THE UNIVERSITY of EDINBURGH
School of Economics

**2025-2026**

# Bayesian Econometrics (ECNM11060)

**DRPS:** http://www.drps.ed.ac.uk/25-26/dpt/cxecnm11060.htm

**Accessibility:** If you require this document or any online resources mentioned in this document in an alternative format, please contact Hazel Blair (H.Blair@ed.ac.uk).

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|---|---|
| Course Code | ECNM11060 |
| Course Name | Bayesian Econometrics |

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**Welcome and Learning Outcomes:**

**Welcome**

Bayesian methods are increasingly used in econometrics, particularly in the field of macroeconomics. This is a course in Bayesian econometrics with a focus on the models used in empirical macroeconomics. The course includes lectures and computer labs. The lectures are given by Niko Hauzenberger and Ping Wu, and the computer sessions are led by Zhoulihua Zhang. You can find out more about the teaching team on their websites:

- https://nhauzenb.github.io/
- https://pingwu.org/

The main course page for this class page is: https://nhauzenb.github.io/SGPE-ECNM11060/

**Learning Outcomes**

**On successful completion of this course, you should be able to:**

- Demonstrate a knowledge and understanding of the basics of Bayesian analysis, VARs, state space modelling and an ability to apply these methods to analyse macroeconomic models; grasp of appropriate computational techniques.

- Demonstrate and develop research and investigative skills such as problem framing and solving and the ability to assemble and evaluate complex evidence and arguments.

- Develop communication skills in order to critique, create and communicate understanding and to collaborate with and relate to others.

- Develop practical/technical skills such as, modelling skills (abstraction, logic, succinctness), qualitative and quantitative analysis and interpretation of data, programming of statistical packages.

The learning outcomes are partially assessed through the formal assessment on the course. Students will have an opportunity to attain these outcomes through their engagement with the course such as attendance of lectures and participation in computer sessions, and also through independent study of the material.

**Course Information**

**Course Outline**

## Overview

Bayesian methods are increasingly used in econometrics, particularly in the field of macroeconomics. This is a course in Bayesian econometrics with a focus on the models used in empirical macroeconomics. It begins with a brief introduction to Bayesian econometrics, describing the main concepts underlying Bayesian theory and showing how Bayesian methods work in the familiar context of the regression model. Computational methods are of great importance in modern Bayesian econometrics and these are discussed in in detail. In light of the Big Data revolution, applied economists often face the situation where the number of variables under consideration is large relative to the number of observations and conventional econometric methods do not work well. We describe various methods that can be used with Big Data in the context of the regression model and emphasise the wider applicability of these methods in other modelling contexts. Subsequently, the course shows how Bayesian methods are used with models which are currently popular in macroeconomics such as vector autoregressions, state space models (including factor models and stochastic volatility models) and machine learning and nonparametric methods such as regression trees.

Two textbooks (one of which is a book of solved exercises) provide much more detail for most of the topics covered in the course:

- Koop, G. (2003). Bayesian Econometrics, published by Wiley.

- Chan, J., Koop, G., Poirier, D. and Tobias, J. (2019). Bayesian Econometric Methods, second edition, Cambridge University Press.

On the website associated with this course, we also provide copies of various readings (which can be downloaded freely) of teaching handouts/monographs on relevant topics. These include:

- Blake, A. and Mumtaz, H. (2017). Applied Bayesian Econometrics for Central Bankers. Bank of England Working Paper.

- Dieppe, A., Legrand, R. and van Roye, B. (2016). The BEAR Toolbox, ECB Working paper No. 1934.

- Koop, G. and Korobilis, D. (2009). Bayesian Multivariate Time Series Methods for Empirical Macroeconomics, monograph in the Foundations and Trends in

Econometrics series.

- Chan, J. C. (2019). Large Bayesian vector autoregressions. In Macroeconomic Forecasting in the Era of Big Data: Theory and Practice, 95-125. Springer International Publishing.

- Hauzenberger, N., Huber, F., & Koop, G. (2024). Macroeconomic forecasting using BVARs. Handbook of Research Methods and Applications in Macroeconomic Forecasting, 15-42.

**Course Organisation**

The course includes weekly lectures (two or three hours each) and four one-hour tutorials over six weeks.

The topics covered in the lectures include:

- An Overview of Bayesian Econometrics
- Bayesian Inference in the Normal Linear Regression Model
- Overview of Recent Advances in Bayesian Macroeconometrics
- Introduction to Bayesian Machine Learning Methods
- Introduction to Bayesian Nonparametrics
- Bayesian Vector Autoregressions (VARs)
- Bayesian State Space Models
- TVP-VARs with Stochastic Volatility
- Bayesian Inference in Factor Models

The tutorial problem sets focus on software programming in MATLAB and running sophisticated Bayesian models.

Lecture and tutorial attendance is a required part of the course, and a register will be taken.

**Timetable**

**Course Contacts:**

| Role | Contact | Room |
|---|---|---|
| Course Organiser | Niko Hauzenberger (niko.hauzenberger@strath.ac.uk) | |
| Course administrator | SGPE office (sgpe@ed.ac.uk) | |
| Lecturers | Ping Wu (ping.wu@strath.ac.uk) | |
| Tutors | Zhoulihua Zhang (zhoulihua.zhang@strath.ac.uk) | |
| Office Hours | Immediately after the lecture or online via Zoom (in this case email in advance) | |

Please include any further contact information you believe is relevant to the delivery of your course –

**Assessment and Feedback Information**

**Assessment Description**

| Assessment Type | Percentage Of Final Mark |
|---|---|
| Course Work I: Journal Article Review | 40% |
| Course Work II: Empirical Project | 60% |

**Important Dates**
Exams are added to your calendar automatically, but you can also view them in the Exam Web Timetable (Opens in a new window).

**Feedback and Grades**

Assessment will be through an Empirical Project and a Journal Article Review. The Empirical Project will be worth 60% of the final grade and the Journal Article Review worth 40%. There will be no exam. Detailed instructions for each are available on the course website. The deadline for the Journal Article Review will be 12 noon, 10 April 2026 and the deadline for the Empirical Project will be 12 noon, 29 May 2026. Detailed written feedback and marks will be returned within two weeks of assessment submission.

Please be aware that grades located within Learn are provisional until these have been confirmed by the exam board, at which point they will be available via EUCLID.

**Marking Scheme**

- University's Common Marking Scheme (Opens in a new window).
- Assessment regulations (Opens in a new window).

**Journal Article Review.** If you do Bayesian empirical work in the future, one of the most important skills you will need is the ability to read the relevant literature so as to use (or adapt) the models and methods in it for use with your data set. This assessment is intended to give you experience in developing this skill. You are asked to read a journal article which uses Bayesian econometric methods in an empirical application involving a model which might be new to you (although, if so, it will be a model closely related to ones covered in the lectures), and to not only summarise it but also critically discuss it. The review should be **a maximum of 2,000 words** and should involve:

1) a brief description of (and definition of) the model,

2) a brief discussion of the properties of the model with a focus on explaining the types of economic problems it might be useful for analysing,

3) a description of how Bayesian methods can be used in the model (i.e., prior, likelihood, method of posterior simulation and, for papers which involve forecasting, methods used for forecasting),

4) a discussion of empirical results (if relevant) or other important issues that arise in your paper, and

5) a critical discussion of 1) to 4). Specifically, guidance on writing a critical review or a referee report (see here) may be helpful in addressing this point.

If you are running up against the 2,000-word length limit, it is acceptable to refer to equation numbers in the paper you are summarising (rather than re-typing equations already in the paper), but if you do please be very clear and explicit.

The course organisers will provide a selection of papers from high-quality journals. However, if you have a particular interest or have found a Bayesian paper you would like to study in an area of interest to you, it might be possible for you to use that for your Journal Article Review.

**Empirical Project.** The projects will be marked 0-100 by a marker and then moderated to ensure consistent standards are applied across the course. The general description of the empirical project are:

1) describe methods for Bayesian estimation of the model,

2) write or adapt existing code for doing Bayesian estimation, and

3) present empirical results using your code and data set.

Beyond this general description, we are deliberately leaving details of the assessment flexible so that you can push your answer in any direction you want and reveal your ability to motivate and explain clearly a piece of Bayesian empirical work. Your written answer should be a maximum of **2,500 words** plus up to two pages of tables/graphs presenting your empirical results. You may choose between one of the following three topics. The first topic is a new model you will be unfamiliar with (although it is closely related to models covered in the lectures) and we did not provide Matlab code for it in the computer tutorials. You will have to write your own code (or find some on the internet, e.g., at Joshua Chan's webpage). Hence, we would expect more discussion of the econometrics (i.e., describing the form of the model and how the MCMC algorithm works) and your empirical results section can be correspondingly shortened. The second topic involves a more sophisticated model, but it is one covered in the lectures and for which code has been provided (you can even use the BEAR toolbox discussed in the course for this topic). Hence we would expect less discussion of the econometrics (i.e., only a very brief discussion of the model, priors and Bayesian estimation methods based on lecture material), but a more in-depth empirical analysis. The third topic, involving Bayesian Additive Regression Trees (BART), is the most advanced but if you are interested in microeconomic topics involving cross-sectional data sets is the most relevant. And we offer advice which should greatly simplify the coding process provided you either know **R** or are willing to spend a small amount of time learning the basics of **R**.

## Extensions and Exceptional Circumstances

Extensions for the coursework assessment are allowed under the standard School policy. Late submissions will incur the penalty of 5% of the maximum mark per calendar day, up to 7 days, after which zero mark is awarded.

## Advice and Good Academic Practices

There will be an emphasis on critical thinking and independent learning. The purpose of both assessments is to develop these skills. Moreover, the empirical project is intended to enhance students' abilities to carry out independent, hands-on empirical analyses using advanced Bayesian econometric techniques.

## Changes to course for 2025-26

No specific changes compared to the previous year, except for the Journal Article Review. Rather than asking students to simply summarise a journal article, greater emphasis will be placed on critically evaluating it this academic year.