

Homework 11

1. In this exercise, we will investigate the empirical relationship between the output gap and inflation rate which is the so-called "Phillips Curve". To begin with, download the following data for the period 1978Q1 -2019Q4.

- Quarterly, seasonally adjusted data on CPI for all urban consumers and all items in U.S. city average and real GDP.
- Quarterly data on real potential GDP and inflation expectation by Michigan Survey of Consumers.

All of these can be downloaded from FRED, the Federal Reserve Bank of St.Louis database: <https://fred.stlouisfed.org/>. Once you download data, follow the steps below to construct dataset used in the analysis.

i. By taking log difference, calculate the annualized inflation rate

$$\pi_t = 400 \times \ln(CPI_t/CPI_{t-1})$$

for each time period t .

ii. Using real GDP and potential GDP, calculate the output gap

$$\hat{Y}_t = 100 \times \ln(GDP_t/GDP_t^P)$$

for each period t (we multiply 100 instead of 400 since it is already annualized). Here, GDP_t is the real GDP and GDP_t^P is the potential real GDP.

iii. For the expected inflation rate π_t^e at period t , use the 4 period lagged value from Michigan Survey of Consumers

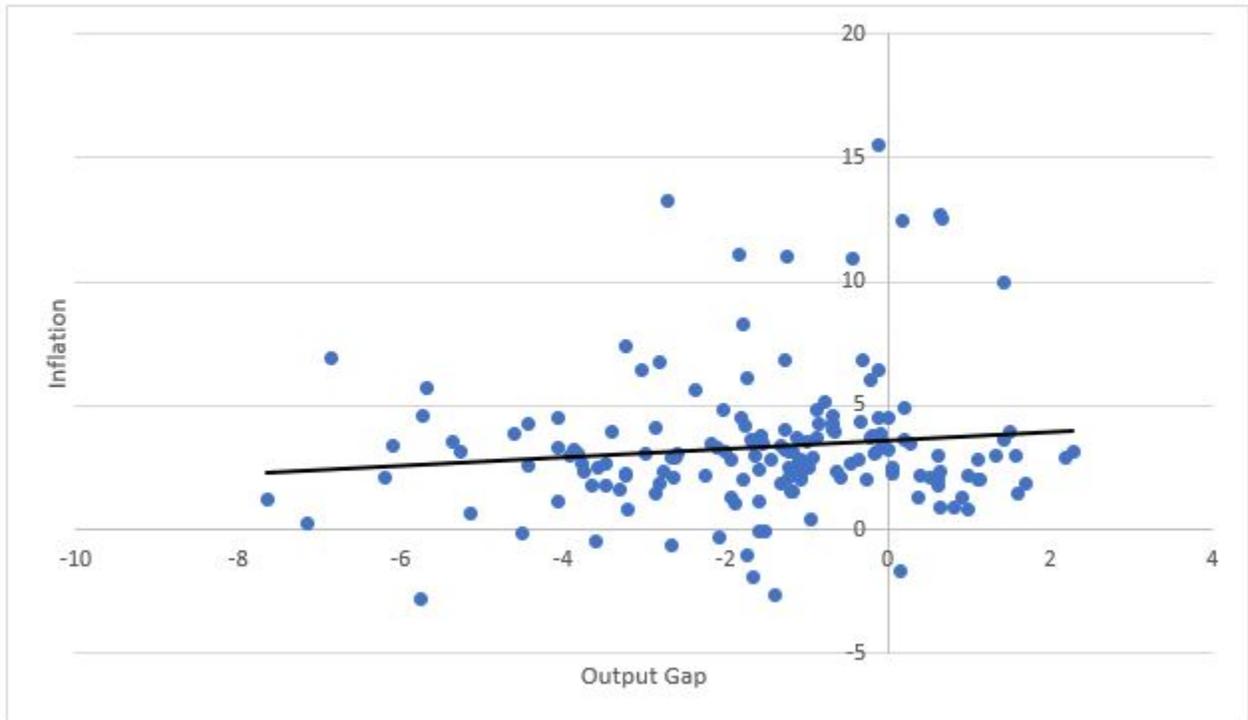
$$\pi_t^e = E_{t-4}[\pi_t]$$

since each data point at time t represents one-year-ahead inflation forecast $E_t[\pi_{t+4}]$, e.g. 2000Q4 value means the inflation expectation for 2001Q4 in Michigan Survey of Consumers.

Once these are constructed, exclude 2008 Q4, which is an outlier in the data, and use the sample period 1979Q1 - 2019Q4 in the following questions.

- a. Create a scatter plot of the inflation rate on the vertical axis and the output gap on the horizontal axis with a trendline. Report the correlation coefficient between these variables.

Answer:



The correlation coefficient is 0.1203.

- b. Run a regression of the inflation rate on the output gap. Report the coefficient estimate and t -statistic for the output gap. Is this coefficient different from zero in statistical sense? How can you reconcile this finding with the model we learned in class?

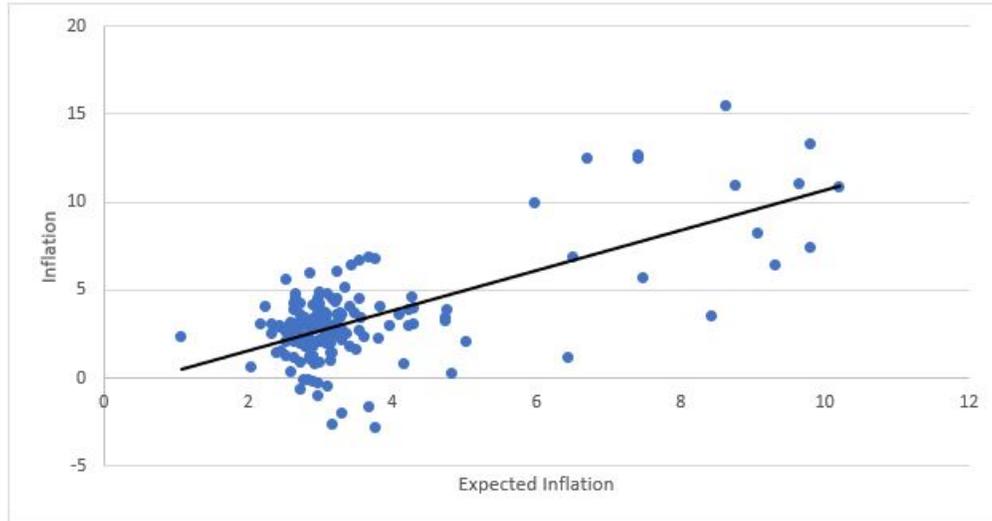
Answer:

	Coefficients	t-stat
Intercept	3.61	13.05
GDP Gap	0.17	1.54

Since the t -statistic is 1.54 which is smaller than 1.645 (10% level), we can't reject that the coefficient estimate is different from zero at 10 % level. However, this result doesn't contradict to the model we learned in class since we don't take into account the expected inflation rate.

- c. Create scatter plot of the inflation rate on the vertical axis and the expected inflation on the horizontal axis with a trendline. Report the correlation coefficient between these variables.

Answer:



The correlation coefficient is 0.6851.

- d. Run a regression of the inflation rate on the expected inflation. Report the coefficient estimate and t -statistic for the expected inflation.

Answer:

	Coefficients	t-stat
Intercept	-0.74	-1.97
Expected Inflation	1.14	11.93

- e. Run a regression of the inflation on the output gap and the expected inflation. Report the coefficient estimates and t -statistics for both variables. Is the result consistent with the model we learned in class?

Answer:

	Coefficients	t-stat
Intercept	-0.50	-1.42
GDP Gap	0.41	5.29
Expected Inflation	1.25	13.75

Yes, it shows the positive relationship between inflation rate and GDP gap conditional on the expected inflation, which is consistent the model.