

2007/2008

## *Masters*

- *Mathematical Economics and Econometric Methods*
- *Operations Research and Management Science*
- *Quantitative Finance and Actuarial Sciences*

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*This brochure was prepared with great care, however, Tilburg University reserves the right to change without notice any programmes, policies, requirements or regulations published in this brochure.*

## Introduction

Do you have a solid background in mathematics and statistics and an interest in economics? Then Tilburg University could be the obvious choice for you.

The Faculty of Economics and Business Administration (FEB) of Tilburg University is renowned for its programmes in Econometrics and Operations Research, a unique combination of economics, mathematics and statistics. FEB offers three one-year Master of Science programmes in the field of quantitative economics: Mathematical Economics and Econometric Methods, Operations Research and Management Science and Quantitative Finance and Actuarial Sciences. These three flagship programmes are particularly suited for students who are keen on applying quantitative methods (mathematics and/or statistics) to economic problems. Additionally, there are two-year research master's programme in Economics and in Business offered by CentER, the Faculty's Graduate School.

In this brochure, you will find a detailed description of the three MSc programmes in econometrics. This brochure aims to set out what you need to know to make an informed decision about your graduate studies. To give you a more personal account of what our graduate programmes have to offer, we have also included statements from some of our professors.

Separate brochures of the other master's programmes of the Faculty of Economics and Business Administration are also available. For international students there is an additional brochure about application procedures and the services of the International Affairs Office. For additional copies of this or other brochures, please send an e-mail to [study-info@uvt.nl](mailto:study-info@uvt.nl).

We are looking forward to receiving your application for the next academic year and welcoming you to Tilburg University.



# Tilburg University



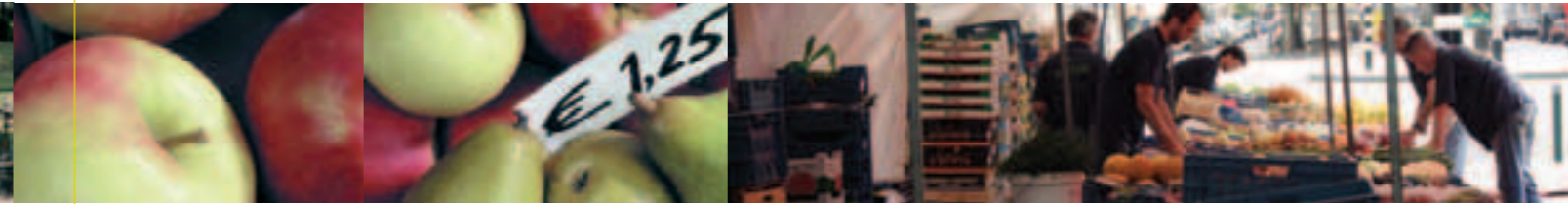
Tilburg University is an internationally oriented, fully accredited, top university in the Netherlands. It is well known for its high standards in education and scientific research as well as its excellent support facilities. In yearly rankings, Tilburg University has taken a leading position for many years now.

Since 1927, Tilburg University has expanded its horizons and has grown into a university with six faculties and an Executive Business School (TIAS, Executive MBA). Specialised in the Social Sciences and the Humanities, Tilburg University belongs to Europe's top in business, economics and law. Its 1,700 staff members provide liberal education for 11,000 students in the disciplines of Arts, Economics and Business Administration, Law, Philosophy, Social and Behavioural Sciences, and Theology.

All study programmes have achieved accreditation by the Dutch Flemish Validation Council (NVAO). The research programmes offered by CentER Graduate School (part of the Faculty of Economics and Business Administration) have also been accredited by the Royal Netherlands Academy of Arts and Sciences. Additionally, the business programmes have achieved accreditation by AACSB International. All represent hallmarks of excellence that make it possible for Tilburg University to compete not only with European Universities, but also with some of the best Universities in the world.

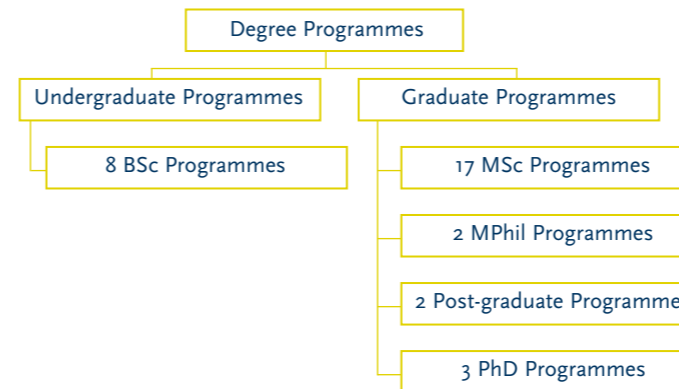
Tilburg University invites you to take part in a challenging student life in a truly international setting. The university has 180 partner universities on all five continents. You can enjoy interactive teaching in small groups, including case studies and teamwork. You will have access to all campus facilities such as wireless internet, a high-tech library, a language centre and internet cafes. The compact campus set-up offers you the opportunity to meet professors, researchers, lecturers and students of different backgrounds and nationalities.

## Faculty of Economics and Business Administration



The Faculty of Economics and Business Administration is Tilburg University's largest Faculty and the most prestigious one in the Netherlands. The Faculty enjoys high rankings for its excellent quality in education and research, for example, it is the current number one economics research institute in Europe and the number three business research institute. With about 500 staff members, the Faculty of Economics and Business Administration offers 32 undergraduate and graduate programmes in the fields of Economics and Business to approximately 5000 students. Education and research are provided by the Faculty's departments: Accountancy, Econometrics and Operations Research, Economics, Finance, Fiscal Economics, Information Systems and Management, Marketing, and Organization and Strategy.

The Master's programmes Mathematical Economics and Econometric Methods, Operations Research and Management Science and Quantitative Finance and Actuarial Sciences are offered by the department of Econometrics and Operations Research.

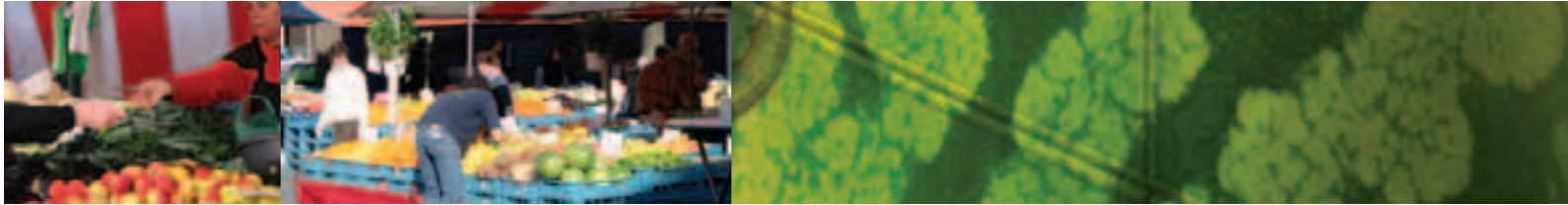


### Rankings

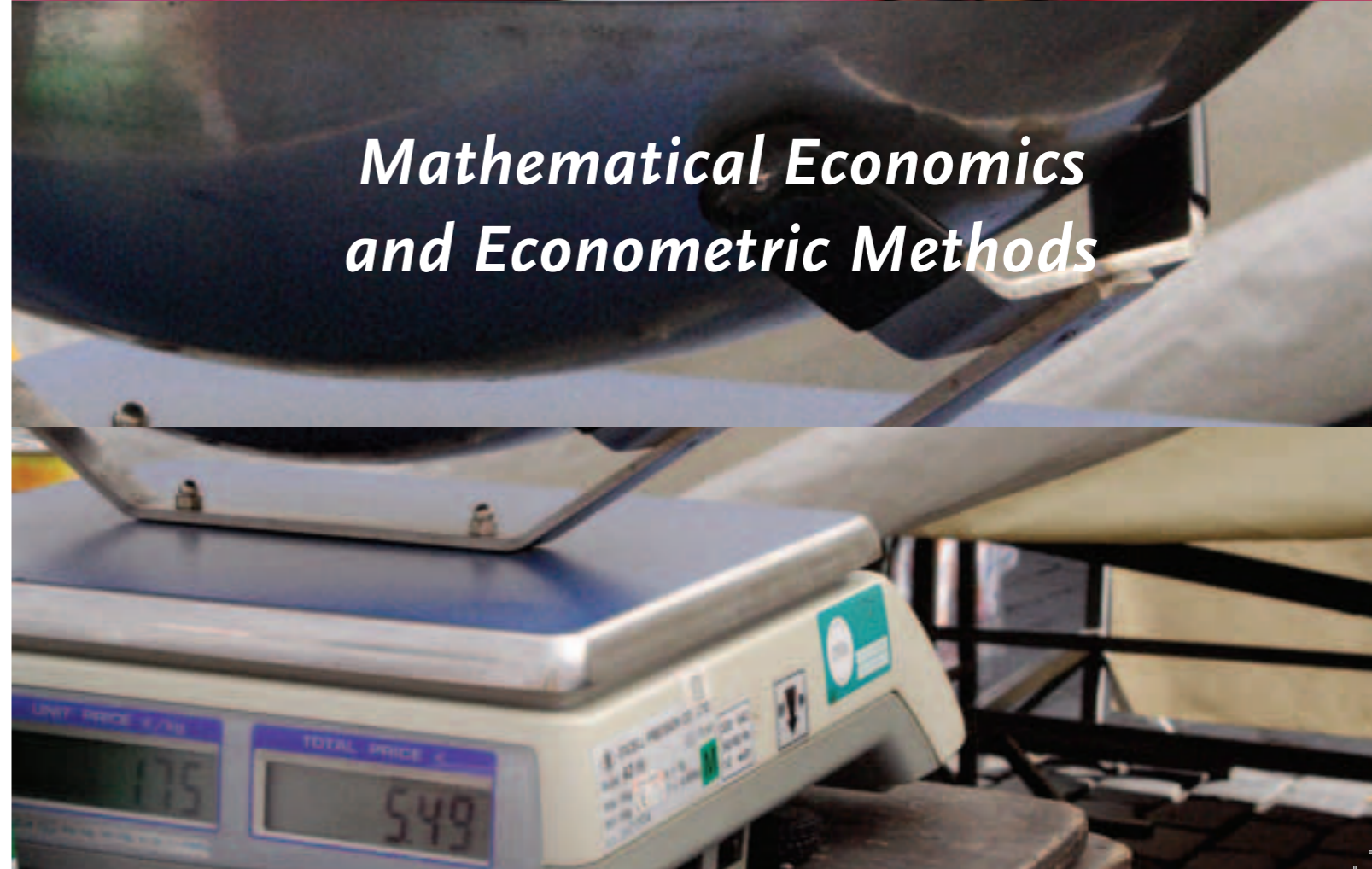
The Faculty of Economics and Business Administration is consistently ranked in the top best universities in Europe.

Some of the most recent rankings:

- Number one in Economics research in Europe (Journal of the European Economic Association, 2003)
- Number three in Economics research in Europe (www.econphd.net 2006)
- Number three in Business research in Europe (University of Texas at Dallas, 2005)



Tilburg University is renowned for its programme in Econometrics and Operations Research, a unique combination of economics, mathematics and statistics. Research in the department covers a wide variety of topics: (general) Econometrics, Quantitative Finance, Actuarial Sciences, Operations Research, Quantitative Logistics, Microeconomics and Game Theory. The department offers an internationally oriented and lively research environment aiming for top quality with approximately 40-50 staff members and 15-20 PhD students. The record in obtaining research grants is excellent. Most researchers have a strong quantitative background in mathematics and statistics. Departmental members participate in six out of nine research groups of CentER (the Faculty's research institute): Econometrics, Macroeconomics, Microeconomics, Finance, Operations Research and Accounting. The department is directly responsible for the bachelor's programme in Econometrics and Operations Research and the three master's programmes in Quantitative Finance and Actuarial Sciences (with a possible entry to become actuary), Operations Research and Management Science, and Mathematical Economics and Econometric Methods. Furthermore, the department is responsible for the mathematics and statistics component within several bachelor's programmes. Moreover, the department actively participates in courses in the CentER Graduate Programmes in Economics and Business.





# Mathematical Economics and Econometric Methods



## At a Glance

Name	Mathematical Economics and Econometric Methods
Croho*	60056
Duration	1-year master's programme
Type	full-time
Title	Master of Science
Education	Lectures and assignments
Language of instruction	English
Exams	written exams, papers
Best Preparatory Bachelor's	Econometrics and Operations Research
Core Courses	Dynamic Capital Investment, Empirical Applications, Industrial Organisation and Micro-Econometrics
Career Opportunities	Government, consultancy, large companies, non profit sector, science
Start	September
Information Day	23 November 2006 and 22 February 2007
More information	<a href="http://www.tilburguniversity.nl/masters">www.tilburguniversity.nl/masters</a>

\* Registration Code for Dutch students to register with the IB-Group.

## Characteristics

The programme Mathematical Economics and Econometric Methods focuses on the mathematical and quantitative analysis of economic problems. While Econometric Methods makes an explicit link between statistical techniques and the economic problem formulation, Mathematical Economics structures the economic problem, using models that incorporate both competitive and cooperative aspects. Applications deal with auctions, labour market, capital investment, industrial organisation, strategic behaviour of firms, and incomplete markets.

The MSc in Mathematical Economics and Econometric Methods shares a common quantitative basis with the master's programmes in Operations Research and Management Science, and in Quantitative Finance and Actuarial Sciences. Each programme has a different focus, but because they are offered in an integrated way, you are able to fully exploit the existing links between the programmes.

### Is this the right programme for me?

The MSc in Mathematical Economics and Econometric Methods is an intense and rigorous programme, which offers you an exceptional opportunity to earn a highly regarded graduate degree in the challenging field of quantitative economics. Alumni in this field do not need to worry about their future. The programme is taught entirely in English by a range of carefully selected top researchers and well-known professors in the field.

## Case

### The Multi-Stage Game

Firms choose their size (capacity) before they choose the price of the product, depending on the choices of their competitors in the market. This strategic behaviour can be modelled as a two-stage non-cooperative game in which firms choose their capacity in the first stage and their prices in the second stage. A pre-stage could be to decide to enter the market or not. A multi-stage game can be solved by first solving the game in the last stage for all possible outcomes of the second-last stage and then by solving the game of the second-last stage knowing the solution of the last game in the stage, and so on. The final solution of the game in the first stage then determines the solution at all stages. Thus, whether the firms enter or not, how much capacity is chosen and which prices are set.

## Programme

The programme consists of 60 Credits (ECTS), equivalent to 1680 hours of study. During the master's year you will take 4 core courses and 3 electives of 6 ECTS each, and write a Master's thesis of 18 ECTS. The courses are offered over two semesters. From the core courses listed below, you have to select at least 3 courses indicated with a \*. The first semester starts in September, with exams in December and January. The second semester runs from January to June, but is divided in two. From January to March, you will take courses. From April on, you will be able to focus on writing your Master's thesis.

### Core Courses

- Dynamic Capital Investment\*
- Empirical Applications\*
- Financial Models
- Industrial Organization\*
- Issues in Finance and Insurance
- Micro-Econometrics\*
- Queueing Models
- Simulation
- Stochastic Models

### Electives

- Asset Liability Management
- Auctions and Public Sector Economics
- Cases in Operations Research and Information Technology
- Combinatorial Optimisation
- Econometric Methods
- Game Theory
- Inventory Management
- Life Insurance
- Production Management
- Quantitative Finance
- Quantitative Supply Chain Management
- Risk Theory
- Core Courses not already selected
- Other FEB electives to be approved by the Examination Committee

*The quantitative analysis of economic problems*

This programme is provisional. Please refer to the electronic study guide for the latest updates: [www.tilburguniversity.nl/studyguide](http://www.tilburguniversity.nl/studyguide).

## Interview



**Prof. Dr. Dolf Talman**

Professor of Game Theory and Equilibrium Programming  
Coordinator MSc MEEM

### *Learn the newest theories, techniques and applications*

“The Master’s programme in Mathematical Economics and Econometric Methods focuses on tools from mathematics and statistics that are used to analyse economic problems in a quantitative way. You will learn how to apply modern methods and techniques, so that later on new mathematical or statistical tools can be developed instead of simplifying or adjusting the problem in order to utilise known tools.

All our teachers are members of the renowned research institute CentER of our university. CentER creates the excellent environment and facilities to publish in high quality international journals and to teach on a high scientific level. It guarantees that our master’s students in Tilburg learn the newest theories, techniques and applications.”

### Empirical Applications

This course will give you a broad overview of empirical applications, in terms of fields of applications as well as in terms of econometric models and techniques used in these applications. For example, the predictability of asset returns (particularly based on linear regression), various models to explain the market micro structure (including, among other things, ordered response models), the estimation and testing of CAPM and APT models (linear regression, factor analysis & principal components, panel data applications) or estimation of indemnity (estimation of compound distributions using ML).

### Industrial Organisation

Industrial Organisation offers you insights into the organisation of markets. You will become acquainted with the theory of industrial economics, by applying methods from welfare analysis and game theory, and with the analysis of strategic behaviour of agents under asymmetric information.

### Micro-Econometrics

How can microeconomic and behavioural models and techniques be applied to analyse economic issues? The relation between data, econometric models and techniques, and economic models, will be studied and many economic applications are given.

For more information about the programme and the courses, please refer to the electronic study guide on our web pages at [www.tilburguniversity.nl/studyguide](http://www.tilburguniversity.nl/studyguide).

### Career Opportunities

With a Master of Science in Mathematical Economics and Econometric Methods your job opportunities are in governmental agencies, research institutes, consultancy agencies or research departments of large companies, banks, insurance companies, non-profit sector and pension funds. Many alumni later on become manager of the department they started their career or they move to a position where they fulfil management tasks in combination with their regular tasks. A scientific career in econometrics, mathematical economics, operations research or quantitative economics is also possible. After this MSc programme, you can apply for the second year of the MPhil programme in Business or Economics of CentER Graduate School. After that, you might enter into a PhD-track and subsequently proceed as post-doc or tenure-track assistant professor. Many of today’s professors in economics have a background in Mathematical Economics and Econometric Methods.

### Admission Requirements

In order for you to be able to successfully complete the master’s programme in Mathematical Economics and Econometric Methods, you must have a solid background in mathematics and statistics. With a bachelor’s degree in Econometrics and Operations Research, or equivalent, you can be admitted to the programme. But also any bachelor’s degree with sufficient demonstrated knowledge of mathematics and statistics will result in admission to the master’s programme. In that case, the admission committee will assess your application. In case of an insufficient demonstrated knowledge of mathematics and statistics you may be offered an extended master’s programme in Mathematical Economics and Econometric Methods, which includes five additional courses (30 ECTS).

To be sure that you meet the required entry levels, you should review the following literature:

- Bain, L.J. and M. Engelhardt: Introduction to Probability and Mathematical Statistics (Duxbury, 2nd Edition 1992)
- Sydsaeter K. and P. Hammond: Essential Mathematics for Economic Analysis (Pearson Educational Limited, Essex 1974)
- Lay D.C.: Linear Algebra and its Applications (Addison-Wesley, 2nd Edition, Amsterdam, 1997).



## Interview

Dr. Pavel Čížek

Lecturer Mathematical Economics and Econometric Methods

### *A unique cross section through classical and modern econometric methods*

"As an econometrician, I develop new estimation methods with applications in labour economics, finance, and so on. And since any method is useless if nobody can use it correctly, I highly value and like very much the programme Mathematical Economics and Econometric Methods. In my opinion, it presents a unique cross section through classical and modern econometric methods as they are applied in microeconomics, industrial organization, finance, and many other fields with emphasis on real applications and understanding the story data tell us. In addition, students have the possibility to go deeper under the surface and widen their understanding by choosing electives."



## *Operations Research and Management Science*



# Operations Research and Management Science

## At a Glance

Name	Operations Research and Management Science
Croho*	60057
Duration	1-year master's programme
Type	full-time
Title	Master of Science
Education	Lectures and assignments
Language of Instruction	English
Exams	written exams and papers
Best Preparatory Bachelor's	Econometrics and Operations Research
Core Courses	Dynamic Capital Investment, Queueing Models, Simulation and Stochastic Models
Career perspectives	Management Consultancy and Research
Start	September
Information Day	23 November 2006 and 22 February 2007
More information	<a href="http://www.tilburguniversity.nl/masters">www.tilburguniversity.nl/masters</a>

\* Registration Code for Dutch students to register with the IB-Group.

## Characteristics

Operations Research and Management Science is pre-eminently an applied field. The goal is to solve complicated decision problems in business and in the public sector, using mathematical models and techniques. Topics include quantitative logistics, inventory management, combinatorial optimisation and queueing theory.

Operations Research and Management Science shares a common quantitative basis with the master's programmes in Mathematical Economics and Econometric Methods, and in Quantitative Finance and Actuarial Sciences. Each programme has a different focus, but because they are offered in an integrated way, you are able to fully exploit the existing links between the programmes.

### Is this the right programme for me?

The MSc in Operations Research and Management Science is especially designed for talented students who are eager to thoroughly analyse complex quantitative problems. You are ready to study and solve both practical and scientific problems by utilising a scientifically quantitative approach. Besides this, you will also learn to apply relevant computer software and write and present reports and articles.

## Case

### Demand Planning Impact on Supply Chain Bottom-line

The development of a demand plan is typically a joint effort between different functional units such as Logistics, Marketing, Sales and the upper management on the one hand, and between different business units on the other. Starting a project to structurally improve the demand planning often requires convincing all parties involved in such an effort. The key is to quantify the bottom-line impact of an increased demand planning reliability in the supply chain.

A Master student from Tilburg University studied the supply chain of LG. Philips Displays Europe. This study proposed a system dynamics simulation modelling framework that allowed different managers to examine how improvements in their demand reliability would impact the overall corporate bottom-line. For example, supply chain managers could investigate how proposed changes in the supply chain demand forecasting structure, different suppliers, different logistics routes, or alternative inventory methods, influenced the overall profitability. The simulation model was tested and validated with real-life case data.

The model offered the opportunity to simulate future collaborative forecasting scenarios. A number of fixed and variable cost elements and a number of financial parameters, among others the expected payment periods of incoming and outgoing invoices and the Weighted Average Cost of Capital, were included in the model for measuring the bottom-line impact of collaboration in the chain. Overall, the simulation results showed that by different demand (sales) planning improvement strategies, the current planning reliabilities could be increased to 90%, resulting in an increase in the Economic Value Added of approximately 4.6 million Euros.

## Programme

The programme consists of 60 Credits (ECTS), equivalent to 1680 hours of study. During the Master's year you will take 4 core courses and 3 electives of 6 ECTS each, and write a Master's thesis of 18 ECTS. The courses are offered over two semesters. From the core courses listed below, you have to select at least 3 courses indicated with a \*. The first semester starts in September, with exams in December and January. The second semester runs from January to June, but is divided in two. From January to March, you will take courses. From April on, you will be able to focus on writing your Master's thesis.

### Core Courses

- Dynamic Capital Investment\*
- Empirical Applications
- Financial Models
- Industrial Organization
- Issues in Finance and Insurance
- Micro-Econometrics
- Queueing Models\*
- Simulation\*
- Stochastic Models\*

### Electives

- Quantitative Finance
- Risk Theory
- Combinatorial Optimisation
- Econometric Methods
- Production Management
- Game Theory
- Asset Liability Management
- Inventory Management
- Auctions and Public Sector Economics
- Life Insurance
- Cases in Operations Research and Information Technology
- Quantitative Supply Chain Management
- Core Courses not already selected
- Other FEB electives to be approved by the Examination Committee

This programme is provisional. Please refer to the electronic study guide for the latest updates: [www.tilburguniversity.nl/studyguide](http://www.tilburguniversity.nl/studyguide)

*Solving decision problems using mathematical models and techniques*



## Interview



**Prof. Dr. Ir. Dick den Hertog**  
Professor of Operations Research, Coordinator MSc ORMS,  
Vice-dean Research

### *Mathematical models of practical decision problems*

“My research is closely related to practical problems. One of my research areas is simulation-based optimisation. Nowadays, for many decision problems deterministic or stochastic computer simulation is used to evaluate possible decisions. Such a simulation run can be very time-consuming. The aim is to find the best decision with as few simulation runs as possible. Using these techniques, e.g. production flow lines or inventory management systems can be optimised. Operations Research and Management Science is pre-eminently an applied science. Students of this Master’s programme like to make mathematical models of practical decision problems in industry or for the public sector, and to solve them with the help of mathematical techniques. And if the existing techniques are not sufficient, it is a challenge for them to develop new ones. Additionally, they like quantitative techniques and have good ICT and communication skills to really make the ORMS work in practice.”

### Queueing Models

Queueing models are developed for the performance evaluation of service systems for shared use, such as production and assembly systems, traffic and transportation networks, and hospitals. Queues build up through a combination of limited service capacity, uncertainty of the arrival pattern of customers, fluctuations in the service times and possible disturbances in the service process. This implies that queueing models are stochastic, in general. On the basis of assumptions about the arrival and service process performance, measures like the queue length distribution and the waiting time distribution are determined or computed.

### Simulation

Simulation is an Operations Research method very often applied in practice, which uses computers to model the behaviour of a dynamic system (for example, a production system or a telecommunication network). These models are used to quantify the performance of these systems, to optimise the system or to do sensitivity (‘what-if’) and uncertainty (risk) analyses.

### Stochastic Models

This course aims to increase the capability of analysing managerial problems under uncertainty, which occur, for example, in inventory and production control, telecommunications, maintenance, and insurance. The emphasis is on providing insight and thorough understanding of renewal theory and the theory of discrete-time and continuous-time Markov processes, and applications in various areas.

For more information about the programme and the courses, please refer to the electronic study guide on our web pages at [www.tilburguniversity.nl/studyguide](http://www.tilburguniversity.nl/studyguide).



### Career Opportunities

After successful completion of the programme in Operations Research and Management Science, you will be awarded an internationally recognised Master of Science degree, with many career opportunities. To give some examples, graduates in Operations Research and Management Science can start

- at Operations Research consultancy bureaus
- at management or logistics consultancy bureaus
- at firms developing logistics software
- as a management trainee, as an OR-specialist, or as a quantitative logistics specialist
- a PhD in Economics or Econometrics

### Admission Requirements

In order for you to be able to successfully complete the master’s programme in Operations Research and Management Science, you must have a solid background in mathematics and statistics. With a bachelor’s degree in Econometrics and Operations Research, or equivalent, you can be admitted to the programme. But also any bachelor’s degree with sufficient demonstrated knowledge of mathematics and statistics will result in admission to the master’s programme. In that case, the admission committee will assess your application.

In case of an insufficient demonstrated knowledge of mathematics and statistics you may be offered an extended master’s programme in Operations Research and Management Science, which includes five additional courses (30 ECTS).

To be sure that you meet the required entry levels, you should review the following literature:

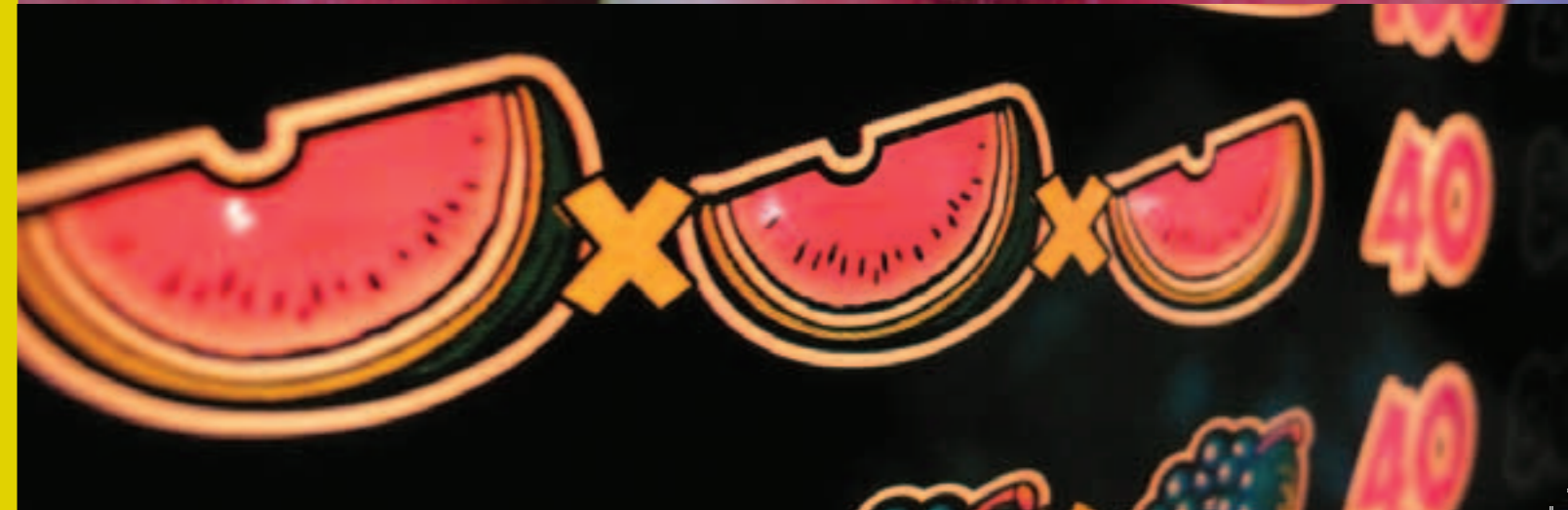
- Bain, L.J. and M. Engelhardt: Introduction to Probability and Mathematical Statistics (Duxbury, 2nd Edition 1992)
- Sydsaeter K. and P. Hammond: Essential Mathematics for Economic Analysis (Pearson Educational Limited, Essex 1974)
- Lay D.C.: Linear Algebra and its Applications (Addison-Wesley, 2nd Edition, Amsterdam, 1997).

## Interview

**Prof.Dr.Ir. Jalal Ashayeri**  
Professor of Supply Chain Management

### *The future is bright*

"The master's programme in Operations Research and Management Science combines the fields of economics, mathematics and statistics to equip students with advanced tools to solve contemporary management problems. Today, businesses and industries are increasingly global and complex. Prompt, forward-thinking and decision-making abilities are required to manage the design and administration of production systems, supply chains, and supporting IT solutions. In this programme, you will learn state-of-the-art operations enabling tools that help business thrive. You will also have the opportunity to participate in attractive internships at world-class organisations, where you can solve real-life practical problems and write a thesis. In this labour market, there is huge demand for students who have theoretical and applied knowledge of logistics, supply chain management, and quantitative methods. The future is bright for Operations Research and Management Science students!"





# Quantitative Finance and Actuarial Sciences



## At a Glance

Name	Quantitative Finance and Actuarial Sciences
Croho*	60058
Duration	1-year master's programme
Type	full-time
Title	Master of Science
Education	Lectures and assignments
Language of instruction	English
Exams	written exams, oral exams, papers
Best Preparatory Bachelor's	Econometrics and Operations Research
Core Courses	Dynamic Capital Investment, Empirical Applications, Financial Models and Issues in Finance and Insurance
Career Opportunities	Analyst, researcher, consultant, trader, risk manager
Start	September
Information Day	23 November 2006 and 22 February 2007
More information	<a href="http://www.tilburguniversity.nl/masters">www.tilburguniversity.nl/masters</a>

\* Registration Code for Dutch students to register with the IB-Group.

## Characteristics

The central theme of the master's programme Quantitative Finance and Actuarial Sciences is risk management, based explicitly on quantitative models. Investors apply risk management to weigh risk against return; insurers apply it to limit their risks by calculating the appropriate premiums, and option traders balance their books by calculating the sensitivities of their positions with respect to the relevant risk factors. Topics include continuous time finance, empirical applications from finance and the actuarial sciences, risk theory and asset liability management.

Quantitative Finance and Actuarial Sciences shares a common quantitative basis with the master's programmes in Mathematical Economics and Econometric Methods and in Operations Research and Management Science. Each programme has a different focus, but because they are offered in an integrated way, you are able to fully exploit the existing links between the programmes.

### Is this the right programme for me?

The MSc in Quantitative Finance and Actuarial Sciences is strongly focused on the management of financial risks. For students who want to continue in Actuarial Sciences towards the title of Actuaris AG, the QFAS programme provides direct access to a post-Master professional education programme offered by the Dutch Actuarial Institute.

## Case

### The importance of hedging

In 1999, Equitable Life was the second largest life insurer in the United Kingdom and was named 'pension provider of the year' by the pension industry magazine. Founded in 1762, the company was proud to present itself as the oldest mutual life insurer in the UK. In December 2000, Equitable closed for new business and put itself up for sale. There were no buyers. About a million policyholders were faced with substantial reductions of their retirement benefits. How could this dramatic downturn take place? The demise of Equitable was caused by risks that were taken knowingly and willingly by the company's financial leadership. During the 1970's and early 1980's, Equitable had been selling pension plans involving a guaranteed annuity return, that is, a minimal interest rate to be paid on a given sum for the duration of the life of the policyholder. The guaranteed rates were much lower than the actual rates that were common in those days of high inflation. In the mid-nineties however, interest rates went down considerably and when the guaranteed rates became payable, Equitable sank into major difficulties.

A guaranteed annuity return is like an option contract, which may or may not have value at the payment date depending on the level of some related indicator such as a stock index or an interest rate. Modern financial theory says that the risk involved in such contracts can be greatly reduced through the application of hedging strategies. The idea is to construct portfolios in such a way that losses in one part are compensated for by gains in another part, and vice versa; implementation of such strategies requires accurate valuation of future liabilities and careful modeling of correlations. It would not have been very expensive for Equitable to set up such a hedge in the time it sold the contracts with the guaranteed annuity returns; even a coarse hedge would have prevented most of the problems that the company got itself into. Hedging is extensively discussed in the QFAS programme. It is one of the objectives of the programme to ensure that QFAS graduates will succeed where the Equitable management has failed, namely to develop financial products that are useful to customers, without creating undue risks for the company that provides these products.

## Programme

The programme consists of 60 Credits (ECTS), equivalent to 1680 hours of study. During the master's year you will take 4 core courses and 3 electives of 6 ECTS each, and write a Master's thesis of 18 ECTS. The courses are offered over two semesters. From the core courses listed below, you have to select at least 3 courses indicated with a \*. The first semester starts in September, with exams in December and January. The second semester runs from January to June, but is divided in two. From January to March, you will take courses. From April on, you will be able to focus on writing your Master's thesis.

### Core Courses

- Dynamic Capital Investment\*
- Empirical Applications\*
- Financial Models\*
- Industrial Organization
- Issues in Finance and Insurance\*
- Micro-Econometrics
- Queueing Models
- Simulation
- Stochastic Models

### Electives

- Quantitative Finance
- Risk Theory
- Combinatorial Optimisation
- Econometric Methods
- Production Management
- Game Theory
- Asset Liability Management
- Inventory Management
- Life Insurance
- Auctions and Public Sector Economics
- Cases in Operations Research and Information Technology
- Quantitative Supply Chain Management
- Financial Markets and Institutions
- Financial Analysis and Investor Behaviour
- Introduction to Economics and Finance of Aging
- Microeconomics of Insurance and Redistribution
- Core Courses not already selected
- Other FEB electives to be approved by the Examination Committee

This programme is provisional. Please refer to the electronic study guide for the latest updates: [www.tilburguniversity.nl/studyguide](http://www.tilburguniversity.nl/studyguide)

## Risk management based on quantitative models

## Interview



**Prof. Dr. Hans Schumacher**  
Professor of Mathematics, Coordinator MSc QFAS

### *Training at a high technical level*

"The Master's programme in Quantitative Finance and Actuarial Sciences at Tilburg University offers training in modern portfolio management and risk control at a high technical level. The curriculum includes advanced courses on the modeling of financial and insurance markets on the basis of the theory of stochastic processes. Analytic as well as empirical aspects are covered. Wherever possible, finance and insurance are addressed in an integrated fashion so as to bring out both the similarities and the differences between these fields. In this way, the QFAS programme responds to the continuing process of integration of the finance and insurance industries. A wide range of electives is available for students, including courses from the Master's programmes in Investment Analysis and in Economics and Finance of Aging."

### Dynamic Capital Investment

In this course, you will develop your economic intuition concerning the theory of investment under uncertainty (real options) and deterministic dynamic models of a firm. The course provides you with the mathematical tools needed to study deterministic and stochastic dynamic optimisation problems. In particular, Itô's lemma, (stochastic) dynamic programming, optimal stopping, Pontryagin's maximum principle, and phase diagram analysis.

### Financial Models

This course offers a systematic introduction to the mathematical modeling of financial markets. Continuous-time models are discussed extensively with applications to derivative pricing and hedging in equity and bond markets. The course also includes a discussion of computational techniques such as finite-difference schemes and the Monte Carlo method.

### Issues in Finance and Insurance

During this course, you discuss topics from the recent journal literature in the area of quantitative finance and actuarial sciences. The contents of this course may change from year to year, depending on recent developments. Some examples of subjects are: coherent risk measures, prospect theory, premium principles vs. pricing rules, allocation of risk capital, and modeling of dependence.

For more information about the programme and the courses, please refer to the electronic study guide on our web pages at [www.tilburguniversity.nl/studyguide](http://www.tilburguniversity.nl/studyguide).



### Career Opportunities

After successful completion of the programme in Quantitative Finance and Actuarial Sciences, you will be awarded an internationally recognised Master of Science degree, with many career opportunities. To give some examples, graduates in Quantitative Finance and Actuarial Sciences find their way into:

- Large financial institutions
- Pension funds
- Insurance companies
- Consultancy agencies like Watson Wyatt, William M. Mercer, Towers Perrin, etc.
- Regulating institutions (central banks)
- Treasury departments of large companies
- PhD in Economics or Econometrics

### Admission Requirements

In order for you to be able to successfully complete the master's programme in Quantitative Finance and Actuarial Sciences, you must have a solid background in mathematics and statistics. With a bachelor's degree in Econometrics and Operations Research, or equivalent, you can be admitted to the programme. But also any bachelor's degree with sufficient demonstrated knowledge of mathematics and statistics will result in admission to the master's programme. In that case, the admission committee will assess your application. In case of an insufficient demonstrated knowledge of mathematics and statistics you may be offered an extended master's programme in Quantitative Finance and Actuarial Sciences, which includes five additional courses (30 ECTS).

To be sure that you meet the required entry levels, you should review the following literature:

- Bain, L.J. and M. Engelhardt: Introduction to Probability and Mathematical Statistics (Duxbury, 2nd Edition 1992)
- Sydsaeter K. and P. Hammond: Essential Mathematics for Economic Analysis (Pearson Educational Limited, Essex 1974)
- Lay D.C.: Linear Algebra and its Applications (Addison-Wesley, 2nd Edition, Amsterdam, 1997).



## Interview

Anja de Waegenare

associate professor Econometrics and Accountancy

### *We have observed a dramatic increase in expected lifetime*

"Together with Hans Schumacher, I currently teach the master course 'Issues in Finance and Insurance'. This course focuses on important breakthroughs as well as recent developments in the academic literature in the fields of Finance and Insurance. Students are required to read academic papers and prepare answers to a number of discussion items related to the topic of the paper.

My current research focuses on 'longevity risk', i.e. the risk related to the fact that the remaining lifetime of individuals is uncertain. In the past century, we have observed a dramatic increase in expected lifetime. For example, in 1925, the expected remaining lifetime of a 25 year old man was approximately 45 years. In 2000, that number had increased to approximately 51 years. This past evolution clearly suggests that further improvement is to be expected. This has important consequences for pension funds and insurers, whose liabilities clearly depend on the remaining lifetime of individuals. As part of the Netspar PhD project of Norbert Hari, we have developed models to forecast future mortality, and to quantify the related uncertainties. As a researcher, I particularly enjoy the challenge of trying to tackle problems that have societal relevance and for which mathematical modeling can provide useful insights."



## Tuition Fee



The tuition fees for 2007-2008 will be available in December 2006 on [www.tilburguniversity.nl/prospectivestudents](http://www.tilburguniversity.nl/prospectivestudents).

As an indication, the tuition fees for the academic year 2006-2007 are:

EEA citizens,	€ 1519
non-EEA citizens with a right to 'studiefinanciering', students with an official status as refugee (UAF students)	
Non-EEA citizens	€ 9480

- To students from EEA countries who do not have a right to 'studiefinanciering', the Dutch government reimburses € 800 per year of the tuition fee.
- Tuition fee payments are non-refundable if a student must unexpectedly leave the programme before graduation.
- If students do not complete the MSc programme within a year they will need to register for a second year and pay tuition accordingly.

### EEA Countries

Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, the United Kingdom, also including Switzerland.

## Application Procedures

There are different application procedures for students with a Dutch Bachelor's degree and with a non-Dutch bachelor's degree.

Do you have a bachelor's degree from Tilburg University or any other Dutch University?

- See the web pages on [www.tilburguniversity.nl/masters](http://www.tilburguniversity.nl/masters)

Do you have a non-Dutch bachelor's degree?

- See the web pages on [www.tilburguniversity.nl/prospectivestudents](http://www.tilburguniversity.nl/prospectivestudents)
- See the International Student Services brochure for information about application procedures.

Do you have a Dutch Professional bachelor's degree (hbo)?

- See the web pages on [www.uvt.nl/nahbo](http://www.uvt.nl/nahbo)
- See the guide 'Opleidingen na hbo'

# More Information



Once you have read this brochure, you may still have some questions that cannot be answered within the scope of this brochure. If that is the case, please check our website or send an e-mail to [study-info@uvt.nl](mailto:study-info@uvt.nl). A professional team of academic advisors, who are committed to helping you make the right study choices, handles all incoming e-mails. So please feel free to contact them.

### Website

More information about the master's programmes and courses of Tilburg University can be found on the website:

[www.tilburguniversity.nl/masters](http://www.tilburguniversity.nl/masters)

There is a special website for students with a non-Dutch bachelor's degree:

[www.tilburguniversity.nl/prospectivestudents](http://www.tilburguniversity.nl/prospectivestudents)

### Contact

#### Students with a Dutch bachelor's degree

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Faculty of Economics and Business Administration  
Tilburg University

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Fax: +31 13 466 3072  
E-mail: [feb-owb@uvt.nl](mailto:feb-owb@uvt.nl)

#### Students with a non-Dutch bachelor's degree

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[www.tilburguniversity.nl/masters](http://www.tilburguniversity.nl/masters)

**Master's programmes**

- Accounting
- Accountancy en Management Control
- Economics
- Economics and Finance of Aging
- Financial Management
- Fiscale Economie
- Information Management
- International Business
- International Economics and Finance
- Investment Analysis
- Logistics and Operations Management
- Marketing Management
- Marketing Research
- **Mathematical Economics and Econometric Methods**
- **Operations Research and Management Science**
- **Quantitative Finance and Actuarial Sciences**
- Research Master in Business
- Research Master in Economics
- Strategic Management

