DSGE Methods

Introduction to Matlab/Dynare

Fabian Gößling, M.Sc.

Institute of Econometrics and Empirical Economics
University of Münster
Fabian.Goessling@uni-muenster.de

Winter 2016

Getting started:

- Install Matlab and Dynare.
- Create and add a working directory.
- Add the *.mod* to the known Matlab file extensions.
- Download the *get_simul_replications.m* file, add it the working directory.
- Explore the help function of Matlab, e.g. execute *sum()*.
- Remember: Researchers worldwide use Matlab and Dynare, thus
  - mathworks.com
  - dynare.org
  - google.de

  are very useful.

Functions:

- Write a function, which computes

$$f(x, y, z) = x^a + b \cdot z - y,$$

  where a and b are constants.
- Expand your function with an additional input/output. I.e. it should display something like *"The function value is: f(x,y,z)"* in the Matlab command window, if the additional input is "TRUE". The function *fprintf()* might be of use.
- Expand your function by dynamic inputs a and b. Create a function handle , which allows to evaluate the function for x given y,z,a and b.

Loops:

- Open a new script file.
- Create an empty $5 \times 5 \times 5$ array A
- Create vectors x,y,z with dimensions 1×5. Fill the vectors with random standard normal distributed numbers.
- Use a for loop to fill the array A with elements $x_i \cdot y_j \cdot z_k$. Reshape the array into a vector V.
- Sum up all elements in V. Can you avoid using a for loop?
- Sum up all absolute values of the elements in V until the sum is larger then 20. Report the corresponding index and a use a loop.

Simulation:

- Write a function F that simulates the following process:

$$x_t = \rho x_{t-1} + \epsilon_t$$

- Additional requirements:
  - ϵ_t is normal distributed, where μ and σ are input arguments of F.
  - x_0 is an input argument of F.
  - The number of periods N_p in the simulation is an input argument of F.
  - The number of simulations N_s is an input argument of F.
  - The output of the function is a $N_s \times N_p$ matrix.
- Use your function to simulate the process 50 times for 480 periods. Plot all paths of x_t.
- Plot the expected value $E(x)$ and variance $V(x)$ of a simulated trajectory and illustrate the convergence to true values. Use the *subplot()* command to produce a single figure.

A simple model (Collard, Juillard and Villemot 2009):

- Open a new script file and enter the model (levels) equations. Save it with the *.mod* extension
- Run the *.mod* file using the *dynare FILE* command
- Explore the outputs

Elaboration of the .mod file:

- Change the options for *stoch_simul()*, explore the differences
- Run the .mod file using the *dynare FILENAME* command
- How is the *initval* block derived? Use the *resid(1)* command in the .mod file to print the residuals of the equations. Change some initial values, does the solution change? Why? Why not?

Embedding Dynare in a script:

- Create a script file and set all parameters of the model. Save the parameters in a file 'params' using the *save()* command
- Copy your *.mod* file and rename it. Make the parameters dynamic by using the load('params') command in the *.mod* file. Set the parameters by using e.g. *set_param_value('alpha',alpha);*
- After checking that your .mod file works, use the *simuls_replic = 50* option to run 50 simulations. Use the *get_simul_replications(M_,options_)* function to save the simulations to an array.

Model sensitivity:

- Choose a variable and a parameter. Create a corresponding vector with different values of your chosen parameter. Write a "for" loop over the vector and on each iteration...
  - ... save the parameters to the 'params' file
  - ... run the .mod file
  - ... extract the simulations
  - ... calculate and save the expected value of the chosen variable
- Plot the relation between the chosen parameter and your variable. Interpret the results.