### **Case Study: Decoding the Economy's Classic Trade-Off**

### **Phase 1: Ask**

This initial and critical phase is all about understanding the problem. Before any data is analyzed, it's essential to define what we are trying to solve. For our project at the Federal Economic Advisory Council (FEAC), this means getting to the heart of a core economic debate.

**Key Questions for Our Project:**

* **What is the problem or question you are trying to solve?** The central problem is to determine if the traditional inverse relationship between inflation and unemployment (the Phillips Curve) is still a valid model for the modern U.S. economy. Senior policymakers need to know if they can still rely on this long-held theory.
* **What are the goals and expectations of your stakeholders?** Our primary stakeholder, Dr. Anya Sharma, expects a clear, data-driven analysis that validates or challenges the Phillips Curve theory. The ultimate stakeholders, the Senior Policy Committee, expect these findings to be distilled into a concise, unambiguous recommendation that helps them shape future national economic policy.
* **What would a successful outcome look like?** A successful outcome is a final report with compelling visualizations that confidently answers the core question. This report will be the foundation for a high-impact policy briefing that directly influences a major economic strategy decision.
* **What data might be needed to answer the question?** To properly investigate this relationship, we will need long-term historical data that tracks the U.S. unemployment rate and a key measure of inflation, like the Consumer Price Index (CPI), on a consistent, month-by-month basis.

### **Phase 2: Prepare**

Once the questions are defined, the next step is to prepare the data. This phase involves identifying the necessary data, understanding its origins, and organizing it for the subsequent steps.

**Key Questions for Our Project:**

* **What data do you need to answer the questions?** We need the macro\_monthly.csv dataset provided by the FEAC research team. Specifically, we will use the Year, Month, Consumer\_Price Index (as our measure for inflation), and Unemployment\_Rate columns. The fact that this data reflects the *rate of change* is a key feature that will help us analyze economic momentum.
* **Where can you find this data?** The data has been provided and is located in the project's shared directory. It is a trusted, pre-processed dataset with origins from the highly credible Federal Reserve Economic Data (FRED) database.
* **How will you collect and store the data securely and ethically?** The data is already securely stored on FEAC's internal network. As it's aggregated public data with no personally identifiable information (PII), there are no major privacy concerns. We will handle the data in line with FEAC's strict data governance and integrity policies.
* **What are the limitations of the data you've collected?** The primary limitation is that the data begins in 1993, excluding earlier economic periods which may have shown different trends. Furthermore, while CPI is a strong proxy for inflation, it is not the only one. We must acknowledge these constraints in our final analysis.

### **Phase 3: Process**

Raw data is often messy, but in this case, a senior analyst has already performed the intensive work of cleaning and formatting. Our role in this phase is to verify that work and ensure the data is pristine for analysis.

**Key Questions for Our Project:**

* **What errors, inaccuracies, or missing values exist in the data?** Our initial inspection confirms the senior analyst's work: the provided macro\_monthly.csv file has no missing values or inaccuracies in the columns critical to our analysis (Consumer\_Price Index and Unemployment\_Rate).
* **How can you clean and transform the data to make it usable?** No further cleaning or transformation is required. The data is already in a usable state, with monthly rates of change pre-calculated and all values appropriately formatted. Our main task is to load it correctly into our analysis software.
* **What tools and techniques will you use for data cleaning?** Since no cleaning is needed, we will not be using cleaning tools. We will use **Python with the Pandas library** to load the data and verify its structure.
* **How can you ensure the integrity and quality of the cleaned data?** We will ensure integrity by loading the CSV file into a Pandas DataFrame and running the .info() and .head() commands. This will allow us to verify that the data has loaded correctly, the data types are appropriate (e.g., floats for our key metrics), and the columns and row counts match our expectations. This confirms the data is ready for the analysis phase.

### **Phase 4: Analyze**

### **Deliverable: A Summary of Your Analysis**

This summary details the findings from the analysis of the macro\_monthly.csv dataset, with the goal of answering our central question: In the modern U.S. economy, what is the actual relationship between the rate of inflation and the rate of unemployment?

**Organization and Formatting of Data**

The data was loaded into a pandas DataFrame, which is a standard tabular structure ideal for this type of analysis. The key columns, Consumer\_Price\_Index (as a proxy for inflation) and Unemployment\_Rate, were selected for analysis. The data was already properly formatted and cleaned, with the only minor adjustment being the programmatic correction of a column name for easier use.

**Key Findings: Trends, Relationships, and Surprises**

The analysis revealed several key insights, including a significant surprise that challenges the traditional understanding of the Phillips Curve.

**1. Surprise: The Overall Relationship is Extremely Weak**

The most surprising discovery is the lack of a strong, consistent relationship between the monthly change in inflation and the monthly change in unemployment from 1993 to the present.

* The overall Pearson correlation coefficient is **-0.2165**. A value this close to zero indicates a very weak negative linear relationship. This finding directly contradicts the textbook Phillips Curve theory, which posits a strong, reliable inverse relationship.

This weakness is visualized in the scatter plot below. While the regression line (red dashes) slopes slightly downwards, the data points are widely dispersed, indicating that knowing the change in inflation for a given month gives you very little predictive power over the change in unemployment.

**2. Trend: The Relationship is Not Stable Over Time**

By aggregating the data by decade, we found that the relationship between inflation and unemployment has been inconsistent.

| **Decade** | **Average CPI Change** | **Average Unemployment Rate Change** |
| --- | --- | --- |
| **1990s** | 0.2036 | -0.6998 |
| **2000s** | 0.2116 | 0.7988 |
| **2010s** | 0.1448 | -0.8126 |
| **2020s** | 0.3435 | 2.3243 |

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* **Insight:** The 1990s and 2010s loosely followed the expected pattern: positive inflation change was, on average, paired with negative unemployment change. However, the 2000s and 2020s completely defy this trend, showing that, on average, *both* were increasing. This instability is a critical finding.

**3. Relationship: The Phillips Curve Appears in Specific Conditions**

While the overall relationship is weak, we found a fascinating insight when filtering the data.

* During **High-Inflation Months** (CPI change > 0.5%), the average change in the unemployment rate was **-0.6826**.
* During **Low-Inflation Months** (CPI change &lt;= 0.5%), the average change in the unemployment rate was **+0.3062**.
* **Insight:** This finding does support a piece of the theory. When inflation was rising quickly, unemployment was more likely to be falling. Conversely, when inflation was stable or low, unemployment was more likely to be rising. This suggests the trade-off might exist, but only under specific, more extreme conditions.

**Answering the Business Question**

These insights directly address the core business question for the Federal Economic Advisory Council (FEAC): **Does the classic inflation-unemployment trade-off still exist?**

The analysis concludes that:

1. There is **no simple, stable, or reliable** trade-off between the monthly change in inflation and unemployment that can be used as a consistent policy guide.
2. The relationship's weakness and, more importantly, its **instability across decades**, is the most critical finding. Relying on this trade-off is risky.
3. While hints of the relationship appear under certain conditions (e.g., high inflation), it is not strong enough to be a foundational assumption for broad economic strategy.

This analysis provides the FEAC with a crucial, data-driven answer: the classic Phillips Curve model is not a reliable map for the modern economic landscape

### **Phase 5: Share**

### **Answering the Key Questions for the Share Phase**

**● Who is your audience, and what is the best way to communicate your findings to them?**

* **Audience:** We have two primary audiences:  
  + **Dr. Anya Sharma (Your Manager):** An expert economist who will want to understand your analytical rigor and methodology.
  + **The Senior Policy Committee:** A group of high-level, busy executives who are policy experts but not necessarily data scientists. They need the conclusions and their implications delivered clearly and concisely.
* **Best Way to Communicate:** A "pyramid" or "top-down" approach is ideal.  
  + **Start with the Answer:** Lead with the single most important conclusion: "The classic Phillips Curve is not a reliable model for the modern U.S. economy."
  + **Provide Supporting Arguments:** Follow up with the three key findings (the relationship is weak, unstable over time, and only appears in specific conditions).
  + **Show the Evidence:** Use clear, simple visuals to back up each point. The format should be a concise executive summary or a few slides in a presentation, avoiding overly technical jargon.

**● What are the key insights and recommendations you want to convey?**

* **Key Insights:**
  1. The overall relationship between monthly inflation changes and unemployment changes is statistically very weak.
  2. The relationship is highly unstable, showing different and even contradictory patterns across different decades (e.g., 1990s vs. 2000s).
  3. A hint of the classic trade-off *does* appear, but only under specific conditions (unemployment tends to fall in months with very high inflation).
* **Key Recommendations:**
  1. **Primary Recommendation:** The FEAC should advise policymakers that the classic Phillips Curve is an outdated and unreliable tool for making national economic policy today.
  2. **Secondary Recommendation:** Policy decisions should be based on a wider, more modern set of indicators rather than relying on this single, simple trade-off.

**● What visualizations (e.g., charts, graphs, dashboards) will best illustrate your findings?**

To effectively tell our story, we need three specific visualizations, which the Python code in our previous step was designed to create:

1. **A Scatter Plot:** This is the most important visual. It immediately shows the weak overall relationship between inflation and unemployment, supporting our main conclusion.
2. **A Bar Chart by Decade:** This chart is crucial for showing the *instability* of the relationship over time, highlighting how the averages have changed dramatically from one decade to the next.
3. **A Bar Chart of the Conditional Analysis:** This nuanced chart shows where the theory *does* seem to work (in high- vs. low-inflation environments), adding credibility and depth to our analysis.

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### **Phase 6: Act**

This phase is about translating our analytical insights into concrete, forward-looking actions for the Federal Economic Advisory Council (FEAC) and its stakeholders. Here is a breakdown based on the key questions for this phase.

### **Answering the Key Questions for the Act Phase**

**● What are the recommended actions based on your findings?**

This is the culmination of our analysis. The following three actions are recommended to be presented to Dr. Sharma and the Senior Policy Committee:

1. **Revise Official Policy Guidance:** The FEAC should formally recommend that the Senior Policy Committee **de-emphasize the classic Phillips Curve** as a primary predictive tool in economic modeling and public statements. Policy should shift from relying on a simple trade-off to acknowledging a more complex set of drivers for inflation and unemployment.
2. **Enhance the Analytical Framework:** Our research team should be tasked with developing a more sophisticated **"Economic Health Dashboard"**. This would go beyond the two variables we analyzed and incorporate other influential factors from our dataset, such as Money Supply (M2), Industrial Production, and Consumer Sentiment, to provide a more holistic view of the economy.
3. **Develop a Strategic Communications Brief:** Dr. Sharma should spearhead the creation of a policy brief for the Senior Committee. This brief will use the clear visualizations we created to simply and powerfully communicate *why* this shift in thinking is necessary, focusing on the data that shows the relationship's instability over the last 30 years.

**● How can stakeholders use these insights to make better decisions?**

These insights empower our stakeholders, particularly the Senior Policy Committee, to make more nuanced and resilient decisions:

* **Avoiding Policy Errors:** By not assuming that low unemployment will automatically trigger high inflation (or vice versa), they can avoid reactive policy mistakes. For example, they can prevent needlessly slowing the economy out of fear of inflation when other data suggests it's not a threat, or they can act faster on inflation even if unemployment is stable.
* **Asking Better Questions:** This analysis shifts the conversation from "Where are we on the curve?" to "What are the *current drivers* of inflation and unemployment?" This encourages a deeper, more accurate diagnosis of the economic situation before prescribing a policy solution.
* **Promoting Data-Driven Modernization:** These findings give the committee the evidence needed to justify modernizing their forecasting models and moving beyond legacy theories that are no longer supported by data.

**● What is the potential impact of these actions?**

Implementing these recommendations would have significant positive impacts:

* **More Effective Economic Policy:** The primary impact would be economic policy that is better tailored to the current environment and less prone to systemic error, leading to more stable economic growth.
* **Enhanced Institutional Credibility:** By proactively acknowledging that a classic theory is no longer fully applicable and adapting its approach based on evidence, the FEAC reinforces its reputation as a credible, forward-thinking, and data-driven institution.
* **Improved Risk Mitigation:** A more nuanced view of the economy helps mitigate the risk of being blindsided by events that the classic Phillips Curve cannot explain, such as periods of stagflation (high inflation and high unemployment occurring simultaneously).

**● How can the outcomes of these actions be measured and monitored?**

To ensure these actions have the desired effect and to continue our data-driven approach, we can implement the following monitoring systems:

1. **Track Forecast Accuracy:** We can measure the forecast accuracy of the new "Economic Health Dashboard" (from Recommendation 2) against actual economic outcomes. This performance can be benchmarked against the less accurate predictions that a simple Phillips Curve model would have made.
2. **Conduct Annual Retrospectives:** The FEAC can commit to an annual review of major policy decisions, assessing them against our new, more nuanced understanding of the economy. This creates accountability and a cycle of continuous learning.
3. **Monitor the Relationship Dynamically:** We should create an internal dashboard that continuously tracks the correlation between inflation and unemployment over a rolling 3-to-5-year window. This will alert us if the relationship's dynamics are shifting again, ensuring our framework never becomes outdated.