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How did the Seattle Minimum Wage Affect Poor and Near-Poor Workers?

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How did the Seattle Minimum Wage Affect Poor and Near-Poor Workers? Longitudinal Evidence from New Merged Administrative Data

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Abstract: *This brief reports on new and preliminary research examining how the first two steps of the Seattle minimum wage increase affected low-income residents who were both workers and lived in households served by Washington State programs. Overall results suggest that the mandated wage increases to $11 and then $13 per hour increased the wages and earnings of members of these households who working for less than $11 when the policy first took effect. While the wage increases reduced this group's quarterly hours worked, they did not change the overall employment rate. For an overlapping second cohort of workers employed at less than $13 before the step up to $13, the policy increased wages but decreased hours worked so that overall earnings were unaffected. Benefits from the policy accrued most strongly to workers with household income just above the poverty line.*

Advocates who support raising minimum wages base their position in part on claims that higher wages will improve the material well-being of low-income workers and their families. This brief presents new and preliminary evidence on the effect of the initial two phase in steps of the Seattle minimum wage on the hourly wages, employment, and earnings of workers who lived in households served by the Washington State Department of Social and Health Services (DSHS) or Health Care Authority (HCA). We examine overall effects on state clients. Then, using a DSHS-created household poverty measure based on client-reported income, we examine how short-run longitudinal outcomes varied by income level relative to the federal poverty line.

The study population consists of two overlapping cohorts of state program clients: the group of clients who were employed and earning less than $11 in the first quarter of 2015 (prior to the first step-up to $11 in April 2015) and the group of clients earning less than $13 in the final quarter of 2015 (prior to the second step-up to $13 in January 2016). Replicating the approach of Jardim and colleagues (2018), we use a difference-in-differences-in-differences (DDD) approach in which those who work in Seattle ("treated") are matched using a nearest-neighbor approach to those outside the county containing Seattle ("untreated"). We compare these cohorts to a placebo cohort from an earlier period to further account for enduring Seattle-specific trends. Appendix 1 details our data and methods. This work is preliminary and based on the heterogeneous group of workers from households that come into contact with a set of state programs, most, but not all of which, target lower-income workers.

The strongest effects are found when we follow a cohort of workers who earned less than $11 per hour before the wage ordinance took effect. For this group, we find initial gains in income following the April 2015 increase to $11 per hour. Over the three quarters following that increase, results suggest that the policy increased quarterly earnings by $257 for this group. The subsequent increase to $13 per hour in January 2016 had smaller effects on earnings due to decreases in hours worked. The wage policy did not affect this group's overall employment rate.

For the second cohort, those who were working and earned less than $13 per hour prior to the January 2016 increase, we find that wage gains offset reductions in hours, leading to no net change in quarterly earnings. Again, the policy did not affect the cohort's employment.

State programs serve clients both below and above the federal poverty line. The minimum wage law increased wages for clients at all income levels. However, in the first cohort clients below the poverty line experienced smaller increases in wages and larger decreases in quarterly employment relative to those above the poverty line.

This work provides a first look at how the Seattle Minimum Wage Ordinance affected a population of workers from low-income households. Future iterations of our merged dataset will allow us to examine effects for households using specific programs commonly used by working poor households, such as food assistance, as well as allow us to test different household income measures.

While preliminary, we believe this trajectory analysis shows that the Seattle Minimum Wage raised hourly wages of workers who live in households served by state programs without decreasing the likelihood of being employed. Decreases in hours worked offset these wage gains, leading to no significant change in quarterly earnings. Clients with household income both below and above the poverty line experienced wage increases, and workers above the poverty line saw gains in earnings.

Attachments:

Appendix 1. Data and Methods

Appendix 2. Tables

Appendix 1. Data and Methodology

Results reported in this brief use individual employment and household income data from the Washington Merged Longitudinal Administrative Dataset to analyze the impact of Seattle's 2015 and 2016 minimum wage increases on a subset of Washington workers who were clients in Washington State Department of Social and Health Services (DSHS) or Health Care Authority programs. The empirical work replicates the approach used by Ekaterina Jardim, Mark Long, Robert Plotnick, Emma van Inwegen, Jacob Vigdor, and Hilary Wething, henceforth referenced as Jardim et al (2018a). The Jardim et al analysis and any other based on Unemployment Insurance (UI) records cannot distinguish low-wage workers in poor households from those in non-poor households. By adding household information from state program records, the current work can focus on workers from poor- and near-poor households, one of the groups that policymakers aimed to help by increasing the minimum wage.

1. Data

The analysis follows the employment trajectories of state clients who were engaged in low-wage work immediately before each minimum wage increase. Longitudinal workforce data collected by the state of Washington's Employment Security Department (ESD), collected for administering UI, let us track employment, quarterly hours, earnings, and average hourly wages before and after the minimum wage increases. We link these records to DSHS data on income as a percent of the federal poverty line. We analyze the impact of the city's minimum wage ordinance on wages, hours, employment, and earnings for all state program clients who held low-wage jobs before the wage increased, then disaggregate by poverty status to estimate differential effects based on household income. This analysis does not capture all workers from low-income families, but since DSHS serves approximately 4 in 10 Washington residents, it does capture a large number of such workers.

1.1 DSHS Client Status

These analyses are restricted to workers who have entries in the DSHS data in the 4th quarter of 2014 (2014.4), indicating that they lived in a household that received services from the state Health Care Authority or DSHS during that time period. DSHS manages client data for the Health Care Authority, which administers the state Medicaid program among others. DSHS programs include WorkFirst (Washington's Temporary Assistance for Needy Families program), Basic Food (Washington's Supplemental Nutrition Assistance Program), Basic Food Employment and Training, Working Connections Child Care, and child support, among others. These 2014Q4 state program clients represented 15% of workers earning under $11 before the first major minimum wage increase (in 2015.1), and 15% of workers earning under $13 per hour before the second major minimum wage increase (in 2015.4).

1.2 Household Income

To estimate differential impacts of the minimum wage increases by household poverty, we link ESD data to DSHS estimates of household-level income. DSHS groups individuals into households based on information about program assistance units, then aggregates data on household income as reported by clients to program administrators. We use DSHS's calculated household income as a percentage of the federal poverty threshold, which incorporates information on all earned and unearned income reported to program case workers. This includes

wages as well as program benefits, self-employment income, and gifts. While this is a self-reported measure, it is subject to quality assurance procedures administered by program staff. The measure is reported monthly; we use the average of all non-missing values for October, November, and December 2014.

A share of the DSHS population is recorded as having income at 0% of the federal poverty line. We suspect the income measure is not accurate in some of these cases. In checking these households against UI records, we find that some households recorded by DSHS as having an income of 0 include workers who earned wages. We suspect that these households take part in programs that do not collect household income data, and we are working with DSHS to understand these data oddities. We include these 0% poverty line income households as a separate group in some analyses and exclude them in others (see table notes for details).

1.3 Employment – Hours and Earnings[1]

This analysis uses administrative employment data from Washington State covering the period from the first quarter of 2005 (i.e., 2005.1) through the third quarter of 2016 (2016.3). Washington's Employment Security Department collects quarterly payroll records for all workers who received wages in Washington and are covered by UI.[2] In addition to quarterly earnings, ESD requires employers to report actual hours worked for employees paid by the hour, and either actual hours worked or 40 times the number of weeks worked for salaried employees.[3] The hours data permit measurement of the average hourly wage earned by each worker in each quarter by dividing total quarterly earnings from all jobs by total quarterly hours worked from all jobs.[4, 5] This, in turn, allows us to identify workers likely to be directly affected by an increase in the minimum wage and trace their employment trajectories forward in time.[6]

We consider individuals employed if they are observed in the ESD data anywhere in Washington. As a person can have earnings from multiple employers in one quarter by working

[1] This and the following sections draw heavily and at many points verbatim from the Jardim et al (2018a) exposition.

[2] The ESD data exclude 1099 contract employment, employment outside Washington State, as well as "under the table" employment.

[3] Individuals are eligible for unemployment benefits in Washington after they have logged 680 hours with their employer. This hours test necessitates the collection of hours worked data. As noted in Jardim et al. (2018a), the distribution of hours worked in the ESD data departs most notably from self-reports in the CPS by its lack of pronounced "spikes" at round numbers. Minnesota, Oregon, and Rhode Island also collect hours data. For an independent assessment of the accuracy of administrative hours data in Washington, see Lachowska, Mas, and Woodbury (2018).

[4] We convert all dollar values to 2015.2 prices using the national CPI-W. We have chosen CPI-W because the state minimum wage and Seattle's minimum wage (once fully phased-in) use this index to adjust the minimum wage to inflation.

[5] Workers may occasionally be paid in one quarter for work performed in another. Our analysis excludes observations with calculated wages below $8 in 2015 dollars, observations with zero hours, and observations with calculated wages above $500 if reported hours were below 10 in a calendar quarter. We chose the cutoff of $8 because it approximately corresponds to the level of wages which can be legally paid to trainees and workers with disabilities, whose wages cannot be lower than 75% of the state minimum wage, which was $9.47 in 2015.2. Wages below $8 likely reflect exceptions or errors in the data and often are associated with implausibly high quarterly hours worked. We also exclude workers reporting greater than 2,190 hours worked in any calendar quarter.

[6] The average hourly wage construct used here differs from the self-reported hourly wage in the CPS. CPS respondents are instructed to report their base hourly wage excluding overtime, commissions, or tips. A previous study comparing the distribution of hourly wages between CPS and state administrative data finds strong cross-sectional and time-series concordance (Cengiz et al., 2017).

multiple jobs or transitioning between employees, we measure a worker's quarterly hours worked and quarterly earnings as the sum of hours and earnings from all jobs worked during the quarter. The great majority of workers we study match to a single employer in a given quarter; aggregating across jobs for the minority of individuals working multiple jobs permits us to more accurately describe a worker's total labor market income.[7]

The data identify business entities as UI account holders. Our identification strategy hinges on placing workers into regions based on the location of a worker's primary employer, which we define as the employer that paid the worker the most in the baseline quarter. ESD data include the employer's mailing address, which we geocode to determine if a business is located within Seattle, outlying King County, or the remainder of Washington State.

Firms operating in multiple locations may either establish separate UI accounts for each location or report all employment on a single account linked to a single address. We are unable to definitively locate employment for multi-site businesses utilizing a single account. We therefore exclude from the analysis "non-locatable" workers whose baseline employment was at a multi-site single-account business. These establishments employed 36% of workers in each of the cohorts we study (see Table 2). Additionally, we are unable to geocode businesses with invalid addresses or those whose address is listed only as "statewide" or "unknown." This leads us to exclude an additional 5% (6%) of workers in Cohort 1 (2). Henceforth we refer to the remaining firms included in the analysis as "locatable" businesses.[8] We also exclude workers employed at baseline by both a Seattle employer and an employer outside of Seattle. Such workers can be thought of as receiving a partial dosage of the Seattle minimum wage "treatment." Finally, we drop workers employed at baseline by an employer in King County outside of Seattle. As shown in Jardim et al. (2018b), evidence suggests that Seattle's ordinance had spillover impacts in the surrounding region.

Ultimately, these restrictions mean that our analysis focuses on subsets of employed state program clients. In the first (fourth) quarter of 2015, 42% (41%) of employed state program clients earning under $11 ($13) per hour met our location restrictions. While we require these workers to have locatable employment meeting the criteria above to be included in the analysis, it is important to emphasize that for the included workers, the outcome measures incorporate all employment regardless of location in Washington state.

2. Methodology

We use a difference-in-differences-in-differences (DDD) framework to estimate the effect of Seattle's first two phased minimum wage increases. In brief, this method contrasts the differences in treated and control workers' outcomes in quarters after enforcement of the

[7] Table 3 shows that about 6% of Seattle state program clients in low-wage jobs we study held more than one job in the calendar quarter immediately before the city's first minimum wage increase. Note, however, that individuals holding jobs both inside and outside the city, or with one job inside the city and one or more with a location that cannot be determined in our administrative data, are excluded from analysis.

[8] Minimum wage laws may elicit differential responses from "non-locatable" firms relative to our analysis sample. These employers, which tend to be larger, are more likely to face the faster phase-in schedule under Seattle's Ordinance shown in Table 1. Firms with establishments inside and outside of the affected jurisdiction might more easily absorb the added labor costs from their affected locations, implying a less elastic response to a local wage mandate. Alternatively, such firms might have an easier time relocating work to their existing sites outside of the affected jurisdiction, implying a greater elasticity. Jardim et al. (2018a) presents evidence from both administrative and survey data that suggest that the exclusion of non-locatable firms is unlikely to have a large affect our results.

Ordinance to differences observed at baseline (difference-in-differences) and then difference this result from the same exercise applied to a placebo cohort of Seattle and outlying Washington workers observed in an earlier period of time when there was no local minimum wage law.

2.1 Identifying the "treated" sample of interest

Seattle's minimum wage is imposed on employers rather than workers, which creates a challenge for assigning treatment status to individual workers. The Ordinance covers work done within the city boundaries of Seattle, defined by the physical location of the employer or the workplace if the work is done outside of the employer's premises. Movements of workers to and from Seattle's labor market can be thought of as non-compliance in terms of traditional treatment effect literature. Given this worker mobility, our estimated effects can be considered "intent to treat" (ITT).

We define workers assigned to treatment as those with 100 percent of their baseline quarter (2015.1) employment in locatable Seattle businesses, who earned at least $8 but less than $11 per hour in that quarter, and who were state program clients in 2014.4. We track these "Cohort 1" workers for the six following quarters (2015.2 – 2016.3). We compare these treated workers to workers in Washington State who received all of their earnings from locatable employers outside of King County in the relevant baseline quarter but were otherwise similar to Seattle workers in terms of their recent employment history and earnings.

We also report findings for "Cohort 2" treated workers, defined as those who had 100 percent of their baseline quarter (2015.4) employment in locatable firms in Seattle, earned at least $8 but less than $13 per hour in that quarter, and were state program clients in 2014.4. We track those workers for the three subsequent quarters (2016.1 – 2016.3). Note that this cohort may have been endogenously selected as their employment in Seattle could have been affected by the first minimum wage increase to $11. If the first minimum wage increase had a disemployment effect, then Cohort 2 would consist of the workers who "survived" this first minimum wage hike. We present results with this caveat in mind.

2.2 Matching methods and pseudo-cohort differencing

Rather than utilize the entire sample of wage-eligible workers outside King County as controls, we apply a nearest neighbor matching strategy to minimize observed treatment-control differences in baseline characteristics. Matching methods are often criticized on the grounds that narrowing observable differences between treated and control observations can actually exacerbate unobserved differences. These concerns are amplified in scenarios where individuals faced a personal choice regarding whether to obtain the treatment. In this case, selecting "control" observations with no employment in King County in a baseline period before the treatment was actually implemented mitigates the concern. As we discuss below, concerns regarding non-match on unobservables persist and we address them by differencing results between a treated and untreated cohort.

For each treated worker, we identify the nearest neighbor without replacement.[9] We match exactly on workers' employment status and whether they were first observed in

[9] Nearest neighbor without replacement is recommended by Abadie and Spiess (2016) so as to derive valid standard errors. For inference, we follow their suggestion of using a non-parametric block bootstrap that resamples matched-pairs of treatment and control workers. We produce 1,000 block bootstrapped samples for each point estimate. Alternate models using nearest neighbor matching with replacement and one to four matches yield point estimates similar to those presented here. There are tradeoffs in the choice of the number of matches. While increasing the

Washington State data in the three quarters prior to each minimum wage hike – the baseline quarter as well as the two prior quarters. In addition, we continuously match workers on quarterly hours worked in all jobs in the baseline quarter and each of the two prior quarters, hourly wages (conditional on employment) in each of three quarters, having earnings from more than one employer in a quarter (conditional on employment), the number of quarters a worker has been linked to their current primary employer, and the number of quarters since the worker first appeared in Washington State data. These duration measures are left-censored for workers whose employment history extends before 2005. We use Mahalanobis (1936) distance, $D_{ij,}$ to measure the distance between individual i and individual j, defined as:

$$D_{ij} = (X_i - X_j)' \Sigma^{-1} (X_i - X_j),$$

where Σ is the sample-covariance matrix of the covariates, X, in the pool of potential control workers.

The first difference in the DDD estimator is the difference between the mean outcomes of treatment and control workers in quarter q following an increase in Seattle's minimum wage (with q ranging from 1 to 6 for cohort 1 and 1 to 3 for cohort 2). This difference can be represented as follows:

$$\frac{1}{N_{Treated}} \sum_{i=1}^{N_{Treated}} [Y_{iq}] - \frac{1}{N_{Treated}} \sum_{i=N_{Treated}+1}^{2N_{Treated}} [Y_{iq}]$$

with the observations sorted by treatment status such that treated observations are indexed from $i = 1$ to $i = N_{Treated}$ and their matched control observations are indexed from $i = N_{Treated} + 1$ to $i = 2N_{Treated}$.

Because we match on several continuous covariates, the matching estimator which compares each observation to its neighbors may be biased (Abadie and Imbens 2011). We follow Abadie and Imbens (2011) and implement bias-correction by running a regression of the outcome of interest on the continuous covariates using the sample of the treated observations to obtain $\hat{\beta}_1$ and repeating with the sample of control observations to obtain $\hat{\beta}_0$. We then compute the bias-corrected difference between the mean outcomes of treatment and control workers in quarter q as follows:

$$\frac{1}{N_{Treated}} \sum_{i=1}^{N_{Treated}} [Y_{iq} + (X_i \hat{\beta}_0 - X_{i+N_{Treated}} \hat{\beta}_0)] - \frac{1}{N_{Treated}} \sum_{i=N_{Treated}+1}^{2N_{Treated}} [Y_{iq} + (X_i \hat{\beta}_1 - X_{i-N_{Treated}} \hat{\beta}_1)]$$

The second difference in the DDD estimator takes the difference between the bias-corrected difference for quarter q (post-minimum wage hike) and the bias corrected difference for the baseline quarter, $q = 0$ (i.e., the quarter before the minimum wage hike). As shown in the following section, these baseline differences are typically very small.

The third difference takes the difference between the DD estimate and a DD estimate produced for a pseudo-treated cohort. This third difference controls for the possibility that Seattle workers may diverge from their matched counterparts in the rest of the state for reasons unrelated to the minimum wage ordinance. While our procedure ensures that treated and control workers match closely on pre-treatment characteristics, control workers may face very different

number of neighbors allows for a more stable control group and reduces the variance of the estimates, it comes at the expense of allowing lower quality matches into the sample.

local labor market conditions.[10] To assess this possibility, we estimate the effect of a *pseudo minimum wage ordinance* on pre-policy data. We impose a pseudo minimum wage ordinance beginning in the second quarter of 2012 and identify treated workers as state program clients who earn less than $11 per hour in 2015.2 dollars and who have 100 percent of their earnings in locatable firms in Seattle or outside King County in the quarter prior (2012.1) – this is our *pseudo-Cohort 1*.[11] We then follow them for six quarters after the pseudo minimum ordinance, 2012.2-2013.3. We define *pseudo-Cohort 2* as state program clients who earn less than $13 per hour and who have 100 percent of their earnings in locatable firms in Seattle or outside King County in 2012.4, the baseline quarter for the second pseudo minimum wage increase, and follow workers in the three quarters after, 2013.1 – 2013.3. We utilize the same matching process described above and estimate the DD for each of the pseudo cohorts.

Our methodology is thus robust to differences in labor market conditions between treated workers and matched controls, so long as the nature of those differences remained stable between cohorts but for Seattle's minimum wage increase.

In addition to deriving overall treatment effects, we test whether the effects of the minimum wage vary by household income as a percentage of the federal poverty line. We first split workers into two groups based on household income – those with income at or below the poverty line, and those with income above the poverty line. For reasons outlined above, we exclude the DSHS population recorded as having income at 0% of the federal poverty line from the above-below analyses. For each subsample, we compute the DDD estimates described above. We difference the results for workers at or below the poverty line with workers above the poverty line to produce a DDDD estimate. We again use a block bootstrapping procedure to produce standard errors for the DDDD estimates. Finally, we further disaggregate income by computing DDD estimates for five categories of workers based on income: 1) income at 0% of the federal poverty line; 2) 0% to 75%; 3) 75% to 100%; 4) 100% - 125%; and 5) 125% or greater. In this case, the 0% FPL group is included as a separate category, but – as noted above – we know less about this group.

We focus on four general outcomes of interest. First, we study if Seattle's minimum wage has affected workers' hourly wages for those workers who remain employed (i.e., the first order effect desired and expected by policymakers). Second, we evaluate workers' probability of being employed anywhere in the state, including jobs with non-locatable employers and/or jobs outside

[10] Unpublished robustness tests updating the Jardim et al (2018a) paper suggest that the parallel trends assumption holds well for quantiles up to the 75th percentile. At the 95th and 99th percentiles, however, Seattle workers perform well ahead of their counterparts. At these percentiles matched control workers have hourly wages of roughly $16 and $25, respectively, while Seattle workers at the same percentiles see wages of roughly $19 and $27. It appears that the upper tail of the distribution reflects individuals who accelerate rapidly out of the low-wage labor market, for example because they complete an educational degree or training program and transition to higher-skilled work. These opportunities may be more plentiful in the City of Seattle, which is home to approximately one-tenth of Washington's population but more than one-sixth of the state's colleges according to the U.S. Department of Education. Among the city's 13 postsecondary institutions is the state's largest by enrollment, the University of Washington. This phenomenon appears across several specifications suggesting that this is a relatively permanent characteristic of the Seattle labor market.

[11] Note that we chose 2012.1 as a starting point because (a) it is sufficiently early that when followed for six quarters hence (i.e., to 2013.3) it is still pre-passage of the Seattle minimum wage ordinance, (b) by beginning in a first quarter, we are comparing workers employed at the same calendar quarter as the real cohort 1 which is followed from 2015.1, and (c) it is sufficiently after the Great Recession of 2007.4 to 2009.2 (NBER, 2018) such that we can reasonably assume that labor market outcomes for this pseudo-treated cohort are a counterfactual for the actually treated cohort.

of Seattle. Third, we look at the impacts of the minimum wage on hours worked, setting hours worked to zero for workers not observed in the data in a given quarter. Finally, we study if the minimum wage led to gains in earnings for workers in low-wage jobs (the principal aim of policymakers), again assigning a value of zero to workers not observed in employment data in a given quarter.

To parse the findings on employment and hours, we examine two supplementary outcomes. We assess the probability that workers remain employed by their baseline employer, or equivalently job turnover. We also differentiate impacts on hours worked inside and outside the city.

2.3 Assessing match quality

For Cohorts 1 and 2 respectively, Tables 3a and 3b compare pre-policy covariates for treated workers, the pool of potential control workers (i.e., all state program clients in low-wage jobs in Washington employed outside of King County at baseline), and the control workers chosen as nearest neighbors. As a measure of balance, we present the normalized differences in covariates between treated and control workers. Even prior to matching, normalized differences between the treated workers and the pool of potential control workers are not typically large and have a mean absolute value of 0.06 (0.09) for cohort 1 (2). For both cohorts, Seattle's workers in low-wage jobs earned higher hourly wages yet worked fewer hours at baseline and in the quarters before baseline and tended to have a lower probability of having earnings from multiple employers than potential control workers. This shows that workers in Seattle either have lower rates of job switching or are less likely to have more than one job at a time.

After matching, most normalized differences disappear or become barely perceptible. By construction we achieve perfect balance between the treated and matched control sample based on the variables used for exact matching, i.e. workers' employment history in two quarters before baseline, and whether we have observed them in Washington workforce for the first time. Similarly, we achieve near perfect balance for discrete variables for which we potentially allow imperfect matches, i.e. the indicators for whether workers had earnings from more than one employer at baseline or during the two previous quarters. The matching algorithm successfully identified workers in Washington who had similar tenure at their primary employer and similar number of quarters since we have observed them in Washington data for the first time. The differences in both variables decline from 0.02-0.04 standard deviations before matching to 0.00-0.01 standard variations in the matched sample. We also fairly closely match quarterly hours of the Seattle workers. The treatment-control difference in hours worked falls from 0.04-0.09 standard deviations before matching to 0.02-0.04 standard deviations for the matched sample.

Match quality is somewhat worse for pre-baseline hourly wages. Though there are virtually no baseline wage differences between Seattle workers and the matched controls for both cohorts, there are some modest discrepancies in wages in the two quarters before baseline. In particular, Seattle workers in both cohorts were paid 29-65 cents more per hour than their matched Washington State counterparts three to nine months before the baseline period. The "Ashenfelter dips" exhibited by Seattle workers appear slightly steeper than those seen elsewhere in Washington, even after matching (Ashenfelter, 1978). These differences amount to 0.08-0.12 standard deviations, which are quite small in an absolute sense.

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Appendix 2. Tables

Summary of tables and key take-aways. Tables 4-6 present findings.

- Table 1. Seattle Minimum Wage Ordinance phase-in-schedule
- Table 2. Study population size
- Table 3. Balance between treated and matched control workers
- Table 4a: For those state program clients employed in the quarter prior to the Seattle minimum wage being enforced (2015q1) and earning less than $11 per hour in the quarter, the first wage hike to as much as $11 per hour increased their quarterly earnings on average by $257 in the first three quarters (2015q2 to 2015q4), but the second wage hike to as much as $13 per hour had a smaller effect, increasing their quarterly earnings on average by $103 in the next three quarters (2016q1 to 2016q3). Hours per quarter fell on average by 16, partially offsetting the $1.36 gain in wages during these three quarters.
- Table 4b: For those state program clients employed in the quarter prior to the Seattle minimum wage rising to as much as $13 per hour (2015q4) and earning less than $13 per hour in this quarter, the minimum wage increase caused wages to rise by an average of $0.54 during the next three quarters (2016q1 to 2016q3), but this gain was offset by an average loss of 11 hours per quarter such that quarterly earnings were nearly unaffected (up $6 per quarter on average).
- Table 5a: For those state program clients employed in the quarter prior to the Seattle minimum wage being enforced (2015q1) and earning less than $11 per hour in the quarter, those from families with income below the poverty line experienced smaller increases in wages (+$0.78 versus +$1.72), larger decreases in quarterly hours (-16 versus -5), and smaller increases in average quarterly earnings (+$2 versus $294) during the first three quarters of 2016 compared to those from families with income above the poverty line.
- Table 5b: For those state program clients employed in the quarter prior to the Seattle minimum wage rising to as much as $13 per hour (2015q4) and earning less than $13 per hour in this quarter, those from families with income below the poverty line experienced similar increases in wages (+$0.62 versus +$0.63), *smaller* decreases in quarterly hours (-7 versus -18), and larger increases in average quarterly earnings (+$96 versus -$40) during the first three quarters of 2016 compared to those from families with income above the poverty line.
- Table 6a and 6b: With data more finely split by family income relative to the poverty line, estimates become noisier. However, we find that wages rose significantly for all groups affected, while earnings growth for those state program clients employed in the quarter prior to the Seattle minimum wage being enforced (2015q1) and earning less than $11 per hour in the quarter, to be concentrated in families whose income is just above the poverty line.

Table 1: Minimum Wage Schedule under the Seattle Minimum Wage Ordinance

	Large Employers[a]		Small Employers	
Effective Date	No Benefits	With Benefits[b]	No Benefits or Tips	Benefits or Tips[c]
	Before Seattle Ordinance			
January 1, 2015	$9.47	$9.47	$9.47	$9.47
	After Ordinance			
April 1, 2015	$11.00	$11.00	$11.00	$10.00
January 1, 2016	$13.00	$12.50	$12.00	$10.50
January 1, 2017	$15.00[d]	$13.50	$13.00	$11.00
January 1, 2018		$15.00[e]	$14.00	$11.50
January 1, 2019			$15.00[f]	$12.00
January 1, 2020				$13.50
January 1, 2021				$15.00[g]

Notes:

a A large employer employs 501 or more employees worldwide, including all franchises associated with a franchise or a network of franchises.

b Employers who pay towards medical benefits.

c Employers who pay toward medical benefits and/or employees who are paid tips. Total minimum hourly compensations (including tips and benefits) is the same as for small employers who do not pay towards medical benefits and/or tips.

d For large employers, in the years after the minimum wage reaches $15.00 it is indexed to inflation using the CPI-W for Seattle-Tacoma-Bremerton Area.

e In subsequent years, starting January 1, 2019, payment by the employer of medical benefits for employees no longer affects the hourly minimum wage paid by a large employer.

f After the minimum hourly compensation for small employers reaches $15 it goes up to $15.75 until January 1, 2021 when it converges with the minimum wage schedule for large employers.

g The minimum wage for small employers with benefits or tips will converge with other employers by 2025.

Table 2: Number of DSHS/HCA Clients Included and Excluded in the Analysis

Sample	Cohort 1: Wage in 2015.1 <$11	Cohort 2: Wage in 2015.4<$13
Low-Wage Workers Who Are DSHS or HCA Clients in 2014.4	51,448	88,492
Excluded from Analysis Because of Baseline Employment at:		
Non-Locatable Multi-Site Employer	18,709	31,895
Non-Locatable Single-Site Employer	2,438	5,155
Employers not solely in Seattle nor solely outside of King County	8,599	14,783
Included in Analysis (Treated + Pool of Potential Control Workers)	21,702	36,659

Notes: the number excluded reflects those excluded after dropping workers for conditions show in prior rows.
DSHS = Department of Social and Health Services, HCA = Health Care Authority.

Table 3a: Balance Between Treated Workers, Potential Control Workers, and Matched Control Workers

Cohort 1: Workers Earning <$11 Per Hour at Baseline (2015.1)

	Treated Workers		Pool of Potential Control Workers			Matched Control Workers		
	Mean	(S.D.)	Mean	(S.D.)	Normalized Difference from Treated	Mean	(S.D.)	Normalized Difference from Treated
Variables Matched Exactly:								
Employed in 2015.1	1.00		1.00		NA	1.00		NA
Employed in 2014.4	0.81		0.84		-0.08	0.81		0.00
Employed in 2014.3	0.74		0.77		-0.06	0.74		0.00
New Entrant in 2015.1	0.07		0.06		0.04	0.07		0.00
New Entrant in 2014.4	0.05		0.04		0.03	0.05		0.00
New Entrant in 2014.3	0.05		0.05		0.00	0.05		0.00
Variables Matched Non-Exactly:								
Job Tenure at Baseline (2015.1) Employer	6.0	(8.5)	5.6	(7.8)	0.04	5.9	(8.5)	0.01
Potential Experience at Baseline (2015.1))	21.6	(15.5)	21.9	(15.3)	-0.02	21.5	(15.5)	0.00
Hours Worked in 2015.1	237	(190)	253	(174)	-0.09	233	(179)	0.02
Hours Worked in 2014.4	231	(203)	248	(196)	-0.09	227	(196)	0.02
Hours Worked in 2014.3	220	(207)	239	(211)	-0.09	213	(199)	0.04
Wage in 2015.1	$10.07	($0.51)	$10.00	($0.47)	0.13	$10.07	($0.48)	-0.01
Wage in 2014.4 (Conditional on Employment)	$10.93	($3.98)	$10.78	($7.59)	0.02	$10.64	($3.40)	0.08
Wage in 2014.3 (Conditional on Employment)	$11.24	($7.01)	$11.10	($7.50)	0.02	$10.59	($2.77)	0.12
Earnings from More Than One Employer in 2015.1	0.054		0.087		-0.12	0.054		0.00
Earnings from More Than One Employer in 2014.4	0.128		0.151		0.02	0.128		0.00
Earnings from More Than One Employer in 2014.3	0.109		0.188		-0.11	0.108		0.00
Mean of Absolute Values					0.06			0.02
Observations	1,791		19,911			1,791		

Table 3b: Balance Between Treated Workers, Potential Control Workers, and Matched Control Workers

Cohort 2: Workers Earning <$13 Per Hour at Baseline (2015.4)

	Treated Workers		Pool of Potential Control Workers			Matched Control Workers		
	Mean	(S.D.)	Mean	(S.D.)	Normalized Difference from Treated	Mean	(S.D.)	Normalized Difference from Treated
Variables Matched Exactly:								
Employed in 2015.4	1.00		1.00		NA	1.00		NA
Employed in 2016.1	0.84		0.86		-0.06	0.84		0.00
Employed in 2016.2	0.75		0.76		-0.03	0.75		0.00
New Entrant in 2015.4	0.05		0.05		0.01	0.05		0.00
New Entrant in 2016.1	0.05		0.05		-0.02	0.05		0.00
New Entrant in 2016.2	0.04		0.04		-0.01	0.04		0.00
Variables Matched Non-Exactly:								
Job Tenure at Baseline (2015.4) Employer	6.4	(9.0)	6.0	(8.6)	0.04	6.3	(8.9)	0.01
Potential Experience at Baseline (2015.4))	24.1	(16.5)	24.4	(16.5)	-0.02	24.1	(16.6)	0.00
Hours Worked in 2015.4	291	(219)	299	(193)	-0.04	286	(202)	0.02
Hours Worked in 2016.1	267	(214)	284	(212)	-0.08	262	(204)	0.02
Hours Worked in 2016.2	233	(215)	245	(216)	-0.06	229	(209)	0.02
Wage in 2015.4	$11.49	($0.92)	$10.92	($1.08)	0.53	$11.48	($0.90)	0.01
Wage in 2016.1 (Conditional on Employment)	$12.56	($11.96)	$11.80	($7.89)	0.09	$11.95	($9.42)	0.06
Wage in 2016.2 (Conditional on Employment)	$12.54	($8.44)	$11.29	($5.37)	0.22	$12.13	($8.68)	0.05
Earnings from More Than One Employer in 2015.4	0.064		0.104		-0.13	0.063		0.00
Earnings from More Than One Employer in 2016.1	0.137		0.190		-0.07	0.137		0.00
Earnings from More Than One Employer in 2016.2	0.119		0.177		-0.05	0.118		0.00
Mean of Absolute Values					0.09			0.01
Observations	3,274		33,385			3,274		

Table 4a: Estimated Effect of the Seattle Minimum Wage Ordinance on Wages, Hours, Jobs, and Payroll

Cohort 1: Workers Earning <$11 Per Hour at Baseline (2015.1)

	Treated Cohort							Pseudo-Treated Cohort						
Panel A: Effect on Wages	2015.1	2015.2	2015.3	2015.4	2016.1	2016.2	2016.3	2012.1	2012.2	2012.3	2012.4	2013.1	2013.2	2013.3
Treated (Seattle Workers), Mean	$10.07	$11.58	$12.44	$13.20	$13.82	$14.09	$15.13	$9.95	$10.78	$11.00	$11.67	$11.87	$12.12	$12.63
Control (Matched Workers), Mean	$10.07	$10.54	$11.35	$11.81	$11.82	$12.12	$13.25	$9.95	$10.38	$10.82	$11.20	$11.11	$11.45	$12.02
Difference (Bias Corrected)	-$0.01	$1.13	$1.22	$1.49	$2.08	$2.09	$2.06	$0.01	$0.44	$0.23	$0.54	$0.80	$0.73	$0.70
Difference-in-Differences		$1.14	$1.23	$1.50	$2.09	$2.11	$2.07		$0.43	$0.22	$0.53	$0.79	$0.71	$0.69
Difference-in-Differences-in-Differences		$0.71	$1.02	$0.97	$1.30	$1.39	$1.38							
Block boostrapped standard error		($0.11)	($0.15)	($0.21)	($0.23)	($0.23)	($0.34)							
p -value		0.000	0.000	0.000	0.000	0.000	0.000							
Panel B: Effect on Employment														
Treated (Seattle Workers), Mean	1.000	0.873	0.822	0.775	0.743	0.719	0.713	1.000	0.877	0.822	0.774	0.742	0.733	0.726
Control (Matched Workers), Mean	1.000	0.882	0.814	0.765	0.740	0.747	0.724	1.000	0.903	0.836	0.793	0.742	0.745	0.733
Difference (Bias Corrected)	0.000	-0.001	0.019	0.019	0.012	-0.017	0.002	0.000	-0.022	-0.008	-0.015	0.004	-0.007	-0.003
Difference-in-Differences		-0.001	0.019	0.019	0.012	-0.017	0.002		-0.022	-0.008	-0.015	0.004	-0.007	-0.003
Difference-in-Differences-in-Differences		0.021	0.027	0.034	0.008	-0.010	0.004							
Block boostrapped standard error		(0.013)	(0.016)	(0.018)	(0.019)	(0.019)	(0.020)							
p -value		0.119	0.093	0.059	0.655	0.592	0.838							
Panel C: Effect on Quarterly Hours Worked														
Treated (Seattle Workers), Mean	237.4	250.1	261.1	250.6	219.1	232.4	243.5	251.8	269.8	275.5	255.9	235.9	249.3	259.8
Control (Matched Workers), Mean	232.5	262.7	260.2	245.5	224.6	251.6	255.6	249.8	274.9	277.6	259.0	235.2	253.9	257.9
Difference (Bias Corrected)	14.8	-6.8	7.0	10.2	0.2	-14.1	-6.6	6.0	-4.2	-0.9	-2.2	1.7	-3.9	2.8
Difference-in-Differences		-21.6	-7.9	-4.6	-14.6	-28.9	-21.4		-10.2	-6.9	-8.2	-4.3	-9.9	-3.2
Difference-in-Differences-in-Differences		-11.4	-1.0	3.6	-10.3	-19.0	-18.2							
Block boostrapped standard error		(5.8)	(7.7)	(7.9)	(7.9)	(8.5)	(9.6)							
p -value		0.049	0.902	0.645	0.189	0.026	0.057							
Panel D: Effect on Quarterly Earnings														
Treated (Seattle Workers), Mean	$2,399	$2,930	$3,354	$3,295	$3,025	$3,272	$3,651	$2,527	$2,908	$3,046	$3,005	$2,799	$3,074	$3,333
Control (Matched Workers), Mean	$2,356	$2,788	$2,938	$2,940	$2,672	$3,098	$3,324	$2,508	$2,876	$3,004	$2,943	$2,643	$2,937	$3,086
Difference (Bias Corrected)	$138	$228	$522	$455	$440	$269	$440	$60	$51	$66	$84	$174	$158	$273
Difference-in-Differences		$90	$384	$317	$302	$131	$301		-$9	$6	$23	$114	$98	$213
Difference-in-Differences-in-Differences		$99	$378	$293	$188	$32	$89							
Block boostrapped standard error		($72)	($99)	($110)	($111)	($125)	($144)							
p -value		0.169	0.000	0.008	0.090	0.796	0.537							

Notes: This analysis is restricted to workers who were DSHS or HCA clients in 2014.4. Treated workers are defined as those employed in 2015.1 in locatable establishments in Seattle, not employed elsewhere in the state, and earning <$11 per hour. Control workers are defined as those employed in 2015.1 in locatable establishments in Washington State, but not employed in King County, and earning <$11 per hour. Each treated worker is matched to his/her nearest neighbor control worker, without replacement. The control sample is exact matched in employment status in 2015.1, 2014.4, and 2014.3, and on an indicator for worker first observed in Washington State in 2015.1, 2014.4, or 2014.3. Matching using Mahalanobis distance is based on wage rate, hours worked, tenure on the primary job, number of quarters since first observed in Washington, and indicators for having earnings from more than one job in 2015.1, 2014.4, and 2014.3. The pseudo-treated cohort is constructed analogously, yet beginning from 2012.1. Estimators were bias adjusted using wage rate, hours worked, tenure on the primary job, and number of quarters since first observed in WA in the baseline quarter and prior two quarters.

	Treated Cohort							Pseudo-Treated Cohort						
Employed by Baseline Employer Conditional on Employment	2015.1	2015.2	2015.3	2015.4	2016.1	2016.2	2016.3	2012.1	2012.2	2012.3	2012.4	2013.1	2013.2	2013.3
Treated (Seattle Workers), Mean	1.000	0.857	0.724	0.661	0.620	0.551	0.512	1.000	0.870	0.736	0.652	0.600	0.539	0.479
Control (Matched Workers), Mean	1.000	0.861	0.729	0.650	0.618	0.550	0.485	1.000	0.887	0.767	0.693	0.662	0.580	0.508
Difference (Bias Corrected)	0.000	-0.003	0.000	0.016	0.006	0.008	0.032	0.000	-0.016	-0.028	-0.037	-0.058	-0.036	-0.024
Difference-in-Differences		-0.003	0.000	0.016	0.006	0.008	0.032		-0.016	-0.028	-0.037	-0.058	-0.036	-0.024
Block boostrapped standard error		(0.012)	(0.016)	(0.017)	(0.018)	(0.019)	(0.019)		($0.01)	($0.01)	($0.01)	($0.02)	($0.02)	($0.02)
p -value		0.785	0.981	0.341	0.721	0.657	0.089		0.104	0.037	0.014	0.000	0.026	0.129
Difference-in-Differences-in-Differences		0.013	0.028	0.053	0.064	0.044	0.055							
Block boostrapped standard error		(0.015)	(0.021)	(0.022)	(0.024)	(0.024)	(0.024)							
p -value		0.391	0.182	0.018	0.007	0.069	0.022							
Hours Worked in Seattle	2015.1	2015.2	2015.3	2015.4	2016.1	2016.2	2016.3	2012.1	2012.2	2012.3	2012.4	2013.1	2013.2	2013.3
Treated (Seattle Workers), Mean	237.4	232.6	219.7	201.3	170.2	171.0	174.9	251.8	259.4	243.9	211.5	186.8	190.5	189.7
Control (Matched Workers), Mean	0.0	0.4	3.9	7.4	5.6	7.4	9.6	0.0	0.8	2.7	5.2	6.2	8.3	10.5
Difference (Bias Corrected)	242.3	235.4	219.7	196.8	167.5	166.3	168.0	253.8	259.3	242.2	207.2	181.4	183.1	180.1
Difference-in-Differences		-7.0	-22.6	-45.5	-74.8	-76.0	-74.3		5.4	-11.6	-46.7	-72.5	-70.7	-73.7
Difference-in-Differences-in-Differences		-12.4	-11.0	1.1	-2.4	-5.3	-0.6							
Block boostrapped standard error		(4.3)	(6.0)	(6.1)	(6.2)	(6.5)	(7.2)							
p -value		0.004	0.065	0.852	0.702	0.419	0.933							
Hours Worked Outside Seattle	2015.1	2015.2	2015.3	2015.4	2016.1	2016.2	2016.3	2012.1	2012.2	2012.3	2012.4	2013.1	2013.2	2013.3
Treated (Seattle Workers), Mean	0.0	17.5	41.4	49.3	49.0	61.4	68.6	0.0	10.4	31.6	44.4	49.1	58.8	70.1
Control (Matched Workers), Mean	232.5	262.2	256.4	238.0	219.0	244.2	246.0	249.8	274.1	275.0	253.8	229.0	245.7	247.3
Difference (Bias Corrected)	-227.5	-242.2	-212.8	-186.6	-167.3	-180.4	-174.6	-247.8	-263.5	-243.1	-209.4	-179.7	-187.0	-177.3
Difference-in-Differences		-14.7	14.7	40.9	60.2	47.1	52.9		-15.7	4.7	38.4	68.1	60.8	70.6
Difference-in-Differences-in-Differences		1.0	10.1	2.5	-8.0	-13.7	-17.6							
Block boostrapped standard error		(5.1)	(6.8)	(7.1)	(7.1)	(7.8)	(8.6)							
p -value		0.843	0.140	0.724	0.264	0.078	0.039							

Table 4b: Estimated Effect of the Seattle Minimum Wage Ordinance on Wages, Hours, Jobs, and Payroll

Cohort 2: Workers Earning <$13 Per Hour at Baseline (2015.4)

	Treated Cohort				Pseudo-Treated Cohort			
Panel A: Effect on Wages	2015.4	2016.1	2016.2	2016.3	2012.4	2013.1	2013.2	2013.3
Treated (Seattle Workers), Mean	$11.49	$12.83	$13.15	$14.09	$11.03	$11.64	$12.07	$12.67
Control (Matched Workers), Mean	$11.49	$11.87	$12.25	$12.84	$11.01	$11.24	$11.53	$12.08
Difference (Bias Corrected)	$0.03	$1.00	$0.94	$1.32	$0.06	$0.46	$0.61	$0.69
Difference-in-Differences		$0.97	$0.91	$1.29		$0.40	$0.54	$0.63
Difference-in-Differences-in-Differences		$0.57	$0.37	$0.66				
Block boostrapped standard error		($0.09)	($0.11)	($0.17)				
p -value		0.000	0.001	0.000				
Panel B: Effect on Employment								
Treated (Seattle Workers), Mean	1.000	0.826	0.800	0.776	1.000	0.855	0.828	0.811
Control (Matched Workers), Mean	1.000	0.845	0.823	0.766	1.000	0.842	0.826	0.800
Difference (Bias Corrected)	0.000	-0.013	-0.017	0.016	0.000	0.020	0.008	0.016
Difference-in-Differences		-0.013	-0.017	0.016		0.020	0.008	0.016
Difference-in-Differences-in-Differences		-0.033	-0.024	0.000				
Block boostrapped standard error		(0.010)	(0.012)	(0.013)				
p -value		0.002	0.040	0.991				
Panel C: Effect on Quarterly Hours Worked								
Treated (Seattle Workers), Mean	289.8	254.9	265.6	273.0	302.1	275.5	287.7	293.6
Control (Matched Workers), Mean	285.5	258.5	267.5	269.7	300.0	266.8	282.3	286.5
Difference (Bias Corrected)	12.9	2.2	3.6	8.4	6.5	11.7	8.2	8.7
Difference-in-Differences		-10.7	-9.3	-4.4		5.2	1.7	2.2
Difference-in-Differences-in-Differences		-15.8	-11.0	-6.6				
Block boostrapped standard error		(4.3)	(5.1)	(6.2)				
p -value		0.000	0.032	0.282				
Panel D: Effect on Quarterly Earnings								
Treated (Seattle Workers), Mean	$3,364	$3,283	$3,517	$3,885	$3,388	$3,220	$3,513	$3,752
Control (Matched Workers), Mean	$3,317	$3,098	$3,308	$3,481	$3,357	$3,036	$3,291	$3,453
Difference (Bias Corrected)	$150	$266	$289	$490	$92	$235	$274	$342
Difference-in-Differences		$116	$139	$340		$144	$182	$251
Difference-in-Differences-in-Differences		-$27	-$43	$90				
Block boostrapped standard error		($57)	($73)	($92)				
p -value		0.631	0.552	0.330				

Notes: This analysis is restricted to workers who were DSHS or HCA clients in 2014.4. Treated workers are defined as those employed in 2015.4 in locatable establishments in Seattle, not employed elsewhere in the state, and earning <$13 per hour. Control workers are defined as those employed in 2015.4 in locatable establishments in Washington State, but not employed in King County, and earning <$13 per hour. Each treated worker is matched to his/her nearest neighbor control worker, without replacement. The control sample is exact matched in employment status in 2015.3, 2015.2, and 2015.1, and on an indicator for worker first observed in WA in 2015.3, 2015.2, and 2015.1. Matching using Mahalanobis distance is based on wage rate, hours worked, tenure on the primary job, number of quarters since first observed in WA, and indicators for having earnings from more than one job in 2015.3, 2015.2, and 2015.1. The pseudo-treated cohort is constructed analogously, yet beginning from 2012.4. Estimators were bias adjusted using wage rate, hours worked, tenure on the primary job, and number of quarters since first observed in WA in the baseline quarter and prior two quarters.

	Treated Cohort				Pseudo-Treated Cohort			
Employed by Baseline Employer Conditional on Employment	2015.4	2016.1	2016.2	2016.3	2012.4	2013.1	2013.2	2013.3
Treated (Seattle Workers), Mean	1.000	0.865	0.747	0.672	1.000	0.875	0.768	0.670
Control (Matched Workers), Mean	1.000	0.870	0.743	0.660	1.000	0.899	0.788	0.713
Difference (Bias Corrected)	0.000	-0.002	0.009	0.017	0.000	-0.023	-0.016	-0.039
Difference-in-Differences		-0.002	0.009	0.017		-0.023	-0.016	-0.039
Block boostrapped standard error		(0.009)	(0.012)	(0.013)		($0.01)	($0.01)	($0.01)
p -value		0.830	0.458	0.182		0.001	0.105	0.000
Difference-in-Differences-in-Differences		0.021	0.024	0.056				
Block boostrapped standard error		(0.011)	(0.015)	(0.017)				
p -value		0.071	0.111	0.001				
Hours Worked in Seattle	2015.4	2016.1	2016.2	2016.3	2012.4	2013.1	2013.2	2013.3
Treated (Seattle Workers), Mean	289.8	239.7	230.0	223.2	302.1	262.4	258.9	247.9
Control (Matched Workers), Mean	0.0	1.0	4.7	7.0	0.0	0.3	2.3	5.6
Difference (Bias Corrected)	294.1	241.7	228.1	218.8	304.3	263.4	258.0	243.3
Difference-in-Differences		-52.4	-66.0	-75.4		-40.9	-46.2	-61.0
Difference-in-Differences-in-Differences		-11.6	-19.7	-14.4				
Block boostrapped standard error		(3.3)	(4.2)	(4.9)				
p -value		0.000	0.000	0.003				
Hours Worked Outside Seattle	2015.4	2016.1	2016.2	2016.3	2012.4	2013.1	2013.2	2013.3
Treated (Seattle Workers), Mean	0.0	15.2	35.5	49.8	0.0	13.0	28.8	45.7
Control (Matched Workers), Mean	285.5	257.4	262.8	262.7	300.0	266.5	280.1	280.9
Difference (Bias Corrected)	-281.3	-239.5	-224.6	-210.3	-297.8	-251.8	-249.9	-234.6
Difference-in-Differences		41.8	56.7	70.9		46.0	47.9	63.2
Difference-in-Differences-in-Differences		-4.2	8.8	7.8				
Block boostrapped standard error		(3.6)	(4.9)	(5.8)				
p -value		0.243	0.074	0.182				

Table 5a: Heterogeneity in Estimated Effects of the Seattle Minimum Wage Ordinance by Hours

Cohort 1: Workers Earning <$11 Per Hour at Baseline (2015.1)

	Baseline Mean	Estimate	2015.2	2015.3	2015.4	2016.1	2016.2	2016.3
Panel A: Effect on Wages								
Workers At or Below	$10.08	DDD	$0.39	$0.71	$0.74	$1.06	$0.98	$0.28
Poverty Line		(s.e.)	($0.17)	($0.26)	($0.31)	($0.33)	($0.33)	($0.56)
		p -value	0.026	0.005	0.016	0.001	0.003	0.614
Workers Above	$10.05	DDD	$1.05	$1.14	$1.31	$1.30	$1.58	$2.29
Povery Line		(s.e.)	($0.19)	($0.25)	($0.39)	($0.40)	($0.39)	($0.57)
		p -value	0.000	0.000	0.001	0.001	0.000	0.000
(At or Below Poverty Line) -		DDDD	-$0.67	-$0.43	-$0.57	-$0.24	-$0.60	-$2.01
(Above Poverty Line)		(s.e.)	($0.25)	($0.36)	($0.51)	($0.54)	($0.52)	($0.79)
		p -value	0.008	0.226	0.263	0.659	0.255	0.011
Panel B: Effect on Employment								
Workers At or Below	1.000	DDD	0.044	0.070	0.057	0.044	0.011	0.006
Poverty Line		(s.e.)	(0.022)	(0.026)	(0.029)	(0.031)	(0.030)	(0.031)
		p -value	0.049	0.008	0.052	0.157	0.724	0.837
Workers Above	1.000	DDD	0.002	-0.014	0.036	-0.007	-0.010	-0.004
Povery Line		(s.e.)	(0.022)	(0.026)	(0.030)	(0.031)	(0.032)	(0.032)
		p -value	0.928	0.605	0.224	0.833	0.755	0.904
(At or Below Poverty Line) -		DDDD	0.042	0.083	0.021	0.051	0.021	0.010
(Above Poverty Line)		(s.e.)	(0.032)	(0.038)	(0.042)	(0.045)	(0.044)	(0.045)
		p -value	0.184	0.029	0.623	0.264	0.639	0.819
Panel C: Effect on Quarterly Hours Worked								
Workers At or Below	225.1	DDD	-2.9	8.2	2.2	-6.8	-12.5	-29.4
Poverty Line		(s.e.)	(9.8)	(12.9)	(13.7)	(13.1)	(14.7)	(15.3)
		p -value	0.770	0.527	0.872	0.603	0.392	0.055
Workers Above	232.4	DDD	-18.7	-3.0	17.4	-1.7	-9.7	-3.0
Povery Line		(s.e.)	(9.7)	(13.0)	(13.4)	(13.7)	(14.1)	(14.7)
		p -value	0.054	0.817	0.194	0.901	0.490	0.836
(At or Below Poverty Line) -		DDDD	15.8	11.2	-15.2	-5.1	-2.8	-26.4
(Above Poverty Line)		(s.e.)	(13.8)	(18.3)	(19.5)	(19.2)	(20.2)	(21.1)
		p -value	0.251	0.542	0.436	0.789	0.889	0.212
Panel D: Effect on Quarterly Earnings								
Workers At or Below	$2,283	DDD	$130	$408	$288	$146	$65	-$206
Poverty Line		(s.e.)	($112)	($166)	($178)	($184)	($198)	($222)
		p -value	0.247	0.014	0.105	0.425	0.745	0.354
Workers Above	$2,346	DDD	$97	$375	$463	$352	$166	$362
Povery Line		(s.e.)	($121)	($171)	($184)	($175)	($205)	($240)
		p -value	0.425	0.029	0.012	0.044	0.418	0.131
(At or Below Poverty Line) -		DDDD	$33	$33	-$175	-$206	-$102	-$568
(Above Poverty Line)		(s.e.)	($166)	($241)	($260)	($255)	($285)	($333)
		p -value	0.842	0.891	0.501	0.419	0.721	0.088

Notes: This analysis is restricted to workers who were DSHS or HCA clients in 2014.4. Income as a percentage of the federal poverty line is based on earned and unearned income reported to DSHS case workers in 2014.4. Monthly income as a percentage of the federal poverty line for October, November, and December of 2014 are averaged. Workers reported to have income at 0% of the federal poverty line were excluded from this analysis. Treated workers are defined as those employed in 2015.1 in locatable establishments in Seattle, not employed elsewhere in the state, and earning <$11 per hour. Control workers are defined as those employed in 2015.1 in locatable establishments in Washington State, but not employed in King County, and earning <$11 per hour. Each treated worker is matched to his/her nearest neighbor control worker, without replacement. The control sample is exact matched in employment status in 2015.1, 2014.4, and 2014.3, and on an indicator for worker first observed in WA in 2015.1, 2014.4, or 2014.3. Matching using Mahalanobis distance is based on wage rate, hours worked, tenure on the primary job, number of quarters since first observed in WA, and indicators for having earnings from more than one job in 2015.1, 2014.4, and 2014.3. The pseudo-treated cohort is constructed analogously, yet beginning from 2012.1. Estimators were bias adjusted using wage rate, hours worked, tenure on the primary job, and number of quarters since first observed in WA in the baseline quarter and prior two quarters.

	Baseline Mean	Estimate	2015.2	2015.3	2015.4	2016.1	2016.2	2016.3
Employed by Baseline Employer Conditional on Employment								
Workers At or Below Poverty Line	1.000	DDD	-0.020	-0.009	0.029	0.043	0.043	0.084
		(s.e.)	(0.025)	(0.032)	(0.037)	(0.040)	(0.042)	(0.043)
		p -value	0.404	0.778	0.441	0.283	0.309	0.049
Workers Above Povery Line	1.000	DDD	0.021	0.053	0.068	0.075	0.069	0.062
		(s.e.)	(0.025)	(0.033)	(0.037)	(0.038)	(0.039)	(0.041)
		p -value	0.403	0.112	0.064	0.049	0.079	0.128
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	-0.042	-0.062	-0.039	-0.032	-0.026	0.022
		(s.e.)	(0.036)	(0.046)	(0.052)	(0.056)	(0.057)	(0.058)
		p -value	0.244	0.182	0.447	0.567	0.651	0.709
Hours Worked In Seattle								
Workers At or Below Poverty Line	113.6	DDD	-11.3	-1.4	7.0	2.7	7.6	8.4
		(s.e.)	(7.9)	(10.3)	(10.9)	(10.3)	(11.1)	(11.5)
		p -value	0.156	0.894	0.522	0.790	0.496	0.465
Workers Above Povery Line	116.8	DDD	-12.8	-7.2	13.7	7.2	2.1	3.9
		(s.e.)	(7.2)	(10.0)	(10.1)	(10.4)	(11.0)	(11.9)
		p -value	0.074	0.471	0.176	0.488	0.852	0.746
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	1.5	5.8	-6.7	-4.5	5.5	4.6
		(s.e.)	(10.8)	(14.1)	(14.7)	(14.5)	(15.3)	(16.3)
		p -value	0.887	0.678	0.646	0.756	0.719	0.779
Hours Worked Outside Seattle								
Workers At or Below Poverty Line	111.5	DDD	8.4	9.5	-4.7	-9.5	-20.1	-37.8
		(s.e.)	(7.6)	(10.5)	(11.8)	(11.6)	(12.6)	(13.4)
		p -value	0.269	0.362	0.686	0.410	0.112	0.005
Workers Above Povery Line	115.6	DDD	-5.9	4.2	3.7	-8.9	-11.8	-6.9
		(s.e.)	(8.0)	(11.1)	(11.6)	(11.6)	(13.1)	(14.3)
		p -value	0.459	0.705	0.747	0.443	0.370	0.629
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	14.3	5.3	-8.5	-0.6	-8.3	-30.9
		(s.e.)	(11.2)	(14.9)	(16.5)	(16.6)	(18.2)	(19.8)
		p -value	0.203	0.720	0.608	0.970	0.648	0.118

Table 5b: Heterogeneity in Estimated Effects of the Seattle Minimum Wage Ordinance by Hours Worked in Baseline and Prior Two Quarters

Cohort 2: Workers Earning <$13 Per Hour at Baseline (2015.4)

	Baseline Mean	Estimate	2016.1	2016.2	2016.3
Panel A: Effect on Wages					
Workers At or Below Poverty Line	$11.47	DDD	$0.68	$0.44	$0.74
		(s.e.)	($0.15)	($0.19)	($0.27)
		p -value	0.000	0.024	0.006
Workers Above Povery Line	$11.50	DDD	$0.61	$0.42	$0.86
		(s.e.)	($0.15)	($0.18)	($0.27)
		p -value	0.000	0.018	0.001
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	$0.08	$0.02	-$0.12
		(s.e.)	($0.22)	($0.27)	($0.38)
		p -value	0.733	0.939	0.744
Panel B: Effect on Employment					
Workers At or Below Poverty Line	1.000	DDD	-0.025	-0.019	0.016
		(s.e.)	(0.018)	(0.020)	(0.022)
		p -value	0.167	0.336	0.464
Workers Above Povery Line	1.000	DDD	-0.031	-0.038	-0.009
		(s.e.)	(0.017)	(0.019)	(0.022)
		p -value	0.073	0.054	0.684
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	0.006	0.018	0.025
		(s.e.)	(0.025)	(0.028)	(0.031)
		p -value	0.803	0.505	0.414
Panel C: Effect on Quarterly Hours Worked					
Workers At or Below Poverty Line	288.8	DDD	-16.8	-8.8	4.5
		(s.e.)	(7.4)	(9.0)	(10.1)
		p -value	0.023	0.325	0.655
Workers Above Povery Line	284.6	DDD	-20.4	-14.8	-18.6
		(s.e.)	(6.8)	(8.5)	(10.8)
		p -value	0.003	0.081	0.085
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	3.6	6.0	23.1
		(s.e.)	(10.4)	(12.6)	(14.9)
		p -value	0.727	0.634	0.121
Panel D: Effect on Quarterly Earnings					
Workers At or Below Poverty Line	$3,349	DDD	-$6	$3	$291
		(s.e.)	($92)	($115)	($150)
		p -value	0.950	0.979	0.052
Workers Above Povery Line	$3,302	DDD	-$57	-$93	$30
		(s.e.)	($94)	($114)	($151)
		p -value	0.544	0.412	0.844
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	$51	$96	$261
		(s.e.)	($128)	($159)	($213)
		p -value	0.691	0.545	0.219

Notes: This analysis is restricted to workers who were DSHS or HCA clients in 2014.4. Income as a percentage of the federal poverty line is based on earned and unearned income reported to DSHS case workers in 2014.4. Monthly income as a percentage of the federal poverty line for October, November, and December of 2014 are averaged. Workers reported to have income at 0% of the federal poverty line were excluded from this analysis. Treated workers are defined as those employed in 2015.4 in locatable establishments in Seattle, not employed elsewhere in the state, and earning <$13 per hour. Control workers are defined as those employed in 2015.4 in locatable establishments in Washington State, but not employed in King County, and earning <$13 per hour. Each treated worker is matched to his/her nearest neighbor control worker, without replacement. The control sample is exact matched in employment status in 2015.3, 2015.2, and 2015.1, and on an indicator for worker first observed in WA in 2015.3, 2015.2, and 2015.1. Matching using Mahalanobis distance is based on wage rate, hours worked, tenure on the primary job, number of quarters since first observed in WA, and indicators for having earnings from more than one job in 2015.3, 2015.2, and 2015.1. The pseudo-treated cohort is constructed analogously, yet beginning from 2012.4. Estimators were bias adjusted using wage rate, hours worked, tenure on the primary job, and number of quarters since first observed in WA in the baseline quarter and prior two quarters.

	Baseline Mean	Estimate	2016.1	2016.2	2016.3
Employed by Baseline Employer Conditional on Employment					
Workers At or Below Poverty Line	1.000	DDD	0.026	0.021	0.038
		(s.e.)	(0.019)	(0.025)	(0.029)
		p -value	0.175	0.405	0.190
Workers Above Povery Line	1.000	DDD	0.027	0.034	0.079
		(s.e.)	(0.018)	(0.024)	(0.027)
		p -value	0.146	0.168	0.003
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	-0.001	-0.013	-0.042
		(s.e.)	(0.027)	(0.035)	(0.039)
		p -value	0.967	0.716	0.287
Hours Worked In Seattle					
Workers At or Below Poverty Line	145.6	DDD	-12.7	-16.9	-6.6
		(s.e.)	5.8	7.1	8.1
		p -value	0.030	0.017	0.413
Workers Above Povery Line	143.3	DDD	-10.5	-22.5	-17.6
		(s.e.)	5.7	6.9	8.3
		p -value	0.066	0.001	0.034
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	-2.2	5.6	11.0
		(s.e.)	8.2	9.9	11.5
		p -value	0.789	0.573	0.337
Hours Worked Outside Seattle					
Workers At or Below Poverty Line	143.3	DDD	-4.1	8.1	11.1
		(s.e.)	6.0	8.0	9.6
		p -value	0.490	0.312	0.248
Workers Above Povery Line	141.4	DDD	-10.0	7.6	-1.0
		(s.e.)	5.8	7.8	9.6
		p -value	0.088	0.329	0.920
(At or Below Poverty Line) - (Above Poverty Line)		DDDD	5.8	0.4	12.1
		(s.e.)	8.4	11.2	13.5
		p -value	0.489	0.969	0.372

Table 6a: Heterogeneity in Estimated Effects of the Ordinance by Decile of Hours Worked in Baseline and Prior Two Quarters

Cohort 1: Workers Earning <$11 Per Hour at Baseline (2015.1)

	2015.2	2015.3	2015.4	2016.1	2016.2	2016.3
Panel A: Effect on Wages						
%FPL = 0	$0.67 *	$1.31 *	$0.84 *	$1.67 *	$1.70 *	$1.76 *
0% < %FPL < 75%	$0.15	$0.86 *	$0.75 *	$0.75 *	$1.06 *	$0.03
75% <= %FPL < 100%	$0.83 *	$0.50	$0.75	$1.59 *	$0.87	$1.00
100% <= %FPL < 125%	$1.14 *	$1.14 *	$0.86	$2.05 *	$1.83 *	$3.04 *
125% <= %FPL	$1.01 *	$1.08 *	$1.45 *	$0.89 *	$1.42 *	$1.90 *
Panel B: Effect on Employment						
%FPL = 0	0.01	0.02	0.00	-0.03	-0.04	0.01
0% < %FPL < 75%	0.02	0.05	0.06 *	0.05	0.02	0.03
75% <= %FPL < 100%	0.08 *	0.11 *	0.05	0.04	0.00	-0.03
100% <= %FPL < 125%	0.06	0.06	0.05	0.05	0.07	0.06
125% <= %FPL	-0.02	-0.05	0.03	-0.03	-0.05	-0.03
Panel C: Effect on Quarterly Hours Worked						
%FPL = 0	-15.67	-13.84	-15.02	-29.46 *	-43.59 *	-26.02
0% < %FPL < 75%	-12.84	9.70	2.36	-1.10	-8.19	-20.89
75% <= %FPL < 100%	11.61	6.65	3.34	-13.80	-19.66	-43.73 *
100% <= %FPL < 125%	-4.68	7.31	36.20	14.96	13.32	11.65
125% <= %FPL	-25.01 *	-9.73	6.83	-11.55	-20.86	-12.87
Panel D: Effect on Quarterly Earnings						
%FPL = 0	$45	$326	$60	$14	-$217	$121
0% < %FPL < 75%	-$43	$406 *	$290	$94	$45	-$154
75% <= %FPL < 100%	$396 *	$446 *	$289	$283	$102	-$257
100% <= %FPL < 125%	$258	$522 *	$685 *	$604 *	$557	$786 *
125% <= %FPL	$25	$268	$324	$205	-$19	$113

Notes: This analysis is restricted to workers who were DSHS or HCA clients in 2014.4. Income as a percentage of the federal poverty line is based on earned and unearned income reported to DSHS case workers in 2014.4. Monthly income as a percentage of the federal poverty line for October, November, and December of 2014 are averaged. Treated workers are defined as those employed in 2015.1 in locatable establishments in Seattle, not employed elsewhere in the state, and earning <$11 per hour. Control workers are defined as those employed in 2015.1 in locatable establishments in Washington State, but not employed in King County, and earning <$11 per hour. Each treated worker is matched to his/her nearest neighbor control worker, without replacement. The control sample is exact matched in employment status in 2015.1, 2014.4, and 2014.3, and on an indicator for worker first observed in WA in 2015.1, 2014.4, or 2014.3. Matching using Mahalanobis distance is based on wage rate, hours worked, tenure on the primary job, number of quarters since first observed in WA, and indicators for having earnings from more than one job in 2015.1, 2014.4, and 2014.3. The pseudo-treated cohort is constructed analogously, yet beginning from 2012.1. Estimators were bias adjusted using wage rate, hours worked, tenure on the primary job, and number of quarters since first observed in Washington State in the baseline quarter and prior two quarters. * denotes two-tailed p-value less than or equal to 0.10.

	2015.2	2015.3	2015.4	2016.1	2016.2	2016.3
Employed by Baseline Employer Conditional on Employment						
%FPL = 0	0.05 *	0.05	0.06	0.08 *	0.01	0.00
0% < %FPL < 75%	0.02	0.01	0.02	0.10 *	0.08	0.09 *
75% <= %FPL < 100%	-0.10 *	-0.05	0.04	-0.05	-0.03	0.07
100% <= %FPL < 125%	0.08	0.12 *	0.16 *	0.16 *	0.16 *	0.16 *
125% <= %FPL	0.00	0.03	0.03	0.04	0.03	0.02
Hours Worked in Seattle						
%FPL = 0	-14.18	-30.97 *	-25.86 *	-24.80 *	-35.77 *	-21.35
0% < %FPL < 75%	-7.30	15.27	24.27 *	24.32 *	29.25 *	26.91 *
75% <= %FPL < 100%	-19.00	-27.43 *	-22.28 *	-33.74 *	-29.95 *	-21.77
100% <= %FPL < 125%	-5.58	12.04	38.02 *	34.94 *	32.87 *	26.40
125% <= %FPL	-16.36 *	-17.68	1.82	-6.04	-12.39	-8.00
Hours Worked Outside Seattle						
%FPL = 0	-1.49	17.13	10.84	-4.65	-7.82	-4.68
0% < %FPL < 75%	-5.55	-5.57	-21.91	-25.42 *	-37.44 *	-47.80 *
75% <= %FPL < 100%	30.61 *	34.08 *	25.62	19.94	10.28	-21.96
100% <= %FPL < 125%	0.89	-4.73	-1.82	-19.98	-19.55	-14.74
125% <= %FPL	-8.65	7.95	5.01	-5.51	-8.48	-4.86

Table 6b: Heterogeneity in Estimated Effects of the Ordinance by Decile of Hours Worked in Baseline and Prior Two Quarters

Cohort 2: Workers Earning <$13 Per Hour at Baseline (2015.4)

	2016.1	2016.2	2016.3
Panel A: Effect on Wages			
%FPL = 0	$0.54 *	$0.43 *	$0.55 *
0% < %FPL < 75%	$0.42 *	$0.33	$0.50
75% <= %FPL < 100%	$1.14 *	$0.66 *	$1.27 *
100% <= %FPL < 125%	$0.83 *	$0.51	$0.84 *
125% <= %FPL	$0.51 *	$0.38 *	$0.85 *
Panel B: Effect on Employment			
%FPL = 0	-0.05 *	-0.01	-0.01
0% < %FPL < 75%	-0.04 *	-0.01	0.02
75% <= %FPL < 100%	0.00	-0.02	0.02
100% <= %FPL < 125%	-0.06 *	-0.01	0.03
125% <= %FPL	-0.02	-0.06 *	-0.03
Panel C: Effect on Quarterly Hours Worked			
%FPL = 0	-12.71	-11.78	-8.14
0% < %FPL < 75%	-11.27	-8.64	3.61
75% <= %FPL < 100%	-27.90 *	-9.82	7.02
100% <= %FPL < 125%	-46.88 *	-17.29	-22.01
125% <= %FPL	-6.99	-13.17	-17.02
Panel D: Effect on Quarterly Earnings			
%FPL = 0	-$32	-$20	-$69
0% < %FPL < 75%	$27	-$40	$264
75% <= %FPL < 100%	-$71	$70	$383
100% <= %FPL < 125%	-$320 *	-$48	-$4
125% <= %FPL	$77	-$105	$36

Notes: This analysis is restricted to workers who were DSHS or HCA clients in 2014.4. Income as a percentage of the federal poverty line is based on earned and unearned income reported to DSHS case workers in 2014.4. Monthly income as a percentage of the federal poverty line for October, November, and December of 2014 are averaged. Treated workers are defined as those employed in 2015.4 in locatable establishments in Seattle, not employed elsewhere in the state, and earning <$13 per hour. Control workers are defined as those employed in 2015.4 in locatable establishments in Washington State, but not employed in King County, and earning <$13 per hour. Each treated worker is matched to his/her nearest neighbor control worker, without replacement. The control sample is exact matched in employment status in 2015.3, 2015.2, and 2015.1, and on an indicator for worker first observed in WA in 2015.3, 2015.2, and 2015.1. Matching using Mahalanobis distance is based on wage rate, hours worked, tenure on the primary job, number of quarters since first observed in WA, and indicators for having earnings from more than one job in 2015.3, 2015.2, and 2015.1. The pseudo-treated cohort is constructed analogously, yet beginning from 2012.4. Estimators were bias adjusted using wage rate, hours worked, tenure on the primary job, and number of quarters since first observed in WA in the baseline quarter and prior two quarters. * denotes two-tailed p-value less than or equal to 0.10.

	2016.1	2016.2	2016.3
Employed by Baseline Employer Conditional on Employment			
%FPL = 0	0.01	0.02	0.05
0% < %FPL < 75%	0.03	0.02	0.04
75% <= %FPL < 100%	0.01	0.01	0.04
100% <= %FPL < 125%	0.01	-0.01	0.00
125% <= %FPL	0.04	0.06 *	0.12 *
Hours Worked in Seattle			
%FPL = 0	-12.51 *	-21.44 *	-22.12 *
0% < %FPL < 75%	-6.46	-15.84 *	-8.13
75% <= %FPL < 100%	-22.83 *	-18.29	-3.79
100% <= %FPL < 125%	-21.03 *	-24.62 *	-19.41
125% <= %FPL	-5.91	-21.69 *	-16.57
Hours Worked Outside Seattle			
%FPL = 0	-0.20	9.67	13.97
0% < %FPL < 75%	-4.81	7.20	11.74
75% <= %FPL < 100%	-5.07	8.47	10.81
100% <= %FPL < 125%	-25.85 *	7.34	-2.60
125% <= %FPL	-1.08	8.52	-0.45