

Clarifying Questions, Assumptions, and Caveats

This section outlines the key assumptions made throughout the analysis, identifies open questions that remain unresolved, and acknowledges the limitations (caveats) that may influence the interpretation of results. By being transparent about the analytical boundaries, we aim to provide clarity, increase rigor, and ensure responsible use of the findings.

Clarifying Questions

Several important questions emerged during the analysis that could benefit from further exploration or complementary data:

1. What is the precise causal relationship between money supply (M2) and inflation (CPI)?

While a strong correlation was observed, does M2 directly drive inflation in all contexts, or are there moderating factors such as productivity, demand shocks, or global supply chain disruptions?

2. How consistent is the time lag between monetary policy changes and inflation outcomes?

The analysis suggests a 6–12 month delay, but is this lag stable across different regimes or economic conditions?

3. To what extent does fiscal policy interact with monetary policy in influencing inflation?

Stimulus packages, government spending, and tax reliefs were significant during the pandemic—how did they amplify or offset monetary effects?

4. Are structural breaks present in the data that may distort trends?

The pandemic represents a once-in-a-century disruption. Should its data be treated differently when building forecasting models or interpreting long-term relationships?

5. Can regime shifts be predicted in real time?

The KMeans clustering model revealed regime shifts retrospectively, but what signals might help detect these transitions as they are unfolding?

Key Assumptions

To maintain a manageable and consistent scope, the following assumptions were adopted in the analysis:

1. **Economic Indicators Are Reliable Proxies**

We assumed that CPI, M2, interest rates, and SOFR are representative of inflationary pressures and monetary policy stance, despite other variables (e.g., employment, GDP, expectations) also influencing outcomes.

2. **Monthly Data Is Sufficient for Analysis**

All data used was reported on a monthly basis. We assumed this frequency was granular enough to capture key macroeconomic trends and correlations.

3. **Data Is Clean and Accurate**

The dataset was cleaned of missing values and formatted consistently. It is assumed that the original sources (e.g., FRED, BLS, BEA) are authoritative and error-free.

4. **Stationarity Within Regimes**

During clustering, it was assumed that each regime exhibits relatively consistent behavior internally, even though overall economic relationships may evolve over time.

5. **KMeans Clustering Is an Appropriate Tool**

KMeans was selected for its simplicity and interpretability. Other unsupervised learning models (e.g., DBSCAN, HMMs) may yield different regime structures or transition patterns.

Caveats and Limitations

While the project produced valuable insights, several limitations should be acknowledged:

1. **Correlation \neq Causation**

Although strong correlations were observed, this does not confirm direct causality. External variables may be influencing both CPI and M2, or acting as hidden confounders.

2. **Exclusion of Global Variables**

The analysis focused solely on U.S. domestic indicators. In reality, inflation and interest rates are influenced by global commodity prices, foreign exchange movements, and international capital flows.

3. **Simplified Policy Modeling**

The interaction between policy instruments (rates, QE, guidance) and market behavior is highly complex. This analysis does not fully capture expectation effects or behavioral feedback loops.

4. **Static Model Parameters**

Model parameters (e.g., number of clusters, correlation thresholds) were selected based on exploratory analysis, not formally optimized. Future work could validate these using out-of-sample testing or alternative algorithms.

5. **No Forecasting or Predictive Modeling**

This study is descriptive and exploratory. While it observes trends through mid-2025, it does not attempt to predict future inflation or interest rates beyond that point.