Pontificia Universidad Católica de Chile
Facultad de Ciencias Económicas y Administrativas
April 9, 2018

Midterm exam 1

Macroeconomía II

Instructions

1. The duration of this test is 2 hours.

2. This test has 5 pages. You should also receive an answer sheet with 14 pages plus the "Código de Honor". If you did not receive all of it, ask the TA.

3. Write your name and signature on the "Código de Honor" and on **every page** of the answer sheet on the assigned space (even if you do not use it).

4. On the front page of each sheet of the answer sheet, you must write which question you are answering on that sheet on the assigned space. You can use more than one sheet to answer one question, but **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.

5. Answers can be written in English or in Spanish.

6. Explain clearly what is asked, but do not be wordy. The more you say, the more likely you are to say something wrong, and that will cost you points.

7. This test has 6 points. Your grade will be 1 plus the number of points you get. Good luck!

Question 1 (1 point)

Answer TRUE or FALSE to the following statements. You **do not need to justify** your answers, but **there is a penalty** for wrong answers: **every two items you answer incorrectly cancels one item you answered correctly** (as long as you have items answered correctly to cancel, of course). Therefore, 1 mistake costs you nothing; 2 or 3 mistakes costs you 1 right item; 4 mistakes costs you 2 right items. Thus, it may be optimal not to answer some questions if you are not sure.

1. In an economy in which people only use currency to make transactions, the money multiplier is zero. (1/6 points)

2. According to the Baumol-Tobin model, an increase in the cost of going to the bank will increase the elasticity of the money demand with respect to the interest rate. (1/6 points)

3. Suppose the velocity of money is constant in time. According to the quantitative theory of money, a country with a positive growth rate of the money supply will always have a positive inflation rate. (1/6 points)

4. According to what you a read in a "Parable of Macroeconomics", if all of a sudden everyone has a desire to spend less, a decrease in the quantity of money makes everyone better off, by adjusting the quantity of money to the lower level of desired spending. (1/6 points)

5. When the central banks buys \$50 in bonds from the public and at the same time buys \$50 in foreign exchange, the monetary base increases. (1/6 points)

6. Suppose a country has a money demand function $M^d/P = \kappa y$, where $\kappa > 0$ is a constant parameter and y is real income (y is exogenous does not depend on the money demand). Thus, a higher κ implies a lower velocity of money. (1/6 points)

Question 2 (1 point)

Suppose an economy has two types of deposits: demand deposits (D_v) and savings deposits (D_p). We define the money aggregate $M1$ as the sum of demand deposits and currency (C), that is, $M1 \equiv D_v + C$. We define the money aggregate $M2$ as $M2 \equiv M1 + D_p$. The monetary base is given by $H \equiv C + R$, where R denote total reserves in the banking sector. The total amount of deposits D is given by $D \equiv D_v + D_p$. Assume agents always keep a ratio of currency (C) to total deposits (D) equal to 1/4, that is:

$$\frac{C}{D} = \frac{1}{4}.$$

Moreover, the ratio of demand deposits to total deposits and savings deposits to total deposits is constant and given by

$$\frac{D_v}{D} = \frac{3}{4} \quad \text{and} \quad \frac{D_p}{D} = \frac{1}{4}.$$

Banks keep a ratio of reserves (R) to total deposits equal to some number $\theta \in (0,1)$:

$$\frac{R}{D} = \theta.$$

1. Compute the $M1$ money multiplier (that is $M1/H$) as a function of θ. (1/3 points)

2. Compute the $M2$ money multiplier (that is $M2/H$) as a function θ. (1/3 points)

3. Find a condition that implies a $M1$ money multiplier smaller than one. (1/3 points)

Question 3 (2 points)

Consider an economy in which there is a single good that can be used as capital or for consumption. Time is discrete and indexed by $t \in \{-1, 0, 1, 2, ...\}$. Consider the following problem of the representative household:

$$\begin{aligned}
\max_{\{c_t, k_t, B_t, M_t\}_{t \geq 0}} \quad & \sum_{t=0}^{\infty} \beta^t u\left(c_t\right) \\
\text{s.t.} \quad & P_t c_t + P_t k_t + B_t + M_t = P_t f(k_{t-1}) + (1 + i_{t-1}) B_{t-1} + M_{t-1} + (1-\delta) P_t k_{t-1} + T_t, \quad \forall t \geq 0 \\
& \psi P_t c_t \leq M_{t-1} + T_t, \quad \forall t \geq 0 \\
& k_{-1} = \overline{k} > 0,\ B_{-1} = \overline{B} > 0,\ M_{-1} = \overline{M} > 0 \\
& \lim_{t \to \infty} \left(B_t / P_t\right) = 0, \\
& k_t, c_t, M_t \geq 0, \quad \forall t \geq 0.
\end{aligned}$$

The notation is standard and is the same used in class: $u(c)$ is the instantaneous utility function; $f(k)$ is the production function; P_t denotes the price of the good at date t; B_t is the nominal amount of bonds the household chooses to hold at date t; M_t is the quantity of money he chooses to carry from date t to date $t+1$; i_t is the nominal interest rate between dates t and $t+1$; c_t is the household consumption at date t; k_t is the amount of capital he carries from date t to $t+1$; T_t are cash transfers received at date t; $\beta \in (0,1)$ is the discount factor and $\delta \in (0,1)$ is the depreciation rate of capital. Define $b_t \equiv B_t/P_t$, $m_t \equiv M_t/P_t$, $\pi_t \equiv (P_t - P_{t-1})/P_{t-1}$,$\tau_t \equiv T_t/P_t$ and let r_t denote the real interest rate between dates t and $t+1$.

The constraint $\psi P_t c_t \leq M_{t-1} + T_t$ is interpreted as a standard cash-in-advance constraint, except that now only a fraction $\psi \in (0,1)$ of the household consumption is purchased using cash.

In what follows, assume that $u(\cdot)$ and $f(\cdot)$ satisfy all the usual assumptions that guarantee an unique interior solution (and thus the non-negativity constraints $k_t, c_t, M_t \geq 0$ never bind in the optimal choice and you can ignore them). Moreover, assume the cash-in-advance constraint binds at all dates in the optimal solution (which is true if $i_t > 0$, for every t). There is no uncertainty and the household takes as given the path of all exogenous variables.

1. Rewrite the budget constraint and the cash-in-advance constraint in real units (that is, in terms of only the real variables $\{c_t, k_t, b_t, m_t, r_t, \tau_t\}_{t\geq 0}$ and the inflation rate $\{\pi_t\}_{t\geq 0}$). (Tip: use the Fisher equation to get rid of nominal interest rates). (0.5 points)

2. Denote by $\{\lambda_t\}_{t\geq 0}$ the Lagrange multipliers associated to the budget constraint and by $\{\mu_t\}_{t\geq 0}$ the Lagrange multipliers associated to the cash-in-advance constraint. Write down the Lagrangian using the budget constraints in real units and derive the first order conditions for c_t, k_t, b_t and m_t. (0.5 points)

3. In the optimal solution we get the following Euler equation:

$$\frac{u'(c_t)}{u'(c_{t+1})} = \beta\,(1 + r_t)\,h(i_{t-1}, i_t, \psi)$$

   where $h(i_{t-1}, i_t, \psi)$ is a function of i_{t-1}, i_t and ψ. Derive the functional form of $h(i_{t-1}, i_t, \psi)$. (0.5 points)

4. Interpret economically the Euler equation you found in the previous item when $\psi = 1$. (Tip: you may find useful to rearrange the equation before your interpret it.) (0.5 points)

Question 4 (1 point)

In the money in the utility function model (without labor) seen in class, we have shown under the optimal choice of money and consumption, the following equation holds:

$$\frac{u_m\,(c_t, m_t)}{u_c\,(c_t, m_t)} = \frac{i_t}{1 + i_t}, \tag{1}$$

where $u_m(c_t, m_t)$ and $u_c(c_t, m_t)$ denote the marginal utility of real money balances (m_t) and consumption (c_t), respectively, and i_t denotes the nominal interest rate. We also know that the household choice satisfies a standard Euler equation:

$$u_c(c_t, m_t) = \beta\,(1 + r_t)\,u_c(c_{t+1}, m_{t+1}). \tag{2}$$

1. Show that the household choice satisfies:

$$u_m(c_t, m_t) = \frac{i_t}{1+\pi_{t+1}} \beta u_c(c_{t+1}, m_{t+1}).$$

   Interpret this equation. (0.5 points)

2. Assume that $u(c,m) = \ln c - (m-5)^2$. What is the nominal interest rate and inflation rate that maximize the representative household utility in the steady state? If the nominal interest rate is chosen to maximize the household's utility at the steady state, how much money is demanded at the steady state? Provide an intuition for the optimal nominal interest rate. (Tip: remember that money is superneutral in this model.) (0.5 points)

Question 5 (1 point)

Consider the basic Cagan's model in which the log of the price level (p_t) and the log of the money supply (m_t) satisfy the following difference equation:

$$m_t - p_t = -\eta (p_{t+1} - p_t) \tag{1}$$

where is a constant larger than zero. For simplicity, suppose that m_t is constant and equal to $\tilde{m}$, for every t. We know that a solution to (1) is given by

$$p_t = \frac{1}{1+\eta} \sum_{i=0}^{\infty} \left(\frac{\eta}{1+\eta} \right)^i m_{t+i} = \tilde{m}$$

The solution above is called the fundamental solution, but we know that there are other solutions to (1). Answer the questions below:

1. Propose another (non-fundamental) solution and show that it also satisfies (1). (0.5 points)

2. Discuss the economic intuition behind the non-fundamental solutions in which prices increase over time, even though the money supply is constant. (Tip: you may want to start with *"Suppose everyone expects prices to increase a lot in the future. Then..."*) (0.5 points)