



## Dynamic Programming: Theory, Numeric Implementation and Applications

Recursive methods and their numerical application, in particular dynamic programming, have become the most important solution methods in modern macroeconomics. Today the areas of their application encompass almost all areas of macroeconomics, e.g. growth theory, monetary economics, social insurance, and fiscal policy. Despite their widespread use in research, they have not yet become part of the standard curriculum at European economic faculties. The course aims at closing this gap. It introduces dynamic programming from a theoretical perspective and discusses numerical solution methods. Subsequently, these methods are applied to solve the real business cycle model, which is the workhorse model of modern quantitative macroeconomics and constitutes the starting point to analyse, e.g. fiscal policy and social insurance in a dynamic economic environment.

### Seminar Benefits

Researchers broaden their methodological expertise and improve programming skills

### Target Group

PhD students and postgraduates in macroeconomics as well as researchers in the financial sector

### Required Knowledge

Basic macro- and microeconomic theory as well as calculus

### Learning and Teaching Methods

Presentations and workshop sessions on programming, practical exercises with MATLAB

### Seminar Date and Location

19 to 21 September 2011, 9:00 am – 5:30 pm  
Centre for European Economic Research (ZEW), Mannheim, Germany

## Programme

19 to 21 September 2011

### Numerical Basis: Optimisation, Root-Finding and Approximation Methods

- Optimisation: One-Dimensional Methods, Newton, and Quasi-Newton Methods
- Root-Finding: Newton Algorithm, Gauss-Seidel, and Gauss-Jacobi Method
- Approximation Methods

### Dynamic Programming

- Theory: The Bellman Equation and the Principle of Optimality
- Numerical Implementation: Discretization and Continuous Approximation of the Value Function with Focus on Value Function Iteration

### Application: Numerical Solution of Real Business Cycle Model

- Numerical Implementation: Solving the RBC Model by Value Function Iteration
- Simulation: Calibration of Model Economy and Simulation of Time Paths
- Interpretation of Numerical Results

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### Seminar Fee

EUR 850,- (plus VAT). Please notice our discount system. The number of participants is limited.

### Organisation, Accommodation

For further information on the organisation of the seminar and/or accommodation please contact Vera Pauli, E-mail [pauli@zew.de](mailto:pauli@zew.de), Phone +49/621/1235-124, Fax +49/621/1235-125

## Tutors



**Prof. Dr. Alexander Ludwig**, University of Cologne, studied economics at the universities of Mannheim and California at Berkeley. In 2001, he began his graduate studies at the University of Mannheim, the Mannheim Research Institute for the Economics of Aging (MEA), and the University Pompeu Fabra (UPF), Barcelona. Since 2005, he has worked as head of the research unit “Macroeconomics” at MEA and since October 2009 he has been Professor for Macroeconomics at the University of Cologne. He conducts research in dynamic macroeconomics, public finance, computational economics, growth, and decision theoretical applications to macro questions.



**Dr. Tim Mennel**, ZEW, studied mathematics at the universities of Bonn and Paris VII. From 1999 to 2004 he pursued graduate studies in economics at the Bonn Graduate School of Economics (BGSE). In 2001, he visited the Graduate Program of Economics and Management of the University Pompeu Fabra (UPF), Barcelona, as a European Doctoral Programme (EDP) exchange student. During this time he worked in the area of dynamic principal-agent models. Since October 2005, he has been employed at the ZEW in the research department “Environmental and Resource Economics, Environmental Management”. He works on quantitative modelling of environmental and energy policy.



**Martin Scheffel**, ZEW, completed his undergraduate studies in economics and political sciences at the University of Heidelberg. Afterwards, he spent one year as graduate student at Brown University, Providence (RI), and received an A.M. in economics. After a short internship at the “Deutsche Bundesbank”, he continued his PhD studies at the Graduate School of Economics and Social Sciences (GESS) at the University of Mannheim and worked as a research assistant at the chair of Prof. Tom Krebs, PhD. Since January 2008, Martin Scheffel has been a researcher at ZEW. His major interest lies in dynamic stochastic macroeconomic modelling.