**Results and Discussion – Andrew Vo**

**I, Results**

**Notes:** For two OLS Pooled Cross Section results below, my goal is to estimate the effect of interest-rates drop on GDP during recession. Besides the variables mentioned in the Data & Methods file, I’ve switch CPI and federal\_funds\_rate values to lCPI and lfederal\_funds\_rate which are the logs of CPI and federal\_funds\_rate values. I’ve also created dummy variables: *treatment* (turn 1 when there is interest rate drop during the Great Recession and 0 otherwise) and *recession* (turn 1 when the time line is in the Great Recession and 0 otherwise). To see more detail on how I code and come to the results and conclusions below, please go to [Link](https://gitlab.com/hiep.vo/econ342_RecessionUs/-/blob/master/Results_&_Discussion/Pooled_Cross_Section.ipynb):

OLS Estimates of the Effect of Interest-rates Drop on GDP Depedent

Variable: Log of yearly GDP 1987-2010

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Dep. Variable: log(GDP) R-squared: **0.182**

Model: OLS Adj. R-squared: 0.173

Method: Least Squares F-statistic: 19.71

Date: Tue, 05 May 2020 Prob (F-statistic): 1.44e-11

Time: 10:44:52 Log-Likelihood: -64.411

No. Observations: 270 AIC: 136.8

Df Residuals: 266 BIC: 151.2

Df Model: 3

Covariance Type: nonrobust

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coef std err t P>|t| [0.025 0.975]

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Intercept 15.9988 0.026 618.226 0.000 15.948 16.050

treatment -0.0935 0.039 -2.370 0.019 -0.171 -0.016

recession 0.4935 0.141 3.505 0.001 0.216 0.771

treatment **0.1002** 0.166 **0.604** 0.546 -0.227 0.427

during-recession

Breusch Pagan test for Hetereoskedasticity

'p-value': 26.087803056373588, 'f-value': 9.142091747883228e-06

White test for Hetereoskedasticity

'p-value': 26.078826802746146, 'f-value': 2.1729749135484476e-06

**Description**: The table above is the Pooled Cross Section regression result from regressing the log of yearly GDP on 3 variables: *treatment, recession* and *treatment-during-recession* (the product: *treatment \* recession*). The coefficient for *treatment-during-recession* will indicate the effect of interest-rates drop during recession of GDP change. Here, the coefficient is 0.1 which indicates that if there is interest-rates drop during recession, the GDP is predicted to increase 10%, holding all other variables constant. However, since the t-statistic for such coefficient is only 0.604 and the Adjusted R squared is only 0.182 which means this prediction is insignificant. This can be due to limited number of variables (only 3). At least it’s can be concluded that the data points are distributed evenly throughout the dataset since the p-value for 2 Hetereoskedasticity tests are > 1

OLS Estimates of the Effect of Interest-rates Drop on GDP Depedent

Variable: Log of yearly GDP 1987-2010

(All Variables included)

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Dep. Variable: log(GDP) R-squared: 0.999

Model: OLS Adj. R-squared **0.999**

Method: Least Squares F-statistic: 2.611e+04

Date: Tue, 05 May 2020 Prob (F-statistic): 0.00

Time: 10:48:44 Log-Likelihood: 917.53

No. Observations: 270 AIC: -1799.

Df Residuals: 252 BIC: -1734.

Df Model: 17

Covariance Type: nonrobust

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coef std err t P>|t| [0.025 0.975]

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Intercept 15.2896 0.021 718.714 0.000 15.248 15.331

treatment -0.0058 0.001 -4.669 0.000 -0.008 -0.003

recession -0.0371 0.006 -6.378 0.000 -0.049 -0.026

treatment **0.0140** 0.005 **2.814** 0.005 0.004 0.024

-during-recession

CPI\_Inflation 0.0111 0.006 1.940 0.054 -0.000 0.022

avg\_HPI -0.0304 0.012 -2.446 0.015 -0.055 -0.006

long\_term -0.0306 0.008 -3.992 0.000 -0.046 -0.015

\_interest

budget\_on\_

education 0.0434 0.008 5.233 0.000 0.027 0.060

population 0.8046 0.034 23.376 0.000 0.737 0.872

employed\_percent 0.2267 0.027 8.474 0.000 0.174 0.279

unemployed\_percent 0.0467 0.020 2.309 0.022 0.007 0.086

lowest -0.0470 0.013 -3.487 0.001 -0.074 -0.020

second 0.0042 0.016 0.258 0.796 -0.028 0.037

third 0.0200 0.020 1.003 0.317 -0.019 0.059

fourth -0.0831 0.029 -2.852 0.005 -0.140 -0.026

top\_5\_percent 0.1006 0.025 4.012 0.000 0.051 0.150

log(CPI) 0.3471 0.027 12.663 0.000 0.293 0.401

log(federal\_funds -0.0048 0.010 -0.481 0.631 -0.025 0.015

\_rates)

Breusch Pagan test for Hetereoskedasticity

'p-value': 69.45603647864841, 'f-value': 2.6752573275078854e-08

White test for Hetereoskedasticity

'p-value', 7.98683192716144, 'f-value': 0.018436627582135184

**Description**: The table above is the Pooled Cross Section regression result from regressing the log of yearly GDP on 3 variables *treatment, recession*, *treatment-during-recession* and all other variables from the data. The coefficient for *treatment-during-recession* in this case is 0.014 (much smaller than previous result but still positive) which indicates that if there is interest-rates drop during recession, the GDP is predicted to increase 1.4%, holding all other variables constant. In this case, the t-statistic for such coefficient is 2.814 and the Adjusted R squared is very high (0.999) which means this prediction very statistically significant. Also, there would be no Hetereoskedasticity error since the p-value for 2 Hetereoskedasticity tests are > 1

**Conclude:** From the above Pooled Cross Section model, I can conclude that it’s statistically significant for GDP to increase during Recession thanks to a decrease of interest rates. In particular, if there is a sign of interests rates decrease during recession, holding all other variables constant GDP can increase 1.4%.

**II, Discussion**

I have chosen the topic of my project to be predicting the effect of interest-rates drop on GDP changes. My initial thoughts were a bit different, I want to predict more in specific of how much interest-rates has to drop for an effect on GDP increase instead of just having a signal of interest-rates decrease during recession of no matter what amount. However, by seeing the positive coefficient with statistically significant, I can still conclude that the recession can be less extreme when there is interest-rate drop. I want to make this prediction because by March of 2020, president Trump has declared the interest-rates drop from 2.25% to nearly 0% during this Corona Virus pandemic (technically a recession). I believe that my model can conclusion can be applicable for policy changes during economy hardships like Trump’s decision and it would be further expressed if US GDP can benefit from this decision. I’m just a bit concern that the effect of such interest-rate drop of recession GDP is quite small (1.4%) and the R Squared is quite too high (0.999) which may indicate some variable bias in my data even though I constantly have tests for Hetereoskadasticity. Besides this model for policy change on interest-rates during recession, I also contruct normal OLS regression for GDP all variables to gasp the general effects of interest-rates as well as other variables on GDP overall. My models can be further improve if it can specifically predict the amount of interest-rate changed needed for the GDP to benefit.

**Links to my models:**

* Pooled Cross Section Model: <https://gitlab.com/hiep.vo/econ342_RecessionUs/-/blob/master/Results_&_Discussion/Pooled_Cross_Section.ipynb>
* Normal OLS Regression: <https://gitlab.com/hiep.vo/econ342_RecessionUs/-/blob/master/Results_&_Discussion/Normal_OLS_Regression.ipynb>