Computational Methods in Economics

Introduction

January 9, 2020

Objectives

- Introduction to serious data work.
- Numerical methods to solve complex problems.
- Computational implementation.
- Use data, model, and estimation

Example

- Consider an optimal stopping model
  - Search for a product
  - Search for a job
- Key feature is a reservation value.

Basic job search theory (1) - The basic model

- Job search theory arises initially out of a basic model describing the behavior of a person looking for work in a situation of imperfect information
- The basic job search model has the following assumptions
  - They are not allowed to select the intensity of their search
  - They cannot look for jobs once they are employed
  - They cannot recall job offers once rejected (sequential search)

Basic job search theory (2) - The basic model

- The job-seeker does not know exactly what wage each job pays. So by looking, he can expect to improve his prospect of earnings.
- We further assume that this distribution is the same at each date, and that successive wage offers are independent draws from this distribution
- The optimal strategy of a person looking for work consists simply of choosing a *reservation wage* that represents the lowest remuneration he will accept

Wage posting

Revisiting
Burdett and Mortensen(1998)
Bontemps, Robin and Van der berg(2000)

Assumptions

- Population m
- Stock of unemployed u
- Employment opportunities occur at rate λ_u representing the parameter of a Poisson Distribution.
- Employment are destroyed at rate δ
- The utility of an agent consists of the wage w if she is employed, or b if she is unemployed.
- The distributions of offered and accepted wages are respectively denoted by F, and G with support $[\underline{w}, \overline{w}]$
- Individuals discount future earnings at rate ρ
- Firms post contract.

Agents problem: with on-the-job-search

Unemployed agents

$$\rho V_u = b + \lambda_u \int_{\phi}^{\overline{w}} \left[V^e(x) - V^u \right] dF(x)$$

Employed agents

$$\rho V_e(w) = w + \delta[V^u - V^e(w)] + \lambda_e \int_{w}^{\overline{w}} \left[V^e(x) - V^e(w) \right] dF(x)$$

Reservation wage (1)

The reservation wage is given by:

$$\phi = b + \left[\lambda_u - \lambda_e\right] \int_{\phi}^{\overline{w}} \frac{\overline{F}(x)}{\rho + \delta + \lambda_e \overline{F}(x)} d(x)$$

Reservation wage (2)

This is nonlinear equation, which requires root-finding techniques!

Reservation wage (3)

This is nonlinear equation, and as the wage offer distribution $F()$ is not observed, evaluating the reservation wage requires numerical integration.

Reservation wage (4)

Assume b has a distribution such that there exists a $\phi(b)$. Evaluating ϕ is costly, so one may be tempted to create a grid for b, and evaluate for the values of the grid, and then use interpolation techniques to recover $\phi(b)$.

Reservation wage (5)

- Given data on wages, it is possible to estimate all the structural parameters $\lambda_u, \lambda_e, \delta$ and the parameters of the wage offer distribution.
- Let Θ be the set of parameters to be estimated and then consider the criterion function

$$min_{\Theta} ||W - \hat{\phi}(\Theta)|| \tag{1}$$

- Nonlinear optimization.

Organization

- Tuesday: Lecture
- Thursday: Applications
- Office hours: Email appointment
- Questions?

Evaluation

- Class applications (40%)
- Problem sets (60%)

Plan of the course

- Algorithm: Theory and Introduction to R/C++
- Data: Theory and Application
- Maximum Likelihood Estimation
- Root Finding Techniques
- Numerical Optimization
- Simulation Techniques
- Numerical Integration
- Interpolation and Extrapolation
- Dynamic Programming
- Final

R/C++

- Build R.
- Install Rstudio.
- Install some packages (Rcpp, RcppArmadillo, Zelig).
- Compile a first c++ file.