A Course on DSGE Models with Financial Frictions
Part 1: Introduction

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Summary

- Real Businesses Cycles
- New Keynesian models

DSGE models

- Dynamic Stochastic General Equilibrium
- RBC & NK (plain vanilla) models assume perfect financial markets
  $\rightarrow$ DSGE models with financial frictions go a step further

Summary

- DSGE models are micro-founded
- They make assumptions regarding:
  (1) Preferences (log utility, CRRA, GHH...)

  (2) Technology (Cobb Douglas PF, CES...)

  (3) Market structure (Complete-incomplete markets, heterogeneity, FF...)

Background Literature

- Seminal RBC models: Kydland and Prescott (1982) & Long Jr and Plosser (1983)

- New Keynesian main textbooks:
    - Galí (2015) *Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian framework and Its Applications, Second Edition*. Princeton University Press
    - Woodford (2011) *Interest and Prices. Foundations of a Theory of Monetary Policy*. Princeton University Press

- General DSGE
    - Miao (2020) *Economic Dynamics in Discrete Time*. MIT press

- State of the art multi-shock and frictions NK-DSGE model: Smets and Wouters (2007)

RBC to NK to FF DSGE

- RBC: Neoclassical model where agents optimize with rational expectations
- New Keynesian environment adds price and/ or wage stickiness
- Financial frictions eliminate complete markets
  - Sometimes these frictions are very specific, derived from micro-founded behaviour, while sometimes they are more ad-hoc (reduced form)
- Next: From the model set up to the model solution

Models' Solution

- What characterizes the solution of a DSGE model?
  - The optimality conditions obtained through the various maximizations
  - The constraints
  - The shock processes
- The steady state equilibrium
- is obtained by transforming all equations from dynamic to static

Models' Solution

- What is the solution of a DSGE model?
  - A set of policy functions

- A simple RBC model example
  - $C_t = g_c(K_t, Z_t)$
  - $K_t = g_k(K_{t-1}, Z_t)$

- Finding the policy function can be a very difficult problem: there is rarely an analytical solution and we therefore use numerical techniques

- The general idea is to approximate the policy function with a polynomial

$$\hat{g}_c(K_t, Z_t) \approx g_c(K_t, Z_t)$$

  where

$$\hat{g}_c(K_t, Z_t) = \alpha_c + \alpha_{c,k} K_t + \alpha_{c,z} Z_t$$

  [here a first order polynomial approximation]

Solution Methods

- A large number of solution methods have been proposed to solve DSGE models
  - See Fernández-Villaverde *et al.* (2016) for an almost complete characterization

- Perturbation algorithms build Taylor series approximations to the solution of a DSGE model around its deterministic steady state
  - This is what Dynare does, $g(x_t) \approx g(\bar{x}) + (x_t - \bar{x})g'(\bar{x}) + \frac{1}{2}(x_t - \bar{x})^2 g''(\bar{x})$...
  - We will focus on this

- Projection methods handle DSGE models by building a function indexed by some coefficients that approximately solves our set of functions
  - The coefficients are selected to minimize a residual function that evaluates how far away the solution is from generating a zero residual
  - Example: Parametrized Expectations Algorithm by: Den Haan and Marcet (1990)

- Value function iterations

Den Haan, W. J. and Marcet, A. (1990). Solving the stochastic growth model by parameterizing expectations. *Journal of Business & Economic Statistics*, **8**(1), 31–34.

Fernández-Villaverde, J., Rubio-Ramírez, J. F., and Schorfheide, F. (2016). Solution and estimation methods for dsge models. In *Handbook of macroeconomics*, volume 2, pages 527–724. Elsevier.

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Kydland, F. E. and Prescott, E. C. (1982). Time to build and aggregate fluctuations. *Econometrica*, pages 1345–1370.

Long Jr, J. B. and Plosser, C. I. (1983). Real business cycles. *Journal of Political Economy*, **91**(1), 39–69.

Miao, J. (2020). *Economic dynamics in discrete time*. MIT press.

Smets, F. and Wouters, R. (2007). Shocks and frictions in us business cycles: A bayesian dsge approach. *American economic review*, **97**(3), 586–606.

Woodford, M. (2011). *Interest and prices: Foundations of a theory of monetary policy*. princeton university press.