

# A Course on DSGE Models with Financial Frictions

## Part 1: Introduction

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# About The Course (and myself)

- Stelios Tsiaras, email at [stylianos.tsiaras@eui.eu](mailto:stylianos.tsiaras@eui.eu)
- Working on macro-finance, unconventional monetary policy, macroprudential policy
- Feel free to ask me anything on research!

# The Course

- An introduction to the main **financial frictions** DSGE models
- Together with models of simple **heterogeneity**
- And a short view on models with **unconventional monetary policy** and **macroprudential policy**
- Usually, if you have the FF set-up, everything else adds up easily

# Overview

- **This lecture:** Introduction on DSGE models, solution techniques, RBC refresher and how to solve models in Dynare
- Lecture 2: Models with **asymmetric information**: Essentially the [Bernanke \*et al.\* \(1999\)](#)
- Lecture 3: Models with **moral hazard problems**: Essentially the [Gertler and Kiyotaki \(2010\)](#); [Gertler and Karadi \(2011\)](#)
- Lecture 4: Models with **simple form of heterogeneity**: [Bilbiie \(2008\)](#), [Mankiw \(2000\)](#)
- Lecture 5: Models with **unconventional MP** and **macroprudential policy** (building on the previous blocks)

# DSGE models

- Real Businesses Cycles
  - New Keynesian models
  - Dynamic Stochastic General Equilibrium
- } DSGE models
- RBC & NK (plain vanilla) models assume perfect financial markets  
→ 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,  $g(x_t) \approx g(\bar{x}) + (x_t - \bar{x})g'(\bar{x}) + \frac{1}{2}(x_t - \bar{x})^2g''(\bar{x})\dots$
  - 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

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