DGE–CRED Practice Session 4 and 5: Implementing the DGE–CRED Model

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Outline I

1. Task 1: Debugging (1)
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6. Task 6: Enter the Euler equation for foreign assets.

Outline II

7. Task 7: Enter the Euler equation for foreign assets.
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12. Task 12: Enter the sector aggregate specific production function.
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Outline III

Task 1: Try to run the `DGE_CRED_Model.mod` model stored in the folder `DGE_CRED_Model_Training`.

- Make sure that the number of sectors and regions is 3, respectively.
- Execute the `RunSimulations.m` file
- Why do you receive an error?
- How can you resolve the error?

Task 2: Try to run the `DGE_CRED_Model.mod` model stored in the folder `DGE_CRED_Model_Training`.

- Make sure that the number of sectors and regions is 3, respectively.
- Execute the `RunSimulations.m` file
- Why do you receive an error?
- How can you resolve the error?

Task 3: Enter the FOC of households with respect to capital.

- Missing Equations are represented by $0 = 0$ in the `DGE_CRED_Model_Equations.mod` file.

$$\frac{\left(\frac{P_{t+1}\, C_{t+1}}{Pop_{t+1}}\right)^{(-\sigma^C)}}{\left(1+\tau_t^C\right)\, P_{t+1}}\, \beta\, P_{k,r\,t+1}\, r_{k,r\,t+1}\, \left(1-\tau_{t+1}^{K,H}\right) + \beta\, \omega^I_{k,r\,t+1}\, \left(1-\delta-D^K_{k,r,t+1}\right) = \omega^I_{k,r\,t} \tag{1}$$

Task 4: Enter the law of motion for capital.

- Missing Equations are represented by $0 = 0$ in the `DGE_CRED_Model_Equations.mod` file.

$$K_{k,r_{t+1}} = K_{k,r_t}\left(1 - \delta - D^K_{k,r,t}\right) + I_{k,r,t}\,\Gamma\left(\frac{I_{k,r_t}}{I_{k,r_{t-1}}}\right) \tag{2}$$

Task 5: Enter the FOC of households with respect to labour.

- Missing Equations are represented by $0 = 0$ in the `DGE_CRED_Model_Equations.mod` file.

$$\frac{W_{k,r\,t}\left(1-\tau_t^{N,H}\right)\left(\frac{C_t}{Pop_t}\right)^{\left(-\sigma^C\right)}}{\left(1+\tau_t^C\right)\,P_t} = \phi^L\,{N_{k\,t}}^{\sigma^L} \tag{3}$$

Task 6: Enter the Euler equation for foreign assets.

- Missing Equations are represented by $0 = 0$ in the `DGE_CRED_Model_Equations.mod` file.

$$\frac{\left(\frac{C_{t+1}}{Pop_{t+1}}\right)^{(-\sigma^C)}}{\left(1+\tau_t^C\right) P_{t+1}} \beta \, S^f{}_{t+1} \exp\left(-\phi^B \left(\frac{B_{t+1} \, S^f{}_{t+1} \, r^f{}_{t+1}}{Y_{t+1}} + \frac{NX_{t+1}}{Y_{t+1}}\right)\right) \left(1 + r^f{}_{t+1}\right) = \ldots \quad (4)$$

$$\frac{\left(\frac{C_t}{Pop_t}\right)^{(-\sigma^C)}}{P_t \left(1+\tau_t^C\right)}$$

Task 7: Enter the Euler equation for foreign assets.

- Missing Equations are represented by $0 = 0$ in the `DGE_CRED_Model_Equations.mod` file.

$$\frac{\left(\frac{C_{t+1}}{Pop_{t+1}}\right)^{(-\sigma^C)}}{\left(1+\tau_t^C\right) P_{t+1}} \beta \, S^f{}_{t+1} \exp\left(-\phi^B \left(\frac{B_{t+1} \, S^f{}_{t+1} \, r^f{}_{t+1}}{Y_{t+1}} + \frac{NX_{t+1}}{Y_{t+1}}\right)\right) \left(1 + r^f{}_{t+1}\right) = \ldots \quad (5)$$

$$\ldots \frac{\left(\frac{C_t}{Pop_t}\right)^{(-\sigma^C)}}{P_t \left(1+\tau_t^C\right)}$$

Task 8: Complete the government budget constraint.

$$P_t\, G_t + \sum_{r}^{R} \sum_{k}^{K} P_t \sum_{z} G_{k,r,t}^{A,z} + P_t\, B_{t+1}^{G} = P_t\, S_t^{f}\ \left(1 + r^{f}{}_{t}\right)\ B_t^{G} \ldots \qquad (6)$$

$$+ C_t\, P_t\, \tau_t^{C} + \sum_{k}^{K} \sum_{r}^{R} N_{k,r,t}\, W_{k,r,t} \left(\tau_t^{N,H} + \tau_{k,r,t}^{N,F}\right) + K_{k,r_t}\, r_{k,r_t}\, P_{k,r_t} \left(\tau_t^{K,H} + \tau_{k,r,t}^{K,F}\right)$$

Task 9: Enter government policy instruments.

- tax rates on capital expenditure firms

$$\tau^{K,F}_{k,r,t} = \tau^{K,F}_{k,r,0} + \eta^{\tau^{K,F}}_{k,r,t} \tag{7}$$

- tax rates on labour compensation firms

$$\tau^{N,F}_{k,r,t} = \tau^{N,F}_{k,r,0} + \eta^{\tau^{N,F}}_{k,r,t} \tag{8}$$

- tax rates on capital expenditure households

$$\tau^{K,H}_{k,t} = \tau^{K,H}_{r,0} + \eta^{\tau^{K,H}}_{r,t} \tag{9}$$

- tax rates on labour compensation households

$$\tau^{N,H}_{r,t} = \tau^{N,H}_{r,0} + \eta^{\tau^{N,H}}_{r,t} \tag{10}$$

Task 10: Enter the resource constraint.

$$Y_t = C_t + I_t + G_t + \sum_{k}^{K} \sum_{r}^{R} G^{A}_{k,r,t} + NX_t \tag{11}$$

Task 11: Enter the demand equation for sectoral output.

$$\frac{P_{kt}}{P_t} = \omega_k^{Q\,\frac{1}{\eta^Q}} \left(\frac{Y_{kt}}{Y_t}\right)^{\frac{(-1)}{\eta^Q}} \tag{12}$$

Task 12: Enter the sector aggregate specific production function.

$$Y_{k,t} = \left(\sum_{r}^{R} \omega_{k,r}^{Q}{}^{\frac{1}{\eta_k^Q}} \; Y_{k,r_t}{}^{\frac{\eta_k^Q - 1}{\eta_k^Q}} \right)^{\frac{\eta_k^Q}{\eta_k^Q - 1}} \tag{13}$$

Task 13: Enter damage function on TFP.

$$
\begin{aligned}
D_{k,r_t} = \Big\{ & \left(a_{T,1,k,r}\, T_{rt} + a_{T,2,k,r}\, (T_{rt})^{a_{T,3,k,r}}\right) exp\left(-\phi^{G^{A,T}_{k,r}}\, G^{A,T}_{k,r,t}\right) \\
& + \left(a_{SL,1,k,r}\, SL_t + a_{SL,2,k,r}\, (SL_t)^{a_{SL,3,k,r}}\right) I\left(SL_t > \frac{K^{A,SL}_{k,r,t}}{\phi^{G^{A,SL}_{k,r}}}\right) \\
& + \left(a_{W,1,k,r}\, WS_{rt} + a_{W,2,k,r}\, (WS_{rt})^{a_{W,3,k,r}}\right) exp\left(-\phi^{G^{A,WS}_{k,r}}\, G^{A,WS}_{k,r,t}\right) \\
& + \left(a_{P,1,k,r}\, PREC_{rt} + a_{P,2,k,r}\, (PREC_{rt})^{a_{P,3,k,r}}\right) exp\left(-\phi^{G^{A,PREC}_{k,r}}\, G^{A,PREC}_{k,r,t}\right) \\
& + \left(a_{C,1,k,r}\, CYC_{rt} + a_{C,2,k,r}\, (CYC_{rt})^{a_{C,3,k,r}}\right) exp\left(-\phi^{G^{A,CYC}_{k,r}}\, G^{A,CYC}_{k,r,t}\right) \\
& + \left(a_{D,1,k,r}\, DRO_{rt} + a_{D,2,k,r}\, (DRO_{rt})^{a_{DRO,3,k,r}}\right) exp\left(-\phi^{G^{A,DRO}_{k,r}}\, G^{A,DRO}_{k,r,t}\right) \Big\}
\end{aligned}
\tag{14}
$$

Task 14: Enter regional sectoral production function and demand for production factors.

- production function

$$Y_{k,r_t} = A_{k,r_t}\left(1 - D_{k,r_t}\right)\left(\alpha^{K}_{k,r}{}^{\frac{1}{\eta^{N,K}_{k,r}}}\left(K_{k,r_t}\right)^{\frac{\eta^{N,K}_{k,r}-1}{\eta^{N,K}_{k,r}}} + \alpha^{N}_{k,r}{}^{\frac{1}{\eta^{N,K}_{k,r}}}\left(A^{N}_{k,r_t}\left(1 - D^{N}_{k,r,t}\right) Pop_t\, N_{k,r_t}\right)^{\frac{\eta^{N,K}_{k,r}-1}{\eta^{N,K}_{k,r}}}\right)^{\frac{\eta^{N,K}_{k,r}}{\eta^{N,K}_{k,r}-1}} \tag{15}$$

- firms FOC capital

$$r_{k,r_t}\left(1 + \tau^{K,F}_{k,r,t}\right) = \alpha^{K}_{k,r}{}^{\frac{1}{\eta^{N,K}_{k,r}}}\left(A_{k,r_t}\left(1 - D_{k,r,t}\right)\right)^{\frac{\eta^{N,K}_{k,r}-1}{\eta^{N,K}_{k,r}}}\left(\frac{K_{k,r_t}}{Y_{k,r_t}}\right)^{\frac{-1}{\eta^{N,K}_{k,r}}} \tag{16}$$

- firms FOC labour

$$\frac{W_{k,r_t}\left(1 + \tau^{N,F}_{k,r,t}\right)}{P_{k,r_t}} = \alpha^{N}_{k,r}{}^{\frac{1}{\eta^{N,K}_{k,r}}}\left(A_{k,r,t}\left(1 - D_{k,r,t}\right) A^{N}_{k,r,t}\left(1 - D^{N}_{k,r,t}\right)\right)^{\frac{\eta^{N,K}_{k,r}-1}{\eta^{N,K}_{k,r}}}\left(\frac{Pop_t\, N_{k,r_t}}{Y_{k,r_t}}\right)^{\frac{-1}{\eta^{N,K}_{k,r}}} \tag{17}$$