

Name: \_\_\_\_\_ . Code: \_\_\_\_\_

**Nova School of Business and Economics**  
**Macroeconomics, 1103 - 1st Semester 2012-2013**  
**Prof. André C. Silva**  
**TA: João Morgado**

## **Midterm 2**

Maximum points: 20. Time: 1h. Pages: 10.

The exam is closed books, closed notes. No calculators are allowed. Answer the questions in the space provided. Indicate if you need to use the back of the pages.

1. (2 pts) What is the evidence about the relation between money growth and inflation? Explain.

2. (2 pts) Fill in the spaces below or circle the correct answer.

a. \_\_\_\_\_ are the main mechanism of fluctuations in real business cycle models.

b. \_\_\_\_\_ imply non-neutrality of money in New Keynesian models.

c. According to the Solow growth model, a permanent increase in the savings rate implies a (permanent / temporary) increase in the output growth rate.

d. Suppose that current government expenditures increase. The predicted effect of this change is (a decrease / approximately no change / an increase) in interest rates.

3. (2 pts) The figure below shows the evolution of exports and imports as a percentage of GDP for Portugal. The data is quarterly and is from the Bank of Portugal.
- a. (1 pt) Indicate in the graph which line corresponds to exports over GDP and which line corresponds to imports over GDP.
- b. (1 pt) Discuss the behavior of the trade deficit from 2008 for Portugal.



4. (6 pts) Suppose that an economy is initially in a long-run equilibrium with output  $Y_1$ , interest rates  $r_1$ , price level  $N_1$ , real wages  $w_1$ , and money supply  $M_1$ . Then, the central bank decreases the interest rate to  $r_2$ ,  $r_2 < r_1$ .
- a. (4 pts) In accordance to the New-Keynesian model, obtain the predicted effects of this change on output, wages, and employment. Use diagrams to answer.

(Additional Space)

b. (2 pts) According to the predictions, is employment countercyclical or procyclical?  
Does this prediction agree with the data?

5. (8 pts) The consumers in an economy have preferences

$$u(c, l) = \log c + \log l, \quad (1)$$

where  $c$  and  $l$  denote consumption and leisure. Total time available is  $h$ . The consumers obtain consumption with the technology

$$c = zN, \quad (2)$$

where  $N = h - l$  is hours worked and  $z$  is the productivity. Government consumption and taxes are equal to zero.

a. (4 pts) What will be the choices of consumption and labor in this economy?

(Additional Space)

b. (4 pts) Suppose that  $z$  grows at a constant rate  $g$ . That is,  $\frac{z_{t+1}}{z_t} = 1 + g$ . How will be the evolution of consumption and hours of work over time?

(Additional Space)

## SOLUTION SKETCH

1. (2 pts) What is the evidence about the relation between money growth and inflation? Explain.

**Answer**

The evidence is that money growth is strongly correlated with inflation. Especially long run money growth and long run inflation. The correlation is such that an increase of one percentage point in the growth rate of money is related to a one percentage point increase in the rate of inflation. That is, the correlation is close to one. This evidence is analyzed in the study of McCandless and Weber, mentioned in class. See the slides on Money and Inflation for a graph that summarizes the relation between money growth and inflation.

2. (2 pts) Fill in the spaces below or circle the correct answer.

**Answer**

Productivity shocks are the main mechanism of fluctuations in real business cycle models.

Sticky prices imply non-neutrality of money in New Keynesian models.

According to the Solow growth model, a permanent increase in the savings rate implies a temporary increase in the output growth rate.

Suppose that current government expenditures increase. The predicted effect of this change is an increase in interest rates.

3. (2 pts) The figure below shows the evolution of exports and imports as a percentage of GDP for Portugal. The data is quarterly and is from the Bank of Portugal.

a. (1 pt) Indicate in the graph which line corresponds to exports over GDP and which line corresponds to imports over GDP.

**Answer**

The line on the top shows the data for Imports and the line on the bottom shows the data for Exports.

b. (1 pt) Discuss the behavior of the trade deficit from 2008 for Portugal.

**Answer**

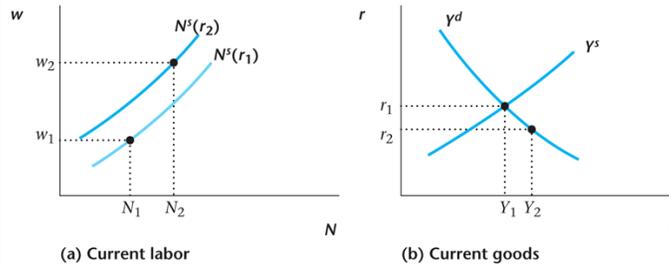
Exports have been increasing sharply since 2008, at a faster rate than imports. As a result, the trade deficit has been decreasing since 2008.

4. (6 pts) Suppose that an economy is initially in a long-run equilibrium with output  $Y_1$ , interest rates  $r_1$ , price level  $N_1$ , real wages  $w_1$ , and money supply  $M_1$ . Then, the central bank decreases the interest rate to  $r_2$ ,  $r_2 < r_1$ .

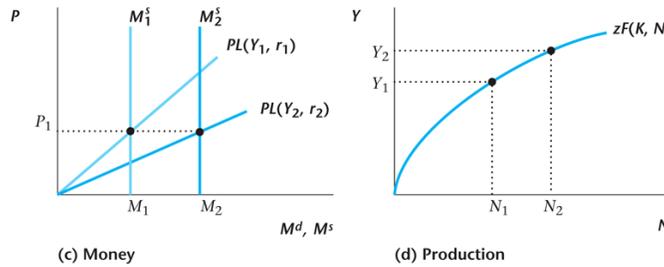
a. (4 pts) In accordance to the New-Keynesian model, obtain the predicted effects of this change on output, wages, and employment. Use diagrams to answer.

**Answer**

The graphs that describe the situation of this economy are below, reproduced from chapter 13 of the book. Following the assumptions of the New-Keynesian model, prices are sticky at  $P_1$ . From the interest rate  $r_1$ , the central bank decreases the interest rate to  $r_2$ . As prices are sticky, this change affects real interest rates represented in the goods markets. Given the smaller interest rates, the demand changes to a higher output  $Y_2$ .  $Y_2$  is not given by the supply, as  $Y_2$  is not the optimal response of firms under  $r_2$ . This is so because prices cannot change. The equilibrium is given by  $Y^d$  rather than by  $Y^s$ .



To obtain employment to allow the supply of  $Y_2$ , use the diagram  $Y \times N$ . According to this diagram, employment increases to  $N_2$ . Given  $N_2$ , using the supply curve for labor  $N^s$ , wages increase to  $w_2$ . Notice that  $N^s$  shifts to the left, as the interest rate decreased from its initial level.



We have already obtained the effects on output, wages, and employment, which suffices to answer the question. For completeness, the effects on money and the average labor productivity can be obtained by graphs c and d. Using graph c, on the money market, we have that money supply increases to reestablish the equilibrium

at  $M_2$ . Note that the demand for money increased by the combined effects of the increase in  $Y$  and decrease in  $r$ . With graph d, we have that a straight line from the origin has a smaller slope when its final point from  $N_1$  to  $N_2$ . So, average labor productivity decreases.

b. (2 pts) According to the predictions, is employment countercyclical or procyclical? Does this prediction agree with the data?

**Answer**

The model predicts that output will increase and that employment will increase. Therefore, output and employment will increase at the same time: employment is predicted to be procyclical. The data also show that employment is procyclical. So, this prediction agrees with the data.

5. (8 pts) The consumers in an economy have preferences

$$u(c, l) = \log c + \log l, \quad (1)$$

where  $c$  and  $l$  denote consumption and leisure. Total time available is  $h$ . The consumers obtain consumption with the technology

$$c = zN, \quad (2)$$

where  $N = h - l$  is hours worked and  $z$  is the productivity. Government consumption and taxes are equal to zero.

a. (4 pts) What will be the choices of consumption and labor in this economy?

**Answer**

The consumers in this economy will solve the problem

$$\begin{aligned} \max_{c,l} \quad & \log c + \log l \\ \text{s.t.} \quad & c = z(h - l). \end{aligned} \quad (3)$$

Substituting  $c = z(h - l)$  in the objective function, the problem simplifies to

$$\max_l \log z + \log(h - l) + \log l. \quad (4)$$

The first order condition of this problem is

$$-\frac{1}{h - l} + \frac{1}{l} = 0 \quad (5)$$

which implies

$$\frac{1}{h - l} = \frac{1}{l} \Rightarrow l = h - l \quad (6)$$

$$l^* = \frac{h}{2}. \quad (7)$$

Hours worked are given by  $N^* = h - l^*$ . Therefore,

$$N^* = \frac{h}{2}. \quad (8)$$

Consumption is given by  $c^* = zN^*$ , so

$$c^* = z\frac{h}{2}. \quad (9)$$

b. (4 pts) Suppose that  $z$  grows at a constant rate  $g$ . That is,  $\frac{z_{t+1}}{z_t} = 1 + g$ . How will be the evolution of consumption and labor over time?

**Answer**

Given the results above, hours of work do not depend on  $z$ . The substitution and the income effects on labor cancel each other. On the other hand, consumption is proportional to  $z$ .

Therefore,  $N = \frac{h}{2}$ , constant. Labor will be constant over time, even though  $z$  increases.

For consumption, as  $c = z\frac{h}{2}$ , we have that  $\frac{c_{t+1}}{c_t} = \frac{z_{t+1}h/2}{z_t h/2} = \frac{z_{t+1}}{z_t} = 1 + g$ . So, consumption will increase at the rate  $g$ , the same rate of the improvement of the technology.