EC 450 Advanced Macroeconomics Instructor: Sharif F. Khan Department of Economics Wilfrid Laurier University Winter 2008

# Assignment 2 (OPTIONAL)

## **Total Marks: 50**

### Part A

#### **Short Questions**

[20 marks]

For the question A1 only:

Explain why the following statement is True, False, or Uncertain according to economic principles. Use diagrams and / or numerical examples where appropriate. Unsupported answers will receive no marks. It is the explanation that is important. Each question is worth 10 marks.

- A1. In the general Solow model, an increase in the savings rate raises the long-run growth rate of aggregate output per worker. [Diagrams required]
- A2. Consider a general Solow economy on its balanced growth path. Assume that the production function is Cobb-Douglas:

$$Y_t = K_t^{\lambda} (A_t N_t)^{1-\lambda}, \qquad 0 < \lambda < 1,$$

where Y is aggregate output, K is the stock of aggregate capital, N is total labor and A is the effectiveness of labor. Assume that N and A grow exogenously at constant rates n and g, respectively. Suppose the growth accounting techniques are applied to this economy.

- (a) What fraction of growth in output per worker does growth accounting attribute to growth in capital per worker? What fraction does it attribute to technological progress? [5 marks]
- (b) How can you reconcile your results in (a) with the fact that the general Solow model implies that the growth rate of output per worker on the balanced growth path is determined solely by the rate of technological progress? [5 marks]

#### Part B

Read each part of the question very carefully. Show all the steps of your calculations to get full marks.

#### B1. [30 Marks]

Consider a general Solow economy with labor-augmenting technological progress.  $Y_t = K_t^{\lambda} (A_t N_t)^{1-\lambda}, \qquad 0 < \lambda < 1,$ 

where Y is aggregate output, K is the stock of aggregate capital, N is total labor and A is the effectiveness of labor. Assume that L and A grow exogenously at constant rates n and g, respectively. Capital depreciates at a constant rate  $\delta$ . Denote with lower case letters the variables in unit of effective labor. That means,

$$\tilde{y} \equiv \frac{Y}{AL}$$
 and  $\tilde{k} \equiv \frac{K}{AL}$ .

The evolution of aggregate capital in the economy is given by

$$K_{t+1} - K_t = sY_t - \delta K_t$$

where s is a constant and exogenous saving rate.

- (a) Derive the law of motion, or the transition equation, for capital per effective worker. What is the economic interpretation of this equation? Plot the transition equation in a diagram. Explain how the level of capital per worker will converge to the steady state value from a given positive initial value. [7 marks]
- (b) Solve for the steady state equilibrium values of capital per effective worker, output per effective worker, consumption per effective worker, the real rental rate for capital and the real wage rate for labor. Illustrate the steady-state equilibrium values of capital per effective worker, output per effective worker and consumption per effective worker in a diagram. [7 marks]
- (c) Find the growth rates of capital per effective worker, output per effective worker, output per labor, capital per labor, aggregate output and aggregate capital on the balanced growth path. [6 marks]

- (d) Find the elasticity of the steady state equilibrium value of output per worker with respect to the saving rate. For an empirically reasonable value of the capital share discuss whether the steady state prediction of the general Solow model about the influences of the saving rate on output per worker is consistent with the data. [3 marks]
- (e) Find the golden rule savings rate and the golden rule level of capital per effective worker. Solve for the steady state equilibrium values of output per effective worker and consumption per effective worker assuming that the exogenous saving rate is equal to the golden rule savings rate. Illustrate the golden rule levels of capital per effective worker, output per effective worker and consumption per effective worker in a diagram. [7 marks]