During the first block of Econometrics and Operations Research, all students take the same compulsory theory courses. From the second block onwards, you’ll choose one of four specialisations:

- Actuarial Science
- Econometrics
- Mathematical Economics
- Operations Research

**Actuarial Science**

**What’s it all about?**

Floods, earthquakes, diseases, car accidents - the world is a risky place. In most cases, it’s hard to estimate how risky the world really is because we don’t know exactly when an area will be flooded or when we’ll need a doctor, for example. And yet in the Actuarial Sciences specialisation, you’ll learn to predict just these types of events:

- learn to estimate risks and calculate the financial consequences
- study market demand and manage return on investment, both in the short and long term
- complete some of the compulsory study material you’ll need to pursue a Dutch actuarial qualification
- be exempted from part of the actuarial qualification programme offered by the Dutch Actuarial Institute, and from part of the content of the German Deutsche Aktuarvereinigung e.V.

**What you’ll actually do:**

- study the financial models that form the basis of insurance and pensions
- learn to communicate your opinions and solutions professionally and clearly in order to persuade others
- break down financial problems into smaller components in order to solve them
- use a two-sided approach to look at problems, from both an asset and liability point of view
- demonstrate financial expertise in the pension and insurance sectors
Student profile

Actuarial Science is a good fit if you:

- enjoy solving economic problems
- have a background in mathematics, especially statistics
- are an analytical thinker
- work in insurance or pension funds and want higher qualification

Econometrics

What’s it all about?

Complex economic and financial issues faced by policy makers, companies and investors require rigorous and advanced data analysis. The econometrics specialisation provides you with the tools to perform such an analysis in a variety of fields. These techniques allow you to determine relationships between economic variables, to quantify the effects of policy interventions, and to predict future developments, as well as to quantify uncertainty surrounding your outcomes. Specifically, you will learn how to:

- analyse economic and financial data gathered over time
- conduct analyses for economic datasets collected over a large number of individuals or companies (possibly also over time), such as surveys
- deal with 'Big Data', where the number of variables may exceed the number of observed data
- empirically analyse financial markets

Graduates of this programme are highly sought-after by industry, banks, insurers and governmental and commercial organisations.

What you’ll actually do:

- learn statistical techniques for the analysis of economic and financial datasets
- study the mathematical foundations of econometric techniques
- critically assess statistical techniques and develop modifications for particular applications
- implement econometric techniques in statistical software, and apply them to economic and financial data

Student profile

Econometrics is a good fit if you:

- want to develop a quantitative understanding of developments in macroeconomics or microeconomics
- want to predict financial and economic developments
- have an interest in economic problem-solving
- have a background in mathematics or statistics
- want to build statistical models for Big Data
**Mathematical Economics**

**What’s it all about?**

Mathematical methods can be used to solve a whole range of business problems, from a company’s finances to the organisation of its people. In order to do this strategically, the Mathematical Economics track looks at theories and models that can help you make the right decisions. With a unique blend of theory and practice, you will become indispensable in making decisions about the internal and external organisation of a company and its finances.

**What you’ll actually do:**

- apply theoretical models to solve business problems
- make informed decisions on resources, finances and organisational structure
- learn to analyse problems quickly and assess them accurately

**Student profile**

Mathematical Economics is a good fit if you:

- have an interest in mathematical analysis
- have a theoretical mind
- are curious about how economic developments play out
- enjoy creating models and theories in order to solve problems

**Operations Research**

**What’s it all about?**

Operations Research is about applying technology to business situations in order to solve real problems. The track will not only give you the means to use computer programming to your advantage, but also to communicate your proposed solutions to the business decision-makers effectively.

**What you’ll actually do:**

- use and develop software to find optimal solutions for logistical scheduling problems
- find technical solutions to business and economic problems
- use tools like simulations and regression analysis
- have the opportunity to combine an 8-week internship with your master’s thesis

**Student profile**

Operations Research is a good fit if you:
Master Econometrics and Operations Research

- are a tech-savvy person who enjoys solving problems
- have an affinity for information technology
- are interested in a diverse range of fields including logistics, planning, information management and telecom
- have an interest in IT and technology (though this is not a programming specialisation, you can take a programming course)

Specialisation courses

**Specialisation Actuarial Sciences**

School of Business and Economics

**Life Insurance I**

**Full course description**

1. Pricing by Replication: Role of the actuary; Basic idea fair value; Bonds; Forward rates; Duration; Inflation.
3. Equity Options: Unit linked insurance; Intro to option theory; Equity derivatives; With-profit policies.
4. Time-Consistent and Market-Consistent Pricing: Pricing financial & insurance risk simultaneously; Two-step pricing operator; Pricing in continuous time; Market-consistent embedded value.
5. Interest Rates: Interest rate swaps; Swaptions; Extrapolating the term-structure of interest rates.
6. Risk Management: Risk measures; Calculation of Value-at-Risk; Economic Capital; Solvency II.
7. Portfolio Replication: Cash flow output; Choosing objective function; Linear regression; Diagnostic statistics.

Study-load and grading:

- Study-load = 6.5 ECTS (= 182 study-hours).
- The course takes 7 weeks, with 4 contact hours every week plus mandatory homework assignments every week.
- Students work in groups of max. 4 students on the homework assignments. Each post-discussion two groups present their solution to the tutorial group, which will then be discussed by the tutorial group.
- Please note that the homework assignments are based on real-life cases. This means that the assignments are relatively unstructured. This also means that there is usually not a unique "correct" solution for the assignment. It is therefore important that students can motivate and defend the choices they have made to obtain their solution. Discussing the pro's and con's of different solutions will be an important aspect of the post-discussion.
- Average grade for all homework-presentations in the post-discussion counts for 50% of final grade. Final written exam counts for 50% of final grade.
Course objectives

In this course we aim to teach students the basic principles of pricing life-insurance and pension contract and basic principles of measuring value creation on a market-consistent basis (Market-Consistent Embedded Value).

The underlying principle for this course is the notion that the market-consistent value of a life-insurance or pension contract is based on the market-value of the Replicating Portfolio plus an “addon” for the remaining (unhedgeable) portions of the risk that are not covered by the Replicating Portfolio.

Prerequisites

Bachelor Level Econometrics and Operations Research, including preparatory courses Actuarial Sciences.

Recommended reading

To be announced.

EBC4119
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:

• A.A.J. Pelsser

Teaching methods:
PBL, Lecture(s), Assignment(s)
Assessment methods:
Participation, Written exam
School of Business and Economics

Life Insurance II

Full course description

The course aims at providing the students with statistical models that are useful in life insurance. We discuss methods to model mortality rates. A particular focus is on the Lee-Carter model and its extensions. We also learn how to estimate these models. Furthermore, students get an introduction to statistical models, in particular regression models, that are appropriate for lifetime distributions. For instance, we address the Cox-model, the AFT model and multiple decrement models. We then discuss how these models can be used to calculate life insurance premiums.
Mathematical Finance

Full course description

The aim of the course is to provide students with an appreciation and understanding of the main ideas and concepts of mathematical finance. The core of mathematical finance concerns questions of pricing and hedging of financial derivatives such as options whose value depend on that of an underlying risky asset. We will discuss the general principles of continuous-time financial markets where the investor can buy and sell d+1 assets. As a special case we will consider the Black-Scholes model for a financial market. We will further point out the link between the no-arbitrage condition and certain probability measures, the so called equivalent martingale measures. In complete markets as well as in incomplete markets these measures allow to price financial derivatives in an arbitrage-free way. Moreover, we will consider probabilistic models for bond markets and apply the theory of equivalent martingale measures to the pricing of fixed income securities. Finally, we will address the issue of estimating the parameters of the probabilistic models from historical data.
Course objectives

The principal aim of this course is to provide students with an appreciation and understanding of how the application of mathematics, particularly stochastic mathematics, to the field of finance may be used to illuminate this field and model its randomness, resulting in greater understanding and quantification of investment returns and security prices.

Prerequisites

Students should have knowledge of stochastic processes, in particular Brownian motion, geometric Brownian motion and the underlying stochastic differential equations. Moreover, students should be familiar with the Ito integral and the Ito formula. Knowledge of the Girsanov transformation is helpful, but not required.

Recommended reading


Stochastic Processes

Full course description

Deterministic dynamic systems are usually not well suited for modelling real world dynamics in economics, finance and business. Allowing for random components in dynamic systems leads to stochastic dynamic modelling, which is based on stochastic processes. This course covers models of stochastic processes in discrete and continuous time. This includes Markov chains, Poisson processes and Brownian motion. We introduce various tools that are very useful for deriving and understanding the asymptotic properties of modern econometric techniques. They include the functional central limit theorem and stochastic integrals. Finally, we discuss stochastic differential equations and their applications in finance and related fields, e.g. for pricing financial derivatives.
Course objectives

The purpose of the course is to introduce students to the study of stochastic processes in discrete and continuous time. Students will have learned the essentials of the subject and should be able to apply the acquired theoretical tools to problems in econometrics, economics, finance, and other fields.

Prerequisites

Only Master students can take Econometrics Master courses. Students require a solid background in mathematical statistics and probability theory on the level of the BSc Econometrics programme.

An advanced level of English.

Recommended reading

- Reader

ECTS credits: 6.5
Instruction language: English
Coordinator: M.B. Eichler

Teaching methods: PBL, Assignment(s), Lecture(s)
Assessment methods: Written exam, Participation
School of Business and Economics

Time Series Methods and Dynamic Econometrics

Full course description

The emphasis of this course is on the study of methods for the analysis of possibly nonstationary economic time series. We consider both theoretical and practical aspects. We cover and discuss issues related to exogeneity and causality in dynamic econometric models, modelling univariate and multivariate nonstationary processes, unit roots, cointegration as well as the asymptotic theory for integrated processes. Empirical applications are also considered so that the course will provide students with practical experience in analysing univariate and multivariate time series cointegration, factor models as well as from economics or business.
**Course objectives**

The objectives of this course are to provide students with an understanding of the concepts of modern time series methods as well as practical experience in analysing time series from economics or business. Students will have learned recent econometric methods to study multivariate economic time series. Students should be able to apply these methods to economic data.

**Prerequisites**

Econometric methods (EBC2111), Stochastic Processes (EBC4004).

Exchange students need to have a solid background in econometric methods, probability theory, mathematical statistics, and some knowledge in stochastic processes (some familiarity with Brownian Motion theory is important). Exchange students need to have obtained a Bachelor degree and an advanced level in mathematics and probability and statistics.

An advanced level of English.

**Recommended reading**


**ECTS credits:**
6.5

**Instruction language:**
English

**Coordinators:**
- A.W. Hecq
- S.J.M. Smeekes

**Teaching methods:**
PBL, Presentation(s), Lecture(s), Work in subgroups

**Assessment methods:**
Written exam, Participation, Final paper

**School of Business and Economics**

**Game Theory and Optimisation**

**Full course description**

Topics in optimization include duality theorems in LP, branch and bound and cutting plane algorithms in IP, and Kuhn-Tucker conditions for NLP.
Topics in game theory and economics include computation of Nash equilibrium and refinements, selfish routing in networks and the price of anarchy, and non-emptiness of the core.

**Course objectives**

This course provides a comprehensive overview of optimization techniques such as linear and integer programming, and non-linear programming, with applications in game theory and economics. Students learn optimization techniques from mathematics and operations research, and how to apply them in models from game theory and economic theory.

**Prerequisites**

Only Master students can take this course. Exchange students need to have obtained a BSc degree in Economics, International Business, Econometrics, or a related topic. Familiarity with the basic concepts of optimization and linear programming will be helpful. A solid basis in mathematics and calculus is also recommendable.

**Recommended reading**

The course will be based on chapters from standard textbooks plus additional readers.

Recommended literature for background reading :

- David Luenberger and Yinyu Ye : Linear and Nonlinear Programming.

EBC4188
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
6.5
Coordinators:
- A.J. Vermeulen
- M. Staudigl

Teaching methods:
PBL, Lecture(s)
Assessment methods:
Written exam
Specialisation Econometrics

School of Business and Economics

Econometric Methods for Cross-sectional and Panel Data

Full course description

The main topics of the course are (1) unobserved effects models for panel data, (2) probit and logit models for binary choice, (3) tobit and related censored regression models, (4) models dealing with sample selectivity, and (5) the estimation of average treatment effects (a.k.a. policy impact evaluation). Dynamic extensions of the models are considered when feasible. Estimation and testing methods are applied in a number of empirical assignments and their properties are investigated.

Course objectives

- Thorough understanding of the most frequently used econometric models and methods for the analysis of panel data, categorical choice and limited dependent variables.
- Some practice in the application of the methods, the interpretation of the models, and the evaluation of inferences.
- The experience of conducting a theoretical, experimental and/or empirical investigation of the methods.

Prerequisites

- Calculus, matrix algebra, probability, mathematical statistics, asymptotic theory, linear statistical models.
- Familiarity with statistical software like Stata and Gauss, Matlab, or R.
- Econometric methods at the level of Greene (2008) or Davidson & MacKinnon (2004), ideally as in courses Econometric Methods I (EBC2111), and Econometric Methods II (EBC2120).

The course is intended for students in the Econometrics Master programme as well as others with a comparable background and motivation. FLUENCY IN MATRIX ALGEBRA AND IN ASYMPTOTIC THEORY is necessary.

An advanced level of English.

Recommended reading


These references will be supplemented with a reading list of journal articles and book chapters.

EBC4006
Period 4
5 Feb 2018
Empirical Analysis of Financial Markets

Full course description

In this course we consider in depth the fluctuations of stock prices. The purpose of the course is to provide you with an overview of recent empirical research in asset pricing and portfolio management. How are theoretical models of asset pricing being tested in practice? What are the strengths and weaknesses of various methodologies? What kind of statistical techniques are used?

A second aim of the course is to let you gain some experience in doing empirical research. An important aspect of the course is learning about the characteristics of stock returns by doing a small research project. The research projects are concerned with predictability of stock returns and the profitability of various trading strategies based on (seeming) anomalies. At the end of the course you should be able to make your own assessment about events on financial markets. Are reported superior returns pure chance, statistical illusion, a reward for risk or really an anomaly?

Course objectives

The purpose of the course is to provide students with an overview of empirical methods and stylised facts that will enable them to make their own assessment of events on financial markets.

Prerequisites

Knowledge of basics of asset pricing and portfolio management, and linear regression models. Exchange students need to have obtained a Bachelor degree in economics or business administration, and sufficient quantitative background. Exchange students need to major in finance in their master.

An advanced level of English.

Recommended reading

- recent research papers
Master Econometrics and Operations Research

- recent journal articles

EBC4010
Period 5
9 Apr 2018
8 Jun 2018
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:

- P.C. Schotman

Teaching methods:
PBL, Presentation(s), Lecture(s), Assignment(s), Work in subgroups
Assessment methods:
Final paper, Participation, Written exam
School of Business and Economics

Stochastic Processes

Full course description

Deterministic dynamic systems are usually not well suited for modelling real world dynamics in economics, finance and business. Allowing for random components in dynamic systems leads to stochastic dynamic modelling, which is based on stochastic processes. This course covers models of stochastic processes in discrete and continuous time. This includes Markov chains, Poisson processes and Brownian motion. We introduce various tools that are very useful for deriving and understanding the asymptotic properties of modern econometric techniques. They include the functional central limit theorem and stochastic integrals. Finally, we discuss stochastic differential equations and their applications in finance and related fields, e.g. for pricing financial derivatives.

Course objectives

The purpose of the course is to introduce students to the study of stochastic processes in discrete and continuous time. Students will have learned the essentials of the subject and should be able to apply the acquired theoretical tools to problems in econometrics, economics, finance, and other fields.

Prerequisites

Only Master students can take Econometrics Master courses. Students require a solid background in mathematical statistics and probability theory on the level of the BSc Econometrics programme.

An advanced level of English.
**Recommended reading**

- Reader

**EBC4004**  
Period 1  
4 Sep 2017  
27 Oct 2017  
[Print course description](#)  
ECTS credits:  
6.5  
Instruction language:  
English  
Coordinator:  
- [M.B. Eichler](#)

**Teaching methods:**  
PBL, Assignment(s), Lecture(s)  
**Assessment methods:**  
Written exam, Participation  
School of Business and Economics

## Time Series Methods and Dynamic Econometrics

### Full course description

The emphasis of this course is on the study of methods for the analysis of possibly nonstationary economic time series. We consider both theoretical and practical aspects. We cover and discuss issues related to exogeneity and causality in dynamic econometric models, modelling univariate and multivariate nonstationary processes, unit roots, cointegration as well as the asymptotic theory for integrated processes. Empirical applications are also considered so that the course will provide students with practical experience in analysing univariate and multivariate time series cointegration, factor models as well as from economics or business.

### Course objectives

The objectives of this course are to provide students with an understanding of the concepts of modern time series methods as well as practical experience in analysing time series from economics or business. Students will have learned recent econometric methods to study multivariate economic time series. Students should be able to apply these methods to economic data.

### Prerequisites

- Econometric methods (EBC2111), Stochastic Processes (EBC4004).

Exchange students need to have a solid background in econometric methods, probability theory, mathematical statistics, and some knowledge in stochastic processes (some familiarity with Brownian Motion theory is important). Exchange students need to have obtained a Bachelor degree.
Master Econometrics and Operations Research
and an advanced level in mathematics and probability and statistics.

An advanced level of English.

**Recommended reading**

- Reader.

EBC4008
Period 2
30 Oct 2017
22 Dec 2017
[Print course description](#)

ECTS credits:
6.5

Instruction language:
English

Coordinators:

- [A.W. Hecq](#)
- [S.J.M. Smeekes](#)

Teaching methods:
PBL, Presentation(s), Lecture(s), Work in subgroups

Assessment methods:
Written exam, Participation, Final paper

School of Business and Economics

**Game Theory and Optimisation**

**Full course description**

Topics in optimization include duality theorems in LP, branch and bound and cutting plane algorithms in IP, and Kuhn-Tucker conditions for NLP.

Topics in game theory and economics include computation of Nash equilibrium and refinements, selfish routing in networks and the price of anarchy, and non-emptiness of the core.

**Course objectives**

This course provides a comprehensive overview of optimization techniques such as linear and integer programming, and non-linear programming, with applications in game theory and economics. Students learn optimization techniques from mathematics and operations research, and how to apply them in models from game theory and economic theory.

**Prerequisites**

Only Master students can take this course. Exchange students need to have obtained a BSc degree.
Master Econometrics and Operations Research
in Economics, International Business, Econometrics, or a related topic. Familiarity with the basic concepts of optimization and linear programming will be helpful. A solid basis in mathematics and calculus is also recommendable.

**Recommended reading**

The course will be based on chapters from standard textbooks plus additional readers.

**Recommended literature for background reading**:

- David Luenberger and Yinyu Ye : Linear and Nonlinear Programming.

EBC4188
Period 1
4 Sep 2017
27 Oct 2017

Print course description
ECTS credits:
6.5

Coordinators:
- A.J. Vermeulen
- M. Staudigl

Teaching methods:
PBL, Lecture(s)
Assessment methods:
Written exam

**Specialisation Mathematical Economics**

School of Business and Economics

**Social Choice Theory**

**Full course description**

In collective decision-making (e.g., elections) the rules and procedures used to arrive at a decision may have a considerable impact on the final result. Different rules may lead to different decisions. In this course such rules are studied. In particular, desirable properties like Pareto-optimality and non-manipulability are investigated.
Master Econometrics and Operations Research

Some topics are:

- voting schemes for two alternatives, theorem of May;
- voting schemes for more than two alternatives, score rules, veto rules;
- Condorcet winners, dictatorial rules, anonymity, neutrality, positive association, impossibility theorems of Arrow, Gibbard and Satterthwaite;
- location problems;
- strategy-proof division;
- implementation.

**Course objectives**

In this course the student will learn to formally analyse collective decision rules w.r.t. various aspects such as anonymity, Pareto-optimality, neutrality, and strategy-proofness.

**Prerequisites**

A mathematic level comparable to a BSc Econometrics & Operations Research meets the prerequisites.

Exchange students need to have obtained a Bachelor degree and an advanced level in mathematics.

An advanced level of English.

**Recommended reading**

Lecture notes.

EBC4005
Period 2
30 Oct 2017
22 Dec 2017
[Print course description](#)

ECTS credits:
6.5

Instruction language:
English

Coordinator:

- A.J.A. Storcken

Teaching methods:
PBL, Lecture(s)

Assessment methods:
Written exam

School of Business and Economics

**Industrial Economics**
Full course description

Industrial economics studies the competition between firms in various disguises: competition in prices, competition in quantities, product differentiation, price discrimination, entry and exit, and combinations of these. The crucial question is always: As a manager of the firm, what decision would you take, and why? In this course we show how to set up such models of competition between firms, both in a static and a dynamic setting. We also show that these models can be successfully analyzed by using tools from game theory, such as Nash equilibrium and subgame perfect equilibrium. It is no surprise that game theory plays an important role here, since in order to make a good decision for your own firm you must reason about the decisions of the other firms. That is exactly what game theory is about. This beautiful marriage between economics and game theory will be at the center stage of this course.

Course objectives

The goal of this course is to show how various situations of competition between firms can be modeled, and how game theoretic tools can be used to analyze these models. It provides an excellent basis for doing research in industrial economics or a related field, but is also essential outside the academic world, for instance in managerial decision making or competition policy.

Prerequisites

A good understanding of micro economics, and a basic knowledge of game theory.

Recommended reading


EBC4007
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinators:
  - A. Perea y Monsuwé
  - C.J. Woolnough

Teaching methods:
PBL, Lecture(s)
Assessment methods:
Written exam
School of Business and Economics
Equilibrium Theory and Financial Markets

Full course description

After introducing the necessary mathematical preliminaries and extending our knowledge on selected ingredients from consumer theory, the course focuses on general equilibrium models with complete markets, in particular classical exchange and production economies. Central concepts to be studied are the competitive equilibrium and the core. Next, the model is extended to include time and uncertainty, and the strong assumption of complete markets is relaxed. This makes it possible to incorporate financial markets in a satisfactory way. We study the relationships between equilibrium and arbitrage opportunities, and the valuation of financial securities. The well-known CAPM is a special case of the model studied. A rigorous derivation of the CAPM is provided.

Course objectives

- Learn about the notion of competition in a setting with many households, firms, and commodities.
- Understand the notions of competitive equilibrium, the first and second fundamental welfare theorem, and the core.
- Understand the role of financial markets in reshuffling income across time and states of the world.
- Learn about the consequences of market incompleteness.
- Understand the Capital Asset Pricing Model.

Prerequisites

Intermediate microeconomics course, e.g. Microeconomics, or Information, Markets and Organisation. Exchange students need to have obtained a Bachelor degree with a major in Economics or Econometrics and have an advanced level in mathematics.

An advanced level of English.

Recommended reading


EBC4009
Period 5
9 Apr 2018
8 Jun 2018
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:
- C.J. Woolnough
Stochastic Processes

Full course description

Deterministic dynamic systems are usually not well suited for modelling real world dynamics in economics, finance and business. Allowing for random components in dynamic systems leads to stochastic dynamic modelling, which is based on stochastic processes. This course covers models of stochastic processes in discrete and continuous time. This includes Markov chains, Poisson processes and Brownian motion. We introduce various tools that are very useful for deriving and understanding the asymptotic properties of modern econometric techniques. They include the functional central limit theorem and stochastic integrals. Finally, we discuss stochastic differential equations and their applications in finance and related fields, e.g. for pricing financial derivatives.

Course objectives

The purpose of the course is to introduce students to the study of stochastic processes in discrete and continuous time. Students will have learned the essentials of the subject and should be able to apply the acquired theoretical tools to problems in econometrics, economics, finance, and other fields.

Prerequisites

Only Master students can take Econometrics Master courses. Students require a solid background in mathematical statistics and probability theory on the level of the BSc Econometrics programme.

An advanced level of English.

Recommended reading

- Reader

EBC4004
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:
Master Econometrics and Operations Research

- M.B. Eichler

Teaching methods:
PBL, Assignment(s), Lecture(s)
Assessment methods:
Written exam, Participation
School of Business and Economics

Game Theory and Optimisation

Full course description

Topics in optimization include duality theorems in LP, branch and bound and cutting plane algorithms in IP, and Kuhn-Tucker conditions for NLP.

Topics in game theory and economics include computation of Nash equilibrium and refinements, selfish routing in networks and the price of anarchy, and non-emptiness of the core.

Course objectives

This course provides a comprehensive overview of optimization techniques such as linear and integer programming, and non-linear programming, with applications in game theory and economics. Students learn optimization techniques from mathematics and operations research, and how to apply them in models from game theory and economic theory.

Prerequisites

Only Master students can take this course. Exchange students need to have obtained a BSc degree in Economics, International Business, Econometrics, or a related topic. Familiarity with the basic concepts of optimization and linear programming will be helpful. A solid basis in mathematics and calculus is also recommendable.

Recommended reading

The course will be based on chapters from standard textbooks plus additional readers.

Recommended literature for background reading:

- David Luenberger and Yinyu Ye : Linear and Nonlinear Programming.
Specialisation Operations Research

School of Business and Economics

Algorithms and Optimisation

Full course description

This course is devoted to mathematical models and solution methods for hard optimization problems. First, we study the theory of computational complexity, including the concept of P versus NP. In particular, we prove that some problems are computationally intractable. Given the complexity insights, solving such problems is a challenge. Therefore, we study the design and analysis of approximation algorithms and approximation schemes, as well as the derivation of inapproximability results. We also discuss local search frameworks such as Simulated Annealing, Genetic Algorithms and Tabu Search. The course is open ended in the sense that some topics can be chosen according to student interests. Classical problems that will be covered are, among others, scheduling, colouring, set covering, and packing.

Course objectives

Ability to analyse the complexity of optimization problems, and ability to design fast algorithms providing good-quality solutions for hard optimization problems.

Prerequisites

Students need to have obtained a Bachelor degree in Econometrics, Operations Research, Mathematics, or Computer Science. Knowledge in optimization (Linear Programming) and basic graph theory is highly recommended. Familiarity with basic algorithms and the analysis of algorithms (runtime complexity) is certainly helpful. C++ (or Java/Python/Basic) Programming skills are also prerequisites as there will be a practical programming case.

An advanced level of English.
Recommended reading

- Selected chapters from several books on combinatorial optimization.
- Research papers.

Modelling and Solver Technology

Full course description

This course is devoted to mathematical modelling of hard optimisation problems. We focus on integer programming techniques to solve these optimisation problems. During this course techniques as branch and bound, cutting planes and column generation will be discussed as well as the theory needed to understand these techniques. Furthermore, partially by using LP and ILP solvers, these techniques will be implemented in C++.

Course objectives

After this course, the student is able to model (hard) optimisation problems as mathematical programs and knows several techniques to solve these problems. Moreover, the student can use general purpose software tools to solve these problems.

Prerequisites

Linear programming (including the simplex method), duality, basics in integer programming, combinatorial optimisation, graph theory, C++. Exchange students need to have obtained a Bachelor degree and an advanced level in mathematics.

An advanced level of English.
Recommended reading

- Selected papers.
- Lecture notes.

EBC4051
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits: 6.5
Instruction language: English
Coordinator:
  - A. Abiad Monge

Teaching methods:
Work in subgroups, Lecture(s), PBL, Presentation(s)
Assessment methods:
Attendance, Final paper, Participation
School of Business and Economics

Operations Research Applications

Full course description

This course is devoted to mathematical models and solution methods in logistics and telecommunication. Based on recent articles from scientific journals, we review classical as well as new optimisation models from problem domains such as facility location, vehicle routing, personnel scheduling, network design, traffic network analysis, railway planning, optical telecom networks, frequency planning for GSM-networks, and site location in UMTS. These problems are analysed with respect to solvability, complexity, and approximability. In particular, exact and approximation algorithms as well as heuristic techniques for these problem are studied. Students will learn how techniques learned from the courses "Algorithms and Optimisation" and "Modelling and Solver Technology" are applied to real world problems, and how these techniques can be refined in order to address specific problem structures.

Course objectives

Students learn how to apply general techniques from mathematical programming and combinatorial optimisation to specific classes of problems as well as to real-life applications in these areas. This includes the mathematical analysis of approximation algorithms and heuristics for these applications. Students will learn how to read state-of-the-art research articles, to understand the technical details, and to give presentations on the subjects.
Master Econometrics and Operations Research

**Prerequisites**

Students have to be familiar with the subjects of the Master courses "Algorithms and Optimisation" and "Modelling and Solver Technology" from the Master programme Econometrics and Operations Research. This includes at least basic algebra, linear programming, problems and techniques from combinatorial optimisation and complexity theory. Programming abilities in C++ and CPLEX.

**Recommended reading**

Recent research articles and lecture notes will be provided.

EBC4187
Period 5
9 Apr 2018
8 Jun 2018

Print course description
ECTS credits:
6.5
Coordinator:

- [A. Berger](#)

Teaching methods:
PBL, Paper(s), Assignment(s), Presentation(s), Lecture(s), Work in subgroups
Assessment methods:
Final paper, Participation
School of Business and Economics

**Stochastic Processes**

**Full course description**

Deterministic dynamic systems are usually not well suited for modelling real world dynamics in economics, finance and business. Allowing for random components in dynamic systems leads to stochastic dynamic modelling, which is based on stochastic processes. This course covers models of stochastic processes in discrete and continuous time. This includes Markov chains, Poisson processes and Brownian motion. We introduce various tools that are very useful for deriving and understanding the asymptotic properties of modern econometric techniques. They include the functional central limit theorem and stochastic integrals. Finally, we discuss stochastic differential equations and their applications in finance and related fields, e.g. for pricing financial derivatives.

**Course objectives**

The purpose of the course is to introduce students to the study of stochastic processes in discrete and continuous time. Students will have learned the essentials of the subject and should be able to apply the acquired theoretical tools to problems in econometrics, economics, finance, and other fields.
Prerequisites

Only Master students can take Econometrics Master courses. Students require a solid background in mathematical statistics and probability theory on the level of the BSc Econometrics programme.

An advanced level of English.

Recommended reading

- Reader

EBC4004
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:

- M.B. Eichler

Teaching methods:
PBL, Assignment(s), Lecture(s)
Assessment methods:
Written exam, Participation
School of Business and Economics

Game Theory and Optimisation

Full course description

Topics in optimization include duality theorems in LP, branch and bound and cutting plane algorithms in IP, and Kuhn-Tucker conditions for NLP.

Topics in game theory and economics include computation of Nash equilibrium and refinements, selfish routing in networks and the price of anarchy, and non-emptiness of the core.

Course objectives

This course provides a comprehensive overview of optimization techniques such as linear and integer programming, and non-linear programming, with applications in game theory and economics. Students learn optimization techniques from mathematics and operations research, and how to apply them in models from game theory and economic theory.
Prerequisites

Only Master students can take this course. Exchange students need to have obtained a BSc degree in Economics, International Business, Econometrics, or a related topic. Familiarity with the basic concepts of optimization and linear programming will be helpful. A solid basis in mathematics and calculus is also recommendable.

Recommended reading

The course will be based on chapters from standard textbooks plus additional readers.

Recommended literature for background reading:

- David Luenberger and Yinyu Ye: Linear and Nonlinear Programming.

EBC4188
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits: 6.5
Coordinators:

- A.J. Vermeulen
- M. Staudigl

Teaching methods: PBL, Lecture(s)
Assessment methods: Written exam
Elective courses

Econometrics & OR Electives

School of Business and Economics

Social Choice Theory

Full course description

In collective decision-making (e.g., elections) the rules and procedures used to arrive at a decision
Master Econometrics and Operations Research

may have a considerable impact on the final result. Different rules may lead to different decisions. In this course such rules are studied. In particular, desirable properties like Pareto-optimality and non-manipulability are investigated.

Some topics are:

- voting schemes for two alternatives, theorem of May;
- voting schemes for more than two alternatives, score rules, veto rules;
- Condorcet winners, dictatorial rules, anonymity, neutrality, positive association, impossibility theorems of Arrow, Gibbard and Satterthwaite;
- location problems;
- strategy-proof division;
- implementation.

**Course objectives**

In this course the student will learn to formally analyse collective decision rules w.r.t. various aspects such as anonymity, Pareto-optimality, neutrality, and strategy-proofness.

**Prerequisites**

A mathematic level comparable to a BSc Econometrics & Operations Research meets the prerequisites.

Exchange students need to have obtained a Bachelor degree and an advanced level in mathematics.

An advanced level of English.

**Recommended reading**

Lecture notes.

EBC4005
Period 2
30 Oct 2017
22 Dec 2017

[Print course description](#)

ECTS credits:
6.5

Instruction language:
English

Coordinator:

- A.J.A. Storcken

Teaching methods:
PBL, Lecture(s)

Assessment methods:
Written exam

School of Business and Economics
Econometric Methods for Cross-sectional and Panel Data

Full course description

The main topics of the course are (1) unobserved effects models for panel data, (2) probit and logit models for binary choice, (3) tobit and related censored regression models, (4) models dealing with sample selectivity, and (5) the estimation of average treatment effects (a.k.a. policy impact evaluation). Dynamic extensions of the models are considered when feasible. Estimation and testing methods are applied in a number of empirical assignments and their properties are investigated.

Course objectives

- Thorough understanding of the most frequently used econometric models and methods for the analysis of panel data, categorical choice and limited dependent variables.
- Some practice in the application of the methods, the interpretation of the models, and the evaluation of inferences.
- The experience of conducting a theoretical, experimental and/or empirical investigation of the methods.

Prerequisites

- Calculus, matrix algebra, probability, mathematical statistics, asymptotic theory, linear statistical models.
- Familiarity with statistical software like Stata and Gauss, Matlab, or R.
- Econometric methods at the level of Greene (2008) or Davidson & MacKinnon (2004), ideally as in courses Econometric Methods I (EBC2111), and Econometric Methods II (EBC2120).

The course is intended for students in the Econometrics Master programme as well as others with a comparable background and motivation. FLUENCY IN MATRIX ALGEBRA AND IN ASYMPTOTIC THEORY is necessary.

An advanced level of English.

Recommended reading


These references will be supplemented with a reading list of journal articles and book chapters.

EBC4006
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
6.5
Industrial Economics

Full course description

Industrial economics studies the competition between firms in various disguises: competition in prices, competition in quantities, product differentiation, price discrimination, entry and exit, and combinations of these. The crucial question is always: As a manager of the firm, what decision would you take, and why? In this course we show how to set up such models of competition between firms, both in a static and a dynamic setting. We also show that these models can be successfully analyzed by using tools from game theory, such as Nash equilibrium and subgame perfect equilibrium. It is no surprise that game theory plays an important role here, since in order to make a good decision for your own firm you must reason about the decisions of the other firms. That is exactly what game theory is about. This beautiful marriage between economics and game theory will be at the center stage of this course.

Course objectives

The goal of this course is to show how various situations of competition between firms can be modeled, and how game theoretic tools can be used to analyze these models. It provides an excellent basis for doing research in industrial economics or a related field, but is also essential outside the academic world, for instance in managerial decision making or competition policy.

Prerequisites

A good understanding of micro economics, and a basic knowledge of game theory.

Recommended reading


ECTS credits:
Equilibrium Theory and Financial Markets

Full course description

After introducing the necessary mathematical preliminaries and extending our knowledge on selected ingredients from consumer theory, the course focuses on general equilibrium models with complete markets, in particular classical exchange and production economies. Central concepts to be studied are the competitive equilibrium and the core. Next, the model is extended to include time and uncertainty, and the strong assumption of complete markets is relaxed. This makes it possible to incorporate financial markets in a satisfactory way. We study the relationships between equilibrium and arbitrage opportunities, and the valuation of financial securities. The well-known CAPM is a special case of the model studied. A rigorous derivation of the CAPM is provided.

Course objectives

- Learn about the notion of competition in a setting with many households, firms, and commodities.
- Understand the notions of competitive equilibrium, the first and second fundamental welfare theorem, and the core.
- Understand the role of financial markets in reshuffling income across time and states of the world.
- Learn about the consequences of market incompleteness.
- Understand the Capital Asset Pricing Model.

Prerequisites

Intermediate microeconomics course, e.g. Microeconomics, or Information, Markets and Organisation. Exchange students need to have obtained a Bachelor degree with a major in Economics or Econometrics and have an advanced level in mathematics.

An advanced level of English.

Recommended reading

- Reny and Jehle, Advanced Microeconomic Theory, Addison-Wesley, 1998
Empirical Analysis of Financial Markets

Full course description

In this course we consider in depth the fluctuations of stock prices. The purpose of the course is to provide you with an overview of recent empirical research in asset pricing and portfolio management. How are theoretical models of asset pricing being tested in practice? What are the strengths and weaknesses of various methodologies? What kind of statistical techniques are used?

A second aim of the course is to let you gain some experience in doing empirical research. An important aspect of the course is learning about the characteristics of stock returns by doing a small research project. The research projects are concerned with predictability of stock returns and the profitability of various trading strategies based on (seeming) anomalies. At the end of the course you should be able to make your own assessment about events on financial markets. Are reported superior returns pure chance, statistical illusion, a reward for risk or really an anomaly?

Course objectives

The purpose of the course is to provide students with an overview of empirical methods and stylised facts that will enable them to make their own assessment of events on financial markets.

Prerequisites

Knowledge of basics of asset pricing and portfolio management, and linear regression models. Exchange students need to have obtained a Bachelor degree in economics or business administration, and sufficient quantitative background. Exchange students need to major in finance in their master.

An advanced level of English.
Recommended reading

- recent research papers
- recent journal articles

EBC4010
Period 5
9 Apr 2018
8 Jun 2018

Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:

- P.C. Schotman

Teaching methods:
PBL, Presentation(s), Lecture(s), Assignment(s), Work in subgroups
Assessment methods:
Final paper, Participation, Written exam

School of Business and Economics

Algorithms and Optimisation

Full course description

This course is devoted to mathematical models and solution methods for hard optimization problems. First, we study the theory of computational complexity, including the concept of P versus NP. In particular, we prove that some problems are computationally intractable. Given the complexity insights, solving such problems is a challenge. Therefore, we study the design and analysis of approximation algorithms and approximation schemes, as well as the derivation of inapproximability results. We also discuss local search frameworks such as Simulated Annealing, Genetic Algorithms and Tabu Search. The course is open ended in the sense that some topics can be chosen according to student interests. Classical problems that will be covered are, among others, scheduling, colouring, set covering, and packing.

Course objectives

Ability to analyse the complexity of optimization problems, and ability to design fast algorithms providing good-quality solutions for hard optimization problems.

Prerequisites

Students need to have obtained a Bachelor degree in Econometrics, Operations Research, Mathematics, or Computer Science. Knowledge in optimization (Linear Programming) and basic graph theory is highly recommended. Familiarity with basic algorithms and the analysis of algorithms (runtime complexity) is certainly helpful. C++ (or Java/Python/Basic) Programming skills are also prerequisites as there will be a practical programming case.
Recommended reading

- Selected chapters from several books on combinatorial optimization.
- Research papers.

EBC4049
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:
- A. Grigoriev

Teaching methods:
PBL, Lecture(s), Assignment(s), Work in subgroups
Assessment methods:
Participation, Written exam
School of Business and Economics

Modelling and Solver Technology

Full course description

This course is devoted to mathematical modelling of hard optimisation problems. We focus on integer programming techniques to solve these optimisation problems. During this course techniques as branch and bound, cutting planes and column generation will be discussed as well as the theory needed to understand these techniques. Furthermore, partially by using LP and ILP solvers, these techniques will be implemented in C++.

Course objectives

After this course, the student is able to model (hard) optimisation problems as mathematical programs and knows several techniques to solve these problems. Moreover, the student can use general purpose software tools to solve these problems.

Prerequisites

Linear programming (including the simplex method), duality, basics in integer programming, combinatorial optimisation, graph theory, C++. Exchange students need to have obtained a Bachelor degree and an advanced level in mathematics.

An advanced level of English.
Recommended reading

- Selected papers.
- Lecture notes.

EBC4051
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:

- A. Abiad Monge

Teaching methods:
Work in subgroups, Lecture(s), PBL, Presentation(s)
Assessment methods:
Attendance, Final paper, Participation
School of Business and Economics

Life Insurance I

Full course description

1. Pricing by Replication: Role of the actuary; Basic idea fair value; Bonds; Forward rates; Duration; Inflation.
3. Equity Options: Unit linked insurance; Intro to option theory; Equity derivatives; With-profit policies.
4. Time-Consistent and Market-Consistent Pricing: Pricing financial & insurance risk simultaneously; Two-step pricing operator; Pricing in continuous time; Market-consistent embedded value.
5. Interest Rates: Interest rate swaps; Swaptions; Extrapolating the term-structure of interest rates.
6. Risk Management: Risk measures; Calculation of Value-at-Risk; Economic Capital; Solvency II.
7. Portfolio Replication: Cash flow output; Choosing objective function; Linear regression; Diagnostic statistics.

Study-load and grading:

- Study-load = 6.5 ECTS (= 182 study-hours).
- The course takes 7 weeks, with 4 contact hours every week plus mandatory homework assignments every week.
- Students work in groups of max. 4 students on the homework assignments. Each post-discussion two groups present their solution to the tutorial group, which will then be discussed.
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by the tutorial group.

- Please note that the homework assignments are based on real-life cases. This means that the assignments are relatively unstructured. This also means that there is usually not a unique "correct" solution for the assignment. It is therefore important that students can motivate and defend the choices they have made to obtain their solution. Discussing the pro's and con's of different solutions will be an important aspect of the post-discussion.
- Average grade for all homework-presentations in the post-discussion counts for 50% of final grade. Final written exam counts for 50% of final grade.

Course objectives

In this course we aim to teach students the basic principles of pricing life-insurance and pension contract and basic principles of measuring value creation on a market-consistent basis (Market-Consistent Embedded Value).

The underlying principle for this course is the notion that the market-consistent value of a life-insurance or pension contract is based on the market-value of the Replicating Portfolio plus an “add-on” for the remaining (unhedgeable) portions of the risk that are not covered by the Replicating Portfolio.

Prerequisites

Bachelor Level Econometrics and Operations Research, including preparatory courses Actuarial Sciences.

Recommended reading

To be announced.

EBC4119
Period 2
30 Oct 2017
22 Dec 2017

Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:

- A.A.J. Pelsser

Teaching methods:
PBL, Lecture(s), Assignment(s)
Assessment methods:
Participation, Written exam
School of Business and Economics
Life Insurance II

Full course description

The course aims at providing the students with statistical models that are useful in life insurance. We discuss methods to model mortality rates. A particular focus is on the Lee-Carter model and its extensions. We also learn how to estimate these models. Furthermore, students get an introduction to statistical models, in particular regression models, that are appropriate for lifetime distributions. For instance, we address the Cox-model, the AFT model and multiple decrement models. We then discuss how these models can be used to calculate life insurance premiums.

Course objectives

To become acquainted with statistical models that can be used in life insurance.

Prerequisites


Recommended reading

Research articles, the slides of the course.

EBC4120
Period 5
9 Apr 2018
8 Jun 2018
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:

- E.A. Beutner

Teaching methods:
PBL, Lecture(s), Assignment(s), Presentation(s)
Assessment methods:
Participation, Written exam, Final paper
School of Business and Economics

Mathematical Finance

Full course description

The aim of the course is to provide students with an appreciation and understanding of the main ideas and concepts of mathematical finance. The core of mathematical finance concerns questions of
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pricing and hedging of financial derivatives such as options whose value depend on that of an underlying risky asset. We will discuss the general principles of continuous-time financial markets where the investor can buy and sell d+1 assets. As a special case we will consider the Black-Scholes model for a financial market. We will further point out the link between the no-arbitrage condition and certain probability measures, the so called equivalent martingale measures. In complete markets as well as in incomplete markets these measures allow to price financial derivatives in an arbitrage-free way. Moreover, we will consider probabilistic models for bond markets and apply the theory of equivalent martingale measures to the pricing of fixed income securities. Finally, we will address the issue of estimating the parameters of the probabilistic models from historical data.

Course objectives

The principal aim of this course is to provide students with an appreciation and understanding of how the application of mathematics, particularly stochastic mathematics, to the field of finance may be used to illuminate this field and model its randomness, resulting in greater understanding and quantification of investment returns and security prices.

Prerequisites

Students should have knowledge of stochastic processes, in particular Brownian motion, geometric Brownian motion and the underlying stochastic differential equations. Moreover, students should be familiar with the Ito integral and the Ito formula. Knowledge of the Girsanov transformation is helpful, but not required.

Recommended reading


EBC4121
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
6.5
Instruction language:
English
Coordinator:
- E.A. Beutner

Teaching methods:
PBL, Lecture(s), Assignment(s), Presentation(s)
Assessment methods:
Participation, Written exam
School of Business and Economics
Operations Research Applications

Full course description

This course is devoted to mathematical models and solution methods in logistics and telecommunication. Based on recent articles from scientific journals, we review classical as well as new optimisation models from problem domains such as facility location, vehicle routing, personnel scheduling, network design, traffic network analysis, railway planning, optical telecom networks, frequency planning for GSM-networks, and site location in UMTS. These problems are analysed with respect to solvability, complexity, and approximability. In particular, exact and approximation algorithms as well as heuristic techniques for these problem are studied. Students will learn how techniques learned from the courses "Algorithms and Optimisation" and "Modelling and Solver Technology" are applied to real world problems, and how these techniques can be refined in order to address specific problem structures.

Course objectives

Students learn how to apply general techniques from mathematical programming and combinatorial optimisation to specific classes of problems as well as to real-life applications in these areas. This includes the mathematical analysis of approximation algorithms and heuristics for these applications. Students will learn how to read state-of-the-art research articles, to understand the technical details, and to give presentations on the subjects.

Prerequisites

Students have to be familiar with the subjects of the Master courses "Algorithms and Optimisation" and "Modelling and Solver Technology" from the Master programme Econometrics and Operations Research. This includes at least basic algebra, linear programming, problems and techniques from combinatorial optimisation and complexity theory. Programming abilities in C++ and CPLEX.

Recommended reading

Recent research articles and lecture notes will be provided.

EBC4187
Period 5
9 Apr 2018
8 Jun 2018
Print course description
ECTS credits:
6.5
Coordinator:
- A. Berger

Teaching methods:
PBL, Paper(s), Assignment(s), Presentation(s), Lecture(s), Work in subgroups
Assessment methods:
Final paper, Participation
High-Dimensional Econometric Methods for Big Data

Full course description

In this course we cover several advanced techniques that have recently been developed in econometrics and statistics for the analysis of high-dimensional problems, which often arise in the context of Big Data. We will discuss theoretical properties of the methods, their practical implementation using the statistical programming language R and the application of these methods to real-life economic and financial datasets.

Topics that are covered include:

- Linear regression with many regressors: the "curse of dimensionality" in standard least squares estimation and standard approaches to model selection (such as information criteria and cross-validation);
- Modern statistical techniques for estimating high-dimensional regression models such as penalized regression (the lasso, ridge and variants): implementation, interpretation and properties;
- The standard modern tool in high-dimensional econometrics: Estimation, inference and forecasting in common factor models;
- Inference in high-dimensional regression models: multiple hypothesis testing, post-model selection inference, construction of 'honest' confidence intervals and hypothesis tests;
- High-dimensional discrete choice/classification methods.

The course will consist of lectures, in which the methods and theory are introduced, and tutorials, in which groups of students present specific papers on the subject. Students also have to write a paper for which they implement and apply the methods to economic problems.

Course objectives

The objective of this course is to provide students with an understanding of modern and advanced econometric techniques for the analysis of high-dimensional data. Students will be able to read and understand theoretical papers on the subject, to implement the techniques themselves in statistical software, and to apply the techniques to data used in economics and business. In addition to gaining this knowledge they will develop the skills to assess such methods critically and consequently adapt them to suit their needs.

Prerequisites

Students need to have solid background in probability theory, mathematical statistics, econometric methods and time series analysis, comparable to the knowledge obtained during the econometric courses of the bachelor programme Econometrics and Operations Research. In addition, a solid knowledge about time series econometrics is recommended, in particular about VAR models. One way to achieve (more than) sufficient knowledge of time series econometrics is by following the course Time Series Analysis and Dynamic Econometrics (potentially in parallel).
Master Econometrics and Operations Research

**Recommended reading**

- Selected papers and book chapters (to be announced on Eleum/Student Portal)

EBC4218
Period 2
30 Oct 2017
22 Dec 2017

Print course description

ECTS credits:
6.5

Coordinator:

- S.J.M. Smeekes

Teaching methods:
Lecture(s), PBL, Presentation(s), Work in subgroups
Assessment methods:
Final paper, Participation, Written exam
School of Business and Economics

**Time Series Methods and Dynamic Econometrics**

**Full course description**

The emphasis of this course is on the study of methods for the analysis of possibly nonstationary economic time series. We consider both theoretical and practical aspects. We cover and discuss issues related to exogeneity and causality in dynamic econometric models, modelling univariate and multivariate nonstationary processes, unit roots, cointegration as well as the asymptotic theory for integrated processes. Empirical applications are also considered so that the course will provide students with practical experience in analysing univariate and multivariate time series cointegration, factor models as well as from economics or business.

**Course objectives**

The objectives of this course are to provide students with an understanding of the concepts of modern time series methods as well as practical experience in analysing time series from economics or business. Students will have learned recent econometric methods to study multivariate economic time series. Students should be able to apply these methods to economic data.

**Prerequisites**

Econometric methods (EBC2111), Stochastic Processes (EBC4004).
Exchange students need to have a solid background in econometric methods, probability theory, mathematical statistics, and some knowledge in stochastic processes (some familiarity with Brownian Motion theory is important). Exchange students need to have obtained a Bachelor degree and an advanced level in mathematics and probability and statistics.

An advanced level of English.

**Recommended reading**

- Reader.

EBC4008
Period 2
30 Oct 2017
22 Dec 2017
[Print course description]
ECTS credits:
6.5
Instruction language:
English
Coordinators:
- [A.W. Hecq](#)
- [S.J.M. Smeekes](#)

Teaching methods:
PBL, Presentation(s), Lecture(s), Work in subgroups
Assessment methods:
Written exam, Participation, Final paper
Thesis

**Master thesis**

School of Business and Economics

**Master's Thesis**

EMTH0001
Year
1 Sep 2017
31 Aug 2018
[Print course description]
ECTS credits:
17.0