

Ec453 Theories of Growth and Development
Fall 2002, Midterm I

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YOU HAVE 3 HOURS FOR THIS EXAM. THUS TIME IS AN EXTREMELY SCARCE GOOD. USE IT **OPTIMALLY**

1) (5 points) Discuss analytically as an economist what you understand from the phrase above, that “time is scarce and you have to allocate it **optimally**”.

2) (15 points)

a) Discuss “knowledge/ideas” as an economic good. What are the key properties of knowledge (ideas) as an economic good? What are the implications of these properties in providing implications for answering questions such as: “why economies grow, and why are some nations richer than others?”

b) Romer (1990) specifies the following relationship for the knowledge function:

$$\dot{A} = \delta L_A A$$

where A is stock of knowledge (ideas), δ is productivity of research-personnel; and L_A is the amount of labor allocated to knowledge production. Discuss the implications and shortcomings of this specification in explaining the nature and rate of growth of real world economies.

c) What are the implications of the above formulation for development policy? Discuss briefly. In particular, can the above formulation be supported in a competitive setting? Is the market equilibrium socially optimal in allocating labor supply between production of final goods and production of knowledge? What could be the role of governments in effecting this allocation?

3) (10 points)

Contrast the two waves of *globalization* as we had witnessed during the last two centuries. What are the similarities and differences? What are the implications for economic policy?

4) (30 points)

Consider the standard neoclassical growth model where output is produced along the production function: $Q = F(K,L)$, where Q is output, and K and L are the inputs of capital and labor, respectively. Labor is constant in supply.

- (i) State sufficient assumptions on $F(.,.)$ such that the output per labor function, q , can be expressed as a function of the capital-labor ratio, k , alone. Prove this assertion using your assumption.
- (ii) Suppose that capital labor ratio changes over time due to additions to the capital stock (per labor) net of depreciation, δ :

$$\dot{k} = sf(k) - \delta k$$

Using a graph of q and k , depict transitional adjustments to long run steady state and the steady state k^* . As an extension of your graph, show the factor allocation shares of output per labor across capital and labor.

- (iii) Discuss the steady state growth properties of the neoclassical model. Why is that under the standard neoclassical (Solowian) assumptions steady state per capita growth rate is zero?
- (iv) Distinguish algebraically concepts of *profits per labor*, *the profit rate* and *the share of capital* using the notation of this model.
- (v) Now, derive the *Golden Rule* where per capita consumption is maximized; and the *Golden Age*, where per capita profits are maximized. Show the respective steady states in the q - k space. Show that the steady state k related with the golden age is lower than that of golden rule. Discuss the reasons and implications for growth.

5) (10 points)

Consider the condition for balanced growth as first stated by Harrod-Domar: $v=(s/n)$, Where v is capital-output ratio, s is savings rate out of national output, and n is the rate of growth of labor. Contrast this rule with the steady state condition of the Solow model, and argue that the neoclassical model satisfies the balanced growth condition.

6) (20 points)

Consider the following Kaldorian economy with no trade: Total output (GNP) denoted by Y , is shared by capitalists and workers. There is a government which spends on public consumption and taxes individuals at the constant tax rate $\tau=0.05$. The total expenditures of the Kaldorian government, G , is 1,000. Total desired investment, I , is given exogenously at 1,900. Suppose further that workers in this economy do not save, and that capitalists' propensity to save out of profits is 0.20.

The aggregate consumption function of the economy is $C = 0.8(1 - \tau) Y$.

- (i) Calculate equilibrium level of income Y .
- (ii) Find the share of profits in total income under the Kaldorian equilibrium.
- (iii) Calculate the government's budget balance.

Now suppose that the size of the budget deficit becomes an issue of concern, and that the Kaldorian government decides to follow a balanced budget strategy. Thus, $G = \tau Y$ (with $\tau=0.05$).

- (iv) calculate the new level of equilibrium Y , and the share of profits. How do you explain the fact that the share of profits under the new equilibrium is higher?

7) (15 points)

Consider the following economy. Output is produced using capital, K , and labor, L , and A , B and α are parameters:

$$Y = AK + BK^\alpha L^{1-\alpha}$$

Labor grows at the rate n , and capital accumulates via,

$$\dot{K} = s(AK + BK^\alpha L^{1-\alpha}) - \delta K$$

- (i) Derive an expression for the law of motion of the capital-labor ratio, k , and show the movement of its growth rate, $\frac{\dot{k}}{k}$, in a graph relating sA , $Bk^{\alpha-1}$ and $(n+\delta)$, to portray the transitional dynamics towards steady state.
- (ii) Show that for "large" values of k the economy displays characteristics of the Rebelo model with AK -type of technology.
- (iii) How would you justify this production technology?