Macroeconomic Theory
Comprehensive Exam 2011

June 2, 2011

You have three and a half hours for this exam. Neither books nor class notes are permitted. No electronic devices are permitted.

The exam consist of 4 pages. There are 180 points in total. Each short question accounts for 15 points and each long question for 60 points. Answer any four short questions and any two of the three long questions. If you choose long question 1, answer either part A or part B.

Please read the whole exam before starting. Wherever you do maths, explain briefly what you are doing.

1 Short Questions

1. Compare the "Golden Rule" and the "Modified Golden Rule" as descriptions of economies in their steady states. What key model assumptions lie behind these rules? Is one rule (model) more sensible than the other? Why?

2. Suppose you are interested in empirically testing the hypothesis that money is neutral. Explain what kinds of data you would want to collect, and what you would do with it to provide a compelling test of this hypothesis.

3. The Economist magazine frequently publishes its Big Mac Index to show which currencies are overvalued and which are undervalued. The exercise is based on apparent deviations from the law of one price as applied to Big Macs in different countries. Comment on why this is, or is not, a sensible measure of the extent to which current exchange rates are "mis-aligned".

4. One criticism of the basic RBC model is that it does not take into account variable capital utilization. Point out briefly how the model could be modified to endogenize capital utilization. How do you expect this to affect the predictions of the model for a given stochastic process for productivity?

5. Name two motives for saving. Explain them. Under what conditions are they operative?

6. Consider an economy composed of dynasties of finitely-lived agents. Members of each dynasty care for their descendants in the sense that they enjoy leaving a bequest to their children, but do not directly care about their children's actually achieved utility. Is the optimal long-run capital tax rate in such an economy zero? Argue.

Long question 1

Part A

In the past three years, there has been much debate in many countries about the ability of governments to "stimulate" their economies through increases in public spending. Write an essay describing the nature of this debate, and the key underlying analytical assumptions that support each position. Feel free to express your own view in this debate.

Part B

2. The "Solow Residual" is often used as an estimate of technical change or of the growth of total factor productivity. Explain precisely (derive) how the Solow Residual is constructed from data, together with the key assumptions under which it can be interpreted as an estimate of technical change. Are there good reasons to think this estimate is biased in one way or another? Explain why it is sometimes called a "measure of our ignorance".

Long question 2

2. Suppose that our economy is well represented by a representative household that derives utility from consumption C_t and leisure $1 - L_t$ according to the following logarithmic specification:

$$u(C_t, 1 - L_t) = \ln C_t + \varepsilon \ln(1 - L_t), \quad \varepsilon > 0.$$

Furthermore she has access to a backyard technology that produces output Y_t combining capital K_t, labor L_t and total factor productivity A_t according to the following production function:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \quad \alpha \in (0, 1).$$

Total factor productivity grows at rate g. Finally, the law of motion of the stock of capital is given by $\dot{K} = Y_t - C_t$. We abstract from depreciation.

1. Set up the Hamiltonian, find the optimality conditions and interpret them.

2. Find a system on K_t and C_t that fully describes the dynamic behavior of our economy. You will find it useful to define a function $L(K, C, \ldots)$ that describes the optimal labor supply for different levels of consumption and capital.

3. Redefine variables in such a way that there is a steady state. Draw the phase diagram.

4. Are consumption and capital constant in steady state? Are hours worked constant in steady state? Show your derivations.

From now on assume that labor is exogenous, so in the rest of the analysis you can ignore the first order condition relative to labor. Furthermore, if you wish, assume total factor productivity is constant.

5. Assume that we have two closed economies (i.e. technology, capital and labor cant flow from one to the other), one of them with low TFP, A_l, and the other with high TFP, A_h. Draw in the same diagram the steady state of both economies. Are the levels of capital and consumption different across economies?

6. Assume each economy begins in its own steady state. A treaty is signed that allows the free flow of capital and ideas but not labor (i.e. both countries now have access to A_h). Sketch graphically the evolution of capital per capita for each economy against time (make sure you have the following phases: before the treaty is signed, when the treaty is signed, along the transition, in the final steady state).

7. Who are there winners and losers in the short run after the treaty is signed? And in the long run?

Long question 3

Consider a worker who lives T years. The worker values consumption at each point in time t with the felicity function $\log(c_t)$. In any time period, the worker can either work full-time ($n_t = 1$) or not at all ($n_t = 0$). Given past employment spells totalling $h_t = \int_0^t n_s ds$, the wage is $w_t = \Phi h_t^{\phi}$, $\Phi > 0, \phi \in [0, 1]$. Working reduces period utility by Bn_t, $B > 0$. In addition, the worker incurs a fixed cost χ at every switch from not working to working or working to not working.

The worker can freely borrow and lend at the market interest rate. For simplicity, assume that the worker's subjective discount rate and the market interest rate are both zero.

1. Express the worker's problem as a dynamic programming problem. State and explain the state and control variables.

2. Now consider the sequence problem. Write down the worker's objective function.

3. For simplicity, let the length of an individual time period go to zero. Write down the same expression for the worker's preferences in continuous time.

4. Give an economic interpretation of the wage function.

5. Write down the life-time budget constraint.

6. What is the optimal timing of labor supply?

7. Write down the present value of labor income at time 0 for someone who works R years and chooses the timing of labor supply optimally.

8. Derive the optimal consumption policy for someone who works R years.

9. For simplicity, set T to 1. State and solve the worker's problem.

10. Give an intuition for the result: what does optimal work length depend on? Explain the role of ϕ.

11. Think about a general equilibrium model with many such workers and with business cycles. Do you think that such a model could replicate key features of the data? Explain. Also explain the effect of the assumption on preferences in being able to match/not match the data.