ECON60111

# THE UNIVERSITY OF MANCHESTER

## MACROECONOMIC ANALYSIS

**Semester 1 2020/21**

**INSTRUCTIONS SPECIFIC TO THIS EXAM**:

- Answer **ONE** question from Section A and **TWO** questions from Section B. Each section is worth 50 points.
- Please submit typed responses. Hand-drawn diagrams are acceptable. Alternatively, you may write all your answers by hand and scan them into PDF format. Either way, you must include the cover page provided on Blackboard.
- Ensure that your answers are oriented correctly. Marks will be deducted if your answers are rotated 90 degrees, upside down, etc.
- Ensure that your answers are legible and the scanned image is clear.
- Students are not permitted to discuss their answers with other students before submission.
- Candidates are expected to demonstrate to the examiners a competent knowledge of all computations.
- Candidates are also advised that the examiners attach considerable importance to the clarity with which answers are expressed.

## SECTION A

**Answer ONE question**

1. **Growth, saving and real interest rate**

Thomas Piketty, in *Capital in the Twenty-First Century*, argues that a fall in the growth rate of the economy is likely to lead to an increase in the difference between the real interest rate and the growth rate. This problem asks you to investigate this issue in the context of the Ramsey-Cass-Koopmans (RCK) model. Specifically, consider a RCK economy that is on its balanced growth path, and suppose there is a permanent fall in $g$.

(a) How, if at all, does this affect the $\dot{k} = 0$ and $\dot{c} = 0$ curves? Illustrate the change in these curves in a diagram and give economic intuition. **(10 points)**

(b) At the time of the change, does $c$ rise, fall, or stay the same, or is it not possible to tell? What about in the long run? Explain. **(10 points)**

(c) At the time of the change, does $r - g$ rise, fall, or stay the same, or is it not possible to tell? What about in the long run? Explain. **(10 points)**

(d) Letting $s \equiv [f(k^*) - c^*]/f(k^*)$ denote the fraction of output that is saved on the balanced growth path, find an expression for $\partial s/\partial g$. Can you tell whether this expression is positive or negative? Explain. **(10 points)**

(e) For the case where the production function is Cobb-Douglas, $f(k) = k^\alpha$, rewrite your answer to part (d) in terms of $\rho$, $n$, $g$, $\theta$, and $\alpha$. (Hint: use the fact that $f'(k^*) = \rho + \theta g$.) **(10 points)**



2. **Optimal Monetary Policy**

Consider the following variant of the canonical New Keynesian model:

$$y_t = E_t[y_{t+1}] - \frac{1}{\theta}\left(i_t - E_t[\pi_{t+1}]\right) + u_t^{IS} \tag{1}$$

$$\pi_t = \beta E_t[\pi_{t+1}] + \kappa(y_t - y_t^n) \tag{2}$$

where $(u_t^{IS}, y_t^n)$ are stochastic shocks and $y_t^n$ is the natural level of output. Suppose central bank sets the nominal interest rate $i_t$ according to

$$i_t = r_t^n + \phi_\pi E_t[\pi_{t+1}] \tag{3}$$

where $r_t^n$ is the economy's natural rate of interest. Let $\tilde{y}_t = y_t - y_t^n$.

(a) Show that Equations (1), (2) and (3) can be written, in matrix form, as

$$\begin{bmatrix} \tilde{y}_t \\ \pi_t \end{bmatrix} = A \begin{bmatrix} E_t\tilde{y}_{t+1} \\ E_t\pi_{t+1} \end{bmatrix}, \quad A = \begin{bmatrix} 1 & (1-\phi_\pi)/\theta \\ \kappa & \beta + \kappa(1-\phi_\pi)/\theta \end{bmatrix} \tag{4}$$

Carefully explain each step of your derivation. **(10 points)**

(b) What does the system of equations, given by Equation (4), simplify to when $\phi_\pi = 1$? What are the eigenvalues of the matrix $A$ in this case? (**10 points**)

(c) Suppose we look for self-fulfilling movements in $\tilde{y}$ and $\pi$ of the form $\pi_t = \lambda^t Z$, $\tilde{y}_t = c\lambda^t Z$, $|\lambda| \leq 1$. When $\phi_\pi = 1$, for what values of $\lambda$ and $c$ does such a solution satisfy Equation (4)? Thus, what form do the self-fulfilling movements in inflation and output take? (**20 points**)

(d) Suppose $\phi_\pi$ is slightly (that is, infinitesimally) greater than 1. Are both eigenvalues inside the unit circle? Is it possible for there to be self-fulfilling equilibria? Why or why not? (**10 points**)

## SECTION B

**Answer TWO questions**

1. Define the golden-rule level of capital in the Solow model. Define the modified golden-rule level of capital in the Ramsey model. Explain the difference between the two and how they relate to each other. (**25 points**)



2. How are assets priced in the Consumption Capital Asset Pricing Model (Consumption CAPM)? Derive the risk premium for assets in this model and give economic intuition. Use this model to explain the equity premium puzzle. (**25 points**)



3. Define the concept of Ricardian equivalence. Show how Ricardian equivalence holds in the Ramsey-Cass-Koopmans model and give economic intuition. Discuss reasons Ricardian equivalence might not hold in practice. (**25 points**)





END OF EXAMINATION