

Econ 100B: Economic Analysis – Macroeconomics
Problem Set #7
Due Date: October 23, 2020

General Instructions:

- Please upload a PDF of your problem set to Gradescope by 11:00 pm.
- **Late homework will not be accepted.**
- Please put your name and student ID at the upper right corner of the front page.

1. Review the recent [FOMC statement](#) and answer the following questions:

- (a) What are the Committee's employment and price goals?
- (b) What is the Committee's target range for the federal funds rate?
- (c) What is the Committee's longer-run inflation goal?
- (d) Did all FOMC members vote for the monetary policy action? If not, who dissented and what was their policy proposal?

2. Use Okun's law to ...

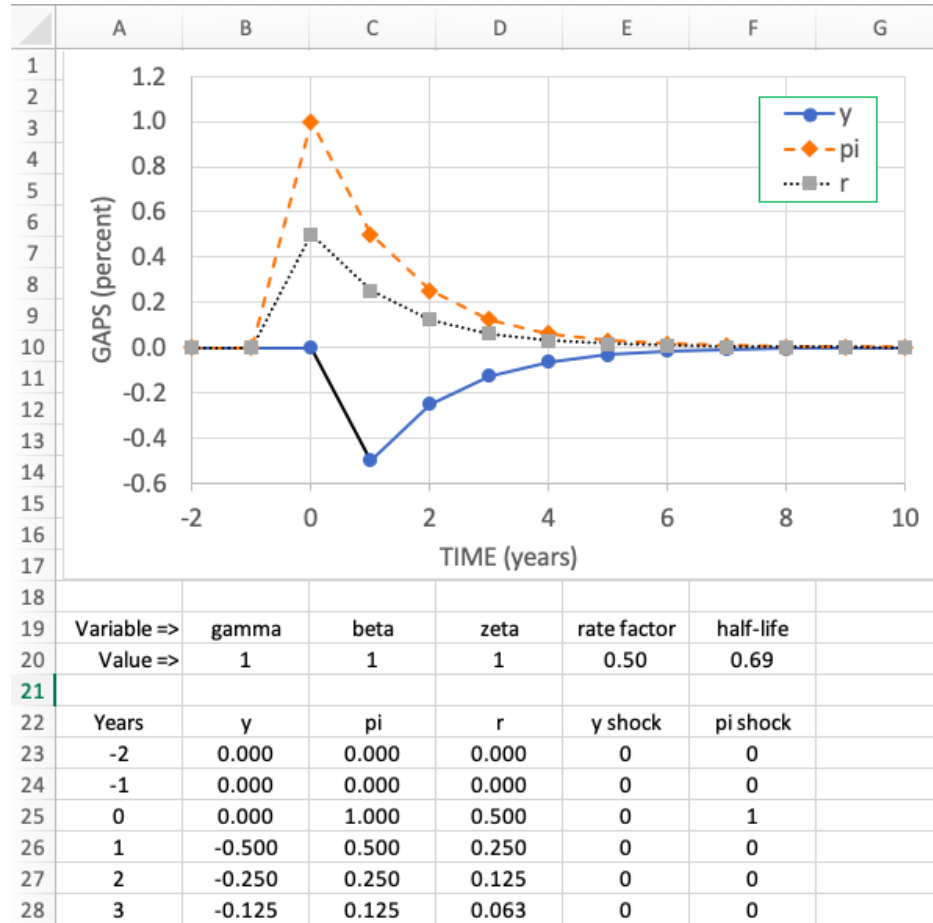
- (a) ...rewrite the central bank loss function in a way that better reflects the dual mandate of the Federal Reserve in terms of unemployment and inflation, and ...
- (b) ...then determine the value of β in the central bank loss function that would result in an equal weighting of the two terms in the dual mandate of the Federal Reserve.

3. Referring to [China unexpectedly cuts reverse repo rate by most in 5 years to support virus-hit economy](#):

- (a) Given the change in the reverse-repo rate discussed in the article how many basis points are in one percent?
- (b) What was the term (number of days) of the reverse-repo rate that the PBOC changed.
- (c) A change in the policy rate can be categorized via the optimal rat rule in terms the change in inflation as follows:
 - *expansionary* if the new rate is lower than what the change in inflation indicated.
 - *contractionary* if the new rate is higher than what the change in inflation indicated.
 - *neither expansionary or contractionary* if the new rate is what the change in inflation indicated.

If there was no change in inflation when the PBOC changed the reverse-repo rate, was their action expansionary, contractionary, or neither? Briefly explain.

4. We will now build a monetary policy calculator using the update algorithm implied by the dynamic IS curve and the Phillips curve. An example of my Excel version of this calculator is shown below. This example was used to generate the graph on slide 5 of lecture 13. You can use your preferred platform (e.g., Python, Matlab, Octave, Mathematica, etc.), but the steps presented below will be given in terms of Excel.



In this simulation we will be evolving the values of the output gap $\tilde{y}_t$, the inflation gap $\tilde{\pi}_t$, and the rate gap $\tilde{r}_t$.

- (a) The variables and their values for the simulation are shown in rows 19 and 20. The rate factor is

$$\frac{1}{\zeta_y \left(\gamma + \frac{1}{\gamma\beta} \right)}$$

which, since we will be using it a lot and it does not change with time, we calculate once here. We also calculate the half-life just to have it around. The half-life is not an input to the simulation.

- (b) Add the headings shown in row 22.

- (c) Populate the years shown in column A.
- (d) Populate the shocks shown in columns E and F. Note the value of “1” for the inflation shock at year 0.
- (e) Set the values of $\tilde{y}_t$, $\tilde{\pi}_t$, and $\tilde{r}_t$ in year -2 (row 23) to zero.
- (f) The evolution of $\tilde{y}_t$ and $\tilde{\pi}_t$ from $t = -2$ to $t = -1$ is accomplished as follows:
 - The output gap $\tilde{y}_t$ evolves according to the gap form of the dynamic IS curve:

$$\tilde{y}_t = -\zeta_y \tilde{r}_{t-1}$$

so

$$\tilde{y}_{-1} = -\zeta_y \tilde{r}_{-2} .$$

To this we add the possibility of a shock to $\tilde{y}_{-1}$ indicated in column E. Adding this term, the complete update—IS curve and shock—is given by

$$B24 = -\$D\$20*D23 + E24 .$$

- The inflation gap $\tilde{\pi}_t$ evolves according to the gap form of the Phillips curve:

$$\tilde{\pi}_t = \tilde{\pi}_{t-1} + \gamma \tilde{y}_t$$

so

$$\tilde{\pi}_{-1} = \tilde{\pi}_{-2} + \gamma \tilde{y}_{-1} .$$

To this we add the possibility of a shock to $\tilde{\pi}_{-1}$ indicated in column F. Adding this term, the complete update—Phillips curve and shock—is given by

$$C24 = C23 + \$B\$20*B24 + F24 .$$

- The rate gap $\tilde{r}_t$ is set by the central bank in response to the value of the inflation gap $\tilde{\pi}_t$ using the gap form of the optimal rate rule:

$$\tilde{r}_t = \frac{1}{\zeta_y \left(\gamma + \frac{1}{\gamma^\beta} \right)} \tilde{\pi}_t$$

so

$$\tilde{r}_{-1} = \frac{1}{\zeta_y \left(\gamma + \frac{1}{\gamma^\beta} \right)} \tilde{\pi}_{-1} .$$

Since there is no shock to the rate because the central bank is setting the rate, the update to the rate $\tilde{r}_{-1}$ is given by

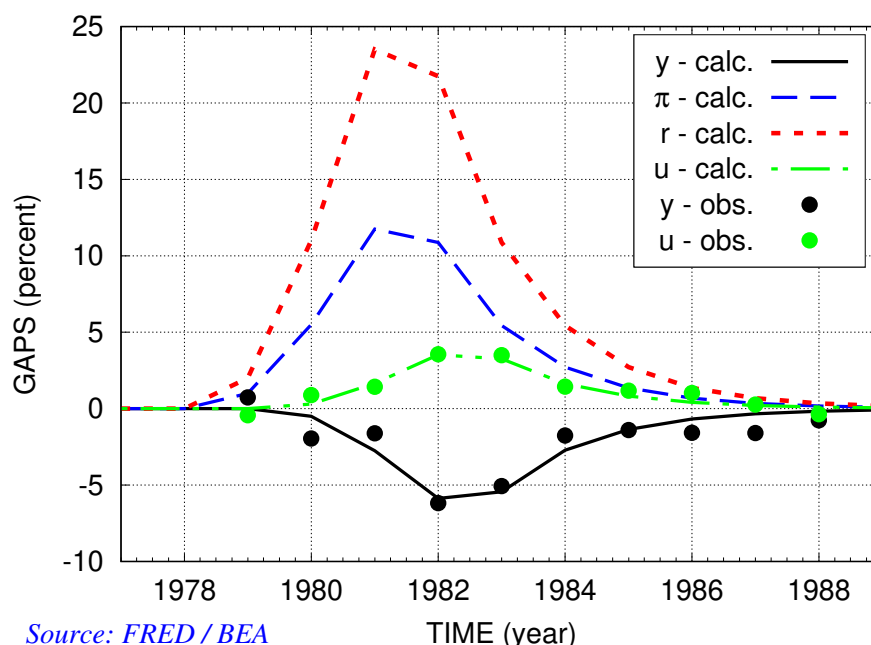
$$D24 = \$E\$20*C24 .$$

- (g) The evolution for all future time ($t > -1$) is the same. If you copy the equations in cells B24, C24, and D24 down for the remaining times given in column A you should see the results shown in the figure.

- (h) You can check that your calculator is working properly (i.e., validate it) by reproducing the gap graph shown on slide 5 of lecture 13.

Your submission for this question should be a screenshot of your calculator showing your calculated results for a single inflation shock of size 1.2 at $t = 2$ years.

5. We will now use the calculator to study the gap changes in the 1980s associated with the Federal Reserve's response to inflation under then Chair Paul Volker.



I used an inflation shock based on a change in the inflation target of the Fed. In the graph “calc” means calculated and “obs.” means observed. My approach to this analysis is as follows:

- Add a column to calculate the unemployment gap from the output gap using Okun's law. This is useful because data for the unemployment gap is more common than is data for the output gap.
- Get annual data from FRED to calculate the output and unemployment gaps. This will be just like your Okun's law data retrieval, but with annual data instead of quarterly data.
- I started a shock sequence at model time $t = 0$ and aligned that with actual time $t = 1979$. The model coefficients were set to $\beta = 1$, $\gamma = 1$, and $\zeta_y = 0.25$.

Your submission for this question should be a screenshot of your calculator showing your calculated version of the graph above together with a brief

discussion of (i) your shock sequence, (ii) the fit to the unemployment and output gaps, and (iii) the resulting rate and inflation gaps.