# Perturbation and Dynare

## Introduction

Tools for Macroeconomists: The essentials

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# Tools for Macroeconomists: The Essentials

- Monday - Wednesday: Solving DSGE models
  - Perturbation in theory and practice
  - Numerical integration, function approximation
  - Projection methods
- Thursday - Friday: Parameterizing DSGE models
  - Kalman filter and Maximum likelihood estimation
  - Introduction into Bayesian estimation and MCMC methods
- Additional material and extensions

# Introduction

# Overview for today

Introduction into numerical methods

Perturbation

- main idea
- first-order perturbation and certainty equivalence

Impulse responses and simulation

- definitions and implementation
- computing business cycle statistics

Implementing perturbation (Dynare)

- introduction into Dynare
- incorporating Dynare into other code
- tips and tricks

# Introduction

## Why DSGE's?

# Why (DSGE) models?

Why not only use tons of data?

- even with super-cool techniques like machine learning?

DSGE models give

- more discipline than reduced-form methods
- discipline comes from “cross-equation” restrictions
  - stochastics of exogenous variables
  - together with forward-looking behavior of agents
  - result in implication for evolution of endogenous variables

# Prior to DSGE models...

- long tradition of large macroeconometric models
- these reduced-form systems have certain drawbacks
  - no “GE”
  - no forward-looking behavior
- changes after Kydland and Prescott (1982)
  - other critical contributions by Hansen, Lucas, Sargent and Sims
- a nice discussion of current state of macro (and identification)
  - Jón Steinsson: A New Macroeconomics?

# Introduction

## What will we cover?

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Computational tools for “Rep-Agent models”

- what do we need to solve for?
  - policy rules (functions)
- why is this a tough problem?
  - forward looking behavior
  - dynamics today depend on expectations of future dynamics
  - focus on recursive problems
  - even then
    - analytical solutions are rare
    - “S” in DSGE necessitates computation of expectations

## What will we cover?

1) Tools for solving DSGE models
   - characterize unknown functions (in several ways)
     - projection
     - perturbation
     - value function iteration

2) Tools for parameterizing DSGE models
   - discussion of alternative methods
     - calibration, estimation, matching moments
   - we'll cover estimation in more detail
     - Maximum Likelihood estimation
     - Introduction into Bayesian estimation


That's all Folks!