

# Intermediate Macro In-Class Problems

## Exploring Romer Model

June 14, 2016

Today we will explore the mechanisms of the simply Romer model by exploring how economies described by this model would react to exogenous changes. First, recall this summary of the Romer model:

$$\begin{aligned} \text{Production : } Y_t &= A_t L_t^y \\ \text{Technological Dynamics : } \Delta A_{t+1} &= \bar{z} A_t L_t^a \\ \text{Resource Constraint : } L_t^y + L_t^a &= \bar{L} \\ \text{Labor Allocation Rule : } L_t^a &= \bar{l} \bar{L} \end{aligned}$$

And the model solution:

$$\begin{aligned} L_t^a &= \bar{l} \bar{L} \\ L_t^y &= (1 - \bar{l}) \bar{L} \\ A_t &= (1 + \bar{z} \bar{l} \bar{L})^t A_0 \\ Y_t &= (1 - \bar{l}) (1 + \bar{z} \bar{l} \bar{L})^t A_0 \bar{L} \end{aligned}$$

## 1 Labor Force

Analyze the effects of a government policy encouraging immigration in the context of the Romer model.

Remember, any proper analysis of policy in a macro model will evaluate the impact of the policy on every aspect of the model – typically, the model parameters, but occasionally also the functional forms (themselves a higher-dimensional parameter).

### Identifying Model Parameters

What are the parameters of the Romer model? What are the quantities that are taken as given, and which are allowed to change as a result of agents' behavior?

## Evaluating the Policy

What is the potential effect of the immigration policy on each of the parameters you identified above?

## 2 Reallocation of Labor

Analyze the effects of a government policy which subsidizes research in the context of the Romer model.

What is the potential effect of the immigration policy on each of the parameters you identified above?

## 3 Textbook Exercises

### 6.1

Explain whether the following goods are rivalrous or nonrivalrous:

1. Beethoven's Fifth Symphony
2. An iPod
3. Monet's painting *Water Lilies*
4. The method of public key cryptography (RSA)
5. Fish in the ocean

### 6.2

Suppose a new piece of computer software – say a word processor with perfect speech recognition – can be created for a onetime cost of \$100 million. Suppose that once it's created, copies of the software can be distributed at a cost of \$1 each.

1. If  $Y$  denotes the number of copies of the computer program produced and  $X$  denotes the amount spent on production, what is the production function; that is, the relation between  $Y$  and  $X$ ?
2. Make a graph of this production function. Does it exhibit increasing returns? Why or why not?
3. Suppose the firm charges a price equal to marginal cost (\$1) and sells a million copies of the software. What are its profits?
4. Suppose the firm charges a price of \$20. How many copies does it have to sell in order to break even? What if the price is \$100 per copy?
5. Why does the scale of the market – the number of copies the firm could sell – matter?

## 6.8: A variation on the Romer model

Consider the following variation:

$$\begin{aligned}Y_t &= A_t^{\frac{1}{2}} L_t^y \\ \Delta A_{t+1} &= \bar{z} A_t L_t^a \\ L_t^y + L_t^a &= \bar{L} \\ L_t^a &= \bar{l} \bar{L}\end{aligned}$$

There is only a single difference: we've changed the exponent on  $A_t$  in the production of the output good so that there is now a diminishing marginal product to ideas in that sector.

1. Provide an economic interpretation for each equation.
2. What is the growth rate of knowledge in this economy?
3. What is the growth rate of output per person in this economy?
4. Solve for the level of output per person at each point in time.