

## Homework 2 Solution

ECON203: Macroeconomics 2

Semester 2, 2019

Australian Catholic University

Student Name:

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## True/False Questions

Consider each of the following statements. Say whether you believe the statement is true or false. Briefly explain your answer in words. Note that most of the marks will be given for the explanation.

**Question 1.** [20 marks] TFP is the only source driving the growth in economy-wide real GDP and real GDP per capita.

**False.** In Solow model, TFP is the only source driving the real GDP per capita growth. Population growth can also lead to real GDP growth. In endogenous growth models, factors such as savings rate can also drive long-run economic growth.

## Problem Solving Questions

**Question 2.** [80 marks] Suppose that the economy-wide expected future marginal product of capital is  $MPK^f = 20 - 0.02K$  where  $K$  is the future capital stock. The depreciation rate of  $K$  is 20%. The current capital stock is 900 units of capital and the price of a unit of capital is 1 unit of output. Firms pay 15% taxes of their output. The consumption function is

$$C = 100 + 0.5Y - 200r$$

where  $C$  is consumption,  $Y$  is output and  $r$  is the real interest rate. Government purchases equal 200 and full-employment output is 1000.

(a) [40 marks] Suppose that the real interest rate is 10% per period. What are the values of the tax-adjusted user cost of capital, the desired future capital stock, and the desired level of investment?

$r = 0.1$ ,  $d = 0.2$ , and  $p_K = 1$ . **The tax-adjusted user cost is**

$$\frac{(r+d)p_K}{1-\tau} = \frac{0.1+0.2}{0.85} = \frac{6}{17}$$

**To pin down the desired future capital stock,**

$$\begin{aligned}(1-\tau)MPK^f &= (r+d)p_K \Rightarrow 0.85(20 - 0.02K) = 0.3 \\ \Rightarrow 17 - 0.017K &= 0.3 \Rightarrow K = \frac{16.7}{0.017} \simeq 982\end{aligned}$$

**The desired investment is**

$$I^d = 982 - 900(1 - 0.2) = 262$$

(b) [40 marks] Now consider the real interest rate determined by goods market equilibrium.

i. [20 marks] Write the tax-adjusted user cost of capital as a function of the real interest  $r$ . Also write the desired future capital stock and desired investment as function of  $r$ .

**The tax-adjusted user cost of capital is**

$$\frac{(r+d)p_K}{1-\tau} = \frac{0.2+r}{0.85}$$

**the desired future capital stock is pinned down by**

$$\begin{aligned}(1 - \tau)(20 - 0.02K) &= (r + d)p_K \\ \Rightarrow 17 - 0.017K &= r + 0.2 \\ \Rightarrow K &= \frac{16.8-r}{0.017}\end{aligned}$$

**the desired investment is**

$$\begin{aligned}I^d &= \frac{16.8-r}{0.017} - 900(1 - 0.2) \\ \Rightarrow I^d &= \frac{16.8-r}{0.017} - 720\end{aligned}$$

ii. [20 marks] Use the investment function derive in Part (i) along with the consumption function and government purchases, to calculate the real interest rate that clears the goods market. What are the goods market-clearing values of consumption, savings and, investment?

**Given the desired consumption function  $C^d = 100 + 0.5Y - 200r$ ,  $G = 200$  and  $Y = 1000$  full-employment. National savings**

$$S^d = Y - C^d - G = 200 + 200r$$

**Let savings equal investment we pin down  $r$**

$$\begin{aligned}S^d = I^d &\Rightarrow 200 + 200r = \frac{16.8-r}{0.017} - 720 \\ \Rightarrow (200 + \frac{1}{0.017})r &= \frac{16.8}{0.017} - 920 \\ \Rightarrow 259r &= 68 \\ \Rightarrow r &= 0.26\end{aligned}$$