

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

**Nova School of Business and Economics**  
**Macroeconomics 1103, 2013-2014, 1st Semester**  
**Prof. André C. Silva**  
**TAs: João Vaz, Paulo Fagandini, and Pedro Freitas**

**Problem Set 1**

Due Date: October 4, Friday

Turn in your problem set at Biblioteca 3, by 17:00

**Turning in the problem sets is optional.** The problem sets can be done in groups, but they have to be turned in individually.

To facilitate the organization of problem sets, please turn in your problem set with your name and code filled out as above, on the top of the first page. You may use this page as a cover page of your problem set.

1. Use the links at the course webpage or other sources to work with data in macroeconomics

a. Choose a data series of your interest. GDP or money over time, for example. The data can be for Portugal or for any other country. You can also work with international comparisons. You decide. The only restriction is that the series be related to macroeconomics. The series must have a reasonable size. At least ten periods. 50 periods is a good number. Use Excel or another program of your choice.

b. Write the reason why you found this series important for macro.

c. Analyze the series. Make a graph of the variable over time. Is it good to use logs in your case? Is it possible to see different growth rates over time? Calculate them. Is it possible to relate the fluctuations of your series with fluctuations of other series? Explain.

2. Download the series for real and nominal GDP and expenditure components from the site of the Bank of Portugal. Transform the series with logarithms. Calculate the correlations of the different components and GDP. What do you obtain? It can be interesting to use a moving average or another method to remove the trend of the series before calculating the correlations, but this is not mandatory for this exercise.

3. Growth rates, logarithms.

a. Explain how the use of logarithms can help to analyze data. Give examples.

b. “If a variable grows at  $x$  percent per year, then its value doubles each  $70/x$  years.” Justify this rule.

4. Consider a consumer with utility function  $\log c + \log l$ , where  $c$  denotes consumption and  $l$  denotes leisure.

a. Draw the indifference curves of this consumer in the diagram  $c \times l$  ( $l$  in the horizontal axis).

b. Let  $h$  denote total time available. Suppose that the consumer has a unit of consumption,  $c = 1$ , and uses half of the time available as leisure,  $l = h/2$ . To keep the welfare of this consumers, how many units of consumption the consumer has to receive for the decrease of one unit of leisure? And when  $l = h/10$ ? Is there any difference? Explain.

Consider the budget constraint  $c \leq w(h - l) + \pi - T$ , where  $w$  denotes the wage rate for unit of work,  $\pi$  denotes profits, and  $T$  denotes taxes,  $\pi - T > 0$ .

c. Draw a graph with the budget constraint and the indifference curves. Show in your graph the choice of consumption and labor. Justify.

5. As in the setup above, a consumer has preferences

$$\log c + \log l,$$

where  $c$  and  $l$  denote consumption and leisure and the budget constraint is given by

$$c \leq wN^s + \pi - T,$$

where  $w$  denotes wages,  $N^s = h - l$  labor supply,  $\pi$  profits, and  $T$  taxes.

a. Show the income effect implied by an increase in  $\pi - T$ . Use the diagram  $c \times l$ .  $l$  in the horizontal axis.

b. Show the substitution and income effects implied by an increase in  $w$ . Use another diagram  $c \times l$ .

c. Obtain the values of  $c$  and  $l$  that this consumer will probably choose. Is the substitution effect stronger than the income effect for  $N^s$ ? Does your answer change if  $\pi - T = 0$ ? Explain.