The Effectiveness of Biden's American Rescue Plan: Linear Regression Analysis*

Yiran Mei

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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 simple linear regression and a multiple regression model. Additionally, statistical techniques such as regression analysis and correlation analysis are applied to analyze the regression model's results. We estimate that the ARP is effective in reducing the unemployment rate in the simple linear regression model but has no statistical significance with respect to these economic indicators based on our multiple regression model. Statistical analysis of data and evaluation of statistical results will be conducted using the R statistical programming language, version 4.1.2.

Contents

*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, 2006(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, 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. The implementation of ARP has been shown to effectively reduce unemployment rates in simple linear regression models. Nonetheless, the data do not show a statistically significant association between the unemployment rate and the implementation of the ARP, indicating that the policy has not been effective or that the effect has not been fully exploited and demonstrated by January 2022.

In the remaining elements of this paper, there are three sections: a data section where the data is analyzed and examined, a model section where the simple and multiple linear regression models are developed, 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.

It is evident from the simple linear analysis that the implementation of APR is associated with the decline in the unemployment rate. The unemployment rate declined by 2.8% following the introduction of the ARP, a result that is statistically significant at a significance level of 10%, but insignificant at a significance level of 5%. Nevertheless, there is no statistical evidence that the implementation of ARP reduces the unemployment rate, suggesting that it may be ineffective.

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 Schauberger (2021)), ggplot2(Wickham (2016)),kableExtra(Zhu (2021)), gtsummary(Sjoberg et al. (2021)), jtools(Long (2020)), and modelsummary(Arel-Bundock (2022)).

2. Data

2.1 Data Source

All data are from the website of FRED, which refers to the Federal Reserve Economic Data. The database is created and maintained by Research Department at the Federal Reserve Bank of St. Louis and contains economic data time series from a range of national, international, public, and private sources. The data were collected and updated by the Federal Reserve on a daily basis. The website tools enables user to combine multiple economic indicators on a single graph/files, and a dataset in excel format is therefore downloaded from the website and imported into R studio directly.

2.2 Data Characteristics

There are nine variables in total on the dataset. The date, unemployment rate, population, 10-year breakeven inflation rate, federal funds effective rate, average hourly earnings, as well as civilian labour force level are from the original dataset downloaded, and the dummy variable reflecting the status of before and after the implementation of the ARP is created through R Markdown. The date is transformed into the time interval collapsed on the date of implementation of the ARP as well to develop the model.

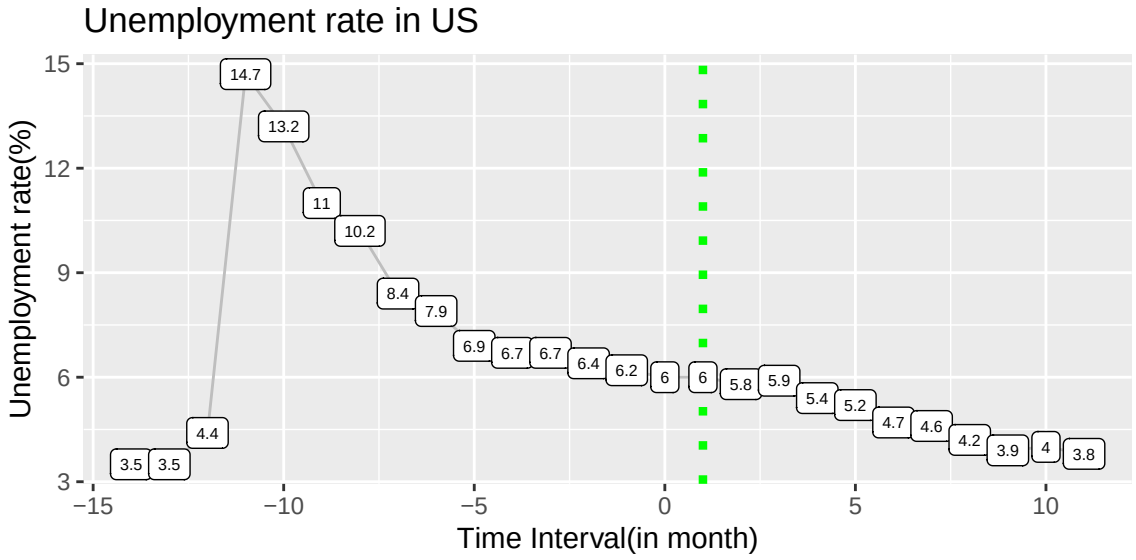


Figure 1: Unemployment rate in US

The unemployment rate, which would be the variable of interest in the model, is calculated by dividing the number of unemployed by the number of employed and achieved through the collection of labor force data. It can be seen in Figure 1 that the unemployment rate increase considerably before period -9(2020-06-01), and then rocketed to 14.7%. This may be due to the widespread outbreak of COVID-19 after March 2020. Afterwards, the unemployment rate dropped to 8.83% and then to 5.9% prior to the implementation of the ARP. It is evident that after the implementation of the ARP, the rate is decreasing continuously. The dummy variable of the implementation of ARP is equal to zero if the quarter precedes the ARP and equal to one if the quarter follows.

There are five control covariates in total. The population includes both local residents and armed forces overseas. For inflation rate, we used the breakeven inflation rate which measures the expected inflation rate derived from 10-Year Treasury Constant Maturity Securities. The latest value implies what market participants expect inflation to be in the next 10 years, on average. Additionally, the federal funds rate was used as an interest rate. Basically, it is the overnight rate that depository institutions within the United

States use to trade the excess reserves of federal funds with other banks, which is determined by the market, but also monitored by the Federal Reserve as a target rate. Including overtime and late shift payments, the average hourly earnings of all private employees is an indicator of the average hourly earnings of all private employees on a "gross" basis. Benefits, irregular bonuses, retroactive pay, and the employer's payroll taxes are not included in this measure. The civilian labor force level is restricted to adults aged 16 and older who reside in a state or the District of Columbia, who are not confined to institutions (such as prisons, mental institutions, or retirement homes for the elderly), and who are not on active duty in the armed forces. These data are derived from the Current Population Survey (Household Survey).

An overview of all variables is provided in Table 1, which indicates the scale and range of each variable.

Table 1: Summary of Data

	quarter	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

The graphs showing the trend of those covariates over the study period are included in Appendix.A. According to Figure 3, the population of the United States has shown an overall increasing trend throughout the period. During periods -4 and -2, it decreased rapidly before increasing slightly. It surged after period 1, reaching more than 332,000,000. During the period illustrated in Figure 4, the inflation rate in the United States fluctuates substantially. For example, it significantly decreased between periods -14 and -12. However, the trend began to accelerate after that, until the period -7. The next increasing period of it occurred between periods -4 and 2 and began to decline one month after the implementation of ARP. According to Figure 5, the effective federal fund rate indicates a stable trend following a decline between periods -13 and -11. Following this decline, the rate remained within the range of 0.7 and 0.9. Figure 6 demonstrates that the average earning in the US increased from period -12 to period -11, reaching $30/hr. Following the jump, the average earning rises steadily over time and exceeds $31 in period 7. A fluctuating trend can also be observed in the civilian labor force in the US, as shown in Figure 7. However, after a significant drop and growth from period -13 to period -9, it fluctuates around 161 million, and has continued to rise since the introduction of ARP in period 1, reaching 162.5 million by the end of period 9.

3. Model

The purpose of this subsection is to examine the relationship between observed economic characteristics; the time collapse on the implementation date and the unemployment rate in the United States, using a regression framework. This analysis entails several steps.

3.1 Model Assumption Tests

To begin with, we need to check if our data meet the four main assumptions for the regression.

Table 2 displays the correlation matrix as a test of the independence of observations. It is evident that none of the correlations display extremely high values, apart from the correlation between the quarter and population and wage. Due to the fact that the quarter is merely a time variable, we can disregard it. Second, we perform a histogram of the dependent variable in order to determine whether it is normal in Figure 8. In light of the small sample size and the presence of an outlier, it is understandable that the histogram of unemployment shows a positive skewness rather than a normal distribution, which violates the assumption. Violating the assumption of normality has few consequences, as it does not result in any bias or inefficiency in the regression model. P values are only affected if the assumption is violated. Following this, we test each

covariate for linearity on the time interval. As can be seen from the figures in Appendix.C, the majority of covariates have a linear relationship with the variable of interest except for a few outliers except the dummy variable ARP. For the Homoscedasticity Assumption Test, we would do it after performing the regression.

Table 2: Correlation Matrix of Variables

	quarter	UnemploymentRate	Population	InflationRate	InterestRate	Laborforce	Wage	ARP
quarter	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

3.2 Model Development

3.2.1 Simple Linear Model

Having completed the tests, we will attempt to construct a simple linear regression in which the dummy variable ARP serves as the running variable and the unemployment rate is the outcome of interest,

$Y_i = \beta\ D_i\ +\ \mu_i\ ,$

where the dummy variable Di is equal to zero if the quarter precedes the ARP and equal to one if the quarter follows, while μ_i represents the error term. The β indicates the coefficient of the treatment variable, ARP on the outcome variable.

3.2.2 Multiple Linear Model with All Covariates

Consequently, we attempt to build multiple linear regression models for the central equation in order to make a better fit. In essence, the equation is as follows:

$Y_i = \beta\ D_i\ +\ \boldsymbol{f(t_i\text{-}t')}+\beta_i\ X_i\ +\ \mu_i\ ,$

taking t_i as the calendar date, and t' as the date on which the ARP was implemented, f(t_i-t') serves as a running variable that represents the relationship between the collapsed date and the outcome of interest. The dummy variable Di is equal to zero if the quarter precedes the ARP and equal to one if the quarter follows.For bias reduction, we add Xi representing other covariates stated before, while μ_i represents the error term.The β indicates the coefficient of the treatment variable, ARP on the outcome variable while the β_i represents the coefficients of all covariates. We build the model with all of the covariates discussed before in this report.

4. Results

4.1 Models Summary

4.1.1 Simple Linear Regression Model

According to Figure 2, the regression line of the simple regression model does not fit well with the plots since there are no observations between ARP equals zero and one. The coefficient of the simple linear model shown in Table 3 tells that the on average, the unemployment rate became 2.8% lower after the introduction of the

ARP, and the result is statistically significant at a 10% significance level but insignificant at 5%. Therefore, the data is evidently sufficient to reject the null hypothesis of the regression and indicating there is a non-zero correlation, which suggests the changes in the independent variable are associated with the changes in the dependent variable at the population level at a significance level of 10%. That is, the implementation of ARP is associated with the reduction of the unemployment rate.

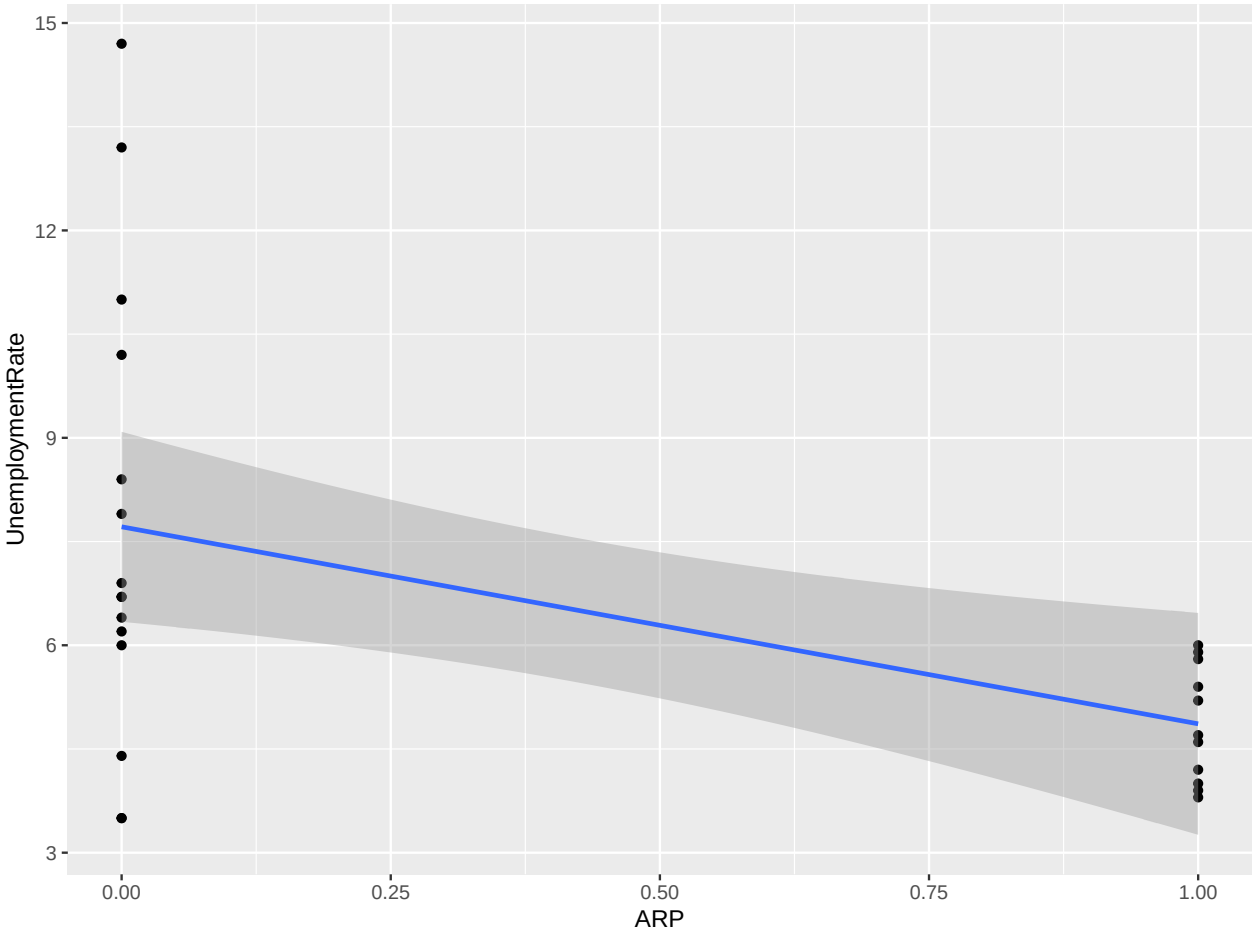


Figure 2: Simple Linear Regression

Table 3: Summary of Simple Linear Regression

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

[1] CI = Confidence Interval

4.1.2 Multiple Linear Regression Model

After performing the multiple linear regression, we examine the regression analysis using the regression summary. In the Table 4, it shows that the coefficient of the variable ARP is 0.37, which suggests a positive relationship with the implementation of the ARP and the unemployment rate. However, this result is not statistically significant as the P-value is 0.6, which is a considerably large value. It implies that there is no sufficient evidence to reject the null hypothesis and find a non-zero correlation. That is, there is no statistical evidence that the implementation of ARP is associated with the reduction of unemployment rate. Moreover,

we can see that only two covariates, interest rate and wage variables, produce statistical significant outcomes with a significance level of 5% and 10%.

Table 4: Summary of Multiple Linear Regression

Characteristic	Beta	95% CI	p-value
quarter	-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

[1] CI = Confidence Interval

4.2 Comparisons of Two Models

From the comparison summary of two models in Table 5, the R-Squared of simple linear regression model is merely 0.2442, which suggests only 24.42% of the variability observed in the unemployment rate is explained by the regression model. The r-squared of the multiple linear regression model is 0.9497624, which indicates that approximately 94.97% of the data fit the regression model. On the other hand, the standard error of the ARP treatment variable in the multiple linear regression model is also smaller than the simple linear regression model. This suggests a more precise prediction of the multiple linear regression model as well.

Table 5: Comparison of Models

	Model 1	Model 2
(Intercept)	7.713	157.682
	(0.666)	(857.630)
ARP	−2.850	0.374
	(1.023)	(0.737)
quarter		−0.956
		(0.321)
Population		−0.001
		(0.003)
InflationRate		1.356
		(1.680)
InterestRate		−4.154
		(1.728)
Wage		5.414
		(1.447)
Laborforce		0.000
		(0.000)
Num.Obs.	26	26
R2	0.244	0.950
R2 Adj.	0.213	0.930
AIC	127.0	68.5
BIC	130.7	79.8
Log.Lik.	−60.477	−25.243
F	7.753	48.577
RMSE	2.58	0.77

4.3 Homoscedasticity Assumption Test

4.3.1 Simple Linear Regression Model

Based on the figures in Appendix.D, the "Residuals vs. Fitted" plot clearly indicates an increase in variance in the fitted values. For fitted values below 5, residuals range from -2 to 2. Alternatively, for larger fitted values beyond 7.5, the difference between residuals is greater. The presence of heteroscedasticity is evident from this observation. On the "Scale-Location"-plot, an increase in the square root of the standardized residuals can be observed across the fitted values. Thus, we can conclude, using both the "Residuals versus Fitted" and the "Scale-Location" plots, that a simple linear regression model does not satisfy the homoscedasticity assumption.

4.3.2 Multiple Linear Regression Model with All Covariates

Images from Appendix.E are used to perform the homoscedasticity assumption test for multiple linear regression. Observe that both the "Residual vs. Fitted" and the "Scales-Location" plots are devoid of heteroscedastic residuals. Despite the fact that the lines in these two plots do not appear to be flat, the residuals show a relatively stable variability that is unaffected by the fitted values. Consequently, the multiple linear regression model does not violate the assumption of homoscedasticity.

5. Discussion

5.1 Discussion and Implications

In the two models we developed for this report, the first ignores all other factors that affect the unemployment rate and directly concludes that its implementation led to a reduction. Unfortunately, incomplete data and a limited time frame distort the efficiency of the model itself, which decreases the degree of credibility of the results. In general, based upon the analysis of the models presented in this report, we may only accept the multiple linear regression model. Unexpectedly, this model suggests that the unemployment rate actually increases due to the introduction, but the association is not statistically significant. There is a greater likelihood that the decline in unemployment rate is related to changes in interest rates and wages. Nevertheless, the change in the interest rate and wage may not be independent of the introduction of ARP. COVID-19 definitely results in a monetary shock on the market, resulting in a decrease in the asset market(Khurshid Adnan (2021)). Consequently, in order to achieve full employment, the U.S. government carries out a temporary expansionary fiscal policy which includes the ARP in order to increase government spending and, subsequently, raise aggregate demand and, therefore, the level of production(Galí, Jordi (2007)). Both interest rates and exchange rates will be impacted by the rising demand for money. As a price in the labor market, wages are also implicated in macroeconomic changes as a whole.Accordingly, the effect of the ARP may be transmitted to the unemployment rate through other mediums, such as the change in interest rate, wage and some other omitted variables in the report. The fact is that we do indeed witness a reduction in unemployment in the United States following the implementation of this policy, but the rationale behind it in the overall economic system is far more complicated than the policy itself. Due to this, we cannot draw an arbitrary conclusion that the ARP is completely ineffective at boosting employment and the economy. More analysis and consideration of numerous economic indicators should be completed and combined in order to render a conclusive and comprehensive assessment of the ARP policy.

5.2 Ethics and biases

The primary drawback of this research and model is that the data is insufficient to support a reliable and sound conclusion. Since the policy was conducted only a short while ago, there is not enough time for us to collect enough information to predict an accurate statistic. Our model can only be built using 26

periods of data with incomplete distributions. Future data will be needed in order to analyze the policy's long-term effectiveness. Secondly, the factors influencing the unemployment rate may be more extensive than those cited in this report. Consequently, an omitted variable bias may be present. In the absence of accounting for relevant independent variables, the coefficient of the variables in the model is likely to be biased and inaccurate. The economy as a whole involves a large number of factors that influence the rate of unemployment and policy in conjunction, and some of these factors may be unknown or unquantifiable. For future research, it would be beneficial to develop a model with more precise and abundant data in order to eliminate the basis described above.

Appendix

Appendix.A

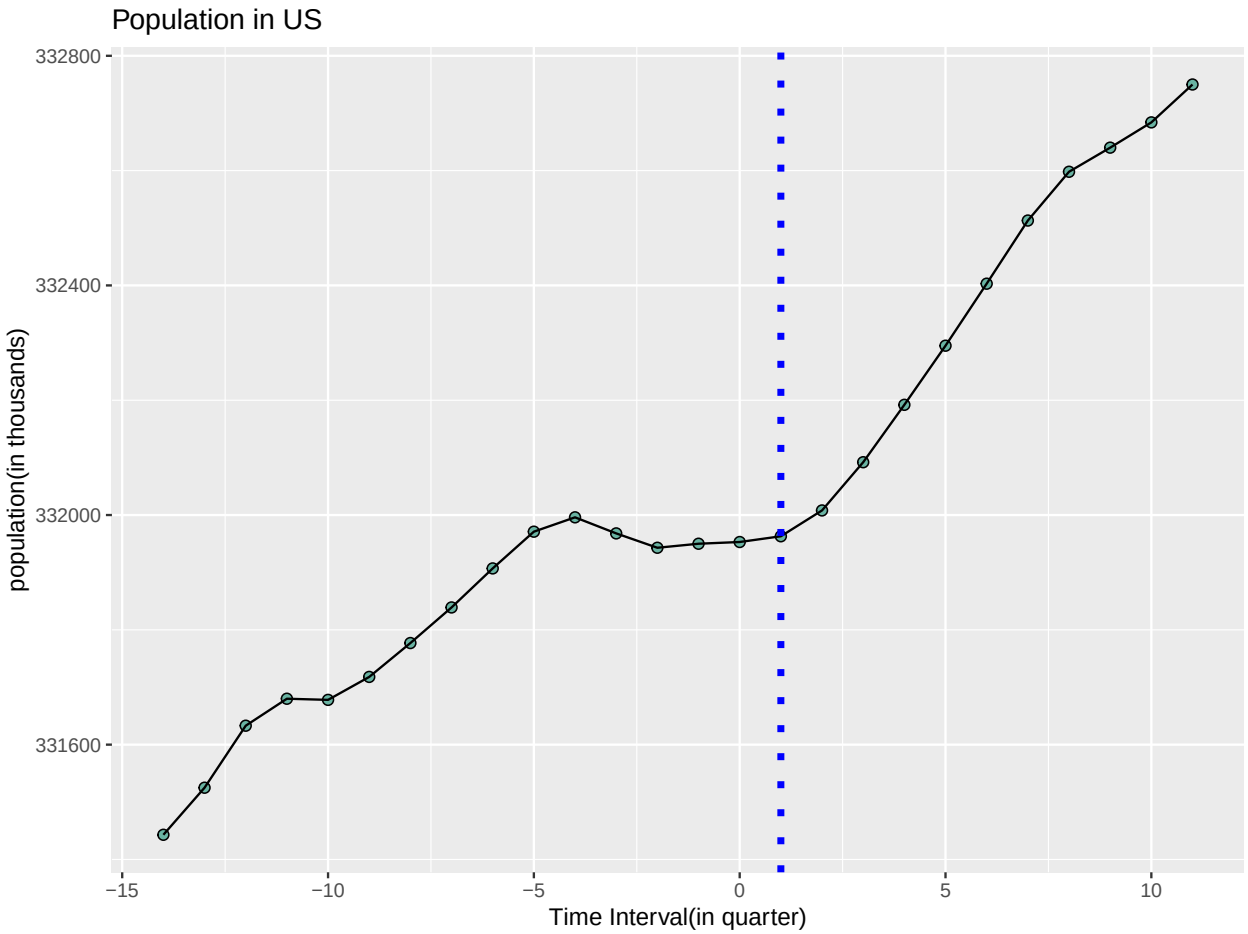


Figure 3: Population in US

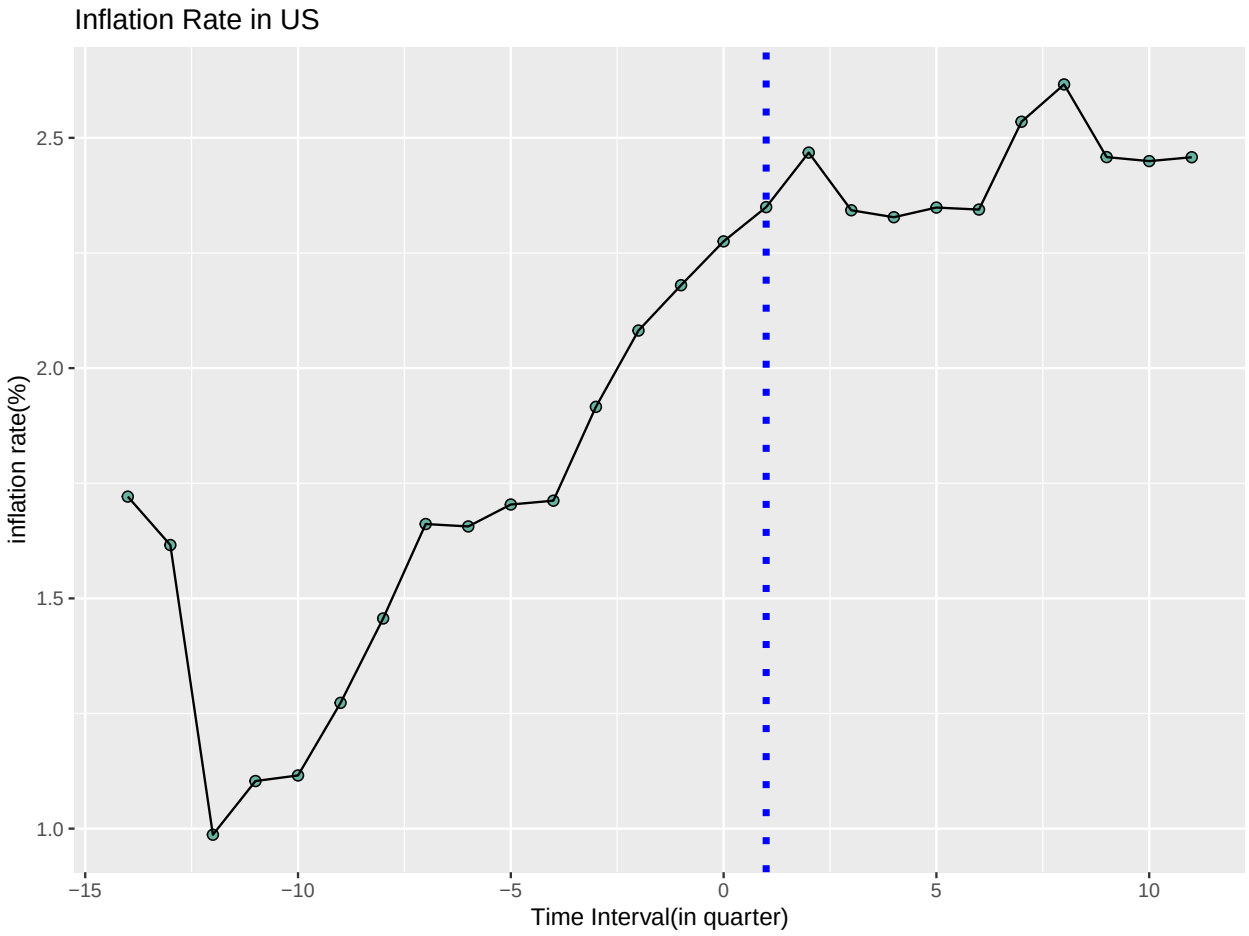


Figure 4: Inflation Rate in US

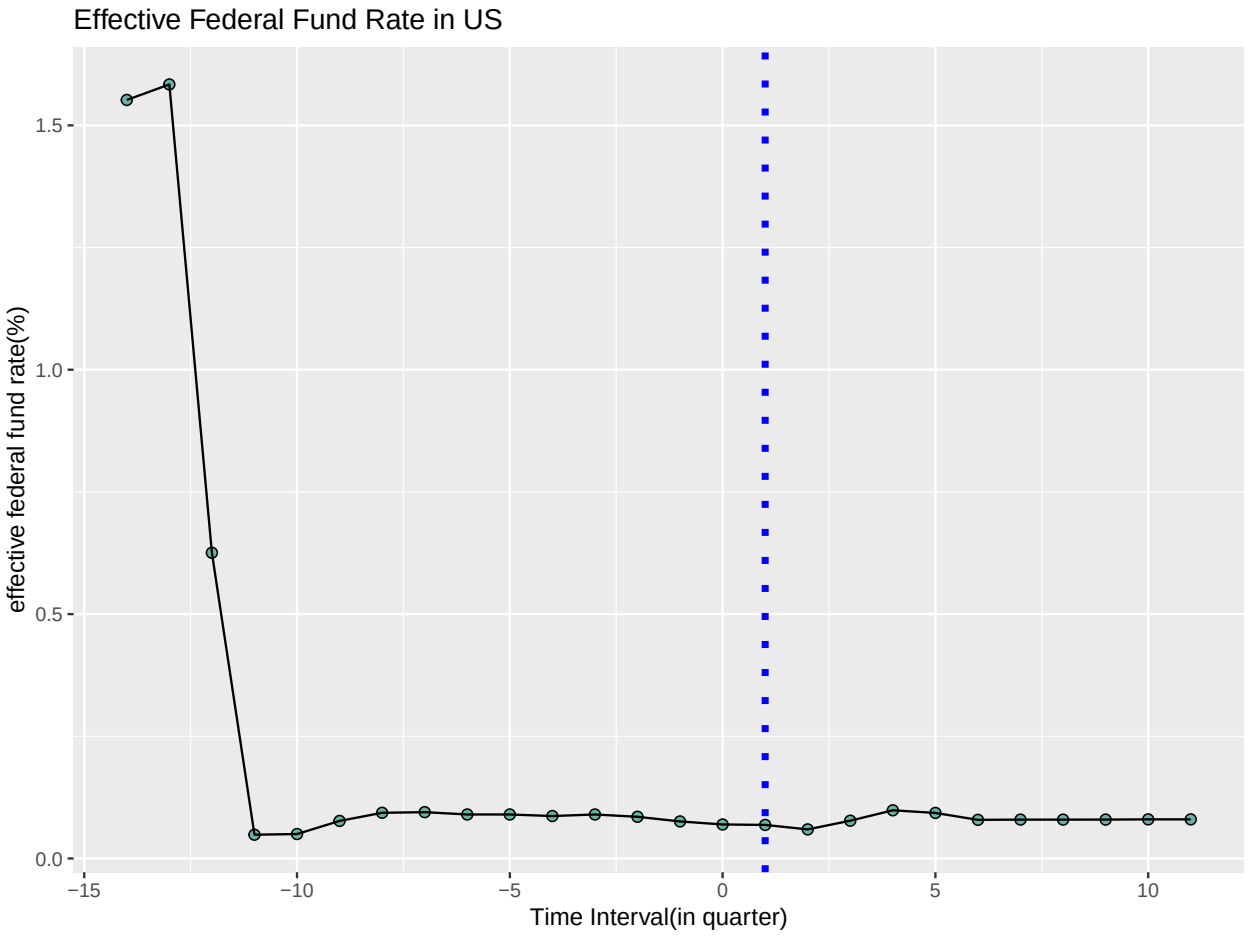


Figure 5: Effective Federal Fund Rate in US

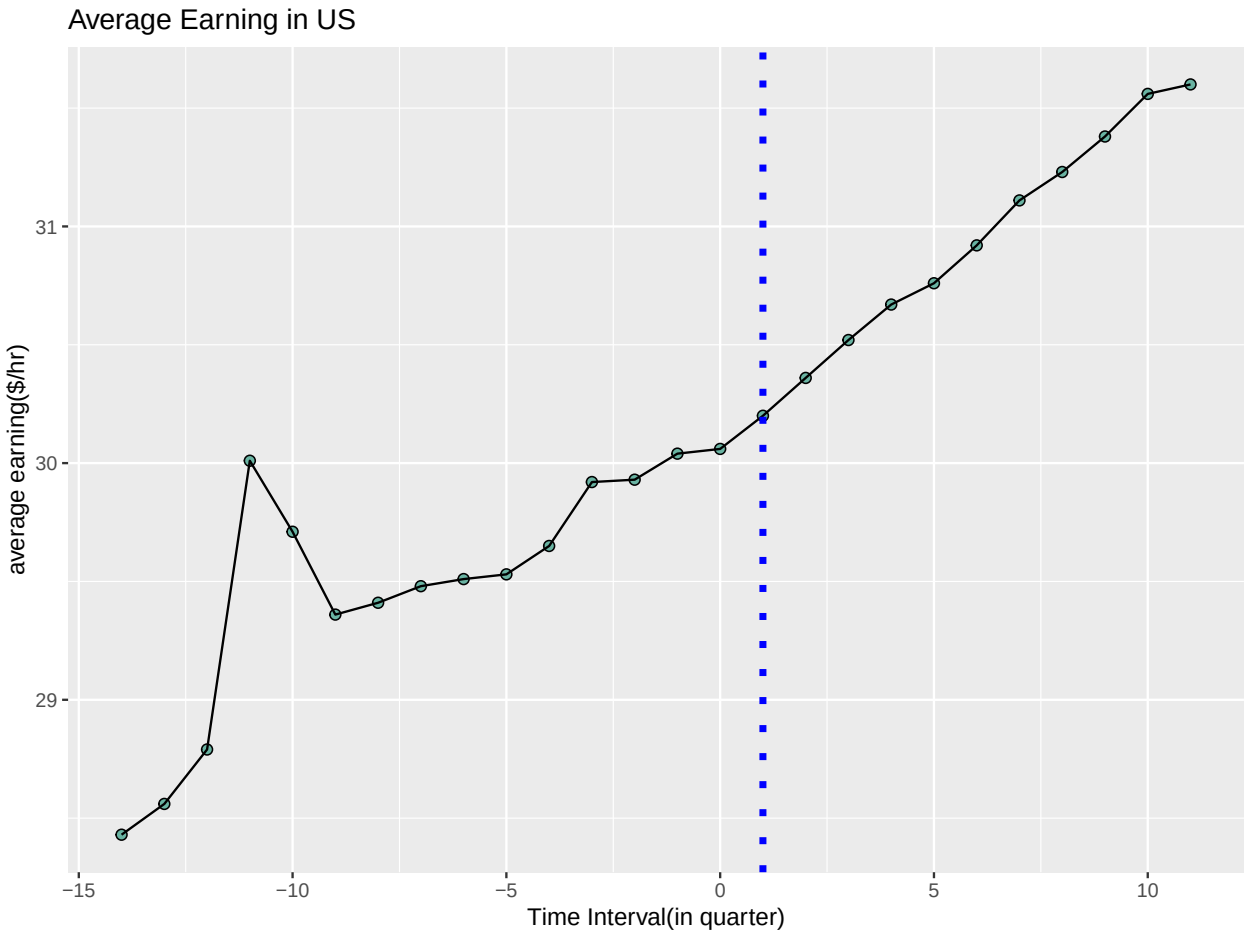


Figure 6: Average Earning in US

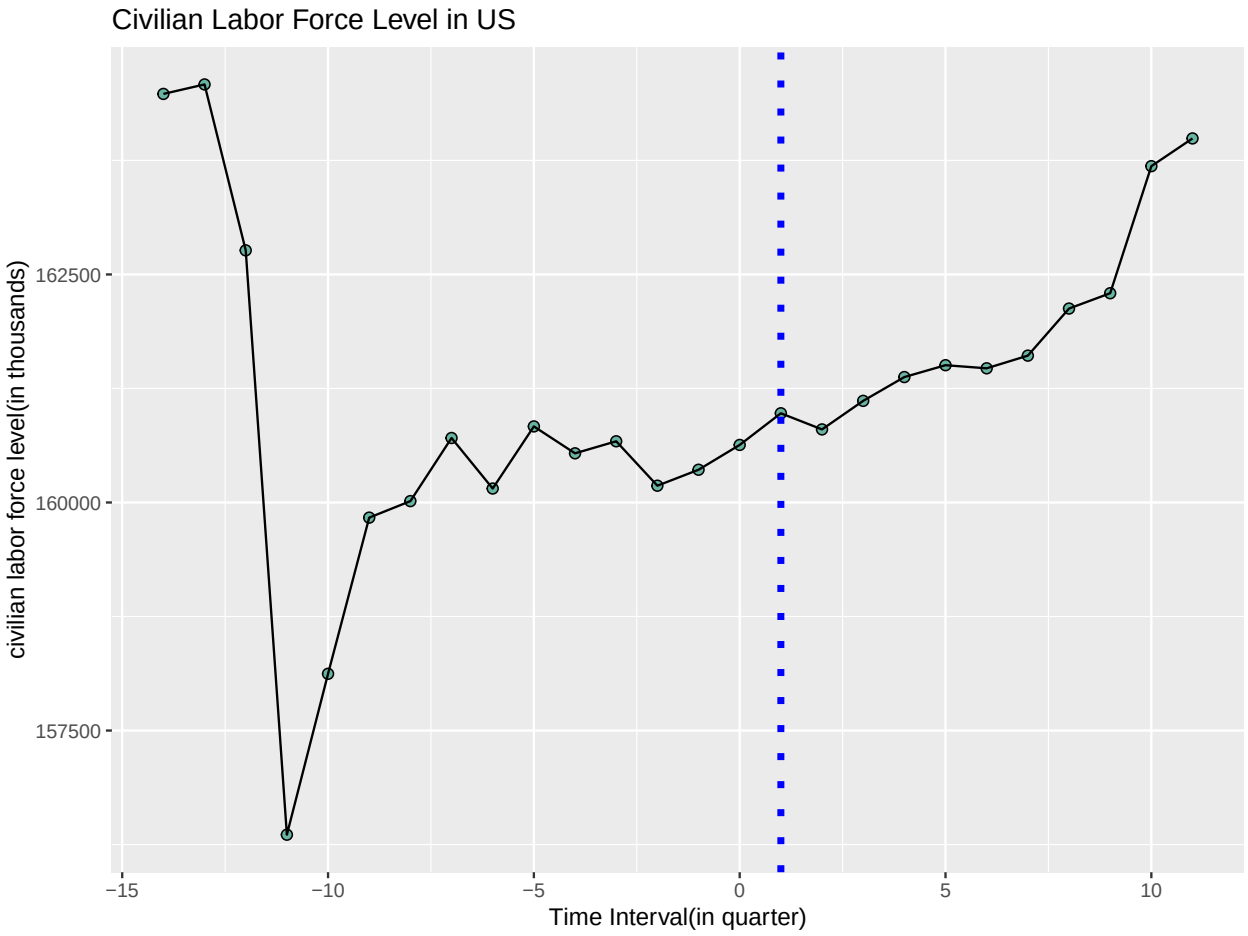


Figure 7: Civilian Labor Force Level in US

Appendix.B

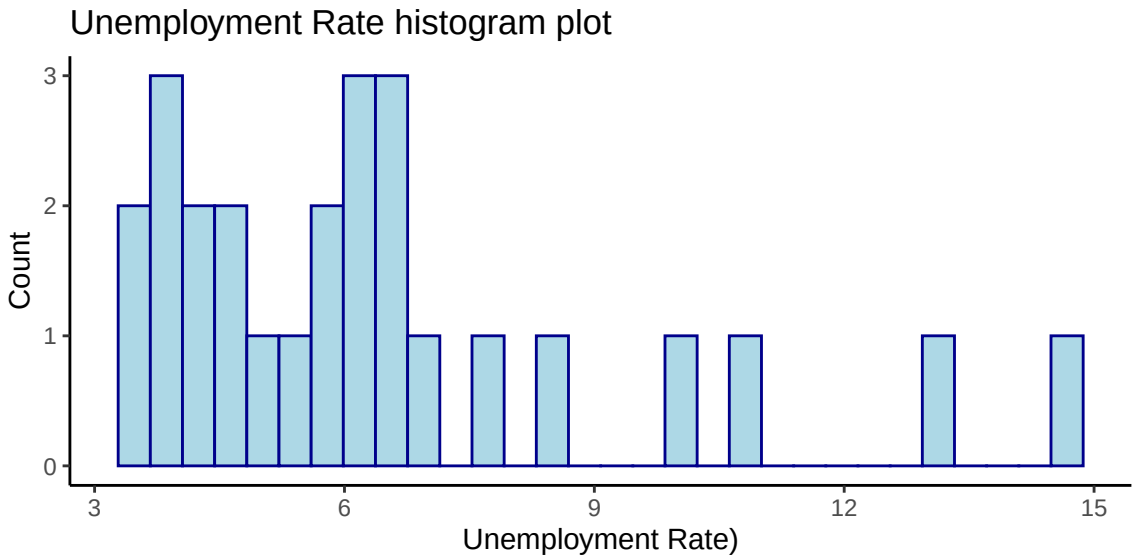
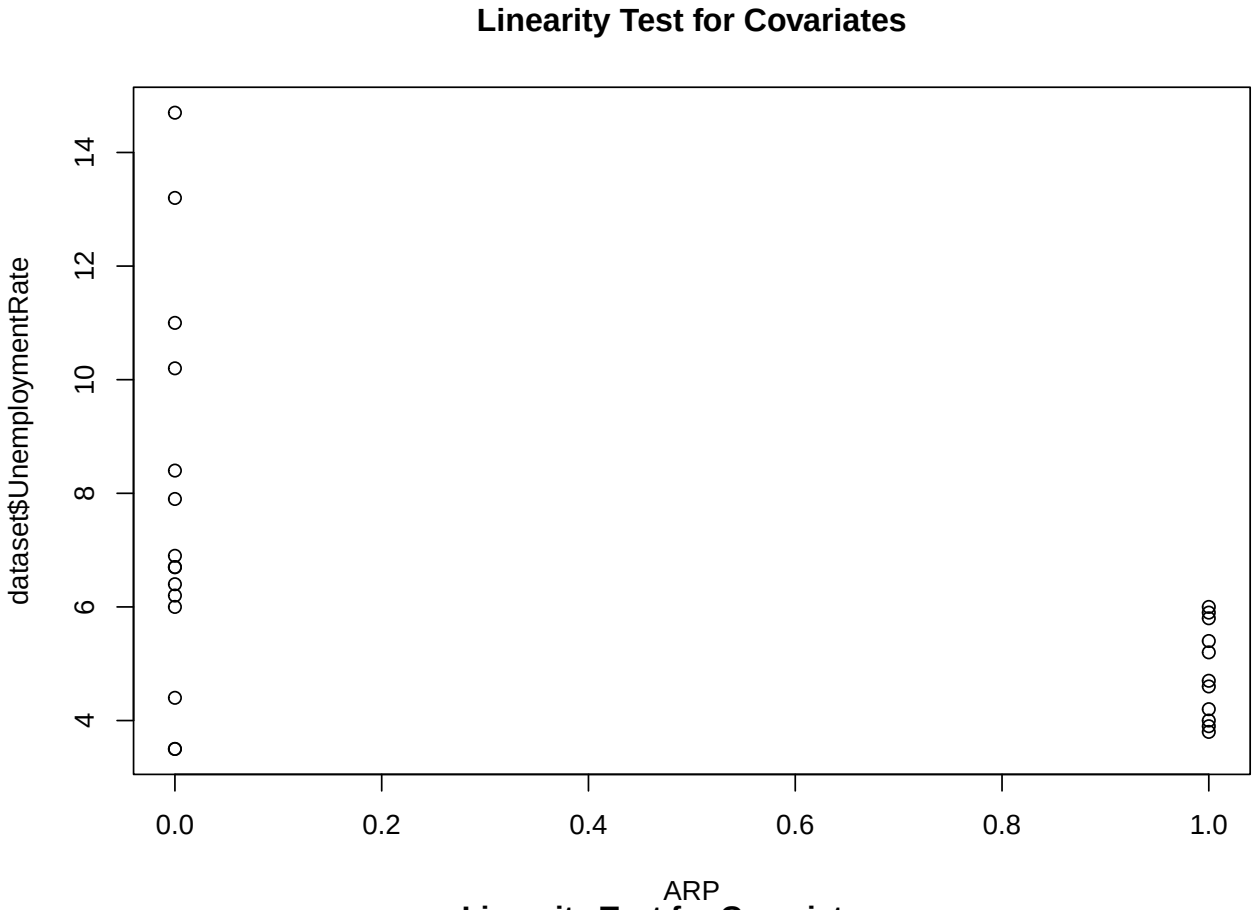


Figure 8: Normality of Unemployment Rate

Appendix.C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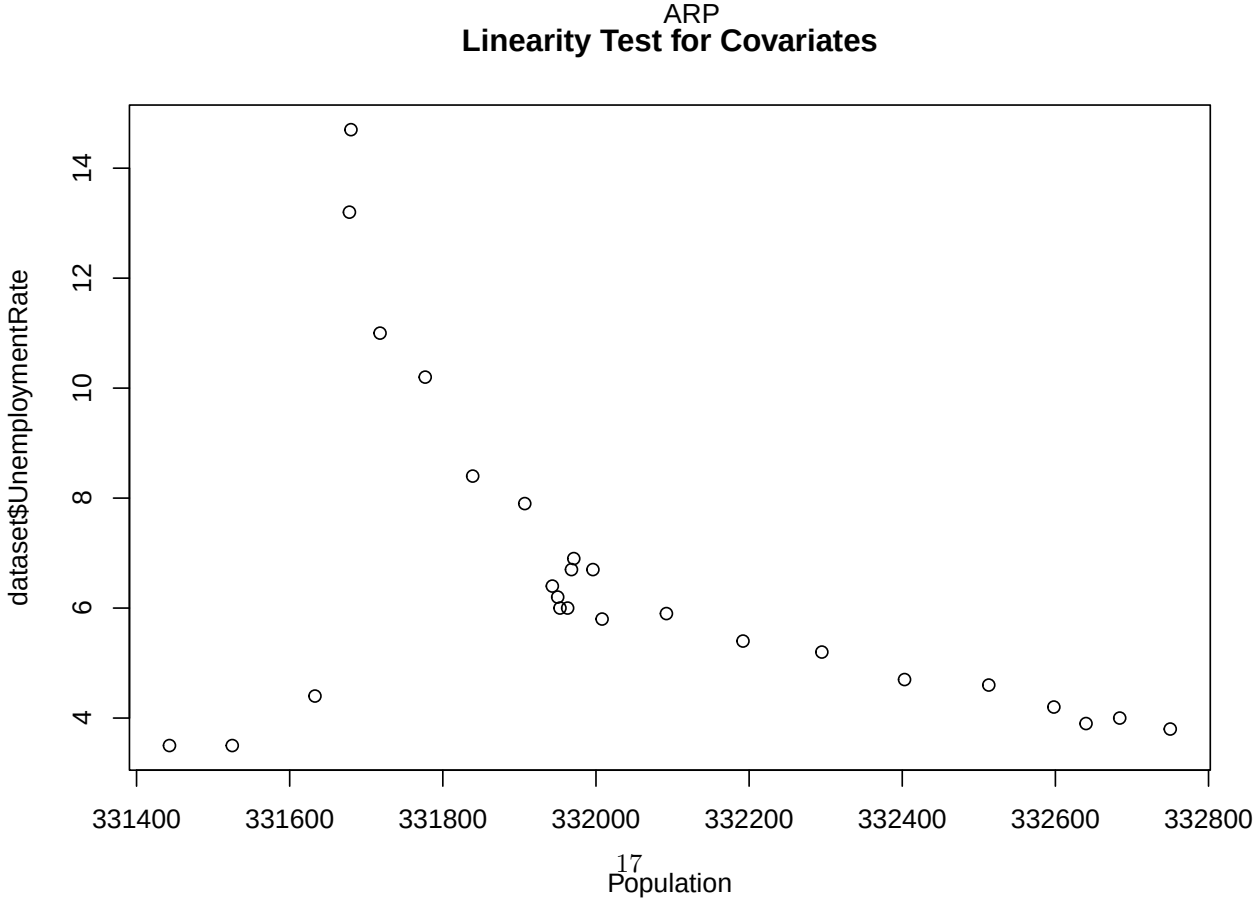
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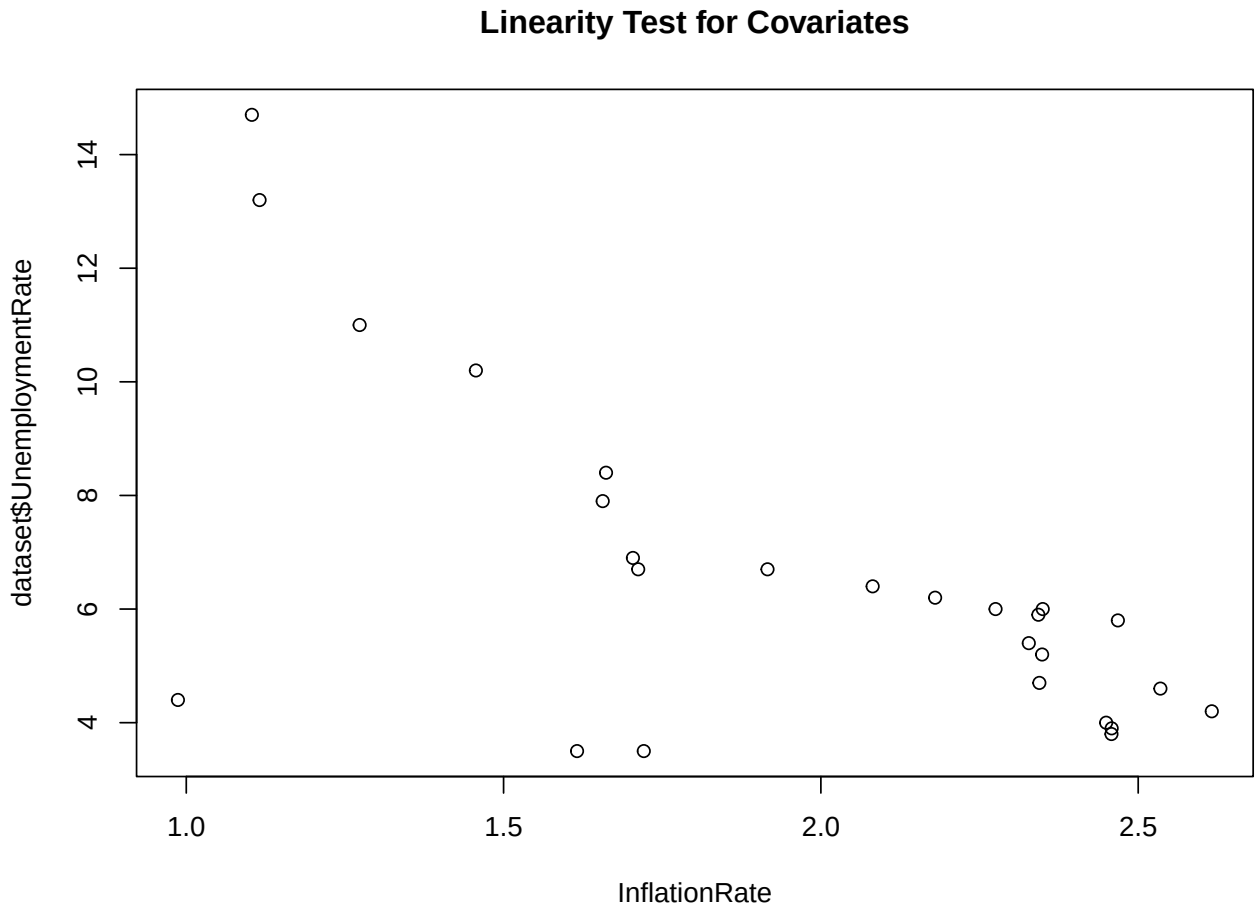
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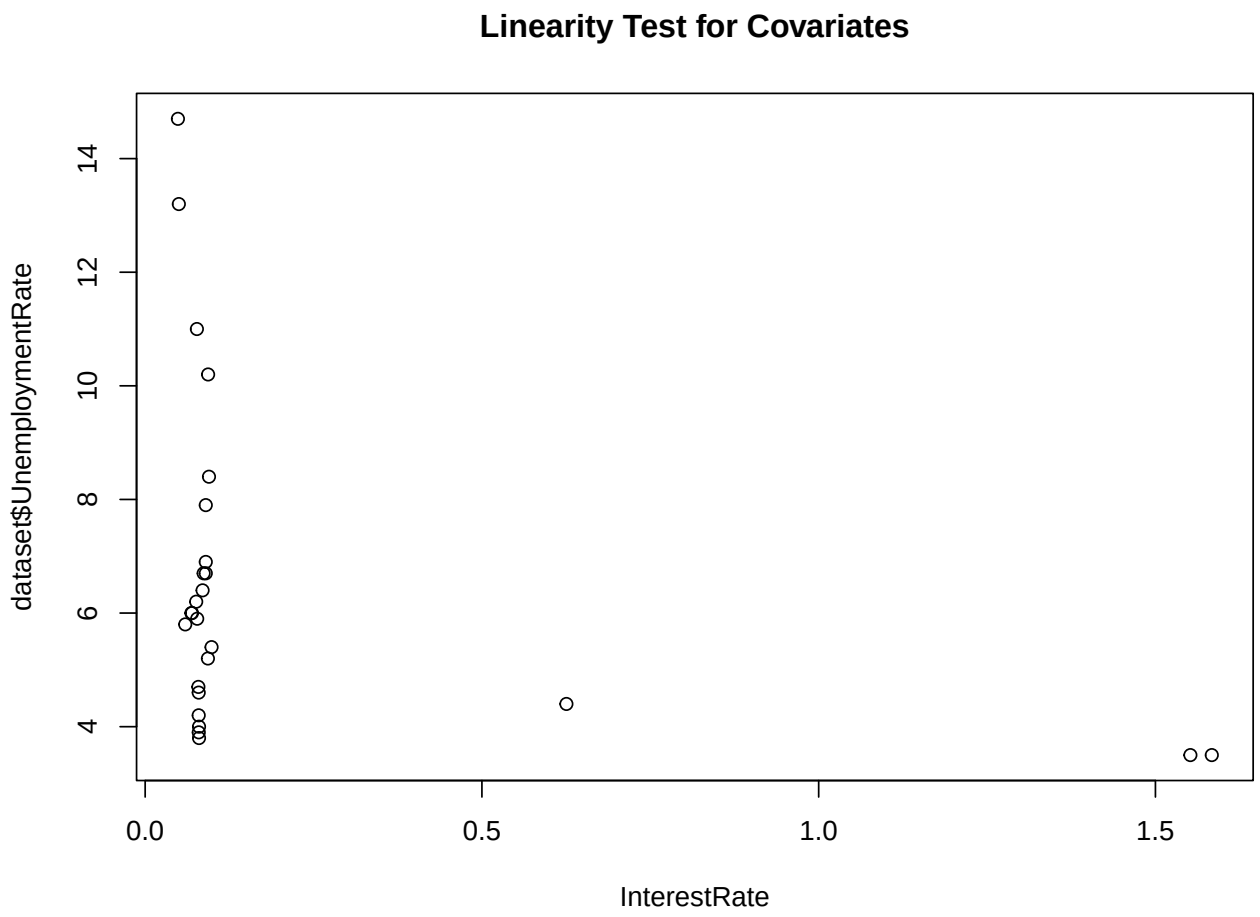
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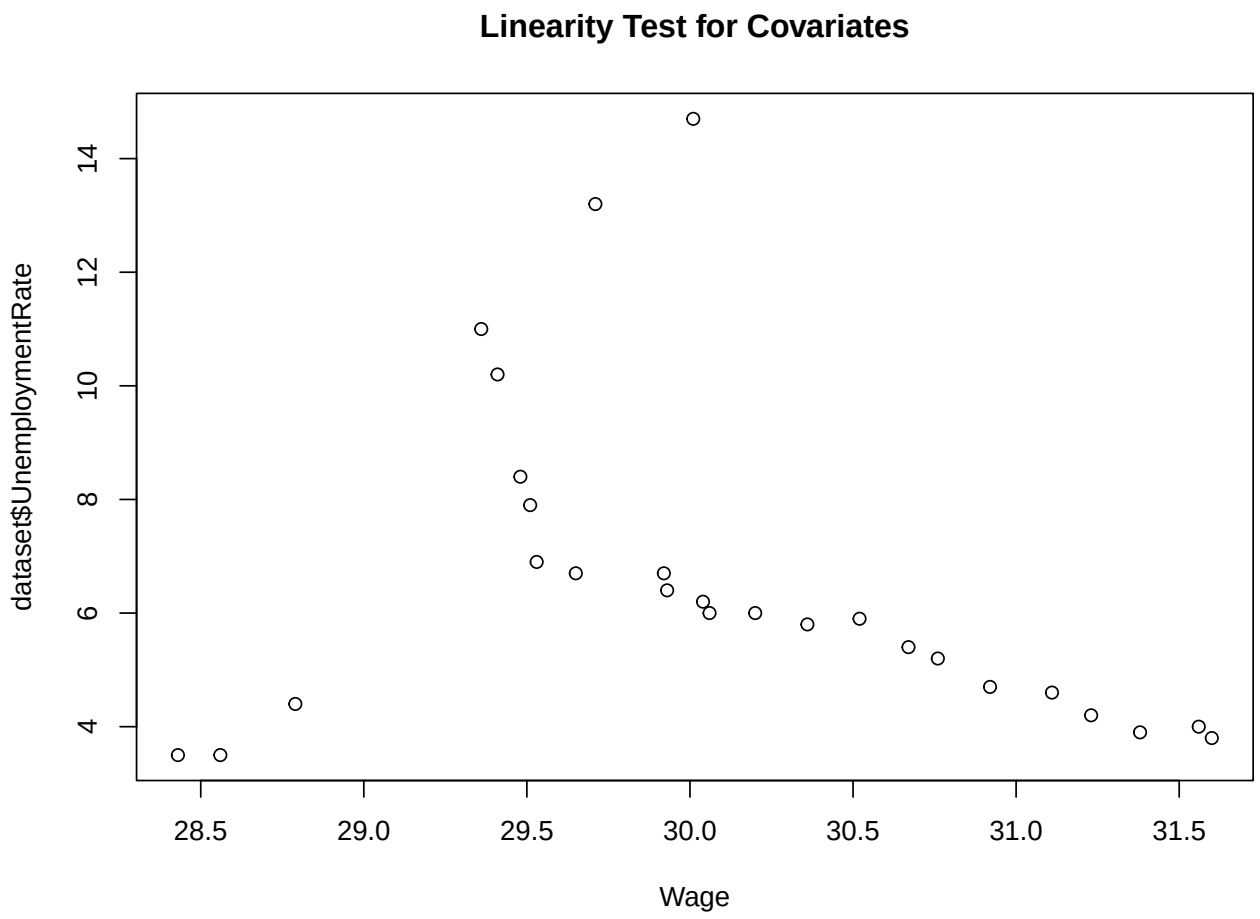
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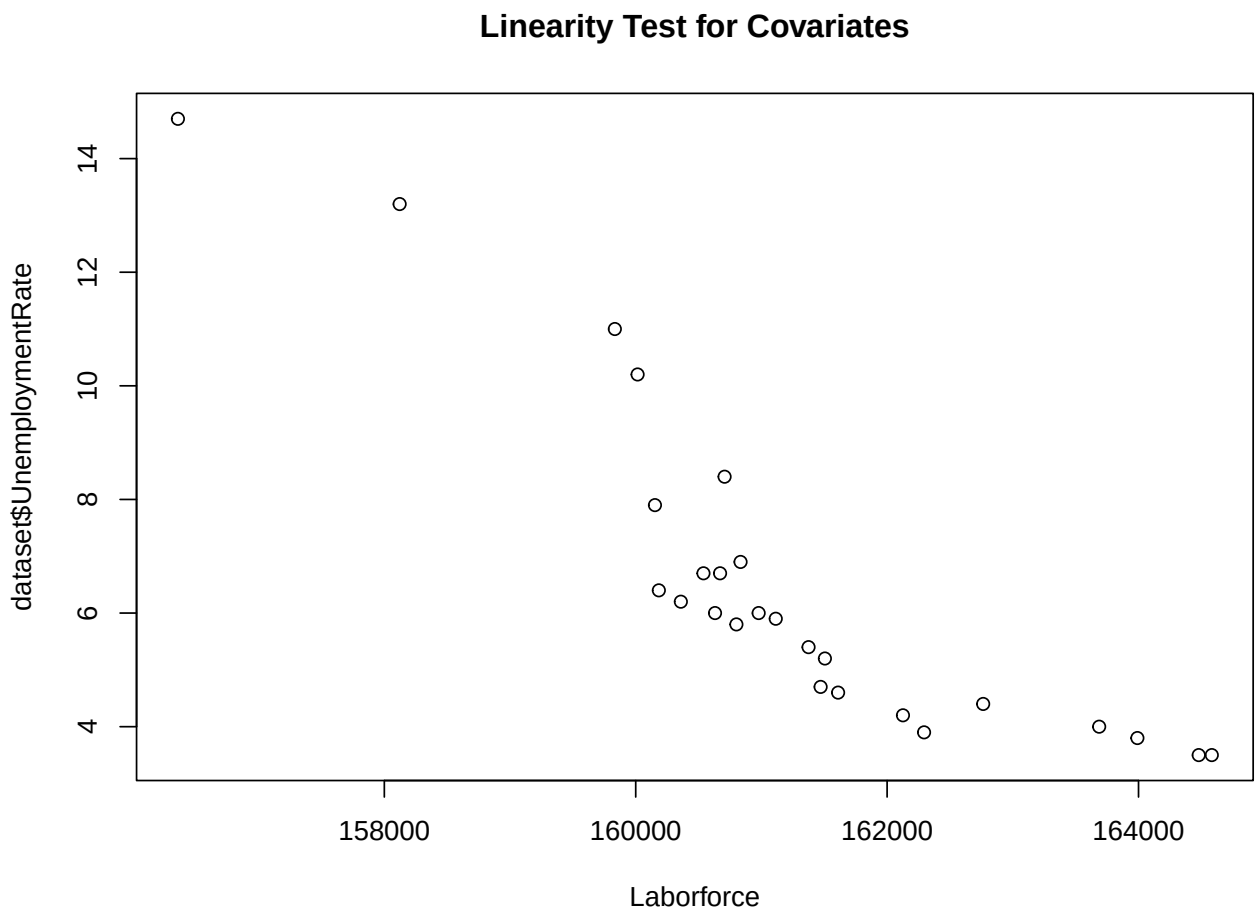
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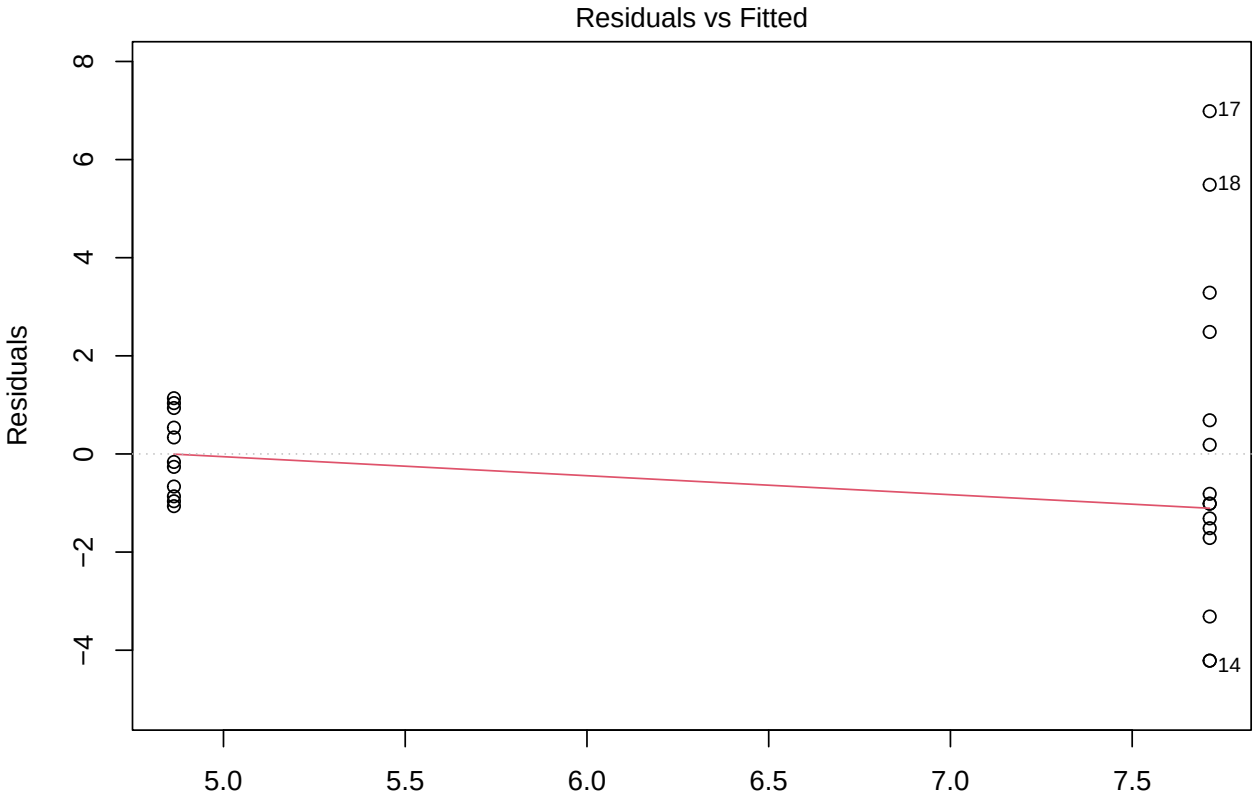
Appendix.D


Residuals vs Fitted
Residuals
Fitted values
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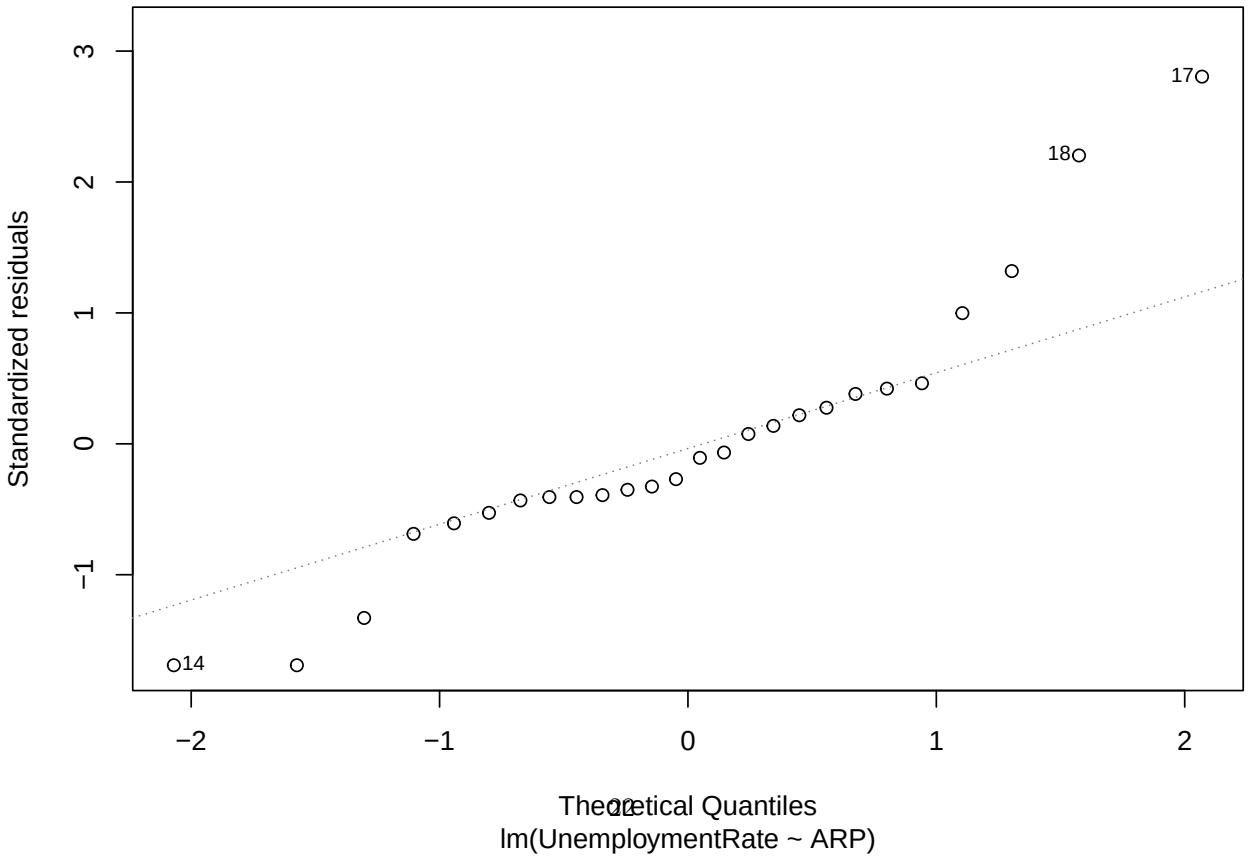
Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(UnemploymentRate ~ ARP)
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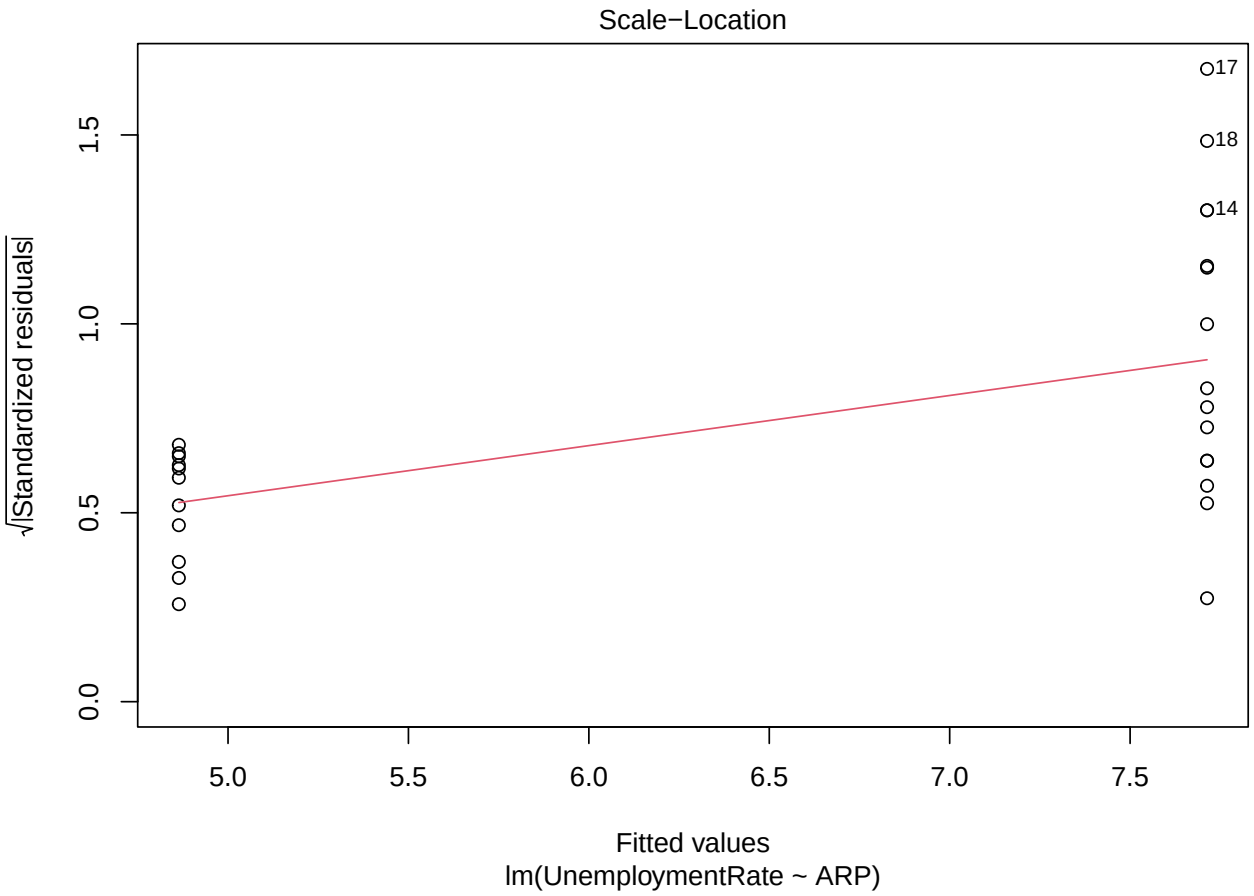
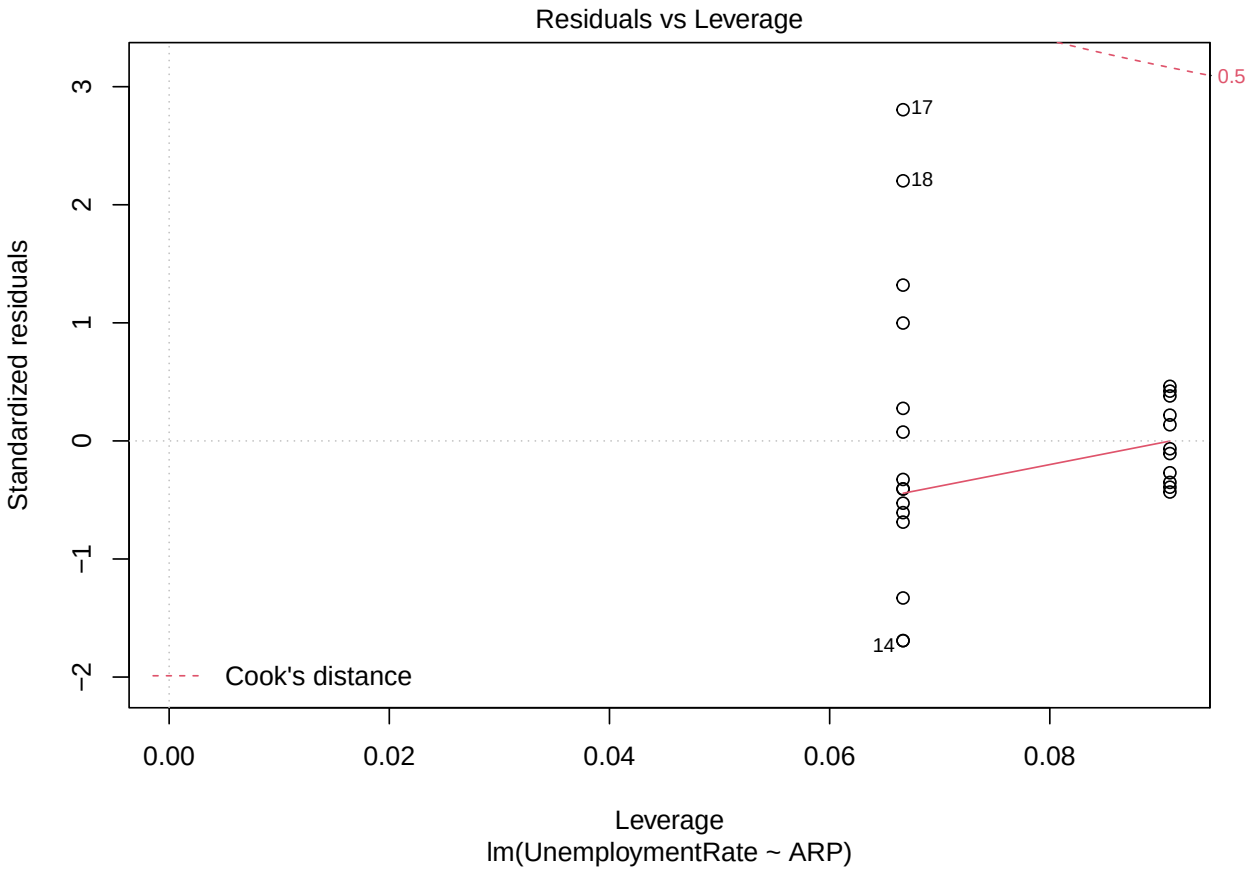
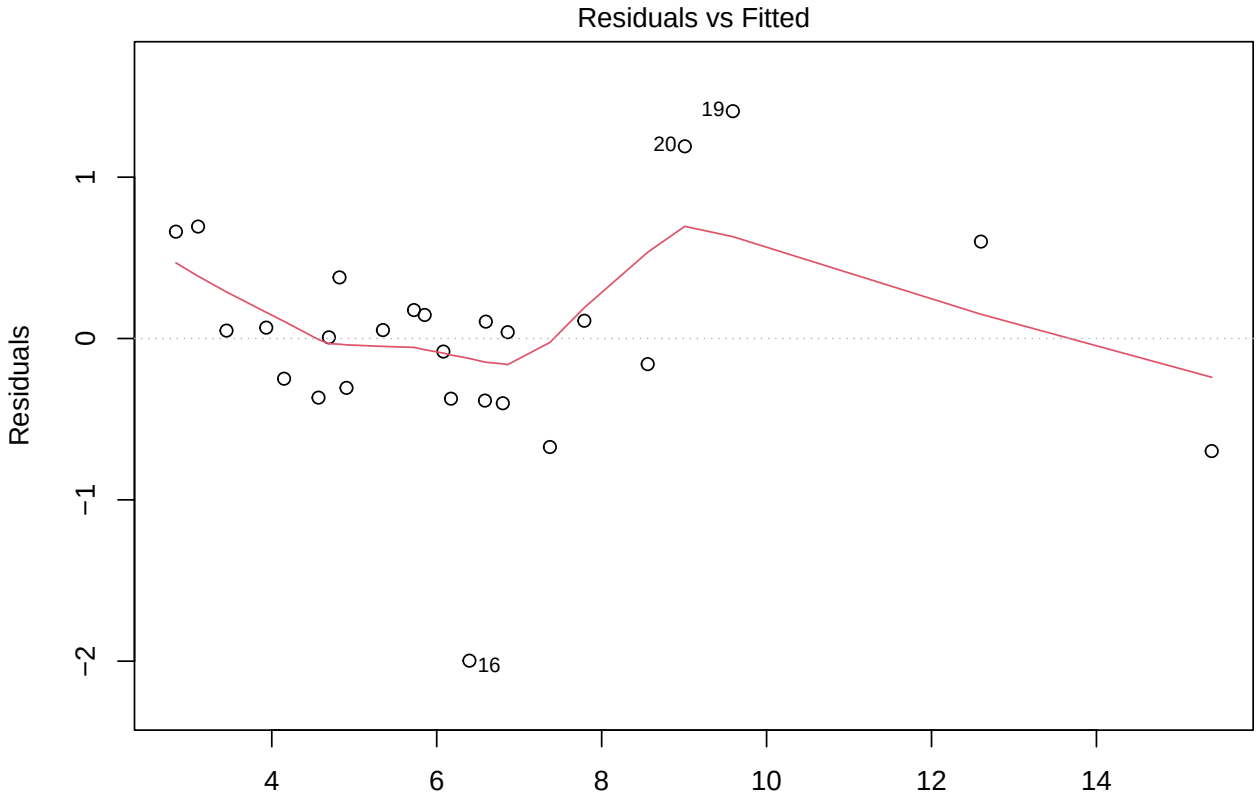
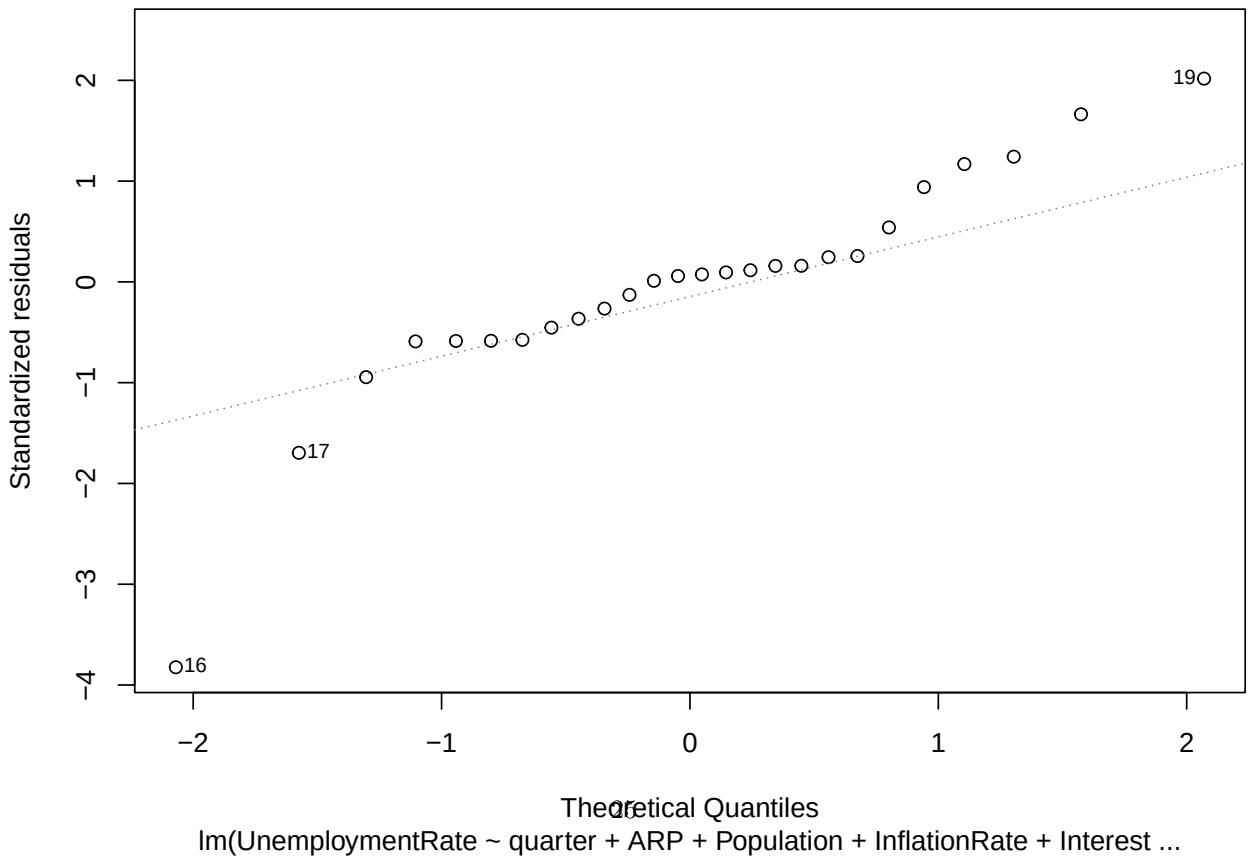
18
14

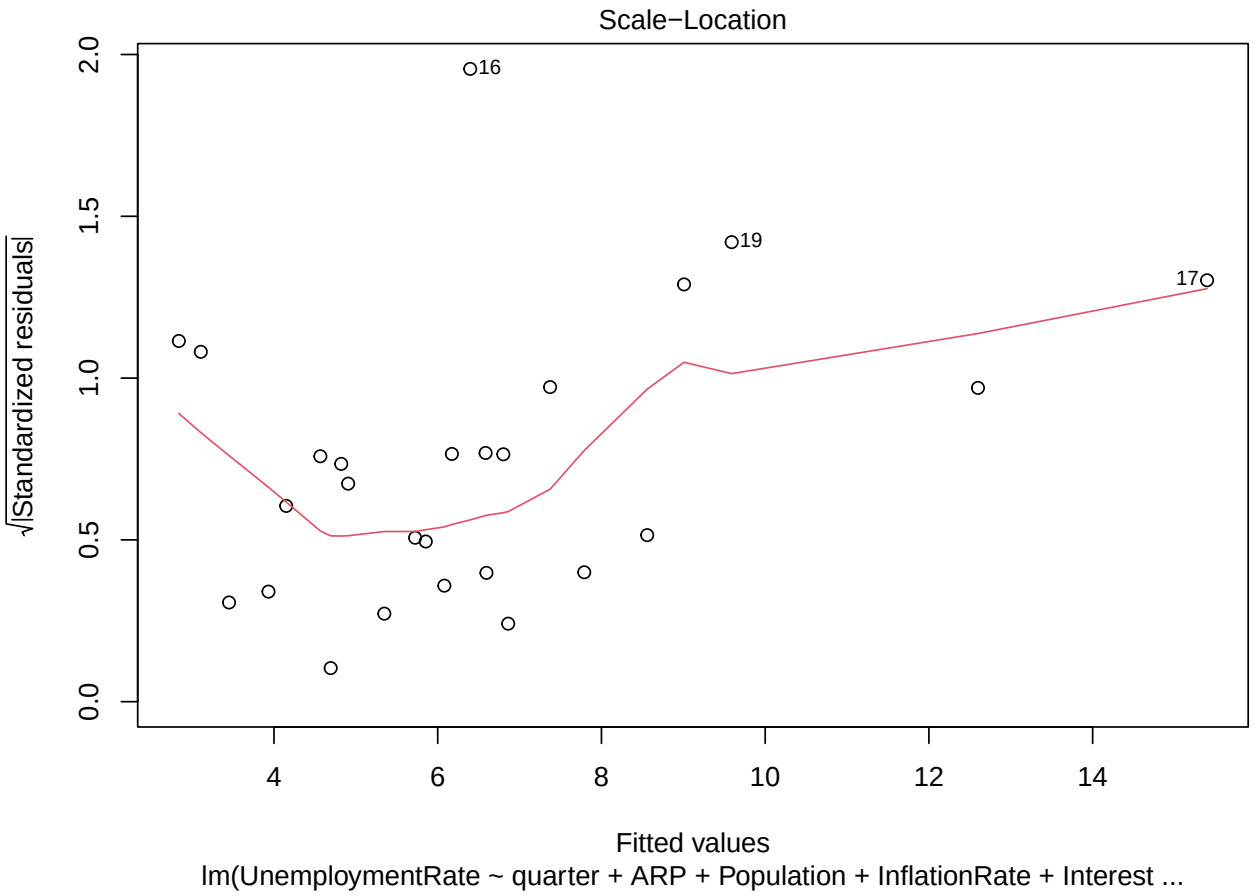

Scale−Location
√|Standardized residuals|
0.0
0.5
1.0
1.5
5.0
5.5
6.0
6.5
7.0
7.5
17
18
14
Fitted values
lm(UnemploymentRate ~ ARP)

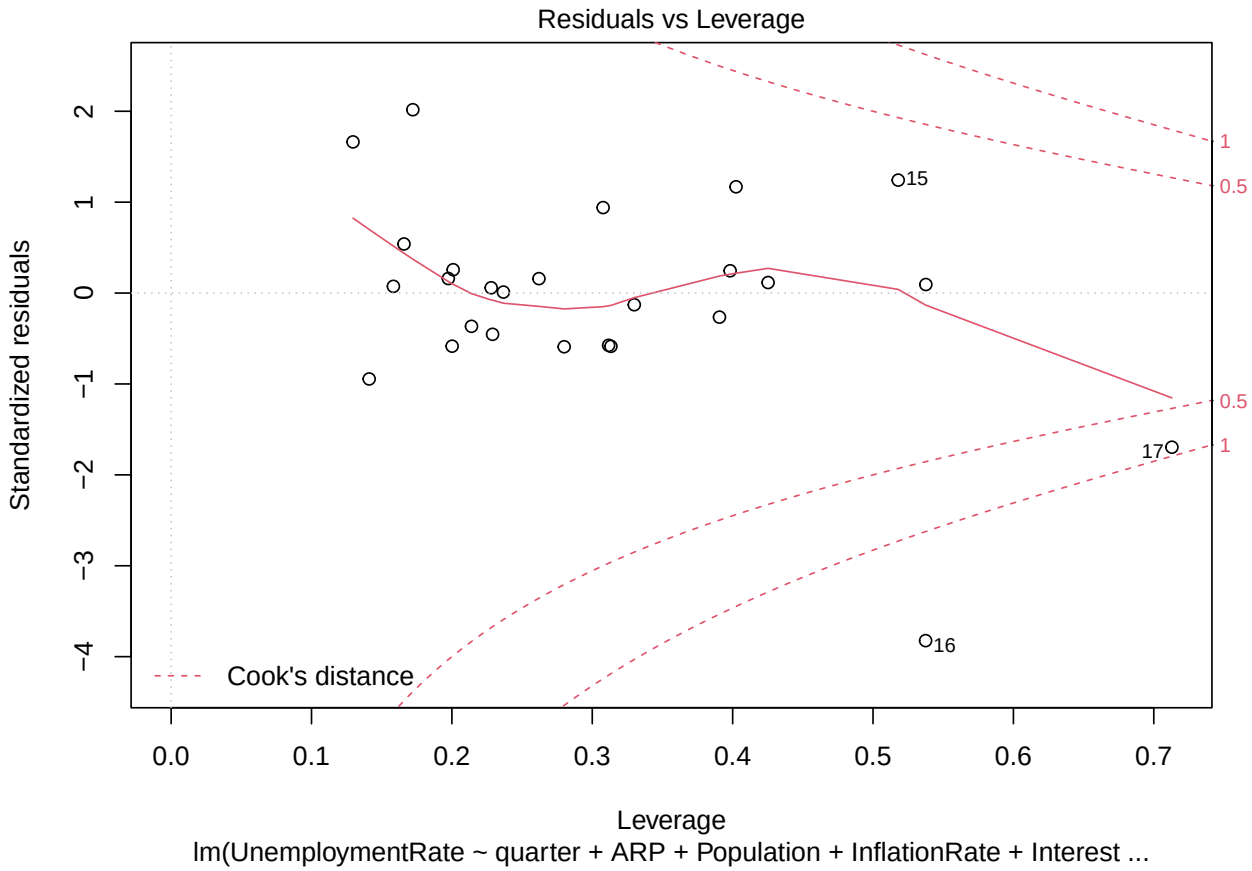

Residuals vs Leverage
Standardized residuals
Leverage
lm(UnemploymentRate ~ ARP)
Cook's distance
0.5
17
18
14
0.00
0.02
0.04
0.06
0.08
−2
−1
0
1
2
3

Appendix.E


Residuals vs Fitted
Residuals
Fitted values
lm(UnemploymentRate ~ quarter + ARP + Population + InflationRate + Interest ...
19
20
16


Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(UnemploymentRate ~ quarter + ARP + Population + InflationRate + Interest ...
19
17
16


Scale−Location
√|Standardized residuals|
0.0
0.5
1.0
1.5
2.0
16
19
17
4
6
8
10
12
14
Fitted values
lm(UnemploymentRate ~ quarter + ARP + Population + InflationRate + Interest ...



Appendix.F

F.1 Motivation

For what purpose was the dataset created? Was there a specific task in mind? Was there a specific gap that needed to be filled? Please provide a description. -The data was gathered by the FRED(Federal Reserve Economic Data) to combines data with a powerful mix of tools that help the user understand, interact with, display, and disseminate the data.

Who created the dataset (e.g., which team, research group) and on behalf of which entity (e.g., company, institution, organization)? -Federal Reserve Economic Data is created and maintained by the Research Department at the Federal Reserve Bank of St. Louis.

Who funded the creation of the dataset? If there is an associated grant, please provide the name of the grantor and the grant name and number. -The Research Department at the Federal Reserve Bank of St. Louis

Any other comment? -No.

F.2 Composition

What do the instances that comprise the dataset represent (e.g., documents, photos, people, countries)? Are there multiple types of instances (e.g., movies, users, and ratings; people and interactions between them; nodes and edges)? Please provide a description. -The observations are datapoints with selected economic factors of certain periods from 2020-01-01 to 2022-02-01.

How many instances are there in total (of each type, if appropriate)? -There is only one observation which is the U.S. economy.

Does the dataset contain all possible instances or is it a sample (not necessarily random) of instances from a larger set? If the dataset is a sample, then what is the larger set? Is the sample representative of the larger set (e.g., geographic coverage)? If so, please describe how this representativeness was validated/verified. If it is not representative of the larger set, please describe why not (e.g., to cover a more diverse range of instances, because instances were withheld or unavailable). -The dataset is for only one observation.

What data does each instance consist of? "Raw" data (e.g., unprocessed text or images) or features? In either case, please provide a description. -The data includes several economic factors such as unemployment rate, interest rate, and inflation rate collected by the FRED.

Is there a label or target associated with each instance? If so, please provide a description. -No, but the first column of the dataset clearly labelled the period of the data.

Is any information missing from individual instances? If so, please provide a description, explaining why this information is missing (e.g., because it was unavailable). This does not include intentionally removed information, but might include, e.g., redacted text. -No.

Are relationships between individual instances made explicit (e.g., users' movie ratings, social network links)? If so, please describe how these relationships are made explicit. -N/A

Are there recommended data splits (e.g., training, development/validation, testing)? If so, please provide a description of these splits, explaining the rationale behind them. -N/A

Are there any errors, sources of noise, or redundancies in the dataset? If so, please provide a description. -There are no errors, sources of noise, or redundancies in the dataset presented.

Is the dataset self-contained, or does it link to or otherwise rely on external resources (e.g., websites, tweets, other datasets)? If it links to or relies on external resources, a) are there guarantees that they will exist, and remain constant, over time; b) are there official archival versions of the complete dataset (i.e., including the external resources as they existed at the time the dataset was created); c) are there any restrictions (e.g., licenses, fees) associated with any of the external resources that might apply to a dataset consumer? Please provide descriptions of all external resources and any restrictions associated with them, as well as links or other access points, as appropriate. -The dataset is self-contained without the link to external sources.

Does the dataset contain data that might be considered confidential (e.g., data that is protected by legal privilege or by doctor-patient confidentiality, data that includes the content of individuals' non-public communications)? If so, please provide a description. -No. The dataset is public.

Does the dataset contain data that, if viewed directly, might be offensive, insulting, threatening, or might otherwise cause anxiety? If so, please describe why. -No.

Does the dataset identify any subpopulations (e.g., by age, gender)? If so, please describe how these subpopulations are identified and provide a description of their respective distributions within the dataset. Is it possible to identify individuals (i.e., one or more natural per- sons), either directly or indirectly (i.e., in combination with other data) from the dataset? If so, please describe how. -No.

Does the dataset contain data that might be considered sensitive in any way (e.g., data that reveals race or ethnic origins, sexual orientations, religious beliefs, political opinions or union memberships, or locations; financial or health data; biometric or genetic data; forms of government identification, such as social security numbers; criminal history)? If so, please provide a description. -No.

Any other comments?

###F.3 Collection Process

How was the data associated with each instance acquired? Was the data directly observable (e.g., raw text, movie ratings), reported by subjects (e.g., survey responses), or indirectly inferred/derived from other data (e.g., part-of-speech tags, model-based guesses for age or language)? If the data was reported by subjects or indirectly inferred/derived from other data, was the data validated/verified? If so, please describe how. -The data was collected, gathered and calculated by the FRED from several credible economic data providers.

What mechanisms or procedures were used to collect the data (e.g., hardware apparatuses or sensors, manual human curation, software programs, software APIs)? How were these mechanisms or procedures validated? -FRED use software programs to gather and collect data.

If the dataset is a sample from a larger set, what was the sampling strategy (e.g., deterministic, probabilistic with specific sampling probabilities)? -N/S

Who was involved in the data collection process (e.g., students, crowdworkers, contractors) and how were they compensated (e.g., how much were crowdworkers paid)? -N/A

Over what timeframe was the data collected? Does this timeframe match the creation timeframe of the data associated with the instances (e.g., recent crawl of old news articles)? If not, please describe the time- frame in which the data associated with the instances was created. -The datapoints are from Jan.1, 2020 to Feb.1, 2022.

Were any ethical review processes conducted (e.g., by an institutional review board)? If so, please provide a description of these review processes, including the outcomes, as well as a link or other access point to any supporting documentation. -N/A

Did you collect the data from the individuals in question directly, or obtain it via third parties or other sources (e.g., websites)? -The data was accessed from the FRED website in the form of a xlsx and then transformed into R dataset.

Were the individuals in question notified about the data collection? If so, please describe (or show with screenshots or other information) how notice was provided, and provide a link or other access point to, or otherwise reproduce, the exact language of the notification itself. -N/A

Did the individuals in question consent to the collection and use of their data? If so, please describe (or show with screenshots or other information) how consent was requested and provided, and provide a link or other access point to, or otherwise reproduce, the exact language to which the individuals consented. -N/A

If consent was obtained, were the consenting individuals provided with a mechanism to revoke their consent in the future or for certain uses? If so, please provide a description, as well as a link or other access point to the mechanism (if appropriate). -N/A

Has an analysis of the potential impact of the dataset and its use on data subjects (e.g., a data protection impact analysis) been conducted? If so, please provide a description of this analysis, including the outcomes, as well as a link or other access point to any supporting documentation. -N/A

Any other comments? -N/A

F.4 Preprocessing/cleaning/labelling

Was any preprocessing/cleaning/labelling of the data done (e.g., discretization or bucketing, tokenization, part-of-speech tagging, SIFT feature extraction, removal of instances, processing of missing values)? If so, please provide a description. If not, you may skip the remaining questions in this section. -The economic factors are selected from the FRED website under the same time frame and then downloaded.

Was the "raw" data saved in addition to the preprocessed/cleaned/labelled data (e.g., to support unanticipated future uses)? If so, please provide a link or other access point to the "raw" data. -Yes, we add a variable of period and a dummy variable of the implementation of the policy.

Is the software that was used to preprocess/clean/label the data available? If so, please provide a link or other access point. -https://fred.stlouisfed.org/

-Any other comments? N/A

F.5 Uses

Has the dataset been used for any tasks already? If so, please provide a description. -The data on the FRED website can be used by anyone who downloaded by selection.

Is there a repository that links to any or all papers or systems that use the dataset? If so, please provide a link or other access point. -N/A

What (other) tasks could the dataset be used for? -The dataset could be used for develop other models with different dependent and independent variables specified.

Is there anything about the composition of the dataset or the way it was collected and preprocessed/cleaned/labelled that might im- pact future uses? For example, is there anything that a dataset consumer might need to know to avoid uses that could result in unfair treatment of individuals or groups (e.g., stereotyping, quality of service issues) or other risks or harms (e.g., legal risks, financial harms)? If so, please provide a description. Is there anything a dataset consumer could do to mitigate these risks or harms? -N/A.

Are there tasks for which the dataset should not be used? If so, please provide a description. -N/A

Any other comments? N/A

F.6 Distribution

Will the dataset be distributed to third parties outside of the entity (e.g., company, institution, organization) on behalf of which the dataset was created? If so, please provide a description. -N/A

How will the dataset will be distributed (e.g., tarball on website, API, GitHub)? Does the dataset have a digital object identifier (DOI)? -It does not have DOI.

When will the dataset be distributed? -The dataset can be downloaded anytime from the website.

Will the dataset be distributed under a copyright or other intellectual property (IP) license, and/or under applicable terms of use (ToU)? If so, please describe this license and/or ToU, and provide a link or other access point to, or otherwise reproduce, any relevant licensing terms or ToU, as well as any fees associated with these restrictions. -https://fred.stlouisfed.org/legal/#full-fred-terms

Have any third parties imposed IP-based or other restrictions on the data associated with the instances? If so, please describe these restrictions, and provide a link or other access point to, or otherwise reproduce, any relevant licensing terms, as well as any fees associated with these restrictions. -N/A

Do any export controls or other regulatory restrictions apply to the dataset or to individual instances? If so, please describe these restrictions, and provide a link or other access point to, or otherwise reproduce, any supporting documentation. -N/A

Any other comments? -No.

F.7 Maintenance

Who will be supporting/hosting/maintaining the dataset? -The Research Department at the Federal Reserve Bank of St. Louis

How can the owner/curator/manager of the dataset be contacted(e.g., email address)? -https://fred.stlouisfed.org/contactus/

Is there an erratum? If so, please provide a link or other access point. -No.

Will the dataset be updated (e.g., to correct labelling errors, add new instances, delete instances)? If so, please describe how often, by whom, and how updates will be communicated to dataset consumers (e.g.,

mailing list, GitHub)? -The dataset may be updated by the FRED in the future if there is a revise on the data.

If the dataset relates to people, are there applicable limits on the retention of the data associated with the instances (e.g., were the individuals in question told that their data would be retained for a fixed period of time and then deleted)? If so, please describe these limits and explain how they will be enforced. -N/A

Will older versions of the dataset continue to be supported/hosted/maintained? If so, please describe how. If not, please describe how its obsolescence will be communicated to dataset consumers. -N/A

If others want to extend/augment/build on/contribute to the dataset, is there a mechanism for them to do so? If so, please provide a description. Will these contributions be validated/verified? If so, please describe how. If not, why not? Is there a process for communicating/distributing these contributions to dataset consumers? If so, please provide a description. -No.

Any other comments? -N/A

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