Does the Phillip Curve Exist? An Econometrics Analysis Report

Jonela Wilson

Dongbei University of Finance and Economics

Abstract

The Phillips’ Curve is a theory that states inflation and unemployment have a stable and inverse relationship. Many scholars I have tested this theory and have found it to be true. In order to test the findings of previous scholars and to prove that this theory exists, the paper provided a set by set practical analysis. This was done by the systematic framing of traditional methodology of Econometrics to evaluate the concept of the Phillip’s Curve. The eight (8) steps of : 1. Statement of theory or hypothesis, 2. Specification of the mathematical model of the theory, 3. Specification of the statistical, or econometric, model, 4. Obtaining the data, 5. Estimation of the parameters of the econometric model, 6. Hypothesis Testing , 7. Forecasting or prediction and 8. Using the model for control or policy purposes helped in concluding that the existence of the Phillips’ Curve.

1. Introduction

Throughout the growth of academia there has been the development of a number of scholarly theories that have survived the test of time. These theories whether in the Medical and or Social Sciences fields have been used to guide the development of numerous policies that aided in better decision making. In the Social Sciences the area of Economics have been bombarded by many economic theories that gave some insight to the micro and macro operations of the economy. Respectively, these theories began with the inner operations of the business (microeconomics), then graduated to the wider economy (macroeconomic) of a country and to a larger extent the economic operations in the world. Although these theories have been useful, most economic theories make statements or hypotheses that are mostly qualitative, thus providing no numerical measure between the variables they may highlight. Since this is the case the Econometrician is tasked with the responsibility to provide the numerical estimates that the Economist did not provide (Gujarati, 2004).

For the purpose of this assignment, the economic theory of The Phillips Curve will be assessed under the realms of the Econometric portfolio. This theory was chosen because the author speculates that the numerical measures of this theory will give her a clearer understanding of how macroeconomics can affect the stability of human capital or human resource. For this paper, the author will follow the eight (8) Traditional Methodology of Econometrics to evaluate the concept of the Phillip’s Curve. These eight (8) steps are as follows: 1. Statement of theory or hypothesis, 2. Specification of the mathematical model of the theory, 3. Specification of the statistical, or econometric, model, 4. Obtaining the data, 5. Estimation of the parameters of the econometric model, 6. Hypothesis Testing , 7. Forecasting or prediction and 8. Using the model for control or policy purposes (Gujarati, 2004). After completing the first to the seventh step in the Econometric Methodology the author will provide recommendation for the Canadian government in the eighth (8) step which focuses on using the model for control or for policy purposes.

2. Statement of Theory or Hypothesis

2.1. Canada

After Russia, the second largest country in the world is Canada. Canada occupies roughly the northern two-fifths of the continent of North America. Despite Canada’s great size, it is one of the world’s most sparsely populated countries. Although Canadians are comparatively few in number, they have crafted what many observers consider to be a model multicultural society, welcoming immigrant populations from every other continent. In addition, Canada harbours and exports a wealth of natural resources and intellectual capital equalled by few other countries. With such a sparsely populated country it will be good to assess ‘The Phillips Curve’ in this country as a means of giving those persons in Human Resource a better understanding of the macroeconomic effects on the rise or decrease in wage prices as it relates to unemployment (Britannia.com) (Nicholson, Krueger, Lewis, & Roger, 2019).

2.2. The Phillips Curve

The economic concept of the Phillips Curve was developed by A.W. Phillips. This theory stated that inflation and unemployment have a stable and inverse relationship. In so doing, the theory claimed that with economic growth there will be inflation. This in turn will lead to more jobs and less unemployment. The concept behind the Phillips Curve states the change in unemployment within an economy has a predictable effect on price inflation. The inverse relationship between unemployment and inflation is depicted as a downward sloping, concave curve, with inflation on the y-axis and unemployment on the x-axis. Increasing inflation decreases unemployment and vice versa. Alternatively, a focus on decreasing unemployment also increases inflation, and
vice versa (Al-zeaud & Al-hosban, 2015). Based on the information provided in this brief literature review the author wishes to test the following hypothesis.

2.3. Hypothesis

**Null Hypothesis (Ho):** There is an inverse relationship between unemployment and inflation.

**Alternative Hypothesis:** There is not an inverse relationship between unemployment and inflation

**Guidelines:** The p-value is a number between 0 and 1.

- If the p-value is \( \leq 0.05 \) the null hypothesis will be rejected.
- If the p-value is \( > 0.05 \) the null hypothesis will not be rejected.

1. **Specification of the Mathematical Model of the Theory**

The functional relationship between the variables posited by The Phillips Curve will be depicted through a simple Mathematical Equation that is linear.

<table>
<thead>
<tr>
<th>Deterministic Relationship: ( Y = \beta_1 + \beta_2 X )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y ) = Inflation (Dependent Variable)</td>
</tr>
<tr>
<td>( X ) = Unemployment (Independent Variable)</td>
</tr>
<tr>
<td>( \beta_1 ) = Parameter 1 - The Intercept, which is the value of ( Y ) when ( X=0 )</td>
</tr>
<tr>
<td>( \beta_2 ) = Parameter 2 - The Slope Coefficient</td>
</tr>
</tbody>
</table>

2. **Specification of the Statistical, or Econometric, Model**

**Econometric Model**

**Linear Econometric Model** \( Y = \beta_1 + \beta_2 X + \mu \)

Since the theory posits an inverse relationship between inflation and unemployment a nonlinear model is also provided (Al-zeaud & Al-hosban, 2015).

**Nonlinear Econometric Model** \( Y_i = \beta_0 X_i \beta \varepsilon_i \)

_{To transform this equation to linear, the product law of logarithm._}

Thus, \( \ln Y_i = \ln \beta_0 + \beta_1 \ln X_i + \ln \varepsilon_i \)

3. **Obtaining the Data**

Data for this assignment was collected from the website, Worldbank.com. This data was collected from the country Canada over a fifty year period which was 1969 to 2018. A snapshot is provided below of the dataset that was used for this assignment. The Eviews software was used to generate: 1. Log graph, 2. Regression Graph, 3. Inverse Graph, 4. Line Graph and finally, 5. Descriptive Statistics of the data.
The four (4) graphs mentioned previously, showed some form of inverse relationship between inflation and unemployment when they were plotted in the Eviews software. Meaning, that with an increase in unemployment there was a decrease in inflation. In particular the line graph showed that there are points where unemployment and inflation were both high. This can be attributed to the concept known as Stagflation. Despite the many outliers depicted in the graphs as well as the issue of Stagflation, on average there seem to be merit for the Phillips Curve. Further discussion will be given for the Descriptive Statistic that is provided on this dataset.
3.5. Descriptive Statistic

The table below gives a number of descriptive statistics on the dataset assessed. As is depicted the dependent variable was inflation; whereas unemployment was independent. There was a sample adjustment from forty nine (49) observations to forty eight (48) observations. The forty eight (8) adjusted observations were used to calculate the estimates depicted in the table. The coefficient measurement shows that with every 1 unit rise in unemployment there is 3.9 unit decrease in inflation.

Figure 1: Graphs Showing Regression, Inverse Relationship and Log Relationship Respectively

Figure 3: Line Graph Showing the Association Among Inflation and
The P-value generated for this dataset was 0.6026 which is greater than the limits of 0.05. For the coefficient of determination or r-squared the results shows that the sample regression line provided fits the data 0.005940, falling within the limits of this measurement; however, it is considerably low. In other words, the total variation in y is explained by the regression model 0.005940. As for the Standard Error (SE), the mean of the sample estimates the mean of the population 0.073845.

4. Estimation of the Parameters of the Econometric Model

\[ Y = \beta_1 + \beta_2 X + \mu \]

Where \( \beta_1 \) stands for the intercept term, and \( \beta_2 \) is the slope of the regression line computed as follows:

The model’s parameters are estimated as follows:

\[
\hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X} \quad \text{And} \quad \hat{\beta}_2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^{n}(X_i - \bar{X})^2}
\]

Where;

\( \bar{X} = 7.751722012 \quad \text{And} \quad \bar{Y} = 3.995969442 \)

After computations we get,

\( \hat{\beta}_1 = 5.99 \) And \( \hat{\beta}_2 = -0.26 \)

Based on the parameters derived, it is determined that at an intercept of 5.99 when the X-axis is at 0, there will be a slope coefficient or rise and run of -0.26 on the Y-axis.

5. Hypothesis Testing

From section (1) of this assignment the following hypotheses and guidelines were provided:

- **Null Hypothesis (Ho):** There is an inverse relationship between unemployment and inflation.
- **Alternative Hypothesis:** There is not an inverse relationship between unemployment and inflation
- **Guidelines:** The p-value is a number between 0 and 1.
  - If the p-value for is (≤ 0.05) the null hypothesis will be rejected.
  - If the p-value is (> 0.05) the null hypothesis will not be rejected.

From the guidelines provided above the Null Hypothesis will not be rejected since the P-value is > 0.05
6. **Forecasting or Prediction**

Using the listed 2018 figure of 5.830800056 for unemployment, the \( (\dot{y}) \) or inflation will be forecasted for that year since it was missing from the dataset.

\[
Y = \beta_1 + \beta_2 X \\
Y_{2018} = 5.99 - 0.26(5.8308) \\
= 4.77
\]

Based on the calculations presented the inflation rate for 2018 as a trade-off from unemployment on average will be 4.47.

7. **Using the Model for Control or Policy Purposes**

With the forecasted inflation rate for 2018 the Canadian government can apply a mix of the appropriate fiscal and monetary policies to manipulate the control variable \( X \) to produce the desired level of the target variable \( Y \). Such policies can also help to guide Human Resource in setting and accepting wage prices.

**Conclusion**

In conclusion, the eight (8) steps of traditional Econometric Methodology have provided an efficient way to sufficiently test theories and hypotheses.

**Traditional Econometric Methodology**

1. Statement of theory or hypothesis
2. Specification of the mathematical model of the theory
3. Specification of the statistical, or econometric, model
4. Obtaining the data
5. Estimation of the parameters of the econometric model
6. Hypothesis Testing
7. Forecasting or prediction
8. Using the model for control or policy purposes

After applying the eight (8) steps listed above, the author can sufficiently state that the hypothesis stated should be accepted as well as The Phillips Curve does exist.

**References**

