14.452 Macroeconomic Theory II
Instructor: **Olivier Blanchard**

Problem Set 1
Due Date: **April 13th**
We encourage you to work together, as long as you write your own solutions.

"**Old Macro**": **Are good news bad news**? (**Blanchard**, **1981**)

Let's consider a continuous-time closed economy with a constant capital stock, fixed prices, and rational expectations. There is one good and three assets: shares (titles to the physical capital), private short-term bonds issued and held by individuals, and money. The two non-money assets are perfect substitutes.

Total spending is expressed as:

$$d = aq + \beta y + g; \ a > 0; \ b \in [0, 1),$$

where d denotes the log of spending, q is the stock market value, y is the log of income, and g is an index of fiscal policy.

Output adjusts to spending over time:

$$\dot{y} = \sigma(d - y); \ \sigma > 0,$$

where a dot denotes a time derivative.

1. How can you interpret the $\dot{y}$ equation? Give some alternative intuitions.

Now, let's add more structure to asset returns. Short-term bonds pay a short-term interest rate of i. Shareholders receive dividends that are equal to the profits of the firm. Profits (π) are assumed to be:

$$\pi = \alpha_0 + \alpha_1 y; \ \alpha_1 \geq 0.$$

2. What is the expected short-term (i.e., instantaneous) return on holding shares? What is the arbitrage condition between short-term bonds and shares?

Finally, let's consider money. Blanchard assumes that the money stock is constant, and uses a conventional LM equation. We shall instead assume that the central bank follows an interest rule, and adjusts money so as to achieve that interest. We assume the rule to be of the form:

$$i = \theta_o + \theta_y y; \ \theta_y > 0$$

3. Using your previous answers, present the equations that characterize this economy (i.e. three equations for the evolution of output, stock market prices, and the interest rate).

4. Characterize the steady state of this economy using a phase diagram. What is the effect of output on the stock market? Why? Give intuition and math.

5. What are the effects on output and the stock market on impact and at the steady state of an unanticipated expansionary monetary policy (i.e., a decrease in θ_o at time t that was not anticipated by the agents)? Give intuition and math.

6. What are the effects on output and the stock market on impact and at the steady state of an anticipated expansionary monetary policy (i.e., a decrease in θ_o at time t that was anticipated by the agents)? Give intuition and math.

7. Does this explain why the stock market sometimes goes up and sometimes down in response to good news about output growth?

Overshooting (Dornbusch, 1976)

Based on "Overshooting meets Inflation Targeting", J. De Gregorio, 2006.

Let's consider an open economy in continuous time with the following structure. Agents have perfect foresight and the uncovered interest rate parity holds:

$$i = i^* + \dot{s}$$

where i is the domestic nominal interest rate, i^* is the foreign interest rate, and s is the log of the nominal exchange rate. Output, in the IS curve, is given by:

$$y = \bar{y} + \phi(s + p^* - p)$$
$$\phi > 0$$

where y is the log of output, $\bar{y}$ is the log of the natural level of output, and p^* is the log of the foreign price level. Let's assume, to save time, that $p^* = 0$. In turn, the evolution of the price level, given by the Phillips curve, is:

$$\dot{p} = \lambda(y - \bar{y})$$

Assume that the money market equilibrium, or the LM curve, is given by:

$$m - p = -\eta i$$

where m is the log of nominal money.

1. Characterize this economy in terms of the law of motion for nominal exchange rate and prices using a phase diagram.

2. Consider the effect on impact and at the steady state of a permanent expansionary monetary policy (i.e., a permanent increase of money). Why do you observe that the exchange rate overshoots? (i.e., the exchange rate changes on impact more than at the steady state). Give intuition and math.

    Let's now consider a Central Bank that follows a monetary policy rule of the following form (so m is endogenously determined):

$$i = i^* + a(p - \bar{p})$$

    where $\bar{p}$ is the target price level.

3. Let's assume again that there is a permanent expansionary monetary policy (i.e., an increase of $\bar{p}$). Does having a monetary policy rule as in the equation above help to reduce nominal exchange rate volatility? Give math and intuition.

4. Does this model help you to understand why there is excess volatility of the exchange rate in some open economies?

How Well Does the IS-LM Model Fit the Post-War U.S. Data? Analytics

This question is based on Galí (1992), *Quarterly Journal of Economics* v.107, n.2: pp. 709-38.

Consider the model in the introduction of the paper:

$$\text{IS Equation: } y = \alpha + \mu_s + \sigma(i - E\Delta p_{+1}) + \mu_{is}$$

$$\text{LM Equation: } m - p = \phi y - \lambda i + \mu_{md}$$

$$\text{Money Supply Process: } \Delta m = \mu_{ms}$$

$$\text{Phillips Curve: } \Delta p = \Delta p_{-1} + \beta(y - \mu_s)$$

where y denotes the log of GNP, i is the nominal interest rate, p is the log of the price level, m is the log of the money stock, Δ is the first difference operator, E is the expectational operator, and μ_s, μ_{is}, μ_{md}, and μ_{ms} are stochastic processes describing aggregate supply, spending, money demand, and money supply driving forces. $E\Delta p_{+1}$ is exogenously given.

1. Give the rationale behind the specification of the IS and LM equations.
2. Assume that $m_t = \overline{m} + \mu_{ms}$. What are the effects of a one-period increase in μ_{ms} on the equilibrium in the IS-LM model?
3. Assume μ_{is} is highly volatile in this economy and you want to stabilize output. Derive and explain a simple money supply rule to do that.
4. (**Extra credit**) From a welfare point of view, do you want to stabilize $(y - \mu_s)$ or y?

Some Identification Issues

1. Read the paper. (Don't worry too much about section II.B)
2. Explain the identification strategy the author uses. What are the short-run and long-run restrictions?
3. Explain in words the theoretical/empirical motivation of the identifying restrictions Galí uses. What do you think about them? Criticize them on theoretical and empirical grounds. Can they be tested? How does the author proceed?

Results

1. What are the main results of the paper in terms of monetary policy?
2. Can you use Galí's results to interpret the stylized facts we discussed at the beginning of the course?