

# Economic Impact Evaluation of the City of Saint Paul's Minimum Wage Ordinance

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# 1 Executive Summary

**Purpose of the study.** The City of Saint Paul commissioned a study of the economic impacts of the minimum wage ordinance adopted in 2018. The phased implementation of the ordinance began in 2020. The principal investigators of the study, hosted by the Federal Reserve Bank of Minneapolis, are providing to the City of Saint Paul the economic impact evaluation for the period 2018-2020.

**Scope of the study.** This report examines the aggregate labor market effects of the minimum wage ordinance. We document the effects on the average hourly wage, total jobs, total hours worked, and total worker earnings.

**Data.** We obtained administrative data from the Department of Employment and Economic Development (DEED) on firms, establishments, and workers. The dataset merges quarterly gross wage earnings and paid hours worked for employees from wage reports of the Unemployment Insurance (UI) data with industry and establishment location data from the Quarterly Census of Employment and Wages (QCEW).

**Methods.** The key to analyzing the impact of a policy change such as a minimum wage increase is the credible estimation of what would have happened in Saint Paul in the absence of the minimum wage ordinance (the "counterfactual"). The difference between the actual outcomes in Saint Paul in the presence of the minimum wage ordinance ("treatment") and the counterfactual outcomes in its absence is interpreted as the causal effect of adopting the minimum wage ordinance on outcomes. To construct counterfactuals, we use synthetic difference-in-differences methods.

**Results for the pre-implementation effects of the 2018 minimum wage ordinance.** Table 1 presents the effects of the minimum wage ordinance on aggregate labor market outcomes for low-wage sectors and separately for restaurant industries. The analysis includes data up to 2019(4), one quarter before the implementation of minimum wage ordinance began. Estimates that are statistically significant at the 5 percent level are presented in bold numbers and

colored in grey. The other estimates cannot be statistically distinguished from zero.

**Table 1:** Effects of the 2018 Minimum Wage Ordinance (Percent Changes)

	Employment Share	Hourly Wages	Total Jobs	Total Hours	Worker Earnings
Retail Trade (44)	7	<b>4</b>	2	<b>-7</b>	<b>-12</b>
Administration and Support (56)	6	3	10	7	-13
Health Care and Social Assistance (62)	18	-1	6	9	5
Accommodation and Food Services (72)	10	<b>3</b>	<b>-10</b>	<b>-11</b>	0
Other Services (81)	4	0	<b>24</b>	2	4
<i>Average (Weighted by Employment Shares)</i>		1	4	1	-1
Full-Service Restaurants (722511)	4	-1	<b>-16</b>	<b>-14</b>	<b>-12</b>
Limited-Service Restaurants (722513)	4	1	<b>-27</b>	<b>-19</b>	<b>-39</b>

Notes: Estimates that are statistically significant at the 5 percent level are presented in bold numbers and colored in grey. Average hourly wages exclude the top 10 percent of the distribution.

**Preliminary results from including the 2020 implementation period.** We present cumulative changes in wages, jobs, hours, and worker earnings through 2020(4), which includes the first phase of the implementation of the minimum wage increase. Further employment declines and wage increases were observed in 2020, but the analysis using 2020 data should be interpreted with caution because this period coincides with the pandemic and civil unrest. In future reports, we will further examine the 2020 period using additional data and additional sources of variation to disentangle the effects of the pandemic and civil unrest from the effects of the minimum wage increase.

## 2 Purpose of the Study

The City of Saint Paul commissioned a study of the economic impacts of the minimum wage ordinance adopted in 2018. The phased implementation of the minimum wage ordinance began in 2020 and is scheduled to reach 15 dollars for all firms in July 2027. The principal investigators of the study, hosted by the Federal Reserve Bank of Minneapolis, are providing to the City of Saint Paul the impact evaluation results for the 2018 Ordinance. Our analysis presents results for pre-implementation effects for the period through 2019(4). We are also providing preliminary results for the 2020 minimum wage increases.

Minnesota first introduced a statewide minimum wage in 1974 and has since updated the wage floor periodically. In the period of our study (2000-2020), the latest policy-driven increase in the state minimum wage was in August 2014. The minimum wage rate was set to increase in stages beginning in August 2014 to 6.5 dollars for small firms and youth employees and to 8 dollars for large firms. Small firms are defined as ones earning an annual revenue less than 500,000 dollars, and large firms are ones that earn an annual revenue higher than this threshold. The rates were set to eventually reach 7.75 and 9.5 dollars per hour by 2016 for small and large firms, respectively.<sup>1</sup> Beginning in 2018, the rate was indexed to the price deflator for personal consumption expenditure, with annual increases capped at 2.5 percent of the previous rate. Table 2 provides the details of these changes over time. Meanwhile, The City of Minneapolis passed a minimum wage ordinance in 2017 and the phased implementation began in 2018.

The City of Saint Paul soon followed Minneapolis in discussing a 15 dollars minimum wage ordinance. In 2018, the Saint Paul City Council passed a minimum wage ordinance. It also chose a phased implementation that began increasing its minimum wage in 2020 to reach 15 dollars by 2027. In January 2020, it increased the minimum wage for macro firms (more than 10,000 employees) to 12.5 dollars. As Table 3 illustrates, in July 2020 the minimum

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<sup>1</sup>Gratuities are not applied to the minimum wage, implying that employers have to pay their employees a wage rate above minimum wage before tips. The Saint Paul minimum wage ordinances adopted a similar policy with respect to gratuities.

**Table 2: Minimum Wage Changes in Minnesota 2000-2020 (Dollars)**

(Annual Revenue in Dollars)	Youth	Small Firms ( $< 500,000$ )	Large Firms ( $\geq 500,000$ )
2000-2005	4.25	4.90	5.15
2006-2013	4.90	5.25	6.15
2014	6.50	6.50	8.00
2015	7.25	7.25	9.00
2016	7.75	7.75	9.50
2017	7.75	7.75	9.50
2018	7.87	7.87	9.65
2019	8.04	8.04	9.86
2020	8.15	8.15	10.00
2021	8.21*	8.21*	10.08*

Notes: \* denotes that the minimum wage is scheduled to increase every year according to the price deflator for personal consumption expenditures produced by the Bureau of Economic Analysis.

wage for larger firms (101 to 10,000 employees) increased to 11.5 dollars, for small firms (6 to 100 employees) to 10 dollars, and for micro firms to 9.25 dollars. The minimum wage will be indexed to inflation once the target level of 15 dollars per hour is reached. Throughout our period of study, the state minimum wage applies to all cities in Minnesota outside of the Twin Cities, and we will consider these cities as potential controls.

**Table 3: Minimum Wage Policy Change in Saint Paul (Dollars)**

<b>Date</b>	<b>Micro Firms (5 or fewer Employees)</b>	<b>Small Firms (6 to 100 Employees)</b>	<b>Large Firms (101 to 10,000 Employees)</b>	<b>Macro Firms (More than 10,000 Emp.)</b>
2020 (Jan)				12.50
2020 (July)	9.25	10.00	11.50	
2021 (July)	10.00	11.00	12.50	
2022 (July)	10.75	12.00	13.50	15.00*
2023 (July)	11.50	13.00	15.00	
2024 (July)	12.25	14.00	Equal to macro firms	
2025 (July)	13.25	15.00		
2026 (July)	14.25	Equal to macro firms		
2027 (July)	15.00			
2028 (July)	Equal to macro firms			

Notes: \* denotes that the minimum wage is scheduled to increase every year according to the price deflator for personal consumption expenditures produced by the Bureau of Economic Analysis.

### 3 Scope of the Study

This report examines the aggregate labor market effects of the minimum wage ordinance in Saint Paul. We document the effects on average hourly wage, total jobs, total hours worked, and total worker earnings. This analysis is based on data received from Department of Employment and Economic Development (DEED). This is the first of a series of annual reports we will be providing to the City of Saint Paul up until 2028. The future reports will use additional data we will be receiving from Department of Human Resources (DHS) and Department of Revenue (DOR). Our ability to merge the DEED-DHS-DOR datasets will allow us to examine several outcomes at a disaggregated level, including worker turnover, effect on workers by demographic characteristics, effect on social benefits received by workers, firms' capital-labor substitution decisions, firms' employee-contractor substitutions, firm profits, and prices inferred from firm-level data.

## 4 Data Sources

We use two main sources of data on workers and firms for our analyses of the effects of the minimum wage increase. Both sources are administrative and non-publicly-available data that were made available to us by Minnesota’s Department of Employment and Economic Development (DEED). The first data source is individual-level data of workers from Unemployment Insurance (UI). Minnesota requires most employers to file quarterly unemployment wage detail reports for the purpose of estimating the amount of unemployment insurance tax they owe. These reports provide us with data on quarterly earnings and hours worked for each worker. We calculate hourly wages for each worker by dividing total quarterly earnings by quarterly hours.<sup>2</sup> Minnesota collects these data for each employee of a firm at the level of the establishment where they work. This feature of the data is especially important in studying the minimum wage effects, as a large part of employment is generated in multi-establishment firms.

The UI data do not contain information on the location of the establishments, which is necessary in order to identify which establishments were affected by the minimum wage increase. To overcome this problem, we merge the UI data with establishment-level data from the Quarterly Census of Employment and Wages (QCEW). The QCEW records jobs that account for roughly 97 percent of employment in the state of Minnesota. From these data, we observe the six-digit North American Industry Classification System code for the industry that the establishment operates in, the location of the establishment, and the firm to which the establishment belongs. The location data consist of both the city and the zip code in which the establishment operates.<sup>3</sup>

The merged data result in a quarterly dataset between 2001(1) and 2020(4). Our geographic unit of analysis is a zip code within a city. This allows the same zip code to be

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<sup>2</sup>For calculating hourly wages, we exclude roughly 5 percent of observations that reported zero hours worked. We keep these observations for calculating other outcomes.

<sup>3</sup>The raw data do not have location information for around 4 percent of observations. In addition, we exclude observations for which the city name and zip codes are contradictory. Such contradictions are rare and constitute roughly 0.1 percent of the total establishments.



affected differently by the treatment if the zip code belongs to two different cities. It also allows for multiple treated units within a city that faces an increase in its minimum wage. For each industry, we calculate average wages, aggregate number of jobs (sum of full-time and part-time jobs), aggregate hours, and aggregate worker earnings paid within geographic units for each quarter. Finally, we aggregate all units that have fewer than 50 full-time equivalent jobs to one unit, separately for each industry and for treatment or control groups.

To summarize, by merging the worker-level UI data with the establishment-level QCEW data, we are able to create a dataset on workers' hours and wages, as well as the establishments at which they are employed, by industry, zip code, and city. Our dataset improves measurement relative to previous studies along three dimensions. First, using administrative sources, we provide estimates for the effects of a minimum wage increase on hours worked.<sup>4</sup> Second, Minnesota is unique in that it records employee hours worked at the establishment level within firms. Thus, we include in our analyses firms with multiple establishments across city borders. Finally, we leverage detailed location data at the zip code level to increase the precision of our estimates.

Table 4 reports the industry distribution of employment shares and the fraction of workers earning below 15 dollars in 2017 by industry.<sup>5</sup> We focus our baseline analyses on the two-digit industries in which 30 percent or more of workers earn below 15 dollars per hour. The six industries that satisfy this criterion are retail trade (44); administrative services (56); health care and social assistance (62); arts, entertainment, and recreation (71); accommodation and food services (72); and other services (81).<sup>6</sup> In addition, we present separate results for full-service and limited-service restaurants. Restaurants account for 8 percent of total employment and have a high fraction of potentially impacted workers.<sup>7</sup>

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<sup>4</sup>Oregon, Rhode Island, and Washington are the three other states in the U.S. that collect hours worked in the matched employer-employee administrative data.

<sup>5</sup>The shares of employment do not add up to 100 percent, as some industries have been excluded due to confidentiality concerns based on the presence of few establishments. The industries excluded are Agriculture, Forestry, Fishing, and Hunting (11); Mining, Quarrying, and Oil and Gas Extraction (21); Construction (23); Information (51); Real Estate and Rental and Leasing (53); and Public Administration (92).

<sup>6</sup>“Other services” consists of repair and maintenance shops, personal and laundry services, and various civic, professional, and religious organizations.

<sup>7</sup>The fraction of workers earning below 15 dollars reported in Table 4 for the restaurant industries is a lower

**Table 4:** Employment Shares and Fraction of Workers Earning below 15 Dollars

(2017)	Share of Employment		Fraction of Workers	
	(percent)		Earning Below \$15	
	SP	Other MN	SP	Other MN
Manufacturing (31)	4	12	18	17
Wholesale Trade (42)	3	4	16	15
Retail Trade (44)	7	12	63	65
Transportation (48)	2	3	21	23
Finance and Insurance (52)	5	4	6	13
Professional Services (54)	4	4	12	12
Management of Companies (55)	4	3	29	12
Administration and Support (56)	6	5	66	48
Educational Services (61)	13	8	23	23
Health Care and Social Assistance (62)	18	17	42	34
Arts, Entertainment, and Recreation (71)	2	2	45	61
Accommodation and Food Services (72)	10	9	63	71
Other Services (81)	4	3	34	49
<b>Restaurant Industries</b>				
Full-Service Restaurants (722511)	4	3	51	56
Limited-Service Restaurants (722513)	4	3	82	90

Note: "SP" denotes Saint Paul and "Other MN" denotes the sum of all other cities in Minnesota except for Minneapolis and Saint Paul.

bound for the fraction of workers who are affected by the minimum wage increase. This is because the wages reported to DEED include tips and the minimum wage ordinance excludes tips.

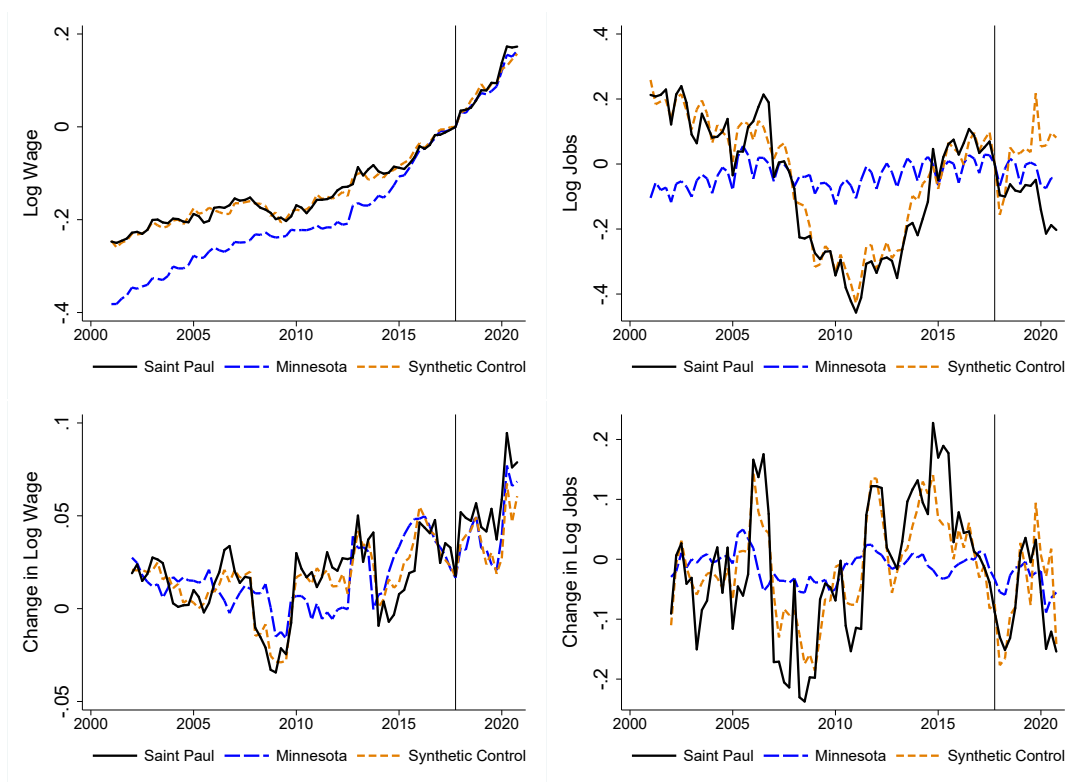
## 5 Methodology

At the core of any policy evaluation lies the fundamental problem of causal inference. The Saint Paul minimum wage ordinance was adopted in 2018. We observe economic outcomes, such as wages, employment, hours, and worker earnings, in Saint Paul before and after the ordinance was adopted. However, researchers do not observe the counterfactual of what the economic outcomes in Saint Paul after the minimum wage ordinance would have been *in the absence* of an ordinance. To answer the question of what the effect of the minimum wage policy announcement is, one needs to know the difference between the actual outcomes (which are observed) and the counterfactual outcomes (which are not observed). The key to evaluating the policy is to construct counterfactual outcomes in a credible manner.

To construct counterfactuals, we use synthetic control methods ([Abadie and Gardeazabal \(2003\)](#), [Abadie et al. \(2015\)](#)) as augmented by [Arkhangelsky et al. \(2019\)](#) with fixed effects. The synthetic control approach takes a weighted average of the geographical units outside Saint Paul to construct the counterfactual. The statistical tool chooses weights such that the synthetic control looks like Saint Paul (in a statistical sense) in terms of outcome variables before 2018. For example, weights would be found so that the time series before 2018 for the synthetic control for the economic outcome matches as closely as possible the same time series in Saint Paul. The counterfactual is built from other geographical regions, but they are averaged in such a way that they approximate as closely as possible Saint Paul before 2018 on the observable dimensions that are relevant for the analysis. This method produces a counterfactual that responds to economic shocks in a way similar to how Saint Paul does in the period before the minimum wage increase. We note that the period after the first phase of implementation of the minimum wage ordinance partly overlaps with the pandemic recession and thus the method should be interpreted with caution when applied to the period that includes the pandemic recession.<sup>8</sup>

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<sup>8</sup>To infer the statistical significance of the estimated impact effects, we use the “placebo method.” The method takes all non-treated units and estimates the treatment effect in these samples, with each sample generated under a placebo treatment of a subset of non-treated units. Since we should be estimating a zero treatment effect in the absence of a treatment, the distribution of treatment effects under the placebo method gives us the distribution of noise inherent in the data. See Algorithm 4 in [Arkhangelsky et al. \(2019\)](#) for exact implementation details to construct the placebo standard errors.



**Figure 1:** Illustration of the Synthetic Control Method

This method is illustrated in Figure 1 in the context of the minimum wage increase in Saint Paul using the retail industry as an example. The upper panels of the figure plot quarterly time series of the average hourly wage and the total number of jobs for the retail trade industry during the period with data coverage between 2001(1) and 2020(4). All series are in logs and normalized to 0 in 2017(4), which is the last quarter before the minimum wage ordinance was implemented in Minneapolis. The solid lines show that retail in Saint Paul experienced an increase in wages over time, whereas the number of jobs declined in the 2000s and then increased in the 2010s.

The long-dashed blue lines show the evolution of wages and jobs for the average of all cities in Minnesota besides Minneapolis and Saint Paul. This average represents the control group in a difference-in-differences specification. This specification would estimate the effect of a minimum wage increase by comparing the changes in outcomes over time between

Saint Paul and the average of other cities. The trends before 2018 are significantly different between Saint Paul and other cities in Minnesota.

The dashed orange line shows the evolution of wages and jobs for the synthetic control of Saint Paul, which is the weighted average of cities in Minnesota other than Minneapolis and Saint Paul.<sup>9</sup> By design, the methodology weights more heavily cities with similar pre-treatment trends and less heavily cities with different pre-treatment trends. As seen in the figure, the time series for the synthetic control reproduce very closely the time series of wages and jobs in Saint Paul in the pre-treatment period, including the decline in retail jobs the city experienced in the 2000s. Using synthetic difference-in-differences, we can visualize the treatment effect of the minimum wage increase as the difference between the dashed orange line and the solid line in the post-2018 period. The changes observed in 2020 should be interpreted with caution because this period coincides with the pandemic and civil unrest.

The empirical estimates presented in Section 6 will focus on outcome variables that are expressed in yearly growth rates.<sup>10</sup> The lower panels of Figure 1 demonstrate that retail wages and jobs growth are substantially more volatile in Saint Paul than in the rest of Minnesota. For the synthetic control, we reestimate the weights in the growth specification of the outcome variable. Similar to the levels specification, the fit during the pre-treatment period is significantly improved relative to the unweighted average that underlies the difference-in-differences specification.

## 5.1 Performance of Synthetic Control in Pre-Implementation Period

Before presenting the impacts of the minimum wage increase, we pause to discuss the performance of the synthetic control method in accounting for the time series of Saint Paul in

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<sup>9</sup>We exclude Minneapolis from the construction of the synthetic control of Saint Paul because Minneapolis began implementing a minimum wage increase in 2018.

<sup>10</sup>There are two reasons why we prefer a specification in growth rates to a specification in levels. First, using a unit fixed effect in a growth specification removes heterogeneity in average growth rates that may be correlated with the treatment of increasing the minimum wage. Second, using yearly growth rates allows us to remove quarterly seasonal variation, thus improving the efficiency of our estimates.

**Table 5:** Pre-treatment Fit: Synthetic Control versus Difference-in-Differences

(R-squared, percent)	Wage <sup>a</sup>		Wage <sup>b</sup>		Jobs		Hours		Earnings	
	SC	DD	SC	DD	SC	DD	SC	DD	SC	DD
Retail Trade (44)	70	2	79	19	79	7	77	2	83	12
Administration and Support (56)	47	0	62	3	84	13	85	13	83	14
Health Care, Social Assistance (62)	90	14	86	7	80	2	86	0	88	9
Arts, Entertainment, Recreation (71)	35	9	30	4	31	1	44	3	38	1
Accommodation, Food Services (72)	77	40	76	45	61	5	59	1	60	6
Other Services (81)	84	38	85	55	79	19	84	11	88	15
Full-Service Restaurants (722511)	77	45	75	43	74	0	66	0	60	2
Limited-Service Restaurants (722513)	74	51	79	62	77	11	68	11	75	9

(a) Average hourly wage, excluding the highest-paying 10 percent of jobs. (b) Average hourly wage, excluding the highest-paying 25 percent of jobs. SC: synthetic control. DD: difference-in-differences.

the period before the minimum wage increase. Table 5 presents R-squared coefficients from regressions of outcome variables in Saint Paul on the outcome variables of the synthetic control. For comparison, we also present the R-squared coefficients when using the outcome variables of the unweighted average of all other zip codes within cities in Minnesota.

The table shows that for five out of the six low-wage industries identified previously in Section 4 and separately for restaurants, the synthetic control accounts for a substantial fraction of the variation of the time series of Saint Paul before the minimum wage increase. To give an example from a key industry that we elaborate upon below, for full-service restaurants during the pre-treatment period, the synthetic control accounts for 74 percent of the time series variation of jobs growth in Saint Paul. The control average of all other units in Minnesota accounts for 0 percent. Despite the overall success in accounting for a substantial variation of the pre-treatment time series, the synthetic control does not perform equally well in all industries. The most notable lack of fit is for the arts, entertainment, and recreation industry. Thus, we drop this industry from our analyses.

## 6 Results

This section first provides the results for the impact of the 2018 minimum wage ordinance during the pre-implementation period up to 2019(4). We then provide preliminary results for the 2020 minimum wage increases, which adds the period 2020(1) to 2020(4) to the analysis.

### 6.1 Pre-implementation Impact of the 2018 Minimum Wage Ordinance

The mayor of Saint Paul affirmed his commitment to raising the city wide minimum wage at the beginning of 2018. This, combined with the 2018 implementation of minimum wage increases in Minneapolis, substantially increased the probability that minimum wages would increase in Saint Paul. Given these advance notices, firms could have reacted before the actual implementation of the minimum wage ordinance began. We now examine the aggregate labor market effects of such potentially anticipated increase in minimum wages.

Table 6 presents results for the low-wage industries identified previously and separately for restaurants. Entries are multiplied by 100 and equal the log point change in outcomes in 2019(4) due to the adoption of minimum wage ordinance. The columns present different outcome variables. To give an example, the first row says that the adoption of the minimum wage ordinance in Saint Paul caused a roughly 1.6 log points (roughly 1.6 percent) increase in the number of retail jobs, relative to the counterfactual in which the minimum wage had not increased. Note that the estimate is the cumulative effect of minimum wage increases between 2018(1) and 2019(4). Each entry in parentheses is the  $p$ -value associated with the estimated treatment effect – that is, the probability of obtaining a treatment effect as extreme as the point estimate under the null hypothesis that the treatment effect is zero. Continuing the example, we see that the placebo method produces a  $p$ -value of 57.7 percent, and thus we conclude that the treatment effect of 1.6 is imprecisely estimated and cannot be statistically distinguished from zero at 5 percent level of significance.<sup>11</sup>

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<sup>11</sup>We have multiple treated units, as our geographic unit of analysis is a zip code within a city. Thus, we construct placebo estimates by assigning a treatment status to 999 random subsamples of zip codes, with each subsample having a size equal to the number of treated units in Saint Paul. We use the formula  $p = 2 \min\{p_H, p_L\}$

**Table 6:** Pre-implementation Impact of the 2018 Minimum Wage Ordinance

	Wage <sup>a</sup>	Wage <sup>b</sup>	Jobs	Hours	Earnings
Retail Trade (44)	3.5 (0.0)	2.6 (0.0)	1.6 (57.7)	-6.7 (3.8)	-11.5 (1.8)
Administration and Support (56)	3.3 (16.0)	4.5 (0.4)	10.3 (27.0)	7.0 (55.1)	-12.8 (5.4)
Health Care and Social Assistance (62)	-1.4 (15.6)	-1.2 (9.4)	6.0 (16.2)	8.8 (10.2)	4.6 (60.3)
Accommodation and Food Services (72)	3.2 (0.0)	1.2 (8.8)	-9.8 (1.2)	-10.9 (1.6)	0.2 (92.5)
Other Services (81)	0.1 (80.3)	0.9 (54.9)	24.3 (0.0)	1.5 (57.5)	4.3 (24.4)
Full-Service Restaurants (722511)	-1.2 (21.6)	-1.1 (15.0)	-15.5 (0.0)	-14.0 (0.0)	-11.9 (1.8)
Limited-Service Restaurants (722513)	0.5 (98.5)	1.5 (70.5)	-26.5 (0.4)	-19.3 (3.2)	-39.0 (0.0)

Notes: (a) Average hourly wage, excluding the highest-paying 10 percent of jobs. (b) Average hourly wage, excluding the highest-paying 25 percent of jobs. The estimates are in log points, multiplied by 100. Entries in parentheses are  $p$ -values using the placebo method. The anticipation effect starts in 2018(1) and the sample covers up to 2019(4), the last quarter before the implementation of the minimum wage increase.

We estimate wage increases at the 5 percent level of significance for retail, administration and support services, and accommodation and food services. For industries with statistically significant increases, we document increases that range between 3 and 5 log points.

Turning to the estimated effects on jobs in the third column, we find statistically significant jobs declines in the accommodation and food services industry and, within this industry, in both restaurant industries. Jobs in full-service restaurants declined by 16 log points and

to calculate the  $p$ -value for a point estimate for Saint Paul, where  $p_H$  is the fraction of placebo samples with point estimates that are higher than the estimate of Saint Paul in 2019(4) and  $p_L$  is the fraction of placebo samples with point estimates that are lower than the estimate of Saint Paul in 2019(4). Similar calculations underlie our  $p$ -values and confidence intervals in other tables.



jobs in limited-service restaurants declined by 27 log points. On the other hand, we find a statistically significant increase in jobs in other services.

Repeating our estimates for total hours in the fourth column, we generally find similar patterns. In addition to statistically significant declines in hours for accommodation and food services and for restaurants, we find a statistically significant decline of 7 log points in retail. Contrary to the jobs finding, we do not find a statistically significant increase of hours in the other services industry. The final column of the table presents the estimated effects on total worker earnings. We find a statistically significant decline in worker earnings at the 5 percent level for retail, full-service restaurants, and limited-service restaurants.

### *Placebo in Time*

So far, we have provided estimates of pre-implementation effects of the minimum wage ordinance on aggregate labor market outcomes. To assess whether these results are indeed driven by the minimum wage policy announcement, we conduct a placebo test that stops the sample in 2015(4) and excludes all subsequent quarters when the possibility of increasing the minimum wage in the Twin Cities was in active discussion. Next, we assign a placebo treatment date of 2013(4) for Saint Paul. Since the period between 2013 and 2015 predates even the discussion of increasing the minimum wage in the Twin Cities, we should not find treatment effects for this placebo treatment.

Table 7 summarizes the results of this exercise for jobs. Using the placebo treatment, we fail to find statistically significant negative jobs effects in any industry. This includes the industries for which we previously found significant job declines following the treatment of the minimum wage increase.

**Table 7: Placebo Jobs Effects of Minimum Wage Increases in 2013(4)**

Industry	Saint Paul
Retail Trade (44)	37.6 (0.0)
Admin. and Support (56)	7.3 (47.6)
Health Care and Social Assistance (62)	-7.1 (13.4)
Accommodation and Food Services (72)	8.8 (16.0)
Other Services (81)	2.5 (50.7)
Full-Service Restaurants (722511)	5.7 (21.4)
Limited-Service Restaurants (722513)	8.9 (35.8)

Notes: These placebo estimates use data from 2001(1) to 2015(4), before the discussions of raising the minimum wage. The estimates are in log points, multiplied by 100. Entries in parentheses are  $p$ -values using the placebo method.

## *Placebo in High-Wage Industries*

As an additional robustness check on the methodology, we conduct a placebo using the two industries with the lowest share of jobs paying less than 15 dollars per hour in 2017. Table 8 repeats our estimates for finance and insurance and professional services. Because there are few low-wage workers in these industries, we expect to find zero treatment effects. As the table illustrates, we fail to detect any significant effects at the 5 percent level.

**Table 8:** Pre-implementation Effects in High-Wage Industries

	Wage <sup>a</sup>	Wage <sup>b</sup>	Jobs	Hours	Earnings
Finance and Insurance (52)	0.5 (11.4)	0.2 (45.4)	1.8 (20.0)	0.9 (43.6)	1.2 (34.4)
Professional Services (54)	-0.4 (21.2)	-0.1 (65.3)	-1.6 (8.8)	-1.1 (30.2)	-0.8 (54.7)

Notes: (a) Average hourly wage, excluding the highest-paying 10 percent of jobs. (b) Average hourly wage, excluding the highest-paying 25 percent of jobs. The estimates are in log points, multiplied by 100. Entries in parentheses are *p*-values using the placebo method.

## **6.2 Preliminary Results from 2020 Analysis**

We committed to deliver to the City results for the 2020 minimum wage increase with the same methodology we used for the impact effects in the pre-implementation period. Table 9 presents our estimates of the 2018 minimum wage ordinance when we include data up to 2020(4). Compared to our previous analyses that used data up to 2019(4), the 2020 data includes the first phase of implementation of the Saint Paul minimum wage ordinance. The estimates in this table should be interpreted with caution because there are confounding factors which may interact with the minimum wage increase. A key assumption of the synthetic

difference-in-differences method is that in the post-policy period, treated units and the synthetic control units react similarly to economic shocks. Since lockdowns during the pandemic were more severe and the civil unrest was more intense in Saint Paul compared with other cities in Minnesota (outside of the Twin Cities), the estimates from using only Minnesota data need to be interpreted with caution and are preliminary.

**Table 9:** Estimates from Including the First Phase Implementation of the 2018 Ordinance

Saint Paul	Wage <sup>a</sup>	Wage <sup>b</sup>	Jobs	Hours	Earnings
Retail Trade (44)	4.6 (0.0)	5.3 (0.0)	-6.7 (28.8)	-12.2 (3.4)	-13.7 (4.4)
Administration and Support (56)	0.7 (92.1)	4.6 (2.8)	2.5 (82.7)	0.3 (80.7)	-20.1 (18.8)
Health Care and Social Assistance (62)	-4.2 (0.2)	-3.6 (0.2)	4.5 (37.6)	9.8 (11.6)	-4.0 (41.6)
Accommodation and Food Services (72)	7.9 (0.0)	5.2 (0.0)	-27.6 (0.0)	-39.5 (0.0)	-20.2 (1.4)
Other Services (81)	2.0 (35.4)	6.0 (0.0)	36.3 (0.0)	13.5 (1.2)	16.4 (0.4)
Full-Service Restaurants (722511)	0.5 (63.3)	1.2 (39.0)	-41.6 (0.0)	-44.8 (0.0)	-44.8 (0.0)
Limited-Service Restaurants (722513)	3.9 (44.4)	5.6 (49.4)	-49.0 (0.0)	-41.3 (0.0)	-59.5 (0.0)

Notes: (a) Average hourly wage, excluding the highest-paying 10 percent of jobs. (b) Average hourly wage, excluding the highest-paying 25 percent of jobs. The estimates are in log points, multiplied by 100. Entries in parentheses are  $p$ -values using the placebo method. The treatment effect starts in 2018(1) and the sample covers up to 2020(4).

In Table 9, estimates continue to show statistically significant increases in wages for retail and accommodation and food services.<sup>12</sup> We also find a statistically significant increase in one of the two wage measures in other services. On the other hand, we find a statistically

<sup>12</sup>Entries in this table are multiplied by 100 and are the log point change in outcomes in 2020(4) and entries in parentheses show  $p$ -values associated with the estimated coefficients.

significant decline in wages in the health sector.

Turning to the estimates on jobs in the third column, we document a 28 log points decline for accommodation and food. We find a 42 log points decline in jobs in full-service restaurants and a 49 log points decline in jobs in limited-service restaurants. At the same time, we continue to find jobs increases in other services, with the magnitude of the increase being 36 log points.

The fourth column presents our estimates on hours. The declines in hours for accommodation and food and for restaurants are larger than the corresponding declines in jobs. The increase in hours for other services is smaller than the corresponding increase in jobs. One notable difference between our results for jobs and our results for hours is that retail hours decline by 12 percent, which is statistically significant at the 5 percent level.

The final column of the tables present the estimated effects on total worker earnings. We find statistically significant declines in retail, accommodation and food, and restaurants. For restaurants, we observe declines of roughly 50 log points. On the other hand, we find a statistically significant increase of 16 log points in worker earnings in other services.

We emphasize, again, that the estimates for cumulative changes through 2020(4) in Table 9 should be interpreted with caution because this period coincides with the pandemic and civil unrest. In future reports, we will further examine the 2020 period using additional data and additional sources of variation to disentangle the effects of the pandemic and civil unrest from the effects of the minimum wage increase.

## Bibliography

- Daniel Aaronson. Price pass-through and the minimum wage. *Review of Economics and Statistics*, 83(1): 158–169, 2001.
- Daniel Aaronson and Eric French. Product market evidence on the employment effects of the minimum wage. *Journal of Labor Economics*, 25(1):167–200, 2007.
- Daniel Aaronson and Brian J Phelan. Wage shocks and the technological substitution of low-wage jobs. *The Economic Journal*, 129(617):1–34, 2019.
- Daniel Aaronson, Eric French, Isaac Sorkin, and Ted To. Industry dynamics and the minimum wage: a putty-clay approach. *International Economic Review*, 59(1):51–84, 2018.
- Alberto Abadie and Javier Gardeazabal. The economic costs of conflict: A case study of the basque country. *The American Economic Review*, 93(1):113–132, 2003.
- Alberto Abadie, Alexis Diamond, and Jens Hainmueller. Comparative politics and the synthetic control method. *American Journal of Political Science*, 59(2):495–510, 2015.
- Daron Acemoglu and David Autor. Skills, tasks and technologies: Implications for employment and earnings. In *Handbook of Labor Economics*, volume 4, pages 1043–1171. Elsevier, 2011.
- John T Addison, McKinley L Blackburn, and Chad D Cotti. Minimum wage increases in a recessionary environment. *Labour Economics*, 23:30–39, 2013.
- Jonas Agell and Kjell Erik Lommerud. Minimum wages and the incentives for skill formation. *Journal of Public Economics*, 64(1):25–40, 1997.
- Philippe Aghion, Yann Algan, and Pierre Cahuc. Civil society and the state: The interplay between cooperation and minimum wage regulation. *Journal of the European Economic Association*, 9(1):3–42, 2011.
- Sylvia Allegretto, Arindrajit Dube, Michael Reich, and Ben Zipperer. Credible research designs for minimum wage studies: A response to neumark, salas, and wascher. *Industrial and Labor Relations Review*, 70(3): 559–592, 2017.
- Sylvia Allegretto, Anna Godoey, Carl Nadler, and Michael Reich. The new wave of local minimum wage policies: Evidence from six cities. *CWED Policy Report*, 2018.
- Sylvia A Allegretto, Arindrajit Dube, and Michael Reich. Do minimum wages really reduce teen employment? accounting for heterogeneity and selectivity in state panel data. *Industrial Relations: A Journal of Economy and Society*, 50(2):205–240, 2011.
- Dmitry Arkhangelsky, Susan Athey, David A Hirshberg, Guido W Imbens, and Stefan Wager. Synthetic difference in differences. Technical report, National Bureau of Economic Research, 2019.
- Orley Ashenfelter and Robert S Smith. Compliance with the minimum wage law. *Journal of Political Economy*, 87(2):333–350, 1979.
- David H Autor, Lawrence F Katz, and Melissa S Kearney. Trends in us wage inequality: Revising the revisionists. *The Review of Economics and Statistics*, 90(2):300–323, 2008.

- Martha J Bailey, John DiNardo, and Bryan A Stuart. The economic impact of a high national minimum wage: Evidence from the 1966 fair labor standards act. Working Paper 26926, National Bureau of Economic Research, April 2020. URL <http://www.nber.org/papers/w26926>.
- Zsófia L Bárány. The minimum wage and inequality: the effects of education and technology. *Journal of Labor Economics*, 34(1):237–274, 2016.
- Garry F Barrett and Daniel S Hamermesh. Labor supply elasticities overcoming nonclassical measurement error using more accurate hours data. *Journal of Human Resources*, 54(1):255–265, 2019.
- Arnab K Basu, Nancy H Chau, and Ravi Kanbur. Turning a blind eye: Costly enforcement, credible commitment and minimum wage laws. *The Economic Journal*, 120(543):244–269, 2010.
- Tito Boeri. Setting the minimum wage. *Labour Economics*, 19(3):281–290, 2012.
- John Bound, Charles Brown, and Nancy Mathiowetz. Measurement error in survey data. In *Handbook of econometrics*, volume 5, pages 3705–3843. Elsevier, 2001.
- Peter Brummund and Michael R Strain. Does employment respond differently to minimum wage increases in the presence of inflation indexing? *Journal of Human Resources*, 55(3):999–1024, 2020.
- David Card and John E DiNardo. Skill-biased technological change and rising wage inequality: Some problems and puzzles. *Journal of Labor Economics*, 20(4):733–783, 2002.
- David Card and Alan B Krueger. Minimum wages and employment: A case study of the fast-food industry in new jersey and pennsylvania. *The American Economic Review*, 84(4):772–93, 1994.
- Doruk Cengiz, Arindrajit Dube, Attila Lindner, and Ben Zipperer. The effect of minimum wages on low-wage jobs. *The Quarterly Journal of Economics*, 134(3):1405–1454, 2019.
- Doruk Cengiz, Arindrajit Dube, Attila S Lindner, and David Zentler-Munro. Seeing beyond the trees: Using machine learning to estimate the impact of minimum wages on labor market outcomes. Technical report, National Bureau of Economic Research, 2021.
- Yang-Ming Chang and Isaac Ehrlich. On the economics of compliance with the minimum wage law. *Journal of Political Economy*, 93(1):84–91, 1985.
- Jeffrey Clemens and Michael R Strain. The heterogeneous effects of large and small minimum wage changes: Evidence over the short and medium run using a pre-analysis plan. Technical report, National Bureau of Economic Research, 2021.
- Jeffrey Clemens and Michael Wither. The minimum wage and the great recession: Evidence of effects on the employment and income trajectories of low-skilled workers. *Journal of Public Economics*, 170:53–67, 2019.
- Kenneth A Couch and David C Wittenburg. The response of hours of work to increases in the minimum wage. *Southern Economic Journal*, pages 171–177, 2001.
- Leif Danziger. The elasticity of labor demand and the minimum wage. *Journal of Population Economics*, 22(3):757–772, 2009.
- Leif Danziger. Endogenous monopsony and the perverse effect of the minimum wage in small firms. *Labour Economics*, 17(1):224–229, 2010.

- H David, Alan Manning, and Christopher L Smith. The contribution of the minimum wage to us wage inequality over three decades: a reassessment. *American Economic Journal: Applied Economics*, 8(1):58–99, 2016.
- Richard Dickens and Alan Manning. Has the national minimum wage reduced uk wage inequality? *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 167(4):613–626, 2004a.
- Richard Dickens and Alan Manning. Spikes and spill-overs: the impact of the national minimum wage on the wage distribution in a low-wage sector, 2004b.
- John DiNardo, Nicole M Fortin, and Thomas Lemieux. Labor market institutions and the distribution of wages, 1973-1992: A semiparametric approach. *Econometrica*, pages 1001–1044, 1996.
- Mirko Draca, Stephen Machin, and John Van Reenen. Minimum wages and firm profitability. *American Economic Journal: Applied Economics*, 3(1):129–51, 2011.
- Arindrajit Dube and Attila Lindner. City limits: What do local-area minimum wages do? *Journal of Economic Perspectives*, 35(1):27–50, 2021.
- Arindrajit Dube, Suresh Naidu, and Michael Reich. The economic effects of a citywide minimum wage. *Industrial and Labor Relations Review*, 60(4):522–543, 2007.
- Arindrajit Dube, T William Lester, and Michael Reich. Minimum wage effects across state borders: Estimates using contiguous counties. *The review of economics and statistics*, 92(4):945–964, 2010.
- Arindrajit Dube, T William Lester, and Michael Reich. Minimum wage shocks, employment flows, and labor market frictions. *Journal of Labor Economics*, 34(3):663–704, 2016.
- Zvi Eckstein, Suqin Ge, and Barbara Petrongolo. Job and wage mobility with minimum wages and imperfect compliance. *Journal of Applied Econometrics*, 26(4):580–612, 2011.
- Hartmut Egger, Peter Egger, and James R Markusen. International welfare and employment linkages arising from minimum wages. *International Economic Review*, 53(3):771–790, 2012.
- W Even and D Macpherson. Where does the minimum wage bite hardest in california? *Journal of Labor Research*, 40:1–23, 2019. doi: 10.1007/s12122-018-9281-z.
- William E Even and David A Macpherson. The wage and employment dynamics of minimum wage workers. *Southern Economic Journal*, pages 676–690, 2003.
- Armin Falk, Ernst Fehr, and Christian Zehnder. Fairness perceptions and reservation wages—the behavioral effects of minimum wage laws. *The Quarterly Journal of Economics*, 121(4):1347–1381, 2006.
- Nicole M Fortin and Thomas Lemieux. Institutional changes and rising wage inequality: Is there a linkage? *Journal of Economic Perspectives*, 11(2):75–96, 1997.
- Richard B Freeman. The minimum wage as a redistributive tool. *The Economic Journal*, 106(436):639–649, 1996.
- S Gilyard and M Podemska-Mikluch. Effects of local, state, and federal minimum wage on employment growth among teenagers in the restaurant industry. *International Advances in Economic Research*, 26:89–101, 2020. doi: 10.1007/s11294-020-09770-8.



- Laura Giuliano. Minimum wage effects on employment, substitution, and the teenage labor supply: Evidence from personnel data. *Journal of Labor Economics*, 31(1):155–194, 2013.
- Anna Godoey and Michael Reich. Are minimum wage effects greater in low-wage areas? *Industrial Relations: A Journal of Economy and Society*, 60(1):36–83, 2021.
- Radhakrishnan Gopalan, Barton H. Hamilton, Ankit Kalda, and David Sovich. State minimum wages, employment, and wage spillovers: Evidence from administrative payroll data. *Journal of Labor Economics*, 39(3): 673–707, 2021. doi: 10.1086/711355.
- Gilles Grenier. On compliance with the minimum wage law. *Journal of Political Economy*, 90(1):184–187, 1982.
- Andrew Harvey and Jared Bernstein. Measurement and testing of inequality from time series of deciles with an application to us wages. *Review of Economics and Statistics*, 85(1):141–152, 2003.
- Masanori Hashimoto. Minimum wage effects on training on the job. *The American Economic Review*, 72(5): 1070–1087, 1982.
- James J Heckman. What has been learned about labor supply in the past twenty years? *The American Economic Review*, 83(2):116–121, 1993.
- Mathias Hungerbühler and Etienne Lehmann. On the optimality of a minimum wage: New insights from optimal tax theory. *Journal of Public Economics*, 93(3-4):464–481, 2009.
- Ekaterina Jardim, Mark C Long, Robert Plotnick, Emma Van Inwegen, Jacob Vigdor, and Hilary Wething. Minimum wage increases, wages, and low-wage employment: Evidence from seattle. Technical report, National Bureau of Economic Research, 2017.
- Ekaterina Jardim, Mark C Long, Robert Plotnick, Emma Van Inwegen, Jacob Vigdor, and Hilary Wething. Minimum wage increases and individual employment trajectories. Technical report, National Bureau of Economic Research, 2018.
- Ekaterina Jardim, Mark C Long, Robert Plotnick, Emma van Inwegen, Jacob Vigdor, and Hilary Wething. Minimum wage increases and low-wage employment: Evidence from seattle. *American Economic Journal: Economic Policy*, 2020.
- William R Johnson and Edgar K Browning. The distributional and efficiency effects of increasing the minimum wage: a simulation. *The American Economic Review*, 73(1):204–211, 1983.
- Amg Kandilov and I Kandilov. The minimum wage and seasonal employment: Evidence from the us agricultural sector. *The Journal of Regional Science*, 60:612–627, 2020. doi: 10.1111/jors.12474.
- Lawrence F Katz and Alan B Krueger. The effect of the new minimum wage law in a low-wage labor market, 1991.
- Lawrence F Katz et al. Changes in the wage structure and earnings inequality. In *Handbook of Labor Economics*, volume 3, pages 1463–1555. Elsevier, 1999.
- Bruce E Kaufman. Institutional economics and the minimum wage: Broadening the theoretical and policy debate. *Industrial and Labor Relations Review*, 63(3):427–453, 2010.

- Hong Soon Kim and SooCheong Shawn Jang. Does a minimum wage increase endanger restaurant jobs? examining the role of franchising. *International Journal of Hospitality Management*, 84:102325, 2020.
- Winfried Koeniger, Marco Leonardi, and Luca Nunziata. Labor market institutions and wage inequality. *Industrial and Labor Relations Review*, 60(3):340–356, 2007.
- Alok Kumar. Capital tax, minimum wage, and labor market outcomes. *Review of Economic Dynamics*, 11(1): 133–154, 2008.
- David Lee and Emmanuel Saez. Optimal minimum wage policy in competitive labor markets. *Journal of Public Economics*, 96(9-10):739–749, 2012.
- David S Lee. Wage inequality in the united states during the 1980s: Rising dispersion or falling minimum wage? *The Quarterly Journal of Economics*, 114(3):977–1023, 1999.
- Andrew Leigh. Does raising the minimum wage help the poor? *Economic Record*, 83(263):432–445, 2007.
- Thomas Lemieux. The changing nature of wage inequality. *Journal of Population Economics*, 21(1):21–48, 2008.
- Sebastian Link. The price and employment response of firms to the introduction of minimum wages. 2019.
- Dara Lee Luca and Michael Luca. Survival of the fittest: the impact of the minimum wage on firm exit. Technical report, National Bureau of Economic Research, 2019.
- Alan Manning. The elusive employment effect of the minimum wage. *Journal of Economic Perspectives*, 35(1):3–26, 2021.
- Jonathan Meer and Jeremy West. Effects of the minimum wage on employment dynamics. *Journal of Human Resources*, 51(2):500–522, 2016.
- Jacob Mincer and Linda S Leighton. Effect of minimum wages on human capital formation, 1980.
- David Neumark and Scott Adams. Do living wage ordinances reduce urban poverty? *Journal of Human Resources*, 38(3):490–521, 2003.
- David Neumark and Olena Nizalova. Minimum wage effects in the longer run. *Journal of Human resources*, 42(2):435–452, 2007.
- David Neumark and Peter Shirley. Myth or measurement: What does the new minimum wage research say about minimum wages and job loss in the united states? Technical report, National Bureau of Economic Research, 2021.
- David Neumark and William Wascher. Minimum wages and training revisited. *Journal of Labor Economics*, 19(3):563–595, 2001.
- David Neumark and William Wascher. Does a higher minimum wage enhance the effectiveness of the earned income tax credit? *Industrial and Labor Relations Review*, 64(4):712–746, 2011.
- David Neumark, Mark Schweitzer, and William Wascher. Minimum wage effects throughout the wage distribution. *Journal of Human Resources*, 39(2):425–450, 2004.
- David Neumark, Mark Schweitzer, and William Wascher. The effects of minimum wages on the distribution of family incomes a nonparametric analysis. *Journal of Human Resources*, 40(4):867–894, 2005.

- David Neumark, JM Ian Salas, and William Wascher. Revisiting the minimum wage–employment debate: Throwing out the baby with the bathwater? *Industrial and Labor Relations Review*, 67(3\_suppl):608–648, 2014.
- Michael Reich, Sylvia Allegretto, and Anna Godoey. Seattle’s minimum wage experience 2015-16. Available at SSRN 3043388, 2017.
- Joseph J Sabia. The effects of minimum wage increases on retail employment and hours: New evidence from monthly cps data. *Journal of Labor Research*, 30(1):75–97, 2009.
- Joseph J Sabia. The effects of minimum wages over the business cycle. *Journal of Labor Research*, 35(3): 227–245, 2014.
- Joseph J Sabia and Richard V Burkhauser. Minimum wages and poverty: will a \$9.50 federal minimum wage really help the working poor? *Southern Economic Journal*, 76(3):592–623, 2010.
- Joseph J Sabia, Richard V Burkhauser, and Benjamin Hansen. Are the effects of minimum wage increases always small? new evidence from a case study of new york state. *Industrial and Labor Relations Review*, 65 (2):350–376, 2012.
- John Schmitt, David Rosnick, et al. The wage and employment impact of minimum-wage laws in three cities. *Center for Economic and Policy Research*. <http://www.cepr.net/documents/publications/min-wage-2011-03.pdf>, 2011.
- Fabián Slonimczyk and Peter Skott. Employment and distribution effects of the minimum wage. *Journal of Economic Behavior & Organization*, 84(1):245–264, 2012.
- Isaac Sorkin. Are there long-run effects of the minimum wage? *Review of economic dynamics*, 18(2):306–333, 2015.
- Coen N Teulings. The contribution of minimum wages to increasing wage inequality. *The Economic Journal*, 113(490):801–833, 2003.
- Evan Totty. The effect of minimum wages on employment: A factor model approach. *Economic Inquiry*, 55(4): 1712–1737, 2017.
- Gerard J Van den Berg and Geert Ridder. An empirical equilibrium search model of the labor market. *Econometrica*, pages 1183–1221, 1998.
- Wuyi Wang, Peter CB Phillips, and Liangjun Su. The heterogeneous effects of the minimum wage on employment across states. *Economics Letters*, 174:179–185, 2019.
- David Weil. Public enforcement/private monitoring: Evaluating a new approach to regulating the minimum wage. *Industrial and Labor Relations Review*, 58(2):238–257, 2005.
- Paul Wolfson and Dale Belman. The minimum wage: Consequences for prices and quantities in low-wage labor markets. *Journal of Business & Economic Statistics*, 22(3):296–311, 2004.
- Madeline Zavodny. The effect of the minimum wage on employment and hours. *Labour Economics*, 7(6): 729–750, 2000.

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## B Additional Tables

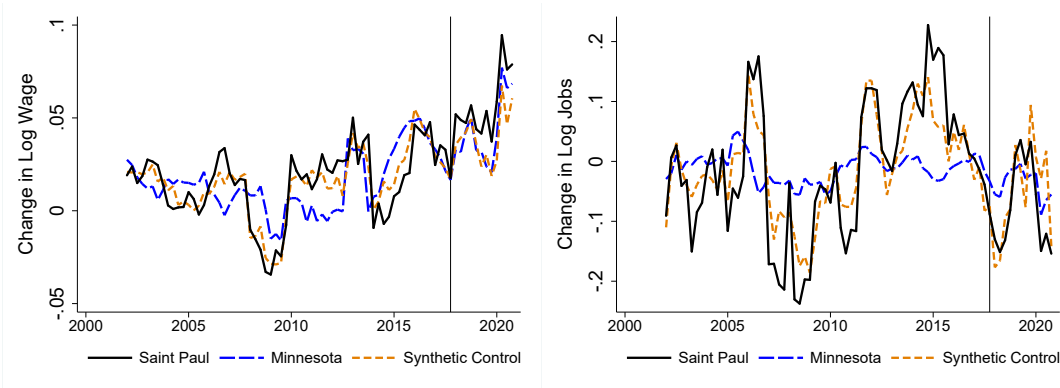
**Table A.1:** Time Line For Minimum Wage Ordinance in Saint Paul

2017	Discussions about raising Saint Paul minimum wage begin.
Nov. 2017	The Saint Paul City Council commissions Citizen's League to study feasibility and implementation of wage hike.
Jan. 2018	First phase of Minneapolis minimum wage increases goes into effect.
Feb. 2018	Newly elected Saint Paul mayor Melvin Carter affirms commitment to raising minimum wage to \$15.
Aug. 2018	Citizen's League releases Phases 1 and 2 of report on Saint Paul minimum wage, recommending an increase to \$15.
Oct. 2018	Saint Paul Mayor Carter and City Council Member Chris Tolbert propose minimum wage ordinance.
Nov. 2018	Saint Paul City Council approves ordinance raising city minimum wage to \$15 by 2027.
Jan. 2020	First phase of Saint Paul minimum wage increase goes into effect.

# C Additional Figures

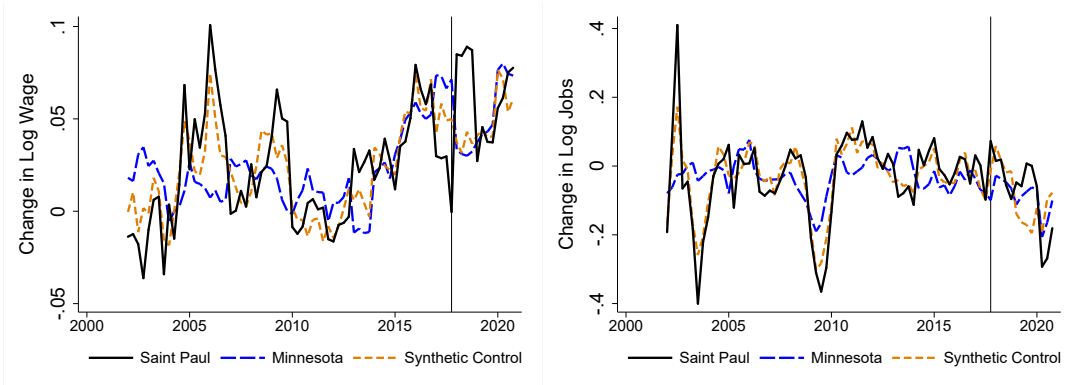
In this appendix section, we plot the growth in the hourly wages<sup>13</sup> and the total number of jobs between 2001(1) and 2020(4) for each of the low wage industries described in the paper. All series are expressed in yearly growth rates. The solid lines depict the series for Saint Paul. The long-dashed blue lines show the growth of wages and jobs for the average of all cities in Minnesota besides Minneapolis and Saint Paul. The dashed orange line shows the growth of wages and jobs for the synthetic control of Saint Paul, which is the *weighted* average of cities in Minnesota other than Minneapolis and Saint Paul. Using synthetic difference-in-differences, we can visualize the treatment effect of the minimum wage increase as the difference between the dashed orange line and the solid line in the post-2018 period. As mentioned before, the changes observed in 2020 should be interpreted with caution because this period coincides with the pandemic and civil unrest.

Figure 2: Retail Sector (44)

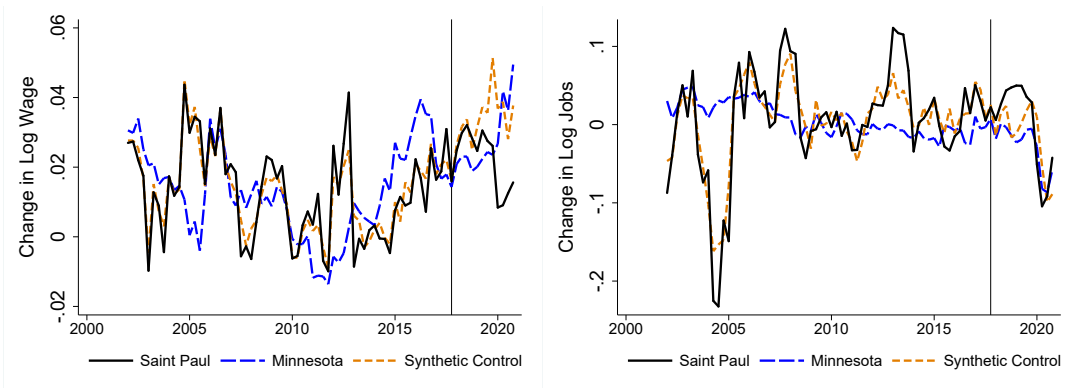


<sup>13</sup>Average hourly wage, excluding the highest-paying 25 percent of jobs.

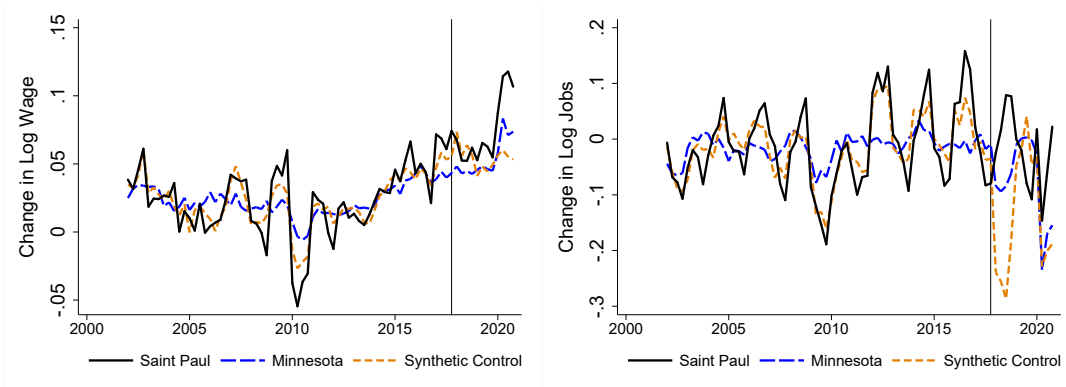
**Figure 3: Administration and Support (56)**



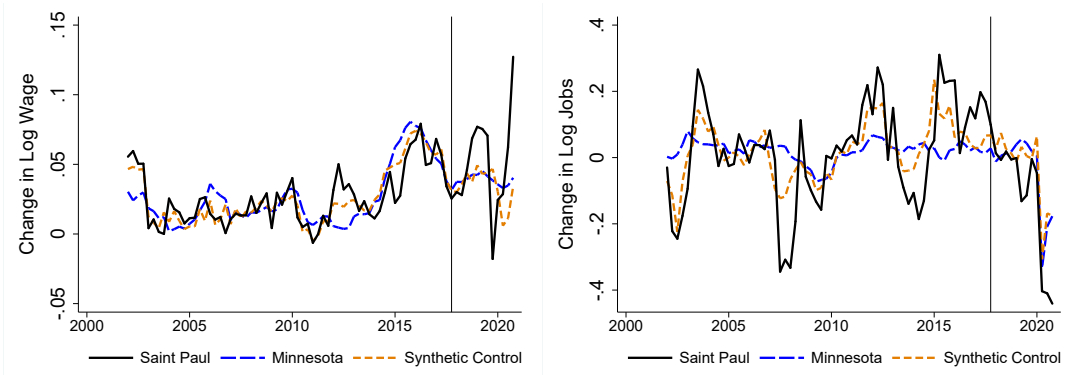
**Figure 4: Health Care and Social Assistance (62)**



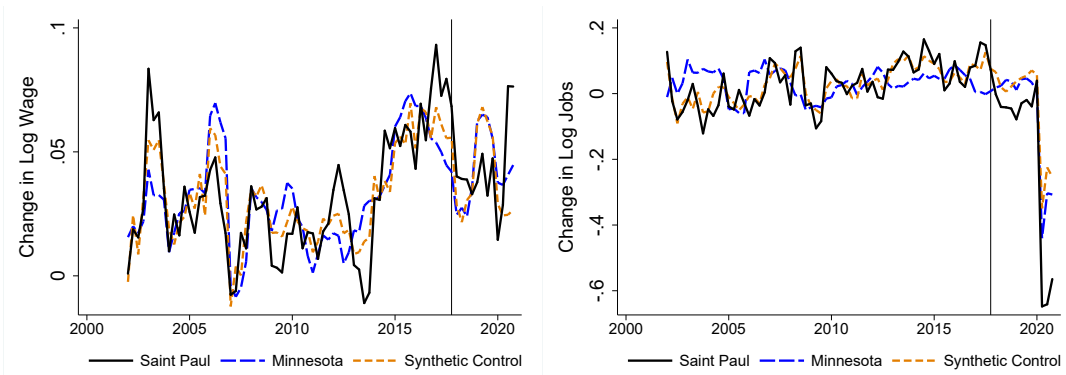
**Figure 5: Other Services (81)**



**Figure 6: Accommodation and Food Services (72)**



**Figure 7: Full-Service Restaurants (722511)**



**Figure 8: Limited-Service Restaurants (722513)**

