Analyzing the Purchasing Power of $100 Over Time (from 1900 to 2024)

Motivation

Inflation impacts every facet of daily life, altering the real value of money and reshaping economic decisions. Understanding how the purchasing power of $100 has changed over time provides critical insights into economic trends, cost-of-living changes, and the relationship between financial metrics and historical events. This project aims to combine advanced data analysis with engaging visual storytelling to make these concepts accessible to a broad audience.

Problem Definition

Tracking inflation and purchasing power over extended periods is a complex task due to:

1. Variability in economic conditions (wars, recessions, policy changes).
2. Lack of intuitive tools for visualizing the impact of inflation.
3. Minimal linkage of historical economic data to real-world events, which limits context.

The goal is to create an interactive visualization that integrates historical events with inflationary trends to reveal patterns in purchasing power, fostering deeper public understanding of economic history.

Survey

A survey of existing tools and approaches reveals:

- **Government and Academic Tools**: While robust, these tend to focus on static visualizations or numerical outputs, such as the U.S. Bureau of Labor Statistics' CPI calculator.
- **Open-Source Libraries**: Python's Pandas and Matplotlib facilitate data processing and visualization but lack built-in tools for integrating event narratives.
- **Commercial Tools**: Tableau and Power BI excel at visualization but require significant customization to handle unique datasets or non-linear relationships.

Proposed Method

By merging the best features of these tools—Tableau's interactivity, Python's computational power, and a curated dataset—this project creates a novel approach to exploring inflation trends and purchasing power in relation to historical events.

Why Should It Be Better than the State of the Art?

This project is unique because it:

- Integrates **historical narratives** directly into financial visualizations, contextualizing data points in a way standard tools do not.

- Offers **interactive capabilities**, allowing users to explore trends dynamically.
- Provides **open-source portability**, enabling the community to expand and adapt the project.

The combination of rigorous computational methods and accessible visualization ensures the tool is both accurate and engaging for users across varying expertise levels.

Description of Your Approaches

Algorithms and Tools

1. **Data Processing**:
   - **Python**: Used Pandas and NumPy for data cleaning, transformation, and merging.
   - **Scikit-learn**: Applied regression models for trend analysis.
2. **Visualization**:
   - **Tableau Dashboards**: Highlighted inflation trends, the value of $100, and significant events over time.
   - **Matplotlib and Seaborn**: Produced supplemental plots to analyze relationships between inflation rates, CPI, and time.

User Interfaces

- Tableau dashboards are designed with a user-friendly interface that allows users to filter by year, compare inflation trends to events, and explore the purchasing power of $100 across decades.
- Python scripts are modular, enabling customization for users who wish to extend the dataset or models.

Experiments/Evaluation

Description of Your Testbed
The experiments sought to address key questions:

1. What are the most significant inflationary trends over time?
2. How well do historical events correlate with economic metrics like CPI and inflation rate?
3. Can machine learning predict future trends based on historical data?

The testbed consisted of a curated dataset spanning 1900 to 2024, enriched with annotations of significant economic, geopolitical, and technological events.

Details of the Experiments and Observations

1. **Data Trends**:

- o A sharp decline in the value of $100 post-World War II, coinciding with the rise of consumerism and globalization.
- o Notable spikes in inflation during the 1970s oil embargo and the 2008 financial crisis.

2. **Event Integration**:
   - o Key events like the Great Depression showed strong alignment with deflationary trends.
   - o Technological advancements (e.g., the introduction of the internet) correlated with CPI stabilization over time.
3. **Modeling Results**:
   - o Regression models demonstrated that inflation trends were non-linear and heavily influenced by external shocks like wars and recessions.
   - o Feature importance analysis highlighted the significance of oil prices and monetary policies in inflation prediction.
4. **Visualization Insights**:
   - o Users consistently appreciated the event overlays, which provided clear context for abstract metrics.
   - o Interactive comparisons of CPI across decades helped illustrate the cumulative impact of inflation.

Conclusions and Discussion

The project successfully created a tool that combines data science with narrative visualization to explore purchasing power trends. Key takeaways include:

1. Inflation's impact is profound but understandable when contextualized with historical events.
2. Data visualizations are powerful tools for communicating complex financial concepts to non-experts.
3. There is potential for further work, such as integrating global inflation data or developing predictive models with higher accuracy.

Future Work

- Expanding the dataset to include global CPI and inflation rates for comparative analysis.
- Refining machine learning models for more accurate predictions.
- Developing a web-based interface for broader accessibility.

Distribution of Team Member Effort

I did this project individually, the project's development, data collection, analysis, and visualization.