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**The Minimum Wage and Teen Unemployment:
A Study of the Effect of the Fair Minimum Wage Act of 2007**

Alexander Pino

Introduction

Minimum wages have been a topic of great disagreement in the field of economics. The textbook microeconomic theory of the minimum wage¹ predicts resulting unemployment in the low-skill labor market if the wage floor is set above the market equilibrium, but many studies within the extensive literature call this into question.

One study that is cited with particular enthusiasm by minimum wage proponents used difference-in-differences analysis to study the effect of a minimum wage increase on the fast food industry in New Jersey, and found that the minimum wage increase actually reduced unemployment (Card & Krueger, 1994). This result was reviewed six years later by David Neumark and William Wascher, who utilized payroll data from fast food firms rather than phone surveys, which had been relied upon in the original study.² Contrary to the original research, they found that the increase in the minimum wage increased unemployment in the New Jersey

¹ See Appendix B for a graphical depiction of this theory.

² Neumark and Wascher found that “the employment data collected by CK indicate substantially more variability over the period between their surveys than do the payroll data. The standard deviation of employment change in CK’s entire sample exceeds that in the payroll data by a factor of nearly three,” leading them to suspect Card and Krueger’s research contained errors-in-variables bias.

fast food industry (Neumark & Wascher, 2000).³ These studies are indicative of both the intensity of debate and the level of disagreement in the minimum wage literature.

The study presented here differs from the aforementioned research in two important ways. First, here we analyze the effect of a national minimum wage increase rather than a state-level change. Secondly, rather than analyzing the effect of a wage increase on a single industry, our study uses a much broader unemployment measurement: the teen unemployment rate. Specifically, this paper will present evidence from a study analyzing the effects of the Fair Minimum Wage Act of 2007 on teen⁴ unemployment in the south, focusing on the only five states in the U.S. that have no state-level minimum wage laws (Alabama, Louisiana, Mississippi, South Carolina, and Tennessee). This statute raised the federal minimum wage from \$5.15 per hour to \$7.25 per hour over three years.

Our research finds that the federal minimum wage increase in 2007 resulted in an increase in the teen unemployment rate in the five states with no state-level minimum wage laws of approximately 4.62 percentage points. This result is important for two reasons. First, we believe that the teen unemployment is a fairly good proxy for low-skill unemployment more generally and therefore can provide insights as to how minimum wage increases affect the employment prospects of low-skill workers. Secondly, we believe teen unemployment is a problem in and of itself as well. The experience, responsibility, and income that a young person gains by working in their teens are quite valuable, and if our policies are making it more difficult for teens to find work that is an issue we should address.

³ Card and Krueger found that the almost 19% minimum wage increase in New Jersey increased employment by between 11 and 16.8 percent, while Neumark and Wascher found it decreased employment by between 3.9 and 4 percent, both relative to the Pennsylvania control group.

⁴ Teens are defined as individuals in the labor market ages 16-19. Adults are defined as those aged 20 and above. These are the standards used by the U.S. Bureau of Labor Statistics.

Theoretical Framework

Our study exploits a key difference between the teen and adult labor markets to assess the effect of the 2007 law. We make the obvious assumption that a far greater proportion of the teen labor force is low-skill labor than that of the adult labor force. Teen laborers, by their very nature, have relatively little schooling, training, and experience. For this reason, they are far likelier than adults to be categorized as low-skill labor, and thus far more likely to be affected by a change in the minimum wage.

We therefore assume that the Fair Minimum Wage Act of 2007 will have a greater effect on teen laborers than adult laborers. This assumption allows us to use the adult unemployment rate as a control group for a natural experiment using difference-in-differences analysis. This is accomplished by using the difference between the teen unemployment rate and the adult unemployment rate as our dependent variable (teen-adult). An increase in this figure demonstrates that the teen unemployment rate has grown with respect to the adult rate, and there have been negative effects on teen employment. Conversely, if the figure decreases it demonstrates that the teen unemployment rate has decreased relative to the adult rate, and there have been positive effects on teen employment.

We chose the states for our study for three particular reasons. First, as mentioned above, these are the only five states in the U.S. with no state minimum wages. Thus we should be able to isolate the impact of the federal minimum wage change without worrying about simultaneous state-level changes. Secondly, the close proximity of the five states⁵ to one another should reduce the degree to which geographic heterogeneities affect our analysis. Four of the five states border one another, with the only exception being South Carolina, which is a mere 60 miles from

⁵ See Appendix A for a map of the region.

the border of Tennessee. Our third reason is that the southeastern U.S. has relatively inexpensive labor, which is a likely reason for the lack of state minimum wage laws in these states.⁶ Again, this should maximize the extent to which the law affects the labor markets in these states, making them ideal candidates for our study.

The percent change in both Gross State Product (GSP) and Gross Domestic Product (GDP) are included as controls in all of our analysis. Fluctuations in the productivity of the economy have a great impact on labor markets, and we attempt to control for those effects using GSP and GDP. As expected, these variables are negatively correlated with the unemployment rates, as can be seen in Table 3.

The Fair Minimum Wage Act of 2007 was phased in over three years. The hourly minimum wage was increased from \$5.15 to \$5.85 in 2007, to \$6.55 in 2008, and finally to \$7.25 in 2009. In order to test for the effect of the law, we collected all of our data for the years 2005 through 2011. This enabled us to arrange our data into three time periods, with period zero consisting of the two years just prior to implementation, period one consisting of the three years during implementation, and period three consisting of two years after implementation. The variable for period in our analysis is Yearid, which takes the value 0, 1, or 2 for the three periods just described.

By differencing the teen and adult unemployment rates and controlling for economic productivity fluctuations in the seven years for which we collected data, we attempt to estimate the impact of the statute on teen unemployment in the five states with no state minimum wage laws.

⁶ The BLS National Compensation Survey for 2010 shows significantly higher mean hourly earnings in northern than in southern states. For instance, the difference in mean hourly earnings between the New England region (CT, RI, MA, NH, VT, ME) and the East South Central region (KY, TN, AS, AL) was 36% in 2010.

Data

All of the data for our estimations was easily obtained through official government sources. GSP and GDP⁷ data were collected from the U.S. Bureau of Economic Analysis (BEA), and all unemployment rates were taken from the Bureau of Labor Statistics (BLS), which is a division of the U.S. Department of Labor. Both the teen and adult unemployment rates used are the official U3 unemployment rates published by the BLS, which consists of the number of employed individuals divided by the labor force. BLS recognizes teens as individuals ages 16-19, and adults as all individuals aged 20 and above. Overall we have 35 total observations: 5 states observed over 7 years, which are strongly balanced, with no missing observations.

Our dependent variable of interest, teen-adult, was acquired by simply subtracting the adult unemployment rate from the teen unemployment rate for each of the five states during each year of our analysis. Table 1 shows the averages of all data for each state during each of the three periods.

⁷ All GSP and GDP data is in real, per capita percent change from previous year.

Table 1 - Average Variable Values¹ for Each State for Each Period

State-Period ²	Minwage	Teenrate	Adultrate	Teen-adult ³	GSP	GDP ⁴
Alabama-P0	\$ 5.15	18.00	3.60	14.40	1.21	1.80
Alabama-P1	\$ 5.85	21.63	6.23	15.40	-1.51	-1.22
Alabama-P2	\$ 7.25	26.35	9.50	16.85	-0.71	0.52
Louisiana-P0	\$ 5.15	13.05	4.85	8.20	3.45	1.80
Louisiana-P1	\$ 5.85	16.53	5.03	11.50	-1.83	-1.22
Louisiana-P2	\$ 7.25	25.50	7.05	18.45	3.16	0.52
Mississippi-P0	\$ 5.15	19.80	6.05	13.75	1.35	1.80
Mississippi-P1	\$ 5.85	23.13	6.57	16.57	0.62	-1.22
Mississippi-P2	\$ 7.25	28.30	9.95	18.35	-1.40	0.52
South Carolina-P0	\$ 5.15	24.25	5.80	18.45	0.01	1.80
South Carolina-P1	\$ 5.85	22.60	8.60	15.23	-2.28	-1.22
South Carolina-P2	\$ 7.25	29.40	5.30	19.35	-0.32	0.52
Tennessee-P0	\$ 5.15	15.95	4.75	11.20	0.96	1.80
Tennessee-P1	\$ 5.85	23.80	6.57	17.23	-2.54	-1.22
Tennessee-P2	\$ 7.25	27.55	8.60	18.95	2.13	0.52

¹All variable values are period averages. (Full Data-set can be found in Appendix D)

²Period 0 is pre-implementation, or 2005-2006. Period 1 is during implementation, or 2007-2009, and period 3 is post-implementation, or 2010-2011.

³Teen-adult is the dependent variable of interest. It is the difference between the two rates, i.e., the teen unemployment rate minus the adult unemployment rate.

⁴GDP is a national variable, and therefore the values are the same for each state.

Note that in Table 1 the average teen unemployment is much higher than the average adult unemployment rate in every period for every state. Additionally, note that the averages for both the teen and adult rates are generally increasing from period to period for each state. We suspect that much of this upward movement is due to the recession that began in 2008, which also explains the lower GSP and GDP numbers in Period 1 and Period 2. Make particular note of the general upward movement of “Teen-adult” in Table 1. The movement of this variable forms the crux of our analysis, as will be demonstrated later.

Table 2 provides further summary statistics of our variables, which are grouped by year.

Table 3 shows the correlation of all of our variables.

Table 2 - Descriptive Statistics of Variables¹

Year	Minwage	Teenrate	Adultrate	Teen-adult	GSP	GDP
2005	\$ 5.15	20.36	5.20	15.16	1.38	1.86
2006	\$ 5.15	16.06	4.82	11.24	1.41	1.73
2007	\$ 5.15	17.60	4.34	13.26	-0.31	0.96
2008	\$ 5.85	19.72	5.46	14.26	-1.42	-1.27
2009	\$ 6.55	27.30	9.26	18.04	-2.79	-3.34
2010	\$ 7.25	29.48	9.12	20.36	1.32	0.30
2011	\$ 7.25	25.36	8.94	16.42	-0.17	0.73
Mean	\$ 6.05	22.27	6.73	15.53	-0.08	0.14
SD²	\$ 0.97	5.12	2.25	3.05	1.61	1.85
Min	\$ 5.15	16.06	4.34	11.24	-2.79	-3.34
Max	\$ 7.25	29.48	9.26	20.36	1.41	1.86

¹States are grouped by year.

²SD is standard deviation; min and max are the minimum and maximum.

Table 3 - Variable Correlations

Variable	Teen-Adult	Teenrate	Adultrate	Minwage	Yearid	GSP	GDP
Teen-adult	1.000						
Teenrate	0.946	1.000					
Adultrate	0.569	0.804	1.000				
Minwage	0.546	0.726	0.843	1.000			
Yearid ²	0.459	0.588	0.653	0.887	1.000		
GSP ³	-0.194	-0.263	-0.314	-0.119	-0.118	1.000	
GDP	-0.291	-0.393	-0.463	-0.398	-0.282	0.512	1.000

¹Both Minwage and Yearid are positively correlated with the unemployment rates.

²Yearid is a period variable with values 0, 1, and 2 for the three periods.

³GSP and GDP are negatively correlated with the unemployment rates, as expected.

Econometric Models and Estimation Methods

As stated previously, the basic causal relationship that we are trying to explain with our study is the effect of the Fair Minimum Wage Act of 2007 on the teen unemployment rate in the five states with no state minimum wage laws. This relationship can be described by the following model:

$$\Delta(\text{Teenrate}-\text{Adultrate})_{it} = \alpha + \beta_1\text{yearid}_{it} + \beta_2\text{GSP}_{it} + \beta_3\text{GDP}_t + \varepsilon_i$$

where $\Delta(\text{Teenrate}-\text{Adultrate})_{it}$ is the change in the difference between the teen unemployment rate and the adult unemployment rate, yearid_{it} is the period variable, GSP_{it} is gross state product, GDP_i is gross domestic product, and ε_i is the error term.

Yearid_{it} should capture the change in the minimum wage from period to period, and thus using a state fixed effects estimation method the coefficient for yearid_{it} will represent the difference in the difference between the teen and adult unemployment rates. In other words, the coefficient of yearid_{it} is the effect of the minimum wage increase on teen unemployment less the effect of the minimum wage increase on adult unemployment.

By using state fixed effects we control for all observed and unobserved state specific factors that do not vary over time which might affect the difference between the teen and adult unemployment rates. Additionally, by differencing the teen and adult unemployment rates, we control for both observed and unobserved variables that are affecting both unemployment rates at the same time.

Our model assumes that yearid_{it} does in fact capture the change in the federal minimum wage. We also utilize models with minwage_{it} as the independent variable, and with both yearid_{it} and minwage_{it} as independent variables, where minwage_{it} is simply a minimum wage variable. We have also clustered all standard errors on state to remove bias.

Results

Our results concur with the textbook microeconomic impact of a minimum wage. We find that the 2007 increase in the minimum wage increased the teen unemployment rate in the states that we observed. Table 4 presents our regression results.

Table 4 - Estimated Effect of the Fair Minimum Wage Act of 2007 on Teen Unemployment in the Five States with no State Minimum Wage Laws

Independent Variable	Regression Model				
	Dependent Variable Teenrate	Dependent Variable Adultrate		Dependent Variable Teen-adult	
	FE ¹ 1	FE 2	FE 3	FE 4	FE 5
Yearid	4.06 ² (0.65)***	1.75 (0.26)***	2.31 ³ (-0.87)***	---	-0.53 (0.70)
Minwage	---	---	---	2.44 (0.69)***	2.86 (1.18)***
GSP	0.05 (0.28)	-0.04 (0.17)	0.09 (0.17)	0.01 (0.15)	0.00 (0.15)
GDP	-0.89 (0.32)***	-0.38 (0.18)***	-0.51 (0.28)*	-0.23 (0.35)	-0.20 (0.38)
Constant	18.34 (0.63)***	5.03 (0.28)***	13.31 (0.87)***	0.81 (4.21)	-1.18 (3.64)
Sample Size	35	35	35	35	35
Adj R²	0.43	0.53	0.21	0.29	0.27

Note: All standard errors are clustered by state and are listed below the coefficients. Coefficients are significant at the *10%, **5%, or ***1% level.

¹“FE” denotes a fixed effects regression model was used.

²Coefficients in models FE 1 and FE 2 represent a change in percentage points per period as a result of the minimum wage increase.

³Coefficients for models FE 3, FE 4, and FE 5 represent the change in percentage points of the teen unemployment rate per period, less the change in percentage points of the adult unemployment rate per period as a result of the minimum wage increase.

FE 1 and FE 2 are fixed effects regressions using the teen unemployment rate and adult unemployment rate as dependent variables, respectively. The coefficient of yearid in FE 1 is greater than the coefficient in FE 2, indicating that the minimum wage increase had a greater effect on teen unemployment than adult unemployment.

The coefficients of GSP are not statistically significant in any of the regressions, so we will not attempt to interpret them. The coefficients of GDP in FE 1 and FE 2 are significant and negative, which was our expectation. This indicates that an increase in U.S. gross domestic product corresponds with a decrease in unemployment, which is a reasonable expectation. The

coefficients of GDP in regressions FE 3, 4, and 5 are also negative, but are not statistically significant.

FE 3, 4, and 5 are the difference-in-difference estimations. The coefficient of yearid in regression FE 3, which is statistically significant at the 1% level, indicates that the change in the teen unemployment rate, less the change in the adult unemployment rate, was approximately 2.31 percentage points per period. That means that over the two observed periods the teen unemployment rate rose by approximately 4.62 percentage points more than the adult unemployment rate as a result of the federal minimum wage increase. This is a very telling result that concurs with the textbook minimum wage model.

FE 4 and FE 5 provide further confirmation. FE 4 uses minwage as the dependent variable rather than yearid, and the results are very similar. The coefficient of minwage in FE 4, which is also statistically significant at the 1% level, is 2.44, indicating that the difference between the teen and adult unemployment rates expanded by approximately 2.44 percentage points per one dollar increase in the minimum wage.

In FE 5, which controls for both yearid and minwage, the coefficient of minwage is again positive and highly significant, indicating an increase in the teen unemployment rate due to the minimum wage increase, as in FE 3 and FE 4. Additionally, the coefficient of yearid in FE 5, while also controlling for minwage, is reduced to -.53. We hesitate to put too much weight in our interpretation of this coefficient, as it is not statistically significant, but the negative coefficient on yearid in FE 5 while controlling for minwage may indicate that our estimates of the effect of the minimum wage on teen unemployment are in fact biased downwards.

Regardless, our estimates as presented in Table 4 indicate that the Fair Minimum Wage Act of 2007 had a large and statistically significant positive effect on teen unemployment in the

states we observed, with an increase in the teen unemployment rate of approximately 4.62 percentage points over the period we studied.⁸

Conclusion

While our study does provide fairly convincing evidence that the minimum wage increase negatively affected teen employment, there are certainly limitations. Ideally, we would have utilized a control group of states that were unaffected by the federal minimum wage increase. Unfortunately, an appropriate group of states does not exist. While there are states that have minimum wages that were consistently above the federal minimum during the time we observed, and thus not directly affected by the law, there was not a single state whose state-level minimum wage was not also increasing over this time period. Therefore it would have been impossible to use any of these states as a control.

Additionally, our sample size was fairly small, due to the simple fact that there are only five states with no state minimum wage laws. It is also unclear whether using state-wide unemployment data is better than using firm or individual level data, as in the Card and Krueger paper. It is likely that both methods of research have their limitations.

There is also the issue that we focused solely on teen unemployment. While we do believe that teens are a fairly good proxy for low-skill labor, and thus for those that are likely to be affected by a minimum wage, there are problems with this approach. Not all teens are low-skill laborers, and not all low-skill laborers are teens. Those facts make it somewhat difficult to interpret our results for the broader population of all low-skill laborers.

Additionally, our study has little relevance for other states. Differences in geography and labor markets are so large that our findings cannot be used to make judgments about other states.

⁸ See Appendix C for a graphical representation of our difference-in-differences model.

However, these differences are a reason why a federal minimum may be undesirable, as it will affect different states and regions quite differently.

Also, it is probably true that policy-makers are more concerned with adult unemployment than with teen unemployment, as adults are more often in a position of providing for dependents, whereas teens are often not working out of strict necessity.

Nevertheless, our results do have value. By using both fixed effects regression and a differencing method, we have controlled for an extensive array of observed and unobserved variables that affect teen unemployment. This adds strength to our results.

Further, while our results specifically speak to the act's effect on teen unemployment, it is likely that they do indicate that there was a positive effect on unemployment for the low-skill labor force at large in these five states. And while policy-makers may be more concerned with the employment of adults, teen unemployment is still an important issue.

Many teens gain great value from holding a job in their youth. Teen jobs are necessary for gaining responsibility, acquiring experience, building a resume, and paying for school, and it is unfortunate that any teen who desires to work should be kept from getting a job due to a government policy. Contrary to the name of the statute, the result is hardly "fair."

Finally, if our assumptions about the labor market in the south are correct, and there is indeed a greater population of workers in that region who will be affected by minimum wage increases, then a federal minimum wage law is a policy that will directly disadvantage the people of some states more than others. A "one size fits all" minimum wage set at the federal level is potentially undesirable in a nation such as the United States that has such a diversity of labor markets. If so, minimum wages are best left to be set at the state level. Further research would

be required to substantiate this claim, but if it is true it is certainly a deleterious effect of federal minimum wages. This is but one possible avenue for further research.

Another avenue would be analyzing low-skill labor in the south at the firm or industry-level. This may provide more generalizable results than a state-wide study. Another avenue of research would be to conduct a similar study to ours, but one that accounts for changes in the labor force participation rate. If one group drops out of the labor force at a greater rate than another, unemployment figures may be an inaccurate representation of the true effect of a minimum wage increase.

To conclude, despite its limitations, our research does obtain significant findings, and its results should be viewed seriously. We find a statistically significant positive effect on teen unemployment in Alabama, Louisiana, Mississippi, South Carolina, and Tennessee as a result of the Fair Minimum Wage Act of 2007.

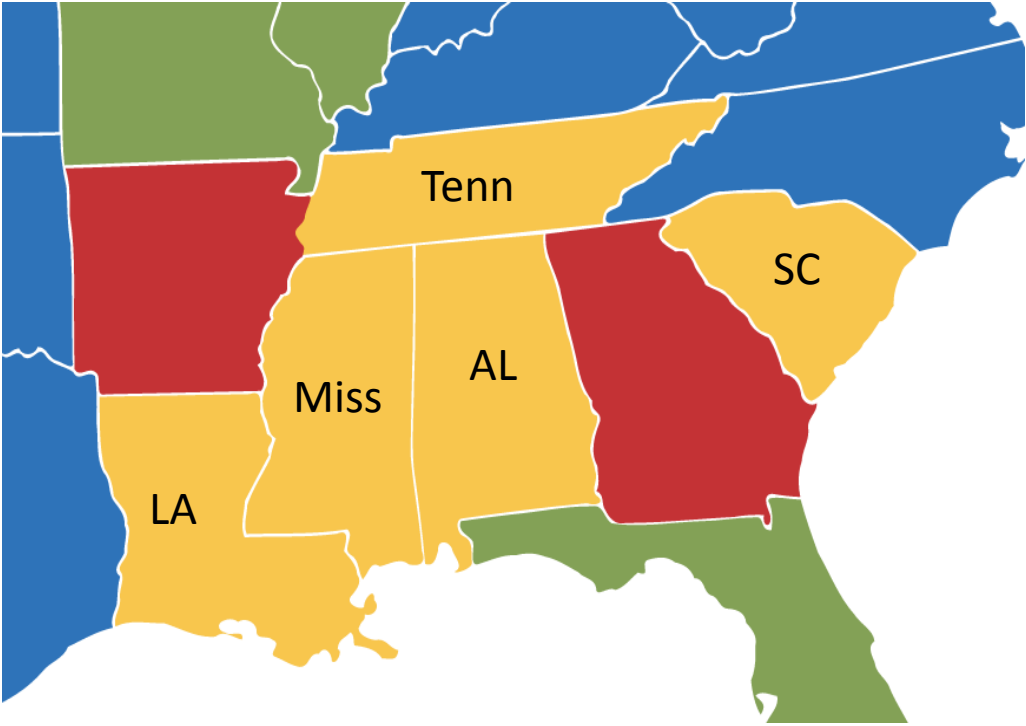
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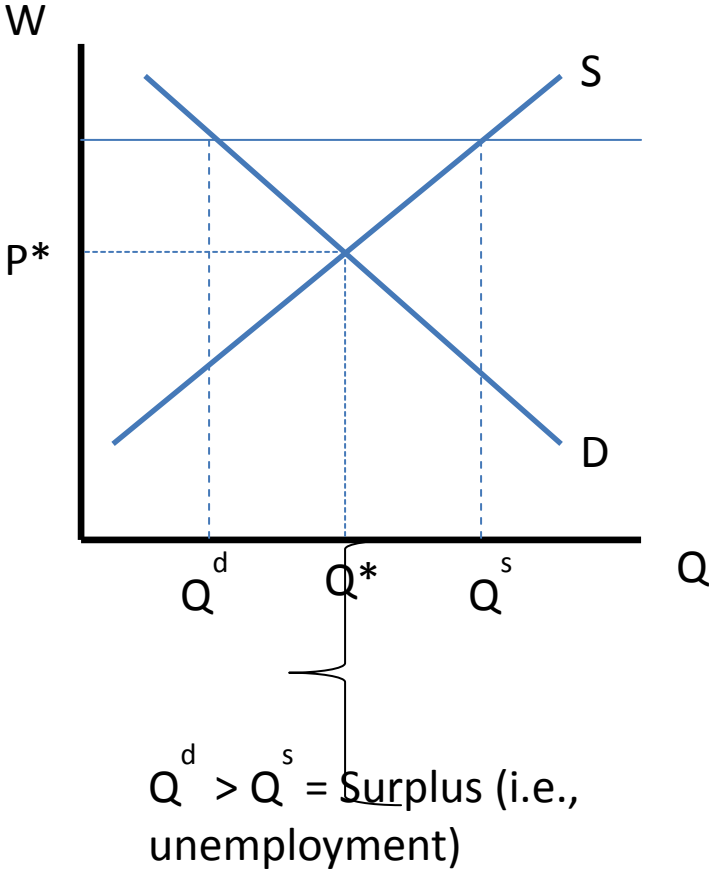
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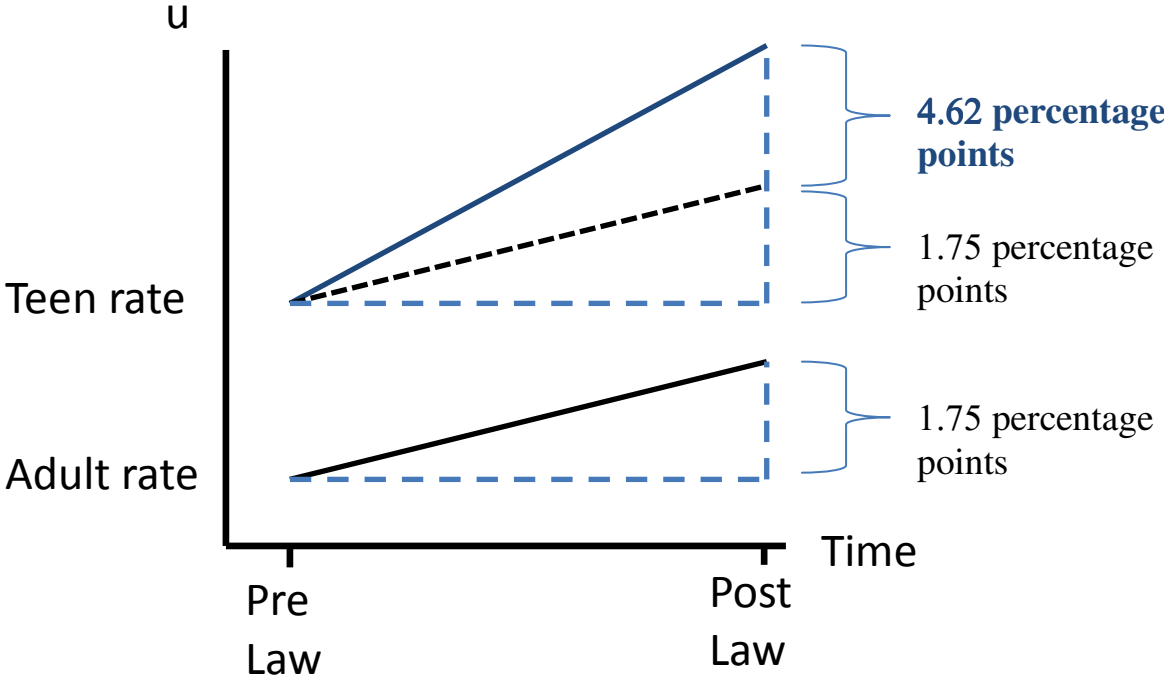
Appendix A –
Map of the Five States with No State Minimum Wage Laws



Appendix B –
Graphical Representation of the Textbook Minimum Wage Model



Appendix C –
Graphical Representation of the Difference-in-Differences Estimation
(Not to scale, numbers are approximations based on regression estimates)



Appendix D –

Full Data (State Codes: 1=Alabama, 2=Louisiana, 3=Mississippi, 4=South Carolina, 5=Tennessee)

state	year	yearid	mw	teenrate	adultrate	teenminusadult	gsp	gdp
1	2005	0	5.15	21.5	3.5	18.0	1.89	1.86
1	2006	0	5.15	14.5	3.7	10.8	0.53	1.73
1	2007	1	5.15	16.8	3.4	13.4	0.33	0.96
1	2008	1	5.85	20.2	5	15.2	-1.06	-1.27
1	2009	1	6.55	27.9	10.3	17.6	-3.79	-3.34
1	2010	2	7.25	30.8	9.7	21.1	-0.29	0.30
1	2011	2	7.25	21.9	9.3	12.6	-1.12	0.73
2	2005	0	5.15	13.1	5.6	7.5	2.85	1.86
2	2006	0	5.15	13	4.1	8.9	4.05	1.73
2	2007	1	5.15	13.7	3.9	9.8	-5.49	0.96
2	2008	1	5.85	16.3	4.6	11.7	-2.75	-1.27
2	2009	1	6.55	19.6	6.6	13.0	2.76	-3.34
2	2010	2	7.25	23.8	7.1	16.7	6.45	0.30
2	2011	2	7.25	27.2	7	20.2	-0.13	0.73
3	2005	0	5.15	22.2	6.2	16.0	0.73	1.86
3	2006	0	5.15	17.4	5.9	11.5	1.97	1.73
3	2007	1	5.15	18.9	5.5	13.4	3.92	0.96
3	2008	1	5.85	20.3	5.8	14.5	0.76	-1.27
3	2009	1	6.55	30.2	8.4	21.8	-2.83	-3.34
3	2010	2	7.25	33.2	9.8	23.4	-1.73	0.30
3	2011	2	7.25	23.4	10.1	13.3	-1.06	0.73
4	2005	0	5.15	25.8	5.9	19.9	0.56	1.86
4	2006	0	5.15	22.7	5.7	17.0	-0.54	1.73
4	2007	1	5.15	21.6	4.9	16.7	0.99	0.96
4	2008	1	5.85	15.9	6.2	9.7	-3.02	-1.27
4	2009	1	6.55	30.3	11	19.3	-4.82	-3.34
4	2010	2	7.25	33.3	10.3	23.0	-0.89	0.30
4	2011	2	7.25	25.5	9.8	15.7	0.26	0.73
5	2005	0	5.15	19.2	4.8	14.4	0.87	1.86
5	2006	0	5.15	12.7	4.7	8.0	1.04	1.73
5	2007	1	5.15	17	4	13.0	-1.30	0.96
5	2008	1	5.85	25.9	5.7	20.2	-1.04	-1.27
5	2009	1	6.55	28.5	10	18.5	-5.28	-3.34
5	2010	2	7.25	26.3	8.7	17.6	3.08	0.30
5	2011	2	7.25	28.8	8.5	20.3	1.18	0.73