ENSAE ParisTech and Master in Economics of Paris-Saclay University
Academic Year 2018-2019

Monetary Economics

Exam

Two hours.

Course presentation slides allowed, in paper format, possibly with hand-written annotations (on the slides or on separate paper sheets).

No other document allowed, nor any electronic device (calculator, mobile phone...).

1 Exercise (10 points)

The goal of this exercise is to assess the desirability of a proposal made in 2010 by three International Monetary Fund economists to raise central banks' inflation target in order to reduce the macroeconomic costs caused by the Zero Lower Bound (ZLB) constraint on central banks' policy rate. [1]

Consider the basic New Keynesian model with an efficient steady state and no cost-push shocks, whose key equations are

$$\begin{aligned}
\widetilde{y}_t &= \mathbb{E}_t\left\{\widetilde{y}_{t+1}\right\} - \frac{1}{\sigma}\left(i_t - \mathbb{E}_t\left\{\pi_{t+1}\right\} - r_t^n\right) && \text{(IS equation)},\\
\pi_t &= \beta\mathbb{E}_t\left\{\pi_{t+1}\right\} + \kappa\widetilde{y}_t && \text{(Phillips curve)},\\
i_t &\geq 0 && \text{(ZLB constraint)},\\
L_t &= \mathbb{E}_t\left\{\sum\nolimits_{k=0}^{+\infty}\beta^k\left[\pi_{t+k}^2 + \lambda\widetilde{y}_{t+k}^2\right]\right\} && \text{(welfare-loss function)},
\end{aligned}$$

where the notations are the same as in the course. Consider a persistent negative natural-rate-of-interest shock hitting the economy from date 0 onwards : $r_0^n = -r < 0$ and, for all $t \geq 1$, if $r_{t-1}^n = -r$ then $r_t^n = -r$ with probability q and $r_t^n = \overline{i} > 0$ with probability $1-q$, while if $r_{t-1}^n = \overline{i}$ then $r_t^n = \overline{i}$ with probability 1. Assume that the probability q is sufficiently small for $0 < q < \overline{q}$, where $\overline{q} \in (0,1)$ is implicitly and uniquely defined by

$$\frac{(1-\overline{q})(1-\beta\overline{q})}{\kappa} = \frac{\overline{q}}{\sigma}.$$

Assume that the mandate of the central bank is to minimize the following loss function :

$$L_t^{CB} = \mathbb{E}_t\left\{\sum\nolimits_{k=0}^{+\infty}\beta^k\left(\pi_{t+k} - \pi^*\right)^2\right\},$$

where $\pi^* \geq 0$ is the central bank's inflation target. Assume that the central bank lacks credibility and therefore minimizes L_t^{CB} under discretion. In the following, we consider in turn two alternative cases for the central bank's inflation target : $\pi^* = 0$ and $\pi^* > 0$.

1. See Blanchard, O., G. Dell'Ariccia, and P. Mauro (2010) : "Rethinking Macroeconomic Policy," IMF Staff Position Note, February 12.

1.1 Zero inflation target

In this subsection, we assume that $\pi^* = 0$.

Question 1 What values for π_t and $\widetilde{y}_t$ does the central bank choose after the shock (i.e. when $r_t^n = \bar{i}$) ? (No computation is needed to answer this question ; one or two sentences are enough.)

Question 2 Explain very briefly (in one or two sentences) why the ZLB constraint is binding during the shock (i.e. while $r_t^n = -r$). Explain also very briefly (in one or two sentences, without any equation) why π_t and $\widetilde{y}_t$ are constant over time during the shock (i.e. while $r_t^n = -r$).

Question 3 Deduce from Questions 1 and 2 that the central bank chooses the values

$$\begin{aligned} \pi(q) &\equiv -\left[\frac{(1-q)(1-\beta q)}{\kappa} - \frac{q}{\sigma}\right]^{-1} \frac{r}{\sigma} < 0 \\ \widetilde{y}(q) &\equiv \left(\frac{1-\beta q}{\kappa}\right) \pi(q) < 0 \end{aligned}$$

for π_t and $\widetilde{y}_t$ during the shock (i.e. while $r_t^n = -r$).

Question 4 Deduce from Questions 1 and 3 that L_0 takes the value

$$L_0(q) \equiv \left(\frac{1}{1-\beta q}\right)\left[1 + \lambda\left(\frac{1-\beta q}{\kappa}\right)^2\right][\pi(q)]^2 .$$

Question 5 Show that $L_0'(q) > 0$, $\lim_{q\to 0} L_0(q) = (\kappa^2+\lambda)r^2/\sigma^2$, and $\lim_{q\to \overline{q}} L_0(q) = +\infty$. (You do not need to compute any derivative to answer this question.) Briefly interpret.

1.2 Positive inflation target

In this subsection, we assume that $\pi^* > 0$.

Question 6 What is the set of possible values for π^* such that the central bank is able to choose $\pi_t = \pi^*$ both during the shock and after the shock, despite the ZLB constraint ?

Question 7 Among these possible values for π^*, which one (denoted by π^{**}) leads to the smallest value of L_0 ? Show that when $\pi^* = \pi^{**}$, L_0 takes the value

$$L_0^{**} \equiv \left(\frac{1}{1-\beta}\right)\left[1 + \lambda\left(\frac{1-\beta}{\kappa}\right)^2\right] r^2.$$

1.3 Optimal inflation target

Question 8 Which of the following two inflation targets is preferable in terms of social welfare : $\pi^* = 0$ or $\pi^* = \pi^{**} > 0$? How does the answer to this question depend on q and on r ? Interpret.

2 Commentary (10 points)

Comment, in the light of the course, upon the following excerpt from the speech entitled "Data Dependence and U.S. Monetary Policy" made by Richard H. Clarida − vice-chairman of the Federal Open Market Committee (FOMC) of the Federal Reserve − on November 27, 2018. In so doing, explain in particular your own view about whether and why it is important for a central bank to : (i) communicate about the expected future path of its policy rate ; (ii) make the policy rate react in a systematic way (i.e., as a rule) to incoming data on, for example, inflation or inflation expectations ; and (iii) make the policy rate react to incoming data that suggest a change in the values of u* and/or r* (assuming we can interpret u* as the flexible-price unemployment rate, which is negatively related to the natural level of output y_t^n, and r* as the natural rate of interest r_t^n).

"*A monetary policy strategy must find a way to combine incoming data and a model of the economy with a healthy dose of judgment − and humility ! − to formulate, and then communicate, a path for the policy rate most consistent with our policy objectives. In the case of the Fed, those objectives are assigned to us by the Congress, and they are to achieve maximum employment and price stability. Importantly, because households and firms must make long-term saving and investment decisions and because these decisions − directly or indirectly − depend on the expected future path for the policy rate, the central bank should find a way to communicate and explain how incoming data are or are not changing the expected path for the policy rate consistent with best meeting its objectives. Absent such communication, inefficient divergences between public expectations and central bank intentions for the policy rate path can emerge and persist in ways that are costly to the economy when reversed.*

Within this general framework, let me now consider two distinct ways in which I think that the path for the federal funds rate should be data dependent. U.S. monetary policy has for some time and will, I believe, continue to be data dependent in the sense that incoming data reveal at the time of each Federal Open Market Committee (FOMC) meeting where the economy is at the time of each meeting relative to the goals of monetary policy. This information on where the economy is relative to the goals of monetary policy is an important input into the policy decision. If, for example, incoming data in the months ahead were to reveal that inflation and inflation expectations are running higher than projected at present and in ways that are inconsistent with our 2 percent objective, then I would be receptive to increasing the policy rate by more than I currently expect will be necessary. Data dependence in this sense is easy to understand, as it is of the type implied by a large family of policy rules in which the parameters of the economy are known.

But what if key parameters that describe the long-run destination of the economy are unknown ? This is indeed the relevant case that the FOMC and other monetary policymakers face in practice. The two most important unknown parameters needed to conduct − and communicate − monetary policy are the rate of unemployment consistent with maximum employment, u, and the riskless real rate of interest consistent with price stability, r*. As a result, in the real world, monetary policy should, I believe, be data dependent in a second sense : that incoming data can reveal at each FOMC meeting signals that will enable it to update its estimates of r* and u* in order to obtain its best estimate of where the economy is heading. And, indeed, as indicated by the SEP [Summary of Economic Projections], FOMC participants have, over the past nearly seven years, revised their estimates of both u* and r* substantially lower as unemployment fell and real interest rates remained well below prior estimates of neutral without the rise in inflation or inflation expectations those*

earlier estimates would have predicted. And these revisions to u and r* almost certainly did have an important influence on the path for the policy rate that was actually realized in recent years. I would expect to revise my estimates of r* and u* as appropriate if incoming data on future inflation and unemployment diverge materially and persistently from my baseline projections today.*"