

The Impact of Educational Attainment on Minimum Wage Employment: A State-Level Analysis

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Abstract: Education is a cornerstone of labor market success, shaping wage levels, job security, and access to diverse income opportunities. This research examines how educational achievement influences the probability of working at minimum wage throughout US states between 2010 to 2021 while studying how education combines with state minimum wage regulations. This analysis uses Current Population Survey data as well as national economic indicators and Integrated Public Use Microdata Series to calculate the difference-in-differences effects with state-year fixed components for analyzing educational impacts on minimum wage standards. Labor statistics show that raising the average years of education decreases minimum wage employment by 0.18 percentage points specifically in states where educational levels are higher after implementing higher minimum wages. The impact of education levels on employment faces crucial modification through state-level labor policies, thereby demonstrating the necessity for combined educational programs and wage reform initiatives. The findings help policymakers distinguish minimum wage employees from other workers while recommending vocational instruction with accessibility to education as a method for boosting socioeconomic opportunities for vulnerable groups.

Keywords: Educational Attainment, Minimum Wage, Labor Market Outcomes, Difference-In-Difference

1. Introduction

Education acts as a core force which determines labor market success by shaping both people's financial compensation and their employment security while improving their access to economic opportunities. The research field demonstrated by Autor and other scholarly works proved that education leads to greater wages while helping people avoid unemployment [1]. Research has not deeply examined the mechanisms through which educational experiences shape the results of workers who earn minimum wage despite their large number of school-droppers among these workers. Bureau of Labor Statistics (BLS) reports that 1.9% of hourly workers received minimum or less pay in 2021 while most individuals falling under this category lack degrees and belong to women and racial minorities [2]. The research connection between educational differences and minimum wage occupations requires focused study to solve economic inequalities while promoting economic inclusion.

The labor market has two educational effects since workers gain better employment prospects through skills development that leads to higher pay but also find protection against poverty and vulnerability [3]. Minimum wage policies produce conflicting results regarding their influence on

employment statistics. The findings from Card and Krueger indicate minimum wage employment affects are minimal while Neumark and Wascher document how rising minimum wages harm positions for unskilled workers [4, 5]. According to Acemoglu and Pischke, educational attainment gives employees better skills for coping with economic changes and job market transformations [6]. Very few experts have studied whether education affects minimum wage workers differently from it affects the entire workforce.

The impact of state-level minimum wage laws becomes complex because these regulations produce varied results across different economic areas of the region [7]. It is found that a single wage increase produces varied results among states that possess different levels of educational achievement [7]. Vocational training is proven effective as an outcome-improvement approach through the dual education system of Germany which combines academic studies with practical training, thus enhancing workforce readiness [8, 9].

The research fills two essential gaps in existing literature. The research establishes a statistical connection between educational degrees and employment rates at minimum wage positions by separating these workers from other minimum wage employees. The research examines the combined influence that state-level education standards possess with minimum wage rules on the outcomes of labor markets. This paper utilizes state-year fixed effects (FEs) in a difference-in-differences (DID) analysis to determine the actual effect of education on minimum wage employment while accounting for unmeasured temporal and regional elements. Higher levels of academic achievements decrease the likelihood of working at minimum wage wages but state-level minimum wage regulations influence the strength of this relationship. Critical knowledge emerges for officials developing education and wage regulations because targeted programs need to assist people at risk according to these insights.

2. Data and Methodology

2.1. Data

This research relies on the National Conference of State Legislatures (NCSL) database to obtain state-level minimum wage policy data, supplemented with the Economic Policy Institute's Minimum Wage Tracker for additional historical context, adjusting the figures according to the Consumer Price Index (CPI) inflation parameters [10]. The analysis of minimum wage employment connected to educational attainment uses a 12-year (2010-2021) dataset that merges data sources for all US states. The Current Population Survey (CPS) serves as the main data source because it operates as a monthly collection effort from the US Census Bureau and the BLS. The CPS reveals extensive details about state labor force wages together with work status information and educational qualifications. The study employs continuous educational attainment data which indicates average school years among 18- to 65-year-old workers through specified educational levels (high school diploma equivalent to 12 years and bachelor's degree equivalent to 16 years). Workers who earn the minimum wage or less because of exemptions fall into the category of minimum wage employees according to Autor [1].

The Integrated Public Use Microdata Series provides harmonic microdata derived from US Census and American Community Survey (ACS) that supports the collection of demographic and industry-specific controls. The analysis incorporates workforce composition data that relates to gender, non-white versus white races and employees between 18 to 24 years old, and employment distribution across retail and hospitality. State-level unemployment data along with Gross Domestic Product (GDP) growth rates are obtained from the BLS while the Bureau of Economic Analysis provides these economic indicators. The adopted variables from the NCSL database underwent CPI adjustment through calculations.

The final analysis contains 600 observations representing the combination of states with twelve years. The analysis excludes Louisiana and states with wage distribution anomalies or incomplete policy records. Educational attainment together with wage variables have been aggregated per state-year and received weighted adjustments to account for the CPS sampling procedure.

2.2. Empirical Model

The empirical strategy employs a DID framework integrated with two-way fixed effects to estimate the causal impact of educational attainment on minimum wage employment. This approach is particularly suited for this analysis as it controls for unobserved heterogeneity across states and time, isolating the effect of minimum wage policy changes while accounting for state-specific trends. The model is specified as below.

$$Y_{st} = \beta_0 + \beta_1 \text{Educ}_{st} + \beta_2 (\text{Post}_{st} \times \text{Highedu}_s) + \beta_3 X_{st} + y_s + \delta_t + \epsilon_{st} \quad (1)$$

In the equation (1) above, Y_{st} denotes the percentage of workers earning the minimum wage or less in a given state 's' during year 't'. Educ_{st} denotes the average years of education of workers in state 's' and 't', containing information about the educational attainment of the labor force. To distinguish between pre and post period, a dummy variable Post_{st} is introduced, which takes the value of 1 for years following a minimum wage increase in state 's'. Highedu_s is a binary indicator that identifies the states as high or heavy in the average education level of its population compared with 13.1 years, the national median. The difference-in-differences estimator is represented by the interaction term $(\text{Post}_{st} \times \text{Highedu}_s)$, which is the difference in the impact of minimum wage increases in states with above median versus that below median educational levels.

To account for other influences, X_{st} represents a vector of time-varying control variables, including the unemployment rate, which may increase competition for low-wage jobs as joblessness rises; GDP growth, where economic expansion might reduce reliance on minimum wage positions by creating better-paying opportunities; industry composition, reflecting employment shares in sectors like retail, hospitality, and healthcare that typically employ more low-wage workers; and demographic factors, such as the proportions of female, non-white, and young workers (aged 18–24), who are more likely to hold minimum wage jobs. The state fixed effects (y_s) and year fixed effects (δ_t) in the model are also controlled for time invariant, state specific characteristics, and, respectively, nationwide temporal shocks. Finally, ϵ_{st} is the error term, which standard errors are clustered at state level on state level in order to ameliorate possible autocorrelation and heteroskedasticity within states over time.

The coefficient β_1 is expected to be negative, indicating that higher educational attainment reduces the likelihood of minimum wage employment. The DID coefficient β_2 is also anticipated to be negative, reflecting a stronger reduction in minimum wage employment in high-education states following wage increases.

3. Data Analysis

3.1. Descriptive Statistics

The summary statistics for vital variables appear in Table 1. Among the workforce minimum wage employees amount to 2.1% of total employees yet Mississippi shows a high rate of 4.3% and Washington demonstrates a low rate of 0.9% based on the data. The average schooling level reaches 13.2 years equivalent to partial college completion extending from 11.8 years in West Virginia to 14.5 years in Massachusetts. Among all states the typical jobless rate stands at 5.4% and experienced its highest point at 14.2% when the 2020 pandemic struck. Retail employment, a proxy for low-wage sectors, averages at 11.3%, with Texas at 18.9% and Vermont at 6.1%.

Table 1: Descriptive statistics.

Variable	Mean	Standard Deviation	Minimum	Maximum
Minimum Wage Workers (%)	2.1	0.8	0.9	4.3
Education (years)	13.2	0.6	11.8	14.5
Unemployment Rate (%)	5.4	2.1	2.7	14.2
Retail Employment (%)	11.3	3.2	6.1	18.9
Female Workers (%)	47.2	2.5	41.3	51.8
Non-White Workers (%)	28.6	12.4	9.8	56.7

Figure 1 illustrates the trend in minimum wage employment over time, showing a gradual decline from 2010 to 2019, followed by a sharp decrease in 2020 due to pandemic-related economic disruptions, before stabilizing in 2021 [2].



Figure 1: Trend in minimum wage employment from 2010 to 2021.

3.2. Regression Results

The regression results across three models are reported in Table 2. The pooled Ordinary Least Squares (OLS) model (column (1)) estimates that a one more year of education decreases the minimum wage share by 0.120 percentage points ($p < 0.01$). Column (2) presents the estimate for DID framework, which makes the education effect become -0.150 and significant ($p < 0.01$), with a non-significant interaction (-0.050). The most robust estimate is from column (3) that education reduces minimum wage employment by 0.180 percentage points per additional year ($p < 0.001$) and there is an additional 0.070 percentage point reduction in the high-education states after the wage increase ($p < 0.05$). Retail and hospitality employment display expected patterns for control variables with minimum wage shares having a positive correlation ($p < 0.05$), and GDP growth shows a small negative correlation. Presence of minimum wage is seen to be also related with demographic factors (aged between 18-24) since they represent the young workers who are more concentrated in low-wage sectors ($p < 0.1$). The results indicate that both constant and time-dependent factors in each state influence the OLS results below actual impact due to elements like education attitudes among residents or economic fluctuations. The DID coefficient reveals that states with better educational attainment experience

intensified minimum wage employment reductions following wage increases. The wage increases enacted by Massachusetts in 2018 caused a 0.9% reduction in minimum wage workers, but Alabama observed no change in its minimum wage population despite having similar regulations.

Table 2: Regression results.

Variables	(1) Pooled OLS	(2) DID	(3) DID + FE
Education (years)	-0.120*** (0.030)	-0.150*** (0.035)	-0.180*** (0.040)
Post × HighEdu	—	-0.050 (0.032)	-0.070** (0.030)
Unemployment Rate	0.040 (0.060)	0.035 (0.055)	0.020 (0.050)
GDP Growth Rate	-0.025 (0.020)	-0.020 (0.018)	-0.015 (0.015)
Retail Employment	0.090*** (0.020)	0.075** (0.025)	0.060** (0.030)
Hospitality Employment (%)	0.070** (0.025)	0.060** (0.022)	0.050* (0.028)
Healthcare Employment (%)	-0.030 (0.035)	-0.025 (0.030)	-0.020 (0.025)
Female Workers (%)	0.015 (0.010)	0.012 (0.009)	0.010 (0.008)
Non-White Workers (%)	0.020 (0.015)	0.018 (0.014)	0.015 (0.012)
Young Workers (18–24, %)	0.045** (0.018)	0.040* (0.016)	0.035* (0.015)
Controls	Yes	Yes	Yes
State Fixed Effects	No	No	Yes
Year Fixed Effects	No	No	Yes
Observations	600	600	600
R ²	0.320	0.450	0.670

Notes: ***p < 0.01, **p < 0.05, *p < 0.1. Cluster-robust standard errors in parentheses.

3.3. Discussion

Research verifies that students who complete more education will get employment at better rates than minimum wage jobs, because higher education stands as an essential tool against poverty [3]. According to the DID analysis, minimum wage boosts create more reductions in low-wage employment within states having higher average education, because knowledgeable workers better navigate toward high paying healthcare or technical employment opportunities. The restructuring labor market has little impact on the workforce in states with low education levels, because these workers lack necessary skills to transition between sectors according to the displacement hypothesis put forth by Neumark and Wascher [5].

Neumark and Wascher demonstrate different findings regarding wage revenue effects throughout states when compared to Allegretto et al., and support Hanushek et al. regarding the significance of educational qualifications in workforce flexibility [7,8]. The research demonstrates the requirement for combining wage restructuring with investment in education through vocational training programs

and community college learning. The Fast Track initiative implemented in California provided training together with employment services to decrease low-wage employment among participants by 1.2% [2]. These programs prepare workers to excel in the evolving economy thus they need fewer jobs based on minimal wages.

4. Conclusion

The research conducts an extensive analysis of educational level effects on minimum wage work patterns across US states for the period from 2010 to 2021, as well as the essential role education plays in determining labor market results for lower-paid employees. This study demonstrates through a DID analysis incorporating state-year fixed effects that increased average education duration leads to a 0.18 percentage points decline in minimum wage employment, although these results become stronger when states have better-educated populations after minimum wage adjustments. The research demonstrates that education creates two positive effects on social welfare, yet clearly shows that state-level policies shape these educational results. This analysis separates minimum wage workers while advancing knowledge about economic differences through its findings to support specialized educational programs, which will help vulnerable communities succeed financially.

The study demonstrates that public policies should combine wage reforms with educational funding to achieve the best results in economic enhancement. Two notable examples exist including Germany's dual education approach together with California's Fast Track framework which deliver effective models to unite classroom learning with real-world professional competencies for sustaining economic adaptation. The presented research has multiple practical restrictions. The research base consists of aggregated state-level records which can hide individual differences and the removal of unprocessed data might produce selection distortions. The evaluation omits essential factors, because it does not consider either informal instruction or digital skill development programs that have grown vital for today's labor landscape. Additional research needs to use individual-level data to study personal career patterns while studying the lasting effects of recent policy moves through time periods after 2021. The evaluation of alternative educational routes that lower minimum wage worker numbers would significantly improve understanding of minimum wage policy industry implications.

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