The Effect of Minimum Wage Policies on the Wage and Occupational Structure of Establishments

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Abstract

Minimum wage increases often result in spillovers above the strict minimum wage cutoff, however the mechanism behind these spillovers is not well understood. Using establishment-level panel data from the Occupational Employment Statistics program, I estimate the effect of minimum wage increases implemented by 10 states in 2014 and 2015 on establishment wage and occupational structures. I show that minimum wage increases lead to wage spillovers within establishments. I find no evidence that minimum wage increases induce establishments to reorganize their occupational structure across major occupational groups, however I find it does lead to a 1% increase in reallocation within 2 digit occupations. I investigate opening and closing establishments, and find that establishments that close after a minimum wage increase have disproportionately more employment in clerical, production, and service occupations and disproportionately less employment in professional and computer-related occupations. Finally, I find that minimum wage increases propagate up the management hierarchy, leading to increased wages for supervisors. Nonetheless, I find overall wage inequality decreases within establishments after minimum wage increases.

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1 Introduction

A striking regularity in the literature studying the effect of the minimum wage is that the minimum wage often increases wages above the threshold. Autor, Manning, and Smith (2016) find strong evidence of spillovers, while Cengiz, Dube, Lindner, and Zipperer (2019) find state-level minimum wage increases lead to wage increases up to three dollars above the threshold.[1] However, the mechanism behind these spillovers is not well understood. In this paper, I confirm wage spillovers occur within establishments, and then investigate two potential channels for these spillovers: occupational restructuring and the propagation of wage changes within the establishment.

First, it could be that establishments respond to minimum wage increases by restructuring production to replace unskilled labor with capital and skilled labor. Consistent with this, two recent papers (Harasztosi and Lindner (2019), Chen (2019)) find establishments increase capital expenditures in response to minimum wage increases, while Aaronson and Phelan (2017) and Lordan and Neumark (2018) also find aggregate evidence that minimum wage increases change the distribution of employment at the expense of more automatable occupations.

Alternatively, it could be that employers increase wages for other workers in the establishment intentionally. Cengiz et al. (2019) use the fact that wage spillovers are driven by incumbent workers to argue that such spillovers are due equity concerns. Similarly, models such as MacLeod and Malcomson (1988) could generate similar mechanisms, as employers maintain the spread of wages to provide efficient incentives throughout the firm.

Using establishment-level data from the Occupational Employment Statistics program, I examine the effect of minimum wage increases in ten states in 2014 and 2015. The OES has a unique data structure, collecting employment counts for each of over 800 occupations in 12 different wage bins. I use several empirical strategies, including difference and dif-

[1] Autor et al. (2016) hypothesize these spillovers may be a fiction of the self-reported wage data, however Cengiz et al. (2019) find similar results in administrative data.

ferences, triple differences, and matching methods. By comparing wages and employment in establishments in states that raised the state minimum wage with establishments in 22 states that did not change their minimum wage since 2009, I show establishments decrease employment in the wage bin up to $9.25 an hour and increase employment in the wage bin up to $11.74 an hour. Further, for establishments in industries with a high fraction of low-wage workers or establishments with many low-wage workers in the pre-period, I find statistically significant employment increases in wage bins up to $23.99 an hour. These results confirm that spillovers from the minimum wage occur *within* establishments.

Next, I turn to the occupational structure of establishments. Across methodologies and samples, I find no evidence that establishments change the type of employment, such as decreasing service occupations or clerical occupations, or increasing technology-related occupations. Thus, I argue that for these particular minimum wage increases, it does not appear to be the case that firms respond by restructuring production. This is consistent with Aaronson, French, Sorkin, and To (2018), who argue that establishments are unable to easily adjust the capital-labor intensity in response to policy changes, and thus aggregate adjustments are driven by establishment entry and exit. However, while I do find that firms that exit after a minimum wage increases have relatively more employment in service, production, and clerical occupations and relatively less employment in professional and computer-related occupations, there does not appear to be any direct selection on the wage structure of establishments, nor the size of establishments.

I then examine how the minimum wage increases spread throughout the establishment. Although few supervisors are employed in the lowest wage bin (up to $9.25), I find a decrease of employment of supervisors in the second wage bin $9.26 to $11.74) and an increase in employment in the third wage bin ($11.75 to $14.74). A triple-difference strategy reveals that this response is only present in establishments that have employment in the smallest bin in the pre-period. Thus, I conclude that one channel by which minimum wages spread through an establishment is due to wage spillovers within supervisory relationships. The

fact that we see variation based on exposure to near-minimum wage workers within the establishment indicates this response is at the establishment level, rather than driven by outside options or other market-wide dynamics.

In addition, I do not find equivalent wage increases for other higher pay occupational groups, including professional occupations, and computer-related occupations. Thus, it appears that this spillover dynamic is driven via direct reporting relationships, rather than wider concerns about wage compression by the employer. Consistent with this, I find the minimum wage increases result in decreased wage inequality within establishments. For highly treated establishments, I find that wages increase throughout the entire establishment, including the highest paid workers. However, I find that wages are increases by the most at the bottom and by smaller amounts at the top, leading to wage compression within establishments.

2 Methodology

2.1 OES Data

The Occupational Employment Statistics is a semi-annual survey of establishments conducted by the Bureau of Labor Statistics. Approximately 400,000 establishments are surveyed each year and establishments are surveyed no more than every three years. The purpose of the survey is to produce high-quality wage estimates for detailed occupations by geography, industry, and establishment size. Although not structured as a panel, many establishment are surveyed multiple times for a variety of reasons. I take advantage of this sampling structure to investigate changes within establishments.

When surveyed, the establishment reports a grid of the employment count for each occupation in twelve wage bins. The wage bins change periodically, however from 2009 through 2018, the lowest bin does not change (up to $9.25). In 2014 the larger bins increased, however this was implemented nation-wide. Table 1 shows the exact dollar cutoffs by year. Reported

wages include tips and bonuses, but exclude overtime and other extra pay.

Although the data is very rich, there are several limitations. First, there is no information on the worker-side, beyond the occupation and wage interval. Thus, it is not possible to measure changes in worker characteristics. Second, the survey does not collect information on hours worked, thus the number of workers in each cell may include a mix of full-time and part-time workers. This means that I am unable to observe whether or not employers change the number of hours in response to minimum wage changes.

Occupations are classified using the 2010 Standard Occupational Classification codes. This consists of 840 detailed occupations, which are grouped into 23 major groups. To evaluate whether there are major changes in the occupational structure of establishments, I combine occupations into five mutually exclusive occupational categories: management (SOC codes 11, plus supervisors from each other category), professional (SOC codes 13-29), clerical (SOC codes 41-43), production (SOC codes 45-53), and service (SOC codes 31-39). In addition, to capture occupations that may be related to technological change, I construct a measure of computer-related occupations (15-11xx) which include occupations such as computer analysts, database administrators, and support specialists.

To evaluate whether minimum wage increases induce more subtle changes in occupational structure, I also construct a dissimilarity index:

$$Index_{ijt} = \frac{1}{2}\sum_{i=1}^{N}(\frac{emp_{ijt}}{emp_{jt}} - \frac{emp_{ijt-1}}{emp_{jt-1}}) \tag{1}$$

where emp_{ijt} is the employment in 6-digit occupation i in establishment j in period t, and emp_{jt} is the total employment in establishment j in period t. This provides a measure of what percent of employment is reallocated across 6-digit occupational categories between two points in time. In addition, I construct the same index within 2-digit occupations, to measure the degree of finer reallocation within broader occupational categories.

2.2 State Minimum Wage Policy Changes

I focus on 10 states that increased their minimum wages substantively in 2014 and 2015 but had not increased their minimum wage since the federal minimum wage increase in 2009. See Figure 1 for a map of these states. I focus on these states for three reasons. First, the criterion of no previous minimum wage change since 2009 allows for a reasonable pre-period before the state minimum wage change. In addition, the pre-period is sufficiently after the Great Recession to reduce contamination from recessionary shocks. Second, because many states increased the minimum wage in 2014 and 2015, there is good cross-sectional variation. Third, by focusing on substantive minimum wage increases, defined by more than a 5% increase, I drop indexed increases that are less likely to be large enough to be salient to employers. The control group is defined as states that did not increase their minimum wage in the 2009 to 2016 period. This results in 22 control states, also marked on Figure 1.

In addition, as a robustness check, I also restrict the set of treated states to those that increased the minimum wage from the federal level: New Jersey, New York, Alaska, Hawaii, Nebraska, South Dakota, and West Virginia. This ensures these states are more similar to the control states, that also were bound by the federal minimum wage in the pre-period.

2.3 Specifications

For the main within-establishment specifications, I restrict analysis to establishments that were surveyed twice: once in Spring 2013-Spring 2014, and once in Fall 2015-Fall 2016. This results in 45,297 establishments in the treatment states and 84,430 in the control states. In addition, I construct several more limited samples. First, I restrict to limited service restaurants, which have been widely studied in the minimum wage literature due to their employment of a high share of low-wage workers. In addition, I construct several samples restricted to industries that had more than 10%, 20%, or 33% of employment in the smallest wage bin in 2003. This allows me to identify establishments that are likely to be impacted by the minimum wage increase, without conditioning on the actual wage structure of the

affected establishments.

In order to capture the wage structure of establishments, I construct several variables. Most simply, I measure the share of establishment employment in each of the 12 bins. However, most employment is in the lower bins, especially for establishments in low-wage industries. So I also construct percentile wages for the establishments. I do this by determining which wage bin the particular percentile for the establishment falls, and then using the interpolated mean wage for the bin constructed by the OES.

I run several related specifications. I begin by running a simple difference in differences:

$$Y_{it} = \beta_0 + \beta_1 * Treated + \beta_2 * Post + \beta_3 * Treated * Post + \epsilon_{it} \tag{2}$$

where $Treated$ is an indicator for states that increased the minimum wage in the post period, which is defined as 2015Q4-2016Q4, and $Post$ is an indicator for the post period. Since there are up to 1.5 year differences in sampling periods, I also include half-year fixed effects, and cluster standard errors at the state level. Summary statistics are described in Table 2.

In addition, I also estimate a triple difference specification, in which I separate establishments based on their exposure to the minimum wage increase, which I define as the share of employees in the smallest bin during the pre-period. In particular, I define five exposure groups: no employment in Bin A in the pre-period, 0- 25% in Bin A, 25-50%, 50-75%, and over 75%. I then estimate the following

$$Y_{it} = \alpha + \sum_{E_j} Treated * Post * E_j\beta + \epsilon_{it} \tag{3}$$

in which E_j is an indicator for the exposure fraction for establishment i in the pre-period. I additionally include half-year fixed effects and cluster the standard errors at the state level.

As an alternative, I also estimate nearest-neighbor match specifications. For each establishment in the treatment states, I identify a matched establishment from the control states that has the same exact characteristics on the following pre-period dimensions: 6-digit

NAICS industry code, half-year the establishment was sampled, and the share of employment in Bin A (using 5 categories: 0, 0-25%, 25-50%, 50-75% and over 75%). I then estimate a first differenced equation:

$$\delta Y_i = \beta_0 + \beta_1 Treated + \epsilon_i \tag{4}$$

in which the omitted category is establishments in the matched set. I bias adjust for large-sample bias using the same characteristics I used to identify matches. I drop the small number of establishments in the treatment group with no exact matches.

Finally, in order to estimate the effect on the wage and occupational distribution for the state labor market as a whole, I run state by group level regressions. This is similar to the specifications in Cengiz et al. (2019), and takes advantage of the fact that at the state level, there should be little effect of the minimum wage on the largest wage bins. Thus, I use these bins to control for the aggregate changes in employment at the state level, in order to identify the effect of the minimum wage on the smaller wage bins. In particular, I aggregate employment by wage bin to the state by year level and estimate:

$$Y_{st} = \alpha + \sum_{Bin_j} Treated * Post * Bin_j \beta + \epsilon_{st} \tag{5}$$

where Bin_j are individual wage bins, excluding bins J through L, and s is the state. These state-level specifications are estimated on a larger set of underlying establishments, since it is not necessary to restrict analysis to establishments surveyed more than once.

3 Results

3.1 Compliance and Wage Spillovers

I begin by examining the effect of the minimum wage increases on the wage structure of establishments. In Table 3, I report the difference-in-differences estimate, that is, the differential change in employment in each wage bin after the minimum wage increase for treated

states compared with the control states. Here we see that, for the full sample, employment in Bin A (up to $9.25) decreased by 2.8 percentage points more in the treated states. We also see that employment increased in Bin B (up to $11.49) by 2.6 percentage points, suggesting that the primary effect of the minimum wage increase was to move individuals from Bin A to Bin B. Nonetheless, since the maximal minimum wage in the sample is $9.00, this reflects a spillover beyond the statutory minimum wage.

I then restrict the sample to industries that are especially dependent on low-wage labor. In the second panel of Table 3, I focus on limited service restaurants. Here we see that employment in Bin A decreases by 33 percentage points, while employment increases by 28 percentage points in Bin B, 5 percentage points in Bin C (up to $14.49), and 2 percentage points in Bin D (up to $18.24), after which point the wage increases fade out. In the matched specification in Panel C, we see nearly identical point estimates. Thus, for limited service restaurants, minimum wage increases appear to increase employment in bins more than five dollars above the statutory minimum wage.

In Panels 4 and 5, I repeat the analysis for establishments in industries that had 1/3 of employment in Bin A in 2003. Here we somewhat smaller magnitudes for the fall in employment share in Bin A than for limited service restaurants, but again we see employment increases in bins up to D for the difference-in-differences estimates, and up to Bin H (up to $45.24) for the matched estimates.

In Table 4, I examine how the change in the wage distribution differs based on the share of employment in Bin A in the pre-period via a triple difference specification. The omitted category is establishments with no employment in Bin A in the pre-period. Here we see that the intensity of the decrease in employment share in Bin A grows with the ex ante share in Bin A, and similarly, the increase in employment share in Bin B also increases with the share of employment in Bin A in the pre-period. Thus, the growth in employment in Bin B is in exactly the establishments that were most likely to be exposed to a binding minimum wage increase, due to employing a large share of employment close to the minimum wage.

In addition, we see growth in employment share in Bin C also increases with the ex ante employment share in Bin A. In the bottom panel of Table 4, I show results are similar if I restrict the set of treated states to states that were at the federal minimum wage before the state minimum wage increase.

I next turn to the bin-by-state level specification. Instead of measuring changes within establishments, this specification measures the average effect across all establishments. In Table 5, we see that the minimum wage increases led to a decrease in the share of employment in Bin A at the state level of 2.6 percentage points, which is very similar to what we saw in the panel difference-in-differences results. In addition, we see that the share of employment in Bin B increased by 1.37 percentage points, which is somewhat smaller than the 2.3 percentage point estimate from the matched difference-in-difference sample. Overall, we again see that employment increases above the cutoff at the state level. Figure 2 illustrates these bin-level changes and how they aggregate to no net-change in employment.

Thus, it appears that establishments in these states not only complied with the minimum wage increases, but increased wages enough to shift employment into wage bins up to several dollars above the statutory minimum wage.

3.2 Occupational Structure

I next turn to the occupational structure of establishments. If firms react to a minimum wage increase by substituting capital for labor, this should lead to a decrease in employment in the occupations that are heaviest hit by the minimum wage. To begin, I first want to identify the occupations that are most affected by minimum wage increases. To do so, in Table 6, I reproduce the state-level specification from Table 5, but now separate the analysis into five mutually exclusive occupational groups: managers and supervisors, clerical, production, service, and professional.

In Panel A, I focus on limited service restaurants. Here we see the only occupation category with a significant reallocation in employment is the service sector, which shows a

25% decrease in employment in wage bin A and a 17% increase in employment in wage bin B. Production and clerical occupations also show a large negative point estimate for wage bin A, but are not statistically significant. In Panel B, I focus on the 33% sample, which also shows the largest magnitude effect for service sector occupations, with a 21% decrease in wage bin A and 6% increase in wage bin B. In the 33% sample we also see a statistically significant reduction in production employment in wage bin A (14%), but no corresponding increase in employment in wage bin B. Finally, only the reallocations among service sector occupations is large enough to show up in the full sample, with a 10% decrease in employment in wage bin A. These results indicate that the primary occupational group that is directly affected by minimum wage increases is service occupations.

In order to evaluate whether employment shifts between occupations, I begin at the state level. In particular, I estimate a specification similar to Equation 5, however now the bins are five mutually exclusive occupational groups: managers and supervisors, clerical, production, and service, with the professional bin omitted. Thus, estimates for occupation x are a triple difference of the change in employment in occupation x, controlling for growth in employment in professional occupations as well as growth in employment in occupation x in the control states.

In Table 7 I report estimates from this specification. In the first column, I restrict analysis to limited service restaurants, in second column, I report results for the 33% sample, and in the last column I include all establishments. Across all samples, we see that the point estimates are small and not statistically significant. The largest magnitude point estimates are for service occupations, but the estimate is around 1% and positive. These estimates rule out a decrease in service occupation employment larger than 1.5% in limited service restaurants, and a decrease larger than 0.14% overall. Thus, in net, it does not appear that the increase in the minimum wage leads to an overall shift in the occupational structure within states.

I next turn to within-establishment results, to investigate whether there may be occu-

pational reallocation occurring within establishments. In Table 8, I investigate whether the employment share within different occupational categories changed in response to minimum wage increases. Here we again see there is little evidence that the occupational structure changed after minimum wage increases. Across the samples, all the estimated magnitudes are small and not statistically significant. In the Appendix, I show similar results using nearest-neighbor matching.

Thus, across broad occupational categories, firms do not appear to be substituting higher-skill employment for near-minimum wage employment. In order to more fully examine whether establishments make any change in occupational structure, I next construct the reallocation index described in Equation 1 which measures what percent of employment is shifted between the 800 6-digit occupations recorded in the OES. This provides a within-establishment measure of reallocation. In Column 1 of Table 9 I show that across samples, about 1% more employment is reallocated across 6-digit occupations in establishments that experience a minimum wage increase.

In Table 8, I showed that there was no reallocation between broad occupational groupings, thus these fine reallocations must be occurring within these broad groupings. In the rest of Table 9 I investigate which occupational groups experience the most within-group reallocation. Here we see almost 2% of management occupations are reallocated within management across specifications, and up to 2% of supervisor positions are reallocated, with some variation across samples. Interestingly, this reallocation rate does not shrink as we move from the more limited samples to the full sample, indicating that even establishments with lower shares of minimum wage workers are affected by this volatility in occupational structure. Similarly, for professional and clerical occupations, we see little impact for establishments in industries with high shares of minimum wage workers, but the point estimates increase as the samples become less restricted.

In contrast, for service occupations, we see a 2-3% increase in reallocation rates for limited service restaurants and the 33% sample, but the point estimates falls with each successive

sample, to 0.3% for the full sample. This suggests the increased reallocation is concentrated in industries that are more directly impacted by the minimum wage increase. Finally, we see little increase in reallocation for production occupations and PC related occupations.

In addition, in the last Column of Table 8, I show there is no statistically significant decrease in employment across the various samples I consider. The point estimates are noisy and range from employment growth to losses, indicating a wide variety of heterogeneity across establishments in employment changes after minimum wage increases.

Thus, while many theories of labor-capital substitution suggest that establishments replace low-wage labor with capital and fewer high-skill workers, the fact that establishment-level employment does not appear to shrink and there is no movement in occupational employment from service occupations to technology related occupations or white collar occupations such as professional or management suggests that firms are not introducing major restructuring in response to the wage increase. This is consistent with the 'clay' portion of the putty-clay hypothesis, which argues that it is difficult to adjust capital investments for ongoing establishments. Nonetheless, I do find evidence of narrower reallocation, with about 1% of employment in affected establishments is reallocated within major occupational categories. This suggests that establishments are able to make finer-tuned adjustments to the occupational structure and production process, which could be consistent with labor-labor substitution. However, since I do not find evidence of a change in establishment size, these fine-tuned adjustments do not appear to lead to a reduction in total headcount. Further, since the reallocations are primarily within occupational categories, it does not appear that firms are substituting service and production workers for professional or technical workers.

3.3 Propagation through the Hierarchy

I next investigate how minimum wage changes propagate through the management hierarchy. I focus on two levels of management: supervisors and managers. Supervisors are occupations that have close contact with their direct reports, and may even split time be-

tween supervising front line workers and directly helping them. Managers are coded in the management major occupation category (11) and may be more removed from the direct operations than supervisors.

In Table 10, I measure the effect of the minimum wage increases on the share of supervisory or managerial employment in each of the bottom three wage bins, and across all of the top nine wage bins. Across samples, there are few supervisors or managers present in Bin A, thus these occupations are minimally directly affected by the minimum wage increase.

In Panel A, I focus on supervisors. In the full sample, we see little effect on Bins A and B, but a 1.2 pp increase in employment in Bin C. When I focus on limited service restaurants, we see a substantial decrease in employment in Bin B (12-14 pp depending on specification), while there is a 6 pp increase in employment in bin C and an 8 pp increase in employment in bins D and above. We see similar results for the 33% industry sample: substantial decreases in bin B and increases in bins C and above. Thus, despite the fact that Bin B is above the minimum wage cutoff for all treated states, we see that minimum wage increases lead supervisors to move up to higher wage bins. In Panel B, I focus on managers. Here we see less of a clear pattern, potentially because most establishments employ too few managers to measure changes across wage bins.

In Table 11, I focus on the triple difference specification. Here we see bigger decreases in employment in Bin B for establishments with a larger share of employment in Bin A in the pre-period, and bigger increases in employment in Bins C and D+. We again see small and statistically insignificant point estimates for managers. In Appendix table A.5, I show that this spillover pattern is unique to supervisors, and does not hold for professional occupations or service occupations.

Thus, one mechanism for minimum wage increases in establishments is through the management hierarchy, with wages increasing for the direct supervisors of minimum wage workers.

3.4 Within-Establishment Wage Inequality

So far I have focused on the effect of minimum wage increases by wage bin, however, the median employee at the average establishment is employed in Bin C and the 90th percentile employee at the average establishment is employed in bin D. This is in contrast to the economy-wide percentiles, with the median employee in Bin D and the 90th percentile employee in Bin H. This is due to low-wage workers clustering at small establishments. Thus, at the establishment-level, the effect of the minimum wage is concentrated.

For each establishment, I calculate the 10th, 50th, and 90th percentile real wages, taking advantage of interpolated wage bin midpoints constructed by the Bureau of Labor Statistics. In Table 12, I show that the minimum wage increased wages through the 90th percentile for all samples, however wages increased at a decreasing rate, leading to falling wage inequality across samples. For the full sample, the 90/10 wage inequality fell by 4%, while for limited service restaurants it fell by between 10 and 12%, depending on the specification. For both limited service restaurants and the 33% sample, 90/50 wage inequality decreased substantially more than the 50/10 wage inequality, leading wage compression to rise in the top half of the wage distribution for these establishments.

3.5 Opening and Closing Establishments

So far I have focused on how minimum wage changes affect wage and occupational distributions within establishments and across establishments within states. In this section I turn to establishments that open or close after the minimum wage increase. As discussed earlier, one potential reason for minimal restructuring in response to minimum wage increases could be because capital decisions have putty-clay properties, where it is difficult for continuing establishments to restructure production, but new establishments will choose a production process that uses less low-wage labor in exchange for more capital and more higher-skill labor. Further, establishments that intensively used minimum wage labor before the wage increase are more likely to exit the market. Consistent with this, Aaronson et al. (2018)

found an increase in both openings and closings of restaurants in response to minimum wage increases. By using OES data, I can directly test how minimum wage increases affect the selection of closing establishments and the characteristics of opening establishments.

To measure closing establishments, I focus on establishments that were surveyed in the Fall of 2011 through the Fall of 2014 and closed in or after Fall 2015, indicating they were open through the minimum wage increase and closed shortly thereafter. This yields 16,345 closed establishments. For opening establishments, I instead measure establishments that first open in Fall 2015 through Spring 2018. This yields 19,934 newly opened establishments.

In order to evaluate whether minimum wage increases affect the characteristics of opening and closing establishments, I estimate the following difference in difference specification comparing establishments in the period *before* the minimum wage increases (e.g. data from Fall 2011 to Fall 2014):

$$Y_{it} = \beta_0 + \beta_1 * Treated_{it} + \beta_2 * Close_{it} + \beta_3 * Treated_{it} * Close_{it} + \epsilon_{it} \tag{6}$$

where Treated indicates establishments are those in states that increased the minimum wage, and Close indicates establishments that closed in or after Fall 2015, in both treatment and control states. This specification controls for differences in establishments in treated and control states, as well as general trends in characteristics of closing establishments.

I run an equivalent specification for establishments that open during or after Fall 2015. In this case, I compare establishments observed in the period of Fall 2015 through Spring 2018, after the minimum wage increases were enacted.

In Table **??**, I examine the effect of the minimum wage increase on wage structure of closing and opening establishments. In the top panel, we see that across samples, there is little evidence that the minimum wage increase induced differential establishment closure across treatment and control states. The only statically significant point estimates are for the full sample, where establishments that closed in minimum wage states had about 1 percentage point more employment in bins B and C, however both bins are above the minimum

wage threshold. In addition, I examine whether total employment differed between closing establishments in treatment and control states. Across samples, we consistently see negative but generally insignificant point estimates. Thus, there is weak evidence that the minimum wage may lead smaller establishments to exit.

In the bottom panel, we turn to opening establishments. Here we again see little difference in the wage structure, but consistently positive and insignificant point estimates for establishment size.

In Table 14, I repeat the previous analysis, however now instead of looking at change in employment share in each wage bins, I investigate the change in employment share in each occupational category. In the top panel, I show results for closing establishments. Here we do see a few differences. Closing establishments in minimum wage states employed a disproportionately low share of professional employment and information technology employment, for all samples except for the limited service restaurants and the full sample. In addition, closing establishments in minimum wage states employed substantially more workers in supervised positions (e.g. non-supervisory clerical, production, and service occupations). This ranges from 1.4 pp for the 33% industry sample to 3.8 pp in the 10% industry sample.

In the bottom panel of Table 14, I instead show differences in the characteristics of opening establishments. Here we see little evidence of systematic differences between opening establishments in treated and control states, compared to continuing establishments in those states. However, since these establishments are observed in the post-minimum-wage-increase period, this indicates that new entrants are not different from the establishments who survived the minimum wage increase, which we saw in the top panel were selected in minimum wage increasing states.

What do these results imply for the putty-clay hypothesis? There was no evidence that closing establishments in minimum wage states were more likely to employ workers in the wage bin that was directly impacted by the minimum wage increases. However, the occupational results indicate that closing establishments were more likely to employ a larger

fraction of employment in lower-wage 'supervised' occupations and a smaller fraction in professional and computer occupations, which are more cognitive and technology-adjacent occupations. This is consistent with other evidence in the literature that minimum wage increases lead to employment shifts away from automatable occupations (Aaronson & Phelan, 2017; Lordan & Neumark, 2018). Although opening establishments do not appear to be different on average from continuing establishments, this process of selected-exit results in employment in establishments in minimum wage increasing states becoming more skilled.

However, the key logic behind labor-labor substitution is that employers can choose to employ more lower-skill/lower-wage workers or can employ fewer higher-skill/higher-wage workers. Minimum wage increases tilt the balance to the higher-skill/higher-wage strategy, which results in less employment. In contrast, I show there is little evidence of this sort of selection on establishment size, with the point estimates suggesting exiting establishments were disproportionately small and entering establishments were disproportionately large.

Thus, while the fact pattern is consistent with minimum wage increases inducing occupational realignment due to establishment exit, it is not fully consistent with the labor-labor substitution hypothesis.

4 Conclusions

In this paper, I have investigated the effect of minimum wage increases on the wage and occupational structure of establishments. I find that minimum wage increases lead to spillovers, with wage increases up to several dollars an hour above the minimum wage cutoff. I show that this is not driven by changes in the occupational structure of establishments, but can partially be explained by wage increases within the supervisory structure. Despite these spillovers, I show that wage compression within affected establishments increases, with particular compression in the top half of the wage distribution.

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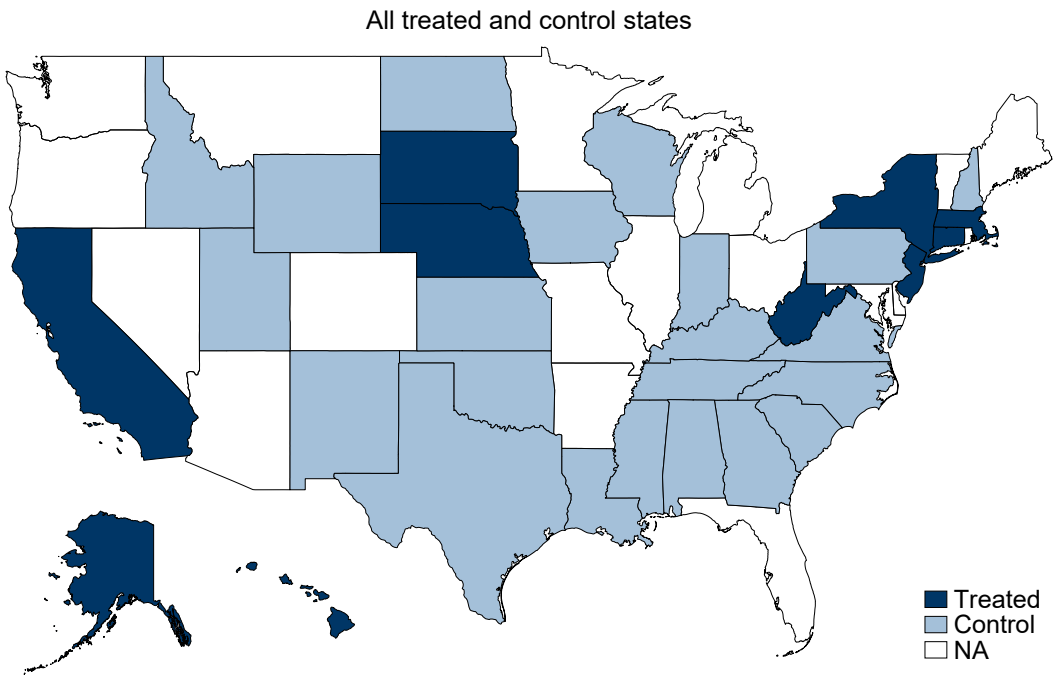

Figure 1

Table 1: Bin Definitions by Year

	A	B	C	D	E	F	G	H	I	J	K	L
2000-2005	≤ 6.75	8.49	10.74	13.49	16.99	21.49	27.24	34.49	43.74	55.49	69.99	≥ 70
2006-2008	≤ 7.5	9.49	11.99	15.24	19.24	24.49	30.99	39.24	49.79	63.24	79.99	≥ 80
2009-2013	≤ 9.25	11.49	14.49	18.24	22.74	28.74	35.99	45.24	56.99	71.49	89.99	≥ 90
2014-2018	≤ 9.25	11.74	14.74	18.74	23.99	30.24	38.49	48.99	61.99	78.74	99.99	≥ 100

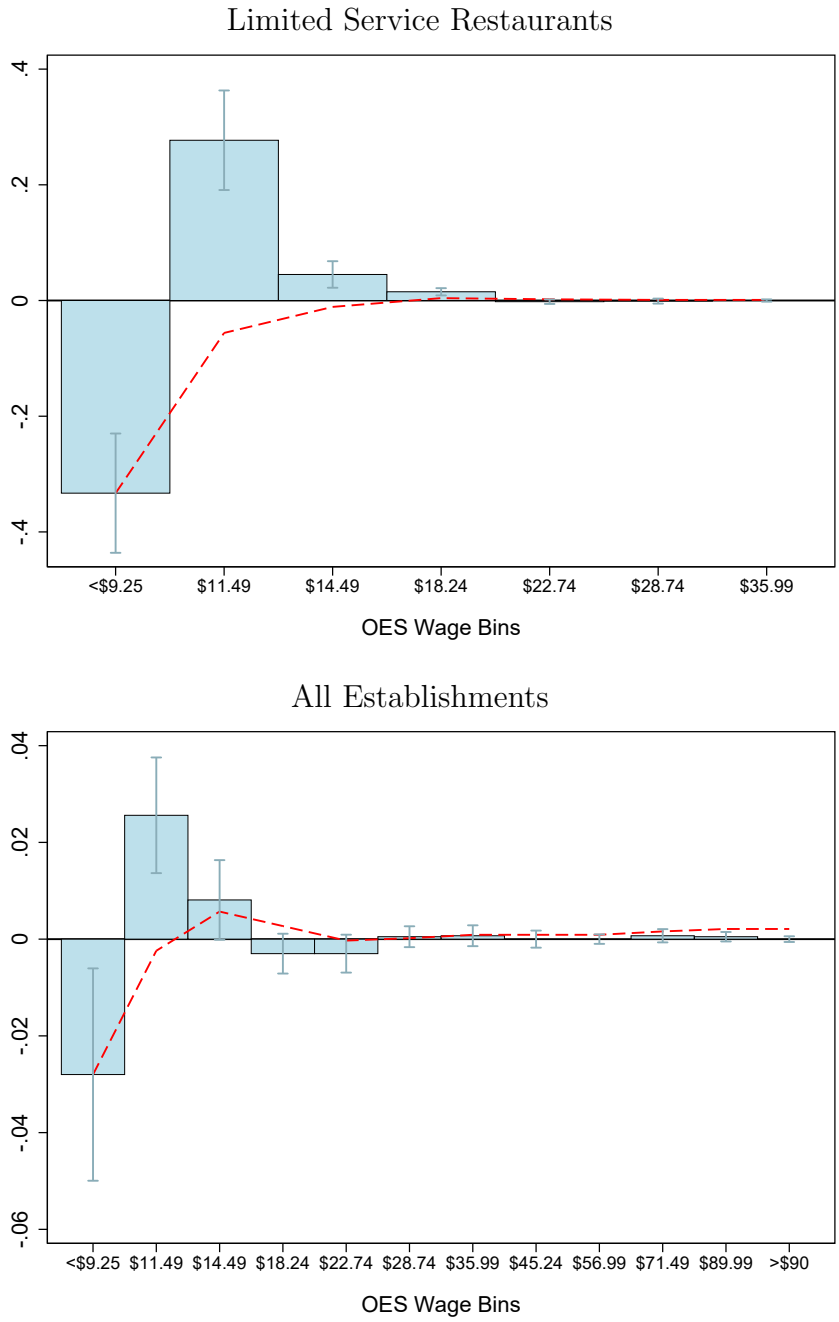

Figure 2: Each figure shows the estimated change in employment in each bin with 95% confidence intervals (see also Table 5). The top figure is restricted to limited service restaurants, the bottom figure shows all establishments. The red dashed line illustrates the cumulative change in employment.

Table 2: Summary Statistics: Means of Key Variables

	Full Sample				
	Treated Pre	Treated Post	Control Pre	Control Post	Diff-in-Diff
Log Real Average Wage	3.15	3.20	2.99	3.03	0.01
Total Employment	109.53	116.72	87.87	92.83	2.23
Share Bin A	0.11	0.05	0.17	0.13	-0.03
Share Bin B	0.12	0.14	0.13	0.14	0.03
Share Bin C	0.13	0.14	0.16	0.15	0.01
Share Bin D+	0.64	0.67	0.54	0.58	-0.01
Share Mgmt	0.12	0.12	0.11	0.11	0.00
Share PC	0.03	0.03	0.02	0.02	0.00
Share Production	0.23	0.23	0.27	0.27	0.00
Share Professional	0.24	0.25	0.21	0.21	0.00
Share Service	0.13	0.13	0.13	0.12	0.00
Log Real 10th Ptile Wage	2.55	2.62	2.46	2.47	0.07
Log Real 25th Ptile Wage	2.63	2.70	2.54	2.56	0.06
Log Real Median Wage	2.78	2.84	2.68	2.69	0.05
Log Real 7th Ptile Wage	2.95	3.00	2.85	2.85	0.05
Log Real 90th Ptile Wage	3.13	3.17	3.04	3.04	0.05
50/10	1.33	1.30	1.31	1.30	-0.02
90/10	2.19	2.09	2.18	2.13	-0.04
90/50	1.58	1.54	1.60	1.57	0.00
	Limited Service Restaurants				
	Treated Pre	Treated Post	Control Pre	Control Post	Diff-in-Diff
Log Real Average Wage	2.38	2.51	2.29	2.32	0.10
Total Employment	39.78	43.36	41.66	43.88	1.36
Share Bin A	0.64	0.22	0.77	0.69	-0.33
Share Bin B	0.21	0.54	0.12	0.18	0.28
Share Bin C	0.07	0.14	0.05	0.06	0.05
Share Bin D+	0.08	0.10	0.06	0.06	0.01
Share Mgmt	0.12	0.12	0.12	0.12	-0.01
Share PC	0.00	0.00	0.00	0.00	0.00
Share Production	0.04	0.04	0.04	0.04	0.00
Share Professional	0.00	0.00	0.00	0.00	0.00
Share Service	0.80	0.80	0.78	0.78	0.01
Log Real 10th Ptile Wage	2.23	2.38	2.18	2.18	0.14
Log Real 25th Ptile Wage	2.24	2.39	2.18	2.18	0.14
Log Real Median Wage	2.26	2.40	2.19	2.20	0.14
Log Real 7th Ptile Wage	2.32	2.45	2.23	2.25	0.11
Log Real 90th Ptile Wage	2.46	2.55	2.38	2.40	0.07
50/10	1.03	1.02	1.02	1.02	-0.01
90/10	1.33	1.23	1.27	1.30	-0.12
90/50	1.29	1.20	1.25	1.26	-0.10

Table 3: Change in Employment by Wage Bin

DV: Share in Bin	$9.25 A	$11.49 B	$14.49 C	$18.24 D	$22.74 E	$28.74 F	$35.99 G	$45.24 H	$56.99 I	$71.49 J	$89.99 K	$90 + L	$18.24+ D to L
Sample: Full, DD													
T× Post	-0.0284*	0.0256***	0.00813	-0.00356	-0.00320	0.000596	0.000776	0.0000917	-0.000782	0.000714	0.000581	-0.000523	-0.00531*
	(0.0112)	(0.00613)	(0.00429)	(0.00212)	(0.00206)	(0.00115)	(0.00114)	(0.000952)	(0.000535)	(0.000749)	(0.000516)	(0.000305)	(0.00252)
N	259454	259454	259454	259454	259454	259454	259454	259454	259454	259454	259454	259454	259454
Sample: LS Restaurants, DD													
T× Post	-0.333***	0.277***	0.0450***	0.0151***	-0.00279	-0.00137	-0.000123	-0.000131	0.000371	-0.0000824	0.000190	0.000232	0.0114**
	(0.0526)	(0.0439)	(0.0117)	(0.00325)	(0.00204)	(0.00220)	(0.00107)	(0.000804)	(0.000283)	(0.000175)	(0.000341)	(0.000176)	(0.00388)
N	3986	3986	3986	3986	3986	3986	3986	3986	3986	3986	3986	3986	3986
Sample: LS Restaurants, Matched													
T× Post	-0.334***	0.253***	0.0598***	0.0161***	0.00303	0.00101	0.000672	-0.000174	0.000241	-0.000147	0.000324*	0.000289	0.0213***
	(0.00918)	(0.00905)	(0.00528)	(0.00234)	(0.00174)	(0.00112)	(0.000658)	(0.000328)	(0.000258)	(0.000221)	(0.000144)	(0.000155)	(0.00355)
N	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285	5285
Sample: 33, DD													
T× Post	-0.253***	0.179***	0.0516**	0.0166**	0.00360	-0.000332	0.00106	0.00124	0.000765	-0.000228	-0.000164	-0.000149	0.0224*
	(0.0448)	(0.0335)	(0.0163)	(0.00464)	(0.00402)	(0.00305)	(0.00219)	(0.000817)	(0.000493)	(0.000281)	(0.000273)	(0.000433)	(0.00879)
N	8724	8724	8724	8724	8724	8724	8724	8724	8724	8724	8724	8724	8724
Sample: 33, Matched													
T× Post	-0.293***	0.191***	0.0601***	0.0248***	0.00948***	0.00407***	0.00229***	0.000904**	0.000383	-0.0000171	0.000223*	0.0000560	0.0422***
	(0.00633)	(0.00605)	(0.00367)	(0.00240)	(0.00163)	(0.00114)	(0.000632)	(0.000339)	(0.000228)	(0.000160)	(0.000113)	(0.000175)	(0.00350)
N	10728	10728	10728	10728	10728	10728	10728	10728	10728	10728	10728	10728	10728

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Share A indicates the share of employment in the establishment in the smallest wage bin in the pre-period. Standard errors clustered at the state-level. Full sample includes all establishments, LS Restaurants indicates limited-service restaurants, and Sample 33 indicates industries with over 33% employment in the bottom wage bin in 2003. DD are difference-in-difference specifications and matched use nearest neighbor matching.

Table 4: Triple Difference Effect of Minimum Wage by Wage Bin

DV: Share in Bin	\$9.25 A	\$11.49 B	\$14.49 C	\$18.24+ Share D+
Panel A: Full Sample				
T× Post	-0.0243***	0.0119***	0.0104*	0.00198
	(0.00511)	(0.00297)	(0.00448)	(0.00442)
T× Post× (0 < Share A ≤25%)	-0.00898	0.0120**	0.00292	-0.00591
	(0.00516)	(0.00339)	(0.00300)	(0.00598)
T× Post× (25%<Share A≤ 50%)	-0.0927**	0.0788***	0.0103	0.00362
	(0.0267)	(0.0125)	(0.00648)	(0.0144)
T × Post × (50%<Share A ≤75%)	-0.168***	0.130***	0.0179*	0.0194
	(0.0455)	(0.0312)	(0.00677)	(0.0135)
T× Post× share A ≥ 75%	-0.244**	0.203**	0.0181*	0.0233
	(0.0846)	(0.0668)	(0.00829)	(0.0155)
N	259454	259454	259454	259454
Panel B: Restricted Sample				
T× Post	-0.0138***	0.00612	0.00228	0.00539
	(0.00295)	(0.00338)	(0.00307)	(0.00608)
T× Post× (0 < Share A ≤25%)	0.000632	0.00815	0.00584	-0.0146**
	(0.00385)	(0.00663)	(0.00389)	(0.00449)
T× Post× (25%<Share A≤ 50%)	-0.0416*	0.0551**	0.00136	-0.0148
	(0.0165)	(0.0173)	(0.00745)	(0.0125)
T × Post × (50%<Share A ≤75%)	-0.0902***	0.0805***	0.0121	-0.00238
	(0.0208)	(0.0208)	(0.00659)	(0.0123)
T× Post× share A ≥ 75%	-0.0971*	0.0896**	0.00851	-0.00103
	(0.0406)	(0.0293)	(0.00957)	(0.0160)
N	209438	209438	209438	209438

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Share A indicates the share of employment in the establishment in the smallest wage bin in the pre-period. Standard errors clustered at the state-level. Full sample includes all establishments, restricted sample is limited to treatment states with federal minimum wage levels in the pre-period.

Table 5: State by Wage Bin Level Specification

Change in Employment by Bin	(1)	(2)
T× Post × Bin A	-0.0258**	-0.0233**
	(0.00719)	(0.00762)
T× Post × Bin B	0.0137*	0.0109
	(0.00525)	(0.00537)
T× Post × Bin C	0.00720	0.00439
	(0.00361)	(0.00335)
T× Post × Bin D	-0.00441	-0.00381
	(0.00391)	(0.00526)
T× Post × Bin E	-0.00116	0.0000392
	(0.00218)	(0.00278)
T× Post × Bin F	-0.00138	-0.00143
	(0.00202)	(0.00261)
T× Post × Bin G	0.00115	0.00162
	(0.00166)	(0.00191)
T× Post × Bin H	-0.000532	-0.000725
	(0.00127)	(0.00169)
T× Post × Bin I	0.000360	0.000293
	(0.000698)	(0.000888)
Observations	3072	2784
Set of Treatments	Full	Restricted
State and year FE	Yes	Yes

Notes: State-level specification with state and year fixed effects. Bins refer to the 12 wage bins. Bins J through L are omitted. T indicates treatment state, Post indicates after the minimum wage increase. Full sample includes all treatment states, restricted sample includes only states that increased their minimum wage from the federal level.

Table 6: State-Bin Level Specifications: Change in Employment by Occupation-Bin

	Service	Production	Clerical	Mgmt	Prof
Panel A: Limited Service Restaurants					
T× Post × Bin A	-0.252***	-0.142	-0.0808	0.0103	-0.0195
	(0.0506)	(0.0782)	(0.127)	(0.0370)	(0.165)
T× Post × Bin B	0.174***	0.0417	0.127	-0.0332	0.107
	(0.0355)	(0.0827)	(0.100)	(0.0561)	(0.177)
T× Post × Bin C	0.0240	-0.0480	0.0737	0.0476	0.0645
	(0.0195)	(0.0647)	(0.0707)	(0.0482)	(0.166)
N	1024	1024	992	1024	640
Panel B: Sample 33					
T× Post × Bin A	-0.209***	-0.142**	-0.0944	-0.00984	-0.0919
	(0.0383)	(0.0452)	(0.0734)	(0.0206)	(0.115)
T× Post Bin B	0.0613*	0.0279	0.0469	-0.0474	0.0184
	(0.0229)	(0.0609)	(0.0457)	(0.0302)	(0.0718)
T× Post × Bin C	-0.00532	-0.0171	0.0744	0.0160	-0.0541
	(0.0138)	(0.0561)	(0.0526)	(0.0283)	(0.0771)
N	1024	1024	1024	1024	992
Panel C: All Firms					
T× Post × Bin A	-0.0975***	-0.0135	-0.0329	0.00564	0.000285
	(0.0230)	(0.0164)	(0.0182)	(0.00591)	(0.00624)
T× Post × Bin B	0.0203	0.0156	0.00513	0.00531	0.000301=
	(0.0180)	(0.0185)	(0.0164)	(0.00757)	(0.00741)
T× Post × Bin C	-0.00710	0.0145	0.00682	0.00943	-0.00236
	(0.0143)	(0.0141)	(0.0130)	(0.00633)	(0.00805)
N	1024	1024	1024	1024	1024

Notes: State-level specification with state and year fixed effects. Bins refer to the 12 wage bins. Bins J through L are omitted. T indicates treatment state, Post indicates after the minimum wage increase. Full sample includes all treatment states, restricted sample includes only states that increased their minimum wage from the federal level.

Table 7: State-Level Changes in Occupational Structure

	LS Restuarants	Sample 33	All
Managers and Supervisors	-0.00512	-0.00446	-0.00135
	(0.00832)	(0.00403)	(0.00332)
Clerical	0.000442	-0.00300	-0.00940
	(0.00915)	(0.00594)	(0.00495)
Production	-0.00702	-0.00232	-0.00386
	(0.00695)	(0.00410)	(0.00579)
Service	0.0113	0.0101	0.00642
	(0.0137)	(0.0101)	(0.00397)
State and year FE	Yes	Yes	Yes
N	1280	1280	1280

Notes: State-level specification with state and year fixed effects. Professional occupations omitted. T indicates treatment state, Post indicates after the minimum wage increase. Full sample includes all treatment states, restricted sample includes only states that increased their minimum wage from the federal level.

Table 8: Change in Employment by Occupation

DV: Share in Occ	Mgmt	Prof.	Clerical	Prod.	Service	PC	Total Emp
Sample: LS Restaurants							
T× Post	-0.00678	-0.000596	-0.00117	-0.00113	0.00968	-0.0000137	1.373
	(0.00616)	(0.000825)	(0.00790)	(0.00447)	(0.0122)	(0.0000336)	(3.505)
N	3986	3986	3986	3986	3986	3986	3986
Sample: 33							
T× Post	-0.00525	-0.00158	-0.00507	-0.00129	0.0132	-0.000715	-0.306
	(0.00367)	(0.00165)	(0.00460)	(0.00281)	(0.00744)	(0.000372)	(2.769)
	8724	8724	8724	8724	8724	8724	8724
Sample: 20							
T× Post	-0.00362	-0.00474	-0.00430	0.00466	0.00800	-0.000286	1.075
	(0.00294)	(0.00243)	(0.00335)	(0.00287)	(0.00418)	(0.000208)	(1.986)
N	28774	28774	28774	28774	28774	28774	28774
Sample: 10							
T× Post	-0.00183	0.00144	0.000150	0.000725	-0.000491	-0.000250	2.139*
	(0.00241)	(0.00230)	(0.00304)	(0.00150)	(0.00342)	(0.000315)	(0.917)
N	58954	58954	58954	58954	58954	58954	58954
Sample: Full							
T× Post	-0.00200	0.00131	-0.00277	0.00286	0.000604	0.000866	2.222
	(0.00296)	(0.00176)	(0.00203)	(0.00157)	(0.00125)	(0.000598)	(1.312)
N	259454	259454	259454	259454	259454	259454	259454

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Share A indicates the share of employment in the establishment in the smallest wage bin in the pre-period. Standard errors clustered at the state-level. Full sample includes all establishments, LS Restaurants indicates limited-service restaurants, and Sample 10, 20, and 33 indicates industries with over 10%, 20%, or 33% employment in the bottom wage bin in 2003, respectively.

Table 9: Occupational Reallocations within Establishment (6-digit)

	Reallocations within:							
	All	Mgmt	Sup.	Prof.	Clerical	Prod.	Service	PC
Sample: LS Restaurants								
T× Post	0.00981	0.0114	0.00684**	0.000400	0.00187	-0.000977	0.0302	-0.000158
	(0.0140)	(0.0111)	(0.00224)	(0.000756)	(0.000942)	(0.000985)	(0.0184)	(0.000140)
	2076	2076	2076	2076	2076	2076	2076	2076
Sample: 33								
T× Post	0.0148	0.0171*	0.0219***	0.00184	0.00726*	0.00206	0.0251*	0.000218
	(0.00792)	(0.00829)	(0.00294)	(0.00128)	(0.00278)	(0.00235)	(0.0102)	(0.000352)
	4480	4480	4480	4480	4480	4480	4480	4480
Sample: 20								
T× Post	0.00979*	0.0191***	0.0209***	0.00989***	0.0125*	0.00607*	0.0122**	0.00136*
	(0.00406)	(0.00521)	(0.00373)	(0.00263)	(0.00521)	(0.00294)	(0.00401)	(0.000564)
	14823	14823	14823	14823	14823	14823	14823	14823
Sample: 10								
T× Post	0.00949**	0.0188***	0.0159***	0.0120*	0.0143**	0.00434	0.00878**	0.00259*
	(0.00282)	(0.00388)	(0.00285)	(0.00460)	(0.00482)	(0.00215)	(0.00246)	(0.00111)
N	30529	30529	30529	30529	30529	30529	30529	30529
Sample: Full								
T× Post	0.00818*	0.0177***	0.00633*	0.0124**	0.0114*	-0.00292	0.00337*	0.00718***
	(0.00347)	(0.00447)	(0.00272)	(0.00364)	(0.00504)	(0.00185)	(0.00132)	(0.00194)
	130259	130259	130259	130259	130259	130259	130259	130259

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Dependent variable is the percent reallocation between the pre- and post-period. Standard errors clustered at the state-level. Full sample includes all establishments, LS Restaurants indicates limited-service restaurants, and Sample 33 indicates industries with over 33% employment in the bottom wage bin in 2003. DD are difference-in-difference specifications and matched use nearest neighbor matching.

Table 10: Employment Spillovers to Supervisors and Managers

	9.25	11.74	14.74	18.74+
DV: Share in Bin	A	B	C	D+
Panel A: Supervisors				
Sample: Full, DD				
T× Post	0.000582	-0.00148	0.0119***	-0.0110*
	(0.00185)	(0.00239)	(0.00225)	(0.00422)
N	145018	145018	145018	145018
Sample: LS Restaurants, DD				
T× Post	-0.00409	-0.141***	0.0632	0.0819*
	(0.0204)	(0.0226)	(0.0380)	(0.0371)
N	3505	3505	3505	3505
Sample: LS Restaurants, Matched				
T× Post	-0.0254*	-0.118***	0.0622***	0.0810***
	(0.00990)	(0.0192)	(0.0187)	(0.0199)
N	4268	4268	4268	4268
Sample: 33, DD				
T× Post	-.0250411***	-.0914802***	.0372898**	.0792314***
	(.0066373)	(.0126081)	(.0127602)	(.0142535)
N	7,691	7,691	7,691	7,691
Sample: 33, Matched				
T× Post	-0.0131	-0.0906***	0.0441	0.0596*
	(0.0148)	(0.0173)	(0.0270)	(0.0235)
N	7010	7010	7010	7010
Panel B: Managers				
Sample: Full, DD				
T× Post	0.000561	0.00128*	0.00153	-0.00520
	(0.000888)	(0.000556)	(0.000992)	(0.0104)
N	151480	151480	151480	259454
Sample: LS Restaurants, DD				
T× Post	-0.000674	0.0267*	0.00651	-0.0676
	(0.00771)	(0.0105)	(0.0245)	(0.0513)
N	1973	1973	1973	3986
Sample: LS Restaurants, Matched				
T× Post	-0.0042	0.007578	.0157508	-.0529089 **
	(0.0040312)	(.0101421)	(.0194999)	(.0196064)
N	1600	1600	1600	5,285
Sample: 33, DD				
T× Post	-.0004026	.0037366	.0068663	-.0039027
	(.0036615)	(.0054652)	(.0104575)	(.0128586)
N	3,595	3,595	3,595	10728
Sample: 33, Matched				
T× Post	0.00362	0.00948	0.0170	-0.0114
	(0.00643)	(0.00646)	(0.0140)	(0.0316)
N	4314	4314	4314	8724

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Dependent variable is the percent reallocation between the pre- and post-period. Standard errors clustered at the state-level. Full sample includes all establishments, LS Restaurants indicates limited-service restaurants, and Sample 33 indicates industries with over 33% employment in the bottom wage bin in 2003. DD are difference-in-difference specifications and matched use nearest neighbor matching.

Table 11: Triple Difference: Employment Spillovers through Management Hierarchy

	A 9.25	B 11.74	C 14.74	D+ 18.74+
Panel A: Supervisors				
Full Sample				
T× Post	-0.000518	0.00134	0.00250	-0.00332
	(0.000498)	(0.00135)	(0.00217)	(0.00291)
T× Post× (0 < Share A ≤ 25%)	0.00110	0.000864	0.0110**	-0.0130**
	(0.00119)	(0.00182)	(0.00339)	(0.00398)
T× Post× (25%<Share A < 50%)	-0.00195	-0.0114*	0.0242**	-0.0109
	(0.00407)	(0.00500)	(0.00755)	(0.00805)
T× Post× (50%<Share A <75%)	-0.0112	0.00661	0.00853	-0.00390
	(0.00654)	(0.0119)	(0.0131)	(0.0197)
T× Post× share A > 75%	-0.0193	-0.0970***	0.0424	0.0739**
	(0.0144)	(0.0143)	(0.0210)	(0.0254)
	145018	145018	145018	145018
Restricted Sample				
T× Post	-0.0000192	0.00248	0.00283	-0.00530
	(0.000660)	(0.00134)	(0.00237)	(0.00277)
T× Post× (0 < Share A ≤ 25%)	0.00187	0.00212	0.00812*	-0.0121*
	(0.00170)	(0.00249)	(0.00370)	(0.00459)
T× Post× (25%<Share A < 50%)	-0.00213	-0.00658	0.0193*	-0.0106
	(0.00517)	(0.00542)	(0.00877)	(0.00861)
T× Post× (50%<Share A <75%)	-0.0125	0.00670	0.00321	0.00258
	(0.00777)	(0.0128)	(0.0149)	(0.0213)
T× Post× share A > 75%	-0.00786	-0.0975***	0.0379	0.0675
	(0.0138)	(0.0172)	(0.0312)	(0.0338)
	116396	116396	116396	116396
Panel B: Managers				
Full Sample				
T× Post	-0.00217*	0.000231	0.000596	-0.00817
	(0.000811)	(0.000374)	(0.000975)	(0.0123)
T× Post× (0 < Share A ≤ 25%)	0.00501**	0.000942	0.000358	0.0136
	(0.00159)	(0.000742)	(0.00127)	(0.00687)
T× Post× (25%<Share A < 50%)	0.00283	-0.00107	0.00498	-0.0129
	(0.00373)	(0.00209)	(0.00345)	(0.0109)
T× Post× (50%<Share A <75%)	0.00497	0.00359	0.00555	0.0195
	(0.00314)	(0.00348)	(0.00908)	(0.0123)
T× Post× share A > 75%	0.00572	0.0249*	-0.0146	0.0152
	(0.00787)	(0.00935)	(0.00974)	(0.0203)
N	151480	151480	151480	259454
Restricted Sample				
T× Post	-0.00196*	-0.0000899	-0.000639	-0.00260
	(0.000765)	(0.000379)	(0.000998)	(0.0104)
T× Post× (0 < Share A ≤ 25%)	0.00538**	0.000548	0.000973	0.0175**
	(0.00161)	(0.000954)	(0.00139)	(0.00622)
T× Post× (25%<Share A < 50%)	0.000798	-0.00292	0.00598	-0.0171
	(0.00408)	(0.00242)	(0.00461)	(0.00859)
T× Post× (50%<Share A <75%)	0.00623	0.00646	0.0132	0.00338
	(0.00358)	(0.00357)	(0.00799)	(0.0141)
T× Post× share A > 75%	0.00741	0.0200	-0.0180	0.000740
	(0.0131)	(0.0160)	(0.0110)	(0.0129)
N	117401	117401	117401	209438

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Share A indicates the share of employment in the establishment in the smallest wage bin in the pre-period. Standard errors clustered at the state-level. The top panel is restricted to supervisor occupations, the bottom panel is restricted to management occupations. Full sample includes all treatment states, restricted sample includes only states that increased their minimum wage from the federal level.

Table 12: Wage Percentiles and Inequality

Wage Ptile	10th	50th	90th	90/10	90/50	50/10
Sample: Full, DD						
T× Post	0.0659***	0.0528***	0.0478*	-0.0412	-0.00454	-0.0191**
	(0.0137)	(0.0138)	(0.0179)	(0.0235)	(0.0112)	(0.00656)
N	259454	259451	259445	259454	259451	259454
Sample: LS Restaurants, DD						
T× Post	0.145***	0.135***	0.0683**	-0.119*	-0.104**	-0.0111
	(0.0185)	(0.0159)	(0.0219)	(0.0478)	(0.0340)	(0.0110)
N	3986	3985	3985	3986	3985	3986
Sample: LS Restaurants, Matched						
T× Post	0.135***	0.125***	0.0728***	-0.0996*	-0.0856***	-0.0114
	(0.0201)	(0.0152)	(0.0189)	(0.0384)	(0.0224)	(0.0101)
N	8724	8723	8723	8724	8723	8724
Sample: 33, DD						
T× Post	0.121***	0.123***	0.0656***	-0.0830***	-0.0841***	0.00190
	(0.00260)	(0.00346)	(0.00964)	(0.0164)	(0.0151)	(0.00302)
N	5285	5284	5284	5285	5284	5285
Sample: 33, Matched						
T× Post	0.119***	0.131***	0.0768***	-0.0655***	-0.0831***	0.0144***
	(0.00213)	(0.00360)	(0.00804)	(0.0141)	(0.0118)	(0.00390)
N	10728	10727	10727	10728	10727	10728

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Dependent variable is the percent reallocation between the pre- and post-period. Standard errors clustered at the state-level. Full sample includes all establishments, LS Restaurants indicates limited-service restaurants, and Sample 33 indicates industries with over 33% employment in the bottom wage bin in 2003. DD are difference-in-difference specifications and matched use nearest neighbor matching.

Table 13: Wage Structure of Closing and Opening Establishments

	$9.25	$11.49	$14.49	$18.24+	Tot. Emp.
Closing Establishments					
Sample: LS Restaurants					
T × Closed	-0.0234	0.0149	0.00741	0.00101	-10.38
	(0.0415)	(0.0236)	(0.0145)	(0.0141)	(6.301)
N	8525	8525	8525	8525	8525
Sample: 33					
T × Closed	0.0284	0.00231	-0.00264	-0.0281	-10.59
	(0.0434)	(0.0182)	(0.0196)	(0.0197)	(5.336)
N	21664	21664	21664	21664	21664
Sample: 20					
T × Closed	0.0181	0.0136	0.00864	-0.0403	-12.50*
	(0.0363)	(0.0147)	(0.0122)	(0.0207)	(6.108)
N	76973	76973	76973	76968	76968
Sample: 10					
T × Closed	0.0186	0.0123	0.00700	-0.0377	-2.838
	(0.0213)	(0.0130)	(0.00850)	(0.0195)	(8.165)
N	160946	160946	160946	160299	160299
Sample: All					
T × Closed	0.0101	0.0104*	0.00888*	-0.0292	-2.685
	(0.0121)	(0.00477)	(0.00334)	(0.0168)	(8.912)
N	640096	640096	640096	639417	639417
Opening Establishments					
Sample: LS Restaurants					
T × Opened	0.0681	-0.0325	-0.0364*	0.000877	2.731
	(0.0417)	(0.0260)	(0.0141)	(0.0161)	(5.950)
N	7414	7414	7414	7414	7414
Sample: 33					
T × Opened	0.0204	-0.0310	0.0284	-0.0178	27.85
	(0.0433)	(0.0233)	(0.0333)	(0.0183)	(13.79)
N	18034	18034	18034	18034	18034
Sample: 20					
T × Opened	0.000766	-0.00638	0.0101	-0.00446	24.19
	(0.0391)	(0.0128)	(0.0243)	(0.0195)	(19.58)
N	64003	64003	64003	64003	64003
Sample: 10					
T × Opened	-0.0131	0.0296	0.00468	-0.0212	19.33
	(0.0270)	(0.0177)	(0.0159)	(0.0177)	(20.70)
N	135649	135649	135649	135649	135649
Sample: All					
T × Opened	-0.00193	0.0189	0.00357	-0.0206	10.88
	(0.0134)	(0.00943)	(0.00312)	(0.0166)	(18.38)
N	542491	542491	542491	542491	542491

Note: Establishment-level specifications, include half-year fixed effects. Close indicates establishments that closed after the minimum wage increase, open indicates establishment that entered after the minimum wage increase. T indicates treatment state. Standard errors clustered at the state-level. Full sample includes all establishments, LS Restaurants indicates limited-service restaurants, and Sample 10, 20, and 33 indicates industries with over 10%, 20%, or 33% employment in the bottom wage bin in 2003, respectively.

Table 14: Occupational Structure of Closing and Opening Establishments

	Mgmt	Prof.	Clerical	Prod.	Service	PC	Supervisor	Supervised
Closing Establishments								
Sample: LS Restaurants								
T × Closed	0.00457	-0.000394	0.0236	0.00875	-0.0365	0.0000892	0.00907	0.00512
	(0.0188)	(0.000466)	(0.0192)	(0.0135)	(0.0240)	(0.0000917)	(0.0160)	(0.00585)
N	8525	8525	8525	8525	8525	8525	8525	8525
Sample: 33								
T × Closed	-0.0103	-0.00416**	-0.0128	-0.0171	0.0443	-0.000675***	-0.00474	0.0142***
	(0.00826)	(0.00143)	(0.0229)	(0.0113)	(0.0308)	(0.000181)	(0.00646)	(0.00381)
N	21664	21664	21664	21664	21664	21664	21664	21664
Sample: 20								
T × Closed	-0.00855	-0.0141*	0.00130	-0.0100	0.0314	-0.000581***	-0.00665	0.0190**
	(0.00818)	(0.00549)	(0.0152)	(0.00812)	(0.0203)	(0.000157)	(0.00559)	(0.00666)
N	76968	76968	76968	76968	76968	76968	76968	76968
Sample: 10								
T × Closed	-0.0114	-0.0307***	0.0216	0.0232**	-0.00269	-0.00116*	-0.00661	0.0385***
	(0.00738)	(0.00686)	(0.0133)	(0.00786)	(0.0130)	(0.000476)	(0.00419)	(0.00801)
N	160299	160299	160299	160299	160299	160299	160299	160299
Sample: All								
T × Closed	-0.00341	-0.0150	0.00602	0.00699	0.00541	0.000201	-0.00154	0.0163
	(0.00605)	(0.00860)	(0.00836)	(0.0155)	(0.00584)	(0.00278)	(0.00238)	(0.0109)
N	639417	639417	639417	639417	639417	639417	639417	639417
Opening Establishments								
Sample: LS Restaurants								
T × Opened	0.00681	-0.00101	0.00159	0.000977	-0.00837	-0.000137	0.00815	0.00297
	(0.0161)	(0.00100)	(0.0117)	(0.0133)	(0.0205)	(0.000133)	(0.0129)	(0.00432)
N	7414	7414	7414	7414	7414	7414	7414	7414
Sample: 33								
T × Opened	-0.0122	0.00372	0.109	0.0127	-0.113	-0.000859*	-0.00647	-0.00209
	(0.00762)	(0.00262)	(0.0674)	(0.0154)	(0.0826)	(0.000409)	(0.00555)	(0.00365)
N	18034	18034	18034	18034	18034	18034	18034	18034
Sample: 20								
T × Opened	-0.0112	-0.00463	0.0113	0.00462	-0.000120	-0.000543*	-0.00804	0.00209
	(0.00632)	(0.00442)	(0.0155)	(0.00912)	(0.0161)	(0.000264)	(0.00412)	(0.00690)
N	64003	64003	64003	64003	64003	64003	64003	64003
Sample: 10								
T × Opened	-0.0126	-0.0166	0.0270	0.00795	-0.00575	-0.000309	-0.00726*	0.0125
	(0.00652)	(0.0122)	(0.0204)	(0.0105)	(0.0148)	(0.000296)	(0.00335)	(0.0122)
N	135649	135649	135649	135649	135649	135649	135649	135649
Sample: All								
T × Opened	-0.00119	-0.0118	0.0132	0.00274	-0.00295	0.00196	-0.00169	0.00799
	(0.00621)	(0.00959)	(0.00974)	(0.0104)	(0.00674)	(0.00268)	(0.00203)	(0.0119)
N	542491	542491	542491	542491	542491	542491	542491	542491

Note: Establishment-level specifications, include half-year fixed effects. Close indicates establishments that closed after the minimum wage increase, open indicates establishment that entered after the minimum wage increase. T indicates treatment state. Standard errors clustered at the state-level. Full sample includes all establishments, LS Restaurants indicates limited-service restaurants, and Sample 10, 20, and 33 indicates industries with over 10%, 20%, or 33% employment in the bottom wage bin in 2003, respectively.

A Appendix Supplemental Tables and Figures

Table A.1: State-Level Change in Occupational Structure

	LS Restaurants		Sample 33		Sample 20		Sample 10		All	
Managers and Supervisors	-0.00512	0.00192	-0.00446	-0.000387	-0.000338	0.00319	-0.00333	-0.000476	-0.00135	-0.00292
	(0.00832)	(0.00903)	(0.00403)	(0.00380)	(0.00481)	(0.00582)	(0.00363)	(0.00440)	(0.00332)	(0.00406)
Clerical	0.000442	-0.00224	-0.00300	-0.00479	-0.00906	-0.0104	-0.0208***	-0.0172**	-0.00940	-0.00881
	(0.00915)	(0.0115)	(0.00594)	(0.00721)	(0.00472)	(0.00547)	(0.00503)	(0.00586)	(0.00495)	(0.00578)
Production	-0.00702	-0.00715	-0.00232	-0.00277	-0.00375	-0.00461	-0.00224	-0.00299	-0.00386	-0.00694
	(0.00695)	(0.00818)	(0.00410)	(0.00520)	(0.00404)	(0.00503)	(0.00417)	(0.00493)	(0.00579)	(0.00558)
Service	0.0113	0.00739	0.0101	0.0125	0.0163	0.0203	0.0158*	0.0143	0.00642	0.00500
	(0.0137)	(0.0170)	(0.0101)	(0.0123)	(0.00967)	(0.0117)	(0.00773)	(0.0101)	(0.00397)	(0.00455)
Sample	Full	Small	Full	Small	Full	Small	Full	Small	Full	Small
N	1280	1160	1280	1160	1280	1160	1280	1160	1280	1160

Note: State by occupation level triple-difference specification with professional occupations omitted. Small sample restricts treated states to those that increased the minimum wage from the federal minimum. All specifications include state and year fixed effects. Standard errors clustered at the state level.

Table A.2: Add caption

	Service	Production	Clerical	Mgmt	Prof	PC
			Panel A: All Firms			
T× Post × Bin A	-0.0830**	-0.00856	-0.0311	0.00701	-0.00286	-0.000381
	(0.0241)	(0.0157)	(0.0236)	(0.00668)	(0.00763)	(0.00664)
T× Post × Bin B	0.0189	0.00788	-0.00470	0.00919	-0.00261	0.00135
	(0.0203)	(0.0250)	(0.0194)	(0.00859)	(0.00976)	(0.00766)
T× Post × Bin C	-0.0102	0.00692	0.00181	0.0102	-0.00726	-0.00120
	(0.0189)	(0.0183)	(0.0166)	(0.00675)	(0.0101)	(0.00847)
N	928	928	928	928	928	928
			Panel B: Limited Service Restaurants			
T× Post × Bin A	-0.202**	-0.0487	0.0308	0.0413	0.0769	0.0382*
	(0.0586)	(0.0768)	(0.161)	(0.0419)	(0.158)	(0.0127)
T× Post × Bin B	0.154**	-0.0372	0.142	0.0312	0.189	0.0504
	(0.0469)	(0.0826)	(0.142)	(0.0602)	(0.218)	(0.0197)
T× Post × Bin C	0.0246	-0.108	0.0858	0.0867	0.0990	0.0578*
	(0.0243)	(0.0763)	(0.100)	(0.0569)	(0.189)	(0.0147)
N	928	928	896	928	576	64
			Panel C: Sample 33			
T× Post × Bin A	-0.177***	-0.0900	-0.0365	0.00982	-0.0889	0.295*
	(0.0382)	(0.0461)	(0.0922)	(0.0208)	(0.159)	(0.112)
T× Post × Bin B	0.0518	-0.0540	0.0549	-0.0145	0.0424	0.317*
	(0.0278)	(0.0517)	(0.0626)	(0.0306)	(0.0866)	(0.125)
T× Post Bin C	-0.00884	-0.0788	0.0990	0.0356	-0.0595	0.331
	(0.0145)	(0.0642)	(0.0685)	(0.0339)	(0.0967)	(0.161)
N	928	928	928	928	896	316

Notes: State-level specification with state and year fixed effects. Wage bins D-L omitted. T indicates treatment state, Post indicates after the minimum wage increase. Each column restricted to employment in the relevant occupation group.

Table A.3: Change in Employment by Occupation

DV: Share in Occ	Mgmt	Prof.	Clerical	Prod.	Service	PC	Total Emp
Sample: LS Restaurants, Matched							
T× Post	0.000752	0.000538	0.00633	0.00579	-0.0134	-0.0000259	-0.641
	(0.00337)	(0.000872)	(0.00485)	(0.00434)	(0.00744)	(0.0000419)	(0.959)
N	5285	5285	5285	5285	5285	5285	5285
Sample: 33, Matched							
T× Post	0.00282	0.00108	0.000741	0.00425	-0.00889*	-0.000138*	-0.0865
	(0.00219)	(0.000719)	(0.00290)	(0.00238)	(0.00437)	(0.0000663)	(0.683)
N	10728	10728	10728	10728	10728	10728	10728

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Share A indicates the share of employment in the establishment in the smallest wage bin in the pre-period. Standard errors clustered at the state-level. Top panel is restricted to limited-service restaurants, bottom panel is restricted to industries with over 33% employment in the bottom wage bin in 2003.

Table A.4: Triple Difference: Wage Percentiles and Inequality

	10th	50th	90th	90/10	90/50	50/10
Panel A: Full Sample						
T× Post	0.0669***	0.0510**	0.0495	-0.0453	0.00255	-0.0246*
	(0.0138)	(0.0170)	(0.0247)	(0.0387)	(0.0177)	(0.0105)
T× Post× (0 < Share A ≤ 25%)	0.0149	0.0372	0.0418	0.0625	0.00122	0.0331
	(0.0103)	(0.0194)	(0.0311)	(0.0573)	(0.0240)	(0.0172)
T× Post× (25%<Share A< 50%)	0.0231	0.0237	0.00319	-0.0516	-0.0356	0.00226
	(0.0150)	(0.0185)	(0.0274)	(0.0501)	(0.0295)	(0.0145)
T× Post× (50%<Share A <75%)	0.0576**	0.0450**	0.0210	-0.0731*	-0.0563**	-0.0229
	(0.0160)	(0.0157)	(0.0225)	(0.0306)	(0.0202)	(0.0136)
T× Post× share A > 75%	0.0553**	0.0634**	0.0363	-0.0153	-0.0414	0.0113
	(0.0163)	(0.0200)	(0.0243)	(0.0342)	(0.0219)	(0.00946)
N	259454	259451	259445	259454	259451	259454
Panel B: Restricted Sample						
T× Post	0.0510***	0.0478*	0.0600*	0.0224	0.0273	-0.00355
	(0.0132)	(0.0185)	(0.0283)	(0.0414)	(0.0202)	(0.0116)
T× Post× (0 < Share A ≤ 25%)	-0.00494	-0.00243	-0.0164	-0.0214	-0.0301	0.00226
	(0.0102)	(0.0169)	(0.0268)	(0.0425)	(0.0192)	(0.0165)
T× Post× (25%<Share A< 50%)	-0.000308	-0.00448	-0.0363	-0.116**	-0.0617*	-0.00979
	(0.0126)	(0.0162)	(0.0212)	(0.0397)	(0.0258)	(0.0221)
T× Post× (50%<Share A <75%)	0.0344**	0.0264	-0.00265	-0.108*	-0.0801**	-0.0198
	(0.0117)	(0.0178)	(0.0267)	(0.0458)	(0.0252)	(0.0183)
T× Post× Share A > 75%	0.0283*	0.0290	0.000255	-0.0558	-0.0495	-0.000396
	(0.0128)	(0.0150)	(0.0208)	(0.0371)	(0.0301)	(0.0132)
N	209438	209435	209431	209438	209435	209438

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Share A indicates the share of employment in the establishment in the smallest wage bin in the pre-period. Standard errors clustered at the state-level. The top panel is restricted to professional occupations, the bottom panel is restricted to service occupations.

Table A.5: Triple Difference: Wage Spillovers by Occupation

	A 9.25	B 11.74	C 14.74	D+ 18.74+
Professional Occupations				
T× Post	-0.00684***	0.00208*	0.00130	0.00346
	(0.00156)	(0.00101)	(0.00195)	(0.00210)
T× Post* <25% Share A	0.00226	-0.000461	0.00577*	-0.00757*
	(0.00118)	(0.00199)	(0.00256)	(0.00294)
T× Post* (25%<Share A< 50%)	-0.0109*	0.0239*	0.00276	-0.0157
	(0.00498)	(0.00980)	(0.0114)	(0.0194)
T× Post* (50%<Share A <75%)	-0.0394	0.0128	0.0139	0.0127
	(0.0208)	(0.0138)	(0.0121)	(0.0272)
T× Post* share A > 75%	-0.107	0.0535	-0.0136	0.0669
	(0.0838)	(0.0292)	(0.0316)	(0.0466)
	154194	154194	154194	154194
Service Occupations				
T× Post	-0.0466***	0.0220	0.0335*	-0.00899
	(0.0102)	(0.0109)	(0.0128)	(0.00970)
T× Post* <25% Share A	-0.0104	0.0215	-0.0226	0.0115
	(0.0138)	(0.0112)	(0.0116)	(0.0113)
T× Post* (25%<Share A< 50%)	-0.132***	0.0796***	0.00931	0.0433*
	(0.0317)	(0.0155)	(0.0131)	(0.0167)
T× Post* (50%<Share A <75%)	-0.217***	0.167***	0.00563	0.0437**
	(0.0564)	(0.0401)	(0.0162)	(0.0140)
T× Post* share A > 75%	-0.301**	0.257***	0.00949	0.0343
	(0.0914)	(0.0686)	(0.0154)	(0.0176)
	81660	81660	81660	81660

Note: Establishment-level specifications, include establishment and half-year fixed effects. T indicates treatment state, Post indicates after the minimum wage increase. Share A indicates the share of employment in the establishment in the smallest wage bin in the pre-period. Standard errors clustered at the state-level. The top panel is restricted to professional occupations, the bottom panel is restricted to service occupations.