

**Macroeconomic Theory ✓
Comprehensive Exam 2013**

May 17, 2013

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

The exam consists of 4 pages. There are 180 points in total. Each short question accounts for 10 points and each long question for 60 points. Answer six of the nine short questions and both long questions.

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

Short Questions (10 points each, answer six questions)

1. Most evidence suggests that real wages do not vary much through the business cycle. During recessions we observe important increases in unemployment with very limited reductions in real wages. Some authors claim that these patterns result from wages affecting the level of effort exerted by workers. Let's assume that there are N workers, each of them exerting effort according to $e(w) = (w - \eta)^\beta$, where w is the wage and $\eta > 0$ and $0 < \beta < 1$ are parameters. Firms have access to the following technology, $Y = A(e(w)L)^\alpha$, where L is employment, A some constant measure of productivity and $0 < \alpha < 1$ is the elasticity of output with respect to effective labor. What are the effects of changes in A on employment and wages?
2. Since more capital allows more output to be produced, it is always better for a country to have (and maintain) more capital. Comment.
3. It is a common practice for developing countries to borrow in a foreign currency, for instance US dollars. Why do they do this? How does this reduce the policy options available (for the developing countries) in the face of a contraction in aggregate demand?
4. A growth model with constant returns to scale and diminishing marginal products of capital and labour cannot explain ongoing rising living standards in the absence of technological improvement. Comment.
5. 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.
6. A permanent increase in the flow of government purchases, which is financed by a permanent increase in (lump sum) taxes, will not lead to any change in real GDP; government expenditure will simply displace private expenditure. Comment.
7. Explain why we cannot directly apply recursive methods (dynamic programming) to some problems that can be solved in sequence form. Give two examples.

8. Consider a standard real business cycle model with elastic labor supply. Aggregate productivity follows a stationary *iid* stochastic process on a positive domain. Suppose that the economy is initially in its steady state. Starting from there, how does it react to an above-average realization of productivity? (This is observed before households take any decisions.) Explain in words the optimal reaction of households and its implications for aggregate output, consumption, investment, labor supply and the real interest rate. Draw the time paths of productivity and of output. Explain.
9. Consider an economy with two agents who value consumption and each receive a stochastic, strictly positive endowment every period. Give an example of a case where the equilibrium features full insurance against idiosyncratic risk although markets are not complete. Explain. In what context of analysis would such a setting be useful?

Long question 1 (60 points)

Two variations of the Solow model

(This is a single question, so you need to do both parts.)

1. Consider a standard Solow model without technological change and with constant population. The level of investment each period, I_t , is a fixed fraction s of output, so

$$\dot{K}_t = p_t I_t - \delta K_t,$$

where p_t is an exogenously given time-varying process. We can think of it as the ratio between the price of output and that of equipment investment. Under this interpretation, p_t has been continuously increasing at a relatively constant rate of 3% since 1950 (think of the price of computers, adjusted for quality, as an example). Lets assume therefore that $\frac{\dot{p}_t}{p_t} = \gamma_K > 0$.

- (a) Assume that the production function is Cobb-Douglas, $Y_t = (K_t)^\alpha (L_t)^{1-\alpha}$. Characterize the unique steady state equilibrium (you might want to define some sort of efficiency adjusted variables) and the associated growth rates of output per capita and capital per capita.
 - (b) Specify Kaldor's stylized facts. Are these facts satisfied along the above stable growth path? Is this a problem? (Think about how capital is measured in the data and how it is measured in this model.)
 - (c) Take a Cobb-Douglas version of the model with technological change, $Y_t = A_t (K_t)^\alpha (L_t)^{1-\alpha}$. Solow (1959) found that only around 1/8 of the growth in output per capita could be attributed to the growth of physical capital per capita. How does this new framework affect his results?
2. Consider the Solow model with no population growth and no technological progress where output is given by the standard Cobb-Douglas technology with the elasticity of output to capital given by α . The saving rate is equal to s and the depreciation rate is given

by δ . Some developed countries have been claiming that there is an unlevel playing field in international trade since wages in developing countries are substantially below those of developed countries. Imagine that, as a result of international pressure and threats of trade restrictions, countries like China or India introduce (or increase) a minimum wage, \bar{w} , such that workers are not allowed to be paid below that level. If labor demand at this wage falls short of L , employment is equal to the amount of labor demanded by firms, L^d . Furthermore, assume that $\lim_{K_{pw} \rightarrow \infty} (1 - \alpha)(K_{pw})^\alpha > \bar{w} > (1 - \alpha)(K_{pw}^*)^\alpha$, where K_{pw}^* is the steady state level of capital *per worker*. Assume the economy begins in steady state and at some time, t_0 , the minimum wage regulation is introduced. Characterize the impact of the minimum wage regulation on capital per capita, capital per worker, employment, wages and the return to capital. (Draw the time paths, before the shock, at the time of the shock and the convergence to the new equilibrium.) As always you might find it useful to draw the Solow diagram to think about what is going on.

Long question 2 (60 points)

Consider the problem of an unemployed agent looking for a job. The agent is infinitely lived, discounts future utility using a discount factor $\beta \in (0, 1)$, and values only consumption with a utility function $\ln c$. While unemployed, the agent has no labor income and receives a transfer b per period. In addition, he/she has initial assets a , which can either be consumed or invested, yielding a constant net return r next period. The agent may find a job with the constant probability p . A job provides constant labor income $w > b$ per period and is kept forever. The investment opportunity remains. Assume that $\beta(1 + r)$ always holds.

1. First consider an agent who has a job.
 - (a) Write down and solve the problem of an agent who has a job.
 - (b) What is the value of a job? What does it depend on?
2. Now write down the problem of an unemployed agent and derive the Euler equation.
3. Compare the unemployed agent's consumption level to that of an unemployed agent who is unemployed forever and has the same level of assets. Explain the difference.
4. Analyze the agent's path of consumption and assets as follows.
 - (a) Show that it is not optimal for an unemployed agent to have a flat consumption profile.
 - (b) Derive an expression for the growth rate of consumption as a function of current consumption.
 - (c) What does the consumption path of an unemployed agent look like?
 - (d) What are the implications for the path of assets? Also give an intuitive explanation for the paths.

5. Now suppose that the agent can choose job search effort. More effort e has a linear utility cost, but a positive and diminishing effect on the job finding probability p .
- (a) Write down the agent's problem. Derive a first order condition for effort, assuming an interior solution.
 - (b) How does effort vary with wealth?
 - (c) Suppose that a policy maker would like to shorten unemployment duration in this economy. His tool for doing so is the profile of support payments $\{b_t\}_{t=1}^{\infty}$ over an unemployment spell. The average payment over the spell should be b , as above. What should the policy maker do? (Give a qualitative answer. Explain. No derivations needed.)