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AI Boot Camp **Project 1**

Inflationary Effects

https://github.com/jbgraham073/ai_group_project_1.git

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Project Overview

Project Purpose / Description

Our objective is to identify primary drivers of inflation within the United States economy. Subsequently, we aim to analyze the repercussions of inflation on various socio-economic factors such as crime rates, unemployment levels, and mental health.

To achieve this, we employed data visualizations, correlations, lagged correlations, and prophet model forecasting.

Our datasets consist of time series comprising daily, monthly, quarterly, and annual data spanning either the past decade or two decades.

Project Overview

Goals/Questions to be addressed

- What economic factors have the strongest correlation with inflation?
- How does inflation impact social behaviors such as mental health, substance abuse, and crime?
- Based on this retrospective analysis what do we predict to happen with inflation in the next two years?
- Post Project Data Analytics Scope.

Project Overview

Approach taken to achieve goals

- Data Collection
- Data Cleaning
  - Casting different time periods
- Exploration
  - Correlation Tables
  - Heat Maps
  - Bar Charts
- Forecast Inflation with Prophet
- Project Management
  - Asana

Project Overview

Overview of data collection, cleanup and exploration process

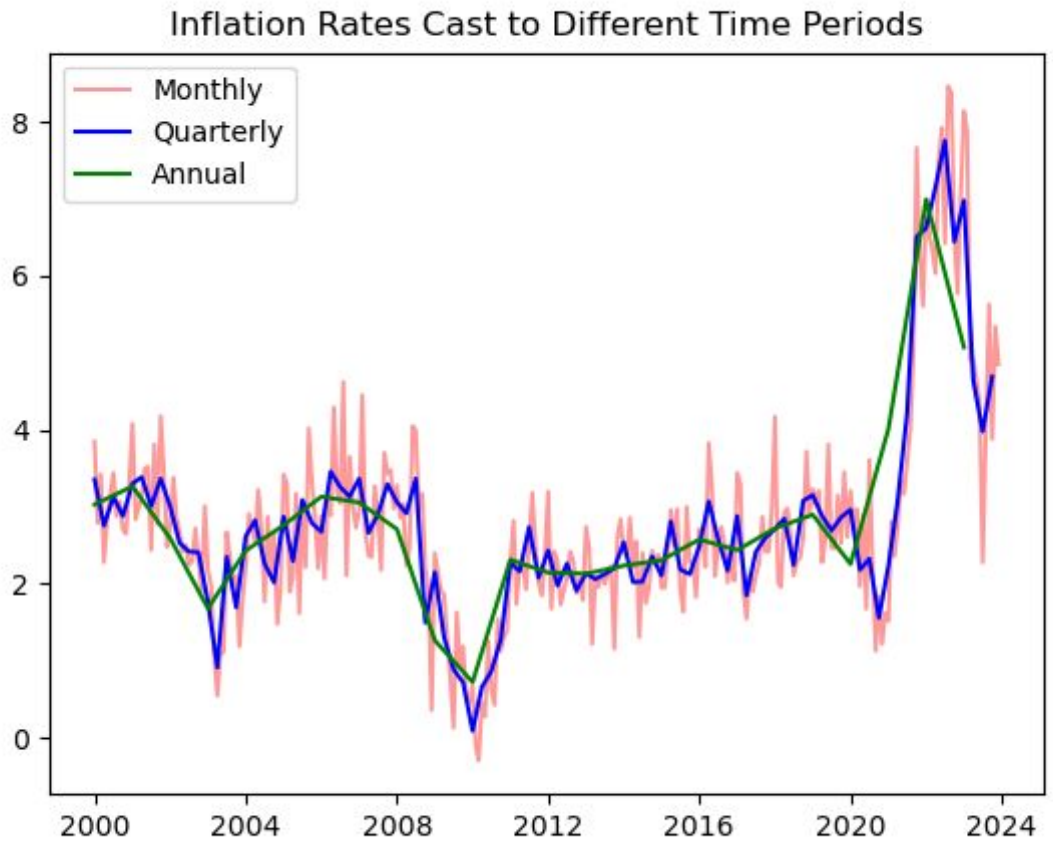
- Sources
  - FRED (Federal Reserve Economic Data) - Economic
  - SAMHSA (Substance Abuse and Mental Health Services Administration) - Mental Health
  - FBI (Federal Bureau of Investigation) - Crime
- Varying Reporting Frequencies
  - Monthly
  - Quarterly
  - Yearly
- Cast Monthly on to Quarterly, Quarterly on to Yearly from 2000 - 2023

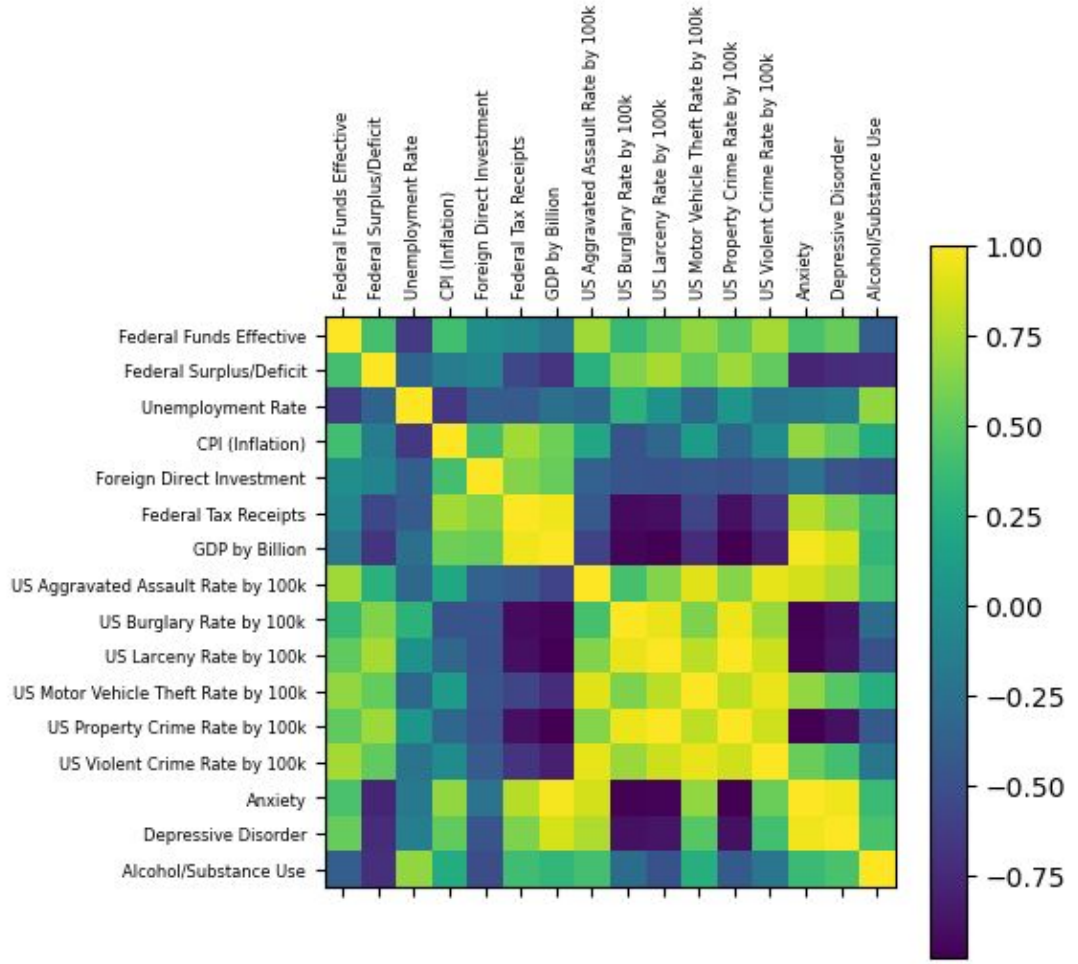
Overview of data collection, cleanup and exploration process

DataSet FileName	Description	Variables	Frequency	Start	End	Links
fed_current_tax_receipts	Quarterly dataset showing the federal tax income.	Federal tax Receipts	quarterly	01/01/2000	07/01/2023	https://fred.stlouisfed.org/series/W006RC1Q027SBEA
fed_surplus_deficit	Monthly data overview of the federal budget surplus or deficit.	Federal Surplus/Deficit	monthly	01/01/2000	12/01/2023	https://fred.stlouisfed.org/series/MTSDS133FMS
mh_sa	Annual mental health data describing diagnoses of anxiety, depression, and substance abuse.	Anxiety, Depressive disorder, Alcohol/substance use	annual	2013	2021	https://www.samhsa.gov/data/data-we-collect/mh-cld-mental-health-client-level-data
consumer_price_index	Median Consumer Price Index (CPI) is a measure of core inflation calculated the Federal Reserve Bank of Cleveland and the Ohio State University.	Inflation	monthly	2000	2023	https://fred.stlouisfed.org/series/MEDCPIM158SFRBCLE
crime_rates	Yearly overview of crime rates for different types of crime.	Crime rate	annual	2000	2022	https://cde.ucr.cjis.gov/LATEST/webapp/#/pages/explorer/crime/crime-trend
data_master_file		Interest rate	monthly	01/01/2000	12/01/2023	
federal_funds_effective	The federal funds rate is the central interest rate in the U.S. financial market.	Federal Funds Rate	daily	2000	2023	https://fred.stlouisfed.org/series/FEDFUNDS
foreign_direct_investment	Quarterly data of Foreign Direct Investments	Foreign Direct Investment	quarterly	01/01/2000	07/01/2023	https://fred.stlouisfed.org/series/ROWFDIQ027S
unemployment_rate	The unemployment rate represents the number of unemployed as a percentage of the labor force.	Unemployment	monthly	2000	2023	https://fred.stlouisfed.org/series/UNRATE

Overview of data collection, cleanup and exploration process

Cleaning Data to Work Together

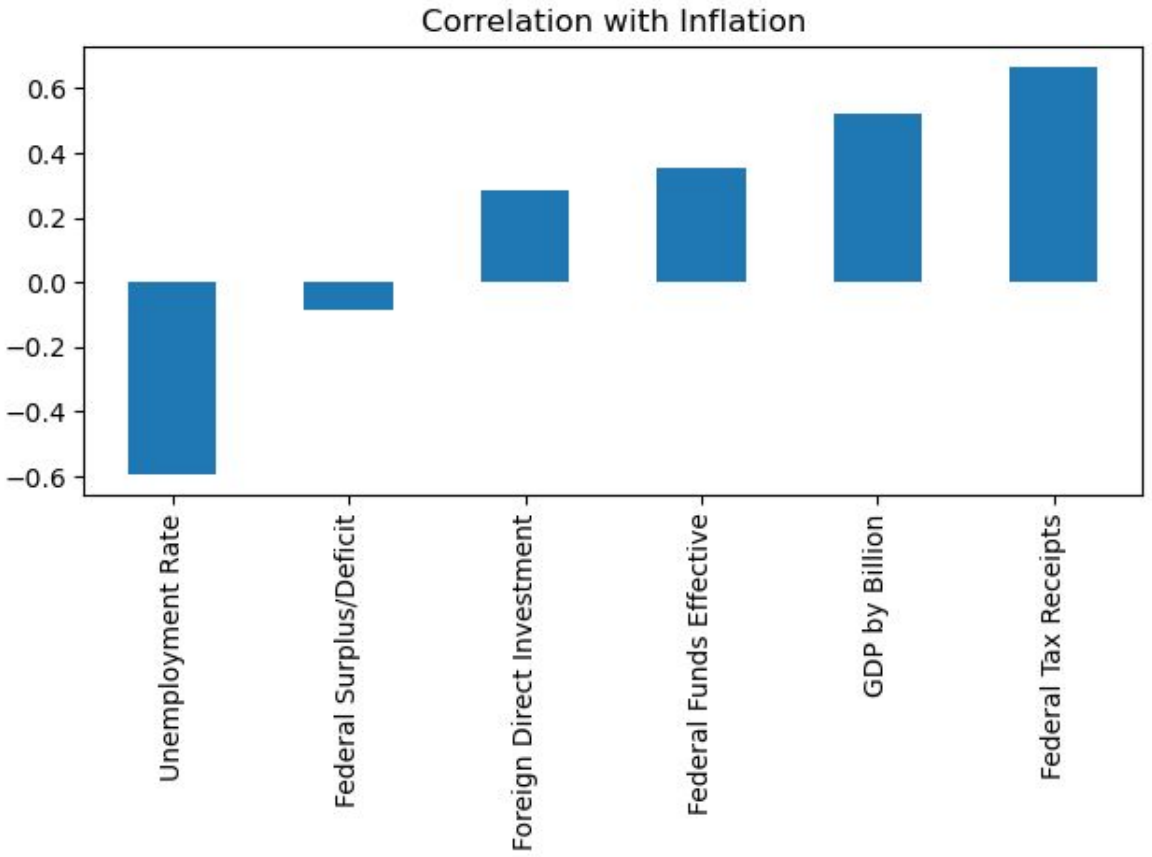


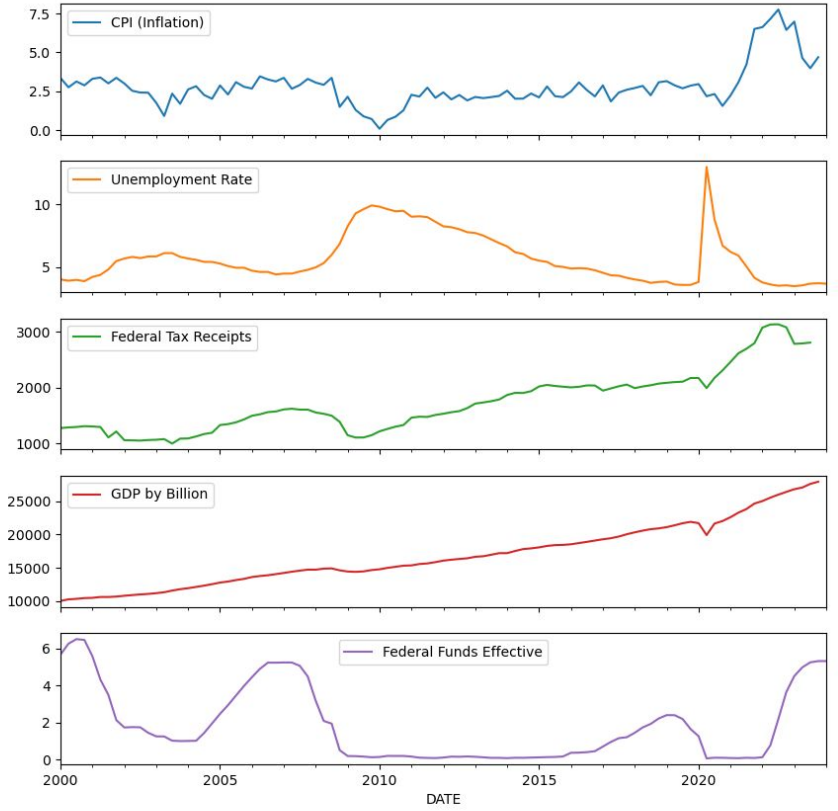


Correlation HeatMap for All Variables

Result/Conclusion 1

Question: What Macroeconomic Factors have the strongest correlation with inflation?



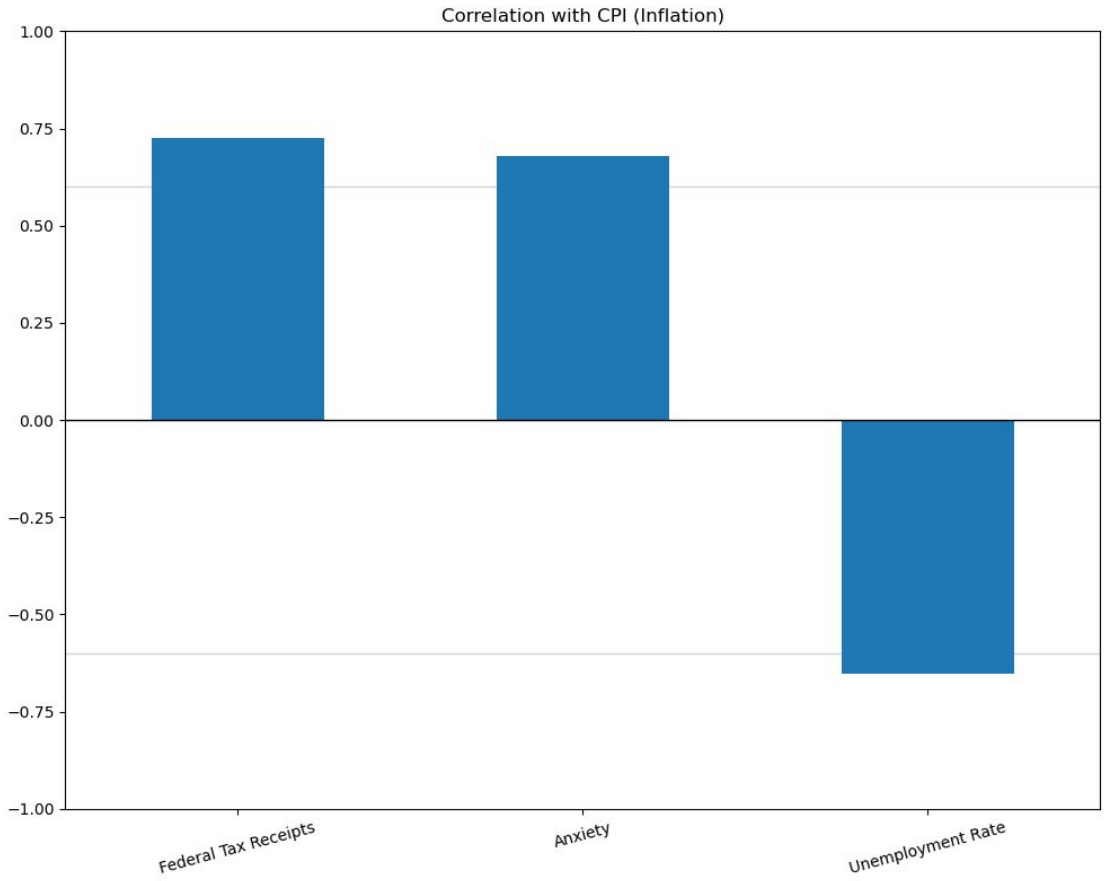


Result/Conclusion 1 cont.

Question: What Macroeconomic Factors have the strongest correlation with inflation?

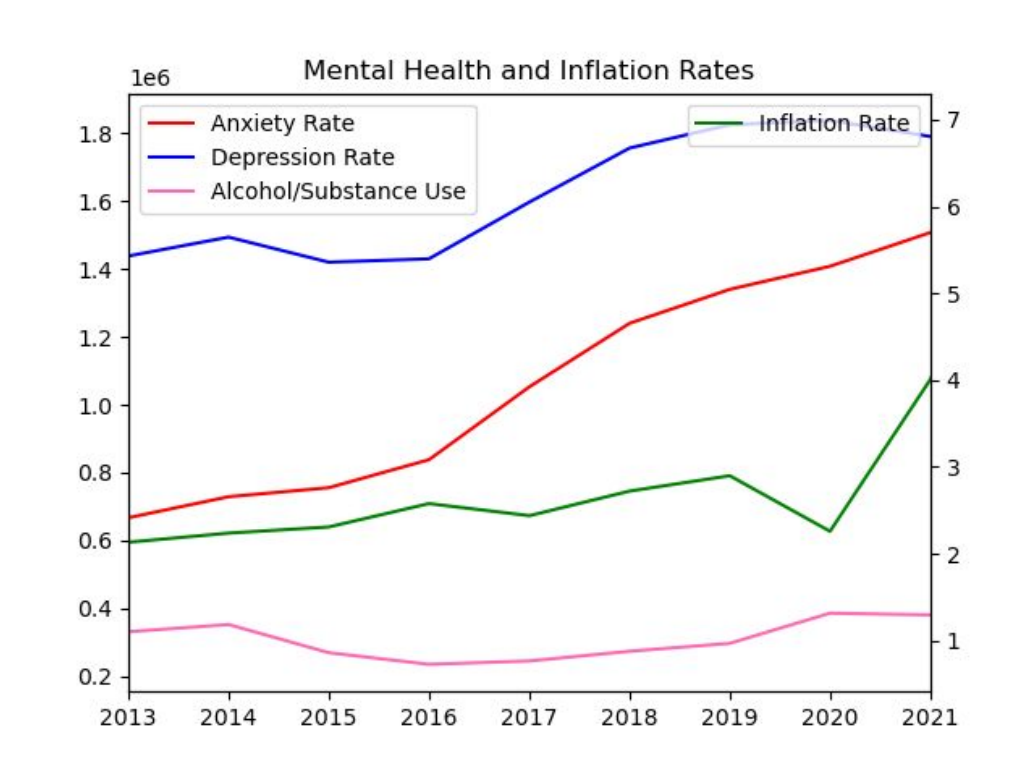
CPI (inflation)	Federal Tax Receipts	0.72
	Anxiety	0.67
	Unemployment Rate	-0.65

As inflation rose, so did taxes and anxiety; unemployment decreased as inflation increased. However, with only 3 strong correlations out of our entire set of data with 16 variables, we don't have enough of the right and most meaningful data sources to infer a holistic picture of what indicators correlate with or cause changes in CPI.



Result/Conclusion 2

Question: How does inflation impact social behaviors such as mental health, substance abuse, and crime?

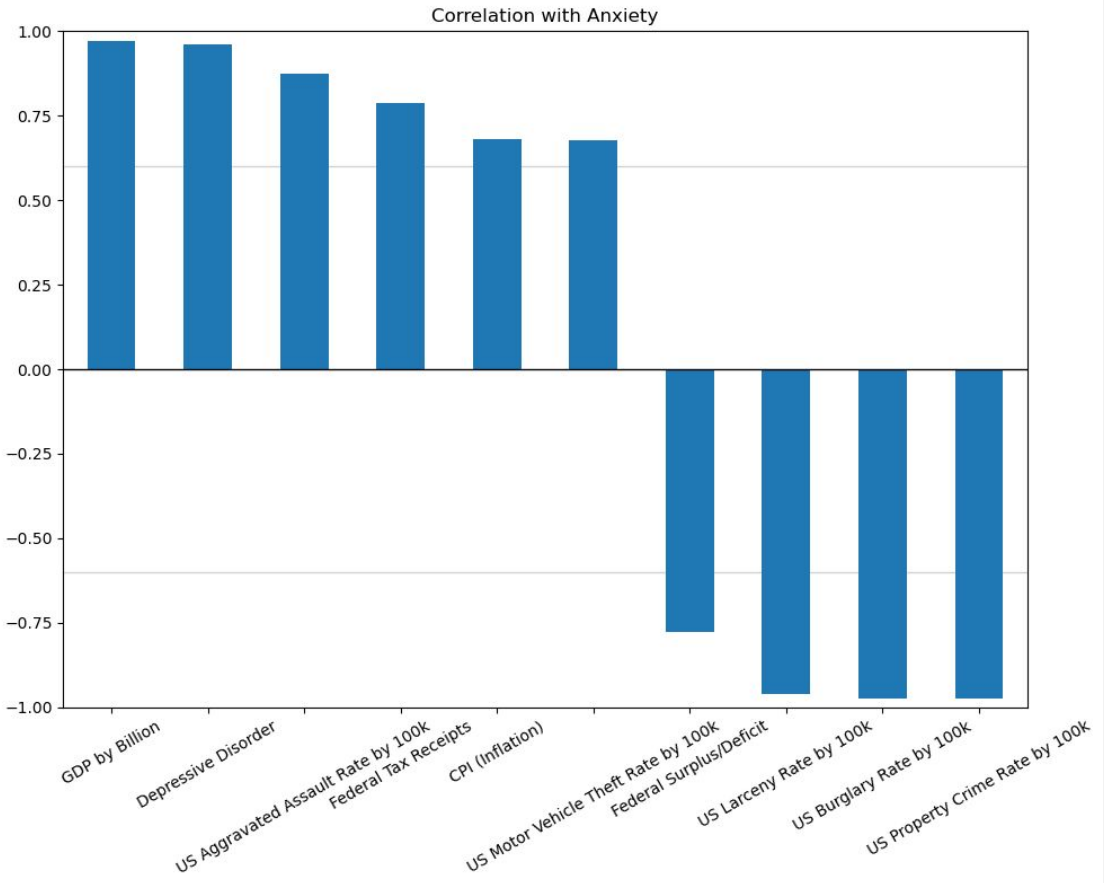


Result/Conclusion 2 cont.

Question: How does inflation impact social behaviors such as mental health, substance abuse, and crime?

Anxiety had strong correlations with 10 out of the 16 variables, from all 3 categories of economy, crime, and mental health. When anxiety was increased, so was inflation, GDP, taxes, and the federal deficit, as well as depression. The crime rate variables of interest decreased when anxiety was increasing.

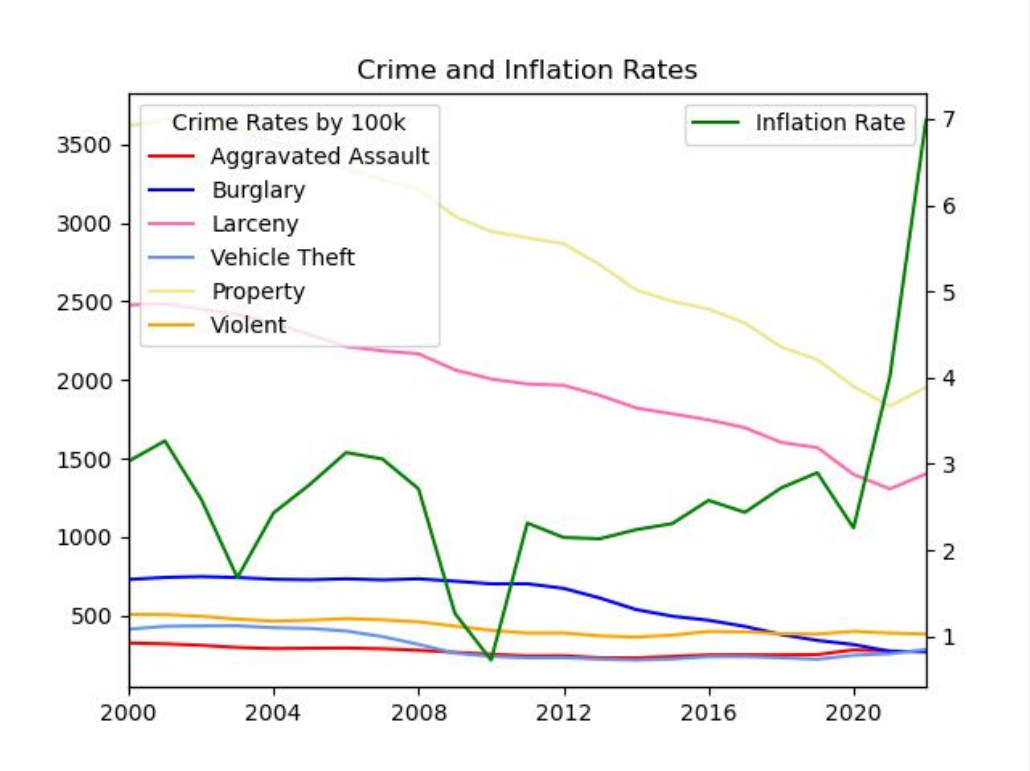
Anxiety	GDP by Billion	0.97
	Depressive Disorder	0.96
	US Aggravated Assault Rate by 100k	0.87
	Federal Tax Receipts	0.79
	CPI (Inflation)	0.68
	US Motor Vehicle Theft Rate by 100k	0.68
	Federal Surplus/Deficit	-0.78
	US Larceny Rate by 100k	-0.96
	US Burglary Rate by 100k	-0.97
	US Property Crime Rate by 100k	-0.98



Result/Conclusion 2 cont.

Question: How does inflation impact social behaviors such as mental health, substance abuse, and crime?

Inflation seems to be independent from the crime rate data we gathered, with little to no correlation on crime rates. In this graph you can see that Inflation is somewhat volatile while crime rates are consistently decreasing from the beginning of our dataset's time frame. (2000 - 2022)

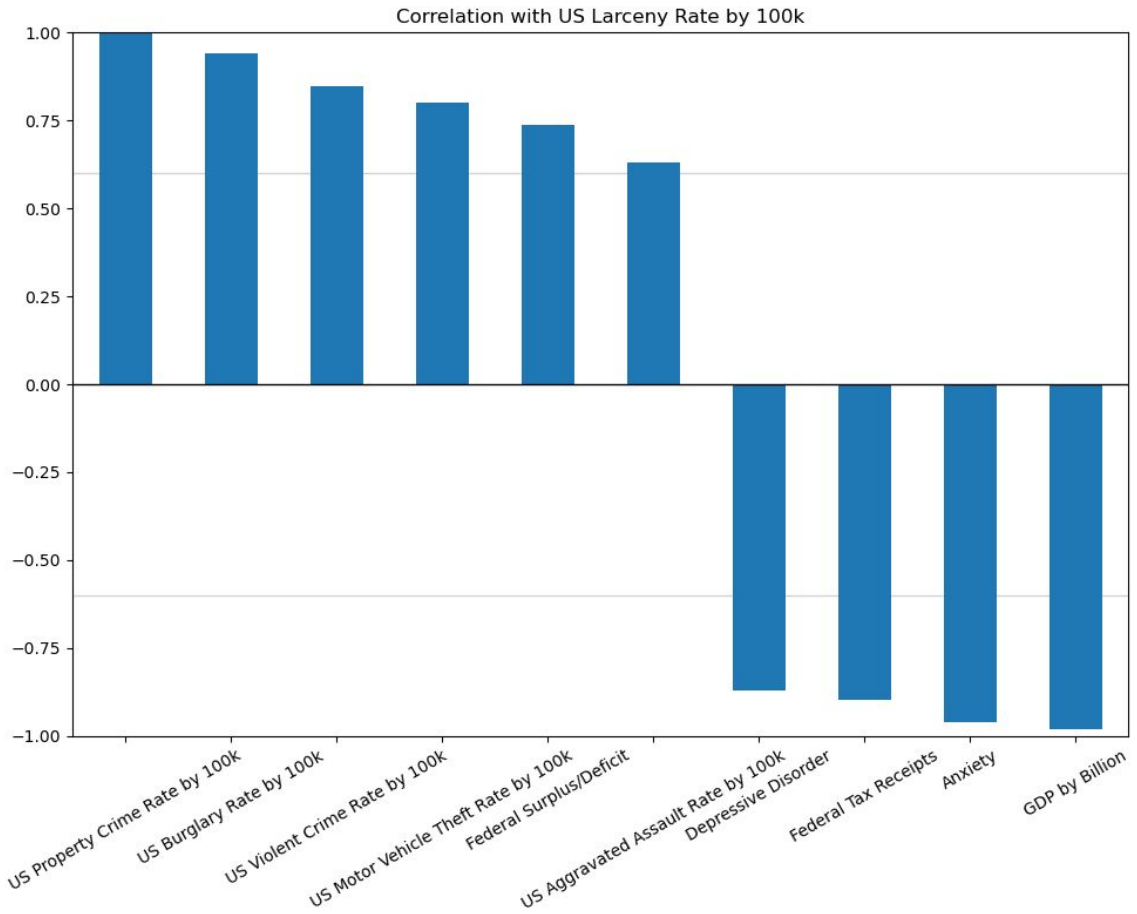


Result/Conclusion 2 cont.

Question: How does inflation impact social behaviors such as mental health, substance abuse, and crime?

Larceny had strong correlations with 10 of the 16 variables, from all 3 categories of economy, crime, and mental health. When larceny was increased, so was property crime, burglary, violent crime, vehicle theft, federal surplus/deficit, and aggravated assault. Depressive disorder, Federal tax receipts, anxiety and GDP exhibited inverse correlation

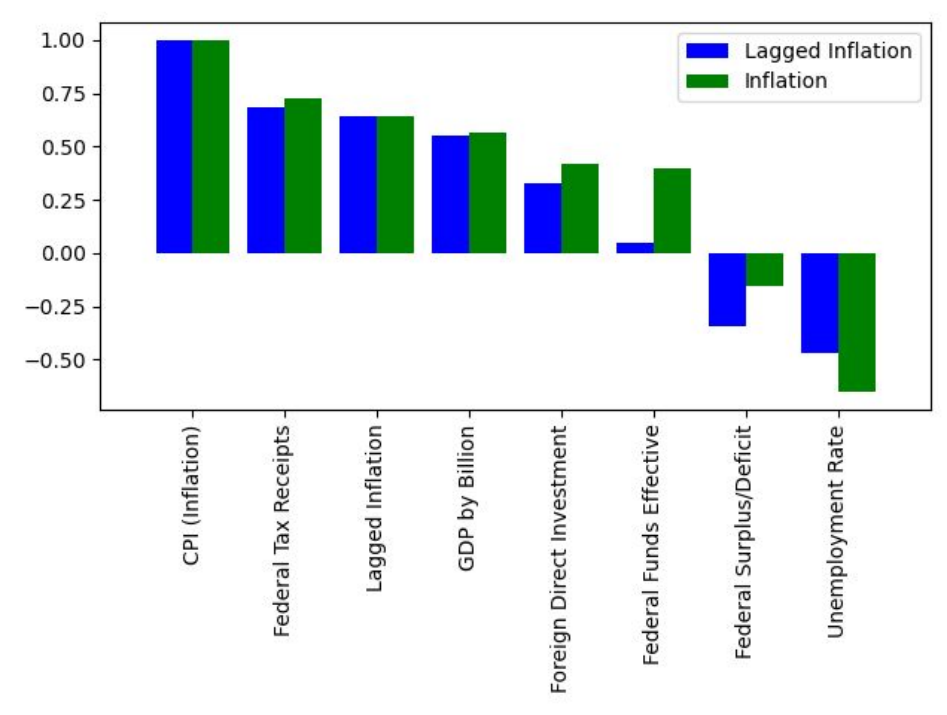
US Larceny Rate	Property Crime	0.99
	Burglary	0.94
	Violent Crime	0.85
	Vehicle Theft	0.80
	Federal Surplus/Deficit	0.74
	Aggravated Assault	0.63
	Depressive Disorder	-0.87
	Federal Tax Receipts	-0.90
	Anxiety	-0.96
	GDP	-0.98



Result/Conclusion 3

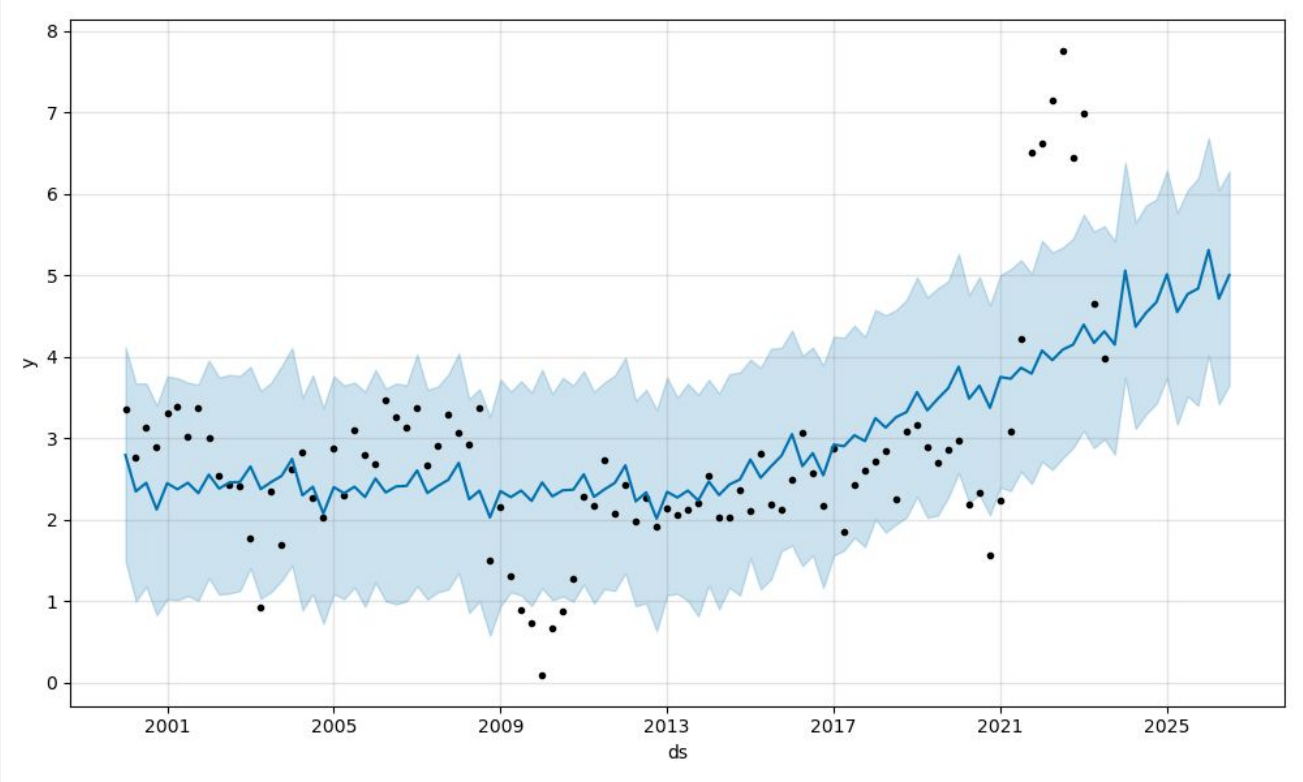
Question: Based on this retrospective analysis what do we predict to happen with inflation in the next two years?

During the course of our data analysis we had a hypothesis that some of the variables would have a reactive correlation to the inflation rate. We offset Inflation by a year to illustrate this hypothesis. The meaningful change noted is in the federal surplus/deficit.



Result/Conclusion 3

Question: Based on this retrospective analysis what do we predict to happen with inflation in the next two years?



Based on the past data we gathered for inflation and utilizing Prophet, we are predicting inflation to continue to rise well into the coming years (2024-2026)

Summary

➔ First Take away: Testing Fed's Monetary Policy Effectiveness

- ➔ Our original objective was to identify primary drivers of inflation within the United States economy. To examine this objective, we made a guess what economic factors might impact inflation, and also what social factors inflation might impact in the United States.
- ➔ We did not find as many strong correlations of various economic variables with inflation as we had expected. There were only 3 total strong correlations with inflation out of 16 (tax income, unemployment (-), and anxiety.
- ➔ Based on our analysis, we do however predict that inflation will continue to rise over the next 2 years.

➔ Second Take away: Social Impact of Inflation

- ➔ Anxiety and larceny had more strong correlations than any other variable with the data sources we used, each with 10 out of the 16 variables resulting in strong correlations, from all 3 categories of economy, crime, and mental health.

➔ Future Research Scope for the Analytics:

It's recommended to have more macro-economic variables and run it through a multiple regression model using Machine Learning skills to detect the key determinants of inflation for the effective monetary policy.

Problems Encountered

- Github
  - branching
- Data Sets
  - Mismatched Time Periods
  - Missing Indices
- Efficacy of Model
  - Initial hypothesis not apparent in data collected
  - Potentially due to constraints of data
  - External shocks, residual factors not tracked in data (Covid)
- Limited subject matter expertise
- Time Constraints

Future Considerations

Summarize any additional questions that surfaced, what your group might research next if more time was available, or share a plan for future development.

- We would have liked to have run multiple regression statistical analysis to run but we lacked time.
- If time allowed we would have liked to find other sources of longitudinal, large scale mental health data.
- We would have liked to examine other phenomena that likely impacted inflation such as political and global events.
- Adding a hypothesis and null hypothesis and doing a full statistical analysis evaluating these would have yielded a stronger analysis.

- *It's recommended to have more macro-economic variables and run it through a multiple regression model using Machine Learning skills to detect the key determinants of inflation for the effective monetary policy.*