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A Study on the Relationship Between Inflation and Unemployment

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Abstract:

The Phillips curve has long pointed out. Inflation and unemployment have a negative relationship. This study checks again. Does this idea work in the United States? The time is from 2000 to 2024. This time had financial crises, pandemics, and supply-side shocks. This study uses monthly inflation and unemployment data from the Bureau of Labor Statistics and the Federal Reserve Economic Database. This study uses an ordinary least squares (OLS) regression. It does this to check if there is a clear linear relationship between the variables people care about. It also does this to see if this relationship is statistically significant. The number that shows how unemployment affects inflation (regression coefficient) is 0.0024. Its p-value is 0.433. The R-squared is 0.001. The results show there is no statistically significant linear relationship between inflation and unemployment in the United States from 2000 to 2024. This challenges the traditional Phillips curve framework. It also suggests its ability to explain things in modern macroeconomics is limited.

Keywords: Phillips Curve; Macroeconomic Policy; Flattening Relationship.

1. Introduction

In 1958, A. W. Phillips first found that when unemployment goes up, wage inflation goes down, and vice versa. Since then, the Phillips curve has become a key part of macroeconomic theory and policy. Early Keynesian economists saw it as proof that there is a steady trade-off. They thought policymakers could pick between higher inflation and lower unemployment based on what they wanted. For much of the time after the war, this framework shaped monetary and fiscal policies.

However the Phillips curve's ability to work in real situations has been questioned many times. In the 1970s, stagflation happened—high unemployment and high inflation were seen together. This went against the simple idea that one goes up when the other goes down. In the 1970s, Friedman and Phelps led the rational expectations revolution. They said the trade-off would not last long. They said people's expectations would change, making demand-side policies have no effect.

In the 21st century, the U.S. economy has given more reasons. People doubt the Phillips curve. After the 2008 financial crisis, inflation stayed low even though unemployment was high for a long time. Lately, there was the COVID-19 pandemic. Then came the recovery. During this time, unemployment

went down. Inflation went up. It hit the highest level in 40 years. These events make people doubt that there is a steady linear relationship between inflation and unemployment.

This study wants to test with real data whether the Phillips curve still works in its traditional form in the modern U.S. economy. This study looks at monthly data from 2000 to 2024. This study checks this: Are inflation and unemployment linked in a straight line? The study also talks about this. What do our findings mean for the bigger macroeconomic picture? This study wants to check if inflation and unemployment in the United States (from 2000 to 2024) are still linked in a simple, straight-line way. The traditional Phillips curve says they are. The study also wants to explain what the results mean for the bigger macroeconomic picture. First, it tests if this linear trade-off is statistically valid. Then, the research does two things: it looks again at a long-used theoretical framework, and it points out if this framework still matters (or if it doesn't) in today's economic conditions. These conditions are shaped by crises, supply shocks, and globalization. The importance of this study is threefold. First, it can add to economic theory—either by questioning the old models or making them better. Second, it can help with policy: it warns people not to rely too much on the too-simple trade-off between inflation and unemployment. Third, it gives useful ideas. These ideas show that today's economies are complex. They also show that the study needs more complete ways to do macroeconomic analysis.

When it comes to how to do the study, this research uses an ordinary least squares (OLS) regression model to test if inflation and unemployment have a linear relationship—this study uses monthly data on U.S. consumer price index (CPI) inflation and unemployment rates from 2000 to 2024, and the study get this data from the Bureau of Labor Statistics and the Federal Reserve Economic Database; the empirical analysis starts with descriptive statistics to summarize how both variables behave, then the study does regression to estimate the Phillips curve and do statistical tests to check if the results are significant [1, 2]. For the paper's structure, it is set up like this: the introduction tells the study's background and why this study did the study, the literature review talks about theoretical and empirical views on the Phillips curve, the methodology section explains where the data comes from and the econometric method the study uses, the results section shows regression outputs with tables and figures, the discussion explains what the results mean for macroeconomic theory and policy, and the conclusion sums up key findings and suggests directions for future research.

2. Literature Review

Early Contributions Phillips found something in the United Kingdom. He saw that when unemployment went up, the rate at which money wages changed went down. This connection was stable [3]. Samuelson and Solow took this further. They looked at price inflation in the U.S. They said policymakers could use the trade-off between inflation and unemployment. This would help them reach their macroeconomic goals [4].

Rational Expectations and the Natural Rate Hypothesis Friedman and Phelps did not agree with the idea of a permanent trade-off. They brought up new ideas: the natural rate of unemployment and adaptive expectations. Their models said something clear. If people try to keep unemployment below its natural rate, inflation will speed up more and more [5, 6]. Lucas went a step further. He said that with rational expectations, planned policy actions would not work. They would not change how the real economy performs [7].

Modern Reassessments Gordon looked back at how the Phillips curve has changed over time. He said it has become less useful in the U.S. Ball and Mazumder found something during the Great Recession. Inflation stayed fairly stable even though unemployment was high. This went against the traditional Phillips curve [8, 9]. Blanchard described the Phillips curve as "flattened". This means unemployment has less effect on how inflation changes [10].

Alternative Perspectives Recent research has focused on certain things. These include global supply chains, stable inflation expectations, and big changes in the labor market. For example, new technology and globalization have made workers less able to ask for higher wages. This has weakened the way wages affect prices. Others have a different idea. They say nonlinearity, sudden structural changes, or shifts in economic conditions may explain why the Phillips curve does not work steadily in real data.

This collection of research gives a base for our study. This study wants to test the Phillips curve again with real data. The study will use the most recent information from the U.S. to do this.

3. Methodology

3.1 Model Specification

To test the Phillips curve, this study estimates the following linear regression model:

$\pi t = \alpha + \beta \mu t + \epsilon t$ (1) πt

is the inflation rate (measured by CPI, year-over-year percentage change) at time t.μt is the unemployment rate at time t.α is the intercept.β is the regression coefficient of unemployment on inflation (the Phillips curve parameter). ϵt is the error term.

If the traditional Phillips curve holds, β should be negative and statistically significant.

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3.2 Data Collection

This study gets monthly inflation data from the Bureau of Labor Statistics. This study gets unemployment data from the Federal Reserve Economic Database (FRED). The data covers January 2000 to March 2024, giving 290 data points. Table 1 shows the main statistics of the dataset.

Table 1. Summary statistics of U.S. monthly inflation and unemployment data (2000–2024)

Variable	Mean	Std. Dev.	Min	Max	Obs.
Inflation Rate (%)	2.47	1.85	-1.3	8.6	290
Unemployment Rate (%)	5.8	2.2	3.1	14.7	290

As Figure 1 shows, inflation averaged about 2.5% during the time studied. It reached 8.6% at its highest during the inflation rise after the pandemic. Unemployment averaged 5.8%. But it went up to 14.7% during the 2008 financial crisis and the COVID-19 pandemic.

3.3 Visualization

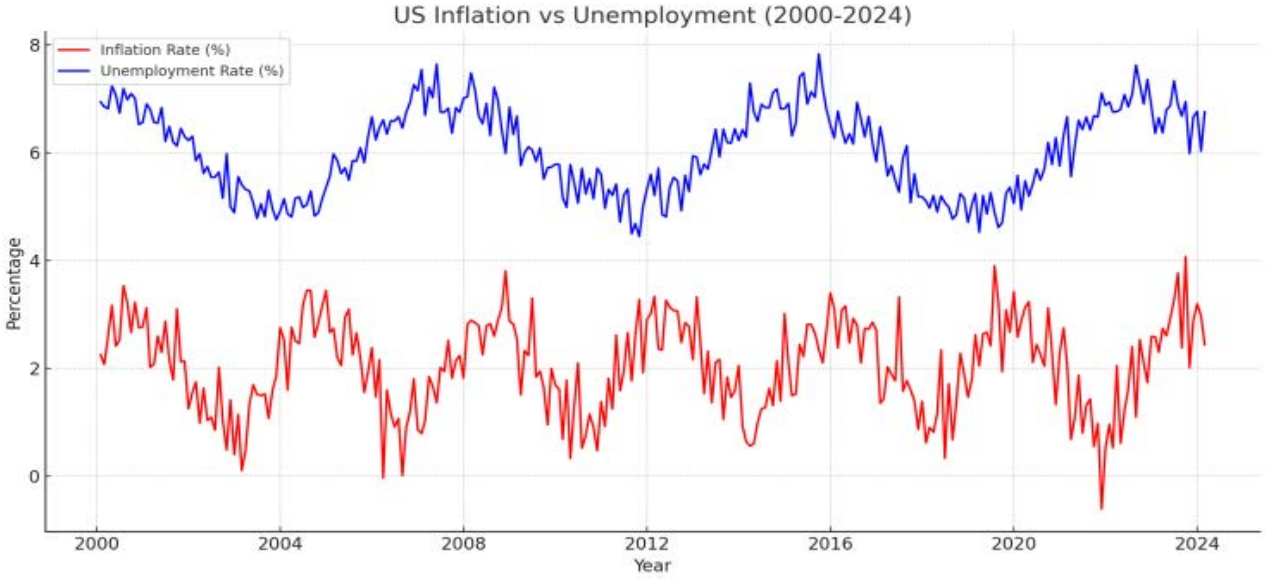

Fig. 1. U.S. monthly inflation rate and unemployment rate, 2000–2024

As Fig. 1 shows, the data shows that unemployment and inflation often move in different directions. This is especially true during the Great Recession and the recovery after the pandemic. After 2021, unemployment dropped fast. But inflation jumped to a 40-year high. This goes against the expected inverse relationship.

3.4 Estimation Procedure

The study uses ordinary least squares (OLS) to calculate the regression. OLS assumes a straight-line relationship, equal spread of errors, no strong connections between variables, and errors that follow a normal distribution. To check if the model is good, the study also makes residual plots. These help us see if errors are spread randomly.

4. Results

Table 2. Regression of inflation on unemployment (OLS, 2000–2024)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Constant	2.41	0.37	6.51	0.000
Unemployment Rate	0.0024	0.0031	0.78	0.433

Model Statistics: R-squared = 0.001

S-Adj. R-squared = -0.002
T-Observations = 290
Fig. 2 shows that unemployment does not explain inflation in a significant way. The coefficient is close to zero and not statistically important. The R-squared value shows that unemployment explains almost none of the changes in inflation. The residual plot (like the figure) shows no clear pattern. This means the OLS assumptions are not badly broken. But it also shows that the unemployment rate does not really help explain inflation in this dataset.

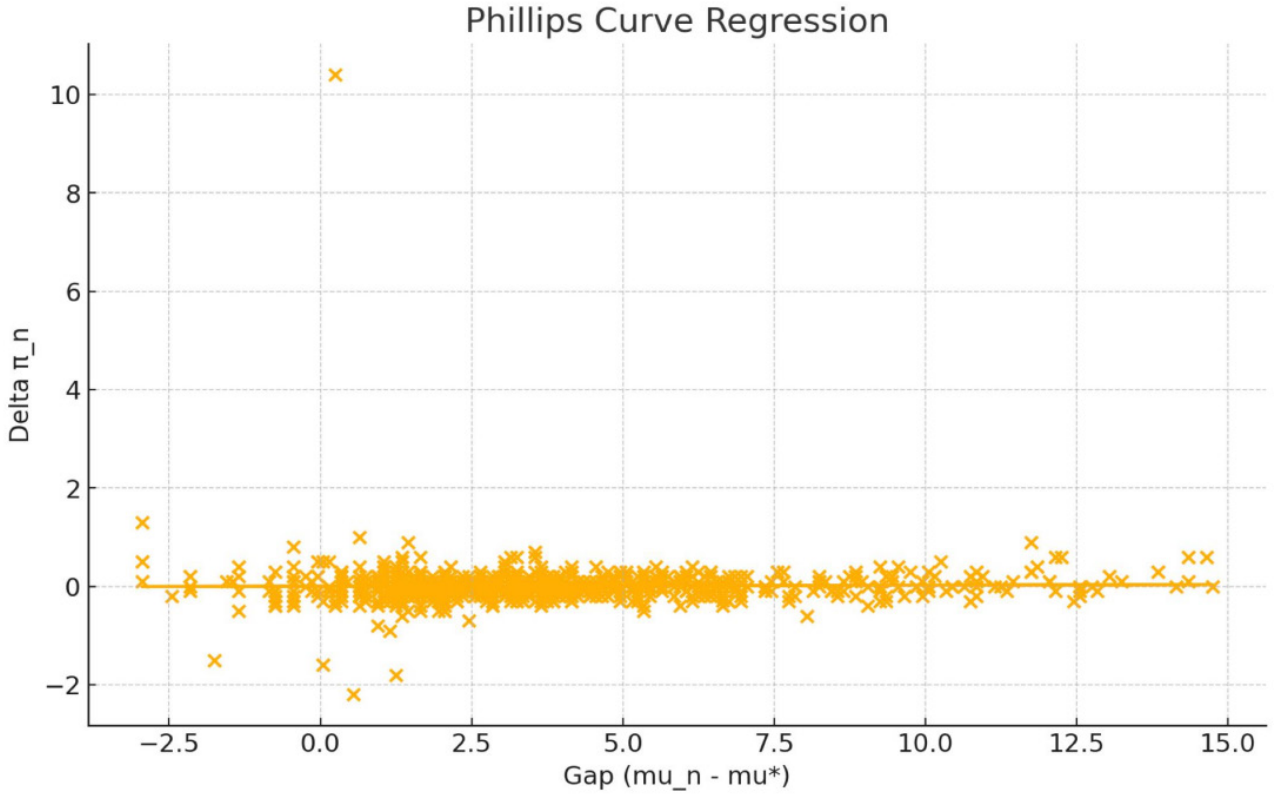

Fig.2. The Scatter Plot of Inflation Changes against Unemployment Gap (2000–2024)

5. Discussion

5.1 The Flattening of the Phillips Curve

Fig. 1 and 2, and Table 2, suggest that the traditional Phillips curve no longer describes how inflation and unemployment work in the U.S. well. There are several possible reasons:
Supply-Side Shocks: Recent inflation pressures come mainly from energy prices, broken supply chains, and geopolitical problems. None of these are directly connected to unemployment.
Anchored Inflation Expectations: When people's expectations about inflation stay stable, changes in unemployment have less effect on what inflation is.
Globalization and Technology: As Figure 1 shows, unemployment hit very low levels, but wages did not cause much inflation until supply shocks happened. This shows big changes in labor markets.

5.2 Policy Implications

The Federal Reserve and those in charge of fiscal policy must change. The Phillips curve does not help predict things much now. Figure 1 shows that in the late 2010s, unemployment was almost the lowest ever, but inflation stayed low. This goes against traditional models. This suggests:
- Monetary policy should include signs of coming supply shocks and inflation expectations.
- Fiscal policy should not think that more jobs from higher demand will automatically cause inflation.

5.3 Theoretical Implications

Fig. 2 shows that a simple straight-line model is not good enough. Future research should look at:
- Nonlinear or threshold models. The trade-off between inflation and unemployment might only show up in extreme situations.
- Models with changing parameters over time. These can show big changes in the economy over time.

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- Models with global variables. U.S. inflation is affected by supply and demand around the world.

5.4 International Comparisons

Data from other countries shows that the Phillips curve is flattening not just in the U.S. The Eurozone and Japan also had low inflation even when unemployment was going down. This supports the idea that the Phillips curve may be getting less useful worldwide. It shows that this study needs other ways to look at the economy.

6. Conclusion

This study looked at the relationship between inflation and unemployment in the U.S. from 2000 to 2024. This study used monthly data, OLS regression, and visual checks. The study founds no important evidence to support the traditional Phillips curve. Figure 2 shows that unemployment does not really affect inflation. Figure 1 shows that how they moved together in the past has become weaker in recent decades. These results challenge the traditional Phillips curve's place in modern macroeconomics. Policymakers should be careful about assuming there is a steady trade-off between inflation and unemployment.

Instead, they must think about more things: supply-side shocks, inflation expectations, and big changes in labor markets. Future research should go further. It could use nonlinear economic methods, include global economic variables, and compare different countries. Moving beyond the linear Phillips curve can help make better models. These models can guide macroeconomic policy in the 21st century.

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