

# Lecture Bayesian Econometrics

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# Why Bayesian Econometrics?(1/2)

- ▶ Bases on the simple rules of probability (Bayes Theorem)
- ▶ Bayesians treats  $\theta$ , the parameter of interest, as a random variable
- ▶ Frequentists, the competitors to Bayesian Statistic, treat  $\theta$  as an unknown constant. Remember: Only  $\hat{\theta}$  is random
- ▶ Bayesians ask: Given the data, what do we know about  $\theta$ ?
- ▶ Frequentists ask: Given  $\theta$ , what do we know about the data?

# Frequentist probability vs Subjective probabilities

- ▶ Frequentist probability:
  - ▶ Probability statements are only possible for random experiments
  - ▶ Random experiments can be repeated arbitrarily often
  - ▶ Examples: dice, coins, random samples
  - ▶ For a frequentist, it is not possible to make a probability statement about the event: “It will be snowing on 1/3/2019”
- ▶ Subjective probabilities:
  - ▶ Probability statements are always possible if there is uncertainty
  - ▶ Random experiments need not be repeatable
  - ▶ Subjective probabilities must satisfy the probability axioms

## Why Bayesian Econometrics?(2/2)

It allows...

- ▶ to incorporate prior information about  $\theta$
- ▶ for probability statements about  $\theta$
- ▶ for probability statements about competing models
- ▶ for probability statements about future outcomes
- ▶ Bayesian estimators often have better frequentist properties than frequentist estimators (e.g. results due to Stein show MLE is inadmissible but Bayes estimators are admissible)
- ▶ But one of the prime reasons to adopt a Bayesian approach is that it may allow feasible inference in situations where frequentist approaches are difficult

# Objectives

- ▶ To get to know the basics of Bayesian statistics
- ▶ To implement Bayesian methods on a computer

# Topics

- ▶ Bayesian Theory
- ▶ Markov Chain Monte Carlo
- ▶ Linear Regression
- ▶ Linear Regression with  $t$  Errors
- ▶ Linear Regression with MA Errors
- ▶ Bayesian Model Comparison
- ▶ Stochastic Search Variable Selection
- ▶ Bayesian LASSO
- ▶ Global-Local Priors
- ▶ Probit and Ordered Probit Model
- ▶ Model with time-varying Parameters
- ▶ Stochastic Volatility Model
- ▶ Markov-Switching Model

# Seminar

- ▶ The course takes place in the first half of the semester
- ▶ After this course students will have the opportunity to take a Seminar in Bayesian Econometrics
- ▶ and to deepen their knowledge in a particular field of Bayesian Econometrics of their choice

# Organisation

## Lecture

- ▶ Wednesday, 2-6 pm, CDI 120
- ▶ Jan Prüser: [prueser@statistik.tu-dortmund.de](mailto:prueser@statistik.tu-dortmund.de)

## Exercises

- ▶ Tuesday, 2-4 pm, CDI 120
- ▶ Niklas Benner: [benner@statistik.tu-dortmund.de](mailto:benner@statistik.tu-dortmund.de)



# Assumed prior knowledge

- ▶ Some background knowledge of econometrics (e.g. linear Regression)
- ▶ Basic knowledge of probability theory
- ▶ Knowledge of basic matrix algebra
- ▶ Knowledge of  $\mathbb{R}$
- ▶ Prior knowledge of Bayesian Econometrics is not necessary