

The Effectiveness of Biden’s American Rescue Plan: A Multiple Linear Regression Analysis*

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Abstract

COVID-19 has dominated people’s daily lives across the globe since its emergence at the beginning of 2020. In order to combat the adverse effects of the recession on the United States economy, President Biden announced and signed the American Rescue Plan (ARP) to stimulate the market. The purpose of this study is to investigate the impact of the plan’s implementation on a number of economic indicators such as the unemployment rate and inflation rate using a multiple regression model. Additionally, statistical techniques such as regression analysis, correlation analysis, and ANOVA are applied to analyze the regression model’s results. We estimate that the ARP has no statistical significance with respect to these economic indicators based on our regression model. Statistical analysis of data and evaluation of statistical results will be conducted using the R statistical programming language, version 4.1.2.

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*Code and data are available at: <https://github.com/YiranMei/American-Rescue-Plan>.

1.Introduction

Since 2020, the outbreak of COVID-19 has adversely affected people's daily lives and the global economy. More than 235 000 cases of infection have occurred in the United States in less than two months since the first case was discovered in Washington on January 20, 2020. As of March 17, the outbreak had spread all over the country, including Washington, New York, and California. The number of COVID-19-related deaths in the United States has exceeded 5000 as of April 2020(Saad B. Omer (2020)). On December 31, 2020, there were more than 20 million infections and more than 346 thousand deaths within the United States, as well as 83,832,334 confirmed cases and 1,824,590 confirmed deaths worldwide(4). Apart from the COVID-19 pandemic, the related economic crisis in the United States has had a detrimental effect on the economic and health well-being of millions of American workers. Over 9.5 million jobs have been lost as a result of COVID-19, with 4 million workers out of work for at least six months(The White House (2021)).

Consequently, in order to stimulate and recover the economy from the foreseeable recession, Biden and the government announced the American Rescue Plan (ARP) on March 11, 2021, under which approximately \$1 trillion in total would be allocated directly to the American people(The White House (2021)). Along with extending PUA (Pandemic Unemployment Assistance) through September 6, 2021(The U.S. Government Publishing Office (2021)), each worker can receive a lump-sum payment of \$1400 and weekly benefits of \$300. A number of provisions were included in the proposed plan, including an extension of unemployment compensation, an increase in the Child Tax Credit, funding for state and local governments, and a subsidy for extra medical expenses resulting from COVID-19(Suzi LeVine (2021)). At this point of reopening and reflecting on the past two years, an examination of the effectiveness of the ARP becomes necessary to assess whether it has boosted the economy.

In light of the foregoing, we conducted this study to investigate whether there is a statistically significant correlation between the growth of the U.S. economy in various aspects and the implementation of ARP using a number of economic indicators from the Federal Reserve Economic Data. We examine the association in this report using a multiple regression model that incorporates covariates such as unemployment rate, real Gross Domestic Product(GDP), population, 10-year breakeven inflation rate, federal funds effective rate, average hourly earnings, as well as civilian labour force level and a dummy variable reflecting the status of before and after the implementation of the ARP. It has been shown that there is no statistical significance in the association between real GDP and the implementation of the ARP, which suggests the policy has been ineffective.

In the remaining elements of this paper, there are four sections: a data section where the data is analyzed and examined, a model section where the regression model is developed, a result section explaining the results, and a discussion section where the limitations and implications are discussed. The findings of this report will provide stakeholders with an insight into how to evaluate ARP policies and make better plans by taking into account findings.

To analyze the data in this report, the R statistical programming language(R Core Team (2021)) will be applied. Moreover, the following packages must be installed in R for cleaning and analysis processes: openxlsx(Philipp Schauburger (2021)), ggplot2(Wickham (2016)),kableExtra(Zhu (2021)), gtsummary(Sjoberg et al. (2021)), jtools(Long (2020)), MASS(Venables and Ripley (2002)) and car(Fox and Weisberg (2019)).

2. Data

2.1 Data Source

2.2 Data Characteristics

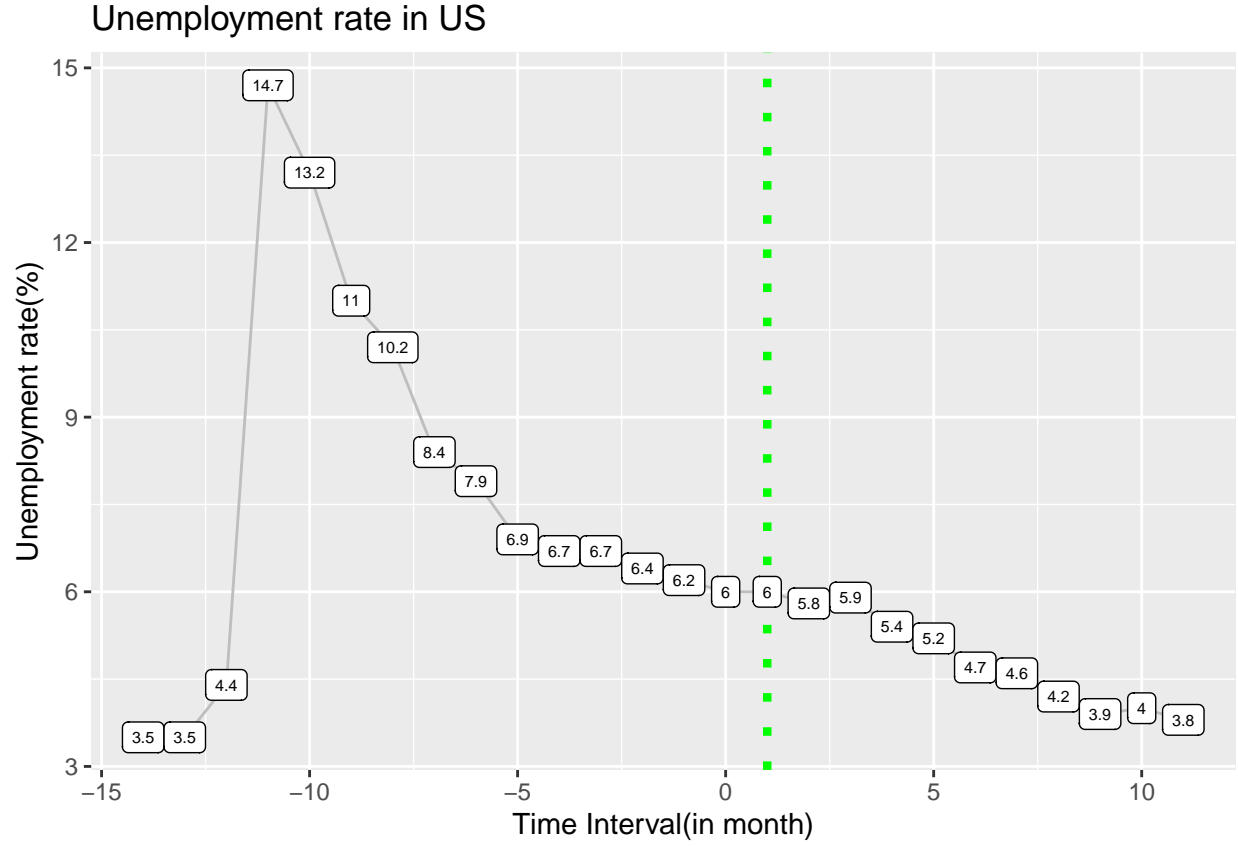


Figure 1: Unemployment rate in US

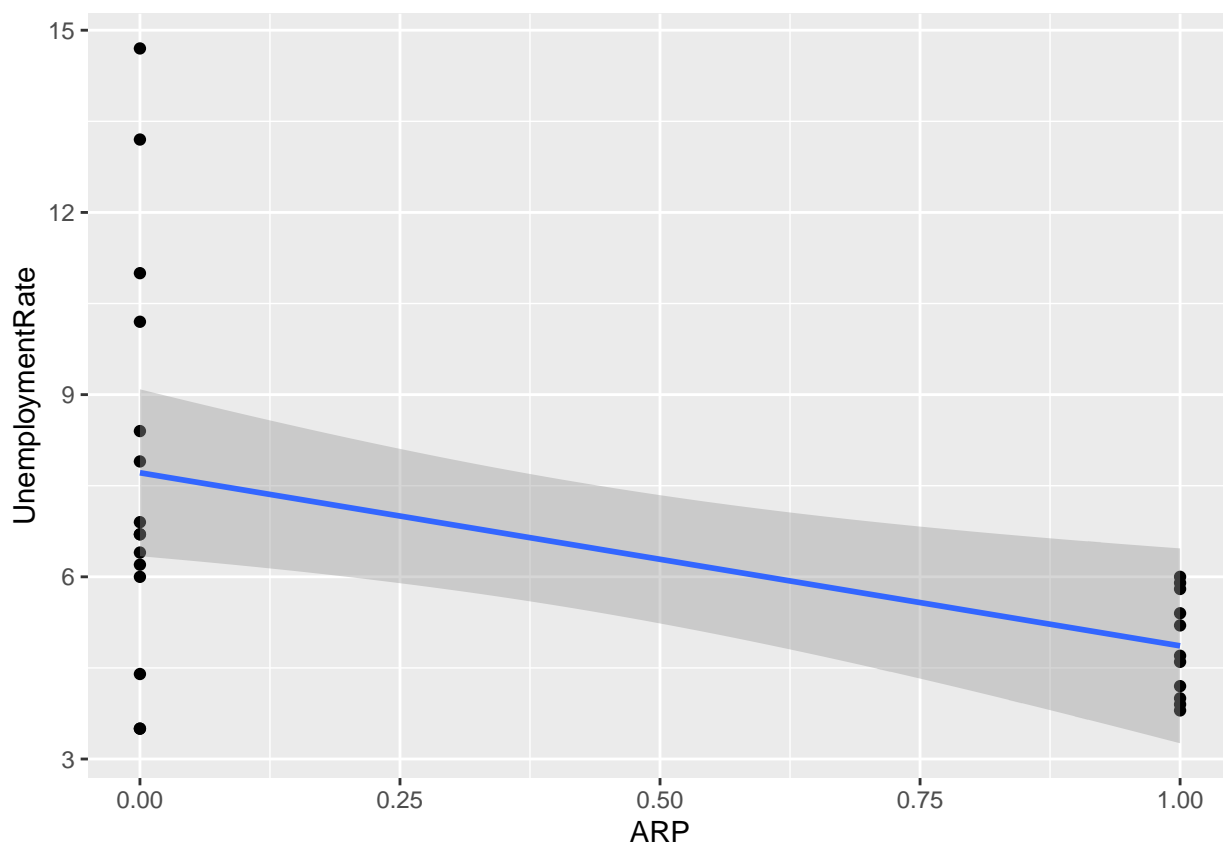
Table 1: Summary of Data

quarter_interval	UnemploymentRate	Population	InflationRate	InterestRate	Laborforce	Wage	ARP
Min. :-14.00	Min. : 3.500	Min. :331443	Min. :0.9868	Min. :0.04864	Min. :156358	Min. :28.43	Min. :0.0000
1st Qu.: -7.75	1st Qu.: 4.450	1st Qu.:331792	1st Qu.:1.6575	1st Qu.:0.07693	1st Qu.:160404	1st Qu.:29.52	1st Qu.:0.0000
Median : -1.50	Median : 5.950	Median :331966	Median :2.1308	Median :0.08000	Median :160906	Median :30.02	Median :0.0000
Mean : -1.50	Mean : 6.508	Mean :332043	Mean :1.9675	Mean :0.21488	Mean :161199	Mean :30.10	Mean :0.4231
3rd Qu.: 4.75	3rd Qu.: 6.850	3rd Qu.:332269	3rd Qu.:2.3493	3rd Qu.:0.09239	3rd Qu.:161997	3rd Qu.:30.74	3rd Qu.:1.0000
Max. : 11.00	Max. :14.700	Max. :332750	Max. :2.6160	Max. :1.58368	Max. :164583	Max. :31.60	Max. :1.0000

3. Model Development

Table 2: Correlation Matrix of Variables

	quarter_interval	UnemploymentRate	Population	InflationRate	InterestRate	Laborforce	Wage	ARP
quarter_interval	1.00	-0.51	0.96	0.90	-0.52	0.27	0.96	0.86
UnemploymentRate	-0.51	1.00	-0.47	-0.66	-0.35	-0.89	-0.28	-0.49
Population	0.96	-0.47	1.00	0.79	-0.49	0.30	0.95	0.79
InflationRate	0.90	-0.66	0.79	1.00	-0.27	0.40	0.78	0.80
InterestRate	-0.52	-0.35	-0.49	-0.27	1.00	0.59	-0.61	-0.29
Laborforce	0.27	-0.89	0.30	0.40	0.59	1.00	0.09	0.34
Wage	0.96	-0.28	0.95	0.78	-0.61	0.09	1.00	0.83
ARP	0.86	-0.49	0.79	0.80	-0.29	0.34	0.83	1.00



Characteristic	**Beta**	**95% CI**	**p-value**
ARP	-2.8	-5.0, -0.74	0.010

Characteristic	**Beta**	**95% CI**	**p-value**
quarter_interval	-1.0	-1.6, -0.28	0.008
ARP	0.37	-1.2, 1.9	0.6
Population	0.00	-0.01, 0.00	0.7
InflationRate	1.4	-2.2, 4.9	0.4
InterestRate	-4.2	-7.8, -0.52	0.027
Wage	5.4	2.4, 8.5	0.001
Laborforce	0.00	0.00, 0.00	0.7

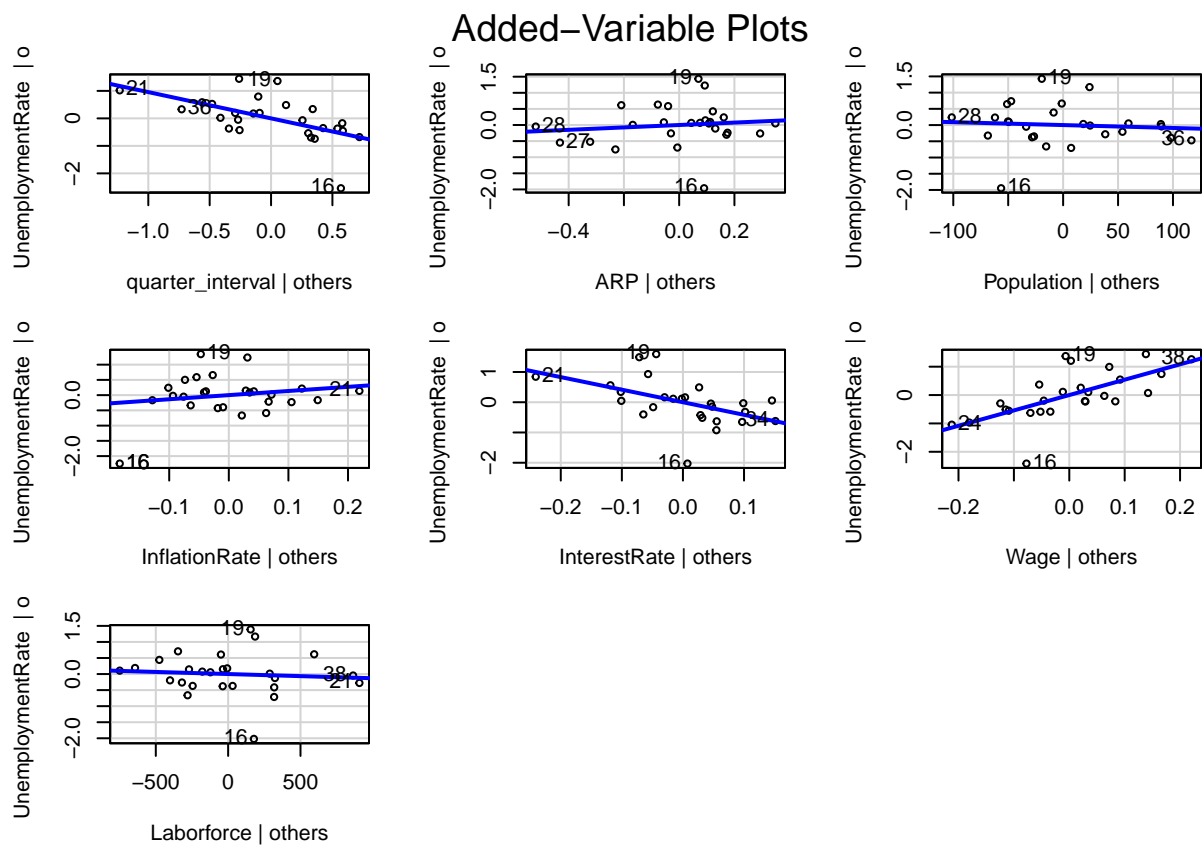


Figure 2: Added-Variable Plots

	Model 1	Model 2
(Intercept)	157.682 (857.630)	-176.799 (23.308)
quarter_interval	-0.956 (0.321)	-1.106 (0.123)
ARP	0.374 (0.737)	
Population	-0.001 (0.003)	
InflationRate	1.356 (1.680)	2.184 (0.934)
InterestRate	-4.154 (1.728)	-4.747 (0.495)
Wage	5.414 (1.447)	5.925 (0.734)
Laborforce	0.000 (0.000)	
Num.Obs.	26	26
R2	0.950	0.947
R2 Adj.	0.930	0.937
AIC	68.5	63.8
BIC	79.8	71.4
Log.Lik.	-25.243	-25.916
F	48.577	93.909
RMSE	0.77	0.73

Characteristic	**Beta**	**95% CI**	**p-value**
(Intercept)	-177	-225, -128	<0.001
quarter_interval	-1.1	-1.4, -0.85	<0.001
InflationRate	2.2	0.24, 4.1	0.029
InterestRate	-4.7	-5.8, -3.7	<0.001
Wage	5.9	4.4, 7.5	<0.001

4. Discussion and Results

4.1 Results

4.2 Discussion

4.2.1 General Findings

4.2.2 Implications

4.2.3 Ethics and biases

Appendix

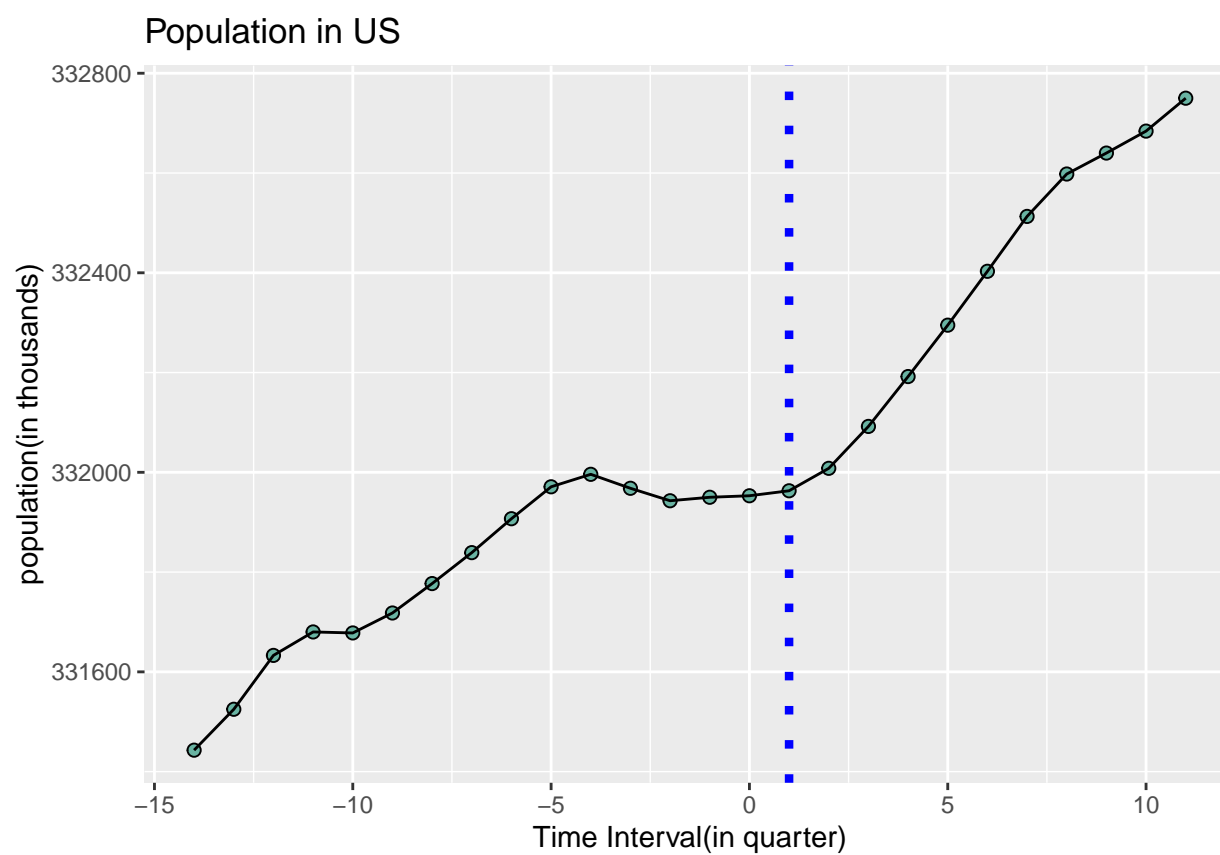
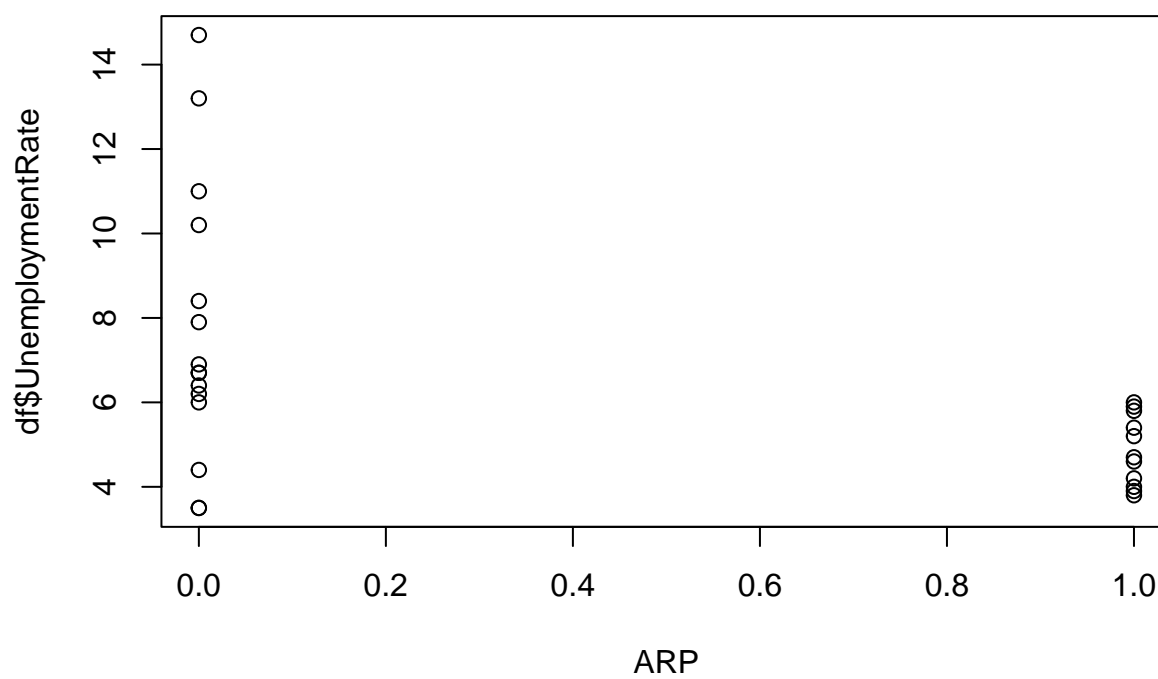


Figure 3: Population in US



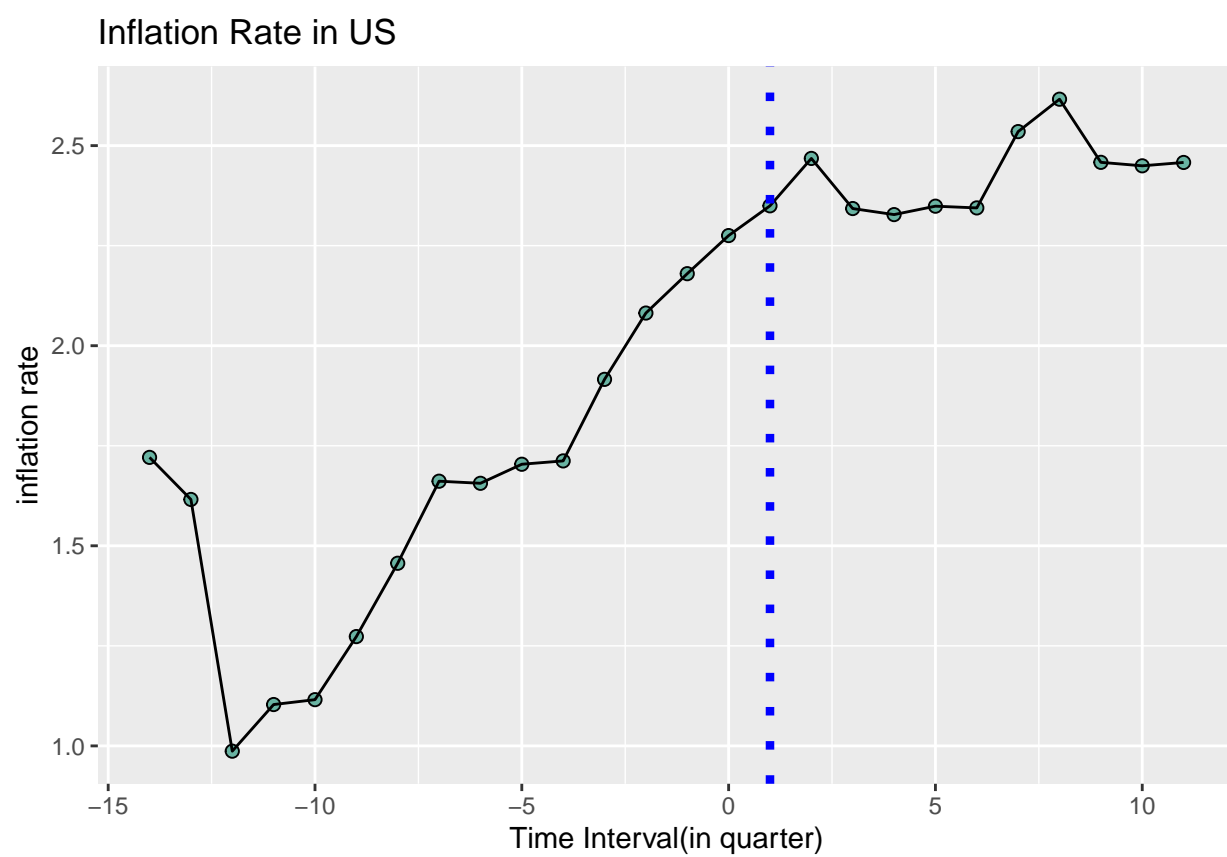


Figure 4: Inflation Rate in US

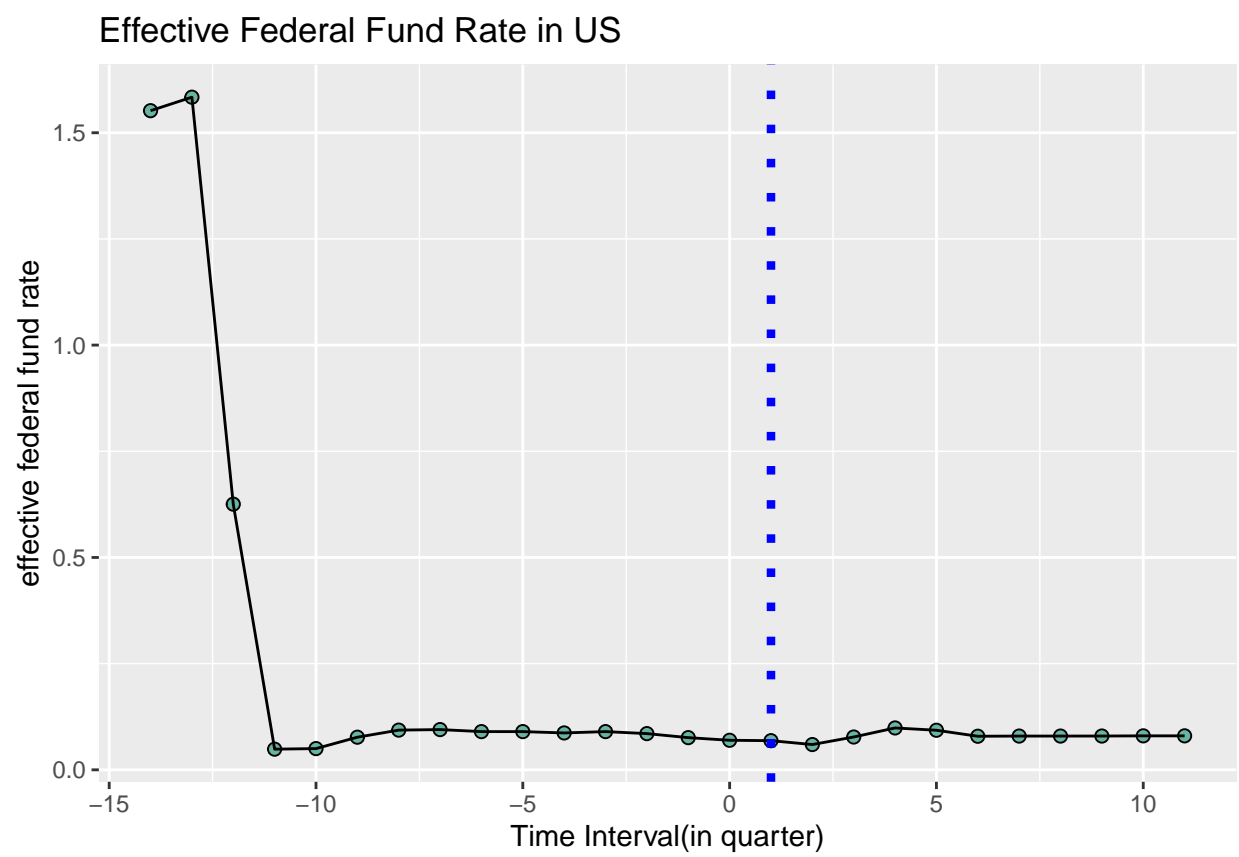


Figure 5: Effective Federal Fund Rate in US

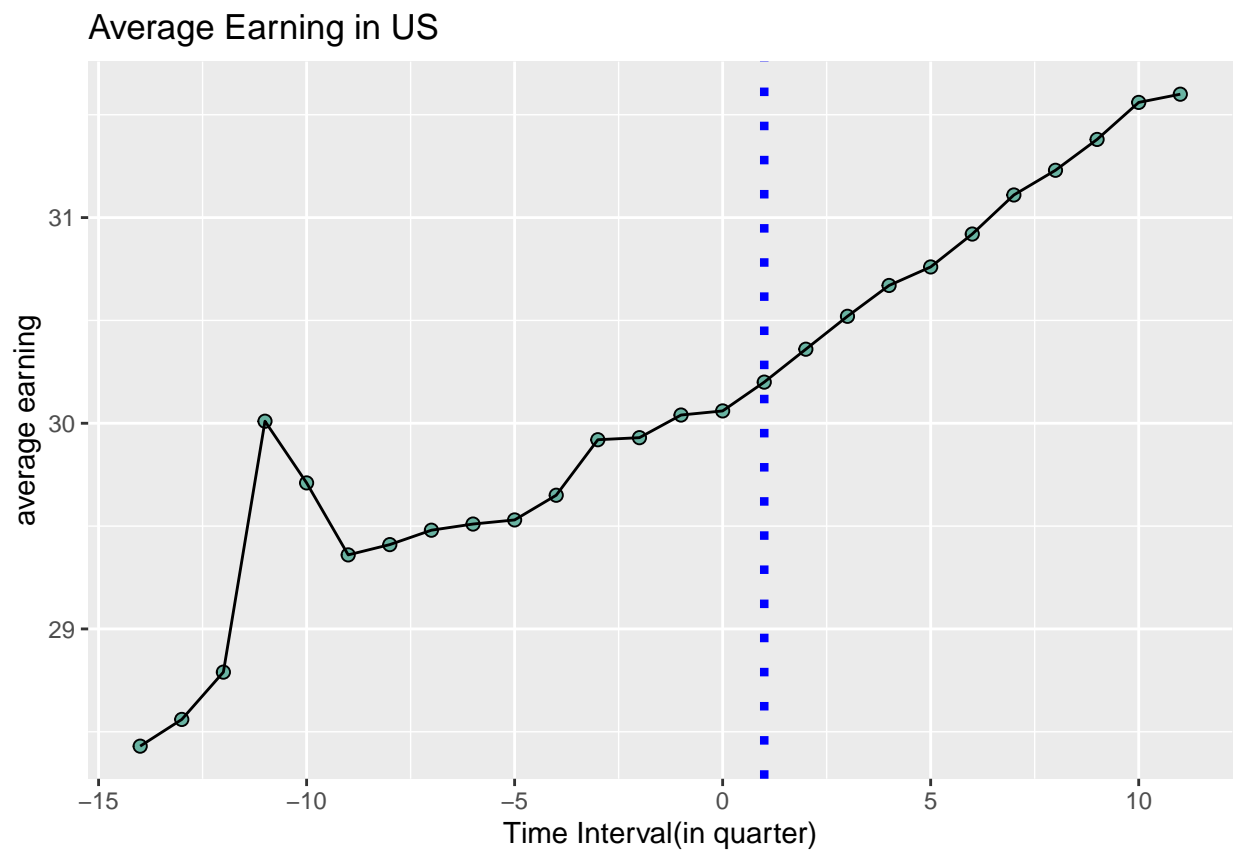


Figure 6: Average Earning in US

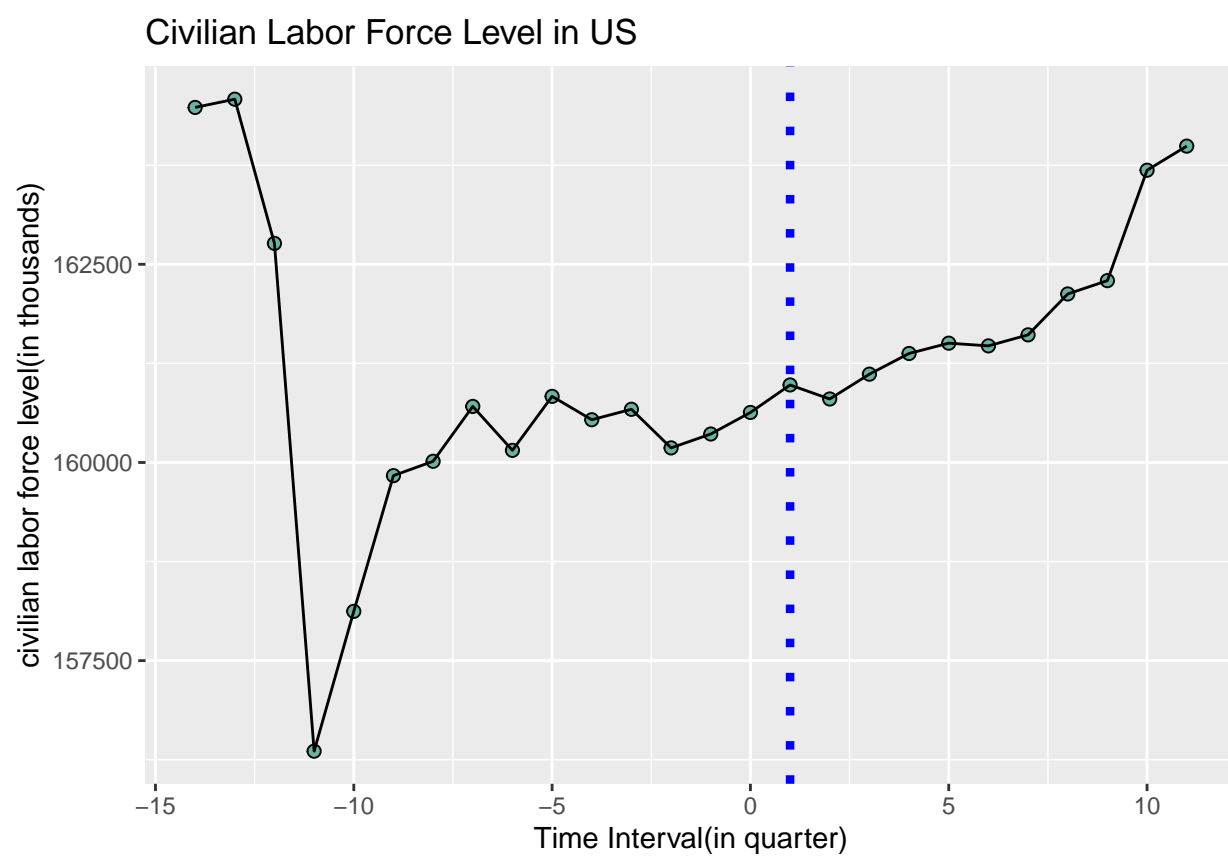


Figure 7: Civilian Labor Force Level in US

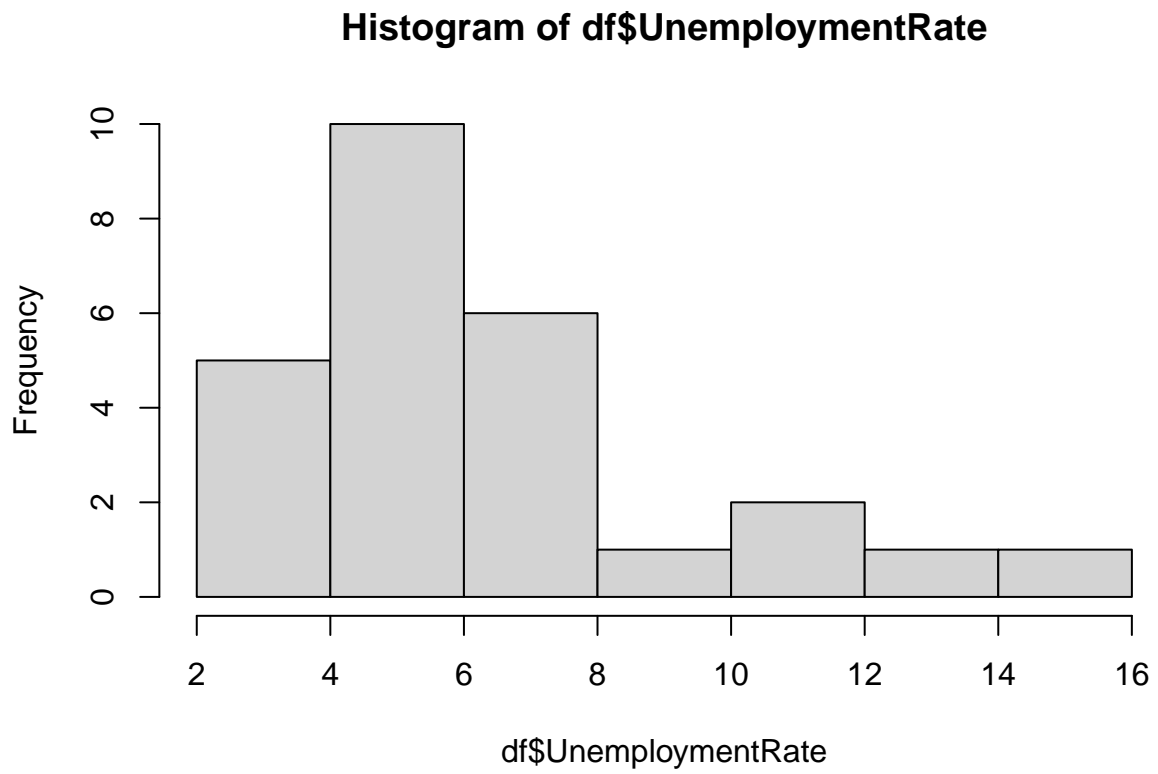
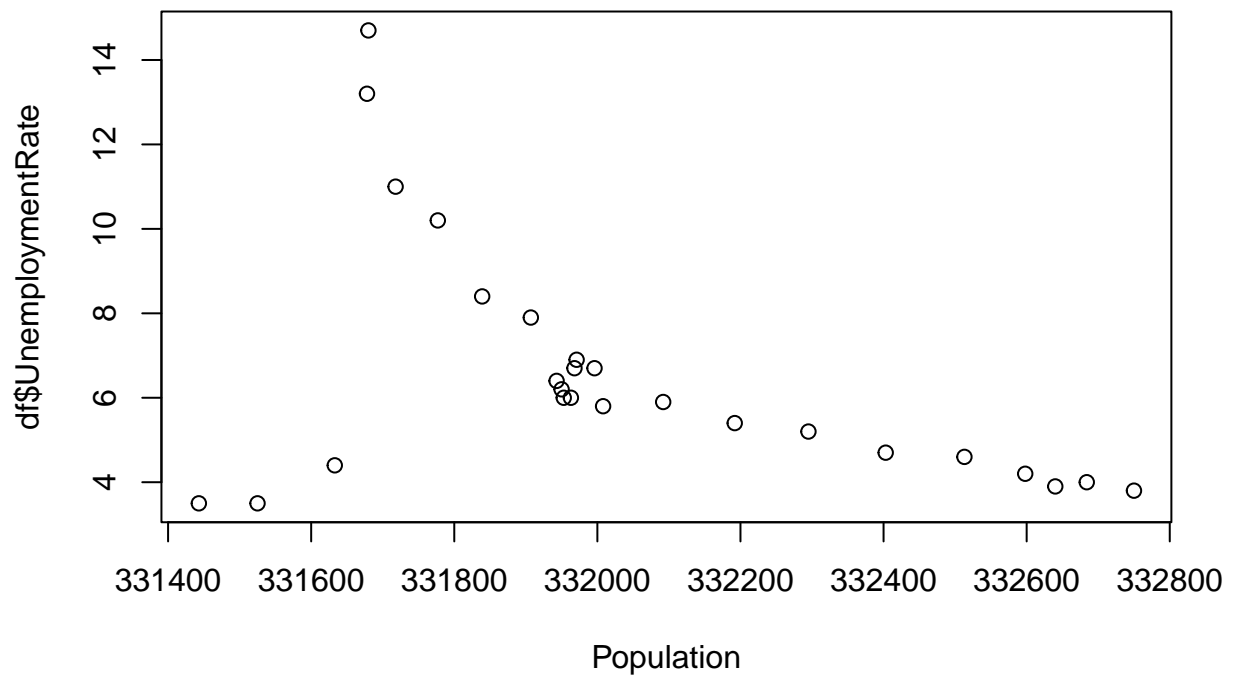
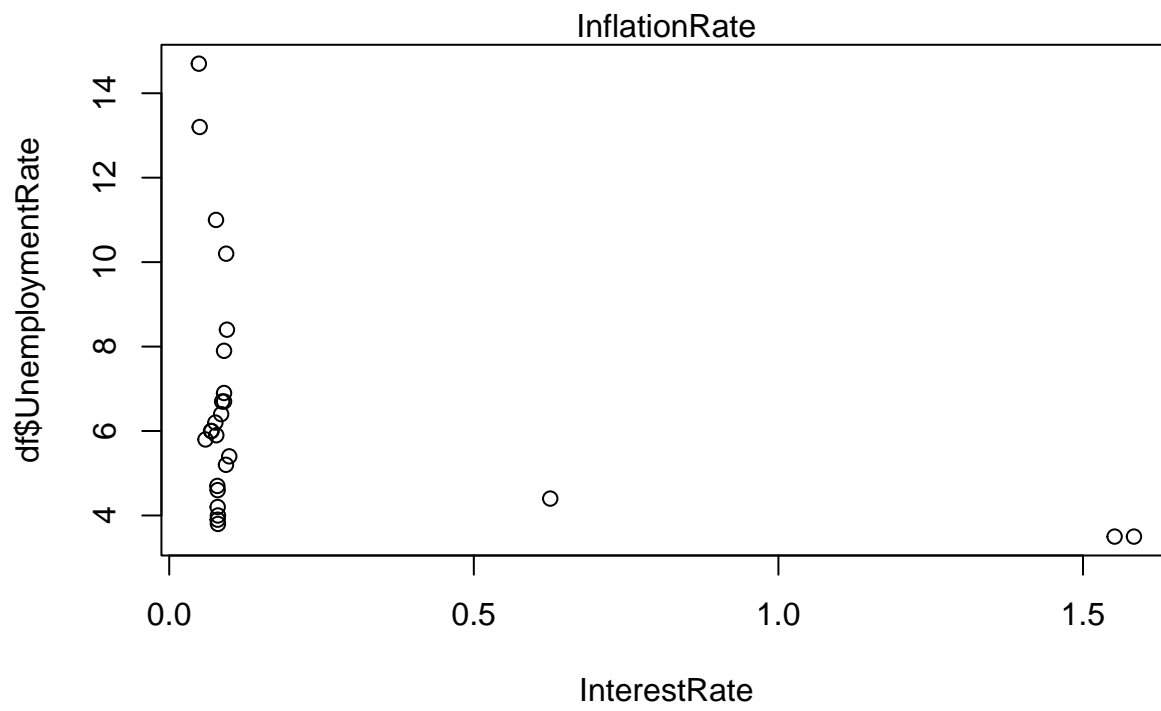
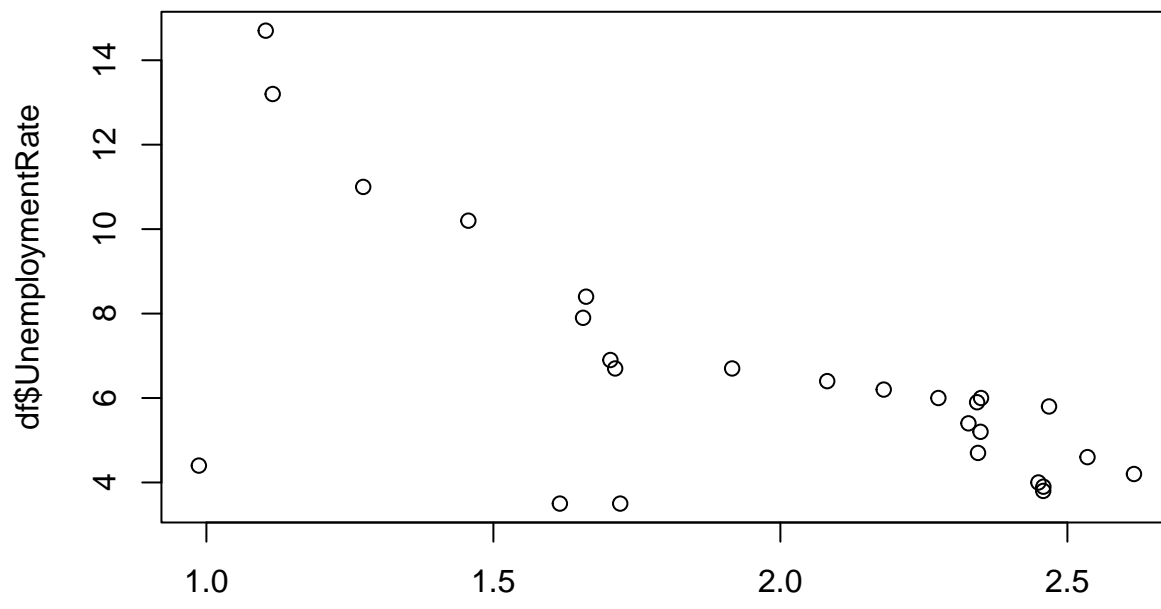
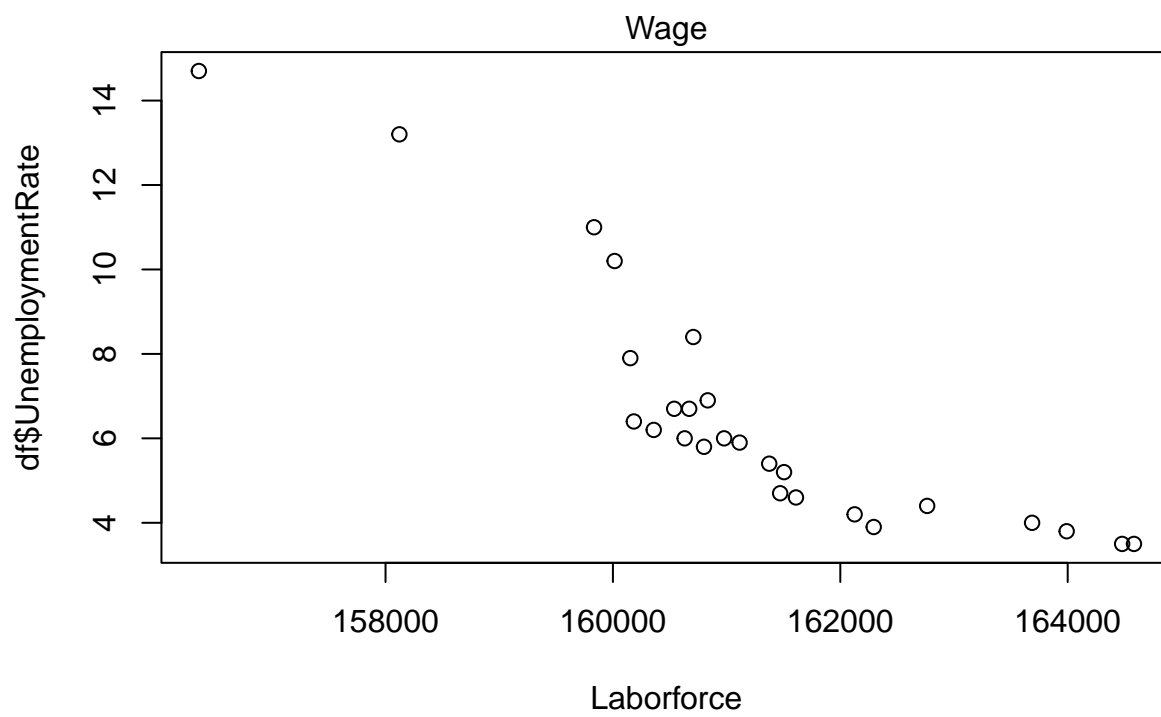
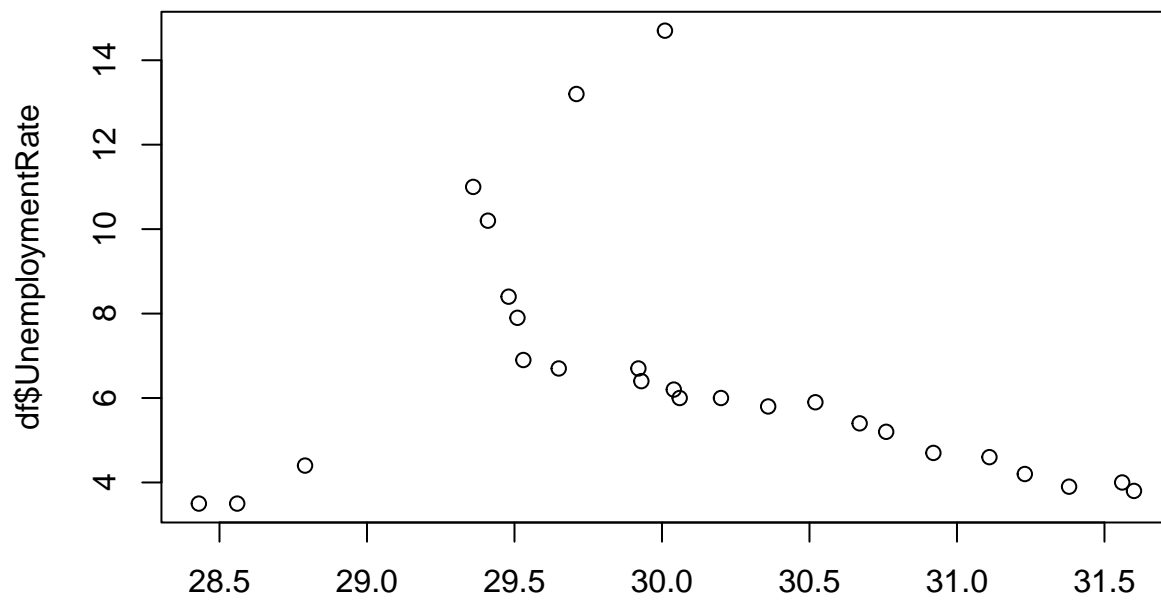
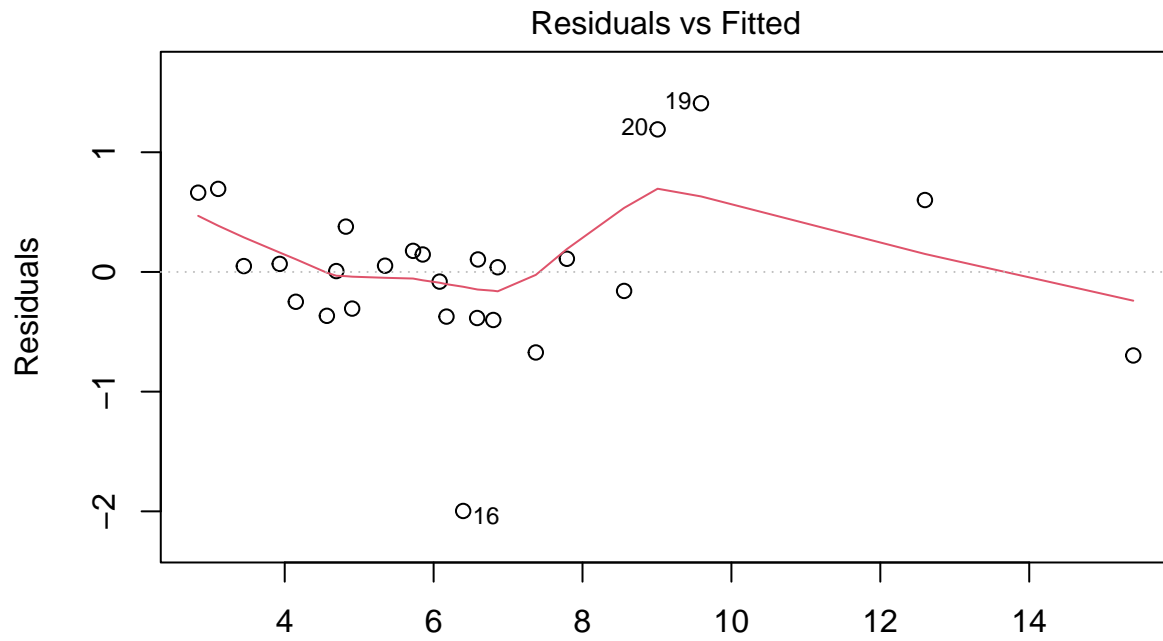


Figure 8: Normality of Unemployment Rate

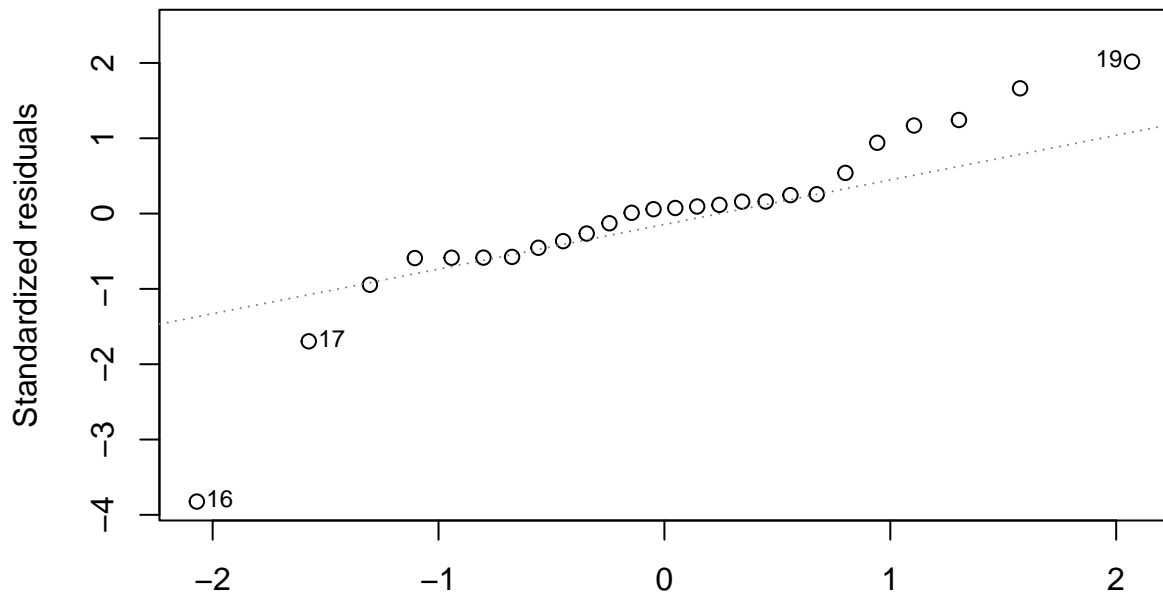




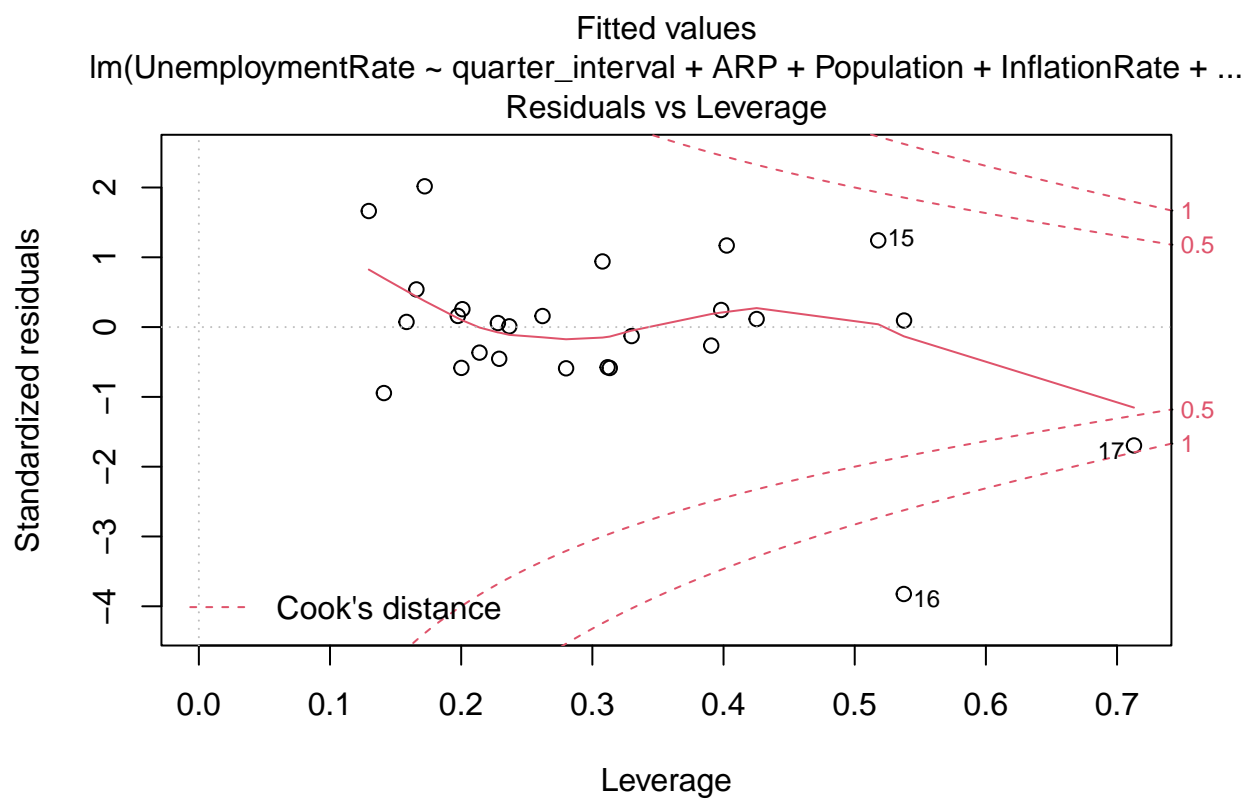
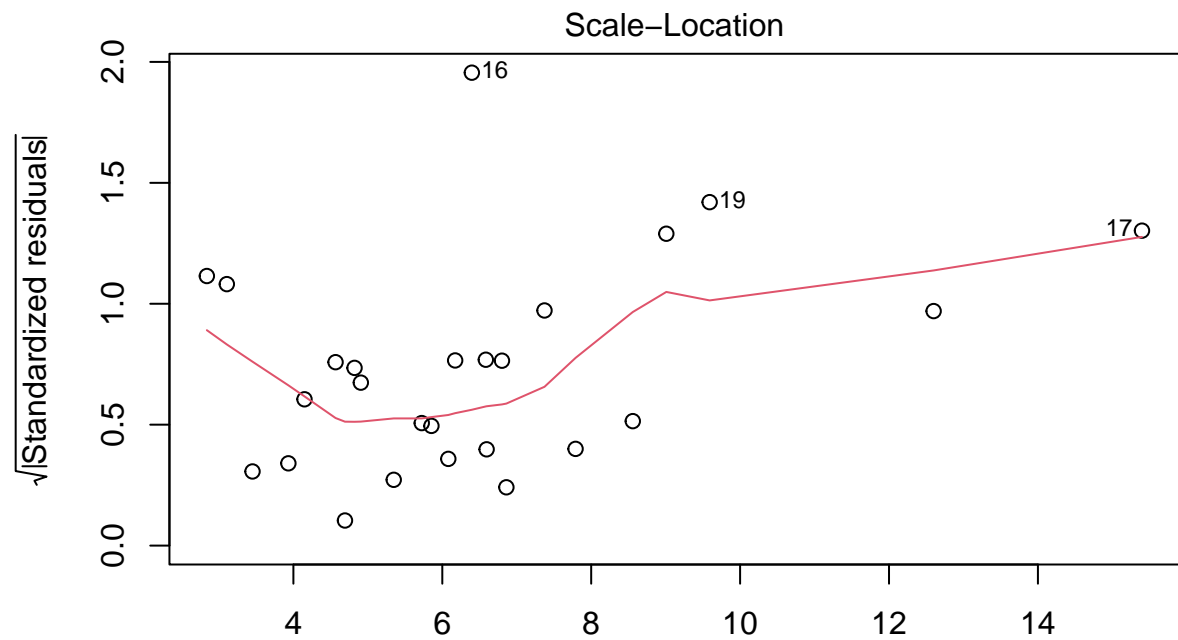




Fitted values
 $\text{lm}(\text{UnemploymentRate} \sim \text{quarter_interval} + \text{ARP} + \text{Population} + \text{InflationRate} + \dots)$
 Normal Q-Q



Theoretical Quantiles
 $\text{lm}(\text{UnemploymentRate} \sim \text{quarter_interval} + \text{ARP} + \text{Population} + \text{InflationRate} + \dots)$



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