Problem Set 1
Macro II - November 2009
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Problem 1)

Consider a different version of the basic RBC model (with fixed labour supply and no real rigidities) presented in the lecture. In particular, assume that:

$$u(C_t) = C_t - \kappa(C_t + v_t)^2$$

where v_t is a white noise preference shock. Moreover assume that:

- $Z_t = \bar{Z} = \frac{1-\beta}{\beta}$
- $\alpha = 1$
- $\delta = 0$

(a) Derive the first order conditions.

(b) Using the method of undetermined coefficient derive the expression for consumption and capital as a function of the states.

(c) Draw (without the use of numerical methods) an impulse response to a one-time shock to v_t.

Problem 2)

Consider a different version of the basic RBC model (without real rigidities but with endogenous labour supply decision) presented in the lecture. In particular, assume that:

$$U\left(C_{t+i}, L_{t+i}\right) = \frac{(C_{t+i}^{\theta} L_{t+i}^{1-\theta})^{1-\sigma}}{1-\sigma}$$

where L_t denotes leisure (and, thus,$L_t = 1 - N_t$).

(a) Calculate the equilibrium conditions and the steady state (which value of θ is consistent with $\overline{N} = 0.25$?).

(b) Simulate (numerically - using either the reds/solds algorithm or Dynare freeware) impulse responses of the endogenous variables in the model to a productivity shock for different values of σ and ρ.

(c) How does the responses compare with the case of separable labour.

Problem 3)

Going back to the separable utility case, assume that the per-period utility function is separable in consumption and leisure and logarithmic in consumption:

$$U\left(C_{t+i}, L_{t+i}\right) = \log C_{t+i}. + \theta \frac{{L_{t+i}}^{1-\varphi}}{1-\varphi}$$

add government spending to the model. In particular, assume that the resource constraint is now

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

where X_t is government spending.[1] Assume that in the long run government spending is a constant fraction of GDP, say 0.2, but that government spending follows the stochastic

process

$$x_t = \rho x_{t-1} + \varepsilon_t.$$

Finally, assume that there are no shocks to technology.

(a) After deriving the deterministic steady-state, derive the log-linear equilibrium conditions of the model.

(b) Using the method of undetermined coefficients, derive the state-space representation of the model.

(c) Plot the impulse-response functions of the endogenous variables in the model to a one-time shock in x_t using the following combinations of φ and ρ.[2] What do your results suggest about government spending as a plausible source of business cycle?

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[1] Note from the way we have writen the budget constraint that we are implicitly assuming that government spending is financed by lump-sum taxation. Right? Are we also assuming that the government budget is balanced?

[2] Note that, given that you have already calculated the state space presentation of the model, you can code the impulse responses manually, without the need of solution algorithms.