BILKENT UNIVERSITY

Department of Economics

Ec453 Theories of Growth and Development I

Fall 2009 Midterm Exam

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1. Short questions (2 points each)

   (a) State the distinguishing hypotheses of a neoclassical macroeconomic model. No proof is necessary.

   (b) Suppose that due to in-migration labor population has increased by twofold in an economy. Suppose that the economy is characterized by neoclassical rules of adjustment. How will the transition and the steady state be affected? If you think that the steady state equilibrium of the economy will be changed, will the per capita output be higher or lower under the new steady state?

   (c) True or False? Suppose that a benevolent social planner would like to choose the "optimal" saving rate in an economy so as to maximize consumption per labor under the steady state. The social planner will set the marginal product of capital equal to the capital share.

   (d) True or False? A profit maximizing competitive firm under the neoclassical model will hire labor until labor productivity is equal to real wage rate.

   (e) In a macroeconomic model suppose that investment demand is given as a separate function of the profit rate and expected output. Saving is generated by fixed propensity to save out of capitalist disposable income. Then in this model profit rate does not necessarily equal to marginal product of capital.

2. (10 points) In a short narrative, discuss the reasons why Britain had an early lead in industrial revolution. State your opinion briefly on why China or the Islamic Arab societies failed to generate a self-sustaining growth path in the early 7th and 10th centuries.

3. (20 points) Consider the following Marxian growth model. Output Y is produced by the following *Leontieff* technology:

$$Y = \min\left[2K, \frac{L}{2}\right]$$

The wage rate is paid *ex-ante* and is known to be fixed at 0.1.

(a) State the capital-output ratio and the labor-output ratio for this economy. Using these ratios, state the unit cost function and the market equilibrium equation as a function of the wage rate, profit rate, consumption per labor and growth rate.

(b) Find the rate of profit, the growth rate and consumption per worker in this economy under Marxian assumptions.

(c) What is the size of the surplus value? What is the rate of exploitation in this economy?

(d) Draw the dynamics of this economy in a four quadrant diagram showing the relationships between wage rate, profit rate, growth rate and consumption per labor.

4. (20 points) Consider the following Kaldorian economy with no trade: Total output (GDP) 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 $C = 0.8(1 - \tau)Y$.

(a) Calculate equilibrium level of income Y.

(b) Find the share of profits in total income under the Kaldorian equilibrium.

(c) Calculate the government's budget balance.

(d) 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 $\tau = 0.05$).

(e) 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?

Now the meat of the exam....

5. (20 points) Consider the Cass-Koopmans-Ramsey model of intertemporal optimization. Suppose that the economy is populated by identical individuals where the representative consumer is confronted with the following problem:

$$Max\ U\ =\ \int_0^\infty e^{-(\rho-n)t}\frac{c_t^{1-\theta}-1}{1-\theta}dt$$

$$\text{subject to }\dot{k}\ =\ f(k)-c-(\delta+n)k$$

where c is consumption per labor, k is capital labor ratio, n is the rate of population growth, ρ is the subjective discount rate, and δ is the depreciation rate. θ is a fixed parameter displaying the inverse of the intertemporal elasticity of substitution. The production technology is given as in Rebelo (1991) with $y = Ak$ where $A > 0$ and is held fixed.

(a) Find the equilibrium rate of growth in this economy, and draw its equilibrium growth path with the aid of a graph showing output per labor as a function of capital per labor.

(b) How is the equilibrium rate of growth affected in response to changes in the parameters ρ and θ?

(c) Define the saving rate in this economy as savings as a ratio to output. Find its equilibrium value. Is the saving rate constant or variable over time? Discuss its behaviour in response to changes in k.

(d) Now suppose that the government decides to build a temple in honor of the growth god, *Rebelonus*, and decides to impose a tax on the private agents to meet its construction expenditures. The options are to levy a tax on *consumption* or a tax on *output*. Thus, in the first case the consumer's constraint is to be changed to:

$$\dot{k} = f(k) - (1+t)c - (\delta+n)k$$

and in the second case it will be:

$$\dot{k} = (1-t)f(k) - c - (\delta+n)k$$

Discuss the growth and welfare implications of both options. Which tax would you prefer from a growth and optimality point of view? Portray the effects of the tax policy options in your graph showing the steady state dynamics for this economy. Clearly mark the new equilibrium growth rate that would be obtained after each tax. Discuss the adjustments that prevail in response to the taxes. In your considerations note that the temple by itself does not yield any utility to the consumers, nor does it imply any advances in sciences or output production.

6. (20 points) The following data is for Turkey 2003 and is obtained from the State Planning Organization. Gross Domestic Product, Y, is 556,875; aggregate capital, K, is 1,662,536 (both are measured in real 1990 prices in billions TL). Labor force, L, is 21,147 thousand workers. The population growth rate, n, is 0.014; rate of technological change, x, is 0.02; and Turkish average saving ratio to Y is $s = 0.20$. Assume away any depreciation costs on capital in this model.

We do not have access to rate of profit data; but instead we know that the real rate of interest is 0.20. Setting real interest rate as a proxy for the profit rate, use $r = 0.20$. (Remember, no depreciation costs).

(a) Calibrate this data to a neoclassical production function of the form

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

(b) Calculate the wage rate that this model will generate given the above data for 2003, using the neoclassical properties of the production function.

(c) Calculate the initial (2003) level of the capital labor ratio and output per labor. Then, implement the neoclassical transition dynamics to the data to find out Turkey's long run steady state equilibrium configuration. What would the steady state capital per labor and output per labor be for Turkey?

(d) Is Turkey heading for the *golden rule* where per capita consumption is maximized with these parametric values and data? What should be done to ensure that Turkish steady state will indeed be the golden rule equilibrium? Find the consumption per labor under the golden rule and the sustaining capital per labor and output per labor ratios. Draw a diagram to depict your equilibrium.

7. **Bonus Questions: 2 points each**

(a) Discuss the problem of "small coinage" in the Medieval Europe. How has this problem been "solved" practically?

(b) When has European Renaissance come into being according to economic historians? What is the significance of that date?

(c) Who has developed the notion and methods of "algorithm" first in the medieval ages? Discuss its significance for Renaissance.

(d) When was *Magna Carta* signed? Discuss its significance for Britain's early lead on industrialization.

(e) What was the name of the horse that Alexander used to ride in his campaigns across Asia?