ECON 410: PROBLEM SET # 3

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1. Harrod-Domar model of economic growth and development was one of the earliest attempt to give a theory of development. They showed "*under certain assumptions*" that the growth in total output, $\frac{\triangle Y}{Y}$ which we denote as g_Y, is given by

$$g_Y = \frac{s}{k}$$

where s is the saving rate, and k is the capital output ratio.

   (a) Derive the above formula.

   (b) Currently India has a savings rate of 20 percent, and the annual growth rate in total output is 4.0 percent per year. India would like to increase its growth rate of total output from 4.0 percent to 6.0 percent per year, what should be the corresponding savings rate? Recommend three important policies that might help India to increase its savings rate.

   (c) According to Harrod-Domar theory of economic development,*the main development concern is to understand how a less developed economy with low savings rate could be made to have a high savings rate, because then the economy will have a sustained high growth and hence development.* Briefly provide the strengths and weaknesses of this view of economic development in the light of economic development processes of the concurrent less developed economies.

2. Explain why Harrod-Domar model does not quite explain the structural change of an underdeveloped economy, and how Lewis' dual economy model is an improvement along this line.

3. What are the main assumptions in Lewis model? Explain the main improvements that Lewis model features as compared to Harrod Domar model as a model of economic development (*economic development in the sense we have discussed in previous classes*)? Give a graphical exposition of the Lewis model, and explain the concepts of "labor surplus", and "labor absorption process" in the manufacturing sector using the Lewis model. In the Lewis model, how does an underdeveloped economy becomes industrialized? What is the role of agricultural sector in this development process? What are the main criticisms of this model as a model of economic development?

4. In Lewis model, explain what role does population growth play? Take two countries A and B. Country A has higher population growth rate than country B. Otherwise both countries are identical at the current moment, including

the population size being the same at the current moment. According to Lewis model, what will be the differences in the rate of growth of income, and the rate of industrialization in countries A and B? Can you construct a criticism of the Lewis model based on your answers, and given the fact that the countries with higher population growth are observed to grow slowly.

5. Explain the concepts of "labor saving technology or equipment", and "capital flight" and explain what are the basic assumptions in Lewis model regarding these two, and how would they affect the development process as depicted in Lewis model if the capitalists in the manufacturing sector use labor saving technology or engage in capital flights activities. Under what circumstances, the capitalist may like to engage in labor saving technology choice (show in your diagram) or in capital flights?

6. It has been often argued by some economists that Lewis model does not describe the development process of contemporary less developed countries since we do not find unemployment in the rural sector, but we see is rather a lot of unemployed workers in the urban sector. Modify the basic Lewis model along the line discussed in details in the class (queing for first to be employed type of mechanism) to give a model of rural-urban migration that will overcome the above criticism.

7. In Lewis model suppose the capitalist is free to import technology from abroad, or invest in the capital markets abroad. Describe under what conditions, free import of technology and unrestricted investment abroad might slow down the development process of the Lewis type. What government policies would you recommend in those situations?

8. State precisely the assumptions of Solow growth model with Harrod neutral technological change and derive the following fundamental difference equation of the Solow growth model

$$\tilde{k}_{t+1} = \frac{sf(\tilde{k}_t) + (1-\delta)\tilde{k}_t}{(1+n)(1+b)}$$

$$\tilde{k}_0 \quad \text{given}$$

where n is the population growth rate, s is the saving rate, δ is the depreciation rate of capital, b is the rate of Harrod neutral technological change, $\tilde{k}$ denotes the capital labor ratio in efficiency unit, and $f(x) \equiv F(x,1)$, where $F(K,L)$ denotes the base period production function with the base period unit of capital K and labor L.

Suppose it has been found that all countries have the same rate of technological change $b = .02$, depreciation rate $\delta = .25$ and share the same Cobb-Douglas technology leading to $f(\tilde{k}) = 3\left(\tilde{k}\right)^{.35}$. Do the following exercises for this economy.

(a) Suppose at time $t = 0$ the capital-labor ratio in efficiency unit of both the U.S. and Japan were equal to 1.5. and all other parameter values are as in in table 1. (i) Compute the capital labor ratio in efficiency unit, per capita income, and rental rates for the next 5 periods. (ii) What are the average of the yearly linear growth rates of per capita income of the U.S. and Japan during the 5 years period that you computed? If they differ, what are the reasons?

(b) What will be Japan's long-run growth rate in per capita income? What will be the long-run growth rate of U.S., India and Korea?

(c) Suppose all countries have $b = 0$. Using the basic indicators in table 1, calculate the steady-state (i.e., long-run) level of per capita income for each country in table 1. If these countries differ in the long-run level of per capita income, explain why they differ?

9. Repeat problem 8 when the production function is given by $F(K, L) = 3K + 4L$.

Table 1: Basic indicators of a few selected countries

Basic Indicators	India	China	Thailand	Mexico	Korea	Singapore	U.S.	Japan
P.C.income ($1994)	320	530	2,410	4,180	8,260	22,500	25,880	34,630
PPP Estimate of PC income	1,280	2,510	6,970	7,040	10,330	21,900	25,880	21,140
pc income gr.rate 1985-94	2.9	7.8	8.6	0.9	7.8	6.1	1.3	3.2
Pop. gr. rate1980-90	2.1	1.5	1.8	2.0	1.2	1.7	0.9	0.6
gr. rate of export 1980-90	5.9	11.5	14.0	6.6	12.0	10.0	5.2	4.8
gr. rate of export 1990-94	13.6	16.0	14.6	4.0	10.6	12.3	6.7	4.0
Savings to GDP ratio 1988	21.0		26.0	23.0	38.0	41.0	13.0	33.0

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