
PRELIMINARY EXAMINATION FOR THE Ph.D. DEGREE

Directions: Answer all questions.

Short Answer Questions - Keep your answers short and concise.

1. In the Solow growth model, how does an increase in the savings rate s alter the growth rate of output per worker in the long run? What is the economic intuition behind this result? Would your answer to question (a) change if the capital share parameter α were equal to 1? Why or why not?
2. Government bonds do not represent net wealth to consumers in a Ramsey model, but they do represent net wealth to the *current* generation of consumers in an overlapping generations model.
3. What is a 'scale effect' in an endogenous growth model? Give an example. Is this a desirable or undesirable feature?
4. The equity premium puzzle is often associated with the "risk-free rate puzzle." What does this refer to - and what is its relevance to the equity premium puzzle?
5. Modern macroeconomic models can be distinguished by their *impulse*, *amplification*, and *propagation* mechanisms. Within the context of real business cycle models, identify those mechanisms and discuss their merits and weaknesses.

Longer Answer Questions

6. Consider a version of the Ramsey model in which population is constant and there is no exogenous technical progress. Households have preferences of the form

$$U = \int_0^{\infty} e^{-\rho t} U(C_t) dt,$$

where ρ is the discount rate, C_t is consumption, and $U(C_t) = C_t^{1-\theta}/(1-\theta)$. Firms produce output from labor and capital using a Cobb-Douglas production function, $Y_t = K_t^\alpha (AL)^{1-\alpha}$, where A and L are both constant. Capital depreciates at a constant rate $\delta > 0$.

- Derive and interpret the Keynes-Ramsey rule.
 - From the first-order conditions for optimal behavior, derive a pair of differential equations in (c, k) . Use them to characterize the economy's steady state.
 - Does the economy necessarily converge to the steady state? How do we know? (Hint: use the phase diagram.)
7. Geometric growth in an RBC model can be introduced by expressing the social planner problem as

$$\max E \left\{ \sum_{t=1}^{\infty} \beta^{t-1} [\ln c_t + A \ln(1 - h_t)] \right\}$$

subject to :

$$c_t + x_t = z_t k_t^\alpha h_t^{1-\alpha}$$

$$k_{t+1} = k_t(1 - \delta) + x_t$$

$$z_t = \theta^t \lambda_t$$

$$\lambda_t = \lambda_{t-1}^\rho \varepsilon_t$$

The steady-state of this economy (i.e. setting $\lambda_t = 1 \forall t$) is a balanced growth path in which consumption, capital, and output all grow at the same rate, ν . (Note, $\nu \neq \theta$.) Labor, on the other hand, is constant. Assume that $\beta = 0.99$ and $\nu = 1.05$. Determine the value of the other parameters (A, δ, α) so that, along the balanced growth path:

- The time spent in work activities is 25%.
- Gross investment, x_t , is 7% of beginning-of-period capital, k_t .
- The capital-output ratio is 3.5.

8. Consider a representative agent economy in which agents each period allocate output between consumption, capital, bonds, and equity. Capital acquired in period t is used to produce output in period $t + 1$; the production function is given by

$$y_t = z_t k_t$$

where z_t denotes a random shock to technology. (The depreciation rate of capital is 100%.) It is assumed that z_t can take on two values $z_1 < z_2$. The evolution of z_t is governed by a symmetric transition probability matrix with diagonal elements $\pi > 1/2$. One and two period bonds are traded. Both bonds cost one unit of consumption in period t and return $R1_t$ and $R2_t^2$, respectively, upon maturity. The remaining asset, equity, pays a dividend each period given by $d_t = \alpha y_t$ where $\alpha \in (0, 1)$. Households choose consumption and assets in order to maximize expected lifetime utility given by:

$$E \left\{ \sum_{t=0}^{\infty} \beta^t \ln c_t \right\}$$

Given this environment, answer the following questions:

- (a) Express the household's maximization problem as a dynamic programming problem.
- (b) Define a recursive competitive equilibrium.
- (c) Characterize the behavior of consumption and savings.
- (d) Characterize the behavior of one-period interest rates. Explain your result.
- (e) Two period rates will be less volatile in this economy relative to one-period rates. Give an intuitive argument for why this makes sense. (It is not necessary to prove your statement.)
- (f) Given that one-period rates are more volatile than two period rates, Economist A states that investors will require a positive risk premium on one period bonds. Do you agree?
- (g) Prove that bond yields and the price of equity are inversely related. Why is this so?