Econometrics and Operations Research (MSc)

Vrije Universiteit Amsterdam - Fac. der Economische Wet. en Bedrijfsk. - M Econometrics and Operations Research - 2013-2014

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I

The Master's programme in Econometrics and Operations Research is an academic programme focusing on the development and application of quantitative methods for analysing economic issues in a broad sense. It is a successful preparation for a professional career in which mathematics, statistics and ICT are used in analysing and solving complex issues in general economics, and business and financial economics. Econometrists are also employed as experts in optimizing strategic and operational business processes like transport flows, stock management and operating systems. Econometrists can be found working at the central banks of Europe, at federal banks in the United States, at central government agencies and ministries, financial institutions, consultancy firms and in the majority of listed companies.

The components of the Master's programme correspond closely with the department's research interests, which means that many of the latest scientific developments in areas like financial econometrics, logistics and game theory find their way directly into the teaching programme. Students also benefit from having the opportunity to study in small groups and work closely with the academic staff.

Read the full description of the programme or use the schedule below for information on the individual courses in the programme.

Vrije Universiteit Amsterdam - Fac. der Economische Wet. en Bedrijfsk. - M Econometrics and Operations Research - 2013-2014

II

Inhoudsopgave

M Econometrics - Ectrie and Math Ec

Vakken:

Naam	Periode	Credits	Code
Adv Corporate Finance 4.1	Periode 1	6.0	E_FIN_ACF
Advanced Econometrics	Periode 1+2	6.0	E_EORM_AECTR
Advanced Macroeconomics	Periode 2	6.0	E_EC_AMAEC
Asset Pricing	Periode 1	6.0	E_FIN_AP
Asymptotic Statistics	Periode 1+2	8.0	X_400323
Business Marketing	Periode 2	6.0	E_MKT_BM
Caput Operation Research	Periode 1	6.0	E_EORM_COR
Case Study	Periode 3	6.0	E_EORM_CASE
Consumer Marketing	Periode 2	6.0	E_MKT_CM
Customer Intelligence	Periode 1	6.0	E_MKT_CI
Data Mining Techniques	Periode 5	6.0	X_400108
Derivatives	Periode 2	6.0	E_FIN_DER
Environmental Economics	Periode 2	6.0	E_STR_EEC
Financial Markets and Institutions	Periode 4	6.0	E_FIN_FMI
Firm Behavior and Market Structures	Periode 4	6.0	E_EC_FBMS
Globalization, Growth and Development	Periode 4	6.0	E_EC_GGD
Labour Economics	Periode 4	6.0	E_EC_LABEC
Mathematical Systems and Control Theory	Periode 1+2	6.0	X_400180
Regional and Urban Economics	Periode 2	6.0	E_STR_RUE
Simulation and Stochastic Systems	Periode 4	6.0	E_EORM_SSS
Stochastic Processes for Finance	Periode 1+2	6.0	X_400352
Strategic and Cooperative Decision Making	Periode 2	6.0	E_EORM_SCDM
Thesis	Ac. Jaar (september)	18.0	E_EORM_THS
Time Series Econometrics	Periode 4	6.0	E_EORM_TSE

M Econometrics - No specialisation

Vakken:

Naam	Periode	Credits	Code
Adv Corporate Finance 4.1	Periode 1	6.0	E_FIN_ACF

[Advanced Econometrics](#)	Periode 1+2	6.0	E_EORM_AECTR
[Advanced Macroeconomics](#)	Periode 2	6.0	E_EC_AMAEC
[Asset Pricing](#)	Periode 1	6.0	E_FIN_AP
[Asymptotic Statistics](#)	Periode 1+2	8.0	X_400323
[Business Marketing](#)	Periode 2	6.0	E_MKT_BM
[Caput Operation Research](#)	Periode 1	6.0	E_EORM_COR
[Case Study](#)	Periode 3	6.0	E_EORM_CASE
[Consumer Marketing](#)	Periode 2	6.0	E_MKT_CM
[Customer Intelligence](#)	Periode 1	6.0	E_MKT_CI
[Data Mining Techniques](#)	Periode 5	6.0	X_400108
[Derivatives](#)	Periode 2	6.0	E_FIN_DER
[Distribution Logistics and Supply Chain Management](#)	Periode 1	6.0	E_BA_DLSCM
[Environmental Economics](#)	Periode 2	6.0	E_STR_EEC
[Evolutionary Computing](#)	Periode 1	6.0	X_400111
[Financial Markets and Institutions](#)	Periode 4	6.0	E_FIN_FMI
[Firm Behavior and Market Structures](#)	Periode 4	6.0	E_EC_FBMS
[Globalization, Growth and Development](#)	Periode 4	6.0	E_EC_GGD
[Labour Economics](#)	Periode 4	6.0	E_EC_LABEC
[Mathematical Systems and Control Theory](#)	Periode 1+2	6.0	X_400180
[Neurale Netwerken](#)	Periode 1	6.0	X_400132
[Regional and Urban Economics](#)	Periode 2	6.0	E_STR_RUE
[Simulation and Stochastic Systems](#)	Periode 4	6.0	E_EORM_SSS
[Stochastic Optimization](#)	Periode 1+2	6.0	X_400336
[Stochastic Processes for Finance](#)	Periode 1+2	6.0	X_400352
[Strategic and Cooperative Decision Making](#)	Periode 2	6.0	E_EORM_SCDM
[Time Series Econometrics](#)	Periode 4	6.0	E_EORM_TSE
[Transport Economics](#)	Periode 4	6.0	E_STR_TREC

M Econometrics - OR and Bus Ectr

Vakken:

Naam	Periode	Credits	Code
[Advanced Econometrics](#)	Periode 1+2	6.0	E_EORM_AECTR
[Asset Pricing](#)	Periode 1	6.0	E_FIN_AP
[Caput Operation Research](#)	Periode 1	6.0	E_EORM_COR
[Case Study](#)	Periode 3	6.0	E_EORM_CASE

[Data Mining Techniques](#)	Periode 5	6.0	X_400108
[Derivatives](#)	Periode 2	6.0	E_FIN_DER
[Distribution Logistics and Supply Chain Management](#)	Periode 1	6.0	E_BA_DLSCM
[Environmental Economics](#)	Periode 2	6.0	E_STR_EEC
[Evolutionary Computing](#)	Periode 1	6.0	X_400111
[Institutional Investments and ALM for Finance](#)	Periode 4	6.0	E_FIN_IIALMF
[Neurale Netwerken](#)	Periode 1	6.0	X_400132
[Simulation and Stochastic Systems](#)	Periode 4	6.0	E_EORM_SSS
[Stochastic Optimization](#)	Periode 1+2	6.0	X_400336
[Strategic and Cooperative Decision Making](#)	Periode 2	6.0	E_EORM_SCDM
[Thesis](#)	Ac. Jaar (september)	18.0	E_EORM_THS
[Time Series Econometrics](#)	Periode 4	6.0	E_EORM_TSE
[Transport Economics](#)	Periode 4	6.0	E_STR_TREC

Adv Corporate Finance 4.1

Vakcode	E_FIN_ACF ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	prof. dr. ir. H.A. Rijken
Docent(en)	prof. dr. ir. H.A. Rijken
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak
Achieve advanced knowledge in the theory and practice of corporate
finance. The main objective is to fully understand theoretical concepts
(their strengths and limitations) and to use these theoretical
frameworks to solve in an effective way practical issues in corporate
finance. After following this course, you:

- understand basic Corporate Finance concepts, including their strengths
and limitations
- have the quantitative skills to apply these basic concepts
- understand the interrelationship between various concepts and link
them in a general framework
- are able to apply this framework in real life cases

Advanced Econometrics

Vakcode	E_EORM_AECTR (64412001)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels

Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. M. Massmann
Docent(en)	prof. dr. S.J. Koopman
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak

To gain a profound and detailed understanding of advanced econometric
theory and methods. By the end of this course, participants will:

have detailed knowledge of
- principles of econometric theory and practical methods at the graduate
level
- advanced statistical concepts used in econometric theory and their
application in econometric modelling

know how to
- estimate and test both cross-section and time-series models
- evaluate econometric procedures by means of simulation experiments
- solve theoretical econometric exercises

understand
- the interplay between econometric techniques and modelling assumptions
- the proofs of asymptotic properties of important estimators and test
statistics

have gained experience in
- solving an econometric research questions as part of a group
- presenting the solution to the class
- discussing other groups' presentations

Inhoud vak

Advanced Econometrics I

The three main topics of this course are:

- Nonlinear regression and generalised least squares,
- Instrumental variable estimation,
- Generalized methods of moments.

This course recaps and extends undergraduate knowledge of econometric
theory and methods at the graduate level, focussing on a number of
selected methods and models. Estimators for both linear and non-linear
models will be examined, including least-squares, and generalized
methods of moments.. Point estimation as well as confidence interval
estimation will be considered. For different estimators and test
statistics the question is addressed of how exact, bootstrap or
asymptotic inference can be conducted.

Note: the econometrics programme is currently under revision. Some
topics may change. Please consult the latest version of the online study
guide.

Advanced Econometrics II

The three main topics in Advanced Econometrics II are maximum likelihood
estimation, multivariate regression analysis and multivariate time

series analysis.

The course recaps and extends undergraduate knowledge of econometric theory and methods at the graduate level, focussing on a number of selected methods and models. Estimators for both linear and non-linear models will be examined. Testing procedures that will take centre stage include Lagrange multiplier test as well as conditional moment tests. For all estimators and test statistics the question is addressed of how exact, bootstrap or asymptotic inference can be conducted.

Note: the econometrics programme is currently under revision. Some topics may change. Please consult the latest version of the online study guide.

Onderwijsvorm
lecture and tutorial

Some lectures can be used for students to give presentations on selected topics.

Toetsvorm
Written examination.

There are two separate written exams for Advanced Econometrics I (period 1) and for Advanced Econometriecs II (period 2). Minimum required result for Advanced Econometrics I is 5.5 and for Advanced Econometrics II is 5.0. Total grade for the combined 6 ECTS version is the average of the two grades and must be at least 5.5 for a pass. The two partial grades are measured in one decimal point; the total grade is the rounded average of the two grades.

Starting September 2010, the first part can be taken as a single elective course for 3 ECTS.

Note: the econometrics programme is under revision. The examination format may change slightly. Please consult the latest version of the online study guide.

Literatuur
Advanced Econometrics I and II:
Davidson, R & J G. MacKinnon, Econometric Theory and Methods. OUP 2004, (compulsory).

Advanced Econometrics II:
Tsay, R., Analysis of Financial Time Series, John Wiley and Sons, 2005, Chapter 8 (parts).

Other references:
- Ruud, P A., An Introduction to Classical Econometric Theory. OUP, 2000.
- Hansen, B E, Econometrics. Manuscript, University of Wisconsin.2009.
Current URL: www.ssc.wisc.edu/~bhansen/econometrics/

Advanced Macroeconomics

Vakcode	E_EC_AMAEC (60422010)
Periode	Periode 2

Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	prof. dr. P.A. Gautier
Examinator	prof. dr. P.A. Gautier
Docent(en)	prof. dr. E.J. Bartelsman, prof. dr. B. Hobijn
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The students will be able to actively read current literature and
embark on their own research projects using the knowledge gained about
the analytical, mathematical, and statistical tools of modern
macroeconomics. The tools include dynamic optimization, signal
extraction, Nash bargaining, and the basic building blocks of DSGE
models.

Inhoud vak

This course provides coverage at an advanced level of the building
blocks of macro economics. Models of economic growth will be built up
from inter- temporal optimisation decisions of firms and households.
The basic model will be extended to take into account the effects on
growth of investment in knowledge (R& D, education). Next, the course
will present the tools of Real Business Cycle analysis and recent
applications. Finally, the course will present the current state of
work in New Keynesian economics and its implications for cyclical
fluctuations, the functioning of the labor market and the conduct of
monetary policy.

Onderwijsvorm

lecture

Toetsvorm

written interim examination
plus problem sets.

Literatuur

Romer, David Advanced Macro Economics. 3rd edition, McGraw Hill.

Asset Pricing

Vakcode	E_FIN_AP ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. F. Brevik
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak

This course aims to deepen your knowledge in the field of asset pricing
and asset allocation. After completion of the course, you should:

- Have a thorough understanding of how security prices are determined in financial markets, including equity and fixed income.
- Understand and be able to apply optimal asset allocations for both individual and institutional investors.
- Acquire an academic and critical attitude towards competing technique in investment problems.
- Be comfortable with doing advanced analyses in Software such as Microsoft Excel.

Inhoud vak
Starting from basic (undergraduate) Investments knowledge, this course centers around the issues of asset pricing and asset allocation. In the first week we revisit the well known mean-variance framework and derive the standard CAPM in this set-up. In the second week we explore empirical deviations from the CAPM and discuss how these can be exploited. Here we also touch upon some issues related to behavioral finance. In the third week we study dynamic optimization. Dynamic programming is introduced by the example of pricing American options. We then use the same technique to solve for the optimal dynamic asset-allocation policy when investment opportunities are constant. In the forth week, we study variations in expected returns and link these to fundamental ratios. In the fifth week we explore how investors should exploit variations in expected returns and introduce the I-CAPM. Consumption based asset pricing is covered in the last week.

Onderwijsvorm
Each of the 6 weeks of the course feature 4 hours of formal lectures and 2 hours of recitations. During recitations we will go through exercises to the topics covered in that week. The exercises are at the end of the relevant chapter of the lecture notes. Draft solutions will be posted on Blackboard after the recitations. In addition there are 3 group work assignments. The focus of these assignments is to apply the theoretical knowledge from class to real world problems using Excel or other software. In addition to gaining a deeper understanding of the topics in the course, the assignments will train you in quantitative computer skills you will need later in their career and prepare you for similar assignments in other courses and your thesis. For each assignment, you work in groups of three students. Assignments will be due at the end of the weeks 1, 3, and 5 of the term.

Toetsvorm
To pass this course, you need a minimum final grade of 6.0 and a minimum grade on the written exam of 5.0. If you score less than 5.0 on the written exam, your final grade is equal to that grade. If you score 5.0 or higher, the final grade is given by:

Final grade = 0.7*(Written exam grade) + 0.3*(Average assignment grade)

Literatuur
- Lecture notes.
- Selected research articles and news clippings.
- [For background reading] Boadie, Kane, Markus: Investments (2008; MacGraw-Hill)

Vereiste voorkennis
You should be familiar with investments at the level of Bodie, Kane & Marcus, Investments. Undergraduate level knowledge of statistics and mathematics is also required (e.g., Berenson, Levine, Krehbiel: Basic Business Statistics; and Sydsaeter and Hammond (2006; Prentice Hall):

Essential Mathematics for Economic Analysis, Sydsaeter, Hammond, Seierstad, and Strom (2005; Prentice Hall): Further mathematics for Economic Analysis (chapters 4 and 11)).

Aanbevolen voorkennis
You are expected to be very versatile in a relevant software package, such as Microsoft Excel (or any other similarly advance package) and use it to perform estimation and optimization. Core texts here are Benninga, Financial Modeling, or (more advanced) Jackson and Staunton, Advanced modeling in Finance using excel and VBA.

Overige informatie
This course may have an in-depth empirical follow-up by choosing an appropriate Investments team-research-project during the January / February period.

Asymptotic Statistics

Vakcode	X_400323 (400323)
Periode	Periode 1+2
Credits	8.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Niveau	500

Inhoud vak
This course is part of the joint national master programme in mathematics. For schedules, course locations and course descriptions see http://www.mastermath.nl. Registration required via http://www.mastermath.nl.

Doelgroep
mMath

Business Marketing

Vakcode	E_MKT_BM (61422130)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak
Business-to-business marketing (B2B) is highly important as about 70% of all turnover is made in business markets. Similarly, most students find employment is positions emphasizing business marketing. Examples of such positions include that of sales manager, consultant, business development manager, and most marketing manager functions.
This course is targeted at the issues, challenges, and trends that organizations face when operating in business markets. This course provides insight into structural and process issues by which

organizations cooperate or compete with other organizations. The course introduces the theoretical and managerial implications of such behavior for marketing. Furthermore, some consideration will be given to intra-organizational issues. The learning objectives involve the attainment of understanding of the concepts and theories used in business marketing through a selection of articles published in renowned academic journals. In addition, the course focus is on competence, i.e., the ability to effectively use and apply these concepts. The course will focus exclusively on business markets, and will address a wide variety of topics such as business relationships, outsourcing, (multi) channel marketing, negotiation, incentives, sales, and pricing. In addition, the course will introduce and discuss a number of recent developments in business marketing. One or two quest lectures are planned to relate the theories discussed to practice. Active participation of the students during discussions is required.

Inhoud vak

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Onderwijsvorm

Lectures and tutorials.

Toetsvorm

The course is assessed 100% on a written exam.

Vereiste voorkennis

Students should have basic knowledge of marketing, including:
- Bachelor Economie en bedrijfseconomie: Marketing 3. 1
- Bachelor Bedrijfskunde: Services Marketing
- Pre- Master students: Marketing (and Thesis)

Overige informatie

Caput Operation Research

Vakcode	E_EORM_COR ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. ir. R.A. Sitters
Docent(en)	dr. ir. R.A. Sitters, prof. dr. G. Schäfer
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak
In this course we will learn how to develop efficient algorithms for
solving fundamental optimization problems with applications in routing,
network design and scheduling. The objectives of the course are:
- get to know models to capture different types of optimization problems
(offline, online, distributed)
- learn basic and advanced techniques to solve such optimization
problems (primal-dual schema, randomized rounding, iterative rounding,
potential functions, local search, etc.)
- use these techniques to design efficient algorithms
- study the computational complexity of optimization problems

Inhoud vak
Topics that will (probably) be covered in the course are:
- Steiner network, facility location, scheduling problems, network
routing, congestion games, network design
- online algorithms, randomized algorithms, approximation algorithms,
local search algorithms
- computational complexity and hardness of approximation

Onderwijsvorm
Lectures and tutorials; take-home assignments will be discussed bi-
weekly

Toetsvorm
written exam

Literatuur
The material to be covered in class is based on the following books.
Book [1] will be used the most and is freely available for download (you
may consider buying it though)

[1] D.P. Williamson and D.B. Shmoys, The Design of Approximation
Algorithms, Cambridge University Press, 2011
[2] Kleinberg and E. Tardos, Algorithm Design, Addison Wesley, 2005.
[3] V. V. Vazirani, Approximation Algorithms, Springer, 1998
[4] N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani (Editors),
Algorithmic Game Theory, Cambridge University Press, 2007
[5] C. H. Papadimitriou and K. Steiglitz, Combinatorial Optimization;
Algorithms and Complexity, Prentice-Hall, 1982.

Vereiste voorkennis
none

Aanbevolen voorkennis

Basic knowledge on algorithms, computational complexity and combinatorial optimization is advantageous (see, e.g., material covered in the bachelor course Combinatorial Optimization and Appendix A+B of book [1] .

Case Study

Vakcode	E_EORM_CASE (64422000)
Periode	Periode 3
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	prof. dr. S.J. Koopman
Docent(en)	prof. dr. G.T. Timmer, prof. dr. S.J. Koopman, prof. dr. ir. G. van der Laan, dr. L.F. Hoogerheide
Lesmethode(n)	Practicum
Niveau	400

Doel vak
Practicing methods of econometrics and operational research using real-life case studies.

Inhoud vak
Students can opt for three variants of this course:
- Financial Econometrics, period 3, Koopman: This part focuses on the measurement and modelling of volatility in time series of financial returns. An introduction will be given of generalised autoregressive conditional heteroskedasticity (GARCH) models for the forecasting of volatility in daily (or lower frequency) financial returns. The Stochastic Volatility (SV) model is considered as an alternative approach that is more closely related to financial theory for option pricing. The merits of both models will be investigated empirically using up-to-date financial time series. The final aim is to use the models for forecasting volatility and pricing options and other financial derivatives. Case-work is done in small groups and when a sufficiently large number of groups can be formed, a volatility forecast competition will be part of the course.

- Applied Optimization, period 3, Gromicho: Participants who chose this variant will be trained in the design and implementation of advanced optimization algorithms which make use of proven optimization technology such as (integer) linear programming solvers. Examples include the generation of valid inequalities to strengthen formulations and lead to sophisticated branch and cut algorithms. After explaining how to implement such techniques in MatLab the participants will be asked to form small groups and focus on a specific hard problem with known benchmark instances and design and implement an exact algorithm for it. Their findings lead to a written essay.

- Allocation Problems, period 3, Van der Laan: In this variant participants will be trained in solving real-life problems allocating costs or benefits of joint projects. The training concerns the formulation of the problem in a manageable quantitative model, to evaluate the theoretical properties of available solutions and their computational complexity, to select appropriate and computational

tractable solutions, to develop a software tool for solving the problem, to carry out the required calculations and to report the results in an essay. Participants work on a real-life case in small groups of 2 or 3 students.

Standard lectures will guide the student through the computational aspects of statistical estimation, simulation and optimisation methods. To gain further insights in the practical detail, computer programs for the implementation of some computer-intensive methods will be developed.

Onderwijsvorm
lecture
working group

Toetsvorm
essay

Literatuur
Selection of articles and papers

Consumer Marketing

Vakcode	E_MKT_CM (61422120)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. R. Prins
Docent(en)	dr. R. Prins
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak
- Acquire knowledge of and insight into concepts and topics that are important to effective consumer marketing management (e. g., customer response to innovation, channel choice, co- creation, consumer decision making processes, and social influences).
- Being able to analyze current and potential applications of consumer behavior and consumer psychology theories for developing marketing strategies.

Inhoud vak
In the business world, the importance of what is known as 'customer focus' cannot be overstated. It is widely recognized as a key to success in the marketplace. This course provides insight into how consumers behave and discusses the theoretical and managerial implications of such behavior for firms. Specifically, the learning objectives involve the attainment of understanding of the concepts and theories of consumer marketing through selected articles. In addition, the course focuses on competence development, i. e., the ability to effectively use and apply these concepts in real- life situations. The course will focus exclusively on consumer markets and will address in greater depth a selection of consumer marketing concepts introduced in the Consumer Behavior course. In addition, the course will introduce a number of recent developments in consumer marketing.

Onderwijsvorm
Lectures and tutorials

Toetsvorm
written (interim) examination

Literatuur
Articles (will be made available on Blackboard)

Vereiste voorkennis
Third- year courses Marketing 3. 1, Marketing Research and Research
tutorial Marketing or equivalent.

Customer Intelligence

Vakcode	E_MKT_CI ()
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. L.J. Paas
Docent(en)	dr. L.J. Paas
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak
- Learn about the various practical customer intelligence questions that
managers may struggle with, e.g., product development questions,
prospect selection questions and customer segmentation questions
- Learn to work with different types of customer intelligence data, such
as customer survey data, transactional data and data resulting from
experiments, for solving the salient customer intelligence questions
firms may have
- Obtain rigorous knowledge of the most important multivariate data
analysis and data mining techniques used for answering customer
intelligence questions
- Applying multivariate data analysis and data mining techniques in SPSS
and interpreting the output of such applications in terms of customer
intelligence questions
- Develop the ability to select the correct data analysis or data mining
technique for a practical customer intelligence problem

Inhoud vak
In this post information-revolution era firms have gathered terabytes of
information about consumers and their customers. The plethora of
information stems from multiple sources, such as consumer and customer
surveys, client-lab experiments and transaction databases. This course
presents state-of-the-art techniques and approaches for transposing the
abundant data into actionable information for marketing managers and
other top-level decision makers. To attain these goals one requires a
sound knowledge of customer intelligence research and data analysis
techniques.
This course offers students thorough insight in the most important
customer intelligence questions, data and data analysis techniques. It

also teaches them how to pursue the analyses in the statistical software package SPSS. Thereby, the course forms a preparation for the empirical research to be conducted for the Master's thesis.

During the lectures at least the following data types will be discussed: survey data, data resulting from experiments on customers and consumers and transactional (data mining) data. The following techniques for analyzing such diverse sources of data will also be discussed: factor analysis, scale construction, linear regression analysis, conjoint analysis, logistic regression, MANOVA and cluster analysis. The discussions concentrates on customer intelligence applications of the techniques instead of technical details. Various practical customer intelligence research examples will illustrate this application. During the tutorials, students will exercise the application of the techniques in SPSS and the interpretation of output, based on real-life customer intelligence data sets.

Toetsvorm
Written interim examination that includes an SPSS assignment: 100 percent

Aanbevolen voorkennis
Knowledge of SPSS and basic statistics

Data Mining Techniques

Vakcode	X_400108 (400108)
Periode	Periode 5
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. M. Hoogendoorn
Docent(en)	dr. M. Hoogendoorn
Lesmethode(n)	Hoorcollege
Niveau	500

Doel vak
The aim of the course is that students acquire data mining knowledge and skills that they can apply in a business environment. How the aims are to be achieved: Students will acquire knowledge and skills mainly through the following: an overview of the most common data mining algorithms and techniques (in lectures), a survey of typical and interesting data mining applications, and practical assignments to gain "hands on" experience. The application of skills in a business environment will be simulated through various assignments of the course.

Inhoud vak
The course will provide a survey of basic data mining techniques and their applications for solving real life problems. After a general introduction to Data Mining we will discuss some "classical" algorithms like Naive Bayes, Decision Trees, Association Rules, etc., and some recently discovered methods such as boosting, Support Vector Machines, and co-learning. A number of successful applications of data mining will also be discussed: marketing, fraud detection, text and Web mining, possibly bioinformatics. In addition to lectures, there will be an

extensive practical part, where students will experiment with various data mining algorithms and data sets. The grade for the course will be based on these practical assignments (i.e., there will be no final examination).

Onderwijsvorm
Lectures and compulsory practical work. Lectures are planned to be interactive: there will be small questions, one-minute discussions, etc.

Toetsvorm
Practical assignments (i.e. there is no exam). There will be three assignments mostly done in groups of three. There is a possibility to get a grade without doing
these assignments: to do a real research project instead (which will most likely to involve more work, but it can also be more rewarding).

Literatuur
Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques (Third Edition). Morgan Kaufmann, January 2011
ISBN 978-0-12-374856-0

Aanbevolen voorkennis
Kansrekening en Statistiek of Algemene Statistiek (knowledge of statistics and probabilities) or equivalent. Recommended: Machine Learning.

Doelgroep
mBA, mCS, mAI, mBio

Derivatives

Vakcode	E_FIN_DER (60442060)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. N.J. Seeger
Docent(en)	dr. N.J. Seeger
Lesmethode(n)	Hoorcollege, Werkgroep
Niveau	400

Doel vak
The primary objective of this course is to provide students with an advanced introduction to derivative instruments. By the end of the course students should have a sound understanding of the pricing concepts, practical applicability, operational complexity, and risks of several linear and non-linear derivatives.

Inhoud vak
In todays financial world, the role of derivatives gets increasingly important. Banks and pension funds use derivatives to manage their balance sheet risk, corporate treasuries need derivatives for mitigation of international trade risk, insurance companies actively apply derivatives strategically in order to hedge long term interest rate

exposures. Worldwide derivatives trading has exploded to unprecedented levels in the last decades. Therefore, a sound understanding of derivatives is indispensable for anyone pursuing a job in finance.

The course aims to help students in developing a general understanding of the fundamental principles related to derivative instruments. When we try to understand derivative instruments we will ask questions like:

1. How do derivative instruments work?
2. Is it possible to decompose derivatives in basic assets?
3. How to determine the fair value of derivative instruments?
4. What are the risks of using derivative instruments?
5. How are derivative instruments applied in practice and are there any relevant operational issues in the real world?

Hence, the course focuses on facilitating conceptual understanding of derivative instruments and of the methods that are needed to apply derivatives in different settings of finance applications; whether it is for trading purposes, structuring products, risk management, etc.

The field of derivatives is one of the most mathematically sophisticated in finance. Therefore, to understand derivatives it is inevitable to deal with mathematical methods. However, we want to emphasize that in the course mathematical methods are primarily used as tools to understand derivatives. We intend to serve a balanced mix of theory, intuition and practical aspects.

The course will treat the following subjects:

- Why derivatives?
- Forwards, futures and options
- Pricing concepts of derivative instruments
- Discrete and continuous time option pricing models
- Understanding Black-Scholes formula
- Beyond Black-Scholes (stochastic volatility and jumps)
- Hedging strategies
- Estimating model parameters
- Credit derivatives / Financial Crisis

Onderwijsvorm
The course spans a period of six weeks. There will be 12 lecture sessions of 2 x 45 minutes each (for dates and times see course schedule), in which the course material is presented. Based on demand there is the possibility of having two more tutorial sessions, each 2 x 45 minutes, in which assignment solutions and open questions can be discussed. Students can hand in two assignments. The assignments make up for 30 percent of the total result. The remaining 70 percent can be achieved via the written final exam. In case of failing the final exam, the assignment grades are not transferable to a future attendance of the course.

Toetsvorm
1. Written exam: 70 percent
2. Assignments: 30 percent

The final grade of the course is the grade of the written exam if this grade is less or equal to 5.0. Otherwise, it is 70% of the written exam grade + 30% of the assignment grades.

The assignments will be a mixture of word problems, which are in style and structure similar to the questions that will be asked in the final exam, and programming problems that are preferably implemented in VBA.

Literatuur
- John Hull: Options, Futures and other Derivatives, 8th Edition, 2011
- Lecture slides

Further References:
- Das, R.K. and S.R. Sundaram: Dervatives: Principles and Practice, McGRAW-Hill International Edition, 2010
- Jarrow, R. and A. Chatterjea: An Introduction to Derivative Securities, Financial Markets, and Risk Management, W. W. Norton & Company, 2013
- Baxter/Rennie: Financial Calculus, Cambridge, 1996. - Neftci: Principles of Financial Engineering, Elsevier, 2nd edition, 2008.
- Bingham/Kiesel: Risk-Neutral Valuation: Pricing and Hedging of Financial Derivatives, Springer, 2004.
- Björk, T.: Arbitrage Theory in Continuous Time, Oxford University Press, 2004.

Vereiste voorkennis
Students entering this course should be familiar with the basic corporate finance principles and techniques (e. g. Berk/DeMarzo, Corporate Finance. 2013) and investment management concepts (e. g. Bodie, Investments. 2010). In order to follow the course material right from the start it is recommended to review the derivatives material that has been covered in the courses: Financiering 2.5 and Investments 3.4. For solving the assignments, programming experience with Excel/VBA is required. A very good introduction to Excel/VBA can be found on the homepage http://xlvu.weebly.com; provided by Dr. Arjen Siegmann.

Distribution Logistics and Supply Chain Management

Vakcode	E_BA_DLSCM (61412300)
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	prof. dr. ir. S.L.J.M. de Leeuw
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak
So far, the Bachelor courses have predominantly focused on decision problems within the context of an individual company. During the Master TSCM courses, this context will be expanded to encompass multiple companies. The central theme is cooperation between shippers, customers and logistics service providers. The objective of this course is to introduce students to the topic of demand & supply chain management and to discuss relevant concepts to matching supply and demand in these chains.

Inhoud vak

We will focus on demand driven Supply Chain Management. After an introduction to the concepts of SCM, we will discuss the design and implementation of SCM concepts taking into account the flow of information, money and materials across the supply chain. More specifically we will discuss:
- Logistics network planning
- Inventory management and forecasting
- Supply contracts for strategic as well as commodity components
- The value of information and the effective use of information in the supply chain
- Supply chain integration
- Centralized and decentralized distribution strategies
- Strategic alliances
- Outsourcing, off-shoring, and procurement strategies
- International supply chain management
- Supply chain management and product design
- Customer value
- Revenue management and pricing strategies.

Onderwijsvorm
Lectures and assignments. In small groups, the students will work on an assignment for a specific supply chain. Separate assignment meetings will be scheduled. Additional relevant theory and literature has to be searched for by the groups.

Toetsvorm
written interim examination (60 percent) assignment (40 percent)

Literatuur
- Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E. (2008). Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies (3rd ed). Irwin: McGraw-Hill.
- Electronic reader (blackboard)

Vereiste voorkennis
All non-TSCM Master students (including all exchange students) are required to contact the course coordinator before enrolling; permission from the course coordinator is obligatory to participate in this course.

Aanbevolen voorkennis
Pre-master TSCM or bachelor with specialization TSCM

Environmental Economics

Vakcode	E_STR_EEC (60442040)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. S. Poelhekke
Docent(en)	dr. G.C. van der Meijden, dr. S. Poelhekke
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak
The aim of this course is to provide students with key insights
regarding the nature of environmental problems and how environmental
policy should be designed. This course consists of two parts. The first
part comprises lectures by the teacher based on journal articles and on
five chapters of an advanced textbook (Perman et al., 2011). The second
part is devoted to group discussions based on readings of classical
articles, which are presented by the students. Moreover, there will be
two homework assignments, which will be discussed in class.

The lectures offer a treatment of modern economic theories and methods
to study the relationship between natural resources, environmental
quality, economic structure, and environmental policy. The student is
expected to develop a thorough understanding of key economic,
environmental and ethical aspects of environmental problems, and of the
link between theory, methods and empirical analysis. The goal of the
homework assignments is to practice working with economic models to
analyze some important mechanisms in the field of environmental
economics. The presentation/discussion sessions are intended to improve
the participants' economic reasoning and communication skills.

After following this course, you:
- have a profound understanding of the fundamental factors why
environmental problems materialize (positive and negative
externalities);
- have a profound understanding about the strengths and weaknesses
of the various environmental policy instruments (taxes, quotas,
voluntary agreements);
- have a good understanding about the linkages between production
technology, natural resources, and sustainability;
- are able to work with simple economic models to analyze the dependence
between natural resource and the economy, and to study the effects of
environmental policy;
- have a good understanding of the economic challenges faced by
resource-rich economies;
- have sharpened your economic reasoning and intuition, and have
improved your presentation skills.

Inhoud vak
The following topics will be dealt with in the lectures:
- biological and physical aspects of environmental processes and
problems;
- the economics of non-renewable and renewable resources;
-advanced topics in the economics of resource-rich economies;
- advanced topics in environmental policy theory (including instrument
choice and the so-called 'Green Paradox');
- advanced theory and methods of monetary valuation of environmental
change;
- models for the analysis of environmental policy and natural resource
use.

The topics for the group discussions and student presentations can be
chosen by the participants. A list of key journal articles is available
for a broad range of topics, but if students wish to present on a topic
that is not on the list, that is possible too.

Onderwijsvorm
Lectures, assignments, student presentations, and group discussions.

Toetsvorm

Written exam (60%), presentation (20%), two assignments (10%), and class participation (10%) conditional on the exam grade being 5.0 or higher

Literatuur

- Chapters 5-7, 11-12, 14-15 and 17 from Perman, P., Y. Ma, M. Common, D. Maddison, and J. McGilvray (2011), Natural Resource and Environmental Economics. Addison Wesley, Longman Ltd, 4th edition.
- Additional articles from the economics literature (available via BlackBoard)

Aanbevolen voorkennis

A thorough understanding of microeconomics.

Evolutionary Computing

Vakcode	X_400111 (400111)
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. A.E. Eiben
Docent(en)	prof. dr. A.E. Eiben
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

To learn about computational methods based on Darwinian principles of evolution. To illustrate the usage of such methods as problem solvers and as simulation, respectively modelling tools.To gain hands-on experience in performing experiments.

Inhoud vak

The course is treating various algorithms based on the Darwinian evolution theory. Driven by natural selection (survival of the fittest), an evolution process is being emulated and solutions for a given problem are being "bred". During this course all "dialects" within evolutionary computing are treated (genetic algorithms, evolutiestrategieën, evolutionary programming, genetic programming, and classifier systems). Applications in optimisation, constraint handling and machine learning are discussed. Specific subjects handled include: various genetic structures (representations), selection techniques, sexual and asexual genetic operators, (self-)adaptivity. If time permits, subjects in Artificial Life and Evolutionary Robotics will be handled. Hands-on-experience is gained by a compulsory programming assignment.

Onderwijsvorm

Oral lectures and compulsory pogramming assignment.

Toetsvorm

Written exam and pogramming assignment (weighted average).

Literatuur
Eiben, A.E., Smith, J.E., Introduction to Evolutionary Computing.
Springer, 2003 ISBN 3-540-40184-9.
Slides available from http://www.cs.vu.nl/~gusz/ecbook/ecbook.html .

Doelgroep
mBA, mAI, mCS, mPDCS

Financial Markets and Institutions

Vakcode	E_FIN_FMI (60442080)
Periode	Periode 4
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	prof. dr. A.F.P. Bakker
Docent(en)	prof. dr. A.F.P. Bakker
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak
Well-functioning financial markets and sound and stable financial
institutions are key to the well-being of the economy. However, recent
episodes of financial crisis have shown that this cannot be taken for
granted. Proper risk management and adequate regulation and supervision
are necessary for maintaining financial stability. International
coordination is needed because of the linkages between global financial
markets.

After the course you should be able to apply theoretical and analytical
concepts to topical financial market issues. You should be able to
formulate recommendations for financial institutions and regulators,
such as: how financial institutions and policymakers should cope with
systemic risk; how central bankers should maintain monetary and
financial stability; how international institutions as the IMF can help
prevent and resolve financial crises; the role of credit rating agencies
and hedge funds in financial markets.

Inhoud vak
The course takes as a starting point the financial crisis of 2008, which
unlike most earlier financial crises originated in advanced countries
and had a global impact. There is not a single factor that caused the
crisis and we can learn from the many failings in the financial system
that became apparent. We then turn to the European sovereign debt crisis
and the challenges this poses for financial and monetary stability.

We analyze how lessons learned are turned into strengthened regulation,
such as Basel III and Solvency II, and discuss whether this will lead to
changed behavior of market participants. We learn how macroprudential
supervision tries to deal with systemic risk. We will examine proposals
to improve the risk management of banks. We will also deal with non-bank
financial institutions such as hedge funds, private equity and
institutional investors. A special course is devoted to the issues which
pension systems face, including increased longevity, historically low
interest rates, disappointing investment results and fiscal problems. We

will finish the course with a discussion of the characteristics of a
more sustainable and robust financial landscape.

Each course will start off with a discussion of topical issues in the
financial press.

Onderwijsvorm
Lectures. Students will be required to follow the financial press during
the course and prepare the lectures by studying the literature in
advance.

Toetsvorm
Written examination with 15 open questions. You also have to write, in
small groups, a paper on an assigned subject. The paper will be judged
and a fail or pass grade will be awarded. The pass grade implies a bonus
of 1 point to the examination result.

Literatuur
Required reading material consists of a textbook, articles and slides of
the lecture. Textbook: Jakob de Haan, Sander Oosterloo and Dirk
Schoenmaker, Financial Markets and Institutions, A European Perspective,
2nd edition, Cambridge University Press, 2012

Vereiste voorkennis
Students should have followed a bachelor course in Money and Banking

Aanbevolen voorkennis
The following book indicates the level of knowledge which is required:
F.S. Mishkin, The Economics of Money, Banking and Financial Markets, 7th
Edition, Addison Wesley.

Firm Behavior and Market Structures

Vakcode	E_EC_FBMS (60422020)
Periode	Periode 4
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. E.I. Motchenkova
Docent(en)	dr. E.I. Motchenkova
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak
This course is designed to give students an overview of the mainstream
theory of Industrial Organization.

After following this course, students
- can define and recognize main types and determinants of market
structure
- can name and explain the determinants of the actions taken by
firms and are able to explain the relationships between firms' actions
and market outcomes
- are able to apply mathematics, game theory, welfare analysis and
micro-economic tools to analyze the problem of collusion, entry and exit

decisions, vertical control, product differentiation, and adoption of
new technologies issues
- can describe and analyze (both analytically and graphically) the main
models used for analysis of strategic behavior of firms under asymmetric
information
- are able to determine optimal firm and regulator behavior conditional
on the type of market structure and nature of competition in the market
and draw policy conclusions

Inhoud vak
Many markets of interest are dominated by only few firms. These firms
not only choose their prices and outputs, but also the quality and
design of their products, engage in advertising campaigns and make
investments in R&D. They also decide on whether to enter or exit
markets, whether to merge, vertically integrate, or to collude with
rival firms. These choices have strong effects on the markets, in which
firms operate, and may also have wider repercussions throughout the
economy. This course presents an approach - based on strategic decision
making - for understanding the functioning of such markets. We also use
this approach to clarify the role of the government in regulating
economic activity.

This course is designed to give students an overview of the mainstream
theory of Industrial Organization, to provide students with insights in
the organization of markets, and to give an overview of the main
analytical tools used for analysis of imperfectly competitive markets.
The course is primarily theoretical. At the same time, a number of
empirical and experimental results will be discussed.

Part 1 of the course concerns non-strategic industrial organization and
consists of the theory of the firm, analysis of monopoly power, price
discrimination and vertical integration. Part 2 studies strategic
industrial organization. The topics are static oligopoly models, dynamic
price competition, spatial competition and advertising,
incumbent/entrant behavior, R&D and adoption of new technologies. Also
substantial attention will be devoted to applications of the IO tools
for analysis of antitrust policy. There we will focus on European and US
competition law, collusion, abuse of dominant position, and mergers.

Onderwijsvorm
Lectures and Workshops

Toetsvorm
written interim examination - 80 percent of the final grade
problem sets and seminar presentations - 20 percent of the final grade

Literatuur
Tirole, J. (1988), The Theory of Industrial Organization. MIT Press.
Motta, M. (2004), Competition Policy: Theory and Practice, Cambridge
University Press.
Reader with articles provided on Black Board

Vereiste voorkennis
Microeconomics course

Aanbevolen voorkennis
Bachelor level courses in Industrial Organization

Globalization, Growth and Development

Vakcode	E_EC_GGD (60442050)
Periode	Periode 4
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	prof. dr. C.T.M. Elbers
Docent(en)	prof. dr. C.T.M. Elbers
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

Aim of the course is to study aspects of globalization, growth and development that are fruitfully studied from the perspective of the economics discipline. After following the course the student will

- know the basic facts concerning the topics discussed in the course
- have a thorough understanding of these topics, in particular their economic dimension
- have learnt various empirical research techniques that can be applied within this field of economics
- be able to present and discuss current journal articles and book chapters on globalization

Inhoud vak

Globalization poses both challenges and offers opportunities to rich and poor countries. The course focuses on a number of themes that have been central in the academic and public discussion of recent trends in the world economy. Among them are:

- Relationship between growth, trade and poverty
- Trends in inequality within and between countries
- Intellectual property rights
- Environmental and labour standards
- Volatility of terms- of- trade
- Financial stability

More topics in globalization are introduced in the course in the form of student presentations. The course stresses the importance of empirical research and devotes significant time to the empirical strategies that have been used by researchers in studying globalization.

Onderwijsvorm

lecture
lectures, student presentations and discussions.

Literatuur

Selected articles

Vereiste voorkennis

Advanced Macroeconomics 4.2 and International Economics 3.2

Institutional Investments and ALM for Finance

Vakcode	E_FIN_IIALMF ()
Periode	Periode 4

Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. M. Boes
Docent(en)	prof. dr. C.G.E. Boender, dr. M. Boes
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

This course has a dual objective.

First, students should achieve advanced knowledge of the investment
process of institutional investors, like pension funds, and the concept
of balance sheet management (Asset
Liability Management).

Second, students should acquire a thorough knowledge of the developments
in fixed income space, in particular the recent advances in the pricing
of fixed income derivatives instruments like swaps and swaptions.

The course not only develops the theoretical background, but also
discusses the way these concepts are used in practice.

After following the course, you:

- Have a thorough understanding of the theory of strategic dynamic asset
allocation (SAA) and Asset Liability Management (ALM) and its
implementation by institutional investors.

- Have a thorough understanding of basic fixed income derivatives such
as (inflation) swaps and swaptions and their strategic use by
institutional investors.

- Have an overview of the practical implementation of ALM studies in the
financial industry.

- Have an up-to-date knowledge of the recent developments in
regulations.

- Have a sound understanding on how linear and non-linear derivatives
can be used by pension funds in their balance sheet management.

- Have knowledge on how pension funds decide on issues like currency
hedging and benchmark choice for investment portfolios.

Inhoud vak

The first week gives a broad introduction to pension funds.
Specifically, the course starts with an overview of the Dutch pension
system, the basic definition, and the regulatory framework (including
UFR). In addition to that the investment problem of a pension fund is
explained and subsequently linked to the investment decision problems
that were treated in earlier courses.

In weeks 2 and 3 we will focus on fixed income derivatives. The
approach taken won't be purely theoretical as the practical usage of
these derivatives will be shown by means of a real-life investment

portfolio of a large Dutch pension fund.

In weeks 4 and 5 the ideas and theories treated so far are translated
into practical balance sheet management of pension funds. We won't focus
solely on fixed income but will also look at the practical consequences
of strategic choices on equity investing and currency hedging.
We intend to finish the course in the sixth week by a guest lecture and
by some exam preparation.

Onderwijsvorm
Lectures (2 times 2 hours per week); plus cases and assignments.

Toetsvorm
Written exam and two cases.

Literatuur
- Zvi Bodie, Alex Kane and Alan J. Marcus: Investments and Portfolio
Management, McGraw Hill (9th edition)
- Additional course material (academic papers, etc.) will be provided on
Blackboard

Overige informatie
The course brings students up to date with the recent developments in
the field of fixed income derivatives and institutional investing. To do
so efficiently, the course builds on earlier courses.

In particular for the fixed income derivatives part, the course presumes
students are familiar with the material from the course Derivatives
(period 2), including the programming assignments of that course.

Students should also master basic Asset Pricing (period 1) theory, and
simple time series models such as the vector autoregression (VAR, e.g.,
Empirical Finance in period 2).

Labour Economics

Vakcode	E_EC_LABEC (60422030)
Periode	Periode 4
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. A.P. van Vuuren
Docent(en)	dr. A.P. van Vuuren
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak
This course provides an analysis of recent theories in labour economics
that focus on labour supply, involuntary unemployment, wage
determination, and (private) investments in education. In addition, the
course focuses on the impact of government policy such as unemployment
benefits and the tax system. The course enables students to get well
acquainted with the recent scientific literature on the functioning of
the labour market as well as with the empirical policy oriented
literature.

By the end of the course the student will

- be able to understand the recent developments in human capital
theory, search theory and the economics of discrimination.
- be able to understand the technical difficulties related to the
estimation of the returns to education, the impact of active labour
market programs, the determinants of the reservation wage and the level
of as well a the causes for discrimination.
- understand why individuals invest in education and why a large part
of government spending is related to education. In addition the student
will understand why the education levels in the United States are in
general higher, while the costs of education are higher as well.
- understand the impact of policy instruments on the search behaviour
of individuals.
- be able to do individual empirical analysis and write a report on the
topics of human capital theory, search theory and the economics of
discrimination.

Inhoud vak
This course is subdivided into three topics: (1) human capital theory,
(2) search theory, and (3) the economics of discrimination.

The first topic analyses the individual decision making of education as
well as the impact of education on society. The empirical analysis
looks at the returns to education. The final part of this topic deals
with active labour market programs.

The second topic looks at the recent developments in search theory. A
basic model is constructed and with this model the impact of on- the-
job search as well as sanctions is analyzed. The topic ends with the
empirical analysis of the determinants of the reservation wage.

The final topic looks at the causes for discrimination and a
theoretical model is built to understand their impact. The empirical
analysis looks at the Oaxaca- Blinder decomposition method and the
impact of selection is discussed.

Onderwijsvorm
lecture

Toetsvorm
written interim examination
75 percent
interim (written report on empirical study)
25 percent

Literatuur
To be determined.

Mathematical Systems and Control Theory

Vakcode	X_400180 (400180)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen

Coördinator	prof. dr. A.C.M. Ran
Docent(en)	prof. dr. A.C.M. Ran
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak
The course aims to introduce the student to the mathematical theory of
control systems.

Inhoud vak
Many phenomena are characterized by dynamic behaviour where we are
interested in a certain input/output behaviour. Examples are to be found
in the exact and natural sciences (mechanics, biology, ecology), in
engineering (air- and spacecraft design, mechanical engineering) as well
as in economics and econometrics (macro- economical models, conjucture,
trend and seasonal influences in demand and supply, production systems).
Systems theory is concerned with modeling, estimation and control of
dynamical phenomena. During the course the following subjects will be
treated: models and representations (linear systems, input-output,
state space, transfer function, stochastic systems, spectrum), control
(stabilisation, feedback, pole placement, dynamic programming, the LQ
problem), and identification and prediction (parameter estimation,
spectral analysis, Kalman- filter, model reduction). Applications are in
the area of optimal control and prediction.

Onderwijsvorm
There is a lecture of two hours each week. In addition, there is another
session which will be half lecture and half practicum, in which there is
the possibility to ask questions about the compulsary computerpracticum.
The practicum makes use of the Matlab package.

Toetsvorm
The computerpracticum counts for 70 %, the oral examination concerns the
theory and counts for 30 %.

Literatuur
Chr. Heij, A.C.M. Ran and F. van Schagen, Introduction to Mathematical
Systems Theory, Birkhauser Verlag.

Aanbevolen voorkennis
Analysis, probability theory, statistics.
Complex analysis and Fourier theory would be useful, but are not
absolutely necessary.

Doelgroep
3W, mBA, mMath

Neurale Netwerken

Vakcode	X_400132 (400132)
Periode	Periode 1
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. M. Hoogendoorn

Examinator	dr. M. Hoogendoorn
Docent(en)	dr. M. Hoogendoorn
Lesmethode(n)	Hoorcollege, Practicum
Niveau	500

Doel vak

The course provides an introduction to key concepts and algorithms for
pattern recognition and neural networks. It strives towards providing
insight both from a theoretical perspective as well as more practical
settings. In the end, the student should be able to confidently apply
the aforementioned techniques in real-life settings and understand their
theoretical basis.

Inhoud vak

The course provides an introduction to key concepts and algorithms for
pattern recognition and neural networks. It covers the following topics:

- classification, regression, and clustering problems,
- elements of statistical pattern recognition,
- methods for estimation of probability distributions,
- linear classifiers, including Support Vector Machines,
- single-layer and multi-layer networks,
- RBF-networks and kernel methods
- methods for dimensionality reduction
- methods for feature extraction and selection

Moreover, several real-life applications of pattern recognition,
including recognition of speech, handwritten characters, images, etc.,
will be discussed in depth.

Onderwijsvorm

Lectures and compulsory programming assignments.

Toetsvorm

Programming assignments and written examination (weighted average).

Literatuur

Simon Haykin, Neural Networks and Learning Machines, Pearson Education,
3rd international edition, 2008

Doelgroep

mAI mBio, mBA, mCS

Overige informatie

More information will be available via Blackboard.

Regional and Urban Economics

Vakcode	E_STR_RUE (60442140)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	prof. dr. H.L.F. de Groot
Examinator	prof. dr. H.L.F. de Groot

Docent(en)	prof. dr. H.L.F. de Groot, prof. dr. J. Rouwendal
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The aim of this course is to provide students with an advanced
introduction in the field of regional and urban economics. Students
learn the theoretical and empirical methods applied in the field, and
get a good understanding of the fundamental questions that are addressed
in the field and the current state of affairs in the literature. They
are trained to critically read and properly understand contributions in
the leading journals in the field. At a more specific level, after
having taken this course, students have a good understanding of the New
Economic Geography Model, are familiar with the theoretical foundations
of agglomeration economies and their empirical evidence, understand the
theoretical foundations of and can apply spatial interaction modelling,
are familiar with regional growth theories, understand the function of
regional labour and housing markets, and have a good understanding of
the determinants of urban structures.

Inhoud vak

This course covers advanced topics in theoretical and empirical research
on regional and urban economics. Key issues are location and potential
reasons for clustering of economic activity, spatial interaction
(migration, trade, FDI and commuting), patterns of regional economic
convergence and divergence, the role of geographic factors in explaining
regional economic growth performance, the impact of (spatial)
externalities of knowledge production, urban size and growth, urban land
use, housing markets and the functioning of regional labour markets. The
topics are addressed from a theoretical as well as an empirical
perspective.

Onderwijsvorm

lecture
tutorial

Literatuur

Steven Brakman, Harry Garretsen and Charles van Marrewijk (2009): The
New Introduction to Geographical Economics, Cambridge University Press,
Cambridge, MA (second edition)

Simulation and Stochastic Systems

Vakcode	E_EORM_SSS (64412010)
Periode	Periode 4
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. A.A.N. Ridder
Docent(en)	dr. A.A.N. Ridder
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The objective of this course is to learn how to develop and execute a simulation study of a stochastic system. This incorporates all aspects of an operations research study: data collecting, modeling, analyzing, programming, writing a report and presenting the results.

Inhoud vak

The course gives a broad treatment of the important aspects of stochastic simulation and its applications to queuing, manufacturing and financial models. The topics covered include discrete-event simulation, random number generators, generating random variates, statistical output analysis, steady-state simulation, variance reduction techniques, rare-event simulation, Markov chain Monte Carlo, and stochastic optimization. The emphasis is on the mathematical analysis of properties of these simulation methods. There will be assignments in which the students apply simulation issues to problems either by theoretical analysis, or by programming. The simulation programs are written in C, C++, Java or Matlab. Towards the end of the course the student studies a scientific paper on a simulation topic and gives a presentation of it.

Onderwijsvorm

lecture and tutorial

Toetsvorm

1. homework problems
2. Paper presentation
3. Written exam

Literatuur

R.Y. Rubinstein and D.P. Kroese. Simulation and the Monte Carlo Method, second edition, Wiley 2008.

Vereiste voorkennis

Probability and Statistics, Stochastic models, Programming experience.

Aanbevolen voorkennis

Probability and Statistics; Stochastic models; Programming skills

Stochastic Optimization

Vakcode	X_400336 (400336)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	dr. S. Bhulai
Docent(en)	dr. S. Bhulai
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The goal of the course is to discuss techniques from the field of stochastic optimization and their applications.

Inhoud vak

This course deals with the theory and algorithms for stochastic
optimization with an application to controlled stochastic systems (e.g.,
call center management, inventory control, optimal design of
communication networks). We discuss aspects of semi-Markov decision
theory and their applications in certain queueing systems. In a
programming assignment, students learn to implement optimization
algorithms and experiment with them. Experience with and insight into
the more theoretical subject is obtained through homework exercises.

Onderwijsvorm

Lectures.

Toetsvorm

Programming and written exercises, final examination.

Literatuur

Lecture notes will be posted on BlackBoard

Vereiste voorkennis

Stochastische Methoden (400391) or equivalent and a programming
language.

Aanbevolen voorkennis

Stochastische Processen (X_401026) and Wachtrijmodellen (X_401061) or
equivalent courses on Stochastic Processes en Queueing Theory and a
programming language.

Doelgroep

mBA, mBa-D, mMath, mSFM

Stochastic Processes for Finance

Vakcode	X_400352 (400352)
Periode	Periode 1+2
Credits	6.0
Voertaal	Engels
Faculteit	Faculteit der Exacte Wetenschappen
Coördinator	prof. dr. J. van den Berg
Docent(en)	prof. dr. J. van den Berg, dr. E.N. Belitser
Lesmethode(n)	Hoorcollege, Werkcollege
Niveau	400

Doel vak

Learn basics of stochastic processes in continuous time, including the
concepts of martingales and stochastic integration. Apply these concepts
to price options on stocks and interest rates by the no-arbitrage
principle.

Inhoud vak

Financial institutions trade in risk, and it is therefore essential to
measure and control such risks. Financial instruments such as options,
swaps, forwards, caps and floors, etc. play an important role in risk
management, and to handle them one needs to be able to price them. This

course gives an introduction to the mathematical tools and theory behind risk management.

A "stochastic process" is a collection of random variables, indexed by a set T. In financial applications the elements of T model time, and T is the set of natural numbers (discrete time), or an interval in the positive real line (continuous time). "Martingales" are processes whose increments over an interval in the future have zero expectation given knowledge of the past history of the process. They play an important role in financial calculus, because the price of an option (on a stock or an interest rate) can be expressed as an expectation under a so-called martingale measure. In this course we develop this theory in discrete and continuous time. Most models for financial processes in continuous time are based on a special Gaussian process, called Brownian motion. We discuss some properties of this process and introduce "stochastic integrals" with Brownian motion as the integrator. Financial processes can next be modeled as solutions to "stochastic differential equations". After developing these mathematical tools we turn to finance by applying the concepts and results to the pricing of derivative instruments and other matters. Foremost, we develop the theory of no-arbitrage pricing of derivatives, which are basic tools for risk management.

Onderwijsvorm
Lectures and exercises.

Toetsvorm
Homework assignments / written examination.

Literatuur
Shreve, S.E., Stochastic Calculus for Finance I: The Binomial Asset Pricing Model. Springer.

Shreve, S.E., Stochastic Calculus for Finance II: Continuous-time models. Springer.

In addition, it is useful to have the following book:
Bjork, T., Arbitrage Theory in Continuous Time, third edition. Oxford University Press.

Vereiste voorkennis
Introductory probability theory and statistics, calculus.

Aanbevolen voorkennis
Introductory probability theory and statistics, calculus.

Doelgroep
mBA, mBA-D, mMath, mSFM, master Econometrics, Quantitative Finance

Overige informatie
A significant part of the course is used to introduce mathematical subjects and techniques like Brownian motion, stochastic integration and Ito calculus. In view of this, the course is NOT meant for students who already followed the master course "Stochastic Integration". On the other hand, after following this course (Stochastic processes for finance), students may be motivated to follow the other one (Stochastic Integration) to study the above mentioned mathematical subjects in a deeper and more rigorous way.

Strategic and Cooperative Decision Making

Vakcode	E_EORM_SCDM (64422010)
Periode	Periode 2
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. J.R. van den Brink
Examinator	dr. J.R. van den Brink
Docent(en)	prof. dr. ir. G. van der Laan, dr. J.R. van den Brink, dr. I.D. Lindner
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak

The aim of this course is to learn and apply methods and techniques
from cooperative and noncooperative game theory to economic and
managerial problems. Students should be able to understand and to apply
results that recently appeared in the international journals.

Inhoud vak

In this course we study strategic and cooperative decision making in
situations where more than one party or agent is involved. In these
situations the outcome is the result of the individual decisions made
by the agents. In strategic decision theory we focus on the decisions
made by the agents, where each agent takes account of the fact that its
decision influences the outcome, and therefore the decision problem of
the other agents. Agents behave strategically if each agent tries to
behave in a way that is best for itself. In cooperative decision theory
we focus on the outcome (and not on the individual decisions), taking
into account the interests of all agents. We study different criteria
that an outcome can satisfy, such as efficiency or equity, and look how
to find a compromise between these criteria when they are conflicting.
The methods we use to analyse and solve these problems borrow from
(non- cooperative and cooperative) game theory, general equilibrium
theory and social choice theory. The topics come from the field of
economics and operations research and include: bargaining problems,
auctions, cost sharing and allocation problems, operations research
games, market games, assignment problems, profit distribution, voting
problems, score rules, location problems and networks.

Onderwijsvorm

lecture
working group

Toetsvorm

written interim examination
and presentations.

Literatuur

- Moulin, H., Fair Division and Collective Welfare. MIT Press, 2003.
- A reader including a selection of recent articles

Vereiste voorkennis

- Mathematical Economics 1
- Recommended: Mathematical Economics 2

Thesis

Vakcode	E_EORM_THS (64462000)
Periode	Ac. Jaar (september)
Credits	18.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. A.A.N. Ridder
Niveau	500

Time Series Econometrics

Vakcode	E_EORM_TSE (64432000)
Periode	Periode 4
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	prof. dr. S.J. Koopman
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak
To gain insights in economic time series modelling with a focus on
theory, methods and computations.

Inhoud vak
This course focuses on the advances of theory and computational methods
for time series econometrics. A methodology of econometric programming
is explored for a number of selected topics in time series analysis. In
particular, time series properties in time and frequency domains,
different modeling strategies, likelihood evaluations, filtering methods
and Monte Carlo simulation methods are studied. Theory and methods are
studied thoroughly while some computer programs need to be developed for
the implementation of the methods.

Onderwijsvorm
lecture
tutorial

Toetsvorm
written interim examination
50 percent
written assignments
50 percent

Literatuur
Selection of literature:
- Brockwell, P.J. & R.A. Davis, Time Series: Theory and Methods.
Springer-Verlag, 1991,2nd edition.
- Durbin, J. & S.J. Koopman, Time Series Analysis by State Space
Methods. Oxford University Press, 2001.

- Kim, C-J & C.R. Nelson, State-Space Models with Regime Switching. The MIT Press, 1999.

Transport Economics

Vakcode	E_STR_TREC (60432050)
Periode	Periode 4
Credits	6.0
Voertaal	Engels
Faculteit	Fac. der Economische Wet. en Bedrijfsk.
Coördinator	dr. A.J.H. Pels
Docent(en)	dr. A.J.H. Pels
Lesmethode(n)	Hoorcollege
Niveau	400

Doel vak
The aim of this course is to provide students with an advanced knowledge of contemporary transport economics, considering both intra-city transport (e.g. congested road traffic, urban transit) and inter-city transport (notably aviation). Students

- learn theoretical and empirical methods applied in the field of transport economics and in related fields, such as transport planning.
- get a good understanding of the fundamental policy questions that are addressed in the field, and the methods with which these are addressed.
- learn the current state of affairs in the literature.
are trained to critically read and properly understand contributions in the leading journals in the field.

Inhoud vak
This course covers advanced topics in theoretical and empirical research on urban transport economics. Key issues are demand analysis; cost functions and scale economies for various modes; congestion analysis in static and dynamic formulations; network equilibrium and optimum for deterministic and stochastic network models; first-best and second-best pricing in static and dynamic networks; investment analysis under first-best and second-best pricing; and industrial organization aspects of intra-city (e.g. roads and transit) and inter-city (e.g. airports and airlines) transport. The topics are addressed from a theoretical as well as an empirical perspective.

Toetsvorm
written interim examination: 70 percent
assignments: 30 percent (paper review tutorial 10 percent, network optimization tutorial 10 percent, methods tutorial 10 percent)

Literatuur
- Small, K.A. and E.T. Verhoef, The Economics of Urban Transportation. Routledge, 2007.
- Additional literature for more specialized topics will be announced at the start of the course.

Aanbevolen voorkennis
Microeconomics for spatial policy or a similar course