

Problem Set 1

ECON 30020: Intermediate Macroeconomics

Professor Sims

University of Notre Dame, Spring 2018

Instructions: You may work on this problem set in groups of up to four people. Should you choose to do so, please make sure to legibly write each group member's name on the first page of your solutions. This problem set is due in class on Thursday January 25.

1. GLS, Appendix A, Exercises 1-4
2. GLS, Chapter 1, Questions 5-8
3. GLS, Chapter 1, Exercises 1 and 3
4. **The Rule of 70:** Suppose that you have some variable, call it X , that is growing at a constant rate, call it g . The value of the variable in period $t + h$ relative to its value in period t is then:

$$X_{t+h} = (1 + g)^h X_t$$

This problem will ask you to work through the proof of a useful result called the “rule of 70.” In particular, we want to find an expression for the number of periods, h , it takes for a variable to double.

- (a) The rule of 70 states that the number of years it takes for a variable to double is approximately 70 divided by the growth rate written in percentage terms. If the variable is growing at 2 percent per year, this would mean $g = 0.02$, and the rule of 70 would say that the number of years it takes the variable X to double is approximately $\frac{70}{100 \times g}$. Show how the rule of 70 is derived (hints: take logs and use the approximation that $\ln(1 + g) \approx g$).
- (b) According to the rule of 70, how many years would it take a variable to double if that variable is growing at annual rates of 2, 5, 7, 10, and 20 percent?
- (c) Let's now check how accurate the rule of 70 is. Create an Excel file. Create a column labeled “Period” and have the periods (entered in rows of this column) run from 0 (the first period) to 100 (the last period). Assume that the variable X takes on a value of 1 in period 0 and grows at constant growth rates of 2, 5, 7, 10, and 20 percent. In your Excel file, calculate how many years it actually takes for the variable to double and compare it to your answers from the rule of 70 in part (b).