STRUCTURAL MACROECONOMETRICS

David N. DeJong
Chetan Dave
Contents

Preface

I Model and Data Preparation

1 Introduction
   1.1 Background
   1.2 Overview
   1.3 Notation

2 Approximating and Solving DSGE Models
   2.1 Linearization
      2.1.1 Taylor Series Approximation
      2.1.2 Logarithmic Approximations
      2.1.3 Examples
   2.2 Solution Methods
      2.2.1 Blanchard and Kahn’s Method
      2.2.2 Sims’s Method
      2.2.3 Klein’s Method
      2.2.4 An Undetermined Coefficients Approach

3 Removing Trends and Isolating Cycles
   3.1 Eliminating Trends
   3.2 Isolating Cycles
   3.3 Spuriousness
4 Summarizing Time Series Data

4.1 Two Useful Reduced-Form Models
   4.1.1 The ARMA Model
   4.1.2 The VAR Model

4.2 Summary Statistics

4.3 The Kalman Filter
   4.3.1 The Filter Without Measurement Errors
   4.3.2 The Filter With Measurement Errors
   4.3.3 Serially Correlated Measurement Errors

5 DSGE Models: Three Examples

5.1 Model I: A Real Business Cycle Model
   5.1.1 Environment
   5.1.2 The Nonlinear System
   5.1.3 Linearization

5.2 Model II: Monopolistic Competition and Monetary Policy
   5.2.1 Environment
   5.2.2 The Non-Linear System
   5.2.3 Linearization

5.3 Model III: Asset Pricing
   5.3.1 Single-Asset Environment
   5.3.2 Multi-Asset Environment
   5.3.3 Alternative Preference Specifications

II Empirical Methods

6 Calibration
   6.1 Historical Origins and Philosophy
6.2 Implementation
6.3 The Welfare Cost of Business Cycles
6.4 Productivity Shocks and Business Cycle Fluctuations
6.5 The Equity Premium Puzzle
6.6 Critiques and Extensions
   6.6.1 Critiques
   6.6.2 Extensions

7 Matching Moments
7.1 Overview
7.2 Implementation
   7.2.1 The Generalized Method of Moments
   7.2.2 The Simulated Method of Moments
   7.2.3 Indirect Inference
7.3 Implementation in DSGE Models
   7.3.1 Analyzing Euler Equations
   7.3.2 Analytical Calculations Based on Linearized DSGE Models
   7.3.3 Simulations Involving Linearized DSGE Models
   7.3.4 Simulations Involving Non-Linear Approximations of DSGE Models
7.4 Empirical Application: Matching RBC Moments

8 Maximum Likelihood
8.1 Overview
8.2 Introduction and Historical Background
8.3 A Primer on Optimization Algorithms
   8.3.1 Simplex Methods
   8.3.2 Derivative Based Methods
8.4 Ill-Behaved Likelihood Surfaces: Problems and Solutions
8.4.1 Problems
8.4.2 Solutions
8.5 Model Diagnostics and Parameter Stability
8.6 Empirical Application: Identifying Sources of Business Cycle Fluctuations

9 Bayesian Methods
9.1 Overview of Objectives
9.2 Preliminaries
9.3 Using Structural Models as Sources of Prior Information for Reduced-Form Analysis
9.4 Implementing Structural Models Directly
  9.4.1 Implementation via Importance Sampling
  9.4.2 Implementation via MCMC
9.5 Model Comparison
9.6 Using an RBC Model as a Source of Prior Information for Forecasting
9.7 Estimating and Comparing Asset-Pricing Models
  9.7.1 Estimates
  9.7.2 Model Comparison

III Beyond Linearization

10 Non-Linear Approximation Methods
10.1 Notation
10.2 Projection Methods
  10.2.1 Overview
  10.2.2 Finite Element Methods
  10.2.3 Orthogonal Polynomials
  10.2.4 Implementation
10.2.5 Extension to the \( \ell \)-dimensional Case

10.2.6 Application to the Optimal Growth Model

10.3 Value-Function Iterations

11 Implementing Non-Linear Approximations Empirically

11.0.1 Simulating the Optimal Growth Model

11.1 Full-Information Analysis Using the Particle Filter

11.1.1 Case 1: No Measurement Error

11.1.2 Case 2: Measurement Error

11.1.3 Approximating the Unconditional Distribution of \( s_0 \)

11.1.4 Data Alignment

11.2 Linear Versus Non-Linear Model Approximation