634 HW 7

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1 Model Setup

The parameter set we need to estimate is:

$$\Theta = \left[\rho_1, \rho_2, \phi_1, \phi_2, \beta, \sigma^2, \sigma_A, \sigma_B\right]'$$

The transition function $X_t = g([X_{t-1}, X_{t-2}, \epsilon_{t-1}, \epsilon_{t-2}], \epsilon_t; \Theta)$ in this model is simply the ARMA(2,2) process:

$$X_t = \rho_1 X_{t-1} + \rho_2 X_{t-2} + \phi_1 \epsilon_{t-1} + \phi_2 \epsilon_{t-2} + \epsilon_t \tag{1}$$

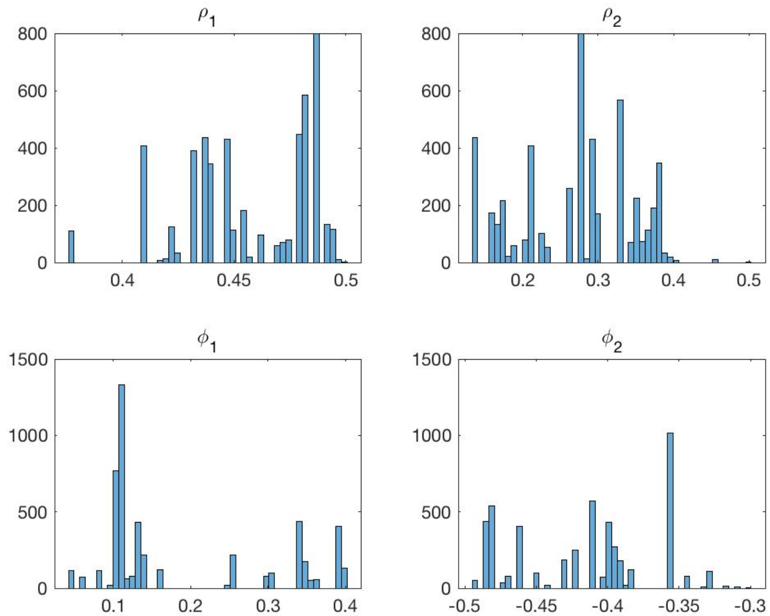
$W_t = \epsilon_t$ is the shock to state variable X_t.
The transition function $Y_t = h(X_t, [v_t^A, v_t^B]; \Theta)$ is:

$$Y_t = \begin{pmatrix} A_t \\ B_t \end{pmatrix} = \begin{pmatrix} e^{X_t + v_t^A} \\ \beta X_t^2 + v_t^B \end{pmatrix} \tag{2}$$

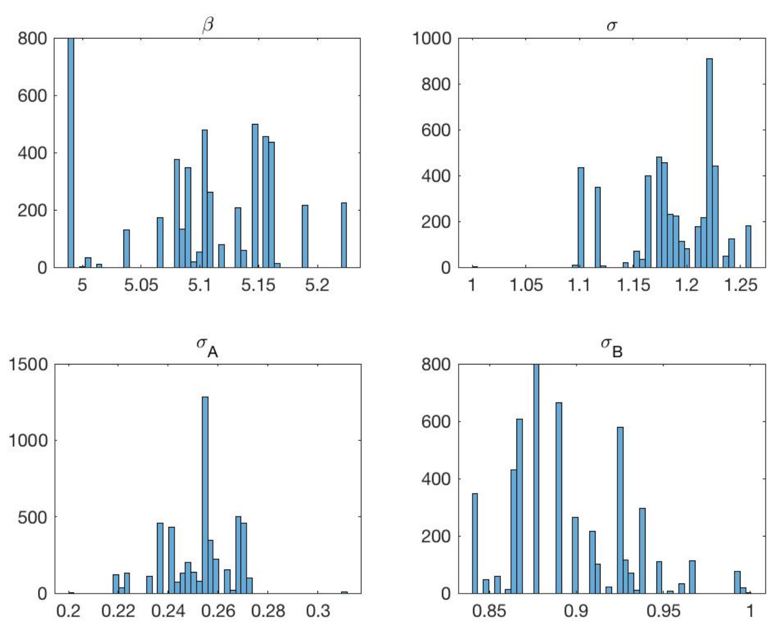
$V_t = [v_t^A,\ v_t^B]$ are shocks to observable variables A_t and B_t, respectively.

2 MatLAB Results

Using particle filter and Metropolis-Hasting algorithm, we have the posterior distributions for each parameter on next page. The acceptance rate is 0.6%, which is really low.



ρ_1
ρ_2
ϕ_1
ϕ_2
0
200
400
600
800
1000
1500
0.4
0.45
0.5
0.2
0.3
0.1
-0.5
-0.45
-0.4
-0.35
-0.3



β
σ
σ_A
σ_B
0
200
400
500
600
800
1000
1500
5
5.05
5.1
5.15
5.2
1
1.05
1.1
1.15
1.2
1.25
0.2
0.22
0.24
0.26
0.28
0.3
0.85
0.9
0.95