060***	0.146	0.012	-0.013	-0.387
	(0.008)	(0.326)	(0.013)	(0.016)	(0.459)
$D_{st} \times I(2 < \tilde{w} \leq 3.5)$	0.043*	-0.313	-0.003	0.001	-0.173
	(0.018)	(0.334)	(0.014)	(0.016)	(0.538)
$D_{st} \times I(3.5 < \tilde{w} \leq 5)$	0.032*	-0.333	-0.012	-0.002	-0.234
	(0.012)	(0.361)	(0.013)	(0.013)	(0.564)
Observations	46,856	46,856	46,856	57,103	57,103
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table C4. Replication of Table 3, Years 2011-2019

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0, 35))$	0.058**	-1.661***	-0.072**	0.025	-0.625
	(0.017)	(0.460)	(0.023)	(0.019)	(0.540)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35, 40])$	0.052*	-0.820*	-0.037*	-0.033	-1.765**
	(0.022)	(0.397)	(0.017)	(0.021)	(0.653)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.153*	-5.001***	-0.097**	-0.007	-4.484**
	(0.063)	(1.265)	(0.030)	(0.038)	(1.363)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0, 35))$	0.060***	-0.027	0.008	-0.012	-0.514
	(0.012)	(0.534)	(0.022)	(0.029)	(0.658)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35, 40])$	0.058***	0.506	0.020	-0.018	-0.253
	(0.011)	(0.386)	(0.016)	(0.018)	(0.550)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	0.077+	-1.200	-0.010	0.017	-0.292
	(0.040)	(1.284)	(0.040)	(0.027)	(1.300)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in (0, 35))$	0.060***	-0.268	0.006	-0.003	-0.228
	(0.014)	(0.538)	(0.022)	(0.026)	(0.799)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [35, 40])$	0.041+	-0.319	-0.007	0.007	0.030
	(0.023)	(0.297)	(0.013)	(0.019)	(0.692)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 > 40)$	-0.028	-0.493	-0.014	-0.025	-1.646
	(0.030)	(1.035)	(0.022)	(0.030)	(2.126)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in (0, 35))$	0.016	-1.336+	-0.067*	-0.040+	-2.096**
	(0.018)	(0.695)	(0.032)	(0.020)	(0.618)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [35, 40])$	0.026+	0.133	0.007	0.010	0.471
	(0.015)	(0.297)	(0.011)	(0.018)	(0.798)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 > 40)$	0.108**	-0.974	-0.005	0.032*	0.386
	(0.032)	(0.861)	(0.020)	(0.016)	(1.048)
Observations	46,856	46,856	46,856	57,103	57,103
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

D. Event-Study Framework Including Lags and Leads

In this subsection, I tested how estimates are affected by the inclusion of the lags and leads of minimum wage increases using the following event-study specifications.

$$\begin{aligned} y_{ijhst} &= \alpha + \sum_{\tau=-2}^{2} \sum_{j} \beta_{j\tau} \times D_{st\tau} \boldsymbol{I}(w^1 \in \text{Group } j) \\ &\quad + X'_{ist}\delta + W'_{st}\eta + \Omega + \lambda_{jh} + \rho_{js} + \rho_{jt} + e_{ist} \end{aligned} \tag{3}$$

$$\begin{aligned} y_{ijhst} &= \alpha + \sum_{\tau=-2}^{2} \sum_{j} \sum_{h} \beta_{jh\tau} \times D_{st\tau} \boldsymbol{I}(w^1 \in \text{Group } j) \times \boldsymbol{I}(h^1 \in \text{Group } h) \\ &\quad + X'_{ist}\delta + W'_{st}\eta + \Omega + \lambda_{jh} + \rho_{js} + \rho_{jt} + e_{ist} \end{aligned} \tag{4}$$

Here, Ω included the indicators for the past and future small-scale and federal level minimum wage increases interacted with the indicators for each wage group. The specification follows the event-study specifications, but interpretation is not straightforward as mentioned. Since information on minimum wage increases is often publicly available several years prior to the actual increases, $\beta_{j\tau}$s and $\beta_{jh\tau}$s for the future minimum wage increases could be interpreted as the effects of the expected minimum wage increases. However, interpretations are not clear for the coefficients for the past minimum wage increases. The groups are defined based on the labor market outcomes during the first-year, which might have already been affected by past minimum wage increases. Therefore, it cannot be understood as the medium-run effects of minimum wage increases without imposing stronger assumptions. These coefficients, especially for the intensive margin responses, might be better understood as additional effects in the following years.

All the regressions included the aforementioned controls and workers in Groups 3 and 4, while I report the coefficients for only the bottom two groups. The top left panel shows the estimates from Equation (3) and the other three panels show them from Equation (4). Year 0 is the case when minimum wage increases occur between first and second year interviews. Year 1 and 2 show the 1 and 2 years after the minimum wage increases, respectively.

Figure D1. Effects on the Log Wage, $w^1 - MW^1 \leq 0.5$

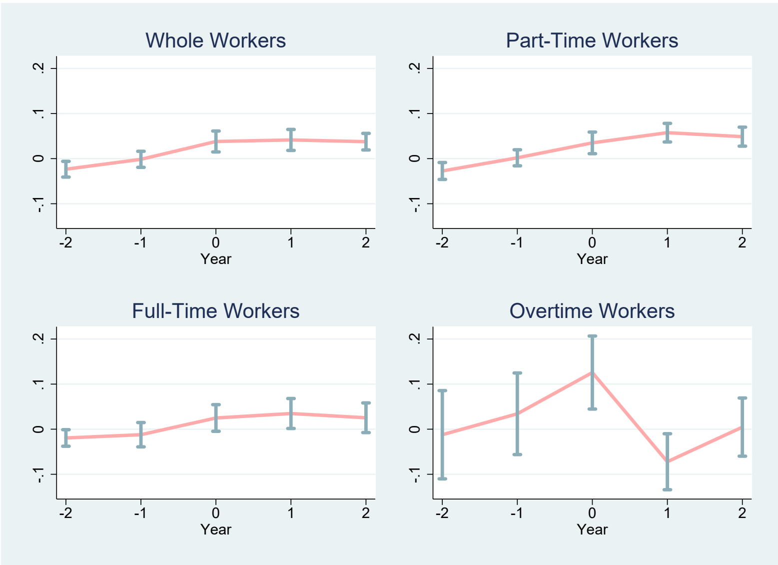
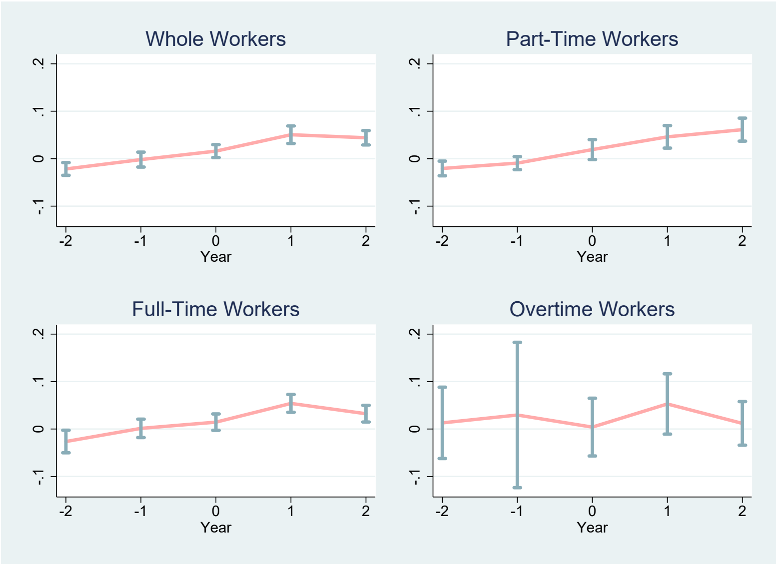


Figure D2. Effects on the Log Wages, $0.5 \leq w^1 - MW^1 \leq 2$



The first two figures show the wage effects. They show that the part-time and full-time workers enjoy wage gains, while some of the positive effects on overtime workers are offsetted. However, given the evidence that some of the overtime workers are moved to part-time work (Table 5), the estimates are difficult to interpret.

Figures D3 through D6 show the intensive margin response. The figures demonstrate an interesting pattern of adjustments. Effects are found only for the first year, and there are no additional adjustments in the following years. It is consistent with the evidence that the working hours are adjusted quickly (Belman and Wolfson 2010).

Figure D3. Effects on the Hours of Work, $w^1 - MW^1 \leq 0.5$

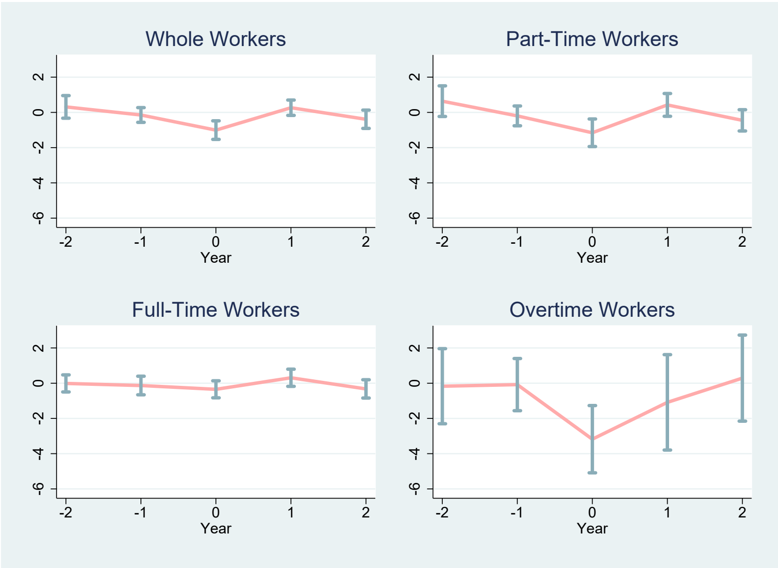


Figure D4. Effects on the Hours of Work, $0.5 \leq w^1 - MW^1 \leq 2$

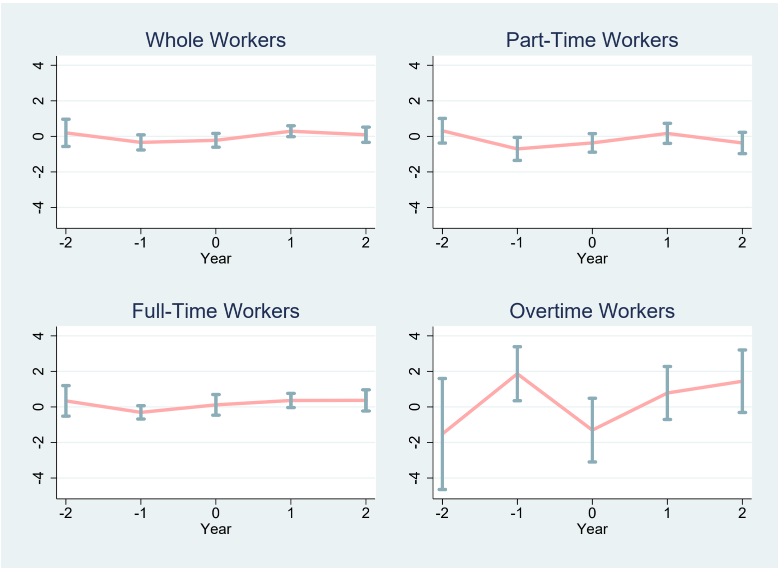


Figure D5. Effects on the Log Hours of Work, $w^1 - MW^1 \leq 0.5$

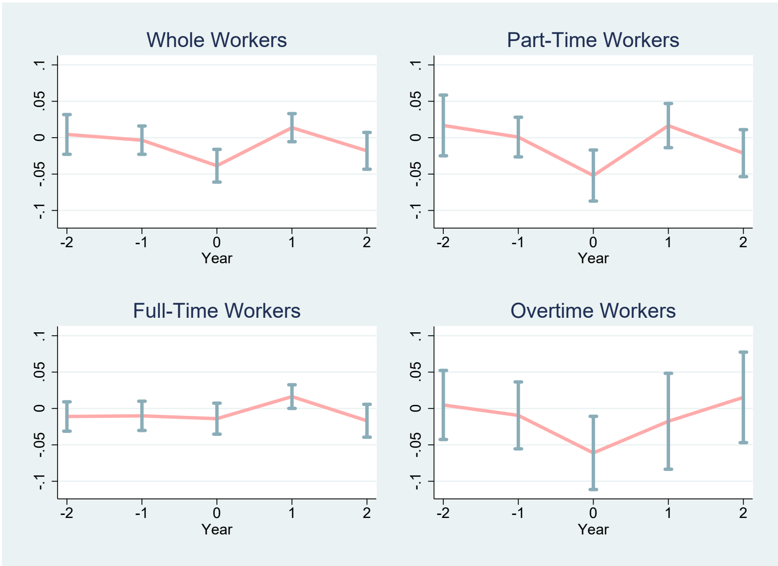


Figure D6. Effects on the Log Hours of Work, $0.5 \leq w^1 - MW^1 \leq 2$

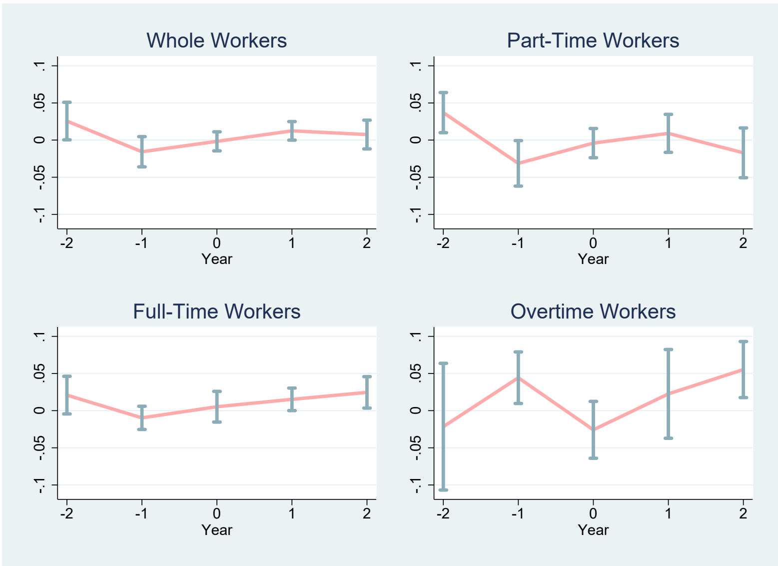


Figure D7. Effects on Work, $w^1 - MW^1 \leq 0.5$

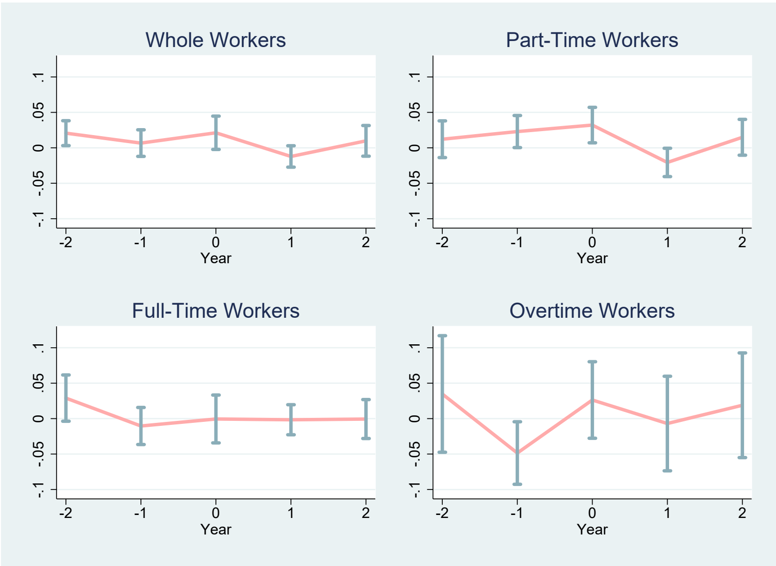
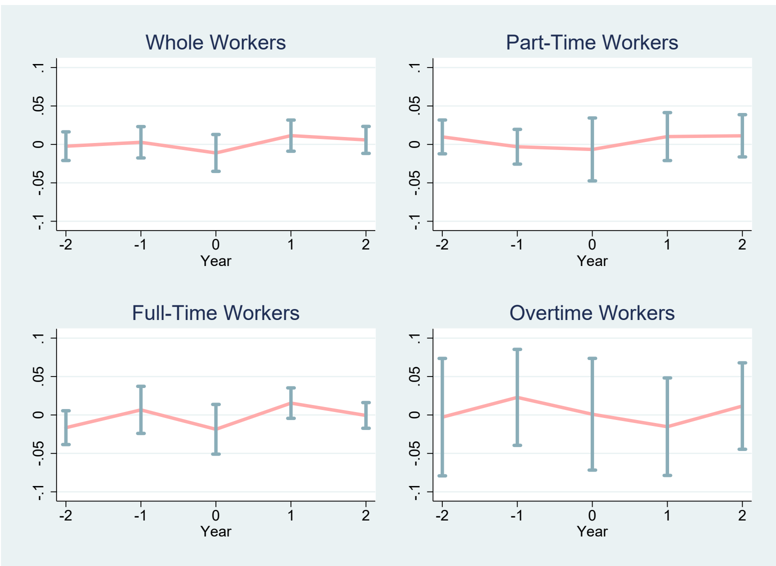


Figure D8. Effects on Work, $0.5 \leq w^1 - MW^1 \leq 2$



The next two figures show the extensive margin responses. They do not show any clear instantaneous effects (year 0) as Tables 2 and 3 do. However, Figure D7 suggested the possibility of extensive margin responses in the year following the minimum wage increases. In this case, the employers may adjust hours first, and then move to the firing channel. This effect is found only for the part-time workers.

Figures D9 through D12 show the effects on the probability of working overtime and 40 hours per week.

Figure D9. Overtime, $w^1 - MW^1 \leq 0.5$

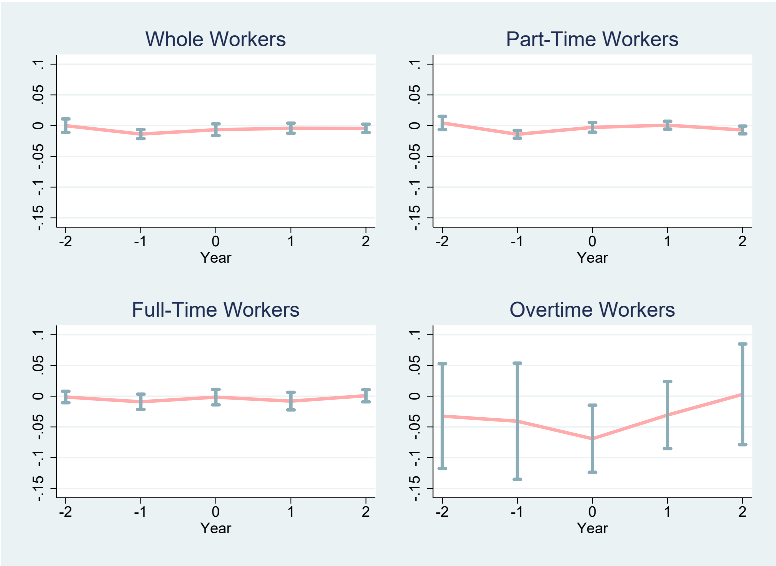


Figure D10. Effects on Overtime, $0.5 \leq w^1 - MW^1 \leq 2$

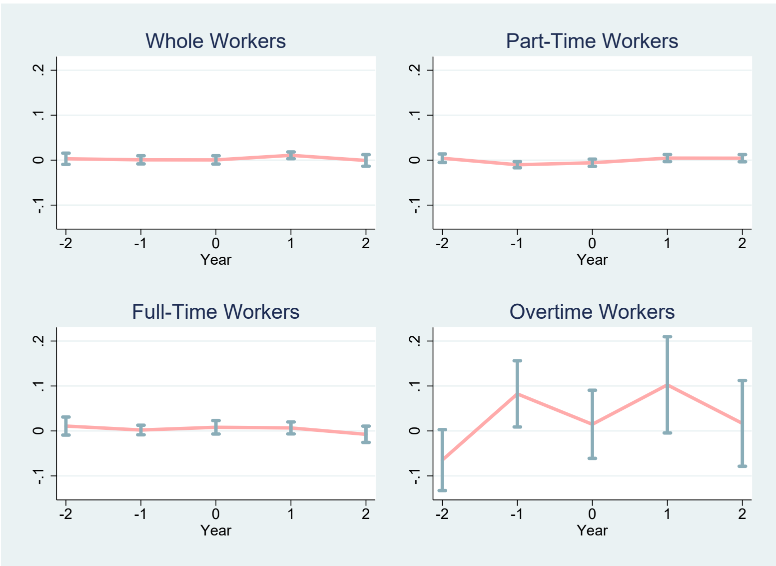


Figure D11. Effects on $h = 40$, $w^1 - MW^1 \leq 0.5$

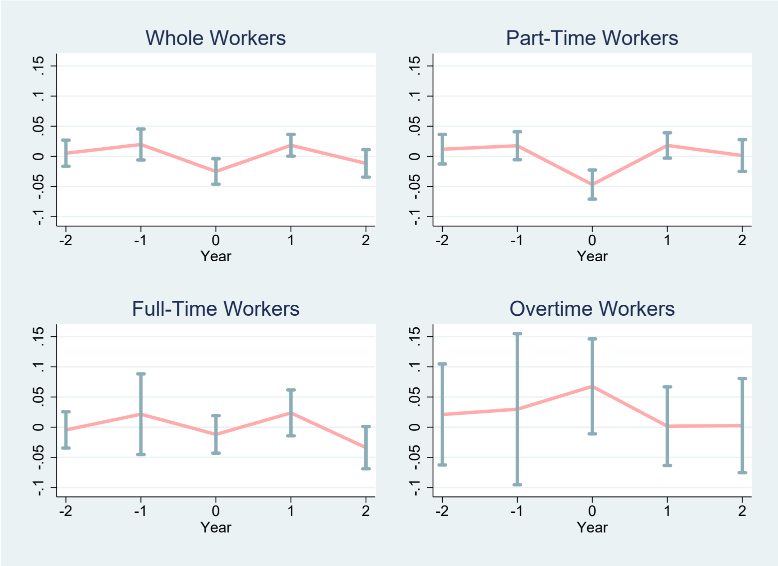
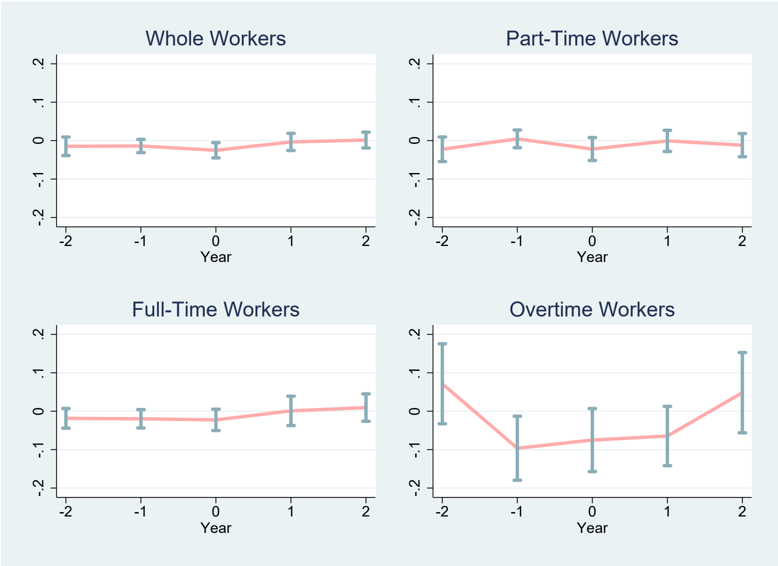


Figure D12. Effects on Overtime, $h = 40, 0.5 \leq w^1 - MW^1 \leq 2$



E. Robustness Check of the TWFE Results

In this subsection, I explored the effects using an alternative estimator proposed by de Chaisemartin and D'Haultfoeuille (2020). In this paper's framework, treatments were not staggered since treatments can be turned 'on' and 'off' in the same state. de Chaisemartin and D'Haultfoeuille (2020)'s estimator can be used in this situation unlike most other estimates proposed in the literature relying on the staggered assumption. To use the estimator provided by Stata's *did_multiplegt* package, I made a few revisions to my model. Since their package is designed for the TWFE model, I first change the regression equation to

$$y_{ihst} = \alpha + \beta D_{st} + X'_{ist}\delta + W'_{ist}\eta + \Omega + \lambda_h + \rho_s + \rho_t + e_{ist}$$

using observations in wage bin j. The next revision is to change the unit of time. All my estimates use month as the unit of time. Since the estimator proposed by de Chaisemartin and D'Haultfoeuille (2020) compares joiners in period t to a stable group that are not treated in both t and $t-1$ and leavers to another stable group who are treated in both periods, if some periods have neither joiners nor leavers, I lose them in the estimation. However, the minimum wage increases are not evenly distributed monthly, so many periods have neither joiners nor leavers. To minimize this concern, I changed the temporal unit to quarters, instead of months.

Table E1. TWFE and the Alternative Estimator

	Work in Both Years			Work in First Year	
	Log Wage (1)	Hours of Work (2)	Log Hour (3)	Work (4)	Hours of Work (5)
Panel A. $\tilde{w} \leq 0.5$					
TWFE	0.052***	-0.806**	-0.030*	0.019	-0.130
	(0.014)	(0.259)	(0.012)	0.019	-0.130
Observations	15,310	15,310	15,310	20,508	20,508
Alternative Estimator	0.079	-1.939	-0.121	-0.005	-1.957
	(0.064)	(1.806)	(0.087)	(0.070)	(2.578)
Observations	5,158	5,158	5,158	7,265	7,265
Panel B. $0.5 < \tilde{w} \leq 2$					
TWFE	0.030**	0.087	0.006	-0.012	-0.365
	(0.009)	(0.229)	(0.007)	(0.014)	(0.416)
Observations	19,117	19,117	19,117	24,102	24,102
Alternative Estimator	0.069	1.575+	0.042	0.036	2.841+
	(0.053)	(0.948)	(0.039)	(0.039)	(1.619)
Observations	6,987	6.987	6,987	8,950	8,950

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1 . Standard errors of alternative estimators are calculated by 500 iterations of bootstrap.

In general, the estimates increase substantially in absolute magnitude if I use an alternative estimator, and it is very imprecisely estimated partly due to the smaller sample size. However, the results are qualitatively similar, except for the positive effects on the working hours of the lower wage group in Panel B.

F. Results Using a More-Detailed Hours Bin

This subsection presents the results using a more-detailed classification of the part-time workers and re-estimating Equation (3). In Table F1, I divide part-time workers into two groups: those who work 20 hours or less and those who work more than 20 hours per week. The first group ($h^1 \in (0, 20]$) has 22,147 workers and the second has 17,584 workers. For Table F2, I divide the part-time workers into three groups: $0 < h^1 < 15, 15 \leq h^1 < 25$, and $25 \leq h^1 < 35$. The three groups have 7,892, 16,956, and 14,883 workers respectively. Although the first group is smaller in total size, its size is roughly similar to the third group if I consider only the workers in the lowest wage group.

Tables F1 and F2 show that the results for the part-time and overtime workers are almost identical, so I focus on variations within the part-time workers. As briefly mentioned in Section 6, the effects are almost the same in Column (3). It suggests that the relationship between the initial hours and intensive margin effects are not continuous; rather, a large, discrete jump occurred between part-time and full-time, whereas the effects are almost identical among the part-time workers.

Table F1. Replication of Table 3 using More Detailed Hours Bin

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0, 20])$	0.054**	-0.947*	-0.049*	0.029	-0.087
	(0.016)	(0.427)	(0.024)	(0.026)	(0.627)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (20, 35))$	0.059***	-1.244**	-0.047**	0.019	-0.425
	(0.015)	(0.362)	(0.014)	(0.013)	(0.477)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35, 40])$	0.035*	-0.135	-0.008	-0.008	-0.426
	(0.015)	(0.226)	(0.009)	(0.019)	(0.672)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.113*	-3.408***	-0.063**	0.017	-2.276*
	(0.044)	(0.854)	(0.022)	(0.027)	(1.104)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0, 20])$	0.031*	0.032	0.007	-0.002	-0.064
	(0.015)	(0.393)	(0.020)	(0.024)	(0.692)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (20, 35))$	0.032*	-0.325	-0.008	-0.012	-0.735
	(0.014)	(0.581)	(0.021)	(0.029)	(0.810)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35, 40])$	0.030**	0.405	0.014	-0.017	-0.327
	(0.010)	(0.299)	(0.009)	(0.013)	(0.516)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	0.026	-0.299	0.000	0.002	-0.091
	(0.029)	(0.954)	(0.025)	(0.033)	(1.438)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in (0, 20])$	0.014	0.285	0.037+	-0.023	-0.299
	(0.019)	(0.369)	(0.019)	(0.018)	(0.482)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in (20, 35))$	0.044**	0.296	0.015	0.008	0.585
	(0.016)	(0.473)	(0.018)	(0.024)	(0.706)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [35, 40])$	0.030+	-0.128	-0.002	0.008	0.195
	(0.016)	(0.277)	(0.011)	(0.011)	(0.397)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 > 40)$	-0.040	0.584	0.006	-0.004	0.350
	(0.027)	(0.894)	(0.018)	(0.017)	(1.113)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in (0, 20])$	0.008	-0.448	-0.017	-0.030	-0.793
	(0.016)	(0.605)	(0.033)	(0.026)	(0.673)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in (20, 35))$	-0.003	0.153	0.007	0.000	0.175
	(0.015)	(0.559)	(0.019)	(0.016)	(0.598)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [35, 40])$	0.006	-0.046	0.000	0.006	0.149
	(0.013)	(0.196)	(0.007)	(0.009)	(0.414)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 > 40)$	0.066*	-0.899	-0.007	0.007	-0.645
	(0.033)	(0.677)	(0.014)	(0.019)	(1.236)
Observations	74,150	74,150	74,150	91,308	91,308
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table F2. Replication of Table 3 using More Detailed Hours Bin

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0, 15))$	0.050+	-0.991	-0.054	0.006	-0.694
	(0.027)	(0.646)	(0.041)	(0.039)	(0.902)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [15, 25))$	0.048***	-0.819*	-0.031+	0.048*	0.536
	(0.012)	(0.381)	(0.016)	(0.022)	(0.649)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [25, 35))$	0.070***	-1.092**	-0.043**	0.016	-0.387
	(0.015)	(0.386)	(0.015)	(0.014)	(0.500)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35, 40])$	0.035*	-0.141	-0.008	-0.008	-0.466
	(0.015)	(0.232)	(0.010)	(0.019)	(0.674)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.113*	-3.467***	-0.067**	0.016	-2.342*
	(0.044)	(0.823)	(0.020)	(0.027)	(1.111)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0, 15))$	0.026+	-0.091	-0.005	-0.016	-0.412
	(0.015)	(0.619)	(0.037)	(0.030)	(0.631)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [15, 25))$	0.027+	0.088	0.012	0.009	0.212
	(0.015)	(0.540)	(0.020)	(0.033)	(0.796)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [25, 35))$	0.039**	-0.346	-0.009	-0.018	-0.914
	(0.015)	(0.481)	(0.017)	(0.026)	(0.874)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35, 40])$	0.030**	0.312	0.009	-0.018	-0.425
	(0.010)	(0.309)	(0.010)	(0.013)	(0.515)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	0.026	-0.358	-0.003	0.001	-0.164
	(0.029)	(0.938)	(0.024)	(0.033)	(1.442)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in (0, 15))$	0.020	0.404	0.069	-0.066*	-0.758
	(0.028)	(0.892)	(0.056)	(0.025)	(0.684)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [15, 25))$	0.015	0.089	0.006	0.007	0.212
	(0.020)	(0.479)	(0.019)	(0.018)	(0.496)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [25, 35))$	0.046**	0.196	0.011	-0.002	0.167
	(0.017)	(0.450)	(0.017)	(0.024)	(0.739)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [35, 40])$	0.030+	-0.113	-0.001	0.008	0.202
	(0.017)	(0.264)	(0.010)	(0.011)	(0.387)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 > 40)$	-0.040	0.622	0.009	-0.004	0.366
	(0.027)	(0.892)	(0.017)	(0.016)	(1.110)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in (0, 15))$	0.007	0.006	-0.021	-0.063	-0.901
	(0.043)	(1.469)	(0.098)	(0.054)	(1.434)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [15, 25))$	0.008	-0.601	-0.021	-0.016	-0.687
	(0.015)	(0.639)	(0.025)	(0.030)	(0.852)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [25, 35))$	-0.005	0.012	0.002	0.002	0.096
	(0.016)	(0.576)	(0.021)	(0.018)	(0.660)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [35, 40])$	0.006	-0.023	0.002	0.006	0.152
	(0.013)	(0.189)	(0.007)	(0.009)	(0.416)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 > 40)$	0.066*	-0.880	-0.006	0.007	-0.643
	(0.033)	(0.688)	(0.015)	(0.019)	(1.243)
Observations	74,150	74,150	74,150	91,308	91,308
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

G. Results using Hourly Paid Workers

Appendix section G shows the effects only using hourly paid workers. I defined hourly paid workers as those who were paid hourly in the first year, regardless of their second year method of payment. The effects on part-time and full-time workers were almost identical. Given that most part-time and full-time low-wage workers were hourly-paid, this result is not surprising. However, the effects on overtime workers were different. There were no significant results for overtime workers. Note that more than half of the overtime workers are salaried, and the ratio was even higher for directly affected workers. Among 1,200 workers in the lowest wage group overtime workers, only 400 were paid hourly in the first year.

Table G1. Replication of Table 2, Hourly Paid Only

	Work in Both Years			Work in First Year	
	Log Wage (1)	Hours of Work (2)	Log Hour (3)	Work (4)	Hours of Work (5)
$D_{st} \times I(\tilde{w} \leq 0.5)$	0.048***	-0.755*	-0.034*	0.022	-0.037
	(0.013)	(0.343)	(0.016)	(0.016)	(0.492)
$D_{st} \times I(0.5 < \tilde{w} \leq 2)$	0.031**	0.080	0.005	-0.012	-0.428
	(0.009)	(0.218)	(0.007)	(0.012)	(0.406)
$D_{st} \times I(2 < \tilde{w} \leq 3.5)$	0.019	-0.073	0.003	-0.002	-0.029
	(0.014)	(0.252)	(0.011)	(0.012)	(0.416)
$D_{st} \times I(3.5 < \tilde{w} \leq 5)$	0.003	-0.052	0.001	0.002	0.070
	(0.013)	(0.226)	(0.009)	(0.010)	(0.379)
Observations	62,942	62,942	62,942	78,266	78,266
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table G2. Replication of Table 3, Hourly Paid Only

	Work in Both Years			Work in First Year	
	Log Wage	Hours of Work	Log Hour	Work	Hours of Work
	(1)	(2)	(3)	(4)	(5)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in (0, 35))$	0.060***	-1.144*	-0.050*	0.025	-0.296
	(0.014)	(0.438)	(0.022)	(0.017)	(0.537)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 \in [35, 40])$	0.028+	0.009	-0.004	0.014	0.469
	(0.016)	(0.287)	(0.012)	(0.022)	(0.772)
$D_{st} \times I(\tilde{w} \leq 0.5, h^1 > 40)$	0.011	-0.742	-0.018	0.034	0.584
	(0.040)	(1.765)	(0.039)	(0.059)	(2.309)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in (0, 35))$	0.031**	-0.110	-0.001	-0.009	-0.446
	(0.011)	(0.314)	(0.011)	(0.025)	(0.648)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 \in [35, 40])$	0.035**	0.379	0.015	-0.013	-0.213
	(0.012)	(0.321)	(0.012)	(0.016)	(0.559)
$D_{st} \times I(0.5 < \tilde{w} \leq 2, h^1 > 40)$	-0.028	-0.738	-0.013	-0.048	-2.637
	(0.034)	(1.436)	(0.039)	(0.052)	(1.765)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in (0, 35))$	0.028+	0.068	0.015	-0.012	-0.195
	(0.016)	(0.362)	(0.016)	(0.017)	(0.512)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 \in [35, 40])$	0.017	-0.211	-0.006	0.008	0.150
	(0.017)	(0.274)	(0.012)	(0.013)	(0.485)
$D_{st} \times I(2 < \tilde{w} \leq 3.5, h^1 > 40)$	-0.036+	0.392	0.004	-0.023	-0.573
	(0.020)	(0.545)	(0.019)	(0.022)	(1.107)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in (0, 35))$	-0.002	-0.299	-0.008	-0.011	-0.459
	(0.011)	(0.451)	(0.022)	(0.014)	(0.464)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 \in [35, 40])$	0.002	-0.027	0.003	0.009	0.234
	(0.016)	(0.211)	(0.008)	(0.011)	(0.472)
$D_{st} \times I(3.5 < \tilde{w} \leq 5, h^1 > 40)$	0.030	0.790	0.026+	0.007	1.102
	(0.031)	(0.605)	(0.013)	(0.030)	(1.534)
Observations	62,942	62,942	62,942	78,266	78,266
Controls	Y	Y	Y	Y	Y
Group-by-State FE	Y	Y	Y	Y	Y
Group-by-Period FE	Y	Y	Y	Y	Y

See note for Table 2. $\tilde{w} = w^1 - MW^1$, i.e., the initial wage minus the initial minimum wage. h^1 refers to the working hours in the first year. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1