Examining the Effects of Minimum Wage Laws on Part-Time Employment

Odysseus Pyrinis

April 2021

Department of Economics
University of California, Berkeley

Undergraduate Honors Thesis
Advised by Professor Christopher Walters[1]

Abstract

Simple economic theory suggests that imposing a minimum wage will shift the labor market equilibrium up the labor demand curve, thereby reducing employment. However, numerous studies have demonstrated that raising the minimum wage in states within the U.S. does not have a significant effect on employment for minimum wage jobs. In this paper, I examine whether the expected effect on employment induced by an increase to a state's or county's minimum wage can be captured through part-time employment. I use a difference in differences research design comparing California and Oregon, for the state analysis, and between San Francisco County and Orange County, for the county analysis. I find that there is no statistically significant effect on the part-time employment ratio when a state increases its minimum wage but there is a positive, statistically significant effect on the part-time employment ratio when a county increases its minimum wage.

Keywords: Part-Time, Minimum Wage, Employment;

[1] I sincerely thank Professor Walters for his feedback and guidance throughout the research and drafting of this thesis. His suggestions were invaluable to further refining the research design and considerations of this paper.

1 Introduction

The policy decision of raising a county, state, or national minimum wage is constantly debated as a potential economic solution to reducing the wage gap within the United States. On the one hand, advocates of raising the minimum wage demonstrate that minimum wage employees would enjoy a higher standard of living as a result of their increased wages. On the other hand, opponents to raising the minimum wage frequently cite textbook economic models of competitive labor markets suggesting that employment would decrease in response to artificially increasing the labor market's minimum wage above its point of equilibrium. This prediction formalizes the intuition that a binding minimum wage increases the cost of employment, thereby reducing the demand for employees and resulting in lower employment figures (Stigler, 1946).

However, the current literature, which is reviewed in the next section, has demonstrated that increasing the minimum wage has had little to no impact on either employment figures or working hours of full-time employees, especially in the fast-food industry which relies on minimum-wage employment (Card & Kreuger, 1993; Stewart & Swaffield, 2008). Attempting to identify an explanation for the counterintuitive observation that raising the minimum wage induces insignificant effects on employment figures, Metcalf concludes that managers of minimum wage employees practice cost-cutting by means other than decreasing their employment figures (Metcalf, 2008). More generally, the findings of previous studies suggest that there is another margin of adjustment affected by the minimum wage which has not yet been measured empirically. An aspect of the minimum wage which has not been studied in the current literature is the effect that minimum wage laws have on part-time employment, rather than general employment figures.

In this paper, I will examine the effect of the minimum wage on part-time employment among low-wage workers. For the analysis section, I conduct two separate difference in differences analyses: one to determine part-time employment effects at the state level and a second to determine part-time employment effects at the county level. I look at both state and county policy changes to assess whether the equilibrium effects of a minimum wage differ depending on local vs. state-wide adoption. I utilize California and Oregon for the state-level analysis due to California maintaining a state minimum wage of $8.00 over a time period where Oregon raised its minimum wage from $8.50 to $8.80. Likewise, I utilize Orange County and San Francisco County in California for the county-level analysis since Orange County maintained a minimum wage rate of $9.00 over a time period where San Francisco County increased its county minimum wage from $11.05 to $12.25. Both the state and county level analysis use data from IPUMS Current Population Survey (CPS). Specifically, monthly data from June 2011 to August 2012 for the states of California and Oregon will be used to determine the state-level effect of the minimum wage on part-time employment and monthly data from January 2015 to October 2015 for the counties of San Francisco and Orange in California will be used to determine the county-level effect of the minimum wage on part-time employment.

In the analysis of the state and county level effects of raising the minimum wage on part-time employment, I first demonstrate that outcomes for the treatment and control groups in my study move in parallel prior to the policy change, which suggests that my research design is valid. I then perform a difference in differences analysis on the state and county level controlling for variables such as age and industry. The analysis of the data does not indicate any statistically significant effect on part-time employment as a result of a state increasing its minimum wage but does indicate a statistically significant positive effect on part-time employment as a result of a

county increasing its minimum wage. A potential explanation as to why the part-time employment ratio increased rather than decreased is that the labor market may not be perfectly competitive. A monopsonistic labor market exhibiting imperfect competition would suggest that an increase in the minimum wage could have a positive effect on employment.

The rest of the paper will be organized as follows. Section 2 provides a brief overview of the current literature on the minimum wage and its effect on employment. Section 3 outlines the data I use to conduct the study and Section 4 describes the empirical strategy for testing whether raising the state or county minimum wage resulted in a change to part-time employment. Section 5 of the paper presents the results generated by the difference in differences analysis along with a discussion of the determined results. The paper concludes with Section 6 providing an overview of the study conducted in the paper and its contribution to the existing literature.

2 Literature Review

There have been numerous studies conducted to determine the effects of minimum wage laws on employment and working hours within industries that are suspected to be most impacted due to their reliance on minimum-wage employment, such as the fast-food industry.

Card and Krueger conducted a difference in differences study to determine the effects of minimum wage on the fast-food industry using Pennsylvania as the control group, which did not pass a new minimum wage law, and New Jersey as the treatment group, which raised their minimum wage (Card & Kreuger, 1993). Card and Kreuger collected data for their regression model by contacting fast-food franchise locations in both New Jersey and Pennsylvania in two phases: the first phase of the survey was conducted in late February and early March of 1992, prior to New Jersey's adoption of a higher minimum wage, and the second phase of the survey was conducted in November and December of 1992, approximately eight months after New Jersey

increased its state-wide minimum wage. They concluded that in the fast-food industry, New Jersey experienced an increase in employment after implementing the new minimum wage and, in general, the cost burden associated with the higher employment cost was passed on to the consumers through higher prices on food items. Card and Krueger also noted that in their study, the effect of minimum wage on the fraction of full-time to part-time employees was ambiguous.

Similar to the Card and Kreuger paper, Steward and Swaffield conducted a difference in differences study in the UK to determine the effects of a national minimum wage on working hours for low-income workers (Stewart & Swaffield, 2008). Steward and Swaffield used data from the annual New Earnings Survey, ranging from April 1994 to April 2000, and quarterly data from the Labour Force Survey, ranging from the first quarter of 1997 to the third quarter of 2000. The authors concluded that both male and female low-wage workers experienced an overall hour or two decrease in their working hours per week as a result of the national minimum wage increase. Additionally, Stewart and Swaffield determined that the effect of the national minimum wage on overtime hours was insignificant for both men and women.

Furthermore, David Metcalf contemplated several potential explanations to his inquiry of why the British national minimum wage had little to no impact on employment (Metcalf, 2008). One of the potential explanations Metcalf considers is the manipulation of working hours rather than employment numbers pursued by businesses in their attempt to reduce the additional operating costs resulting from the higher minimum wage. The author notes that previous studies focusing on general employment numbers of specific industries failed to identify any significant effects to employment as a result of changes to the minimum wage; however, a slight decrease to employee working hours has been identified, such as the conclusions reached by Stewart and Swaffield. Thus, Metcalf suggests that managers and businesses are proactive about reducing

some of their additional operating costs in response to an increase in the minimum wage, further suggesting that another potential variable in the labor market is being affected by minimum wage laws which has not yet been studied.

Straying away from the focus of the current quantitative and qualitative literature on minimum wages, Manning explores, from a purely theoretical standpoint, the potential effects of minimum wage on employment, ultimately concluding that the effect of a minimum wage on employment is theoretically ambiguous (Manning, 2016). Instead of performing quantitative studies on general employment, Manning suggests that further research efforts be dedicated to creating a model that would estimate the maximum minimum wage that can be adopted before adverse effects are experienced by the economy. The author argues that the critical question to answer is not a matter of if the minimum wage negatively affects employment but rather at what point does the minimum wage have a significant negative impact on employment. Thus, determining an upper boundary for minimum wage would be more beneficial than continually polling the labor market to determine if the minimum wage was raised excessively.

2.1 Strengths and Limitations of the Literature

Substantial work has been done with regards to minimum-wage effects on overall employment in the currently existing literature. Some papers, such as the analysis performed by Stewart and Swaffield, highlight a slight reduction in the working hours of full-time employees after a minimum wage is placed into effect, but the general consensus is that the minimum wage does not negatively impact employment, as demonstrated by Card and Kreuger and evidenced by Metcalf. However, the quantitative studies which determine whether the level of employment is affected by the adoption of a higher minimum wage focus on general employment numbers, typically consisting of full-time employees, while failing to consider part-time employees

separately. Additionally, the current literature tends to focus on national minimum wages, such as in the UK, or state mandated minimum wages, such as between Pennsylvania and New Jersey. Although setting the scope of the study to either the national or state level minimum wage are both important, examining county-level minimum wages is seldom the focus in the currently existing literature and has the potential to reveal the impact of minimum wage laws. A possible consideration is that businesses at the county level could more easily relocate labor-intensive operations to a different county while interstate or international mobility is more prohibitive to a business. This paper will fill the void in the current literature by focusing on the impact of minimum wage laws on part-time employment at both the state and county level.

3 Data

To perform the state difference in differences analysis, I will be using data from IPUMS Current Population Survey (CPS) that is recorded on a monthly basis. Specifically, I will be using data from June 2011 to August 2012 in order to visualize data several months before and after Oregon increased its minimum hourly wage to $8.80 from $8.50. During this time frame, California's minimum hourly wage remained unchanged at $8.00. The sample size for Oregon is approximately 1,270 per month and the sample size for California is approximately 7,190 per month.

Similarly, to perform the county difference in differences analysis, I will be using data from IPUMS CPS that is recorded on a monthly basis. I will be using data from January 2015 to October 2015 in order to visualize data several months before and after San Francisco increased its minimum hourly wage to $12.25 from $11.05. During this time frame, the minimum wage within the major cities of Orange County remained unchanged at the state-level minimum wage of $9.00.

The sample size for San Francisco County is approximately 160 per month and the sample size for Orange County is approximately 600 per month.

For both regressions, the main outcome variable of interest will be the fraction of part-time employment for each state and county. The independent variables will include: a dummy variable to indicate the treatment state or county and a dummy variable to indicate whether the time period is before or after the minimum wage is increased. The control variables include the age of the workers and the industry of employment. Age will be categorized into three groups: young workers (age 18 – 30), established workers (age 31 – 49), and senior workers (age 50 – 64). Industry will be categorized into seven groups: construction or manufacturing, retail, lodging or transportation, restaurants, wholesalers, services or utilities, and other or unspecified. Summary statistics for the three age groups in each state and county for part-time employees can be found in Table 1. Likewise, summary statistics for the three age groups in each sampled state and county for full-time employees is presented in Table 2. I observe from the summary statistics for age groups among the compared states and counties to be well matched, featuring very similar statistics for each age group compared. Additionally, the ratio of part-time workers for each industry category (Construction/Manufacturing, Retail, Lodging/Transportation, Restaurants, Wholesalers, Services/Utilities, and Other/Unspecified) within each state and county sampled is presented in Table 3. Likewise, Table 4 displays the ratio of full-time workers for each industry category within each state and county sampled. I observe that the ratios between part-time and full-time employment within each industry is roughly similar between California and Oregon; however, Orange County has a much higher ratio of part-time employees within the restaurant and lodging/transportation industries than San Francisco County. I will be accounting for any effect

on part-time employment caused by each categorized industry by including industry control variables when running the regressions.

Table 1: Summary Statistics for Age Groups of Part-Time Employees

	N	Mean	St. Dev.	Median	Min	Max
California						
Age Group (18 - 30)	6478	23.409	3.597	23	18	30
Age Group (31 - 49)	6966	40.135	5.447	40	31	49
Age Group (50 - 64)	4687	56.342	4.255	56	50	64
Oregon						
Age Group (18 - 30)	1085	23.509	3.781	23	18	30
Age Group (31 - 49)	1308	39.798	5.479	40	31	49
Age Group (50 - 64)	1149	56.823	4.111	57	50	64
Orange County						
Age Group (18 - 30)	370	22.568	3.289	22	18	30
Age Group (31 - 49)	396	39.904	5.265	40	31	49
Age Group (50 - 64)	223	56.350	4.013	56	50	64
San Francisco County						
Age Group (18 - 30)	79	24.658	3.945	26	18	30
Age Group (31 - 49)	122	39.754	5.314	40	31	49
Age Group (50 - 64)	54	55.907	4.743	55	50	64

Notes: This table reports summary statistics for part-time employees who are classified within the three defined age groups for the states of California and Oregon in addition to the counties of Orange and San Francisco in California. Among the summary statistics for each age group given a sample state or county are included the sample count for the age group, the mean age group, the standard deviation of ages, the median age, the minimum age, and the maximum age.

Table 2: Summary Statistics for Age Groups of Full-Time Employees

	N	Mean	St. Dev.	Median	Min	Max
California						
Age Group (18 - 30)	25105	24.144	3.847	24	18	30
Age Group (31 - 49)	38255	40.063	5.493	40	31	49
Age Group (50 - 64)	27316	56.480	4.304	56	50	64
Oregon						
Age Group (18 - 30)	3514	24.419	3.845	25	18	30
Age Group (31 - 49)	5788	39.842	5.386	40	31	49
Age Group (50 - 64)	5064	56.742	4.308	57	50	64
Orange County						
Age Group (18 - 30)	1181	23.707	3.717	24	18	30
Age Group (31 - 49)	2246	40.223	5.335	40	31	49
Age Group (50 - 64)	1632	56.654	4.360	57	50	64
San Francisco County						
Age Group (18 - 30)	438	25.557	3.335	26	18	30
Age Group (31 - 49)	606	39.167	5.489	39	31	49
Age Group (50 - 64)	311	56.174	4.199	56	50	64

Notes: This table reports summary statistics for full-time employees who are classified within the three defined age groups for the states of California and Oregon in addition to the counties of Orange and San Francisco in California. Among the summary statistics for each age group given a sample state or county are included the sample count for the age group, the mean age group, the standard deviation of ages, the median age, the minimum age, and the maximum age.

Table 3: Ratio of Sampled Part-Time Workers within Each Industry Group

	Ratio
California	
Construction/Manufacturing	0.156
Retail	0.304
Lodging/Transportation	0.177
Restaurants	0.379
Wholesalers	0.136
Services/Utilities	0.239
Other/Unspecified	0.095
Oregon	
Construction/Manufacturing	0.153
Retail	0.308
Lodging/Transportation	0.239
Restaurants	0.464
Wholesalers	0.127
Services/Utilities	0.291
Other/Unspecified	0.115
Orange County	
Construction/Manufacturing	0.114
Retail	0.279
Lodging/Transportation	0.300
Restaurants	0.429
Wholesalers	0.138
Services/Utilities	0.217
Other/Unspecified	0.085
San Francisco County	
Construction/Manufacturing	0.081
Retail	0.259
Lodging/Transportation	0.085
Restaurants	0.278
Wholesalers	0.194
Services/Utilities	0.162
Other/Unspecified	0.111

Notes: This table reports the ratio of part-time employees classified by the industry they work in for the states of California and Oregon in addition to the counties of Orange and San Francisco in California.

Table 4: Ratio of Sampled Full-Time Workers within Each Industry Group

	Ratio
California	
Construction/Manufacturing	0.844
Retail	0.696
Lodging/Transportation	0.823
Restaurants	0.620
Wholesalers	0.864
Services/Utilities	0.761
Other/Unspecified	0.905
Oregon	
Construction/Manufacturing	0.847
Retail	0.692
Lodging/Transportation	0.761
Restaurants	0.536
Wholesalers	0.873
Services/Utilities	0.709
Other/Unspecified	0.885
Orange County	
Construction/Manufacturing	0.886
Retail	0.721
Lodging/Transportation	0.700
Restaurants	0.570
Wholesalers	0.862
Services/Utilities	0.783
Other/Unspecified	0.915
San Francisco County	
Construction/Manufacturing	0.919
Retail	0.741
Lodging/Transportation	0.915
Restaurants	0.721
Wholesalers	0.806
Services/Utilities	0.838
Other/Unspecified	0.889

Notes: This table reports the ratio of full-time employees classified by the industry they work in for the states of California and Oregon in addition to the counties of Orange and San Francisco in California.

4 Empirical Strategy

I will conduct a difference in differences analysis to determine the impact of the minimum wage on part-time employment. I will also perform a robustness check on the difference in differences analysis by establishing in the next section that trends in outcomes for part-time employment in California and Oregon are roughly parallel prior to Oregon raising the minimum wage. The same parallel trends assumption will be demonstrated for San Francisco County and Orange County prior to San Francisco increasing their local minimum wage.

I will run the following regression for the state difference in differences analysis:

$$PT_{it} = \beta_1 + \beta_2 D_i + \beta_3 Y_t + \rho(D_i * Y_t) + \beta' X_{it} + \epsilon_{it} \quad (1)$$

In the regression, the dependent variable (PT_{it}) represents the part-time employment variable which varies by state and month and is measured in the regression with a dummy variable indicating whether or not each sampled individual is a part-time worker. The dummy variable (D_i) equals 1 if the person sampled lives in Oregon, the treatment state, and 0 if the person sampled lives in California, the control state. The dummy variable (Y_t) equals 1 if the sample statistic is after Oregon raised its minimum wage, and 0 if the sample statistic is before Oregon raised its minimum wage. (X_{it}) is a vector of control variables to account for the three age groups and seven industry categories I defined in the data section. Additionally, I also run a regression that includes an extra dummy variable in the control vector indicating whether the sampled individual is typically a part-time worker.

After performing the state-level analysis, I run the regression (equation 1) again but this time for the county difference in differences analysis. Like before, the dependent variable (PT_{it}) is the part-time employment variable which varies by county and month and is measured in the regression with a dummy variable indicating whether or not each sampled individual is a part-time

worker. The dummy variable (D_i) equals 1 if the person sampled lives in San Francisco County, the treatment county, and 0 if the person sampled lives in Orange County, the control county. The dummy variable (Y_t) equals 1 if the sample statistic is after San Francisco County raised its minimum wage, and 0 if the sample statistic is before San Francisco County raised its minimum wage. (X_{it}) is a vector of control variables to account for the three age groups and seven industry categories I defined in the data section. Additionally, I also run a regression that includes an extra dummy variable in the control vector indicating whether the sampled individual is typically a part-time worker.

5 Analysis and Results

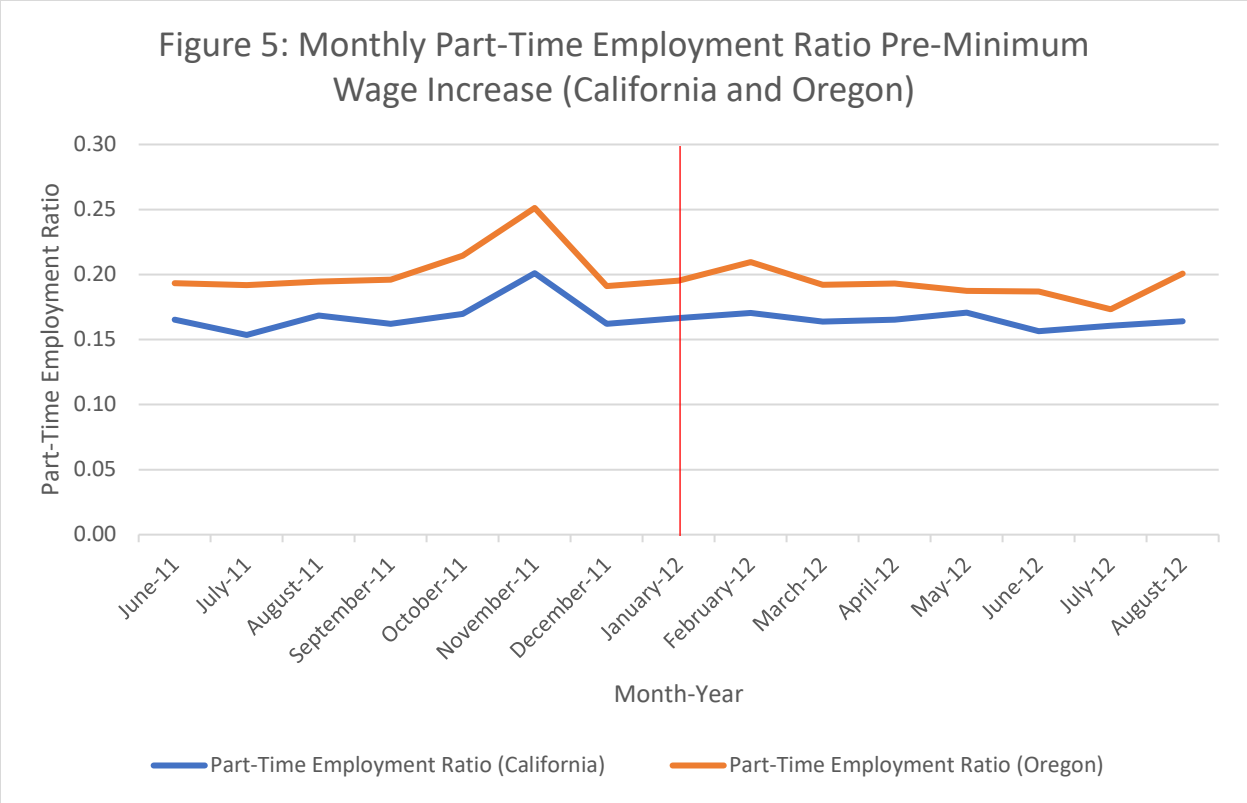
5.1 Hypotheses

This paper will focus on determining the effects of minimum wage on part-time employment. I will be testing the null hypothesis that an increase in the minimum wage has no effect on the part-time employment ratio at both the state and county level. To determine whether I can reject this null hypothesis, I will be conducting two, separate difference in differences analysis. First, I will conduct the difference in differences analysis between the states of California and Oregon from June 2011 to August 2012 to determine the impact on part-time employment when the state minimum wage is increased. I will then conduct a separate difference in differences analysis between San Francisco County and Orange County from January 2015 to October 2015 to determine the impact on part-time employment when the local minimum wage is increased above the state minimum wage.

5.2 Parallel Trends Assumption

To conduct the difference in differences analysis for when a state increases its minimum wage, I will be using IPUMS CPS monthly data from June 2011 to August 2012 for the states of California and Oregon. During this time frame, Oregon raised its minimum wage from $8.50 to $8.80, effective January 1, 2012, while California maintained its previous state minimum wage of $8.00. The difference in differences model will be used to determine whether part-time employment was affected by Oregon's minimum wage increase. In order to use the difference in differences approach, the parallel trends assumption must be satisfied during the pre-treatment period. Figure 5 displays the part-time employment ratio for both Oregon and California for seven months before Oregon raised its minimum wage and seven months after Oregon raised its minimum wage. The vertical red line in Figure 5 indicates when Oregon's new minimum wage took effect. It is observable from Figure 5 that the part-time employment ratio for California and Oregon do follow parallel trends during the pre-treatment period and I can therefore use these two states for the difference in differences analysis. I can also visually observe from the plotted part-time employment ratio after Oregon raised the minimum wage that no significant deviation from California's control trend is observable with Oregon's part-time employment ratio.

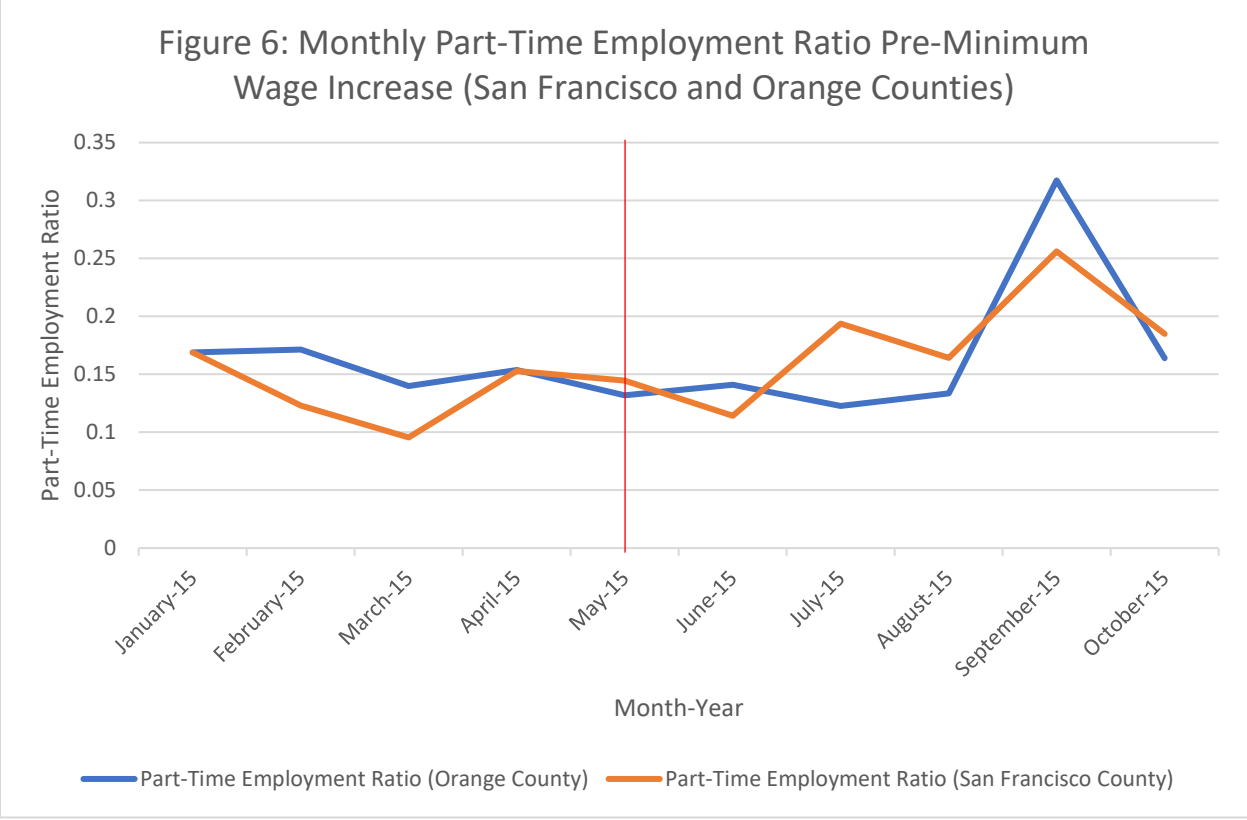
To conduct the difference in differences analysis for when a county increases its minimum wage, I will again be using IPUMS CPS monthly data from January 2015 to October 2015 for the counties of San Francisco and Orange in California. During this time frame, San Francisco County raised its county minimum wage from $11.05 to $12.25, effective May 2015, while Orange County maintained its previous county minimum wage at the state level of $9.00. I will use a difference in differences model to determine whether part-time employment was affected by San Francisco County's minimum wage increase. Once again, to use the difference in differences approach, the



parallel trends assumption must be satisfied during the pre-treatment period. Figure 6 displays the part-time employment ratio for both San Francisco County and Orange County for four months before San Francisco County raised its minimum wage and five months after San Francisco County raised its minimum wage. The vertical red line in Figure 6 indicates when San Francisco County's new minimum wage took effect.

It is observable from Figure 6 that the part-time employment ratio for Orange County and San Francisco County roughly follow parallel trends during the pre-treatment period. The greater variation in the part-time employment ratio is likely due to the reduced sample size at the county level in comparison to the much larger sample size for the state level analysis. Despite Orange County's and San Francisco County's rougher parallel trend in comparison to California and Oregon, San Francisco County's part-time employment ratio still exhibited the same trends as Orange County during the pre-treatment period. During the months where San Francisco County's

part-time employment ratio was declining, so was Orange County's and likewise when San Francisco County's part-time employment ratio began to increase in March 2015 during the pre-treatment period, Orange County's part-time employment ratio also trended upwards. Therefore, the two counties exhibited similar trends during the pre-treatment period and can be compared using a difference in differences analysis. I can also visually observe from the plotted part-time employment ratio after San Francisco County raised the minimum wage that a potential deviation from Orange County's control trend is observable with San Francisco County's part-time employment ratio, initially decreasing and then increasing above Orange County's part-time employment ratio before Orange County caught up with the higher part-time employment ratio. The initial increase to San Francisco's part-time employment ratio may be attributed to the minimum wage increase before some other market forces drove the part-time employment ratio for both counties upwards.



5.3 Description of Results

5.3.1 State Difference in Differences

The regression output for the state difference in differences analysis is summarized in Table 5. There were four regressions run to determine the effect of increasing the state minimum wage on part-time employment. The first regression only consisted of the treatment and time dummy variables for the difference in differences analysis without including any control variables. The second regression adds age control variables to the difference in differences analysis, categorized into the three age groupings previously defined. The third regression adds additional control variables to account for the industry worked by part-time employees. The fourth regression includes an additional control variable which identifies whether or not the sampled individual is typically a part-time worker.

The first regression for the state difference in differences analysis indicates that the estimated mean difference in part-time employment between California and Oregon prior to Oregon raising their minimum wage is 0.028, which is statistically significant with a p-value of less than 0.01. This means that Oregon's part-time employment ratio is estimated to be on average 2.8% higher than California's part-time employment ratio during the time period before Oregon raised its minimum wage. Additionally, the estimated mean change in part-time employment in California from before Oregon raised the minimum wage to after is -0.003, which is statistically significant with a p-value of less than 0.1. This means that California's part-time employment ratio is estimated to decrease by 0.3% over the time frame of observations from the pre-treatment period to the post-treatment period. The difference in differences estimator is also statistically significant with a p-value of less than 0.1 and suggests that the estimated mean change between California and Oregon's part-time employment as a result of Oregon raising the minimum wage

Table 5: Diff-in-Diff of Part-Time Employment in California and Oregon from June 2011 to August 2012

	Dependent variable:			
	Part-Time Employment			
	(1)	(2)	(3)	(4)
Treated Dummy	0.028^{***}	0.033^{***}	0.030^{***}	0.004
	(0.004)	(0.004)	(0.004)	(0.003)
Time Dummy	-0.003^{*}	-0.004^{*}	-0.004^{**}	-0.004^{***}
	(0.002)	(0.002)	(0.002)	(0.002)
Interaction	-0.010^{*}	-0.009^{*}	-0.007	0.003
	(0.005)	(0.005)	(0.005)	(0.004)
Age Group (18 - 30)		0.136^{***}	0.079^{***}	0.060^{***}
		(0.003)	(0.003)	(0.002)
Age Group (31 - 49)		0.085^{***}	0.035^{***}	0.053^{***}
		(0.003)	(0.003)	(0.002)
Age Group (50 - 64)		0.079^{***}	0.043^{***}	0.046^{***}
		(0.003)	(0.003)	(0.002)
Construction or Manufacturing			0.050^{***}	0.054^{***}
			(0.003)	(0.002)
Retail			0.192^{***}	0.100^{***}
			(0.004)	(0.003)
Lodging or Transportation			0.080^{***}	0.058^{***}
			(0.005)	(0.004)
Restaurants			0.274^{***}	0.141^{***}
			(0.005)	(0.004)
Wholesalers			0.030^{***}	0.030^{***}
			(0.007)	(0.005)
Utilities or Services			0.140^{***}	0.077^{***}
			(0.003)	(0.002)
Usually Part-Time				0.792^{***}
				(0.003)
Constant	0.153^{***}	0.071^{***}	0.059^{***}	0.016^{***}
	(0.001)	(0.003)	(0.002)	(0.002)
Observations	152,394	152,394	152,394	152,394
R^2	0.001	0.015	0.057	0.405
Adjusted R^2	0.001	0.015	0.057	0.405
Residual Std. Error	0.362 (df = 152390)	0.359 (df = 152387)	0.351 (df = 152381)	0.279 (df = 152380)
F Statistic	29.625^{***} (df = 3; 152390)	375.112^{***} (df = 6; 152387)	771.336^{***} (df = 12; 152381)	$7{,}975.337^{***}$ (df = 13; 152380)
Note:				*p<0.1; **p<0.05; ***p<0.01

Notes: This table shows the difference in differences estimator for the effect of state-level minimum wage laws on part-time employment controlling for various employee age groups and industries of employment.

is -0.010. This result suggests that raising the minimum wage at the state level has a negative impact on part-time employment. Thus, although the result of the difference in differences estimator is only significant with a p-value of less than 0.1, the first regression suggests that raising the minimum wage at the state level tends to result in a slight decrease to part-time employment.

The second regression for the state difference in differences analysis adds the age group control variables but results in little change to the difference in differences estimators. All three of the age group control variable estimators are statistically significant with p-values of less than 0.01 and indicate that younger workers, within the age group of 18 to 30, are significantly more likely to work for part-time jobs than the other two older age groups. In fact, the estimated positive effect that each age group contributes to the part-time employment ratio decreases as age increases which suggests that part-time employees are typically young workers rather than established or senior workers in the labor force.

The third regression for the state difference in differences analysis adds the industry control variables to the previous controls used in the second regression but again results in little change to the difference in differences estimator value which is still negative, though no longer statistically significant. All of the industry control variable estimators were statistically significant and capture the composition of employees within each industry and their contribution to part-time employment. As expected, the Restaurant industry and Retail industry were the two predominant industries most significantly employing a high percentage of part-time employees.

The fourth regression for the state difference in differences analysis adds another dummy variable indicating whether each sampled individual is typically a part-time employee by choice. The difference in differences estimator's value changed from being slightly negative to slightly positive suggesting that the effect on part-time employment ratio caused by Oregon raising its state

minimum wage was slightly positive, though the estimator is not statistically significant. The additional control variable is statistically significant and captures much of the variation observed in the dependent variable as indicated by the improved R^2 value of 0.405, which is much improved from the prior three regressions.

From the regression outputs for the state difference in differences analysis, I observe that raising the minimum wage, at the state level, does not have a statistically significant effect on the part-time employment ratio. However, the difference in differences estimator suggests that the part-time employment ratio is expected to increase slightly as a result of raising the minimum wage, though the results still remain fairly ambiguous. Constructing a 95% confidence interval for the difference in differences estimator from the fourth regression, I observe that the effect of state-level minimum wages on the part-time employment ratio can range from -0.00484 to 0.01084. The lower and upper boundaries provided by the confidence interval suggest that even if the effect of state-level minimum wages on part-time employment is negative, it is minimal given the small value of the lower bound for the 95% confidence interval.

5.3.2 County Difference in Differences

The regression output for the county difference in differences analysis is summarized in Table 6. Again, there were four regressions run to determine the effect of increasing the county minimum wage on the part-time employment ratio. Like for the state difference in differences analysis, the first regression only consisted of the treatment and time dummy variables. The second regression adds age control variables to the difference in differences analysis, categorized into the three age groupings previously defined. The third regression adds additional control variables to account for the industry groups in which employees work. The fourth regression

Table 6: Diff-in-Diff of Part-Time Employment in San Francisco County and Orange County from January 2015 to October 2015

	Dependent variable:			
	Part-Time Employment			
	(1)	(2)	(3)	(4)
Treated Dummy	−0.018	−0.025*	−0.043***	−0.032***
	(0.014)	(0.014)	(0.014)	(0.010)
Time Dummy	0.006	0.005	0.0003	0.008
	(0.008)	(0.008)	(0.008)	(0.006)
Interaction	0.023	0.027	0.044**	0.033**
	(0.018)	(0.018)	(0.018)	(0.013)
Age Group (18 - 30)		0.150***	0.092***	0.047***
		(0.012)	(0.012)	(0.009)
Age Group (31 - 49)		0.086***	0.043***	0.045***
		(0.010)	(0.011)	(0.008)
Age Group (50 - 64)		0.057***	0.027**	0.034***
		(0.011)	(0.011)	(0.009)
Construction or Manufacturing			0.015	0.033***
			(0.012)	(0.009)
Retail			0.170***	0.067***
			(0.014)	(0.011)
Lodging or Transportation			0.150***	0.079***
			(0.021)	(0.016)
Restaurants			0.287***	0.102***
			(0.018)	(0.014)
Wholesalers			0.051*	0.044**
			(0.027)	(0.020)
Utilities or Services			0.100***	0.066***
			(0.010)	(0.008)
Usually Part-Time				0.813***
				(0.010)
Constant	0.143***	0.067***	0.056***	0.011
	(0.006)	(0.010)	(0.010)	(0.008)
Observations	9,309	9,309	9,309	9,309
R^2	0.0004	0.019	0.063	0.453
Adjusted R^2	0.0001	0.019	0.062	0.452
Residual Std. Error	0.353 (df = 9305)	0.349 (df = 9302)	0.342 (df = 9296)	0.261 (df = 9295)
F Statistic	1.336 (df = 3; 9305)	30.571*** (df = 6; 9302)	52.353*** (df = 12; 9296)	592.726*** (df = 13; 9295)
Note:				*p<0.1; **p<0.05; ***p<0.01

Notes: This table shows the difference in differences estimator for the effect of county-level minimum wage laws on part-time employment controlling for various employee age groups and industries of employment.

includes an additional control variable which identifies whether or not the sampled individual is usually a part-time worker.

The first regression for the county difference in differences analysis indicates that the estimated mean difference in the part-time employment ratio between Orange and San Francisco counties, prior to San Francisco County raising their minimum wage, is -0.018. This means that San Francisco County's part-time employment ratio is estimated to be on average 1.8% lower than Orange County's part-time employment ratio during the time period before San Francisco County raised its minimum wage. Additionally, the estimated mean change in the part-time employment ratio in Orange County, from before San Francisco County raised the minimum wage to after, is 0.006. This means that Orange County's part-time employment ratio is estimated to increase by 0.6% over the time frame of observations from the pre-treatment period to the post-treatment period. However, not only is this estimated value not statistically significant, but also has a standard error greater than the estimated value. This is likely to due to the large fluctuation in Orange County's part-time employment ratio which is especially observable during the post-treatment period. Continuing, the difference in differences estimator is not statistically significant but suggests that the estimated mean change between Orange County and San Francisco County's part-time employment ratio as a result of San Francisco County raising the minimum wage is 0.023. This result suggests that raising the minimum wage at the county level has a positive impact on the part-time employment ratio. Thus, although the result of the difference in differences estimator is not statistically significant, the first regression suggests that raising the minimum wage at the county level tends to result in an increase to the part-time employment ratio.

The second regression for the county difference in difference analysis adds the age group control variables and results in a slight change to the difference in differences estimators. The

estimated mean difference in the part-time employment ratio between Orange and San Francisco counties, prior to San Francisco County raising their minimum wage, is now -0.025 and statistically significant with a p-value less than 0.1. This means that in this regression with age control variables, San Francisco County's part-time employment ratio is estimated to be on average 2.5% lower than Orange County's part-time employment ratio during the time period before San Francisco County raised its minimum wage. Additionally, the difference in differences estimator increased in value to 0.027, although remains statistically insignificant. With respect to the age group control variables, I observe the same pattern as with the state difference in differences analysis in that younger workers represent a greater proportion of part-time employees than older workers.

The third regression for the county difference in differences analysis adds the industry control variables to the previous controls used in the second regression and again results in a change to the difference in differences estimators. In the third regression, the difference in differences estimator is now statistically significant, with a p-value of less than 0.05, and suggests that the estimated mean change between Orange County and San Francisco County's part-time employment ratio as a result of San Francisco County raising the minimum wage is 0.044. This result suggests with a higher confidence that raising the minimum wage at the county level has a positive impact on the part-time employment ratio. With respect to the industry control variable estimators, I observe a similar pattern to the state difference in differences analysis in that the Restaurant industry and Retail industry were the two predominant industries that employed a high percentage of part-time employees followed closely by the lodging and transportation industry.

The fourth regression for the county difference in differences analysis adds another dummy variable indicating whether each sampled individual is typically a part-time employee by choice.

The difference in differences estimator's value decreased to 0.033 but remains statistically significant with a p-value less than 0.05 and reaffirming that raising the minimum wage at the county level has a positive impact on the part-time employment ratio. The additional control variable is statistically significant and captures much of the variation observed in the dependent variable as indicated by the improved R^2 value of 0.453, which is much improved from the prior three regressions.

From the regression outputs for the county difference in differences analysis, I observe that raising the minimum wage at the county level has a statistically significant effect on part-time employment and suggests that in response to a county minimum wage increase, part-time employment is expected to slightly increase. This observation is contradictory to the intuition from competitive labor market models which suggest that employment should decrease due to the higher cost of labor. One possible explanation for this observation follows the logic of Metcalf that businesses are minimizing their operating costs by relying more on part-time employment than full-time employment, hence the observed increase in the part-time employment ratio. Another possible explanation is that the labor market is not in perfect competition for the counties sampled. Considering a monopsonistic labor market rather than a labor market in perfect competition, it is entirely possible that an increase to the minimum wage has a positive effect on employment as long as the marginal product of labor is greater than its cost. Given that the previous literature, which has considered additional states and time periods than the ones presented in this study, observe similar effects on employment as discovered in this study, the monopsonistic labor market theory is more plausible.

5.3.3 Shortcomings

One drawback associated with the design of this study is that I utilize only one control and treatment group, observed over one time period for each, for both the state and county level analysis. Consequently, I cannot rule out the possibility that random shocks to the labor market, which are either group dependent or time dependent, are affecting the observed results. To account for the potential of state or county specific effects on the labor market, this research design can be improved upon by utilizing several states and counties for the state and county level analysis. Additionally, to account for the possibility of time-dependent shocks to the labor market, utilizing several time periods for each analysis would also improve the research design of this study. The additional states and counties would also enable the regressions to be run with clustering on the states and counties. I was unable to perform clustering on either the states or counties in this study which potentially resulted in underestimated standard errors for the regression statistics. The inclusion of additional control and treatment states and counties would enable a future research design to employ clustering on states and counties to obtain more accurate regression statistics that also account for state-specific effects to the labor market.

6 Conclusion

The current literature studying the impact of minimum wage laws on employment demonstrated that raising the minimum wage had little to no significant impact on employment figures. The results of these studies were surprising since classical economic thought would suggest that artificially driving the price of labor above the market equilibrium would result in labor demand decreasing; thus, employment should have decreased. This paper aimed to fill a void in the currently existing literature by observing the impact of minimum wage laws on part-time employment, a dependent variable that has not been focused on by previous literature.

Additionally, this paper does not focus on only observing the effects of state minimum wage laws, but also evaluates the effect on part-time employment when a county within a state raises their minimum wage.

In this paper, I observe the effects on the part-time employment ratio at the state level, between California and Oregon over a period of time where Oregon raises the state minimum wage while California does not, and at the county level, between Orange and San Francisco Counties over a period of time where San Francisco County raises the county minimum wage while Orange County does not. I demonstrated that the parallel trends assumption holds during the pre-treatment period for both states and both counties used in the subsequent difference in differences analysis. At the state level, I observe that the impact on the part-time employment ratio is not statistically significant as a result of Oregon raising its minimum wage, but the estimator suggests that a state raising its minimum wage has a slight positive effect on part-time employment. At the county level, I observe that the impact on the part-time employment ratio is statistically significant as a result of San Francisco County raising its minimum wage. The county difference in differences estimator suggests that a county raising its minimum wage has a positive effect on part-time employment.

One of the main shortcomings to this paper is that only one pair of states and counties are considered in the difference in differences analysis which makes it difficult to discount potential state or county specific effects on the labor market. Also, since only one time period for the state and county level analysis is considered, time-dependent shocks, which could have affected the observed results on part-time employment, cannot be discounted. Additionally, the inclusion of multiple control and treatment states and counties would allow for clustering on states or counties when running the difference in differences analysis, which would produce more accurate

estimators and standard errors. Nevertheless, I find that artificially raising the statutory minimum wage has a positive effect on the part-time employment ratio more-so at the county level than at the state level.

Works Cited

Card, David, and Alan B. Krueger. *Minimum wages and employment: A case study of the fast food industry in New Jersey and Pennsylvania*. No. w4509. National Bureau of Economic Research, 1993.

Manning, Alan. "The elusive employment effect of the minimum wage." (2016).

Metcalf, David. "Why has the British national minimum wage had little or no impact on employment?." *Journal of Industrial Relations* 50, no. 3 (2008): 489-512.

Sarah Flood, Miriam King, Renae Rodgers, Steven Ruggles and J. Robert Warren. Integrated Public Use Microdata Series, Current Population Survey: Version 8.0 [dataset]. Minneapolis, MN: IPUMS, 2020. https://doi.org/10.18128/D030.V8.0

Stewart, Mark B., and Joanna K. Swaffield. "The other margin: do minimum wages cause working hours adjustments for low-wage workers?." *Economica* 75, no. 297 (2008): 148-167.

Stigler, George J. "The economics of minimum wage legislation." *The American Economic Review* 36, no. 3 (1946): 358-365.