Report: Analysis of Economic Indicators Using FRED API

Objective

The project aims to utilize the FRED API to analyze and visualize key economic indicators, specifically the S&P 500 index, unemployment rates, and labor force participation rates. The goal is to provide insights into these economic metrics at both a national and state level, focusing on trends during the COVID-19 pandemic period.

Data Sources

- **Federal Reserve Economic Data (FRED)**:
  The FRED API was used to retrieve time series data for the following:
    - S&P 500 Index
    - Unemployment rates by state
    - Labor force participation rates by state

Methodology

1. S&P 500 Index Analysis

- **Data Extraction**: The SP500 series was retrieved to analyze trends in the S&P 500 index.
- **Visualization**: A line plot was created to show the daily closing values of the index over time, providing a macroeconomic view of market performance.

2. State Unemployment Rates

- **Data Search & Filtering**:
    - A search for unemployment rate data was conducted using the FRED API, filtered for monthly frequency, seasonally adjusted data, and percentage units.
    - Only data series with titles containing "Unemployment Rate" were included.
- **Data Joining**:
    - Data from all states were retrieved, compiled, and cleaned to form a unified dataset.
    - Missing or redundant columns were identified and removed.
- **Visualization**:
    - A bar chart was created to highlight state unemployment rates in May 2020, a period of significant economic impact from the COVID-19 pandemic.

3. Labor Force Participation Rates

- **Data Search & Filtering**:
    - Similar to unemployment rates, participation rate data was retrieved for all states.
    - Data was filtered to include only seasonally adjusted and percentage units.

- **Data Joining**:
    - The retrieved data was compiled and indexed by state.

4. Unemployment vs. Participation Rates

- **Dual-Axis Visualization**:
    - For each state, unemployment and participation rates were plotted on a shared timeline using twin y-axes to compare trends.
    - A subset of data focusing on the COVID-19 period (2020–2022) was used to analyze the relationship between the two metrics.
- **State-Level Analysis**:
    - A focused comparison was performed for California to showcase the dynamic between unemployment and participation rates during the pandemic.

Key Findings

1. **S&P 500 Trends**:
    - The S&P 500 index showed significant volatility, particularly during the early months of the COVID-19 pandemic, reflecting uncertainty in financial markets.
2. **Unemployment Rates**:
    - May 2020 exhibited some of the highest unemployment rates across states due to widespread economic shutdowns.
    - States such as Hawaii and Nevada were heavily impacted, likely due to their reliance on tourism.
3. **Labor Force Participation**:
    - Participation rates generally showed a decline during the pandemic as workers exited the labor force due to health concerns, caregiving responsibilities, or discouragement.
4. **Unemployment vs. Participation Dynamics**:
    - States displayed varied relationships between unemployment and participation. For instance, California saw sharp fluctuations in unemployment rates with corresponding but smaller changes in participation rates, indicating differing labor market dynamics across regions.

Visualizations

1. **S&P 500 Index Line Plot**
    - A clear visualization of market performance and trends.
2. **Unemployment Rates by State (May 2020)**
    - A horizontal bar chart emphasizing the states most affected during the pandemic.
3. **Unemployment vs. Participation Rate by State**
    - Dual-axis plots provided insights into state-level trends during the pandemic period.

4. **California Focused Analysis**
    - A detailed comparison for California highlighted the labor market's resilience and challenges during 2020–2022.

Challenges and Considerations

- **Data Availability**: Some series had limited historical data or gaps, requiring careful filtering and handling of missing values.
- **API Rate Limiting**: Requests to the FRED API were throttled to prevent being blocked, adding latency to data retrieval.
- **Comparability Across States**: Differences in economic structure and policy responses among states posed challenges in drawing uniform conclusions.

Conclusion

This project successfully leveraged the FRED API to extract, analyze, and visualize economic indicators, shedding light on the interplay between key metrics during the COVID-19 pandemic. The insights provide valuable context for policymakers, economists, and researchers seeking to understand the pandemic's impact on the economy at both national and state levels.

Future work could expand on this analysis by incorporating additional indicators (e.g., inflation, housing market trends) or applying advanced statistical models to predict future trends.

Code and Reproducibility

The full code for data extraction, processing, and visualization is included in the accompanying notebook. Users can reproduce this analysis by installing the required libraries (pandas, numpy, matplotlib, plotly, fredapi) and obtaining a valid FRED API key.