The programme information in this document is based on the selection criteria that you entered in the online prospectus (www.maastrichtuniversity.nl/web/Faculties/SBE/TargetGroup/Education/MastersProgrammes/ActuarialSciences/Courses).

Should it not contain the information that you were looking for, we recommend that you try again using different selection criteria.

Please bear in mind that the programme information is continuously updated. It is therefore wise to check the online prospectus regularly.

The information for current and prospective students on the Maastricht University (UM) website has been compiled with the utmost care, and efforts have been made to make it as up to date as possible. Should there be inaccuracies in spite of this, neither UM nor the faculties involved can be held liable. No rights can be derived from any inaccurate or incomplete information.

In the event of doubt or uncertainty about specific information, please contact the School of Business and Economics.
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Stochastic Processes

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1 Startdate: 31-Aug-15 Enddate: 25-Oct-15

Code
EBC4004

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
M.B. Eichler

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.

Goals
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.

Instruction language
EN

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 literature

**Teaching methods**

PBL
Assignment(s)
Lecture(s)

**Assessment methods**

Written exam

**Key words**
Game Theory and Optimisation

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1  Startdate: 31-Aug-15  Enddate: 25-Oct-15

Code
EBC4188

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
T. Harks

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."

Goals

Instruction language

Prerequisites

Recommended literature

Teaching methods

PBL
Lecture(s)

Assessment methods
Written exam

Key words
Time Series Methods and Dynamic E-metric

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period

Code
EBC4008

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
J.R.Y.J. Urbain

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 from economics or business.

Goals
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.

Instruction language
EN

Prerequisites
Econometric methods, Stochastic Processes. - 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 advance level of English.
**Recommended literature**

**Teaching methods**
- PBL
- Presentation(s)
- Lecture(s)
- Work in subgroups
- Paper(s)
- Assignment(s)

**Assessment methods**
- Written exam
- Participation
- Final paper

**Key words**
E-metric Method Cross-sect. + Panel Data

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 4  Startdate: 01-Feb-16  Enddate: 01-Apr-16

Code
EBC4006

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
D.P.I. de Crombrugghe

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.

Goals
- 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.

Instruction language
EN

Prerequisites
- Calculus, matrix algebra, probability, mathematical statistics, asymptotic theory, linear statistical models. - Familiarity with statistical software like Stata and Gauss or Matlab. - Econometric methods at the level of Greene (2008) or Davidson & MacKinnon (2004), as in course Econometric Methods (EBC2111). 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 assumed. An advanced level of English.
**Recommended literature**

**Teaching methods**
PBL
Presentation(s)
Lecture(s)
Assignment(s)
Paper(s)

**Assessment methods**
Final paper
Attendance
Participation
Written exam

**Key words**
Empirical Analysis of Financial Markets

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4010

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
S.F.J.A. Laurent

Description
In this course we consider in depth the fluctuations of stock prices and the performance of trading strategies.

Goals
The purpose of the course is to provide students with sufficient background and some practical experience, so that they can make their own assessment of events on financial markets.

Instruction language
EN

Prerequisites
This block can only be chosen as part of the 2 year Mphil education (BR or EFR).

Recommended literature
- recent research papers - recent journal articles

Teaching methods
PBL
Presentation(s)
Lecture(s)
Assignment(s)
Paper(s)
Assessment methods
Final paper
Participation
Written exam

Key words
Stochastic Processes

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1  Startdate: 31-Aug-15  Enddate: 25-Oct-15

Code
EBC4004

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
M.B. Eichler

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.

Goals
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.

Instruction language
EN

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 literature

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**Teaching methods**
PBL
Assignment(s)
Lecture(s)

**Assessment methods**
Written exam

**Key words**
Game Theory and Optimisation

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1  Startdate: 31-Aug-15  Enddate: 25-Oct-15

Code
EBC4188

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
T. Harks

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.”

Goals

Instruction language

Prerequisites

Recommended literature


Teaching methods

PBL
Lecture(s)

Assessment methods
Written exam

Key words
Social Choice Theory

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period

Code
EBC4005

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A.J.A. Storcken

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. 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."

Goals
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.

Instruction language
EN

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 literature
Coursebook.
**Teaching methods**

PBL
Lecture(s)

**Assessment methods**

Written exam

**Key words**
Industrial Economics

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 4  Startdate: 01-Feb-16  Enddate: 01-Apr-16

Code
EBC4007

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A. Perea y Monsuwé

Description
This advanced course provides theoretical insights of new industrial economics; using modern economic tools as optimising behaviour and strategic behaviour (game theory). This field of economics is concerned with the structure, conduct and performance of firms and markets. Moreover, in a partial equilibrium setting, attention is paid to a normative evaluation of market performance and to the potential role for government intervention. In oligopolistic markets the topics are: price or quantity competition, collusion, product selection, entry and exit, strategic behaviour under uncertainty, and research and development.

Goals
As an advanced course in industrial economics it provides a comprehensive summary of some of the most advanced models of strategic interaction among firms. It is the ideal basis for research in industrial economics or a related field and a must for those planning a career in an (economic) consulting firm.

Instruction language
EN

Prerequisites
Intermediate microeconomics, some game theory or some industrial organisation (at least two of the three), such as: · Varian, 1999, Intermediate microeconomics, A Modern Approach, Norton, New York · Gibbons, R., 1992, A Primer in Game Theory, Harvetser Wheatsheaf, New York · Martin, S., 1994, Industrial Economics, Economic Analysis and Public Policy, Prentice Hall, New Jerseyas covered, for example, in 2.3 micro economics: · Choices, markets and welfare · Game Theory, basic concepts, practice and applications · Game Theory and economics · Strategic Firm Behaviour and Public
Policy. Exchange students need to have obtained a bachelor degree with a major in Business, Economics or Econometrics/Quantitative Economics.

**Recommended literature**

**Teaching methods**
PBL
Assignment(s)

**Assessment methods**
Written exam

**Key words**
Equilibrium Theory and Financial Markets

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4009

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
E. Tsakas

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.

Goals
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.

Instruction language
EN

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.
**Recommended literature**

**Teaching methods**
- PBL
- Assignment(s)

**Assessment methods**
- Written exam

**Key words**
Stochastic Processes

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1  Startdate: 31-Aug-15  Enddate: 25-Oct-15

Code
EBC4004

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
M.B. Eichler

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.

Goals
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.

Instruction language
EN

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 literature
Teaching methods
PBL
Assignment(s)
Lecture(s)

Assessment methods
Written exam

Key words
Game Theory and Optimisation

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1  Startdate: 31-Aug-15  Enddate: 25-Oct-15

Code
EBC4188

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
T. Harks

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."

Goals

Instruction language

Prerequisites

Recommended literature

Teaching methods
PBL
Lecture(s)

Assessment methods
Written exam

**Key words**
Time Series Methods and Dynamic E-metric

Academic year 2015-16

**Date last modified**
13-2-2016 1:29

**Period**

**Code**
EBC4008

**ECTS credits**
6.5

**Organisational unit**
School of Business and Economics

**Coordinator**
J.R.Y.J. Urbain

**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 from economics or business.

**Goals**
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.

**Instruction language**
EN

**Prerequisites**
Econometric methods, Stochastic Processes. - 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 advance level of English.
**Recommended literature**

**Teaching methods**
- PBL
- Presentation(s)
- Lecture(s)
- Work in subgroups
- Paper(s)
- Assignment(s)

**Assessment methods**
- Written exam
- Participation
- Final paper

**Key words**
Life Insurance I

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period

Code
EBC4119

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A.A.J. Peels

Description
"1. Pricing by Replication: Role of the actuary; Basic idea fair value; Bonds; Forward rates; Duration; Inflation. 2. Non-Financial Risks: Non-hedgeable risks; Market value margin; Modelling of mortality; Utility-based pricing. 3. Time-Consistent and Market-Consistent Pricing: Pricing financial & insurance risk simultaneously; Twostep pricing operator; Pricing in continuous time; Market-consistent embedded value. 4. Equity Options: Unit linked insurance; Intro to option theory; Equity derivatives; With-profit policies. 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."

Goals
"In this course we aim to teach students the basic principles of product pricing and measuring value creation (Embedded Value) on a market-consistent basis. The underlying principle for this course is the notion that the market-consistent value of an insurance 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.”

**Instruction language**
EN

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

**Recommended literature**
To be announced

**Teaching methods**
PBL
Lecture(s)
Assignment(s)

**Assessment methods**
Participation
Written exam

**Key words**
Mathematical Finance

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period
Period 4  Startdate: 01-Feb-16  Enddate: 01-Apr-16

Code
EBC4121

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
E.A. Beutner

Description
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. In particular, the course describes how to mix risky assets in order to achieve optimal trade-off between investment return and risk, and how to price or hedge a derivative security, that is, one whose value depends on that of an underlying risky asset or random variable. Following an initial discussion of the assessment and measurement of investment risk, mean-variance portfolio theory is introduced and used to determine the risk and return for a portfolio of risky assets, the composition of the optimal such portfolio, and the location of the efficient frontier. Single- and multi-factor models of asset returns are then introduced and, in conjunction with concepts from mean-variance portfolio theory, lead to the establishment of equilibrium asset pricing models, such as the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT). The various forms of the Efficient Markets Hypothesis are discussed against this background. Attention then turns to stochastic models for security prices, such as geometric Brownian motion, and to the essential mathematical tool required for analysis and solution of the underlying stochastic differential equations, namely the Ito calculus, and, in particular, the Ito integral and the Ito formula. With such a stochastic model for the underlying random variable, it is possible to develop a model for the valuation of a derivative security whose price is contingent on this underlying random variable, and this is a central aspect of the course. The approach to derivative security pricing, and, in particular, option pricing, is built up in stages: first, the discrete-time binomial lattice approach is used; next, the continuous-time Black-Scholes approach is used; and finally, following the introduction of concepts such as martingales and risk-neutral measures, the martingale approach, or, equivalently, the state-price deflator approach is used. Calculations of option prices are extended to the partial derivatives of such prices, the so-called Greeks, and the role of such partial derivatives in the risk management of a portfolio of derivative securities is described. Finally, the risk-neutral and state-price
deflator approaches are applied to the pricing of zero-coupon bonds and interest rate derivatives for general single-factor diffusion models of the risk-free rate of interest, such as those of Vasicek, Coss, Ingersoll, and Ross, and Hull and White.

**Goals**
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.

**Instruction language**
EN

**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 literature**

**Teaching methods**
PBL
Lecture(s)
Assignment(s)
Work in subgroups

**Assessment methods**
Participation
Written exam

**Key words**
Life Insurance II

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period
Period 5 Startdate: 11-Apr-16 Enddate: 27-May-16

Code
EBC4120

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
E.A. Beutner

Description
We analyze one of the most common life insurance products – the so-called participating (or with profits) policy. The participating policies are typically equipped with an interest rate guarantee and possibly also an option to surrender (sell-back) the policy before maturity. The typical participating policy can be decomposed into a risk free bond element, a bonus option, and a surrender option. A dynamic model is constructed in which these elements can be valued separately using contingent claims analysis. The impact of various bonus policies and various levels of the guaranteed interest rate is analyzed numerically.

Goals
To get acquainted with the basic methods in life insurance and their

Instruction language
EN

Prerequisites

Recommended literature
To be announced

Teaching methods
PBL
Lecture(s)
Assignment(s)
Work in subgroups

**Assessment methods**
Participation
Written exam
Final paper

**Key words**
Stochastic Processes

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1 Startdate: 31-Aug-15 Enddate: 25-Oct-15

Code
EBC4004

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
M.B. Eichler

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.

Goals
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.

Instruction language
EN

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 literature

**Teaching methods**

PBL  
Assignment(s)  
Lecture(s)

**Assessment methods**

Written exam

**Key words**
Game Theory and Optimisation

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1 Startdate: 31-Aug-15 Enddate: 25-Oct-15

Code
EBC4188

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
T. Harks

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."

Goals

Instruction language

Prerequisites

Recommended literature

Teaching methods
PBL
Lecture(s)

Assessment methods
Written exam

**Key words**
Algorithms and Optimisation

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period

Code
EBC4049

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A. Grigoriev

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.

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

Instruction language
EN

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 literature

"Algorithms" by Dasgupta, Papadimitriou and Vazirani (Mc Graw-Hill) Selected chapters from several books on combinatorial optimization Research papers"

Teaching methods

PBL
Lecture(s)
Assignment(s)

Assessment methods

Participation
Written exam
Final paper

Key words
Modelling and Solver Technology

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 4  Startdate: 01-Feb-16  Enddate: 01-Apr-16

Code
EBC4051

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
T. Vredeveeld - van der Schaft

Description
This course is devoted to mathematical modeling of hard optimization problems. We focus on integer programming techniques to solve these optimization 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++.

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

Instruction language
EN

Prerequisites
None

Recommended literature
lecture notes

Teaching methods
Assignment(s)
Work in subgroups

**Assessment methods**
Attendance
Final paper

**Key words**
Operations Research Applications

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4187

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A. Berger

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.

Goals

Instruction language

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 literature
Recent research articles and lecture notes will be provided.

Teaching methods
PBL
Paper(s)
Assignment(s)
Presentation(s)
Lecture(s)

Assessment methods
Final paper

Key words
Stochastic Processes

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1  Startdate: 31-Aug-15  Enddate: 25-Oct-15

Code
EBC4004

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
M.B. Eichler

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.

Goals
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.

Instruction language
EN

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 literature

**Teaching methods**

PBL
Assignment(s)
Lecture(s)

**Assessment methods**

Written exam

**Key words**
Game Theory and Optimisation

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 1  Startdate: 31-Aug-15  Enddate: 25-Oct-15

Code
EBC4188

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
T. Harks

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."

Goals

Instruction language

Prerequisites

Recommended literature

Teaching methods
PBL
Lecture(s)

Assessment methods
Written exam

**Key words**
Supply Chain Strategy

Academic year 2015-16

Date last modified
15-4-2016 1:13

Period
Period 1 Startdate: 31-Aug-15 Enddate: 25-Oct-15
Period 4 Startdate: 01-Feb-16 Enddate: 01-Apr-16

Code
EBC4018

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator

Description
Supply Chain Strategy helps the student in the study of organizing and optimizing supply chains. Supply chains are constellations of firms that together form the link between raw materials and end consumer. Both upstream and downstream functions and supporting activities will be reviewed, and what it means to strategically “manage” the different connected organizations for overall performance of the chain. An introduction with background and overview of the different components of the chain to be managed will be followed by a state-of-the-art review of contemporary strategic issues in Supply Chain Management, such as lean manufacturing, third-party logistics (3PL), customer services and fulfillmen, one-stop shopping, supplier development, cost & performance etc.

Goals
Serves as introduction to the discipline, and provides an overview of the pivotal elements of the supply chain management program. Provides students with strategic insights into managing supply chains and a solid basis for understanding the subsequent elements of the program.

Instruction language
EN

Prerequisites
Courses and workload are very demanding for all IB Master courses. Exchange students need to have obtained a Bachelor degree in business. Exchange students need to major in supply chain management/ logistics in their Master.

Recommended literature
Fawcett Stanley E., Ellram Lisa M., Ogden Jeffrey A., Supply Chain Management from Vision to Implementation. Pearson
Teaching methods
PBL
Presentation(s)
Lecture(s)
Assignment(s)
Paper(s)

Assessment methods
Participation
Written exam

Key words
ECB and Monetary Policy

Academic year 2015-16

Date last modified
26-11-2015 1:23

Period
Period 1  Startdate: 31-Aug-15  Enddate: 25-Oct-15

Code
EBC4023

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
J. Muysken

Description
This course aims at deepening the students knowledge of the relation between monetary and real phenomena in an economy. Both theoretical, institutional and practical issues are addressed. The following topics are analysed in particular: - Money in a general equilibrium framework: why does money exist in an economy and how does it effect the dynamic behaviour of that economy? - Theory of monetary (stabilisation) policy: what are the transmission channels between the monetary and the real sphere of the economy and how effective is monetary policy under various conditions? - Dynamics of monetary policy: what is the optimal form of monetary policy (rules or discretion) and does this depend on rational expectations? - The position and policy implementation of the ECB (also visit the ECB). All topics will consistently be related to European Monetary Policy.

Goals

Instruction language
EN

Prerequisites
Intermediate macroeconomics (Burda & Wyplosz or Gärtner) and microeconomics (Varian or Werstein)) Exchange students need to have obtained a Bachelor degree with a major in Economics (not in Business).

Recommended literature

Teaching methods
Paper(s)
Assessment methods
Final paper

Key words
Open Macroeconomics in a Global Society

Academic year 2015-16

Date last modified
2-12-2015 1:18

Period

Code
EBC4029

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
D.P. Blatt

Description
In a world of increasing economic integration, caused by - among other things - technological developments and the liberalization of capital and trade flows, the standard macroeconomic analysis using a closed economy framework does not suffice anymore. In this course we, therefore, start from an open economy perspective. The first part of the course is of a theoretical nature, to provide a general framework of analysis. In the second part, we apply this theoretical framework to real world problems. In the block opening we summarize the theoretical and empirical determinants of nominal and real exchange rates, both in the short and the long run, assuming the exchange rate is free to float. This draws on prior knowledge as presented in the literature for the second year course in International Monetary Economics. Subsequently, tutorial group meetings are used to discuss extensions. These extensions are fourfold. First, fixed exchange rate systems are further investigated. Many governments prefer fixed to floating rates. However, keeping exchange rates fixed proved much more difficult than was once thought. Examples of fixed exchange rate crises, speculative attacks and collapsing regimes abound: the European monetary system in the early nineties, the Mexican crisis of 1994 and the East-Asian crisis of 1997 and 1998 are only the most recent ones. The most disturbing element is the seemingly unjustified behaviour of foreign exchange market participants. It makes policymakers wonder how rational markets are. We analyse a number of models to explain seemingly non-fundamental attacks. Second, interest rate parity is investigated and both non-rationality and risk aversion are discussed as potential problems. In both cases, a portfolio balance model determines the equilibrium exchange rate. Third, the real exchange rate is focus of analysis. In the end, the real exchange rate is more interesting than the nominal one. Ultimately, money may be no more than a (neutral) veil. The real exchange rate determines the terms of trade and relative welfare. Also, the real exchange rate relates financial markets and goods markets to get an overall equilibrium. Persistent real exchange rate developments may have important effects on the domestic economy. Fourth, the possibilities of monetary and fiscal policy to obtain internal and external equilibrium are studied together with the adjustment role of the (real) exchange rate. Also, the link with the labour market and
wage-setting is considered. After the theoretical part, students will be asked to apply their new knowledge to real-world cases. The purpose is to train the student to recognize the underlying characteristics of new (unstructured) problems and to put them in the appropriate framework. The aim is to formulate a strategy to solve the problem at hand based on an appropriate theoretical framework.

Goals
This course is an intermediate macroeconomic course. The students are expected to extend their knowledge in international economics, acquired during their bachelor. At the end of the course the students should be able to: - determine the optimal exchange rate for a country and a particular situation. - investigate both non-rationality and risk aversion are discussed as potential problems. In both cases, a portfolio balance model determines the equilibrium exchange rate. - study a currency and a financial crisis, the real exchange rate is focus of analysis. - analyse the role the real exchange. Ultimately, money may be no more than a (neutral) veil. The real exchange rate determines the terms of trade and relative welfare. Also, the real exchange rate relates financial markets and goods markets to get an overall equilibrium. Persistent real exchange rate developments may have important effects on the domestic economy. - have a fresh idea on the European integration process and its consequences on the monetary, the fiscal policies as well as the role of the single currency.

Instruction language
EN

Prerequisites
Second-year International Monetary Economics course (level book Krugman and Obstfeld), “International Economics: Theory and Policy”. Exchange students need to have obtained a Bachelor degree with a major in Economics or in Econometrics/Quantitative Economics.

Recommended literature
- E. Claassen, Global Monetary Economics, Oxford University Press, 1998 (indicative)- selected articles

Teaching methods
PBL
Presentation(s)

Assessment methods
Participation
Written exam

Key words
Supply Chain Operations

Academic year 2015-16

Date last modified
15-4-2016 1:13

Period
Period 4  Startdate: 01-Feb-16  Enddate: 01-Apr-16

Code
EBC4016

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A. Berger

Description
The course Supply Chain Operations deals with the design, management and improvement of the processes that create a firm's primary services and products. Topics include scheduling, facility layout, facility location, inventory control, service quality and demand management. The course combines the usual theory and exercises with several cases from manufacturing and service industry.

Goals
Understanding the basic concepts of operations management in a supply chain context. The course addresses service operations as well.

Instruction language
EN

Prerequisites
Linear programming modeling, statistics (hypothesis testing, regression), familiarity with Excel and Solver.

Recommended literature
Teaching methods

PBL
Presentation(s)
Lecture(s)
Assignment(s)

Assessment methods

Participation
Written exam

Key words
CapSel: E'trics, Math Eco+Oper Res

Academic year 2015-16

Date last modified
25-11-2015 1:24

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4011

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A.J. Vermeulen

Description
This block is intended for students in economics, business administration, or econometrics who wish to specialise in topics not covered by existing courses. It may be used in particular as a preparation for an internship or master’s thesis.

Goals
Students will have advanced knowledge of econometric and other quantitative methods. They should be able to apply those methods to solve economic or business problems.

Instruction language
EN

Prerequisites
Only (Research) Master students and PhD students can take this course. The general level is the level of the master program Econometrics and Operations Research.

Recommended literature
To be determined

Teaching methods
PBL
Lecture(s)
Assignment(s)
Paper(s)

**Assessment methods**
Participation
Written exam

**Key words**
Growth and Innovation in Europe

Academic year 2015-16

**Date last modified**
25-11-2015 1:24

**Period**
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

**Code**
EBC4020

**ECTS credits**
6.5

**Organisational unit**
School of Business and Economics

**Coordinator**
A.H. van Zon

**Description**
The Lisbon strategy is meant to turn the EU into the most competitive economic entity on the world in order to generate the highest but still sustainable rates of growth possible. To do that it has adopted the promotion of R&D activity as one of its main tactics. In this block, we will look into the theoretical foundations of the growth part of the Lisbon strategy, first by studying traditional growth theory and secondly by focusing more clearly on the additions to the traditional growth framework coming from new (or endogenous) growth theory. There are different proto-typical new growth theory models, each of them focusing on different features of growth performance, but all of them emphasizing the overriding importance of knowledge and human capital accumulation, as accepted in the Lisbon strategy. During the course, we will spend time constructing and simulating these proto-type models, in order to see how, in each of these models, economic policy would be able to influence growth performance in Europe.

**Goals**
The goal is to understand how innovation and technological change cause economic growth, and growth rate differentials between countries and changes in the distribution of income between groups within countries. Students will develop a deep analytical understanding of the relationship between innovation, economic growth and distribution issues.

**Instruction language**
EN

**Prerequisites**
Intermediate knowledge of mathematics and economics is required. Exchange Students need to have obtained a Bachelor degree in economics.
**Recommended literature**
To be announced.

**Teaching methods**
PBL
Lecture(s)
Assignment(s)

**Assessment methods**
Attendance
Written exam

**Key words**
Risk Management

Academic year 2015-16

Date last modified
15-4-2016 1:13

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4056

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
W.F.M. Bams

Description
The course focuses on practical issues in the measurement and management of risk in financial institutions.

Goals
- Understand the different dimensions of risk in financial institutions and corporations - Learn how to measure and monitor market-, credit- and operational risk - Learn how to measure financial risks in corporations - Understand the concepts of regulatory capital and economic capital - Understand the new regulatory framework for capital requirements (Basel II) - Understand the interrelations between different risk types and how to integrate these in a firmwide framework for performance

Instruction language
EN

Prerequisites
Exchange students need to have obtained a Bachelor degree in economics or business administration. Exchange students need to major in finance in their master.

Recommended literature

Teaching methods
PBL
Presentation(s)
Lecture(s)
Assignment(s)

**Assessment methods**
Participation
Written exam

**Key words**
Social Choice Theory

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period

Code
EBC4005

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A.J.A. Storcken

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. 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."

Goals
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.

Instruction language
EN

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 literature
Coursebook.
Teaching methods
PBL
Lecture(s)

Assessment methods
Written exam

Key words
Time Series Methods and Dynamic E-metric

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period

Code
EBC4008

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
J.R.Y.J. Urbain

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 from economics or business.

Goals
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.

Instruction language
EN

Prerequisites
Econometric methods, Stochastic Processes. - 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 advance level of English.
Recommended literature

Teaching methods
PBL
Presentation(s)
Lecture(s)
Work in subgroups
Paper(s)
Assignment(s)

Assessment methods
Written exam
Participation
Final paper

Key words
Algorithms and Optimisation

Academic year 2015-16

**Date last modified**
26-1-2016 1:18

**Period**

**Code**
EBC4049

**ECTS credits**
6.5

**Organisational unit**
School of Business and Economics

**Coordinator**
A. Grigoriev

**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.

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

**Instruction language**
EN

**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 literature

“Algorithms” by Dasgupta, Papadimitriou and Vazirani (Mc Graw-Hill) Selected chapters from several books on combinatorial optimization Research papers.

Teaching methods

PBL
Lecture(s)
Assignment(s)

Assessment methods

Participation
Written exam
Final paper

Key words
Life Insurance I

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period

Code
EBC4119

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A.A.J. Pelsser

Description
"1. Pricing by Replication: Role of the actuary; Basic idea fair value; Bonds; Forward rates; Duration; Inflation. 2. Non-Financial Risks: Non-hedgeable risks; Market value margin; Modelling of mortality; Utility-based pricing. 3. Time-Consistent and Market-Consistent Pricing: Pricing financial & insurance risk simultaneously; Twostep pricing operator; Pricing in continuous time; Market-consistent embedded value. 4. Equity Options: Unit linked insurance; Intro to option theory; Equity derivatives; With-profit policies. 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."

Goals
"In this course we aim to teach students the basic principles of product pricing and measuring value creation (Embedded Value) on a market-consistent basis. The underlying principle for this course is the notion that the market-consistent value of an insurance 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."

**Instruction language**
EN

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

**Recommended literature**
To be announced

**Teaching methods**
PBL
Lecture(s)
Assignment(s)

**Assessment methods**
Participation
Written exam

**Key words**
E-metric Method Cross-sect. + Panel Data

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 4  Startdate: 01-Feb-16  Enddate: 01-Apr-16

Code
EBC4006

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
D.P.I. de Crombrugghe

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.

Goals
- 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.

Instruction language
EN

Prerequisites
- Calculus, matrix algebra, probability, mathematical statistics, asymptotic theory, linear statistical models. - Familiarity with statistical software like Stata and Gauss or Matlab. - Econometric methods at the level of Greene (2008) or Davidson & MacKinnon (2004), as in course Econometric Methods (EBC2111). 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 assumed. An advanced level of English.


**Recommended literature**

**Teaching methods**
PBL
Presentation(s)
Lecture(s)
Assignment(s)
Paper(s)

**Assessment methods**
Final paper
Attendance
Participation
Written exam

**Key words**
Industrial Economics

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 4  Startdate: 01-Feb-16  Enddate: 01-Apr-16

Code
EBC4007

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A. Perea y Monsué

Description
This advanced course provides theoretical insights of new industrial economics; using modern economic tools as optimising behaviour and strategic behaviour (game theory). This field of economics is concerned with the structure, conduct and performance of firms and markets. Moreover, in a partial equilibrium setting, attention is paid to a normative evaluation of market performance and to the potential role for government intervention. In oligopolistic markets the topics are: price or quantity competition, collusion, product selection, entry and exit, strategic behaviour under uncertainty, and research and development.

Goals
As an advanced course in industrial economics it provides a comprehensive summary of some of the most advanced models of strategic interaction among firms. It is the ideal basis for research in industrial economics or a related field and a must for those planning a career in an (economic) consulting firm.

Instruction language
EN

Prerequisites
Policy. Exchange students need to have obtained a bachelor degree with a major in Business, Economics or Econometrics/Quantitative Economics.

**Recommended literature**


**Teaching methods**

PBL
Assignment(s)

**Assessment methods**

Written exam

**Key words**
Modelling and Solver Technology

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 4 Startdate: 01-Feb-16 Enddate: 01-Apr-16

Code
EBC4051

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
T. Vredevenl - van der Schaft

Description
This course is devoted to mathematical modeling of hard optimization problems. We focus on integer programming techniques to solve these optimization 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++.

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

Instruction language
EN

Prerequisites
None

Recommended literature
lecture notes

Teaching methods
Assignment(s)
Work in subgroups

**Assessment methods**
Attendance
Final paper

**Key words**
Mathematical Finance

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period
Period 4  Startdate: 01-Feb-16   Enddate: 01-Apr-16

Code
EBC4121

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
E.A. Beutner

Description
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. In particular, the course describes how to mix risky assets in order to achieve optimal trade-off between investment return and risk, and how to price or hedge a derivative security, that is, one whose value depends on that of an underlying risky asset or random variable. Following an initial discussion of the assessment and measurement of investment risk, mean-variance portfolio theory is introduced and used to determine the risk and return for a portfolio of risky assets, the composition of the optimal such portfolio, and the location of the efficient frontier. Single- and multi-factor models of asset returns are then introduced and, in conjunction with concepts from mean-variance portfolio theory, lead to the establishment of equilibrium asset pricing models, such as the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT). The various forms of the Efficient Markets Hypothesis are discussed against this background. Attention then turns to stochastic models for security prices, such as geometric Brownian motion, and to the essential mathematical tool required for analysis and solution of the underlying stochastic differential equations, namely the Ito calculus, and, in particular, the Ito integral and the Ito formula. With such a stochastic model for the underlying random variable, it is possible to develop a model for the valuation of a derivative security whose price is contingent on this underlying random variable, and this is a central aspect of the course. The approach to derivative security pricing, and, in particular, option pricing, is built up in stages: first, the discrete-time binomial lattice approach is used; next, the continuous-time Black-Scholes approach is used; and finally, following the introduction of concepts such as martingales and risk-neutral measures, the martingale approach, or, equivalently, the state-price deflator approach is used. Calculations of option prices are extended to the partial derivatives of such prices, the so-called Greeks, and the role of such partial derivatives in the risk management of a portfolio of derivative securities is described. Finally, the risk-neutral and state-price
deflator approaches are applied to the pricing of zero-coupon bonds and interest rate derivatives for general single-factor diffusion models of the risk-free rate of interest, such as those of Vasicek, Coss, Ingersoll, and Ross, and Hull and White.

**Goals**
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.

**Instruction language**
EN

**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 literature**

**Teaching methods**
PBL
Lecture(s)
Assignment(s)
Work in subgroups

**Assessment methods**
Participation
Written exam

**Key words**
Equilibrium Theory and Financial Markets

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4009

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
E. Tsakas

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.

Goals
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.

Instruction language
EN

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.
**Recommended literature**

**Teaching methods**
- PBL
- Assignment(s)

**Assessment methods**
- Written exam

**Key words**
Empirical Analysis of Financial Markets

Academic year 2015-16

Date last modified
13-2-2016 1:29

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4010

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
S.F.J.A. Laurent

Description
In this course we consider in depth the fluctuations of stock prices and the performance of trading strategies.

Goals
The purpose of the course is to provide students with sufficient background and some practical experience, so that they can make their own assessment of events on financial markets.

Instruction language
EN

Prerequisites
This block can only be chosen as part of the 2 year Mphil education (BR or EFR).

Recommended literature
· recent research papers · recent journal articles

Teaching methods
PBL
Presentation(s)
Lecture(s)
Assignment(s)
Paper(s)
Assessment methods
Final paper
Participation
Written exam

Key words
Life Insurance II

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4120

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
E.A. Beutner

Description
We analyze one of the most common life insurance products û the so-called participating (or with profits) policy. The participating policies are typically equipped with an interest rate guarantee and possibly also an option to surrender (sell-back) the policy before maturity. The typical participating policy can be decomposed into a risk free bond element, a bonus option, and a surrender option. A dynamic model is constructed in which these elements can be valued separately using contingent claims analysis. The impact of various bonus policies and various levels of the guaranteed interest rate is analyzed numerically.

Goals
To get acquainted with the basic methods in life insurance and their

Instruction language
EN

Prerequisites

Recommended literature
To be announced

Teaching methods
PBL
Lecture(s)
Assignment(s)
Work in subgroups

**Assessment methods**
Participation
Written exam
Final paper

**Key words**
Operations Research Applications

Academic year 2015-16

Date last modified
26-1-2016 1:18

Period
Period 5  Startdate: 11-Apr-16  Enddate: 27-May-16

Code
EBC4187

ECTS credits
6.5

Organisational unit
School of Business and Economics

Coordinator
A. Berger

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.

Goals

Instruction language

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 literature
Recent research articles and lecture notes will be provided.

Teaching methods
PBL
Paper(s)
Assignment(s)
Presentation(s)
Lecture(s)

Assessment methods
Final paper

Key words
Master's Thesis

Academic year 2015-16

Date last modified
19-2-2016 1:31

Period
Year  Startdate: 01-Sep-15  Enddate: 31-Aug-16

Code
EMTH0001

ECTS credits
17.0

Organisational unit
School of Business and Economics

Coordinator
Description
Goals
Instruction language
Prerequisites
Recommended literature
Teaching methods
Assessment methods
Key words
Master's Thesis (Variable credits)

Academic year 2015-16

Date last modified
23-4-2016 1:13

Period
Year  Startdate: 01-Sep-15  Enddate: 31-Aug-16

Code
EMTH0003

ECTS credits
13.0

Organisational unit
School of Business and Economics

Coordinator

Description

Goals

Instruction language

Prerequisites

Recommended literature

Teaching methods

Assessment methods

Key words