The Effect of Minimum Wage on a County by County Basis

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Abstract

This paper will consider the effect of an increase on minimum wage via low skilled employment. In particular, it will compare the impact of an increase on a flat versus an adjusted minimum wage on low skilled employment. This adjusted minimum wage takes into account the cost of living on a county by county basis.

Cost of living is heterogeneous among counties within a given state. Therefore, we would expect raising minimum wage by a flat amount would effect employment for one county different from another. Therefore, this paper seeks to investigate whether or not such differences exists.

Lastly, we would expect some correlation between our error term and unobservable factors among our regressors. Therefore, since we did not construct an IV and a random experiment was not conducted, our findings are not casual.

1. Introduction

Imagine paying a flat tax regardless of whether you earned $15,000 or $1,000,000? Policy makers tend form a general consensus for an adjusted tax rate based on income however fail to recognize the need of adjusted minimum wage given a county's cost of living. A flat $15 federal minimum wage would impose a detrimental impact on employment in places such as Adair, Kentucky where the median gross rent is only $498 per month. Therefore there are significant differences in cost living from the state level but in particular, the county base level. Therefore, his paper will not only seek to show that, controlling for cost of living, there exist significant differences in the impact of minimum wage on low skilled employment moreover, an adjusted minimum would have less of an negative impact than a flat federal or even statewide minimum wage.

Thus, this study will seek to investigate whether or not there exist a difference on the impact of an adjust vs flat minimum wage on low skilled employment. We find that, once we consider a minimum wage that is adjusted by the cost of living for a given county, it has less of a negative impact on low skilled employment.

First we will consider related work on the effects minimum wage has on employment. Next we will provide further description on the data, introduce the model and elaborate further on our findings.

2. Related Work

There are countless papers on the effect minimum wage has on employment and unemployment. Brown et al. (1982) considered a two-sector employment structure, they investigated the heterogeneity among workers(one of which makes less than minimum wage), and lastly they considered the effects regarding teenage and adult minimum wage separately. They found that workers who predominately make minimum wage are more incline to experience unemployment as the minimum wage increases. They also included industries such as farming for their low-skilled labor metric. They split teenage employment by subgroups: 16-17, 18-19 and 20-24 years. They also control for employment by race. They estimate a time-series model, $Y = f(MW, D, X_1, ..., X_n)$ for these subgroups on a macro level. Where Y is a measure of labor force status, MW measures the minimum wage, D is the aggregate business demand and X_i for all $i \in [1, n]$, denotes the exogenous explanatory variables.

They present their results on employment effects in terms of elasticities of minimum wage $\eta(E)$ (for double-log specification they use $\beta_i \cdot \frac{\overline{W_m}}{E/P}$ where W_m is the minimum wage and E/P is employment per capita). They found that, on average, holding all else equal, 10 percent increase on minimum wage lead to 1-3 percent decrease in teenage employment.

Meer and West(2015) find that minimum wage negatively effects employment gradually over the long run. They consider a standard panel fixed effect,

$$emp_{it} = \alpha_i + \tau_t + \gamma_i \cdot t + \beta_0 mw_{it} + \phi \cdot controls_{it} + \epsilon_{it}$$

Where "emp_{it} is the level of employment in jurisdiction i at time t, αi are jurisdiction fixed effects, τ_t are macroeconomic time period fixed effects, $\gamma_i \cdot t$ are jurisdiction-specific linear time trends, and ϵ_{it} is the idiosyncratic error term".(Meer and West 2015). They also use log-differences and distributed lag specifications. They ultimately find that mistakes may arise if true effects are dynamic and including jurisdiction-specific time trends will evoke an increase in bias

3. Data

The data for this study was obtained from the U.S. Census for the year 2014. Each dataset includes all US counties for each corresponding variable, thus 3,124 observations for year 2014 ACS estimates. The variables included in the dataset are: median gross rent(I use this as a proxy for cost of living), total population(population can be used as a proxy for urbanization versus rural), minimum wage (by state) and total employment by major industry. Since I want to specifically look at low skilled labor, I added total employment for low skilled industries such as food, construction, cleaning etc. and divided it by total employment for that county. This provided a variable specific to low skilled workers. I also created an index by dividing the countys median gross rent by the states median gross rent. I then took the product of the index by the states minimum wage. This gave me an adjusted minimum wage value by county within a given state.

Table A	
Variables	Definitions
minwage	state minimum wage
adjminwage	The product of wageindex*minwage
medgrossrent	median gross rent for that county
population	total population per county
wageindex	medgrossrent divided by *medgross_state*
lowskillemploy	I created this variable by adding up industries of low skill labor and dividing by the county's total employment

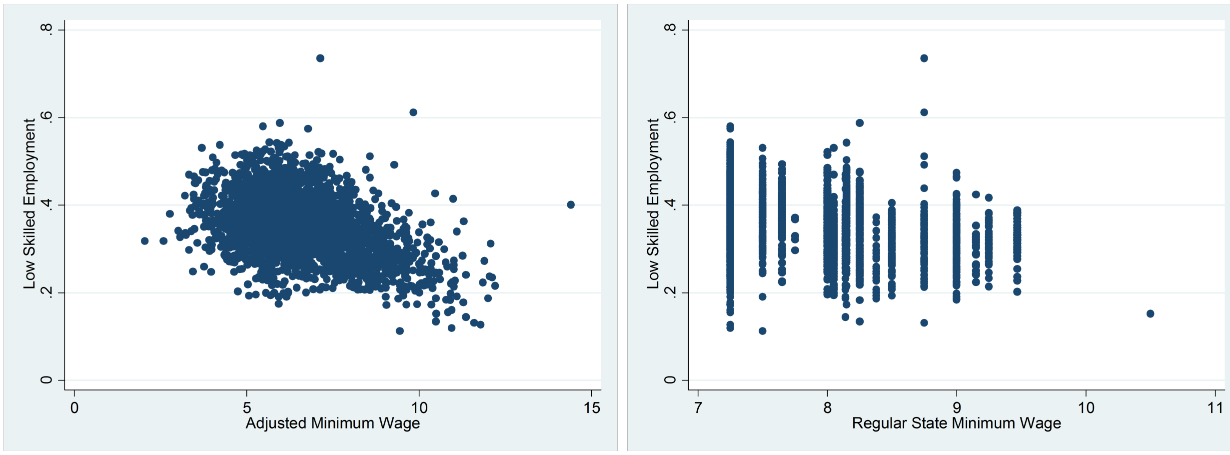
Table A includes the definitions for each regressor and the dependent variable, lowskillemploy. Note that we will conduct two separate regressions: one including the statewide minimum wage, minwage, while the second model considers the adjusted minimum wage, adjminwage.

Table 1. Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
population	99,970.428	319,922.183	73	9,974,203
medgrossrent	696.093	190.251	246	1,802
minwage	7.693	0.613	7.25	10.5
lowskillemploy	36.1	6.70	11.2	73.50
adjminwage	6.376	1.394	1.991	14.163

Notice that the adjusted minimum wage is less than the federal minimum wage. Also notice that on average the median gross rent per county in the United States is only $696 and the average population is less than 100,000. Granted, a minimum wage of $1.99 would seem absurd, however a \$6.38 may be a decent wage for places such as Adair, Kentucky. Whereas residents of Miami-Dade, Florida would require a \$11.24 minimum wage rather than the current \$8.05 (which would imply a 40% increase) in order to sustain current cost of living.

Figure 1. Adjusted versus state-wide minimum wage



(a) Adjusted Minimum Wage

(b) State-wide Minimum Wage

Table 2. Cross-correlation table

Variables	LowSkillEmploy	minWage	MedGrossRent	population	adjminwage
LowSkillEmploy	1.000				
minWage	-0.284	1.000			
MedGrossRent	-0.470	0.262	1.000		
population	-0.261	0.163	0.402	1.000	
adjminwage	-0.416	0.351	0.794	0.342	1.000

In figure 1a, each plot represents a given county. Notice that there are several counties that exceed a minimum wage of $10 whereas figure1b has one outlier, District of Columbia, that exceeds $10. We also notice that, visually, it seems as though counties with higher the minimum wage the more incline it is to decrease the low skilled employment rate, thus creating more unemployment.

From Table 2 we notice that both the low skilled employment rate and the median gross rent by county has a stronger correlation with the adjusted minimum as opposed to the state-wide minimum wage.

4. The Model

We will estimate the two equations:

$$(1)\ lowskillemploy_i = \beta 0 + \beta 1minwage_i + \beta 2medgrossrent_i + \beta_3 population_i + u_i$$

$$(2)\ lowskillemploy_i = \beta 0 + \beta 1adjminwage_i + \beta 2medgrossrent_i + \beta_3 population_i + u_i$$

$$Where\ i\ denotes\ the\ ith\ county$$

Population is used an indication of more urban counties versus rural. Furthermore, densely populated areas tend to have higher cost of living and publicly available goods that low skilled workers take advantage of(such as public transit). Median gross rent serves as another control variable regarding cost of living.

From our visualization from figure 1 we would expect as minimum wage(whether state-wide or adjusted) increase low skilled employment should decrease, ceteris paribus. Intuitively, as labor becomes more expensive employers will hire less workers in order to alleviate for total labor cost. Holding all else constant, as median gross rent increases we may expect low skilled workers to relocate and quit their jobs causing unemployment to go down marginally, thus we would expect a negative coefficient. We can apply the same argument for total population since we are using it as an indicator of cost of living.

We would expect endogenity between our explanatory variables such as median gross rent and low skilled employment. Poverty tends to gravitate towards densely populated areas, which drives up rental prices. These areas are primarily composed of low skilled workers which directly contribute to the employment rate.Thus this study does not include causal effects.

5. Empirical Analysis

Consider the following regression results:

Table 3

VARIABLES	(1) lowskillemploy	(2) lowskillemploy	(3) lowskillemploy
minwage	-0.0183***		
	(0.00174)		
adjminwage		-0.005***	-0.079***
		(0.001)	(0.010)
medgrossrent	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
population	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
sqrt_adjminwage			0.3722***
			(0.048)
Constant	0.600***	0.481***	0.007
	(0.0131)	(0.005)	(0.062)
Observations	3,142	3,142	3,142
R-squared	0.253	0.231	0.246

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Each explanatory variable, including the interactive term *sqrt_adjminwage* is statistically significant with p-values less than 1%. We would expect increasing median gross rent to have a negative effect on low skilled labor as we would anticipate these workers to relocate once rent exceeds their earning threshold. Again, I used population as a proxy for urban, however as the population increases, so does the competition for vacancies within a given area. From economic literature, we would expect increasing minimum wage would decrease low skilled employment. Employers have to pay more money for labor, therefore they may lay off workers in order to cut cost. Notice that, on average holding all else equal, a $1 increase in the adjusted minimum wage leads to a 0.5% decrease in low skilled employment. Whereas, for every $1 increase in the current minimum wage low skilled employment decreases by 1.8%, on average ceterius paribus. Therefore, an adjusted minimum wage has less of a negative impact on employment. Thus the results are consistent with the hypothesis. Next we will consider the economic significance for state-wide minimum wage (model 1) and our interactive term (model 3).

For economic significance for minimum wage we have that a 1% change in state-wide minimum wage causes a 0.003% decrease in low skill employment, on average holding all explanatory variables constant[1]. Thus, since this is less than 20% it is not economically significant.

Our interactive term measures the diminishing returns on adjusted minimum wage. Therefore a 1% increase on adjusted minimum wage will lead to a 0.007% increase on low skilled employment. Since this is less than 20% it is not economically significant

To interpret the interactive term consider:

$$-0.079 + (\tfrac{1}{2}) \cdot 0.372 \cdot 2.510 = 0.388$$

Thus, at the mean value of the adjusted minimum wage, a marginal increase in adjusted minimum wage will lead to a change in low skilled employment of 0.388, on average.

6. Conclusion

Thus we find that, holding all else constant, the adjusted minimum wage had less of a negative impact on low skilled labor than the state-wide minimum wage. Moreover, controlling for cost of living is statistically significant in both models. Therefore, policy makers should consider raising minimum wage that adjust by cost of living for a given county rather than a flat federal minimum wage.

If we adjust by cost of living, we can consider raising minimum wage in places like Miami-Dade, Florida without enduring a strong negative impact on.

We can also calculate the index by dividing median gross rent per county by 649 which is the average median gross rent for all counties in the US.We could then take the product of this new index on minimum and bounded it above by $15 and below by $7.25. This policy

[1]please refer to appendex1 for formal calculations on economic significance

would mkae low skilled workers better off rather than imposing a flat \$15 federal minimum wage which would have devastating effects on places like Adair, Kentucky.

The ACS goes as far back as 2005, therefore be interesting to consider a time component in the future. Moreover, I would like to investigate whether I can create an optimal minimum wage adjustment and evoke causality through the use of random forest tree regressions.

References

[1] Charles Brown et al., *"The Effect of Minimum Wage on Employment and Unemployment"*, Journal of Economic Literature, Vol.20, Issue 2, 1982

[2] Jonathan Meer and Jeremy West, *"Effects of the Minimum Wage on Employment Dynamics"*, Journal of Human Resources, 2015

7. Appendix1

Tot formally test for significance on adjminwage, we can consider the F or t tests. In this example I will consider the F-test

Using model 1 consider the restricted model(we'll call it Model 4)

$$(4)\ lowskillemploy_i = \beta 0 + \beta 1 medgrossrent_i + \beta_2 population_i + u_i$$

We can test that adjminwage is statistically significant by using the test command on STATA (which will yield results using the F-test) or calculate a t-test.This implies:

$$H_0 : \beta_2 = 0$$

$$H_\alpha : \beta_2 \neq 0$$

$$\text{reject } H_0 \text{ if } F = \frac{(R^2_u - R^2_R)/1}{(1-R^2_u)/n-k} > F_{1,n-k,0.05} = F_{1,3213,0.05}$$

STATA yields:

(1) adjminwage = 0

F(1, 3138) = 18.70

$Prob > F = 0.00$

Thus, the F statistic for significance is 18.70 with a p-value of 0.00. Therefore, we can conclude that adjminwage is statistically significant.

To calculate our elasticities, lets first consider testing the economic significance of our interactive term in model 3. Since our interactive term is a polynomial this implies:

$$(\beta_1 + \tfrac{1}{2}\beta_4 \cdot \overline{sqrt\_adjminwage}) \cdot \tfrac{\overline{x}}{\overline{y}} \rightarrow {}_x\eta_y$$

We want to determine whether there was a large change in low skill employment.Using the coefficients found in table 3 and the fact that the mean of *sqrt_adjminwage* is 2.510, we get an elasticity of:

$$(-0.079 + (\tfrac{1}{2}) \cdot 0.372) \cdot \tfrac{2.510}{36.1} = 0.007$$

Lastly, we test the economic significance given the state-wide minimum wage. We will use model 1 from Table 3 for this example. In order to calculate the economic significance for a linear-linear model, consider:

$$\hat{\beta}_1 \cdot \tfrac{\overline{x}}{\overline{y}}$$

Therefore, we get:

$$-0.0183 * (7.693/36.1) = -0.003$$

8. Appendix2

For the corresponding log file (click here)