

Economics Problem Set #5-2: DSGE Linearization

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Exercise 1.

Solution. For all of the coding solutions in this problem set, see the attached notebook `Linearization_Exercises_1-5.ipynb`. We note in the graph in the notebook that close to the steady state this linearization gives approximately the correct solution, but it gets farther away from the true solution the farther we get from the steady state.

Exercise 2.

Solution. See the attached notebook `Linearization_Exercises_1-5.ipynb`

Exercise 3.

Solution. We are given the following equations in Uhlig's notation:

$$E_t\{F\tilde{X}_{t+1} + G\tilde{X}_t + H\tilde{X}_{t-1} + L\tilde{Z}_{t+1} + M\tilde{Z}_t\} = 0$$

$$\tilde{Z}_t = N\tilde{Z}_{t-1} + \epsilon_t$$

$$\tilde{X}_t = P\tilde{X}_{t-1} + Q\tilde{Z}_t$$

We seek to rewrite the first equation in terms of \tilde{X}_{t-1} and \tilde{Z}_t . We note that $\tilde{Z}_{t+1} = N\tilde{Z}_t + \epsilon_{t+1}$, $\tilde{X}_{t+1} = P\tilde{X}_t + PQ\tilde{Z}_t + Q\tilde{Z}_{t+1}$. We also note that the epsilon terms will always have an expectation of 0, so these can be removed from the expectation expression. This yields the following simplification:

$$\begin{aligned} E_t\{F\tilde{X}_{t+1} + G\tilde{X}_t + H\tilde{X}_{t-1} + L\tilde{Z}_{t+1} + M\tilde{Z}_t\} \\ &= F(P\tilde{X}_t + PQ\tilde{Z}_t + Q\tilde{Z}_{t+1}) + H\tilde{X}_{t-1} + G(P\tilde{X}_{t-1} + Q\tilde{Z}_t) + LN\tilde{Z}_t + M\tilde{Z}_t \\ &= (FP^2 + GP + H)\tilde{X}_{t-1} + (FPQ + FQN + GQ + LN + M)\tilde{Z}_t \\ &= ((FP + G)P + H)\tilde{X}_{t-1} + ((FQ + L)N + (FP + G)Q + M)\tilde{Z}_t = 0. \end{aligned}$$

Exercise 4.

Solution. See the attached notebook `Linearization_Exercises_1-5.ipynb`

Exercise 5.

Solution. See the attached notebook `Linearization_Exercises_1-5.ipynb`

Exercise 6.

Solution. See the attached notebook `Linearization_Exercises_6-9.ipynb`

Exercise 7.

Solution. See the attached notebook `Linearization_Exercises_6-9.ipynb`

Exercise 8.

Solution. See the attached notebook `Linearization_Exercises_6-9.ipynb`

Exercise 9.

Solution. See the attached notebook `Linearization_Exercises_6-9.ipynb`

Exercise 10.

Solution. See the attached notebook `Linearization_Exercises_10-11.ipynb`

Exercise 11.

Solution. See the attached notebook `Linearization_Exercises_10-11.ipynb`