

Bayesian Econometrics Lab 1

Ping Wu

University of Strathclyde

ping.wu@strath.ac.uk

Useful Information & Assessment

- Labs are weeks 2, 4, 5 and 6.
- Before each class, I will email you with my teaching materials.
- They will be uploaded after each lab.
- In lab 3 I will provide a quick demo of the BEAR toolbox in case you would like to use it for your empirical project.

What to Aim for in Labs

Don't worry about perfectly completing every exercise or understanding every line of code.

Instead aim to:

- understand the broad ideas behind each exercise/piece of code.
- begin the (gradual!) process of developing your programming skills.
- learn about what strategies might work well for you when trying to understand and modify code for your own work.

Bayesian Econometric Code Structure

The code usually features most of the following parts. If you know this it's harder to get lost.

- ➊ Load data, transform variables (e.g. obtain stationarity) and get into correct format (e.g. one matrix for dependent variable(s), one matrix for predictors).
- ➋ Set prior hyperparameters and estimate OLS quantities.
- ➌ Set up storage matrices to store important numbers in (saves time and memory).
- ➍ Estimation: if analytical results are not available use posterior simulator (e.g. Monte Carlo integration).
- ➎ Produce additional results necessary for interpretation (e.g. impulse response functions).

Some Strategies that May Help

- Begin by looking at the entire script: can you identify the sections outlined in the previous slide?
- Then try to digest small chunks of code at a time. You can paste a section of code into a separate script and experiment. Or you can run different parts of the code separately.
- Keep the relevant lectures notes nearby so you can make connections between: the concepts learned in class, the formulae outlines in class and the code.
- Translate the code into economics:
 $b_0 = 0 \rightarrow \underline{\beta} = 0 \rightarrow$ hyperparameter is equal to 0 \rightarrow prior belief that coefficient β is 0 \rightarrow prior belief that the regressor associated with β has no explanatory power.

Useful Matlab Features

- *evaluate selection*: highlight a section of the script and hit F9
- *help on selection*: highlight a function and hit F1
- *keyboard*: insert into your script to pause at a certain point
- *annotate* your script using %
- divide your code into sections using %%
- to see the contents of a matrix: right click and hit open (or use the *display* command)

Lab 1: Matlab Basics

- Key concepts: Drawing from Standard Distributions, Monte Carlo Integration, Gibbs Sampling
- I'll discuss the Matlab interface and am happy to go through the features discussed on the previous slide.
- You can work through the rest of the exercises at your own pace.

Lab 2: Bayesian Analysis of the Regression Model

- Key concepts: Normal linear regression, BMA, posterior simulator sensitivity.
- Relevant material: Normal Linear Regression Slides, Fat Data Slides.
- Joshua Chan website (for those who want more).

Lab 3: Machine Learning Methods and VARs

- Key concepts: SSVS, The LASSO, BART and Impulse response analysis
- Relevant material: Fat data handout, KK monograph, Gary's BART paper
- I'll begin with the BEAR toolbox demonstration.

Lab 4: State Space Models and TVP-VARs

- Key concepts: State Space Models, TVP-VARs
- Relevant material: KK monograph