

DSGE Models

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Introduction

- Macroeconomists study both long-run and short-run topics
 - Long-run: Economic growth, natural rate of unemployment
 - Short-run: Business cycle, stabilization (monetary, fiscal) policy
- We will focus on dynamic models of aggregate demand and supply to **quantitatively** analyze the business cycle and stabilization policy
 - Nominal vs real variables
 - Closed vs open economy
 - Finite vs infinite horizon
 - Continuous vs discrete time
 - Perfect foresight vs uncertainty
 - Endogenous vs exogenous variables

DSGE Models

- Mathematical representations of an economy subject to shocks
- Acronym stands for Dynamic Stochastic General Equilibrium
 - Dynamic: Agents make intertemporal decisions
 - Stochastic: Random shocks capture uncertainty
 - GE: All markets interact and prices adjust so that supply equals demand
- DSGE models are a central tool for macroeconomic analysis
 - Microeconomic foundations: Optimizing agents (utility, profits)
 - They are internally consistent, not subject to Lucas critique (1976)
- They are used by central banks and international organizations (eg IMF)
 - Simulate and forecast variables of interest
 - Policy and scenario analysis

Module Outline

- We will cover the canonical models
 - Real Business Cycle (RBC) - flexible prices without money
 - Money in the Utility Function (MIUF) - flexible prices with money
 - New Keynesian (NK) - price frictions
- RBC model (Kydland and Prescott, 1982) set standard for analysis of economic fluctuations
 - Productivity shocks, perfect competition, no role for monetary policy
- Building on RBC model, later models introduced new shocks and frictions in line with Keynesian principles
- We will only cover price frictions; recent models add more
 - Habit formation, investment adjustment costs, financial, etc.

Outline of DSGE Models

- Assumptions
- Agents' optimization problems (Lagrange's method)
- Model's equilibrium (short-run)
- Steady state (long-run)
- Calibration
- Log-linearization (Uhlig's method)
- Dynare implementation
- Impulse response functions (IRFs)
 - How endogenous variables respond to exogenous shocks

Representative Agents

- Agents in economy are heterogeneous
 - Agents: Households, firms, financial intermediaries, foreigners
 - Consumers have different preferences, firms use different technologies
- Any economic model is a simplified description of reality
- Canonical DSGE models make use of **representative agents**
 - Goal: Assess macroeconomic policy by analyzing their interactions
 - Recent models use heterogeneous agents explicitly
- **Simplifying assumption:**
 - Large number of identical agents (firms, families) make decisions with infinite time horizons

Calibration

- Dynamic macroeconomic models are a set of **parameters** and **equations** describing relationships between macroeconomic variables
 - Consumption, investment, output, trade balance (exports - imports), employment, prices, interest rates, exchange rates
- Parameter values are key inputs for numerical implementation of model
 - Estimation: Using actual data
 - Calibration: Assign values based on consensus and/or related papers
 - Proceed with caution and common sense
- **Important:** Match length of time period (quarterly, annually) in model

Dynare

- Free collection of routines for solving DSGE (and OLG) models
 - Rational expectations, perfect foresight, learning
 - Discrete time models only (perturbation techniques around a SS)
- Developed by a team led by Michel Julliard; first released in 1996
- Widely used by academic and policy institutions
- A Matlab license is required to run Dynare
 - Alternatives: Octave (limited) and Julia (beta version)
- In practice:
 - Write text (.mod) file: variables, parameters, equations, shocks, output
 - Dynare's preprocessor translates the .mod file into Matlab code
 - Matlab numerically solves model and displays results