VSE Econ502 Advanced Macroeconomics Notes , Oct 2019
RBC Model with Dynare
Tutorial Notes
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1 Installation

1. Install Dynare from http://www.dynare.org/download/dynare-stable, remember where you installed it, as you will need to set path later.

2. After installation, reopen your Matlab and run "addpath *your installation folder, narrow down to matlab folder under the dynare folder*". For example, my location is: "/Applications/Dynare/4.5.4/matlab".

3. After setting path successfully, nothing will happen. If you failed setting path, when you run dynare mod file there will be an error message. If you can't configure it, google is always your best friend.

2 Use of Dynare

Dynare is a matlab add-on package that can help you to solve General Equilibrium Model with system of equations such as RBC(Real Business Cycle) or DSGE(Dynamic Stochastic General Equilibrium) models. The dynare file is usually stored with ".mod" rather than ".m" as common matlab function files.

The ".mod" file for dynare describes your model and what you want dynare to do, it usually has several essential parts[1]:

1. Variable Declaration: The endogenous variables determined in the equilibrium of model is declared using **"var"** command followed by the list of variables, for example in the "RBC.mod" file, there are 10 endogenous variables:

```
var c,k,i,n,l,lambda,y,w,r,z
```

Similarly, set of parameters of the model (e.g. discounting factors, α of C-D production functions...) is defined using **"parameters"** block and exogenous variables are defined using **"varexo"** block.

2. Setting parameter values: After declaration of variables, one can set parameter values for the model parameters, usually these parameters are either calibrated from empirical moments or estimated with different methods.

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[1]For general instructions, please read carefully the dynare manual: https://www.dynare.org/wp-repo/dynarewp001.pdf , or its most up-to-date version

Notice when declaring parameters, we usually include a set of parameters that are steady state values of endogenous variables, which are solved from the model as functions of parameters. These values are useful later as input for steady state value into dynare.

3. Define Model: The model block of mod file starts with `"model;"` command. One needs to write the system of equations that define the entire model, which usually includes Euler Equations, market clearing conditions and identity equations (of auxiliary variables) such as how investment variable is defined using capital.

In the example of simple RBC model ("RBC.mod" file). The RBC model is described as:

Household Choice(Demand):

$$c_t^{-\sigma} = \lambda \quad (FOC)$$

$$\xi n_t^{\eta} = \lambda w_t \quad (FOC)$$

$$c_t^{-\sigma} = E_t c_{t+1}^{-\sigma} \beta (1 + r_{t+1} - \delta) \quad (Intertemporal \quad EE)$$

$$c_t + k_{t+1} = w_t n_t + r_t k_t + (1 - \delta) k_t \quad (Budget \quad Constraint)$$

Firm Choice(Supply):

$$w_t = (1 - \alpha) e^{z_t} k_t^{\alpha} n^{-\alpha}$$

$$r_t = \alpha e^{z_t} k_t^{\alpha-1} n_t^{1-\alpha}$$

Auxiliary variables:

$$i_t = k_{t+1} - k_t + \delta k_t$$

$$y_t = e^{z_t} k_t^{\alpha} n_t 1 - \alpha$$

$$l_t = 1 - n_t \quad (leisure)$$

Shocks:

$$z_t = \rho z_{t-1} + e_t$$

Remark There are 10 equations in total and 10 variables defined, that guarantees the model is solvable. If the model is ill-specified Dynare will pop an error message saying number of variables are not same as number of equations.

4. Steady State: The next block is computing steady state values of endogenous variables. This block starts with command `"initval"` and we need to use some self-computed values to feed into Dynare as it can only compute the steady state with local perturbation method, which is very difficult if the initial values fed in are far from the actual steady state. The number of steady states declared in this block should be the same as number of endogenous variables.

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5. Shocks In the shock block starting with `"shocks;"`, you can specify which shock you want to activate in the system, with standard deviations (size of the shock) specified with `"stderr"` command.

6. Simulation configuration `stoch_simul(irf=80,order=1,periods=4000)`

This command describes the length of impulse responses we want Dynare to plot (80 in this case), the periods described how long you want Dynare to simulate the model for. The graph below is a plot for simulated output (y) and consumption (c):
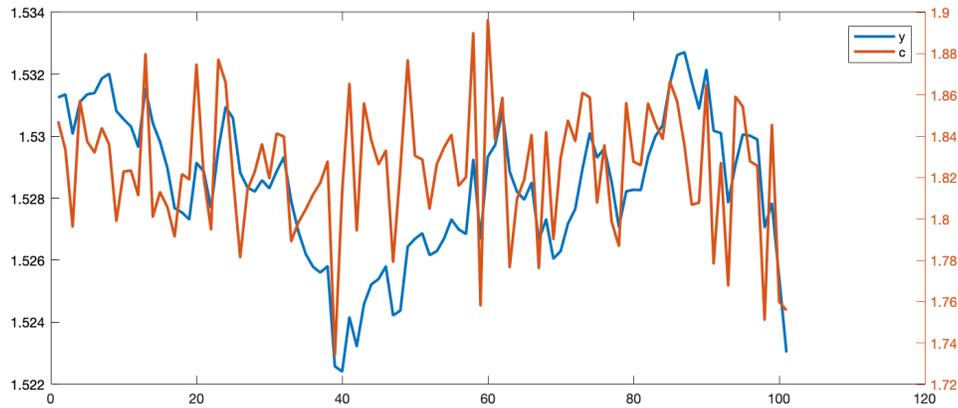

Figure 1

3   Run Dynare

After you finish writing/modifying your .mod file, and setting path for dynare in Matlab. Just type:

```
dynare xxx.mod
```

"xxx" is the name of your mod file.