

Assignment 3
International Macroeconomics
Fall 2007
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1. **Simulating a Small, Open, Endowment Economy**

Background: Two empirical regularities that characterize emerging economies are the countercyclicality of the trade balance-to-output ratio and the fact that consumption growth appears to be more volatile than output growth. In class, we developed a simple small open endowment economy and provided intuitive arguments suggesting that this economy fails to account for these two stylized facts. However, that model does not allow for closed form solutions of second moments of output growth, consumption growth, or the trade balance-to-output ratio. The goal of this assignment is to obtain these implied statistics numerically.

To this end, consider the following parameterization of the model developed in class:

$$y_t - \bar{y} = \rho(y_{t-1} - \bar{y}) + \epsilon_t,$$

with $\rho = 0.9$, $\bar{y} = 1$, and ϵ_t is distributed normally with mean 0 and standard deviation 0.03. Note that the parameter \bar{y} , which in class was implicitly assumed to be nil, represents the deterministic steady state of the output process. Assume further that $r = 1/\beta - 1 = 0.1$, $d_{-1} = \bar{y}/2$, and $y_{-1} = \bar{y}$.

- (a) Simulate the economy for 100 years.
 - (b) Throw away the first 50 years of artificial data to minimize the dependence of the results on initial conditions.
 - (c) Compute the growth rates of output and consumption and the trade balance-to-output ratio.
 - (d) Compute the sample standard deviations of output growth and consumption growth and the correlation between output growth and the trade balance-to-output ratio. Here, we denote these three statistics σ_{gy} , σ_{gc} , and $\rho_{gy,tby}$, respectively.
 - (e) Replicate steps 1 to 4 1000 times. For each replication, keep record of σ_{gy} , σ_{gc} , and $\rho_{gy,tby}$.
 - (f) Report the average of σ_{gy} , σ_{gc} , and $\rho_{gy,tby}$ over the 1000 replications.
 - (g) Discuss your results.
2. Consider a small open economy populated by a large number of households with preferences described by the utility function

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t, h_t),$$

where U is a period utility function given by

$$U(c, h) = -\frac{1}{2} [(c - \bar{c})^2 + h^2],$$

where $\bar{c} > 0$ is a satiation point. The household's budget constraint is given by

$$d_t = (1 + r)d_{t-1} + c_t - y_t,$$

where d_t denotes real debt acquired in period t and due in period $t+1$, $r > 0$ denotes the world interest rate. To avoid inessential dynamics, we impose

$$\beta(1 + r) = 1.$$

The variable y_t denotes output, which is assumed to be produced by the linear technology

$$y_t = Ah_t.$$

Households are also subject to the no-Ponzi-Game constraint $\lim_{j \rightarrow \infty} E_t d_{t+j} / (1 + r)^j \leq 0$.

- (a) Compute the equilibrium laws of motion of consumption, debt, the trade balance, and the current account.
- (b) Assume that the productivity parameter A increases permanently to $A' > A$. Establish the effect of this shock on output, consumption, the trade balance, the current account, and the stock of debt.