

Exam 1

(I) Basic Solow Model *with* population growth (*without* technological change)

Answer the following questions using the model presented in class.

(1) (12 pts)

Draw a diagram to identify the level of **capital per worker** at the Balanced Growth Path (BGP).

What is the growth rate of **output per worker** at the BGP?

What is the growth rate of **consumption per worker** at the BGP?

What is the growth rate **total output** at the BGP?

(2) (12 pts) Suppose the economy is at the BGP and unexpectedly receives a large gift of capital.

What will happen to the **growth rate of capital per worker** in the periods immediately following the gift?

What will happen to the **level of capital per worker** at the BGP? Justify.

What will happen to the **growth rate of output per worker** at the BGP?

(II) Basic Solow Model (*without* population growth and *without* technological change)

Consider a particular example of the Solow Model Economy:

Output per worker as a function of capital per worker: $y = k^{1/3}$

Depreciation rate: $\delta = 0.10$ Population Growth: $n=0$

Savings rate: $s = 0.333$

I calculated that in this case, the level of capital per worker at the BGP is 6.08.

Answer the following questions :

(1) (6 pts) Suppose the initial level of capital per worker (k_0) is 4. Do you think that the growth rate of **capital** per worker in period zero will be positive, negative or zero? Justify (no calculations needed).

(2) (12 pts) Assume that the **savings rate decreases**.

What will happen to the level of **output per worker** along the BGP? What will happen to the level of **consumption per worker** along the BGP? Justify using a diagram and a clear explanations.

(III) Solow Model With Labor Augmenting Technological Change and Population Growth

Answer the following question using the model presented in class.

(10 pts) Consider the case of two countries (Country A and Country B) that are identical in every respect except that the rate of population growth is higher in country A than in country B

(i.e., $n_A > n_B$).

Compare the output per effective unit of labor (Y/AL) at the BGP in both countries.

Compare the growth rate of output per worker at the BGP in both countries.

(IV) Growth Accounting/ Catching up

The table below present estimates of the growth of output, capital and labor during roughly 20 years for Hong Kong (i.e. it presents Y, K and L for the period). Assume as always that the production function for each country can be written as: $Y = A K^\alpha L^{1-\alpha}$.

We also know that the capital shares (α) is: $\alpha_{HK} = 0.38$

Country/Time Period	Estimates of Growth of		
	Output	Labor	Capital
Hong Kong 1971-1990	1.47	0.55	1.6

Remark: Notice that these are large numbers because we are talking about growth in a 20 year period.

Answer the following questions:

- (1) (6 pts) Calculate TFP growth.
- (2) (4 pts) How important was the contribution of : (a) inputs (i.e. capital and labor together) and (b) total factor productivity to the growth of output.
- (3) (4 pts) Look now at Figure 1.11 where the data for Hong Kong was deleted, but where other five High Performing Asian Economies are clearly marked. Divide these economies in two groups. One of the groups should have strong similarities with Hong Kong . Justify clearly the grouping you chose.

Remark: Notice that you do not have enough data to precisely add Hong Kong to Fig. 1.11. This figure presents growth per year in percentages over almost 30 years. Your data from the table presents growth over 20 years .

- (4) (6 pts) Assume that the TFP growth of the “technological leader” in the period 1971-1990 was 0.45 (i.e. $\Delta A^* = 0.45$). Explain whether Hong Kong is “catching Up” or “Falling Behind”.

(V) (6 pts) Income Inequality

The table below gives information about the income distribution in Mexico, Japan and Hong Kong (the information was collected in the eighties and early nineties).

Country	% of income received by	
	Lowest 40%	Highest 20%
Hong Kong	16.2	47.0
Japan	21.9	37.5
Mexico	11.9	55.9

Which of the three countries will have the highest Gini coefficient? Which of the three countries will have the lowest Gini coefficient? Justify briefly.

(VI) E. Asia

(8 pts) Consider the case of a country that maintains a fixed exchange rate. Explain why a devaluation of the currency (i.e. more local currency is needed to buy a dollar) can become a “self fulfilling prophecy”.

(VII) Romer

- (1) (4 pts) State the main assumptions of the model used by Romer to analyze the case of Mauritius.
- (2) (10 pts) Use a diagram to show that although workers are “exploited” by foreign entrepreneurs, they are better off than when the country did not have a garment industry.

Solow Model Equations

(I) Solow with population growth and no technological change.

(population = # of workers)

$$(1) \quad Y = K^\alpha L^{1-\alpha}$$

$$(2) \quad \dot{L} = n, \quad S = s Y, \quad C = (1 - s) Y$$

$$(3) \quad \Delta K = s Y - \delta K$$

$$(4) \quad \dot{K} = s (Y / K) - \delta$$

Y = output, K = capital, L = labor

Define new variables :

$y = Y/L$ (output per worker), $k = K/L$ (capital per worker)

$$(5) \quad \Delta k = s y - (\delta + n) k$$

(II) Solow with technological change and population growth

(population = # of workers)

$$(1) \quad Y = K^\alpha (AL)^{1-\alpha}$$

$$(2) \quad \dot{L} = n, \quad \dot{A} = g, \quad S = s Y, \quad C = (1 - s) Y$$

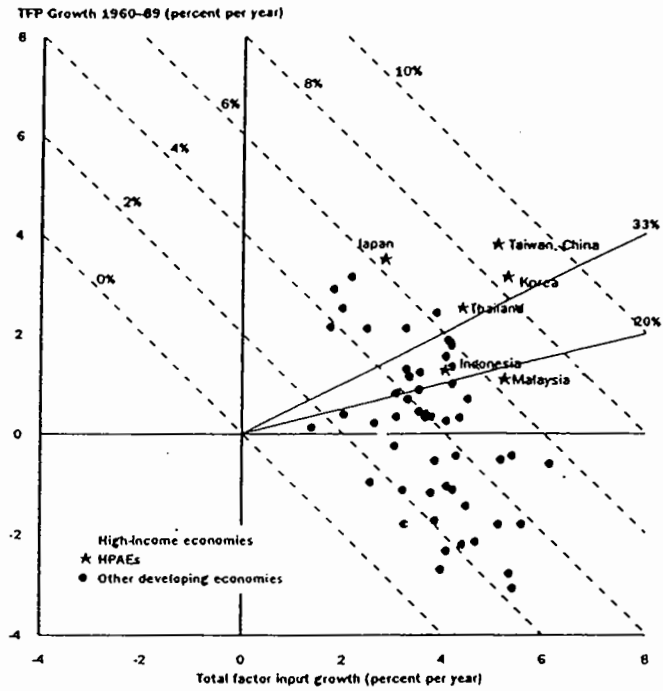
$$(3) \quad \Delta K = s Y - \delta K$$

Define new variables :

$\tilde{k} = K / L A$ (capital per effective unit of labor), $\tilde{y} = Y / L A$ (output per effective unit of labor)

$$(4) \quad \Delta \tilde{k} = s \tilde{y} - (\delta + n + g) \tilde{k}$$

Figure 1.11 Total Factor Productivity Growth and Part of Growth Due to Growth of Factor Inputs, 1960–89



Note: Dashed lines represent total average GDP growth rates, 1960–89. Solid rays represent the contribution to total growth by TFP growth.

Sources: Nehru and Dhareshwar (1993); World Bank data.