Pontificia Universidad Católica de Chile
Facultad de Ciencias Económicas y Administrativas
July 3, 2019

Final exam

Macroeconomía II

Instructions

- The duration of this test is 2 hours.
- **Do not write the answer of two questions on the same sheet** (of course, different items of the same question can be on the same sheet). You can use both sides of each sheet to answer.
- Answers can be written in English or in Spanish.

1 True or False (25 points)

Answer TRUE or FALSE to the following sentences. You must justify your answers.

1. If the central bank wants to reduce inflation, one thing it can do is to use open market operations. To reduce inflation through open market operations, the central bank should sell bonds to the public, increasing the interest rate. (5 points)
2. If the proportion of firms that has fixed prices in an economy increases, then the gap between inflation and expected inflation ($\pi_t - \pi_t^e$) affects less the output gap ($y_t - \overline{y}_t$). (5 points)
3. In an economy with a fixed exchange rate regime and perfect capital mobility, an increase in taxes (T) will be necessarily followed by a reduction of the money supply. (5 points)
4. In the Lucas model of imperfect information, the relationship between output and the price level is determined (among other things) by the volatility of aggregate shocks to the price level and by the volatility of idiosyncratic shocks to the relative prices of each producer (islands). (5 points)
5. Given that agents are rational in the Lucas model, an unexpected increase in the money supply (which leads to an unexpected increase in the price level) will have no real effects. (5 points)

2 IS-LM-PC (25 points)

In the last monetary policy meeting, the Central Bank of Chile (BC) decided to lower the interest rate in 0.5 points, achieving an annual interest rate of 2.5%. This reduction is the largest since 2009,

when the world economy was under the effects of a financial crisis. Among the explanations for that reduction, it was argued that: (i) *"the data available on inflation and economic activity for the second quarter suggests those variables are below market expectations"*; (ii) *"according to new estimates, output is much lower than potential output"*. In this exercise, we want to evaluate the consequences of this reduction in interest rates using the IS-LM-PC model. The 3 equations that describe the economy are:

$$Y = C(Y - T) + I(Y, r) + G \tag{1}$$

$$r = \overline{r} \tag{2}$$

$$\pi - \pi^e = \theta\,(Y - Y_n)\,, \quad \text{with} \quad \theta > 0 \tag{3}$$

The notation is standard: Y denotes output, T denotes taxes, G is government spending, r is the real interest rate, π is inflation, π^e is expected inflation, Y_n is potential output and C and I are the usual functions for consumption and investment, respectively. Equation (1) is the IS relationship, (2) is the LM relationship and (3) is the Phillips curve. From the LM presented, we can conclude that the central bank fixes the real interest rate. To determine π^e, we suppose those are anchored at the inflation target $\overline{\pi}$, that is, $\pi^e = \overline{\pi}$. We denote by r_n the real interest rate consistent with output Y equal to potential output Y_n (in other words, r_n is the natural real interest rate). Finally, denote the initial real interest rate by r_1, and by r_2 the real interest rate after the reduction.

1. Show graphically the adjustment of the economy after the mentioned reduction in the real interest rate using the IS-LM-PC model. In your answer suppose that $r_1 > r_2 > r_n$. (7 points)

2. As a response to the lower expectations of economic growth, recently the ministry for the economy announced a fiscal plan with the objective of *"accelerating projects of public infrastructure, originally planned for 2020, injecting additional fiscal resources of 388 million dollars in the economy."* Assuming $r_1 > r_2 > r_n$, explain and show graphically how the combination of the two mentioned measures in this exercise (fiscal and monetary) could lead output to the level of potential output. Analyze the impact of those measures on the inflation gap $(\pi - \overline{\pi})$. (6 points)

In what follows, suppose that new interest r_2 is equal to the natural real interest rate if potential output is equal to Y_n.

3. Many analysts criticized the reduction in interest rates, classifying it as *"modest"* or *"insufficient"*. They argue that it was based on a wrong measurement of potential output, saying: *"there is a new estimate of potential output, which is 0.25% larger than the one used by the central bank"*. Suppose then that potential output is not Y_n but $Y_n' > Y_n$. Using this new estimate of potential output, evaluate again the impact of the reduction in interest rates on the economy and on the inflation gap $(\pi - \overline{\pi})$. (6 points)

4. After the central bank reduction of interest rates, an academic argued: *The consequences of the reduction of the interest rate on the economy are not obvious. We believe that the central bank is*

over estimating potential output. In fact, we believe that the true potential output is equal to Y_n'', *where* $Y_n'' < Y_n$. Using the academic estimate of potential output, analyze again the reduction in interest rates of the central bank, and its effects on the economy and on the inflation gap $(\pi - \overline{\pi})$. (6 points)

3 Mundell-Fleming (25 points)

To answer the questions below use the Mundell-Fleming model of an open economy. You must always assume that Marshall-Lerner condition holds.

1. Consider a small open economy that has perfect capital mobility and operates under a **flexible** exchange rate regime. Suppose the government increases government spending. How does this shock affects equilibrium output, nominal exchange rates and net exports? Explain using graphs and words. (7 points)

2. Suppose the Federal Reserve of the United States decides to increase the US nominal interest rate. An economist argues that this could trigger a recession in Chile. Is this prediction consistent with the Mundell-Fleming model? Explain using graphs and words. In your answer, consider that Chile is a small open economy that has perfect capital mobility and operates under a **flexible** exchange rate regime. (6 points)

3. Suppose now Chile operates under a **fixed** exchange rate regime, with perfect capital mobility. The domestic currency is the Chilean peso (CLP) and the foreign currency is the US dollar (USD). Moreover:

   - The exchange rate is fixed at one (1 CLP costs 1 USD);
   - Initially the monetary base in Chile is 100 CLP;
   - Initially the Chilean central bank holds 50 USD of (dollars) reserves (those are foreign exchange reserves held by the Central Bank of Chile).

   Explain why the Central Bank of Chile has no control of monetary policy under this fixed exchange rate regime. You must do it by explaining what happens after the Central Bank of Chile decides to buy 10 CLP worth of domestic bonds in an open market operation (say, in an attempt to increase the monetary base). In your answer you must indicate what is the level of the monetary base and the dollar reserves of Central Bank of Chile after the open market operation and after all adjustments have taken place (you should provide the exact number of those variables). (6 points)

4. Consider a small open economy that has perfect capital mobility and operates under a **fixed** exchange rate regime. Suppose the government increases government spending. How does this shock affects equilibrium output? Explain using graphs and words. (6 points)

4 Time inconsistency (25 points)

Suppose the central bank loss function (L) depends on inflation (π) and unemployment (u) and is given by:

$$L = u + \gamma\pi^2, \quad \gamma > 0$$

The Phillips curve in terms of unemployment is:

$$u = u_n - \eta\left(\pi - \pi^e\right), \quad \eta > 0 \tag{PC}$$

where u denotes the unemployment rate, u_n is the natural unemployment rate and π and π^e are inflation and expected inflation, respectively.

1. Find the equilibrium π and L under discretion. (6 points)

2. Find the equilibrium π and L under commitment. (6 points)

In what follows, consider the following modification to the model presented. Suppose the timing is the following:

Stage 1. The central bank announces some inflation π^A;

Stage 2. Agents form their expectations π^e about inflation, to minimize the forecast error $(\pi - \pi^e)^2$;

Stage 3. The central bank fixes the inflation π, and given the inflation chosen unemployment is determined according to the Phillips curve (PC).

We modify the loss function of the central bank, which is now given by:

$$\hat{L} = u + \gamma\pi^2 + \psi\left(\pi - \pi^A\right)^2, \quad \gamma > 0, \quad \psi > 0$$

Notice that we added the term $\psi\left(\pi - \pi^A\right)^2$ to the central bank loss function. It captures, in a reduced form way, the reputation losses of deviating from the announced inflation π^A. Moreover, notice that we are not saying that central bank necessarily needs to honor the announced inflation π^A.

3. Find the equilibrium π, π^A and π^e. (7 points)

4. In equilibrium, does the central bank loss increase or decrease with ψ? Interpret this result. (6 points)