ME2708 Economic Growth

Assignment 4
Natural Resources and Growth

Deadline: May 15, 2018 at 13:15[†]

Instructions

You must solve all exercises in this assignment. Grading is according to the **P-F** scale, but demands are high. You are allowed to work in groups of (*maximum*) three persons; individual work is not only acceptable but also encouraged. When you are asked to derive something, you must show *mathematically* how you came with the given answer[1]. Presentations in exercise classes are voluntary.

Something you might appreciate to know is that, according to previous experience, students who do not intensively work on the assignments struggle to pass this course. The nice thing, however, is that this practice handsomely pays off in the written examination.

[†]Submission of solutions may be done either in person at the beginning of the class or by email to luis.perez@indek.kth.se.

[1]Providing only final answers implies failure of the assignment.

1 Growth with Natural Resources

Consider the following model with natural resources and land:

$$Y(t) = F[K(t), X(t), E(t), A(t)L(t)] = K(t)^{\alpha} X(t)^{\beta} E(t)^{\gamma} [A(t)L(t)]^{1-\alpha-\beta-\gamma} \tag{1}$$

where $\alpha, \beta, \gamma > 0$ are the factor income shares of capital, land and nonrenewables, respectively. Important to know is that,

$$E(t) = s_E R(t), \quad 0 < s_E < 1$$

The remaining set of equations that is needed to solve the model is:

$$\dot{K}(t) = sY(t) - \delta K(t), \quad 0 < \delta < 1 \tag{2}$$

$$\dot{X}(t) = 0 \tag{3}$$

$$\dot{R}(t) = -E(t) \tag{4}$$

$$\dot{L}(t) = nL(t), \quad n > 0 \tag{5}$$

$$\dot{A}(t) = g_A A(t), \quad g_A > 0 \tag{6}$$

This exercise asks you to solve:

(i) Find the growth rate of aggregate output along a BGP

(ii) Find the growth rate of output per capita along a BGP

(iii) To calculate how large the growth drag is along a BGP, i.e. how much smaller is the growth rate of output per worker due to land being fixed and natural resources finite?

2 Returns to Scale

In slide 9 of this course's Lecture 9 you are asked to show that the given production function exhibits constant returns to scale in capital, energy and labor, when these factors are treated as influenceable inputs in production. What typed or returns to scale does the same production function exhibit when technology is treated, also, as an influenceable input?

3 Energy in a CES Production Function

Solve exercise 6 in chapter 10 of Jones' book (page 255).

Further Exam Prep.

You can find additional exercises in the corresponding Chapter(s) in the main (Jones') textbook of this course.