Introduction to DSGE Modelling

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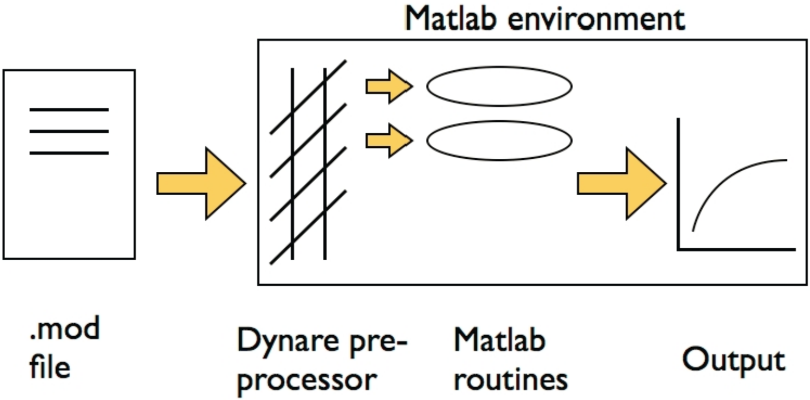
Introduction: the Dynare Enviromet



Steps to Solving and Simulating DSGE

- To use Dynare you need:
- Have an installation of Matlab or Octave on your computer
- Download Dynare fron www.dynare.org and Install Dynare on you computer
- Add Dynare/Matlab Path on you Matlab or Octave Installation
- Write you model in a simple text file and save it as .mod (a very good text editor is Notepad++ that comes standard with Octave or that you can download from http://notepad-plus-plus.org/)
- type "dynare filename.mod" in the Matlab/Octave command window and see the magicMonetary Policy in Emerging Countries (13 and 14)

Neoclassical Model with Fixed Labor

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma} - 1}{1 - \sigma} \tag{1}$$

s.t

$$k_{t+1} = a_t k_t^{\alpha} - c_t + + (1 - \delta) k_t \tag{2}$$

TFP is assumed to follow a mean zero $AR(1)$ in the log:

$$\ln a_t = \rho \ln a_{t-1} + \varepsilon_t$$

First Order Conditions

$$c_t^{-\sigma} = \beta E_t c_{t+1}^{-\sigma} \left(\alpha a_{t+1} k_{t+1}^{\alpha-1} + (1-\delta)\right) \tag{3}$$

$$k_{t+1} = a_t k_t^{\alpha} - c_t + (1-\delta) k_t \tag{4}$$

$$\ln a_t = \rho \ln a_{t-1} + \varepsilon_t \tag{5}$$

$$\lim_{t\to\infty} \beta^t c_t^{-\sigma} k_{t+1} = 0 \tag{6}$$

$$y_t = a_t k_t^{\alpha} \tag{7}$$

$$i_t = y_t - c_t \tag{8}$$

Calibration

The parameters that need to be calibrated are $\sigma, \alpha, \delta, \beta, \rho$ and σ_ε,
$\sigma, = 2$, capital's share
$\alpha = 1/3$, the depreciation rate
$\delta = 0.025$
$\beta = 0.099$
$\sigma_\varepsilon = 0.01$

Timing Convention

$$
\begin{aligned}
c_t^{-\sigma} &= \beta E_t c_{t+1}^{-\sigma} \left(\alpha a_{t+1} k_t^{\alpha-1} + (1-\delta)\right) && (9)\\
k_t &= a_t k_{t-1}^{\alpha} - c_t + + (1-\delta)\, k_t && (10)\\
\ln a_t &= \rho \ln a_{t-1} + \varepsilon_t && (11)\\
\lim_{t\to\infty} \beta^t c_t^{-\sigma} k_t &= 0 && (12)\\
y_t &= a_t k_{t-1}^{\alpha} && (13)\\
i_t &= y_t - c_t && (14)
\end{aligned}
$$

The Dynare Code

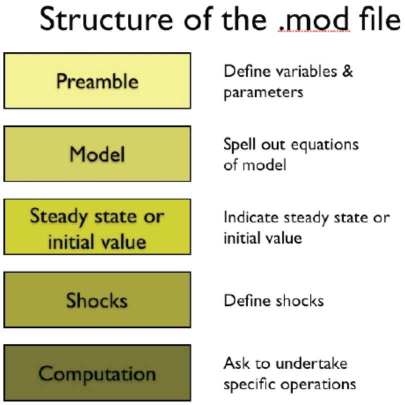


Figure: Structure of the .mod file

The Model

```
var y i k a c;
varexo e;

parameters alpha beta delta rho sigma sigmae;

alpha = 0.33;
beta = 0.99;
delta = 0.025;
rho = 0.95;
sigma = 2;
sigmae = 0.01;
```

The Model

```
model;
exp(c)^(-sigma) = beta*(exp(c(+1))^(-
sigma))*(alpha*exp(a(+1))*(exp(k))^(alpha-1) +
(1-delta));
exp(y) = exp(a)*exp(k(-1))^(alpha);
exp(k) = exp(a)*exp(k(-1))^(alpha) - exp(c) +
(1-delta)*exp(k(-1));
a = rho*a(-1) + e;
exp(i) = exp(y) - exp(c);
end;
```

Why exp(x)

$$\exp(\ln y_t) = \exp(\ln a_t)\exp(\alpha \ln k_t)$$

Now linearize about the steady state:

$$\exp(\ln y^*) + \frac{1}{y^*}\exp(\ln y^*)(y_t - y^*) = \exp(\ln a^*)\exp(\alpha \ln k^*)$$
$$+(a_t - a^*)(\exp(\alpha \ln k^*)) +$$
$$+\frac{\alpha}{k^*}\exp(\ln a^*)\exp(\alpha \ln k^*)(k_t - k^*)$$
$$\frac{1}{y^*}\exp(\ln y^*)(y_t - y^*) = (a_t - a^*)(\exp(\alpha \ln k^*))$$
$$+\frac{\alpha}{k^*}\exp(\ln a^*)\exp(\alpha \ln k^*)(k_t - k^*)$$
$$\frac{y_t - y^*}{y^*} = \frac{(a_t - a^*)}{a^*} + \alpha\frac{(k_t - k^*)}{k^*}$$

so that impulse responses, etc. are all in percentage terms.

More code

```
initval;
k = log(29);
y = log(3);
a = 0;
c = log(2.5);
i = log(1.5);
end;

shocks;
var e = sigmae^2;
end;

steady;
```

“stoch_simul”