Numerical Methods Homework 1

Michael Zdinak

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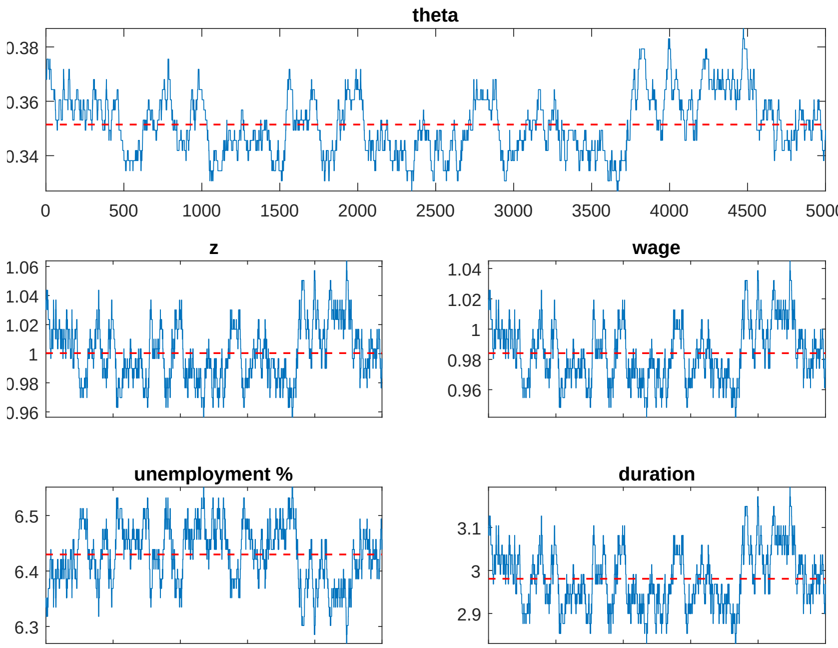
Problem 1. Compute a discrete-time version of a Mortensen-Pissarides model with aggregate fluctuations. Find the labor market tightness for each shock. Simulate some realizations of productivity & compute a time-series of the endogenous variables. What's up with it?

Table 1: Mortensen-Pissarides

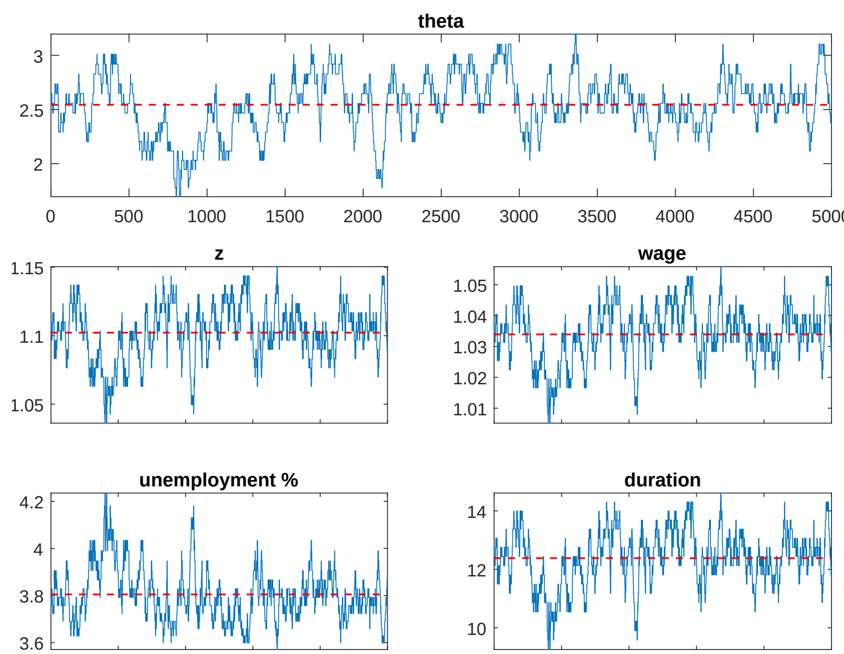
Simulated	Min	Max	Mean	Var
productivity (z)	0.96	1.06	1.00	0.00
labor market (θ)	0.33	0.39	0.35	0.00
work wage (w)	0.94	1.05	0.98	0.00
unemployment (u)	0.06	0.07	0.06	0.00
duration (d)	2.83	3.19	2.98	0.00



Problem 2. Hagedorn and Manovskii (2008) solved the same thing with a different calibration. Again, draw a sequence of productivity shocks and simulate out the endogenous variables. Why is it changed?

Table 2: Hagedorn-Manovskii

Simulated	Min	Max	Mean	Var
productivity (z)	1.05	1.15	1.10	0.00
labor market (θ)	1.70	3.20	2.54	0.07
work wage (w)	1.01	1.06	1.03	0.00
unemployment (u)	0.03	0.04	0.04	0.00
duration (d)	9.25	14.6	12.3	0.89



Preliminary results indicate that increasing a worker's outside option(b) and lowering bargaining power(μ) increases labor market tightness(θ). Here by a factor of 7, while the worker's wage(w) remains unchanged. This results in a large decline in the probability of filling a vacancy(q), increasing the expected duration of being unemployed by a factor of 4. Positive productivity shocks then only decrease the unemployment rate(u), but cannot raise wages or offset the increased duration found in the second specification.

Problem 3. Sample code included. For complete functions see, github.com/zdinakmg .

```
%% MAIN
% Discreetize AR Process
[z,P,~] = rouwenhorst(rho,sigma,1,n);

% Make a starting guess at the solution (zero) & call solver
[theta,fval,exitflag] = MP(kappa,beta,A,alpha,P,mu,z',b,delta,zeros(n,1));

% Impose lower bound on theta
theta( le(theta,(1/A).^(-1./alpha)) ) = (1/A).^(-1./alpha);

% Simulate a stochastic process for series of aggregate shocks
[z_star,ug] = simulateMC(z,P,t);

% Check simulation accuracy by estimating AR(1) process on output
[rho_star, s2, ~] = burg(z_star,1);
sigma_star = sqrt(s2);

% Find corresponding theta_star/theta for each z_star/z
[~,ind] = ismember(z_star',z');
theta_star = theta(ind);

% Realizations of productivity & time-series of the endogenous variables.
[w_star, u_star, d_star] = eMP(kappa,beta,A,alpha,P,mu,z_star, ...
                                          b,delta,theta_star);
%% Output

    Mortensen-Pissarides

    Rho    Rho*    Sigma    Sigma*
    ---    ----    -----    -----
ar  0.990   1.000   0.003   0.003

    Min     Max     Mean     Var
    ---     ----    -----   -----
z*  0.956   1.064   1.000   0.000
t*  0.327   0.387   0.351   0.000
w*  0.942   1.045   0.984   0.000
    ---     ----    -----   -----
u   0.063   0.066   0.064   0.000
d   2.830   3.194   2.981   0.004
    ---     ----    -----   -----

    Elapsed time is 0.064445 seconds.
```