

UCB DATA ANALYSIS Boot Camp

Project _ 1



The Team



W

Wenli Rui



Y

Yuleica Ledezma



D

David Henderson



N

Nahed Jaddaa

A Regression Analysis of US Unemployment Rate & Financial Crisis



APPLICATION FOR UNEMPLOYMENT BENEFITS

GENERAL INFORMATION

Name (Last) _____ (First) _____ (Middle Initial) _____ Phone (Area) _____ (Number) _____

Address (Mailing Address) _____ City _____ State _____ Zip _____

Address (Residence) _____ City _____ State _____ Zip _____

Have you legally worked in the U.S.? Yes No

Have you worked for the employer for whom you are applying? Yes No

Partial functions of the job you are applying for? Yes No

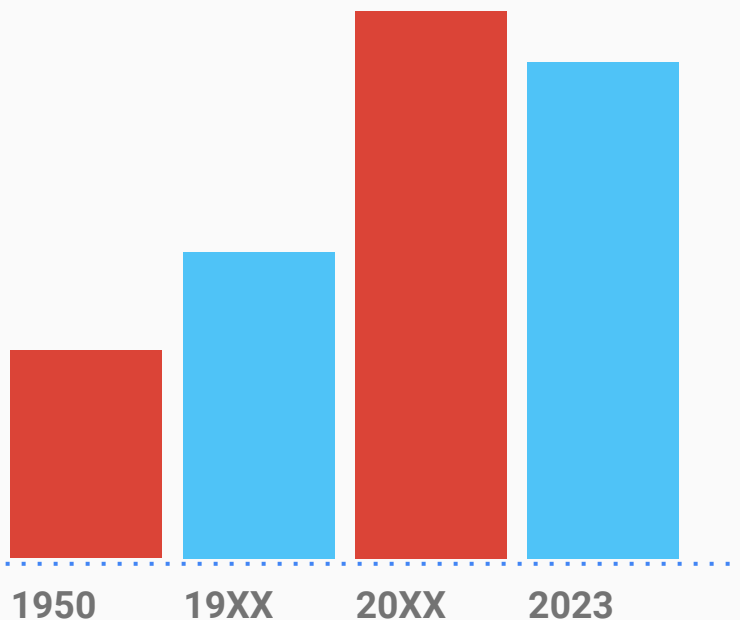
Test Passed? Yes No

Code Earned _____



Table of Contents

1. Introduction
2. Dataset summary
3. Data exploration
4. Regression
5. Diagnostics
6. Conclusion
7. Caveats



The Study



Project Idea

This study investigates whether economic factors influencing monthly unemployment rates in the US differ during financial crises. It employs regression analysis to examine the relationship between unemployment rates and variables such as monthly GDP growth, inflation rate, labor force participation rate, presidential party, and immigration data.

Introduction

Objective

Measure the impact of economic crises on women and men unemployment rates around the event window, taking into account of major economic indicators and president party affiliation.

Methods

Data exploration and OLS regression analysis to analyze abnormal changes in unemployment rates in crisis.

Hypothesis

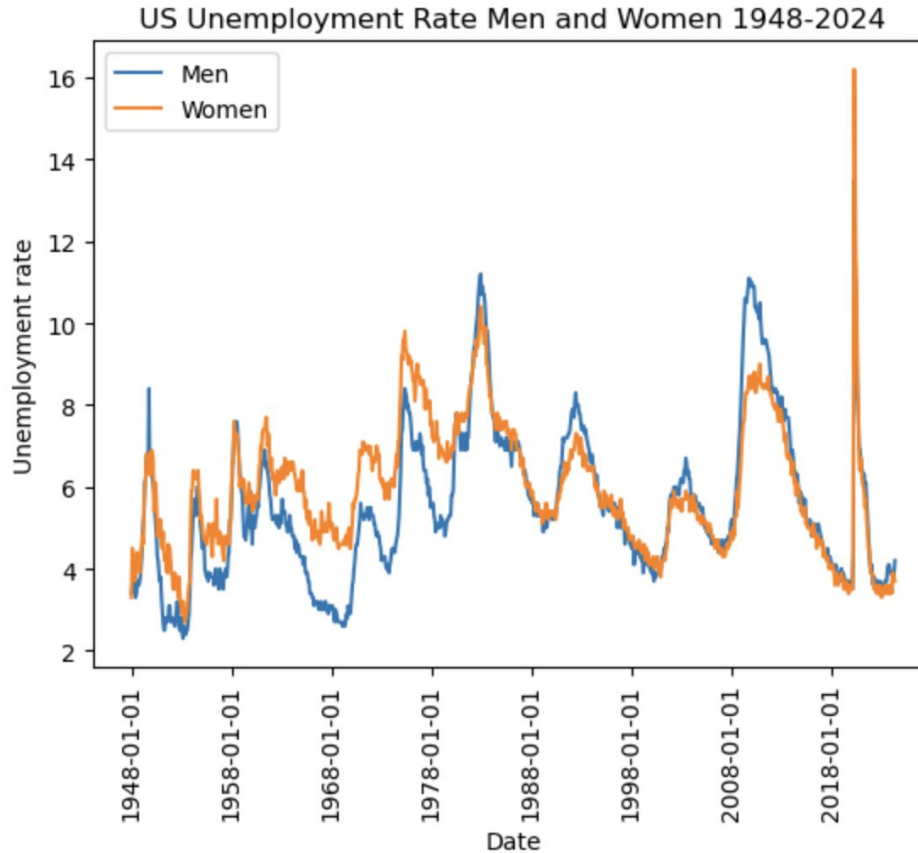
- Null Hypothesis (H0): Economic crises do not cause abnormal changes in women and men unemployment rates, respectively, aftering controlling for major economic indicators and president party affiliation.
- Alternative Hypothesis (H1): Economic crises cause abnormal changes in women and men unemployment rates, respectively, aftering controlling for major economic indicators and president party affiliation.

Summary of Dataset

Data	Description	Summary Statistics
US men and women monthly unemployment rate	Monthly unemployment rate for 16 years and over age group	Women: <u>Min:</u> 0.034 <u>Max:</u> 0.101 <u>Median:</u> 0.053 <u>St. Dev:</u> 0.0168 Men: <u>Min:</u> 0.026 <u>Max:</u> 0.106 <u>Median:</u> 0.059 <u>St. Dev:</u> 0.2095
US monthly Fed fund rate	Monthly interest rate at which depository institutions trade federal funds	<u>Min:</u> 0.05 <u>Median:</u> 4.165 <u>Max:</u> 19.1 <u>St. Dev:</u> 3.592
US monthly CPI	Monthly measurement of average change in prices for a market basket of consumer goods & services	<u>Min:</u> 21.48 <u>Median:</u> 108.0 <u>Max:</u> 313.21 <u>St. Dev:</u> 85.59
US monthly real GDP index	Monthly US GDP index adjusted for inflation	<u>Min:</u> 92.03 <u>Median:</u> 100.07 <u>Max:</u> 102.98 <u>St. Dev:</u> 1.347
US monthly labor force participation	% of the population that is either working or actively looking for job	<u>Min:</u> 58.1 <u>Median:</u> 62.9 <u>Max:</u> 67.3 <u>St. Dev:</u> 2.915
US monthly no. of documented immigrants	No. of people residing in the US who were not US citizens at birth	<u>Min:</u> 147292 <u>Median:</u> 592412 <u>Max:</u> 1826595 <u>St. Dev:</u> 367524
US president party affiliation	Dummy variable which is 1 for republican and 0 for democrat	
US economic crisis	Dummy variable which is 1 for US financial crisis and 0 for no crisis	

Data Exploration

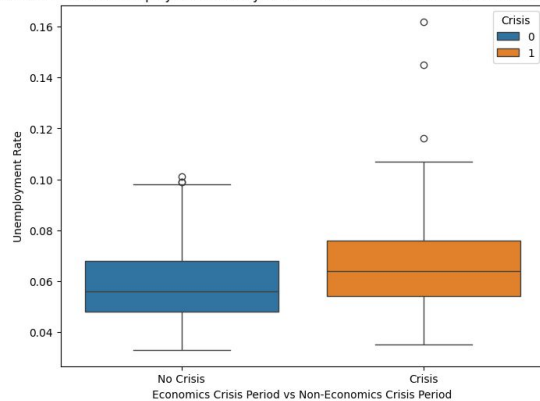
The US Unemployment Rate for Men and Women



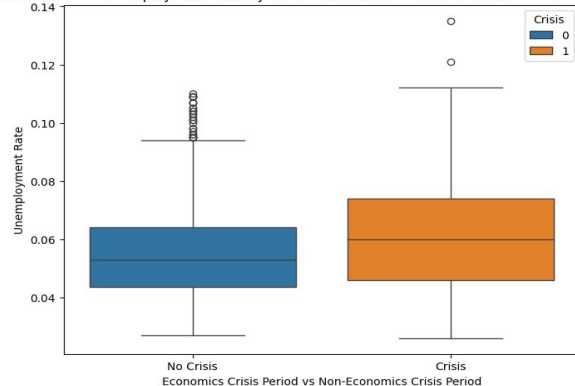
Data Exploration

Boxplot of Unemployment Rate vs. Crisis and President Party Affiliation

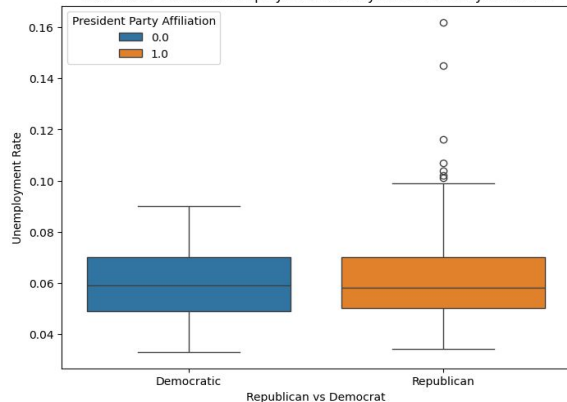
Box Plot of Women Unemployment Rate by Economics Crisis Period vs Non-Economics Crisis Period



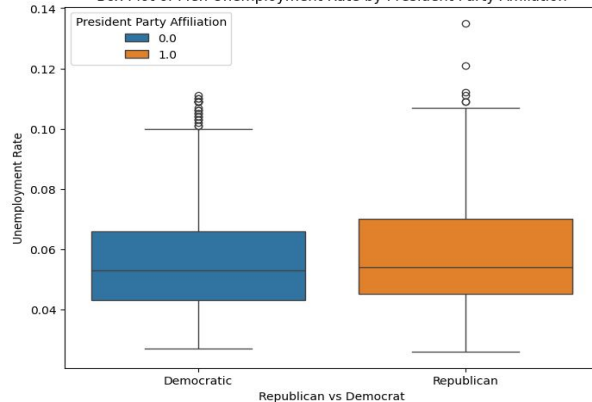
Box Plot of Men Unemployment Rate by Economics Crisis Period vs Non-Economics Crisis Period



Box Plot of Women Unemployment Rate by President Party Affiliation

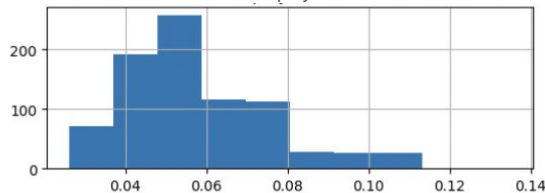
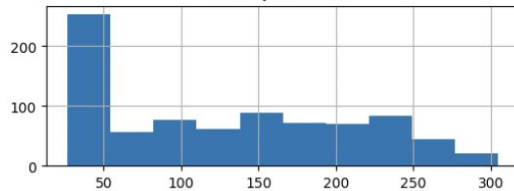
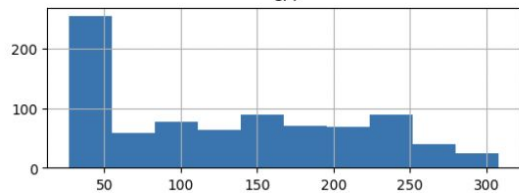
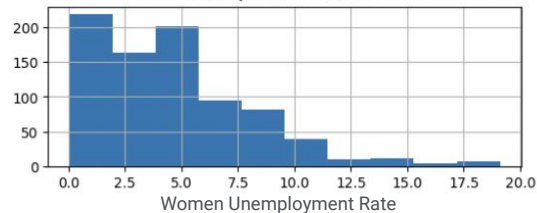
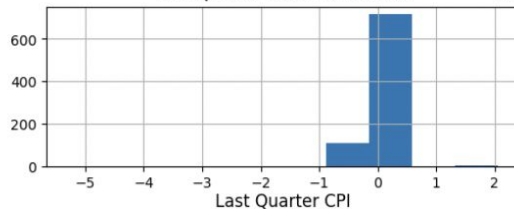
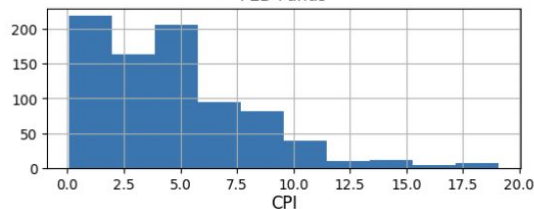
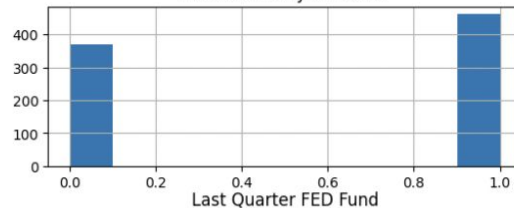
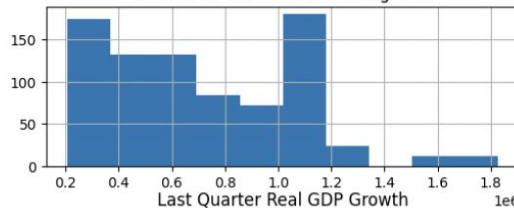
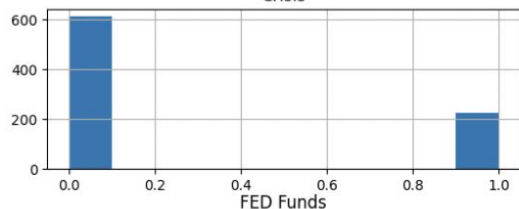
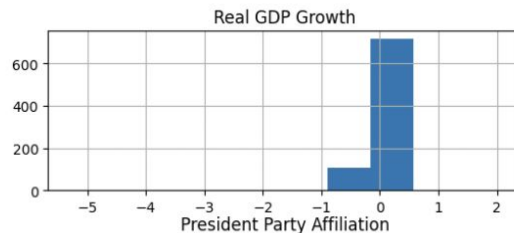
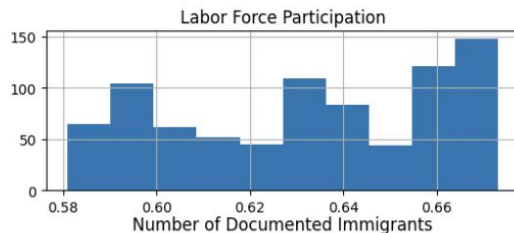
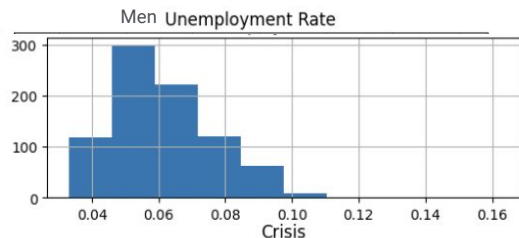


Box Plot of Men Unemployment Rate by President Party Affiliation



Data Exploration

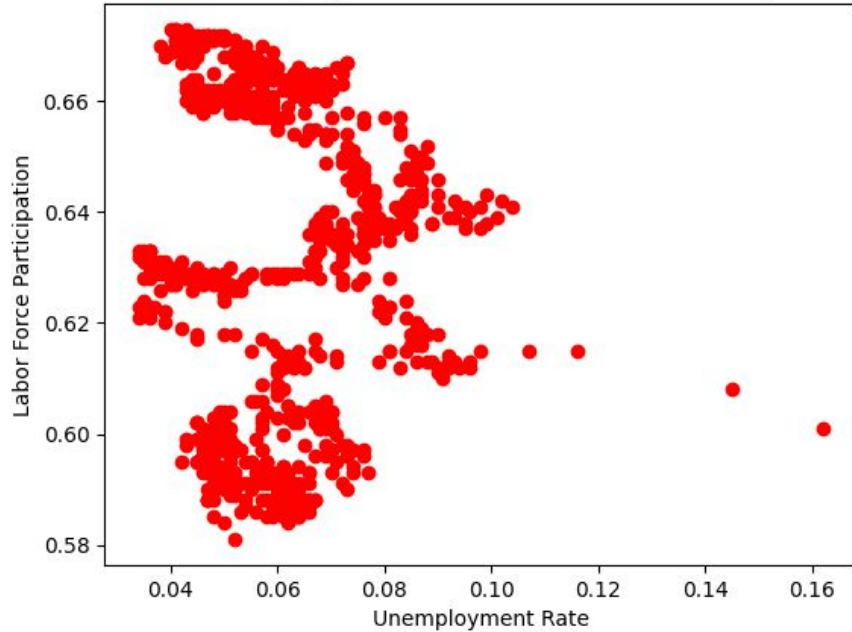
Histogram of Unemployment Rate for Men and Women



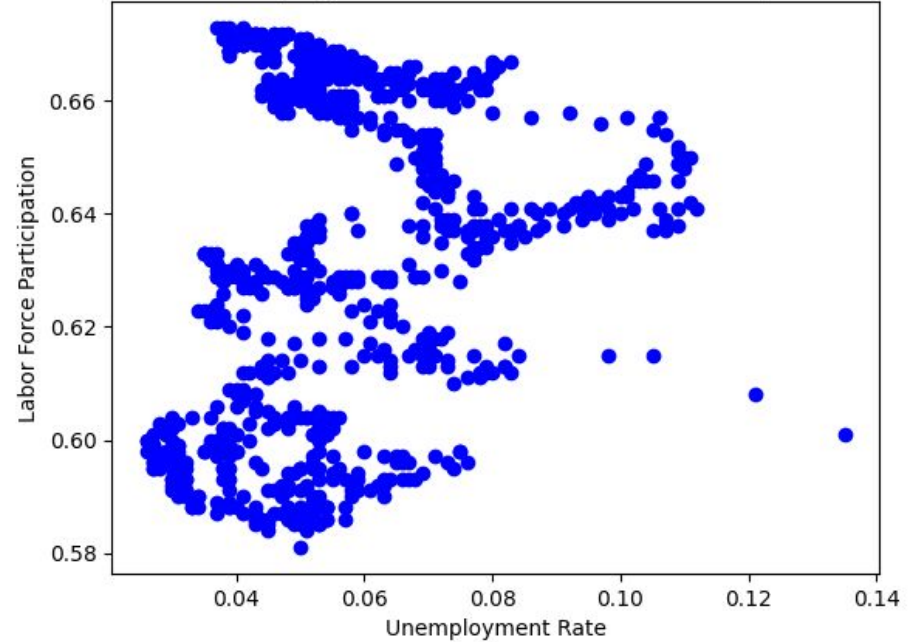
Data Exploration

Unemployment Rate Vs Labor Force Participation

Women Unemployment Rate vs. Labor Force Participation



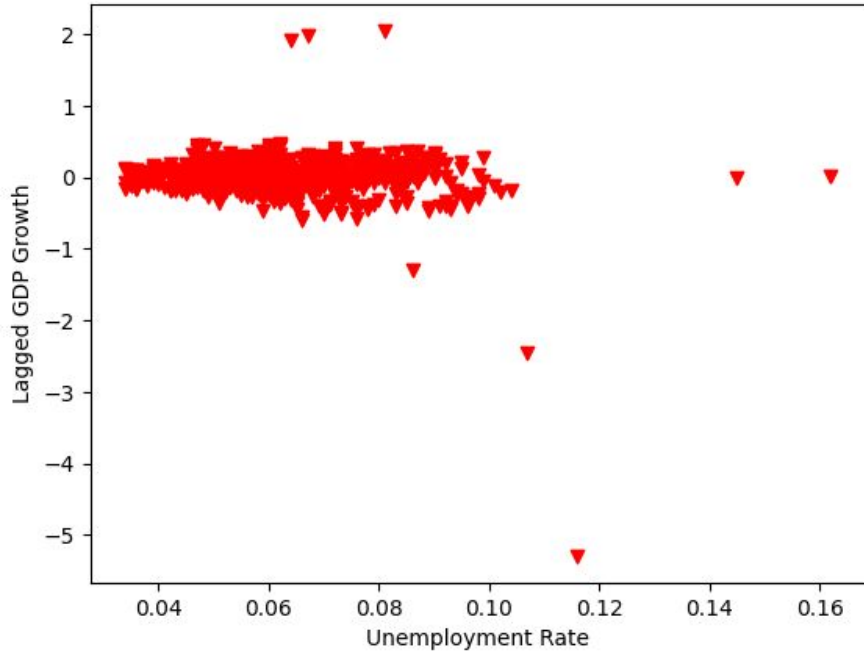
Men Unemployment Rate vs. Labor Force Participation



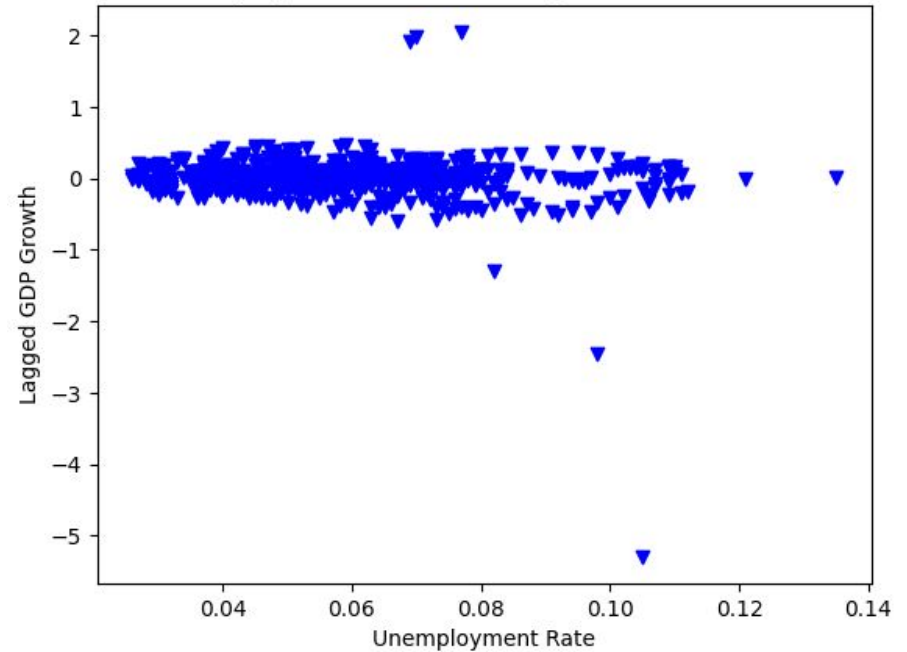
Data Exploration

Unemployment Rate Vs Lagged GDP Growth

Women Unemployment Rate vs. Last Quarter Real GDP Growth

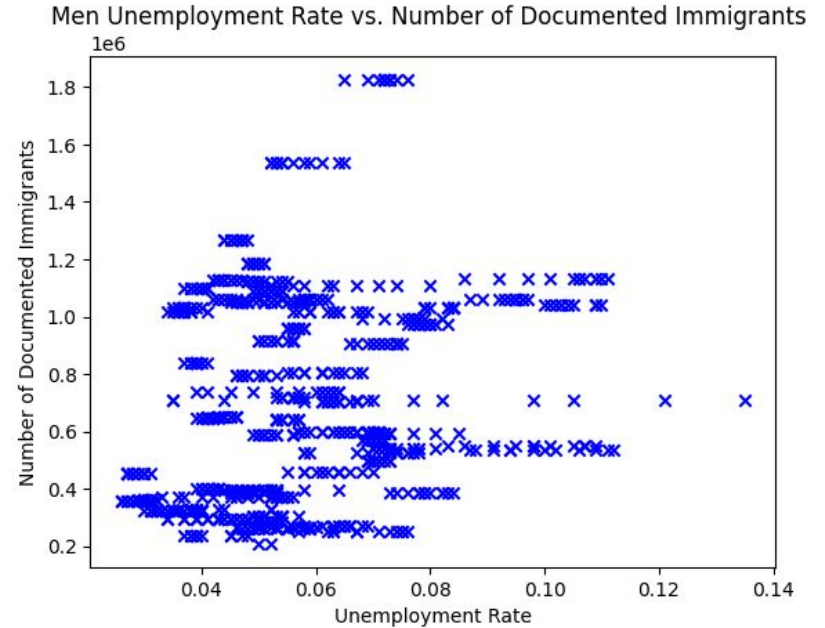
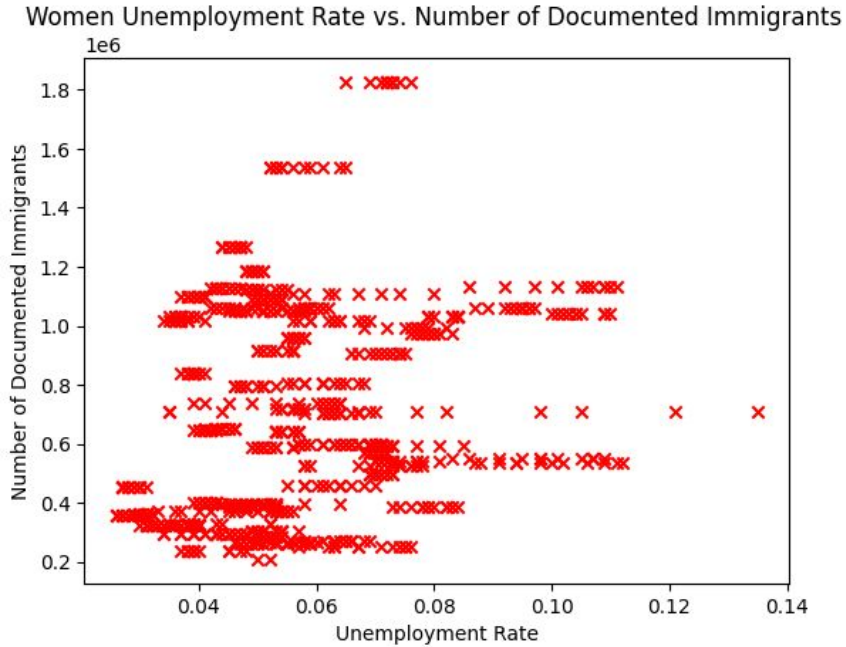


Men Unemployment Rate vs. Last Quarter Real GDP Growth



Data Exploration

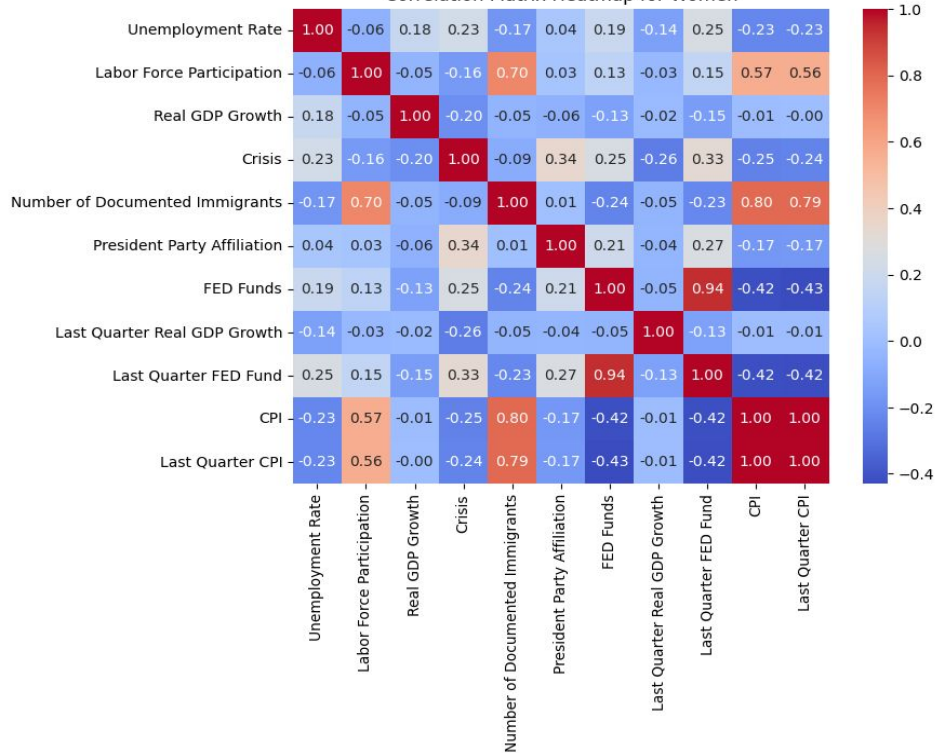
Unemployment Rate Vs Documented Immigrants



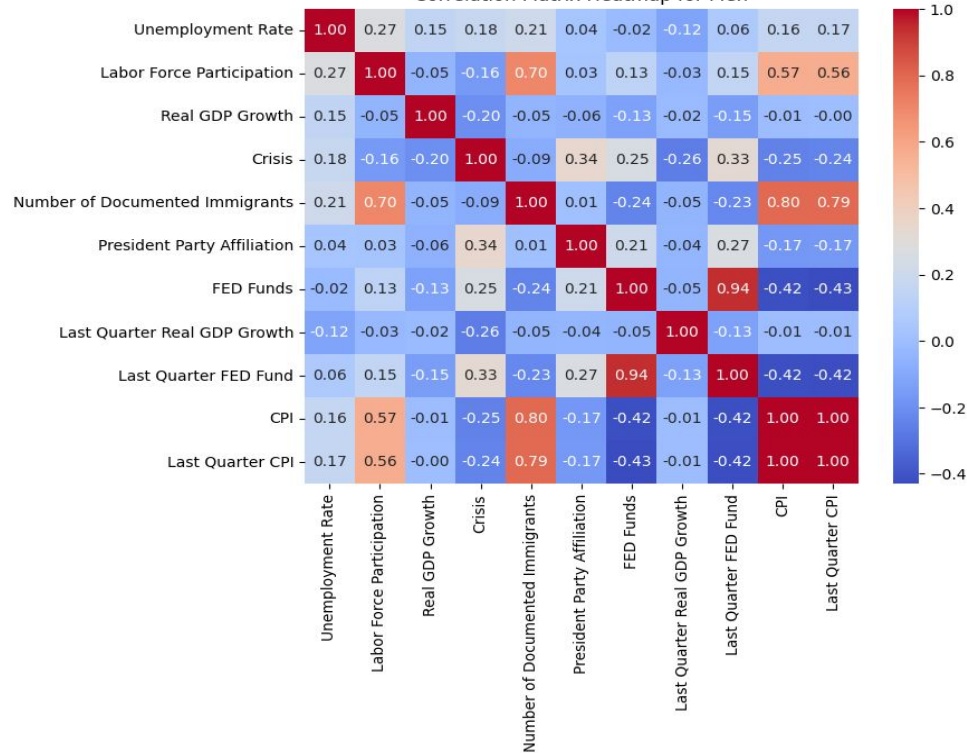
Data Exploration

Correlation Matrix

Correlation Matrix Heatmap for Women



Correlation Matrix Heatmap for Men



OLS Regression Model



Men Unemployment Rate OLS Regression Model

*Log (Men Unemployment Rate) = $\beta_0 + \beta_1 * \text{Log}(\text{Labor Force Participation}) + \beta_2 * \text{Log}(\text{No. Of Immigrants}) + \beta_3 * \text{Log}(\text{Last Quarter Fed Fund Rate}) + \beta_4 * \text{Log}(\text{Last 2 Quarter Fed Fund Rate}) + \beta_5 * \text{Log}(\text{Last Quarter CPI}) + \beta_6 * \text{Log}(\text{President Party Affiliation}) + \beta_7 * \text{Crisis} * \text{Log}(\text{No. Of Immigrants}) + \beta_8 * \text{Crisis} * \text{Log}(\text{Last Quarter Fed Fund Rate}) + \beta_9 * \text{Crisis} * \text{Log}(\text{Last 2 Quarter Fed Fund Rate})$*



Women Unemployment Rate OLS Regression Model

*Log (Men Unemployment Rate) = $\beta_0 + \beta_1 * \text{Log}(\text{Labor Force Participation}) + \beta_2 * \text{Log}(\text{No. Of Immigrants}) + \beta_3 * \text{Log}(\text{Last Quarter Fed Fund Rate}) + \beta_4 * \text{Log}(\text{Last 2 Quarter Fed Fund Rate}) + \beta_5 * \text{Log}(\text{President Party Affiliation}) + \beta_6 * \text{Crisis} * \text{Log}(\text{No. Of Immigrants}) + \beta_7 * \text{Crisis} * \text{Log}(\text{Last Quarter Fed Fund Rate}) + \beta_8 * \text{Crisis} * \text{Log}(\text{Last 2 Quarter Fed Fund Rate}) + \beta_9 * \text{Crisis} * \text{Log}(\text{Labor Force Participation})$*

Regression Results



OLS Regression Results

Dep. Variable:	Log_Unemployment Rate	R-squared:	0.314			
Model:	OLS	Adj. R-squared:	0.305			
Method:	Least Squares	F-statistic:	35.89			
Date:	Wed, 12 Jun 2024	Prob (F-statistic):	6.56e-58			
Time:	20:51:05	Log-Likelihood:	-8.8313			
No. Observations:	796	AIC:	39.66			
Df Residuals:	785	BIC:	91.14			
Df Model:	10					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
const	2.8200	0.777	3.629	0.000	1.295	4.345
Log_Labor Force Participation	52.4775	5.249	9.997	0.000	42.173	62.782
Log_Number of Documented Immigrants	-0.2667	0.052	-5.139	0.000	-0.369	-0.165
Log_Last Quarter FED Fund	-0.2817	0.036	-7.926	0.000	-0.351	-0.212
Crisis_LogImmig	0.0394	0.013	3.009	0.003	0.014	0.065
Crisis_Log2LastQFED	0.0605	0.061	0.996	0.320	-0.059	0.180
Log_Last Quarter CPI	-0.0473	0.039	-1.221	0.222	-0.123	0.029
Crisis_LogLastQFED	0.0493	0.049	1.001	0.317	-0.047	0.146
Prev Two Quarter Log FED Fund	0.1605	0.037	4.384	0.000	0.089	0.232
President Party Affiliation	0.0617	0.020	3.044	0.002	0.022	0.101
Crisis_LogLaborForce	6.8224	3.696	1.846	0.065	-0.432	14.077
Omnibus:	9.504	Durbin-Watson:	0.103			
Prob(Omnibus):	0.009	Jarque-Bera (JB):	6.193			
Skew:	-0.025	Prob(JB):	0.0452			
Kurtosis:	2.571	Cond. No.	8.46e+03			

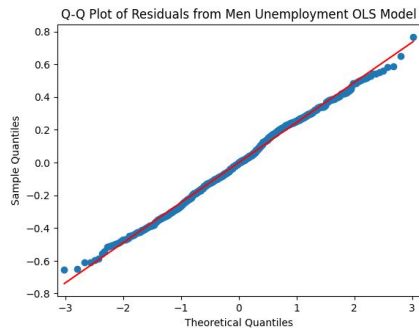


OLS Regression Results

Dep. Variable:	Log_Unemployment Rate	R-squared:	0.197			
Model:	OLS	Adj. R-squared:	0.188			
Method:	Least Squares	F-statistic:	21.75			
Date:	Thu, 13 Jun 2024	Prob (F-statistic):	3.76e-33			
Time:	18:55:58	Log-Likelihood:	104.40			
No. Observations:	808	AIC:	-188.8			
Df Residuals:	798	BIC:	-141.8			
Df Model:	9					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
const	1.7413	0.632	2.754	0.006	0.500	2.982
Log_Labor Force Participation	19.6118	3.725	5.265	0.000	12.300	26.923
Log_Number of Documented Immigrants	-0.2797	0.037	-7.561	0.000	-0.352	-0.207
Log_Last Quarter FED Fund	-0.2620	0.031	-8.531	0.000	-0.322	-0.202
Crisis_LogImmig	0.0461	0.011	4.263	0.000	0.025	0.067
Crisis_Log2LastQFED	-0.1128	0.045	-2.487	0.013	-0.202	-0.024
Crisis_LogLastQFED	0.1695	0.040	4.237	0.000	0.091	0.248
Prev Two Quarter Log FED Fund	0.2195	0.031	7.092	0.000	0.159	0.280
President Party Affiliation	-0.0193	0.017	-1.103	0.270	-0.054	0.015
Crisis_LogLaborForce	10.1677	3.039	3.346	0.001	4.203	16.133
Omnibus:	11.611	Durbin-Watson:	0.075			
Prob(Omnibus):	0.003	Jarque-Bera (JB):	7.423			
Skew:	0.061	Prob(JB):	0.0244			
Kurtosis:	2.547	Cond. No.	7.14e+03			

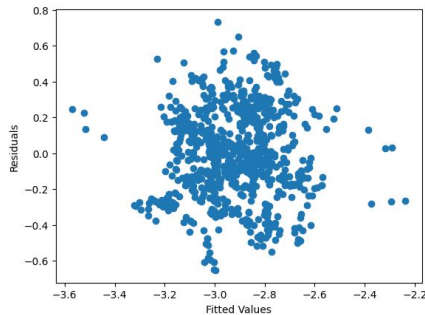
Regression Diagnostic

Test for Normality of Residuals



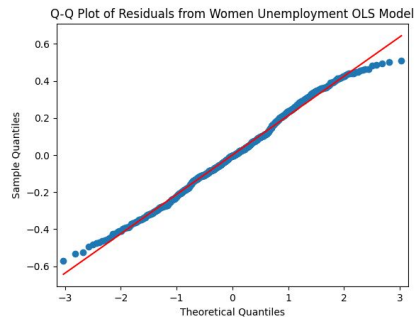
Shapiro-Wilk Test Statistic: 0.99
p-value: 0.02

Test for Constant Var of Residuals

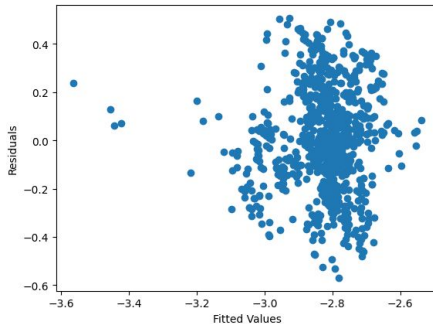


ANOVA Summary

	PR(>F)
Log_Labor_Force_Participation	1.311260e-26
Log_Number_of_Documented_Immigrants	7.089868e-01
Log_Last_Quarter_FED_Fund	8.491212e-20
Crisis_LogImmig	1.040537e-18
Crisis_Log2LastQFED	2.105456e-04
Log_Last_Quarter_CPI	2.356056e-02
Crisis_LogLastQFED	1.815305e-04
Prev_Two_Quarter_Log_FED_Fund	3.362822e-06
President_Party_Affiliation	4.843810e-03
Crisis_LogLaborForce	6.525122e-02
Residual	NaN



Shapiro-Wilk Test Statistic: 0.99
p-value: 0.001



	PR(>F)
Log_Labor_Force_Participation	7.954047e-02
Log_Number_of_Documented_Immigrants	1.100050e-12
Log_Last_Quarter_FED_Fund	5.609475e-05
Crisis_LogImmig	4.112901e-11
Crisis_Log2LastQFED	5.773321e-04
Log_Last_Quarter_CPI	5.500414e-09
Crisis_LogLastQFED	1.363739e-02
Prev_Two_Quarter_Log_FED_Fund	2.484314e-09
President_Party_Affiliation	1.868432e-01
Crisis_LogLaborForce	1.024973e-02
Residual	NaN

Caveats and Future Study

1. Other variables may have a significant impact on unemployment rate include consumer confidence level, government spending.
2. To further address the residual non-normality issue, we may consider incorporating longer-period lag variables or including the dependent variable in squared terms to account for potential nonlinear relationships.
3. Future study can investigate the unemployment rates of women and men together during an economic crisis can provide valuable insights into the differential impacts on these groups.

Appendix

Data Source

Sources

U.S. BUREAU OF LABOR STATISTICS Saint Louis Federal Reserve Bank

- ★ [GDP data](#)
- ★ [Unemployment rate](#)
- ★ [President party](#)
- ★ [Immigration data](#)
- ★ [Interest rate](#)
- ★ [Labor force participation rate](#)
- ★ [President Party](#)



Conclusion

- Summary: Recap key points covered in the presentation.
- Final Thoughts: Importance of understanding and addressing unemployment.