A Cross-Sectional Study on the Effect of State Minimum Wage on Youth Unemployment at the State Level

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Abstract

In this cross sectional study, I examine the correlation between state wage minima and youth unemployment at the state level. I chose to focus on minimum wage at the state level as the state minimum wage began to outpace the federal minimum wage during the early 1980s. I chose to examine its effect on youth unemployment as the youth labor market would most likely be more affected by changes in minimum wage than other labor compositions. Their lower skillset and lack of experience make them more expendable. I modeled this effected with an omitted regression model and a multivariate model. The omitted model showed a small, positive, and statistically insignificant correlation between minimum wage and youth unemployment, with a coefficient of 0.242. The multivariate regression, which included two addititional variables which may also affect youth unemployment, produced the same small, positive, and statistically insignificant correlation between minimum wage and youth unemployment, with a virtually unchanged coefficient of 0.259.

1 Introduction

In this paper, I will examine the correlation between state wage minima and youth unemployment at the state level (including the District of Columbia). My youth demographic consists of individuals between the ages of 16 and 24. This topic is important as the discovery of a reproducable, statistically significant correlation between bothe the variables would have immense policy implications at the state and federal level. My hypothesis is as a state's minimum wage increases so too does that state's youth unemployment rate. This hypothesis is backed by the concept of wage setting in competitive wage markets.

If employers in a competitive markets with a large number of employers and a large supply of workers are allowed to regulate their own wages, they will set wages to the marginal product of labor. For example, if the average worker produces 5 dollars worth of goods and services an hour, a firm can bid wages just up to 5 dolllars an hour to attract workers while still generating a profit. However, if an employer bids anything over 5 dollars an hour in wages, say 6 dollars, they will either have to employ less workers than other firms or risk losses. If a minimum wage is set higher than the equilibrium wage of 5 dollars, say 6 dollars, firms' demands for workers declines while the supply of labor increases. This disequilibrium causes an increase in unemployment. Some workers would gladly work for lower wages and employers would gladly hire them for lower wages but the law forbids it.

In monopsonistic market, a minimum wage can actually mitigate the negative effects of the equilibrium set wage (Rocheteau and Tasci 2007). However, monopsonistic markets are not the norm throughout the US.

Several landmark time-series studies were undergone on the topic of the effect of federal minimum wage on youth unemployment in the late 1970s to early 80s. Virtually everyone of these studies found a small, positive correlation between federal minimum wage and youth unemployment. However, in 1995, David Card and Alan B. Krueger wrote a meta-analysis on this collection of time-series studies. Card and Krueger concluded that each of the 15 studies they analyzed displayed results which showed signs of "specification-searching and publication biases, induced by editors' and authors' tendencies to look for negative and statistically significant estimates of the employment effect of the minimum wage" (Card and Kreuger 1995). Card and Krueger's results persuaded me to scrutinize and question the results of the previous studies.

To explore this relationship between state minimum wage and youth unemployment, I use 2016 data on youth unemployment and the minimum wage rate from the 50 states as well as the District of Columbia to run a linear omitted variable regression. From this model, I found a small, positive correlation between state minimum wage and youth unemployment; thus as a state's minimum wage rises, so to does their youth unemployment rate. This correlation, however, was not statistically significant at any level.

2 Data

I use 2016 data from the Labor Law Center on state minimum wage rates ("2019-2020 Minimum Wage Rates by State" 2019) and Governing magazine on state unemployment rates ("Youth Unemployment Rate, Figures by State" 2017) for my omitted variable regression. The Labor Law Center gathered their wage data from the Department of Labor. Governing magazine gathered their data from the US Bureau of Labor Statistics. For my multivaraite regression I use 2016 data from the US Census Bureau on state poverty rates ("Poverty - 2015 and 2016 American Community" 2017) and Governing magazine on total spending per pupil ("Education Spending Per Student by State" 2016). Governing magazine also gathered their data from the 2016 US Census, specifically the Annual Survey of School System Finances.

Table 1: Variables and Descriptions

Variable	Description
'Yunemp'	Youth Unemployment Rate: Percent of individuals aged 16-24 who are currently unemployed in each State
'MinWage'	Minimum Wage: Minimum hourly wage rate in each state
'TSPP'	Total Spending Per Pupil: How much each state spends on public elementary-secondary education per student
'PovRate'	Poverty Rate: Percent of each state's population who live below the poverty threshold. This threshold varies by family size, number of children, and age of householder

A majority of states offer a minimum wage rate of 7.25 dollars, as shown in Figure 1. The other half of states offer a minimum wage rate between 8 and 10 dollars. The distribution is clearly skewed to the right with a small collection of outlier states who offer significantly higher wage rates than other states. The data showed that on average, the farther north you look, the higher the minimum wage rate tends to be. This tendency however does not necessarily correlate to lower or higher rates of youth unemployment. Summary Statistics are presented in Table 2.

Figure 2 displays the plotted relationship between a state's minimum wage and their youth unemployment rate. The data is very spread out and shows very little sign of a pattern but the regression line suggests there is a slightly positive correlation.

Figures 3 & 4 display the distribution of total spending per pupil across the states and the plotted relationship between state minimum wage against total spending per pupil in each state. The distribution

shows that, on average for 2016, most states spent 9,000 to 12,500 dollars per student in public elementary-secondary school funding. It should also be added that there was a tendency for states farther north of the Mason-Dixon line tended to spend more per pupil than states below. The scatterplot of minimum wage against TSPP displayed a fairly positive correlation between the two variables. As minimum wage or total spending per pupil rose, the other tended to rise as well.

Figures 5 & 6 display the distribution of state poverty rates and the plotted relationship of state poverty rates against youth unemployment. The distribution of the data shows a much wider spread across the states than the other variables presented. However, much of the data is grouped around poverty rates of 10 to 16%. The plotted relationship shows a high correlation between state poverty rates and youth unemployment. This correlation can be attributed to the fact that many of the same factors which cause unemployment also cause individuals to slip into poverty, such as low-quality education and a lack of adequeate food and healthcare (Stevens 2018). Unemployment and poverty also tend to cause each other as becoming unemployed can cause someone to slip into poverty and slipping into poverty can make it harder to get a job.

Figure 7 displays the scatterplot of total spending per pupil against youth unemployment. The plot displays the complete lack of relationship between the two variables. This lack of correlation is puzzling as public education funding leads a better educated youth, which should help decrease youth unemployment. However, the strong correlation between total spending per pupil and state minimum wage may still make it an appropriate control variable for a multivariate regression.

Table 3 displays the correlation table for all variables in my regression.

Table 2: Summary Statistics

States	PovRate	MinWage	TSPP	Yunemp
Length:51	Min. : 7.30	Min. : 7.250	Min. : 6953	Min. : 6.00
Class :character	1st Qu.:11.30	1st Qu.: 7.250	1st Qu.: 9634	1st Qu.: 8.25
Mode :character	Median :13.30	Median : 8.050	Median :11348	Median :10.30
NA	Mean :13.62	Mean : 8.152	Mean :12092	Mean :10.02
NA	3rd Qu.:15.50	3rd Qu.: 8.750	3rd Qu.:14193	3rd Qu.:11.65
NA	Max. :20.80	Max. :11.500	Max. :22366	Max. :15.90

Figure 1: Distribution of Wage Minima by State

Figure 2: Scatterplot of State Minimum Wage on Youth Unemployment

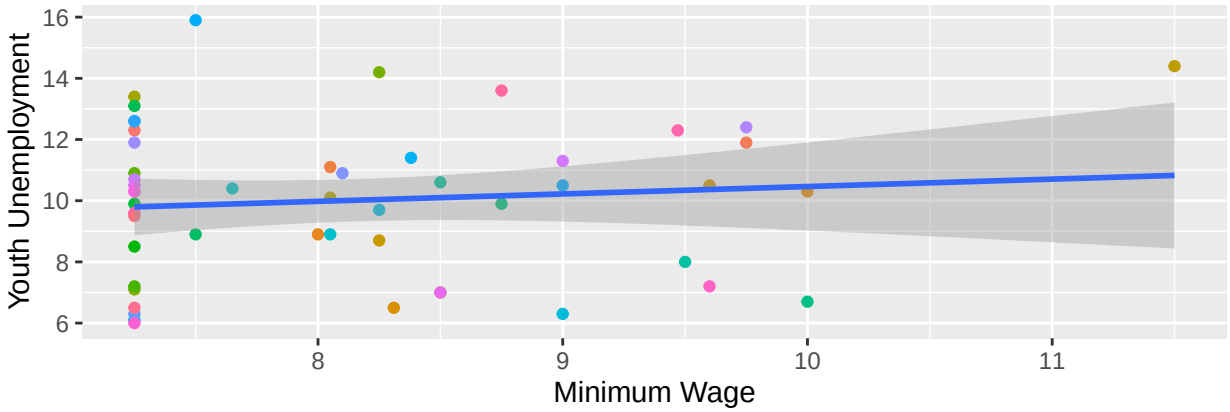

Figure 3: Distribution of Total Spending Per Pupil by State

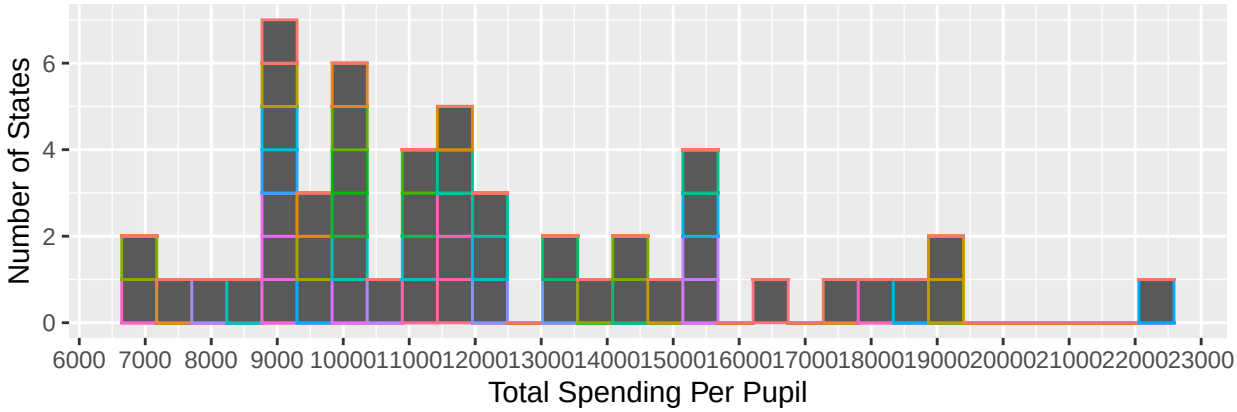

Figure 4: Scatterplot of State Minimum Wage Against Total Spending Per

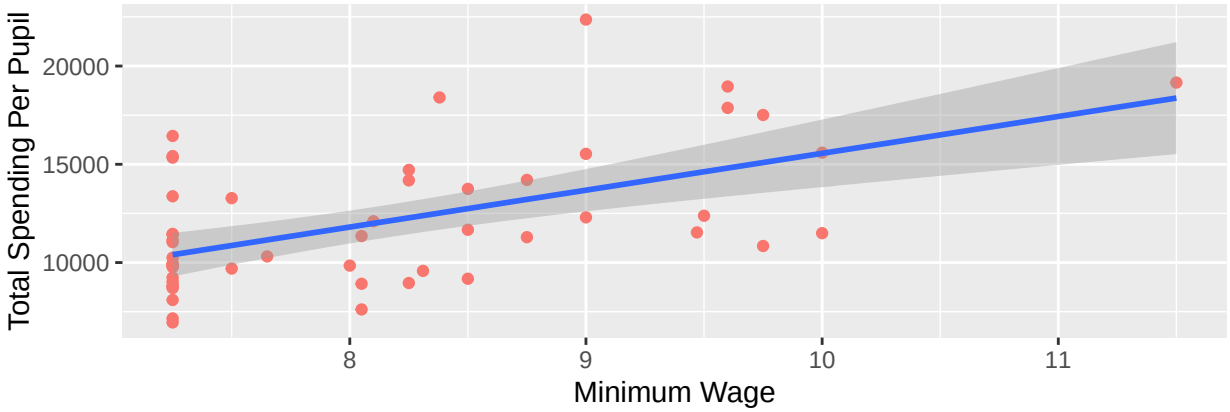

Figure 5: Distribution of Poverty Rates by State

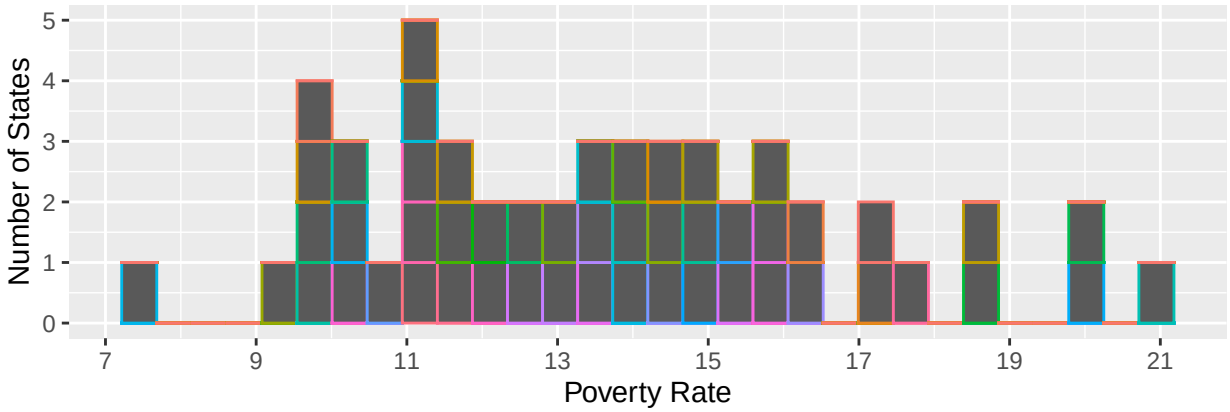

Figure 6: Scatterplot of State Poverty Rates Against Youth Unemployment

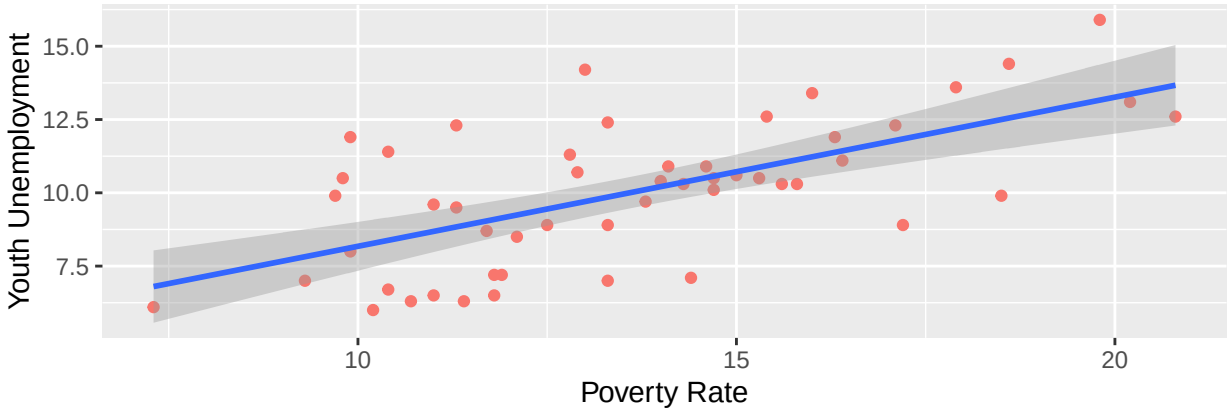

Figure 7: Scatterplot of Total Spending Per Pupil Against Youth Unemployme

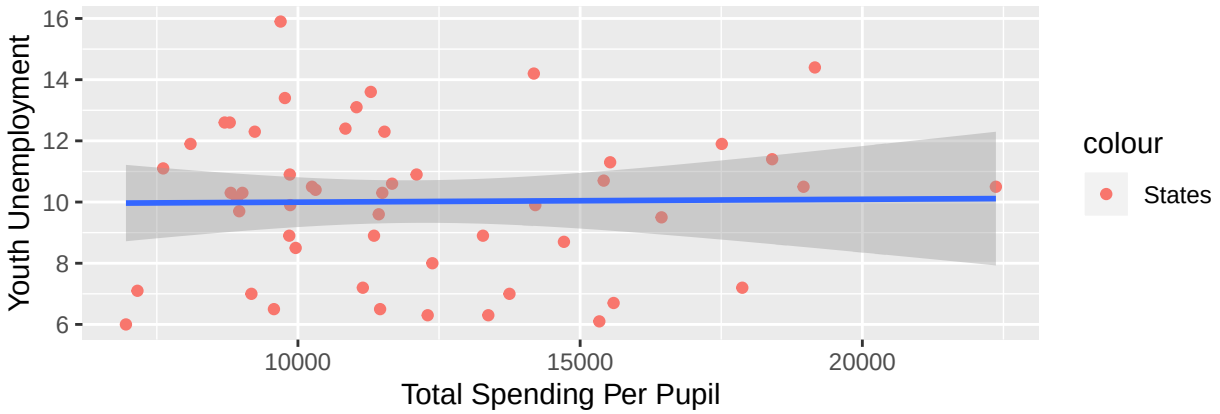

Table 3: Correaltion Table

	Yunemp	MinWage	TSPP	PovRate
Yunemp	1.0000000	0.1013175	0.0134632	0.6385419
MinWage	0.1013175	1.0000000	0.5513404	-0.1926453
TSPP	0.0134632	0.5513404	1.0000000	-0.3936517
PovRate	0.6385419	-0.1926453	-0.3936517	1.0000000

3 Empirical Model

Equation 1 describes the omitted model for my cross-sectional linear regression by state i.

$$\widehat{\text{Yunemp}}_i = \beta_0 + \beta_1 \text{MinWage}_i + u_i \tag{1}$$

I decided that an OLS linear regression is the most appropriate way to estimate the correlation between state minimum wage and youth unemployment. Figure 2, the scatterplot of minimum wage against youth unemployment, presents a slight positive linear relationship between the two variables. The correlation table represented in Table 3 also describes a small positive correlation of 0.101 between minimum wage and youth unemployment.

However the simple linear regression model in equation 1 is likely to be endogenous. There are likely other factors that also determine youth unemployment and correlate with state minimum wage. I believe two of the strongest factors that affect youth unemployment outside of state minimum wage are state poverty rates and total spending per pupil. As stated before, poverty rates and youth unemployment are likely correlated as they are determinants of each other. It is easier to slip into poverty when you or a member of your family

is unemployed and it is harder to become employed when you are currently in poverty. While total spending per pupil does not have a high direct correlation to youth unemployment rates, it does high a relatively high correlation with poverty rate. Table 3 displays relationships between these variables.

Equation 2 describes my multivariate regression, which includes the additional variables which are most likely to bias minimum wage if left in the error term.

$$\widehat{\text{Yunemp}}_i = \beta_0 + \beta_1 \text{MinWage}_i + \beta_2 \text{TSPP}_i + \beta_3 \text{PovRate}_i \tag{2}$$

Total spending per pupil and poverty rate are intended as control variables to test the robustness of the minimum wage coefficient. I also ran the same multivariate regression through the method of iteratively reweighted least squares as well as ordinary least squares. IRLS regression minimizes the least absolute errors rather than the least squared errors. This method checks the robustness of the regression by minimizing the effect of outliers in the data on β_1.

Equations 3 and 4 describe my omitted and multivariate log-log regression models. I ran these regressions so that I can determine the elasticity effect of youth unemployment with respect to state minimum wage.

$$\widehat{\log\text{Yunemp}}_i = \beta_0 + \beta_1 \log\text{MinWage}_i + u_i \tag{3}$$

$$\widehat{\log\text{Yunemp}}_i = \beta_0 + \beta_1 \log\text{MinWage}_i + \beta_2 \log\text{TSPP}_i + \beta_3 \log\text{PovRate}_i \tag{4}$$

I hypothesize that higher state wage minima will have a negative on state youth unemployment rates. Based on basic macroeconomic principles, setting a minimum wage in a competive labor market with several employers and a large supply of workers will not allow the market to regulate itself so that the maximum amount of workers are higher by the maximum amount of firms. Placing a wage minimum above the market equilibrium wage will create a surplus of workers and a deficit of employers willing to hire them. Thus, I believe that $\beta_1 > 0$. I test this against the null hypothesis $\beta_1 <= 0$ with an $a = 0.05$.

4 Results

The results of my linear regressions can be found in Table 4. The β_1 coefficient for my omitted variable regression states as state minimum wage rises by a dollar, youth unemployment also rises by 0.242%. However, this coefficient is not statistically significant to the 0.05 a level. The standard error β_1 is 0.340, which represents the average distance state minimum wage values deviated from the mean. As the β_1 coefficient is

smaller than its standard error of estimate, it cannot be statistically significant to any degree. The R^2 score of the regression is extremely low at only 0.010. Meaning that only 1% of the variation in youth unemployment is explained by the variation in state minimum wage.

Table 4: Linear Regression Results

	Omitted	Multivariate	Robust
Intercept	8.042 **	-2.470	-2.534
	(2.790)	(2.559)	(3.119)
Minimum Wage	0.242	0.259	0.232
	(0.340)	(0.296)	(0.361)
Total Spending Per Pupil		0.000	0.000
		(0.000)	(0.000)
Poverty Rate		0.605 ***	0.613
		(0.090)	(0.109)
N	51	51	51
R2	0.010	0.499	
logLik	-117.261	-99.906	-99.947
AIC	240.522	209.811	209.894

*** p < 0.001; ** p < 0.01; * p < 0.05.

The β_1 coefficient for my multivariate regression is virtually the same despite the presence of controlling variables. As state minimum wage rises by a dollar, youth unemployment increases by 0.259%. The difference between this coefficient and the standard error of the estimate is smaller than in the omitted variable regression, but the standard error is still higher, thus it is not statistically significantly. The results of the multivariate regression also show that the total spending per pupil has no affect on youth employment. This result is expected considering the findings in Figure 7. A state's poverty rate was shown to have a strong effect on youth unemployment. As a state's poverty rate rose by 1%, the state's youth unemployment rate rose by 0.605%. This coefficient was found to be statistically significant to the 0.001 a level. The R^2 score for the multivariate regresrrion is almost 50x stronger than the omitted variable regression. 49% of the variation in youth unemployment could be explained by variation in minimum wage and the poverty rate. Considering how strong the correlation between poverty rate and youth unemployment, I would assume that this increase in R^2 is due to the inclusion of this additional controlling variable.

The robust regression results displayed virtually the same coefficients as the multivariate regression. When the effect of outliers on the β_1 coefficient is minimized, the results show that the coefficient is still not statistically significant.

The loglikelihood and "Akaike Information Criterion" (AIC) scores are good measures for describing the relative strength of model's to fit data across the same dataset. The measures are best used when the difference in score is interpreted rather than the individual score for a regression. A lower loglik and AIC score is preferred over a higher one. The results show that them multivariate regression has significantly lower

scores than the omitted regression. The robust regression has virtually the same scores as the multivariate.

The results of my logarithmic regressions can be found in Table 5. The results of my log-log omitted variable regression show youth unemployment elasticity in respect to state minimum wage as 0.180%. A 1% change in state minimum wage results in a 0.180% increase in youth unemployment. This coefficient is also not statistically significant to any level. The R^2 score is slightly smaller than the linear model at 0.7%.

Table 5: Logarithmic Regression Results

	Log Omitted	Log Multivariate	Log Robust
Intercept	1.897 **	-3.036 *	-3.079
	(0.635)	(1.188)	(1.515)
Log Minimum Wage	0.180	0.157	0.131
	(0.303)	(0.263)	(0.335)
Log Total Spending Per Pupil		0.290 *	0.299
		(0.125)	(0.159)
log Poverty Rate		0.876 ***	0.884
		(0.129)	(0.165)
N	51	51	51
R2	0.007	0.499	
logLik	-1.977	15.442	15.427
AIC	9.955	-20.884	-20.854

*** p < 0.001; ** p < 0.01; * p < 0.05.

The β_1 coefficient of my log-log multivariate regression are virtually the same as my log-log omitted variable regression, much like my linear regressions. However, the logarithimic multivariate model displayed a slightly smaller coefficient than a slightly larger one like the linear multivariate regression produced. The log-log model did, however, describe an elasticity of youth unemployment in respect to total spending per pupil. As total spending per pupil changes by 1%, youth unemployment increases by 0.290. While this elasticity is small, it is statistically significant to the 0.05 a level. The regression also produced a very strong elasticty of youth unemployment in respect to state poverty rates. As poverty rates increase by 1%, youth unemployment increases by 0.876%. However, it is not a stronger correlation than the relationship described in the linear model. This correlation is stastically significant to the highest degree. The logarithmic multivariate model produced the same R^2 score as the linear multivariate model at about 50%.

The robust regression results displayed slightly higher coefficient for β_2 and β_3, as well as slightly higher standard errors. However, the robust regression also displayed a slightly smaller β_1 coefficient with a much higher standard error, much like it did in the linear model. It would appear that state minimum wage was heavily affected by outliers in the data.

Because this is a log-log model, the loglik and AIC scores are reveresed, meaning higher loglik and AIC scores are prefereable to lower ones. The results show that the logarithmic multivariate model has a higher likelihood of fitting the data than the omitted and robust models. This is understandable as the multivariate

model has controlling variables and is not reweighted.

5 Conclusion

Due to the 0.05 *alpha* level constraint, my alternative hypothesis is rejected. However, the results of my linear and logarithmic modelsshow do show a small, positive correlation between state minimum wage and youth unemployment at the state level. This finding was produced in the omitted, multivariate, and robust multivariate regressions. This result suggest that mor research is need to find the true effect of state minimum wage on youth unemployment.

This study has shown that certain controlling variables have varying levels of success at minimizing the biases affecting β_1. While state poverty rate showed strong correlations to youth unemployment rates, total spending per pupil only showed a small positive effect on youth unemployment when viewed through a logarithmic model. These indefinite findings would then suggest the idea that there are several other factors that are determinents of youth unemployment and are also correlated with state minimum wage.

A larger amount of data may also help to define the true relationship between state minimum wage and youth unemployment. A new time-series study which examines the effect of the two variables may produce stronger results than a small cross-sectional study. If Card and Krueger's meta-analysis conclusion is to be believed, most of the results of previous time-series studies of the effect of federal minimum wage on youth unemployment are suspect. Thus it is all the more important for modern studies on the effect of minimum wage on unemployment of different age compositions and demographics to be written. Studies such as these have numerous ramifications on political and economic policy.

References

"2019-2020 Minimum Wage Rates by State." 2019. DC: Department of Labor.

Card, David, and Alan B. Kreuger. 1995. "Time-Series Minimum Wage Studies - a Meta-Analysis." DC: American Economic Association.

"Education Spending Per Student by State." 2016. DC: Department of Commerce.

"Poverty - 2015 and 2016 American Community." 2017. DC: Department of Commerce.

Rocheteau, Guillaume, and Murat Tasci. 2007. "The Minimum Wage and the Labor Market." Ohio: Fed Reserve Bank of Cleveland.

Stevens, Ann. 2018. "Employment and Poverty." Massachussetts: EconoFact.

"Youth Unemployment Rate, Figures by State." 2017. DC: Department of Commerce.