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A Difference-in-Differences Analysis of the Minimum Wage and Employment Relationship Across Arkansas and Mississippi

I. Abstract

This paper explores the relationship between minimum wage policy change and employment. It addresses the research question of whether a rise in minimum wage affects employment by increasing or decreasing the unemployment rate. A difference-in-differences approach is adopted to understand how a minimum wage increase in 2014 in Arkansas affected employment relative to employment in the state of Mississippi, which had no such law change. The econometric approach was chosen for its ability to isolate the effect of the minimum wage change by comparing the difference of the pre- and post-treatment period differences in employment rates between Arkansas and Mississippi. The interaction term, which accounts for the interaction between the time period and policy treatment, is the key independent variable, with employment percentage as the dependent variable. The model's validity relies on the parallel trends assumption that employment trends in Arkansas and Mississippi follow similar patterns that are parallel to each other. Arkansas' and Mississippi's similarity across a variety of characteristics, including demographic and economic attributes, helps to support the assumption. The data was collected from IPUM CPS, a public database that stores all data from the Current Population Survey (Flood, et al. 2024). The experiment uses individual level data and spans from 2008-2018; the pre-treatment cutoff is the year 2014. In line with conventional economic theory, it was hypothesized that Arkansas' policy change did have an effect on employment rate in the post-2014 period. However, the experiment finds no statistically significant evidence to support a rejection of the null hypothesis. The finding aligns with other literature in the field that contradicts conventional theory about the relationship between minimum wage and employment. It also suggests important policy implications, namely the wrongful assumption that an increase in the minimum wage will, without fail, hurt employment. As lawmakers seek to provide better economic conditions for their constituents, raising the minimum wage to a living wage level may be a crucial avenue for economic improvement.

II. Introduction

Every election cycle, the controversial minimum wage question inevitably lands on the ballot. In the majority of American counties, the federal minimum wage level of $7.25 per hour is not a livable wage, according to MIT's Livable Wage Calculator (Glasmeier 2024). Given this, many state governments have passed their own minimum wage laws to provide their citizens with better economic opportunity. Thirteen states, however, have not raised the wage floor above the federal level (Federal Reserve Bank of St. Louis 2024). Opponents of minimum wage hikes frequently cite conventional economic theory that increasing the wage leads to higher unemployment in perfectly competitive markets (Card & Krueger 1994). Yet the empirical evidence often falls flat in supporting this story.

Card and Krueger (1994) famously explore the relationship between minimum wage and employment using a difference-in-differences analysis. They studied the effect of New Jersey's 1992 law, which raised the minimum wage from $4.25 to $5.05 per hour, on employment growth in the fast-food industry. They compare the employment change to that in the eastern Pennsylvania fast-food industry, which shared similar characteristics to New Jersey except that there was no minimum wage change. The experiment shows that full-time employment in New Jersey increased relative to Pennsylvania. Employment contraction only occurred in some stores that had already been paying above minimum wage prior to the law change, and even then, the change was almost identical to the change experienced by Pennsylvania stores (Card & Krueger 1994).

Recent papers have added nuance to the difference-in-differences approach to understand the empiric effects of minimum wage on employment. Meer and West (2016) refine conventional theory by suggesting that wage floors impact employment growth rates in the long run. They construct panels of multi-state employment data and state minimum wage levels, finding that an increase in minimum wage does impact employment, not through a discrete change in level but by reducing job growth rates year over year (Meer & West 2016). Cengiz et al. (2019) similarly uses a difference-in-differences approach in their paper, analyzing the effect of wage floor increases on the entire wage distribution. They look closely at employment changes at the bottom of the wage distribution, which are most impacted by a change to minimum wage. The researchers do not find evidence of large aggregate job losses around the

lower end of the minimum wage distribution, although there is some employment reduction in tradable sectors (Cengiz et al. 2019).

This paper also uses a difference-in-differences analysis to explore the research question: *Does a rise in minimum wage affect employment?*. The subject of study is Arkansas, which passed a law that increased the minimum wage from $6.25 to $7.50 per hour, effective January 1, 2014. The law prescribed that the minimum wage would be raised incrementally through 2017 (National Employment Law Project, 2018). Current research suggests that the policy appeared to drive strong economic growth and low unemployment rates (National Employment Law Project, 2018). To investigate the impact of the 2014 change, post-2014 employment changes in Arkansas can be compared to employment changes in Mississippi, where there was no increase to minimum wage. Mississippi employers abide by federal minimum wage requirements, thus the state acts as a control group for observing employment changes in the same time period but without any changes to minimum wage.

Arkansas and Mississippi are also beneficial test subjects given that they are quite comparable in demographic and economic characteristics, which is useful in isolating how only minimum wage affects employment. The two states border each other and thus share similar geographic and agricultural characteristics. They also have similar economies; education and health services and leisure and hospitality are supersectors in both states, accounting for a large portion of job growth (Mississippi Department of Employment Security 2019; Arkansas Division of Workforce Services, 2024). Average annual wages are fairly close in both regions; in Arkansas, the 2024 average wage income was $51,25 and in Mississippi, it was $47,570 (Arkansas Division of Workforce Services, 2024). Additionally, the two states are understudied relative to other regions in the U.S., further making them interesting units for investigation.

Given the complicated and often ambiguous effect of minimum wage law changes on employment, anticipating the effect of the minimum wage policy on employment in Arkansas is difficult. However, in line with conventional economic theory, I expect that the increase in Arkansas' minimum wage significantly affected employment across the state in the post-2014 period.

II. Data Description

The longitudinal data was compiled from the IPUMS CPS public database. The site harmonizes monthly Current Population Survey (CPS) data including demographic, employment, and health information from 1962 onwards. The data is at the individual unit of analysis. This paper uses a subset of data that includes values for survey year, month, state, employment status, hours usually worked per week at all jobs, total wage and salary income, and a few preselected weights commonly used in IPUMS CPS data subsets. The survey results span from late 2008 to 2018, about five years before and five years after the January 1, 2014 implementation of the Arkansas minimum wage increase.

After downloading the data from the IPUM CPS database, the data was cleaned in Stata. The initial dataset included survey results for a national sample, but was narrowed down given the study's focus on trends in Arkansas and Mississippi. Each individual observation in the sample was tagged with a *STATEFIP* code that corresponded to the state the individual was from (*5* for Arkansas and *28* for Mississippi). The codes were used to extract observations for individuals from Arkansas and Mississippi into a smaller subset of focus.

New variables were then added to the subset as additional controls. The first control variable was *STATE_POP*, which recorded the annual state population for each year of the dataset. Following Meer and and West (2016), controlling for total state population is helpful because it influences both labor supply and demand and can vary non-linearly across different states. The state population data was retrieved from USAFacts, a nonprofit organization that directs various data collection projects at the state and national levels.

The second variable added was a proxy for worker productivity, calculated by dividing the total annual wage and income earned by the annual hours usually worked. In their paper, Meer and West (2016) control for the natural log of real gross state product per capita as a proxy for employee productivity and state-specific business cycle fluctuations (Meer & West 2016). This control is important because differences in productivity across states could influence employment demand and thus invalidate the parallel trend assumption. State gross product data was not available through IPUM CPS, so total annual wage and income was divided by annual hours worked as a proxy for worker productivity.

Table 1 reports basic descriptive statistics for the employment context in Arkansas and Mississippi between 2008 and 2018. The total subset included 54,723 observations, supporting improved accuracy of the results.

Table 1: Descriptive Employment Statistics for Arkansas and Mississippi

Variable	Obs	Mean	Std. dev.	Min	Max
employment~e	54,723	93.50107	2.303509	87.88222	96.87708
period	54,723	.5608428	.4962889	0	1
treat	54,723	.5062222	.4999659	0	1
period_treat	54,723	.2776895	.4478635	0	1
WORKER_PRO~T	54,723	450.9394	807.15	0	3525.638
STATE_POP	54,723	2966120	37457.05	2874554	3012161

Data was collected from the IPUM CPS database; spans 2008-2018.

III. Methodology

The research used a difference-in-differences model to evaluate the relationship between minimum wage changes and employment. The model was chosen for its effectiveness in comparing pre- and post-treatment differences in outcomes between the treatment group, individuals in Arkansas, and the control group, individuals in Mississippi. Drawing from literature in the field, this methodology helps isolate the effect of the minimum wage policy change in 2014 on employment outcomes by accounting for time-invariant differences between states and common trends affecting both states.

The pre-treatment period is 2008-2013, the time period before any minimum wage law change was enacted. The post-treatment period spans 2014-2018, the time period after which the policy (the treatment) was effected. The binary dummy variable *period* was created to denote the time period, coded as zero for pre-treatment and one for post-treatment years. The treatment group is individuals from Arkansas, as they experienced the minimum wage change following 2014. The control group is individuals from Mississippi who did not experience any policy change across both periods. The binary dummy variable *treat* was created to identify the treatment group individuals; it was coded as zero for individuals with the Mississippi state code and one for the individuals with the Arkansas state code. The interaction term *period_treat*, simply the value of the dummy *period* multiplied by the value of the dummy *treat*, serves as the main variable of interest.

New variables were also added to modify the employment status measure. The initial IPUM CPS dataset included the variable *EMPSTAT* with codes *00* through *36* that denoted different labor force and non-labor force statuses. Given that the research question focuses on employment, a new variable for employment percentage, aggregated by state and year, was needed for the outcome variable. First, the binary dummy variable *employed* was created and coded as one if the *EMPSTAT* code for individuals noted them as employed. The variable was coded as zero if individuals were not employed. The total labor force was calculated by generating the dummy variable *labor_force_indicator*, coded one, if individuals were employed or unemployed. Then, both dummy variables were aggregated by state and year such that dividing the total employed individuals by the total labor force generated the total employment percentage by state and year.

Total employment percentage was regressed on the time period, treatment condition, the interaction between the period and treatment, worker productivity, and state population. Specifically, the model takes on the form $Employment\ Percentage_{it} = \beta_0 + \beta_1 Period_t + \beta_2 Treatment_i + \beta_3 (Period_t * Treatment_i) + \beta_4 Worker\ Productivity_{it} + \beta_5 State\ Population_{it} + \epsilon_{it}$ **(1)**. The dependent variable is *Employment Percentage*, representing the employment rate for the individual *i* in year *t*. The variable of interest is the interaction term between the time period and the treatment condition. $Period_t$ is the dummy variable that indicates whether the observation corresponds to the pre-treatment period (2008-2013) or the post-treatment period (2014-2018). $Treatment_i$ is the dummy variable indicating whether the observation is from an individual in Arkansas, the treatment group, or from an individual in Mississippi, the control group. $Period_t * Treatment_i$ is the interaction term of interest, which captures the difference-in-differences effect. It identifies the differential effect of the minimum wage policy on employment in Arkansas relative to Mississippi, after the policy change. $Worker\ Productivity_{it}$ is a control variable representing worker productivity, measured as usual wage per hour. $State\ Population_{it}$ is another control variable representing the state population in each year. Lastly, ϵ_{it} is the error term, capturing unobservable factors that affect *Employment Percentage*.

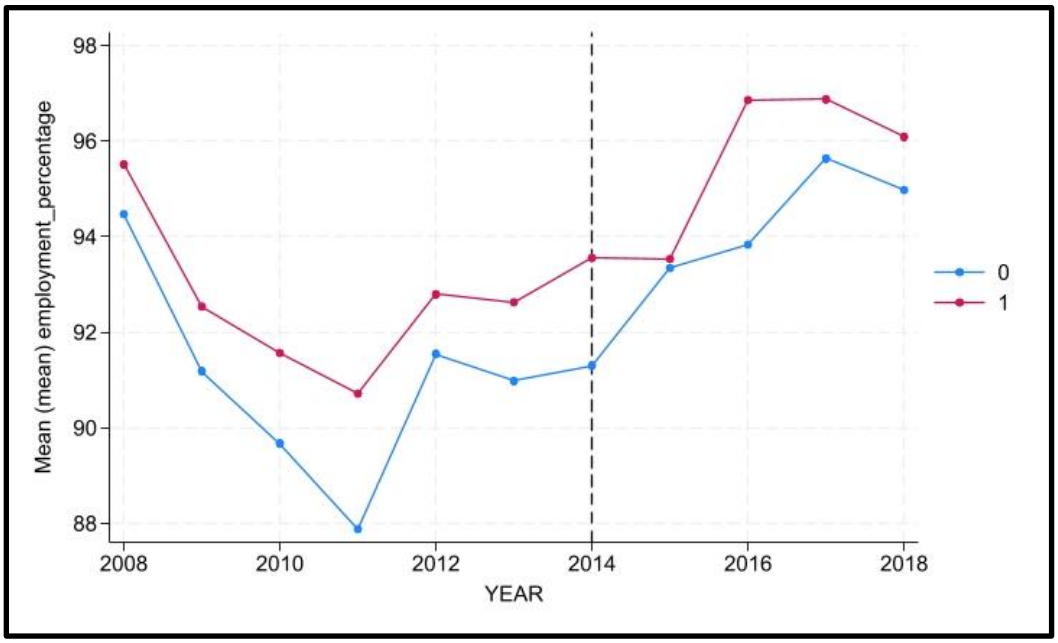
The model is effective for testing the hypothesis that the minimum wage increase in Arkansas in 2014 did have a significant effect on the employment rate in the state. Specifically, the coefficient on the interaction term provides insight into the difference-in-differences effect. If the minimum wage increase had a significant impact on employment in Arkansas relative to

Mississippi, we would expect this coefficient to be statistically different from zero. The econometric approach is particularly appropriate for testing the hypothesis because it compares the pre-treatment and post-treatment outcomes in both the treatment and control groups, controlling for any time-varying factors that might affect employment in both states.

There are several key assumptions that underlie the model framework. The primary assumption is that employment in Arkansas and Mississippi follows a parallel trend. In the absence of the 2014 minimum wage policy, it is assumed that the treatment and control groups would have followed parallel trends in employment over time (the counterfactual). This means that any difference in the post-treatment period should be attributed to the policy change, not to other unobserved factors that affect both states similarly. In other words, we expect that the unobservable factors change at the same rate or affect employment in the same manner in both Arkansas and Mississippi, such that any difference in employment outcomes could not be attributed to the unobservable factors. Any changes in the unobservable factors for the treatment group should essentially be cancelled out by any changes in the unobservable factors for the control group, supporting a perfect counterfactual and allowing for the isolation of the difference-in-differences of employment percentage. As previously discussed, the largely shared demographic, geographic, social, and economic characteristics of both states help support this assumption. Since Arkansas and Mississippi are quite similar across many facets, there is a smaller possibility of unobservable factors behaving differently among the treatment versus control groups.

The parallel trends assumption's validity was further assessed through a graphical visualization of both states' employment trends in the pre-treatment period, shown in Figure 1. Between 2008 and 2013, the employment rates in Arkansas and Mississippi appear to move together. While the distance between the two curves is not perfectly consistent over the pre-treatment period, the visualization gives reason to believe that employment trends in the two states were quite similar in the pre-treatment period before the policy was implemented.

Figure 1: Parallel Trends Assumption Visualization



Data was collected from the IPUM CPS database; spans 2008-2018.

To further bolster the validity of the parallel trends assumption, the control variables worker productivity and state population were added into the regression model. As previously discussed, differences in worker productivity rates and state population growth could reasonably differ between states and time periods, impacting employment rates differently from one state to the next. Controlling for these two variables mitigates major economic or social phenomena that would undermine the two states' comparability.

Based on state research, it is also assumed that no other events or policy changes occurred at the same time as the minimum wage law change in Arkansas that could have simultaneously and significantly affected employment trends. This helps isolate the effect of the minimum wage policy. Additionally, it is assumed that the Arkansas policy did not create spillover effects on Mississippi's employment trends. While this is difficult to test, economic research from the states did not point to any events of mass migration or job-switching between the two states. Therefore, the assumption of no spillover effects is maintained.

IV. Results and Discussion

Table 2 exhibits the results of the difference-in-differences analysis. The column on the left lists the explanatory variables in the regression, and the column on the right contains the

estimated coefficients and their levels of significance (if any). The value of the coefficient on the interaction term, the variable of interest, is 0.749. The coefficient means that, after 2014, the employment percentage in Arkansas was 0.749 percentage points higher than it would have been if Arkansas followed the same employment trend as Mississippi and had no minimum wage change. This effect of 0.749 percentage points reflects the difference-in-differences, controlling for time trends and other factors that affect the states. However, the robust standard error on the coefficient is 0.406, indicating there is uncertainty in the precision of the estimate. In the model, the standard errors were clustered by the observation *STATEFIP* code. This method was chosen to adjust the standard errors for possible correlation within states over time. The clustering was intended to improve the accuracy of the standard errors and prevent underestimation of the true uncertainty.

Table 2: Difference-in-Differences Regression Results

VARIABLES	(1) Difference-in-Differences Regression Results
1.period	3.096***
	(0.0117)
1.treat	1.083
	(0.271)
period_treat	0.749
	(0.406)
WORKER_PRODUCT	-3.26e-06***
	(2.16e-08)
STATE_POP	-1.38e-05
	(5.72e-06)
Constant	132.1*
	(16.98)
Observations	54,723
R-squared	0.559
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1	

Data was collected from the IPUM CPS database; spans 2008-2018.

Importantly, the interaction term coefficient is not significant at the 1%, 5%, nor 10% thresholds. The large p-value on the coefficient indicates that there is not strong statistical

evidence to reject the null hypothesis that the minimum wage change in Arkansas had no effect on employment percentage relative to Mississippi. The lack of statistical significance suggests that there is no clear evidence that the minimum wage increase in 2014 affected employment outcomes in Arkansas compared to Mississippi.

Figure 1 helps provide a visual representation of the lack of effect of the minimum wage policy on employment. In the post-treatment period following 2014, the Arkansas and Mississippi employment rates continue to move in a similar fashion as they did in the pre-treatment period. While there is a convergence in employment rates in 2015 that prevents the employment rates from attaining perfect parallelism, Figure 1 provides reason to believe that the minimum wage change did not significantly affect employment in Arkansas relative to employment in Mississippi.

Both the control variables in the model were significant, suggesting the importance of their inclusion in the model. The coefficient on worker productivity was -3.26e-06, which suggested that every one unit increase in worker productivity corresponded to a decline (albeit miniscule) in employment percentage. The variable was significant at the 1% threshold. This does make sense if increased worker productivity allows firms to achieve the same level of output with fewer workers. State population was similarly significant at the 1% level, although the coefficient of -1.38e-05 was also quite small. Both robust standard errors on the control variable coefficients were small, indiciating precision in the estimates.

The model takes on an R-squared value of 0.559. It suggests that the model explains approximately 56% of the variation in employment percentage. The remaining variation is due to other factors not included in the model, which could be unobserved variables, measurement errors, or other external factors.

V. Conclusion

The results of the difference-in-differences analysis suggests that the 2014 minimum wage policy in Arkansas did not have a significant effect on employment percentage in the state relative to Mississippi. Given that the coefficient on the interaction term was not statistically significant, there was not enough evidence to reject the null hypothesis that the minimum wage change in Arkansas had no effect on employment percentage relative to Mississippi. The finding is related to the Card and Krueger (1994) discovery that the 1992 minimum wage increase in

New Jersey did not contract employment in the state's fast-food industry relative to Pennsylvania, as critics of the policy change argued it would. The researchers found that the policy change likely had no effect on employment in New Jersey's fast-food industry. The results of this paper suggest that conventional economic theory, which asserts that increasing the minimum wage causes employment rates to decrease, may not always be true. If this is in fact the case, the study generates important policy implications for lawmakers. It appears that increasing the minimum wage level provides greater benefits than its cost, at least when it comes to impacts on employment. Raising the minimum wage can provide citizens with more economic opportunities and security, alleviating the formidable challenges associated with the lowest distribution of earnings. The study's results undermine opponents' arguments that employment rates are hurt when the minimum wage rises. In fact, states may further benefit from a rise in wages if those additional earnings are spent and reinvested in the economy.

Still, there are plenty of future avenues for research on the relationship between minimum wage and employment. This study's results included Arkansas and Mississippi residents from all demographics. If minimum wage policies have disproportionate effects on individuals based on their age, gender, race, etc., isolating for employment changes based on demographic attributes could provide insightful analysis for policy making. Future experiments may also go beyond the state level and conduct exploration at the industry level to explore how minimum wage policies may affect industry dynamics unevenly. Industry data could also be factored into the model as a control variable to further bolster the parallel trends assumption by controlling for any industry trends not common to both states.

The results also lack insight into the long-run effects of policy changes on employment. The post-treatment period in this experiment only extends across five years; there is likely value in investigating whether minimum wage increases have any adverse effects on long-term economic growth and employment stability. One must also avoid the assumption that the minimum wage change in 2014 had no effect on every single firm in Arkansas. There could have been cases in which some firms experienced positive effects and others adverse effects. While the lack of aggregate, statewide effects on employment should not warrant large-scale action preventing future minimum wage increases, it is important that local representatives understand how state laws impact their communities and how the provision of local support can help their constituents during times of economic transitions and transformations.

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