

Introduction

The objective of this project is to describe the economic effects of increases in the minimum wage in Arizona. This topic is significant, as the minimum wage is a highly controversial and contested topic of modern political debate. Understanding its effects provides vital insight that can aid in the implementation of effective policy and help economists and legislatures make prudent and informed decisions. It can also further our understanding of the movement of supply and demand in the labor market, the role of incentives, and the neoclassical price theory's relation to the labor market. We will compile data from when the minimum wage in Arizona increased in 2017 due to the passage of the Healthy Families and Fair Wages act. We will compare this data to "control group" states, Utah, Nevada, and New Mexico.

In order to compare what the theory tells us to what happened, we will use the FRED database to gather data on each control group state's unemployment rate and minimum wage. Then we can use a difference-in-difference estimation to find out the impact of Arizona's minimum wage increase on its unemployment rate. Lastly, we can see what our findings really tell us and also what they may fail to capture.

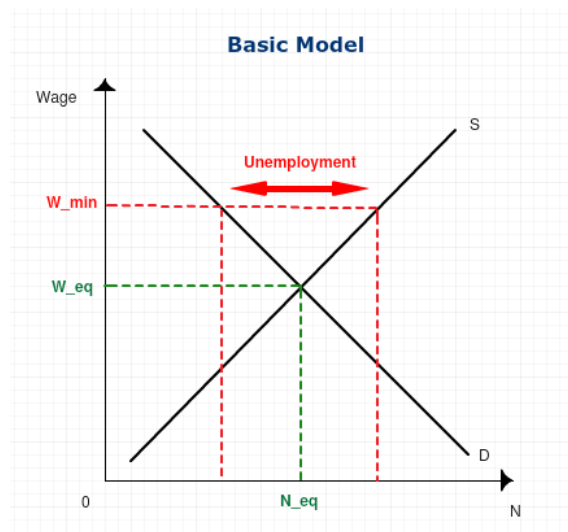
Background:

The idea of a legal minimum wage began in 19th century reform movements, specifically in the United Kingdom. Minimum wages were a result of trade union movements, and the goal at the time was to “democratize” unregulated workplaces. In 1938, President Roosevelt signed the Fair Labor Standards Act, which set the first minimum wage in the United States at 25 cents per hour (U.S. Department of Labor). Today, the federal minimum wage is \$7.25, and it has not changed since 2009. The states have varying minimum wages, the two highest being \$13 in California and \$13.50 in Washington State (“Minimum Wage by State”, 2019). In 2016, Arizona voters passed the Healthy Families and Fair Wages Act which gradually increases the state’s minimum wage each year through 2020 as follows: \$10 on and after January 1st, 2017; \$10.50 on and after January 1st, 2018; \$11 on and after January 1st, 2019; and \$12 on and after January 1st, 2020 (Arizona State Legislature, n.d.). Proponents of the higher minimum wage argue that the cost of living has increased over time and in order to ensure that minimum wage workers can sustain a reasonable standard of living for themselves and their families, we must implement a price floor for labor.

The minimum wage is a topic of much controversy in modern political discourse. Some claim that an increased minimum wage in Arizona is necessary for residents to sustain their standard of living and provide for their families. Others fear that an increased minimum wage will result in unintended economic consequences. According to Thomas C. Leonard, research scholar and lecturer at Princeton University, the core of this debate is the question of where and to what extent the neoclassical price theory can be applied (Leonard, n.d.). The classical price theory states that a product’s cost of production should determine its price, while the neoclassical price theory states that a product’s perceived value by consumers should determine its price. If the classical theory holds true, a minimum wage should stabilize the economy. The opposite is true for neoclassical theory. Recent empirical labor economics

studies suggest that moderate increases in the minimum wage do not lead to adverse effects on employment. These findings are at odds with the neoclassical price theory and time-series econometrics research which predicts increased unemployment with an increased minimum wage.

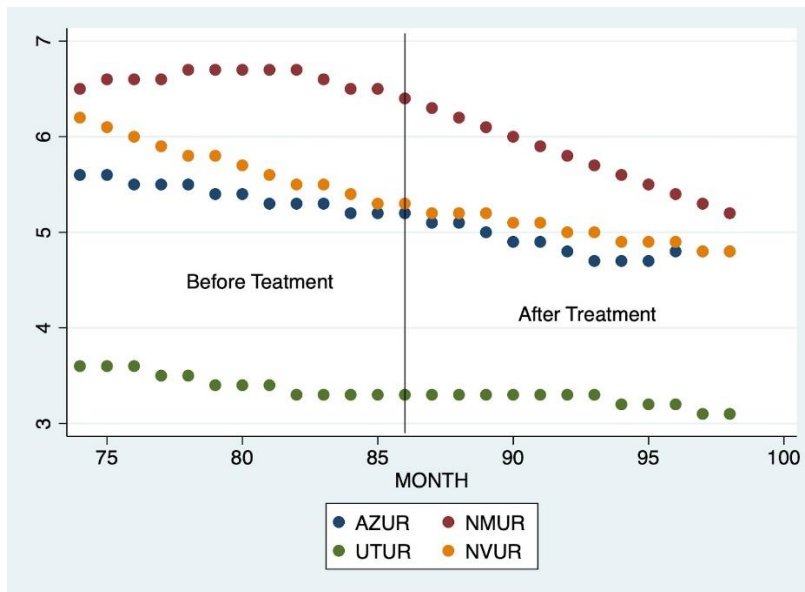
The question of whether the theory of free market equilibrium prices and quantities can be applied to wages and employment is also central to minimum wage debate. Many economists employ the neoclassical price theory and claim that increases in the minimum wage are a hindrance to economic growth, as they decrease unemployment. The theory behind this argument is best demonstrated by a graph such as the one to the right. The minimum wage acts as a price floor. Employers can no longer offer the equilibrium price of labor, where supply meets demand, but legally must offer a higher wage, causing deadweight loss. The magnitude of the deadweight loss depends on the wage increase and the elasticity of labor demand (Leonard, n.d.). Because employers must pay each employee more, they cannot afford to employ as many workers. This is where the theory that increased minimum wages lead to higher unemployment comes from. In addition, the minimum wage also increases the cost of producing goods, which forces firms to increase the prices that consumers pay. This means that all socioeconomic classes are subject to higher prices, but only minimum wage workers experience increased incomes. This gives more purchasing power to lower income individuals (Goddard, 2016). Further, economists argue that as a result of workers losing their jobs due to a rising minimum wage, public assistance may be required to help the unemployed. However, public assistance will create disincentives to work.



Some empirical studies do not support the theory of the minimum wage as an inefficient price floor. A study published by the National Bureau of Economic Research analyzed a theoretical framework which was “general enough to allow minimum wages to have the conventional negative impact on employment, but which also allows for the possibility of a neutral or a positive effect” (Dickens, et. al, 1994). The model was based on labor markets that gave employers some monopsony power. The model also had empirical implications which the researchers tested using data on industry-based minimum wages between 1975 and 1990 that were set by the United Kingdom Wages Councils. At the end of the study, the researchers concluded that “minimum wages significantly compress the distribution of earnings and, contrary to conventional economic wisdom but in line with several recent studies, do not have a negative impact on employment. If anything, the relationship between minimum wages and employment is estimated to be positive” (Dickens, et. al). However, research published by Duke University states that “Most minimum wage studies examine the effect of the minimum wage on overall employment, including jobs not covered by the minimum wage. A large number of displaced covered workers take jobs in uncovered sector jobs paying less than the minimum wage. As a result, these studies seriously understate the job losses attributable to the minimum wage” (Wessels, n.d.). There are contradictory conclusions among economists regarding the impact of the minimum wage on the labor market. This is why our research of the impact on Arizona’s increasing minimum wage is interesting and significant.

Data:

The data we used for this experiment comes from the FRED database. We are using a difference-in-difference (DiD) estimation to compare the mean unemployment rates for a one month through a 4-month period. The results from Arizona will be compared to Utah, New Mexico, and Nevada. The year of the change is 2017, where there was an increase in the Arizona minimum wage from \$8.05 to \$10 per hour. Meanwhile Utah, New Mexico, and Nevada all kept their minimum wages of \$7.25, \$7.50, and \$8.25 respectively. The graph below shows the unemployment rates of each state before and after Arizona's minimum wage increase.



We note from the data that the parallel trend assumption does not appear to hold between Arizona and any of the other observed states between the period of 82 and 90 months. However, it should not necessarily be expected to be since it is such a strong assumption. Therefore, we will continue and assume the trends are similar enough to be used in a comparison. The potential risks of this will be discussed more in the analysis.

Analysis:

The goal of this analysis will be to use data in hopes of understanding if there is any negative effect on unemployment caused by an increase in the minimum wage. Previously, Card and Krueger conducted a DiD estimation experiment between New Jersey and Pennsylvania hoping to uncover the impact on employment of an increase in minimum wage. Similarly, we will be doing a DiD estimation to see if Arizona's unemployment rate increased relative to nearby states as a result of its minimum wage increase.

In order to do this, we must first find the mean unemployment rate for each state over a 1–4-month period before the increase. The table below shows our results, where y equals the number of months before the wage increase.

Unemployment Rate Before	Mean $y = 1$	Mean $y = 2$	Mean $y = 3$	Mean $y = 4$
AZ	5.2	5.2	5.23	5.25
UT	3.3	3.3	3.3	3.3
NV	5.3	5.35	5.4	5.43
NM	6.5	6.5	6.53	6.58

Similarly, we now find the mean unemployment rate for each state over a 1–4-month period after the increase, shown by the table below.

Unemployment Rate After	Mean $y = 1$	Mean $y = 2$	Mean $y = 3$	Mean $y = 4$
AZ	5.1	5.1	5.07	5.03
UT	3.3	3.3	3.3	3.3
NV	5.2	5.2	5.2	5.18
NM	6.3	6.25	6.2	6.15

Next, we subtract the unemployment rates after the wage increase from those before. This will give us the difference in the mean of the rates for both Arizona and the control groups.

Before - After	Mean $y = 1$	Mean $y = 2$	Mean $y = 3$	Mean $y = 4$
AZ	0.1	0.1	0.17	0.23
UT	0	0	0	0
NV	0.1	0.15	0.2	0.25
NM	0.2	0.25	0.33	0.43

Now we are ready to uncover the treatment effect of Arizona's increase in their minimum wage. We do so by subtracting the difference in Arizona's mean unemployment rates before and after the treatment from those in the control groups. This will hopefully isolate the change caused by the increase in unemployment, or in other words, give us the true treatment effect.

Treatment Effect (AZ - other)	Mean y = 1	Mean y = 2	Mean y = 3	Mean y = 4
UT	0.1	0.1	0.17	0.23
NV	0	-0.05	-0.03	-0.02
NM	-0.1	-0.15	-0.17	-0.2
Average Treatment Effects	0.000%	-0.033%	-0.010%	0.003%

To hopefully clarify any confusion at this point I will explain what exactly the numbers and sign for the average treatment effect mean. For an individual control group, let's say Nevada, has a treatment effect given by $(\text{Before}_{AZ} - \text{After}_{AZ}) - (\text{Before}_{NV} - \text{After}_{NV})$. If $\text{Before}_{AZ} - \text{After}_{AZ}$ is negative then Arizona's employment rate decreased after the treatment effect. Similarly, if $\text{Before}_{NV} - \text{After}_{NV}$ is negative then Nevada's unemployment rate decreased. Therefore, if $(\text{Before}_{AZ} - \text{After}_{AZ}) - (\text{Before}_{NV} - \text{After}_{NV})$ is negative then Arizona decreased in unemployment at a slower rate than Nevada. Now we are ready to interpret our results.

The results tell us that Arizona's unemployment rate decreased at a slower rate relative to the control group during the 2- and 3-month period. It also did not relatively change at all during the one-month period and decreased at a slightly faster rate during the 4-month period. The 2 and 3 month results therefore align with theory, meanwhile the 1- and 4-month results do not. Since certain assumptions had to be made it would be justified to question the validity of these results and therefore, an explanation as to why we should take these results lightly will be given.

First consider the assumption made in the data section, the parallel trend assumption. We need to be able to assume that the difference between Arizona and the control groups is constant over time before the minimum wage increase. However, we only assumed they were similar enough, and the consequence of assuming that is our result could be a biased estimation of the causal effect. As a result, our conclusion above from the data may not be entirely accurate.

Moreover, there could have been additional changes in any of the control group states, not made in Arizona, which impacted the unemployment rate. For example, if Walmart decided to expand its number of stores in New Mexico at the start of 2017, the impact would most likely be a decrease in the New Mexico unemployment rate. Through our analysis we would mistake this change as being a result of the minimum wage increase in Arizona. Therefore, we should consider the possibility of other potential changes impacting the control states if they are not also equally impacting Arizona.

Conclusion

From the data, we found the minimum wage and unemployment rate for both Arizona and each state in the control group. We then used this data to find the treatment effect using DiD estimation. We found that Arizona's unemployment rate decreased at a slower rate relative to the control group during the 2- and 3-month periods. Meanwhile for the 1-month period, the unemployment rate decreased at the same rate for the treatment and control groups. It decreased at a faster rate during the 4-month period. However, because we could not confidently hold the parallel trend assumption and other possible factors were overlooked, there is still a lot of research to do in order to determine the true treatment effect Arizona's 2017 minimum wage increase.

References

<https://www.dol.gov/general/aboutdol/history/flsa1938>

https://www.princeton.edu/~tleonard/papers/minimum_wage.pdf

<https://www.nber.org/papers/w4742.pdf>

<https://historynewsnetwork.org/article/164635>

<https://www.dol.gov/general/topic/wages/minimumwage>

<https://www.paycor.com/resource-center/minimum-wage-by-state>

Arizona State Legislature. (n.d.). Retrieved from

<https://www.azleg.gov/viewdocument/?docName=https://www.azleg.gov/ars/23/00363.htm>

http://public.econ.duke.edu/~staff/wrkshop_papers/Wessels.pdf

<https://www.mailman.columbia.edu/research/population-health-methods/difference-difference-estimation>

<https://fred.stlouisfed.org/>

Angrist, Joshua David, and Pischke Jörn-Steffen. *Mostly Harmless Econometrics: an Empiricists Companion*.