Supervision 1
Real Business Cycles
Macroeconomics Part IIB, Paper 2

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1. (**Problem**) Consider an economy consisting of a constant population of infinitely lived individuals. The representative individual maximises the expected value of $\sum_{t=0}^{\infty} \beta^t c_t$, where $\beta \in (0,1)$ is the discount factor. Labour is supplied inelastically, and total labour is normalised to 1. The production function is given by

$$Y_t = Z_t K_t^{\alpha} L_t^{1-\alpha},$$

where $\alpha \in (0,1)$ and Z_t is a time-varying productivity parameter. Technology is stochastic and follows the process:

$$Z_t = (Z_{t-1})^{\mu} \times \Psi_t,$$

where $\mu \in (0,1)$ and Ψ_t, the technology shock, is a white noise process with mean 1 (so that $E_t(\Psi_t) = 1$ for all t). Capital depreciates at rate $\delta \in (0,1)$, so that the aggregate resource constraint is:

$$K_{t+1} = Y_t - C_t + (1-\delta)K_t.$$

   (a) Set up the representative household problem and derive the Euler equation associated with this problem. Interpret this equation

   (b) Set up the representative firm problem and derive the first-order conditions associated with this problem. Explain.

   (c) Describe the equations which characterise the equilibrium of this economics.

(d) Compute the steady state of the model $(\bar{K}, \bar{Y}, \bar{C})$ as a function of α, β, and δ (hint: For the steady-state assume that the random variables are at their unconditional mean).

(e) Use the Euler equation to express K_{t+1} and Y_t as functions of Z_t and Z_{t-1}.

(f) Let lower case letters denote logarithms of the corresponding capital letters. Write down the process for z_t. Express k_{t+1} and y_t as functions of z_t and z_{t-1}. Explain intuitively how an unanticipated technology shock ψ_t affects future output y_{t+1}.

(g) Let $z_0 = 0$. Explain how the dynamic response of output y_t to a one period technology shock $\psi_1 = 1$ depends on the persistence of technology shocks μ.

2. (**Essay**) "Business cycles are an economic phenomenon that is fully understood and explained by economic theory." Discuss. [Tripos 2006]

Main Readings

- Sorensen, P. & H. Whitta-Jacobsen (2005). *Introducing Advanced Macroeconomics: Growth and Business Cycles*, McGraw-Hill.

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- F. E. Kydland and E. C. Prescott (1990), "Business cycles: Real facts and monetary myths", Federal Reserve Bank of Minneapolis Quarterly Review.

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