Group Project

4/15/2021

Introduction

This project aims to analyze how changes in state minimum wages affect changes in the state unemployment level, and we have built three model to explore this relationship. In the first basic model, we simply regress state's unemployment rate on effective minimum wage in 2020 dollars. In the second model, based on the first basic model, we consider year fixed effect and state fixed effect, and we also introduce three dummy variables for 1980-1990, 1990-2000, and 2000-2010 to check whether or not the results change across the three different periods. In the third model, we build a panel regression model in order to include state fixed effect and time fixed effect. Our analysis indicates that state minimum wages have a positive relationship with state unemployment rate.

Result

Model 1: baseline model

```
# model1:
fm0 <- lm(unemployment_rate ~ Effective.Minimum.Wage.2020.Dollars , data = df)
summary(fm0)
```

```
##
## Call:
## lm(formula = unemployment_rate ~ Effective.Minimum.Wage.2020.Dollars,
##     data = df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.0242 -1.4064 -0.2301  1.1018 11.4566
##
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                        0.81211    0.39721   2.045    0.041
## Effective.Minimum.Wage.2020.Dollars  0.63578    0.04892  12.996   <2e-16
##
## (Intercept)                       *
## Effective.Minimum.Wage.2020.Dollars ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.015 on 1987 degrees of freedom
## Multiple R-squared:  0.07834,    Adjusted R-squared:  0.07787
## F-statistic: 168.9 on 1 and 1987 DF,  p-value: < 2.2e-16
```

```
coeftest(fm0, df = Inf, vcov = vcovHC(fm0, type = "HC1"))
```

```
##
## z test of coefficients:
##
```

```
##                                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)                        0.812115   0.414142   1.961  0.04988
## Effective.Minimum.Wage.2020.Dollars 0.635777   0.053239  11.942  < 2e-16
##
## (Intercept)                        *
## Effective.Minimum.Wage.2020.Dollars ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Model2:

baseline model + year fixed effect + year · effective + state fixed effect + state · effective

```
fm1 <- lm(unemployment_rate ~ Effective.Minimum.Wage.2020.Dollars+stateid + dummy8090 + dummy9000 + dumm
summary(fm1)
```

```
##
## Call:
## lm(formula = unemployment_rate ~ Effective.Minimum.Wage.2020.Dollars +
##     stateid + dummy8090 + dummy9000 + dummy0010 + Effective.Minimum.Wage.2020.Dollars *
##     dummy8090 + Effective.Minimum.Wage.2020.Dollars * dummy9000 +
##     Effective.Minimum.Wage.2020.Dollars * dummy0010 + Effective.Minimum.Wage.2020.Dollars *
##     stateid, data = df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.4142 -1.3158 -0.2275  1.0647 10.6917
##
## Coefficients:
##                                                Estimate Std. Error
## (Intercept)                                   5.2923857  1.0100234
## Effective.Minimum.Wage.2020.Dollars           0.1216913  0.1180544
## stateid                                      -0.0133621  0.0244381
## dummy8090                                    -5.4439779  1.1733399
## dummy9000                                     1.1608358  1.4740851
## dummy0010                                    -3.8708776  1.1014332
## Effective.Minimum.Wage.2020.Dollars:dummy8090  0.7735818  0.1375489
## Effective.Minimum.Wage.2020.Dollars:dummy9000 -0.2189786  0.1864537
## Effective.Minimum.Wage.2020.Dollars:dummy0010  0.4042539  0.1331287
## Effective.Minimum.Wage.2020.Dollars:stateid    0.0002691  0.0029792
##                                              t value Pr(>|t|)
## (Intercept)                                    5.240 1.78e-07 ***
## Effective.Minimum.Wage.2020.Dollars            1.031 0.302757
## stateid                                       -0.547 0.584597
## dummy8090                                     -4.640 3.72e-06 ***
## dummy9000                                      0.787 0.431086
## dummy0010                                     -3.514 0.000451 ***
## Effective.Minimum.Wage.2020.Dollars:dummy8090   5.624 2.13e-08 ***
## Effective.Minimum.Wage.2020.Dollars:dummy9000  -1.174 0.240360
## Effective.Minimum.Wage.2020.Dollars:dummy0010   3.037 0.002424 **
## Effective.Minimum.Wage.2020.Dollars:stateid     0.090 0.928027
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 1.907 on 1979 degrees of freedom
## Multiple R-squared:  0.178,  Adjusted R-squared:  0.1742
## F-statistic: 47.61 on 9 and 1979 DF,  p-value: < 2.2e-16
```

```
coeftest(fm1, df = Inf, vcov = vcovHC(fm1, type = "HC1"))
```

```
##
## z test of coefficients:
##
##                                                 Estimate  Std. Error
## (Intercept)                                   5.29238567  0.97619008
## Effective.Minimum.Wage.2020.Dollars           0.12169132  0.11592724
## stateid                                      -0.01336206  0.02162504
## dummy8090                                    -5.44397795  1.19901439
## dummy9000                                     1.16083579  1.27782894
## dummy0010                                    -3.87087764  1.06273173
## Effective.Minimum.Wage.2020.Dollars:dummy8090  0.77358178  0.14264420
## Effective.Minimum.Wage.2020.Dollars:dummy9000 -0.21897860  0.16071860
## Effective.Minimum.Wage.2020.Dollars:dummy0010  0.40425389  0.13036298
## Effective.Minimum.Wage.2020.Dollars:stateid    0.00026914  0.00275314
##                                                z value  Pr(>|z|)
## (Intercept)                                     5.4215 5.911e-08 ***
## Effective.Minimum.Wage.2020.Dollars             1.0497 0.2938462
## stateid                                        -0.6179 0.5366428
## dummy8090                                      -4.5404 5.615e-06 ***
## dummy9000                                       0.9084 0.3636438
## dummy0010                                      -3.6424 0.0002701 ***
## Effective.Minimum.Wage.2020.Dollars:dummy8090   5.4232 5.856e-08 ***
## Effective.Minimum.Wage.2020.Dollars:dummy9000  -1.3625 0.1730411
## Effective.Minimum.Wage.2020.Dollars:dummy0010   3.1010 0.0019288 **
## Effective.Minimum.Wage.2020.Dollars:stateid     0.0978 0.9221253
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Model 3:

baseline model + year fixed effect (treat individual year instead of grouping the year into three) + state fixed effect

```
fm2 <- plm(unemployment_rate ~ Effective.Minimum.Wage.2020.Dollars,
    data = df,
    index = c("State", "Year"),
    model = "within")
summary(fm2)
```

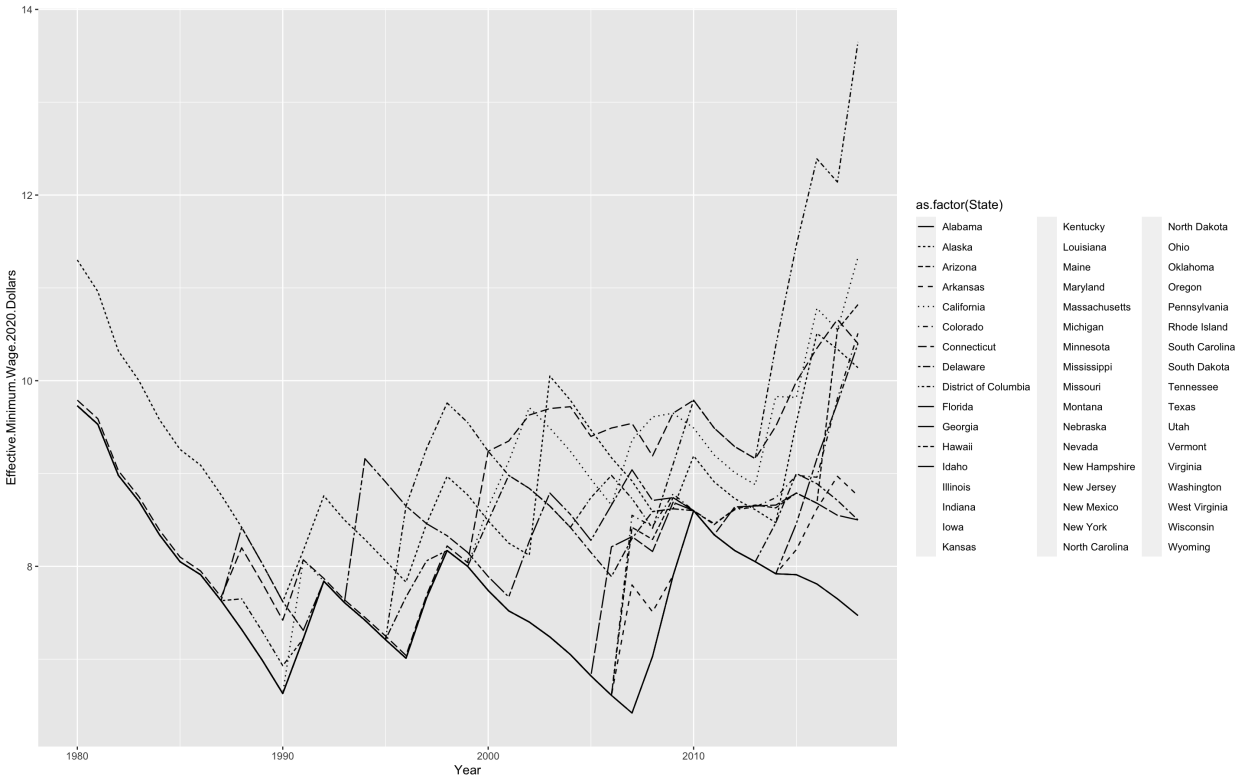
```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = unemployment_rate ~ Effective.Minimum.Wage.2020.Dollars,
##     data = df, model = "within", index = c("State", "Year"))
##
## Balanced Panel: n = 51, T = 39, N = 1989
##
## Residuals:
##     Min.  1st Qu.   Median  3rd Qu.     Max.
```

```
## -4.96930 -1.12716 -0.13286  0.98497  9.06685
##
## Coefficients:
##                                    Estimate Std. Error t-value  Pr(>|t|)
## Effective.Minimum.Wage.2020.Dollars 0.652224   0.047024   13.87 < 2.2e-16
##
## Effective.Minimum.Wage.2020.Dollars ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    6306.6
## Residual Sum of Squares: 5736.8
## R-Squared:      0.090344
## Adj. R-Squared: 0.066394
## F-statistic: 192.377 on 1 and 1937 DF, p-value: < 2.22e-16
```

```
coeftest(fm2, df = Inf, vcov = vcovHC(fm2, type = "HC1"))
```

```
##
## z test of coefficients:
##
##                                    Estimate Std. Error z value  Pr(>|z|)
## Effective.Minimum.Wage.2020.Dollars  0.65222    0.10234  6.3729 1.854e-10
##
## Effective.Minimum.Wage.2020.Dollars ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Result figure



{width =7,height = 5}