Program of the Graduate School

MPhil and PhD program in Economics, Econometrics and Finance 2014/2015

June 2014
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Follow TI on twitter: https://twitter.com/ResearchTI
Visit TI on facebook: https://www.facebook.com/InstituteTinbergen
Preface

It is a pleasure to welcome you to a new year of graduate studies at the Tinbergen Institute (TI), the graduate school and research institute of the economics faculties of the Erasmus University Rotterdam, the University of Amsterdam, and the VU University Amsterdam. The TI MPhil program is a two-year research master in economics, econometrics and finance that is fully dedicated to preparing students for PhD thesis research.

In its first year students receive rigorous training in the core microeconomics, macroeconomics (and finance) and econometrics. In its second year students specialize in their choice from the institute’s many fields of research through field course work and MPhil thesis research. In the first year of the MPhil program students have the possibility to specialize. Students with a strong background in econometrics can choose the advanced econometrics track. Students who aim to pursue a major in finance substitute two core courses in macroeconomics by two courses in finance.

The three faculties participating in Tinbergen Institute have three-year PhD positions available for students who have completed the TI MPhil program. Most students who perform well in the MPhil program find a supervisor at one of the three faculties (usually the MPhil thesis supervisor also acts as PhD supervisor) and continue in a PhD track in Tinbergen Institute.

TI offers job market training to PhD students in the last year of their appointment. This training program consists of workshops where students learn how to prepare for the academic job market, followed by mock interviews in which students learn to present themselves and their research in front of a committee.

Finally, we would like to draw your attention to the annual TI Lectures Series. Also this year, we invited leading researchers who will teach 3-day lectures to an audience of TI students. We start with the Finance Lectures by Franklin Allen (Nippon Life Professor of Finance and Economics at the Wharton School of the University of Pennsylvania and since July 2014 Executive Director of the Brevan Howard Centre for Financial Analysis at Imperial College London) in October 2014. In May 2015 Ricardo Reis (Columbia University) will give the Economics Lectures. Finally in June 2015 Chris Sims (Princeton University and Nobel Prize laureate 2011 together with Thomas Sargent) will teach the Econometrics Lectures.

Amsterdam, July 2014

Massimo Giuliodori
Director of Graduate Studies
Contents

1. Tinbergen Institute Graduate School and Research Institute ................................................. 6
2. General Information on the MPhil/PhD program ................................................................. 8
   2.1 Application procedure .................................................................................................. 8
   2.2 Admission requirements ......................................................................................... 8
   2.3 Tuition fees, registration at the universities ............................................................ 9
   2.4 Funding ...................................................................................................................... 9
   2.5 PhD program ............................................................................................................ 11
   2.6 Job market training .................................................................................................. 11

3. The MPhil program in 2014/2015 .................................................................................... 12
   3.1 Course calendar 2014/2015 .................................................................................... 12
   3.2 Registration for and withdrawal from courses for MPhil students ......................... 12
   3.3 First year of the MPhil program .............................................................................. 13
       3.3.1 MPhil track in Economics ............................................................................... 14
       3.3.2 MPhil track in Econometrics .......................................................................... 16
       3.3.3 MPhil track in Finance .................................................................................... 17
       3.3.4 MPhil research seminar series ........................................................................ 19
       3.3.5 Grading, credits, and retakes in the core ......................................................... 19
       3.3.6 Grading, credits, and retakes in the fields ....................................................... 26
   3.4 Second year of the MPhil program ............................................................................ 20
       3.4.1 Field courses .................................................................................................... 21
       3.4.2 Field papers ...................................................................................................... 24
       3.4.3 Seminars ........................................................................................................... 25
       3.4.4 Other courses and workshops ......................................................................... 25
       3.4.5 Matching to an MPhil thesis and possible PhD thesis supervisor ................. 25
       3.4.6 MPhil thesis ..................................................................................................... 25
       3.4.7 Grading, credits, and retakes in the fields ....................................................... 26
   3.5 The Academic and Examination Regulations and the MPhil’s boards ....................... 27
       3.5.1 Admission Board ............................................................................................ 27
       3.5.2 Examination Board ......................................................................................... 27
       3.5.3 Educational Board .......................................................................................... 28
   3.6 Academic preparations .............................................................................................. 28
       3.6.1 Microeconomics ............................................................................................... 28
       3.6.2 Macroeconomics ............................................................................................. 28
       3.6.3 Asset Pricing and Corporate Finance ............................................................... 29
       3.6.4 Mathematics ..................................................................................................... 29
       3.6.5 Econometrics ................................................................................................... 30
       3.6.6 Principles of Programming in Econometrics .................................................. 30
   4. Course descriptions ......................................................................................................... 31
       4.1 Core courses .......................................................................................................... 31
           4.1.1 Micro Sequence ............................................................................................. 31
           4.1.2 Macro Sequence ........................................................................................... 33
           4.1.3 Econometrics Sequence .............................................................................. 37
           4.1.4 Finance Sequence ....................................................................................... 42
       4.2 Field courses .......................................................................................................... 45

Appendix I Information for 4-year PhD students directly hired by the faculties .................... 78
Appendix II Information for TI PhD students and external participants in TI MPhil courses .... 80
Appendix III Teaching associates 2014/2015 ...................................................................... 82
Appendix IV Addresses and directions ................................................................................. 84
1. Tinbergen Institute Graduate School and Research Institute

Founded in 1987, Tinbergen Institute (TI) is the graduate school and research institute in economics, econometrics and finance of the Erasmus School of Economics of Erasmus University Rotterdam, the Faculty of Economics and Business Administration of VU University Amsterdam, and the Faculty of Economics and Business of the University of Amsterdam.

The **TI Graduate School** offers two years (120 ects) of intensive PhD-level coursework in its Master of Philosophy (MPhil) program. The TI MPhil program has been accredited by the Accreditation Organisation for the Netherlands and Flanders (NVAO) and fits into the framework of the Bologna model and the European Higher Education Area. Students who complete the TI MPhil program are awarded a legally-protected MSc degree in economics.

All courses in the TI program are taught in English and mostly on the institute’s premises in Amsterdam and Rotterdam. Students can also participate in a broad range of related activities organized by and at the institute, such as reading groups, seminars, workshops and conferences. Details about the contents of the program and admission requirements follow in later sections of this brochure.

The MPhil program’s high standards are guaranteed by selecting teaching staff from the best researchers of the three faculties participating in the institute and by inviting internationally renowned experts to serve as guest lecturers in their fields of research. The program’s high quality is also maintained by carefully selecting only the best students from a large international pool of applicants. Each year up to around 25-30 students are admitted to the TI MPhil program. Altogether, some 220 MPhil and PhD students are currently affiliated to the institute.

Students who have completed the institute’s MPhil program should have a thorough, up-to-date knowledge of the theory, empirics, and econometric methodology of economics, econometrics and finance, respectively. They should be able to read and understand top academic journals and to contribute to scientific discussions. Students should have sufficient knowledge, insight and skills to carry out independent research in economics or finance, initially under appropriate academic supervision. The MPhil thesis, which serves as the final exam of the MPhil program, is a first test of this. It should be written as a research paper that can be submitted to an international, peer-reviewed journal. It is supervised by a research fellow of the institute and can serve as a starting point for the PhD thesis.

The MPhil program is fully dedicated to preparing students for PhD thesis research in the three faculties participating in the institute. Students who successfully complete the MPhil program usually transfer to a 3-year PhD position at one of the faculties and are offered full time employment positions with all the benefits of a good salary. PhD students primarily spend their time on writing research papers for the PhD thesis, on participation in conferences, workshops and seminars, and on longer study visits abroad. Tinbergen Institute facilitates PhD students by providing a travel budget and financial support for research costs.

The **TI Research Institute** aims to stimulate fundamental and applied research in economics at the three participating universities and to organize an excellent research training environment for the institute’s students. The research program consists of eight themes, covering the whole spectrum of economic analysis, from theoretical to empirical research and econometric methods:

- Behavioral and Experimental Economics (BEE)
- Cooperative Behavior, Strategic Interaction, and Complex Systems (CSC)
- Econometrics and Operations Research (ECTOR)
- Finance (FIN)
- Macroeconomics and International Economics (MIE)
- Labor, Health, Education and Development (LHED)
- Organizations and Markets (OM)
- Spatial, Transport, and Environmental Economics (STEE)
The cooperation between the three economics faculties in the institute offers many benefits. The best economists from the three participating universities are affiliated to TI as research fellows. TI offers them facilities for organizing conferences and seminars, and for inviting foreign guest researchers for short or long stays. TI has offices in both Amsterdam and Rotterdam, including seminar rooms and a dedicated support staff. The graduate (MPhil and PhD) students also have their own shared office space. The research atmosphere is international, active and lively.

Small-scale locations and the informal atmosphere at TI contribute to a wealth of contacts between students, teachers, research fellows, and visitors. The MPhil students often collaborate on various assignments and become a close-knit group. Yet, they also enjoy regular contacts with more senior (PhD) students. At both locations (Amsterdam and Rotterdam), weekly student lunch seminars are organized. During these seminars students present their work and discuss their progress.

To disseminate research results and to enhance discussion among colleagues, Tinbergen Institute publishes a discussion paper series which can be found at www.tinbergen.nl/discussionpapers.
2. General information on the MPhil/PhD program

2.1 Application procedure

Applications for September 2015 enrolment will be taken from October 2014 and should be submitted via the online application form on the TI website.

The application deadlines for enrolment in September 2015 are February 1, 2015 (all), rolling admission until April 1, 2015 (final deadline non-EEA candidates), and rolling admission until June 1, 2015 (EEA and Swiss nationals only). All applicants are advised to submit their application by the early, February 1 deadline, because slots in the program and funding opportunities are limited. In any case, non-EEA/non-Swiss nationals should apply before the April 1 deadline.

The institute and the international offices of the participating universities will help students who are admitted with immigration procedures, financial arrangements, housing, etc.

Questions about and comments on the application procedure should be directed to the Admissions Officer at applications@tinbergen.nl.

2.2 Admission requirements

The MPhil program is a selective program geared towards excellent students who want to pursue a PhD in economics, econometrics or finance at TI. Admissions are highly selective and competitive. A maximum of around 25-30 students may enrol each year. Students are selected by TI’s Admission Board in a rigorous and careful process according to the following guidelines:

1. Students must have at least a Bachelor’s diploma, preferably in economics, econometrics, mathematics or physics. The Bachelor’s program should be completed before the start of the MPhil program.

2. GRE (Graduate Record Examination): Recent GRE General Test results are required from all (including Dutch) applicants. Scores that are more than five years old on the admission deadline are not valid and will not be considered. Successful applicants typically perform among the top-10% of test-takers on the quantitative part of the GRE. Applicants with a Q score below 160 (tests taken on or after August 1, 2011) or 750 (tests taken prior to August 1, 2011) will not be considered. Tinbergen Institute’s code number for the GRE is 3811.

3. An excellent command of English is crucial. Students whose native language is not English are therefore required to demonstrate English proficiency in one of two ways:
   a. by holding a degree from a Dutch university or an institution at which English is the language of instruction, or
   b. by scoring at least 600 on the paper-based Test of English as a Foreign Language (TOEFL), 250 on the computer-based TOEFL, 100 on the internet-based TOEFL or 7 on the IELTS (International English Language Testing System) test. Scores

1 EEA countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Republic of Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, The Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

2 Details of these and other regulations concerning the MPhil program can be found in the program’s Academic and Examination Regulations, which is available from the institute’s intranet. In case of conflicts between this brochure and the Academic and Examination Regulations, the text of the Academic and Examination Regulations is binding.
that are more than two years old on the date of application are not valid and will not be considered. TI’s code number for the TOEFL is 3811.

Note: Chinese nationals (unless already enrolled at a university in the Netherlands) are required to register with the NUFFIC in Beijing to obtain a NUFFIC Certificate. They should meet the institute’s TOEFL iBT or IELTS requirement, because this is a condition for obtaining a NUFFIC Certificate.

4. Students should be strongly motivated to pursue a PhD in economics, econometrics or finance at the institute. Such motivation will be assessed by a written statement of purpose, including a preliminary research proposal.

5. Applications should include at least two letters of recommendation supporting the capability and aspirations of the applicant.

For more details about additional admission requirements (transcripts, diplomas, writing sample, cv etc.) go to the admission form on the TI website.

2.3 Tuition fees, registration at the universities

Students in the MPhil program are registered at the Erasmus University Rotterdam, the University of Amsterdam or at VU University. The university where the student is registered awards the MSc degree. A tuition fee is charged to all MPhil students. Tuition fees are due until all MPhil examinations, including the MPhil thesis, are passed. The tuition fees are determined annually by the Dutch government and the universities.

The annual tuition fee for the academic year 2014-2015 is € 12,000 for non-EEA students and for students who completed a Dutch master program before coming to TI.

The low annual tuition fee (‘wettelijk collegegeld’) for the academic year 2014-15 is € 1,906. You meet the criteria for a low tuition fee if:

• you are a national of an EEA country, AND
• do not hold a Dutch master degree.

Holding a Dutch master degree?
Tinbergen Institute recognizes that talented students who already earned a Dutch master degree may be discouraged by the high tuition fee. Under certain conditions, TI will offer financial assistance to these students.

The institute supports students with various facilities, such as office space at TI in Rotterdam or Amsterdam and reimbursement of travel expenses between Amsterdam and Rotterdam for MPhil coursework. Details are given in the separate brochure “Facilities - Funding – Refunding. Information for MPhil and PhD students”, which is available from the institute’s intranet.

2.4 Funding

Tinbergen Institute awards scholarships to selected students based on merit. Because the institute’s resources are limited, prospective students are advised to apply for external funding as well (see e.g. www.grantfinder.nl).

Tinbergen Institute offers full or partial scholarships (covering the tuition fee, monthly installments and a contribution to health insurance costs) and tuition fee waivers (tuition fee and contribution to health insurance costs) to selected students. Scholarships and tuition waivers are granted by TI’s Admission Board. Students who accept a TI scholarship or tuition waiver are obliged to sign a statement in which they declare to agree with the scholarship regulations. Scholarships are never cumulative: TI will supplement external scholarships students may receive
from an institution or governmental organization. Initially, a scholarship is granted for the program’s first year (12 months) only.

Scholarships are paid to the student as long as the student actively participates in the program and as long as there is a reasonable expectation that the student will successfully complete the program according to the program’s Academic and Examination Regulations. If a student is temporarily or permanently unable or unwilling to participate in the MPhil program, or if the Director of Graduate Studies asks the student to withdraw from the program because of unsatisfactory performance or misconduct, payment of the monthly stipend may be discontinued. In case students withdraw from the program before the end of the academic year, students are required to cancel their registration with the university and to apply to the university for a (partial) refund of the tuition fees. Refunded fees will be repaid to TI.

In order to maintain or be awarded a full scholarship in the second year of the program, students should fulfill the following requirements at July 1st at the end of the first year of the program:

1. The student’s weighted GPA is 7 or higher.
2. The student has earned at least 56 ECTS out of the total 60 ECTS (the compensation rule\(^3\) within core sequences applies). Students may fail (with a grade below 5) one course of 4 ECTS, provided this occurs in block I or II, and the failed grade is compensated by the other grades to maintain a weighted GPA of at least 7.
3. The failed course should be re-taken in the second year of the program. The scholarship will be immediately terminated in case the student fails the retake (a compensated 5 is considered as a sufficient result).

Students who do not meet these requirements will compete with each other for tuition fee waivers if funds are available.

Also in the second year the scholarship is conditional upon active participation in the program, fulfilling assigned TA duties, and the likelihood of completing the MPhil program according to the program’s Academic and Examination Regulations.

Government support is available for some groups of MPhil students:

a. Full-time students who are Dutch nationals and are under 30 years of age may be eligible for government support (“studiefinanciering”) in the form of a performance grant, a loan, and a public-transport card (see www.ib-groep.nl).

b. The same scheme is open for select groups of nationals of other countries (see www.ib-groep.nl > International student).

c. Finally, EEA and Swiss nationals may be eligible for tuition fee restitution by the government (see www.ib-groep.nl > International student> Study in the Netherlands > grant for tuition or course fees).

For second-year students, additional funding is offered by the institute and the faculties through research and/or teaching assistantships. These jobs offer valuable teaching and research experience. The program’s second year leaves ample time for MPhil thesis research, which could be connected to a research assistantship. The core (first-year) program leaves little or no time for any jobs.

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\(^3\) Compensation rule: within each core (microeconomics, macroeconomics/finance and econometrics/advance econometrics) course sequence, students may compensate at most one 5 with a 7 (or higher) obtained in one other course of the same sequence. The compensation rule applies across years, except for students who have not earned at least 48 ECTS of first year’s credits by July 1 of the first year and/or have not completed the seminar series.
2.5 PhD program

Students who perform well in the MPhil program usually transfer to the three-year PhD program. Students are assisted in the transition to the PhD program and in finding one or more PhD thesis supervisors with whom they prepare a PhD thesis proposal. Ideally, but not necessarily, the MPhil thesis will be the basis of the PhD thesis proposal and the MPhil thesis supervisor will be the PhD thesis supervisor. The main PhD supervisor (the "promotor") should be a full professor in one of the three economics faculties.

Students admitted to the PhD program are typically employed by this faculty as a PhD researcher ("promovendus"). This is a full-time position that comes with all the benefits of employment, including a good salary. Thus, such PhD students are fully funded.

After completion of the MPhil program, students have complied with all coursework requirements of the graduate program and typically spend most or all of their time on PhD research. Nevertheless, students are most welcome to participate in additional field courses during the later (PhD) years of their studies at the institute. PhD students should register for courses using the online registration form available on TI's intranet. No costs will be charged for PhD students who have transferred from the MPhil program. In addition, students may attend courses offered by national educational networks such as the LNMB (www.lnmb.nl), participate in national and international workshops, etcetera.

Some external educational activities involve fees, substantial travel, and other costs. Note that costs are reimbursed according to the regulations and procedures outlined in the separate brochure for TI students “Facilities- Funding –Refunding. Information for MPhil and PhD students” that is available from the institute’s intranet.

Four-year PhD students appointed at the TI faculties and the Research Qualification

PhD students appointed directly by the TI faculties on four-year PhD contracts with as starting date September 1st 2012 or later need to obtain their TI Research Qualification in order to be entitled to TI facilities as training for the job market and an additional travel budget to participate in an international job market event (usually the AEA meetings in the US). For more information on the TI Research Qualification see Appendix I.

2.6 Job market training

Tinbergen Institute offers a number of facilities to PhD students in their final year who are about to enter the (international) academic job market. TI organizes a series of workshops and mock interview sessions to assist PhD students in successfully preparing for the academic job market in general and in particular for the job market at the AEA meetings (Boston, MA on January 3-5, 2015). Students interested in the mock interviews should attend the workshops as well. It is possible to participate in the workshops without subscribing for the interview sessions. Interested students may sign up for the workshops and interview sessions by sending an email to Arianne de Jong (A.dejong@tinbergen.nl). Details will be announced on the website and emailed to all job market candidates.

See TI's placement record at the TI website: [http://www.tinbergen.nl/placement/](http://www.tinbergen.nl/placement/)

PhD students appointed directly by the TI faculties on four-year PhD contracts with as starting date September 1st 2012 or later need to obtain their TI Research Qualification in order to be entitled to TI facilities as training for the job market and an additional travel budget to participate in an international job market event.
3. The MPhil program in 2014/2015

3.1 Course calendar 2014/2015

All regular TI courses are taught in blocks of eight weeks, with one 2.5-hour lecture in each of the first seven weeks; the eighth week of each block typically serves as an exam week. Attendance to core and field courses is mandatory. Attendance is registered via attendance sheets. In addition, first-year (core) courses have weekly one-hour tutorials, taught by a teaching assistant, in which students work on and discuss homework assignments. Attendance of the MPhil seminar series is mandatory for first-year MPhil students.

The schedule for 2014/2015 is

<table>
<thead>
<tr>
<th>Block I Week 36-43</th>
<th>Block II Week 44-52</th>
<th>Block III Week 1-9</th>
<th>Block IV Week 10-17</th>
<th>Block V Week 18-26</th>
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<tr>
<td>Sep 1-5</td>
<td>Oct 27-29</td>
<td>Dec 29-Jan 2</td>
<td>Mar 2-6</td>
<td>Apr 27-May 1</td>
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<td>Christmas Holidays</td>
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<td>Spring Break</td>
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<td>Sep 8-12</td>
<td>Nov 3-7</td>
<td>Jan 5-9</td>
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3.2 Registration for and withdrawal from courses for MPhil students

First-year MPhil students do not have to register for core courses and the MPhil seminar series. In January, first-year students have to register for the field courses in block V by means of the online registration form.

Second- and higher-year MPhil students should register for field courses (and core courses they have to retake) using the online course registration form on the TI intranet before August 15, 2014. Second-year MPhil students can register for at most 10 field courses (excluding first-year field courses they have to retake). Furthermore, they have to indicate two optional courses they can choose in case one of their selected field courses will be cancelled. MPhil students must ask the Director of Graduate Studies for permission to change their selection of courses by sending an email to courses@tinbergen.nl (see Section 3.4). These requests should be made at least two weeks before the start of the block in which the course takes place. These requests should also be agreed with the prospective MPhil/PhD thesis supervisor (if known at the time of the request).

MPhil students who would like to withdraw from courses should notify Carine Horbach by email (courses@tinbergen.nl) no later than Sunday after the first lecture (all TI courses except intensive
field courses) or the day of the first lecture (intensive TI field courses, marked with ‘*’ in Section 3.4.1, only).

3.3 First year of the MPhil program

In the first year of the MPhil program students have to complete 60 ECTS.\(^4\) The first year Economics, Econometrics and Finance programs include 13 core courses (52 ECTS), 2 field courses (6 ECTS), the course Principles of Programming in Econometrics (1 ECTS), the course Academic Writing and the MPhil seminar series (1 ECTS).

At the start of the academic year, students choose one of the tracks: Economics, Econometrics or Finance. The choice of track will be discussed during the intake interview with the Director of Graduate Studies in the first week of September. To a certain extent, exchange between the tracks is possible.

Students in the Econometrics track take Advanced Econometrics instead of Statistics and Econometrics and Measure Theory and Stochastic Processes instead of Mathematics I. Other students have the option to replace Statistics and Econometrics with Advanced Econometrics and/or Measure Theory and Stochastic Processes with Mathematics I. Students in the Finance track take the finance core courses Asset Pricing and Corporate Finance Theory instead of Macroeconomics II and Macroeconomics III. Other students have this option as well, although students who wish to major in macroeconomics are advised to take Macroeconomics II and Macroeconomics III.

All first-year students have to choose 2 field courses out of a selection of field courses organized in block V (listed in Section 3.3.1). The field courses are chosen at the progress meeting with the DGS which takes place in January.

TI will offer a mandatory course academic writing in the first year of the MPhil program, starting in the academic year 2014/15. The course will have two components:

- Three workshops in Block IV, maximum group size 8 students. Under the guidance of a professional editor, students will learn to use some basic practical tools for evaluating, structuring and revising their writing. Each of the workshops features both instruction and opportunities to put theory into practice. Workshops will be given every other week.
- All field courses in block V will include a paper assignment. Students have to submit one of these papers to the lecturer of the writing course. The student will get written feedback on his/her writing. Grading of the paper by the field course lecturers is separate.

The writing course and the research seminars together will yield 1 credit (pass/fail, no grade).

At predetermined times throughout the first year, the DGS interviews students to discuss their progress in the program. July of each year, the institute’s Examination Board issues a formal advice on continuation in the program to all first-year students. In general, only students who have earned at least 48 ECTS of first year’s credits by July 1 of the first year (July 1, 2015 for the 2014 cohort) and who attended the MPhil seminar series and the writing course are advised to continue in the program (see Section 3.3.5 for information on grading, credits, and retakes in the core). In any case, students will only be admitted to second-year field courses when they have earned 48 core ECTS and meet any additional entrance requirements specific to each field course (see Section 4.1).

\(^4\) Here, ‘ECTS’ refers to course credits according to the European Credit Transfer System.
### 3.3.1 MPhil track in Economics

The standard first-year MPhil track in Economics consists of the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI140</td>
<td>Microeconomics I (Individual Decision Making and General Equilibrium)</td>
<td>Karamychev/Van der Laan</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>TI002</td>
<td>Microeconomics II (Game Theory)</td>
<td>Wakker/Moraga</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI141</td>
<td>Microeconomics III (Information and Contract Theory)</td>
<td>Sloof/Visser</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI142</td>
<td>Microeconomics IV (Behavioral Economics)</td>
<td>Wakker/Offerman</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>TI007</td>
<td>Macroeconomics I (Dynamic Stochastic General Equilibrium Models)</td>
<td>Brügemann</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI008</td>
<td>Macroeconomics II (Macroeconomic Policy)</td>
<td>Stoltenberg</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI009</td>
<td>Macroeconomics III (Frictions and Resource Allocation)</td>
<td>Bartelsman/Gautier</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>TI098</td>
<td>Macroeconomics IV (Financial Frictions in Macroeconomics)</td>
<td>Van Wijnbergen</td>
<td>4</td>
<td>V</td>
</tr>
<tr>
<td>TI010</td>
<td>Mathematics I</td>
<td>Wagener</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>TI082</td>
<td>Mathematics II</td>
<td>Brinkhuis</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>TI012</td>
<td>Statistics</td>
<td>Spreij</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI013</td>
<td>Econometrics I</td>
<td>Fok</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI014</td>
<td>Econometrics II</td>
<td>Hoogerheide</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>TI143</td>
<td>Principles of Programming in Econometrics</td>
<td>Bos</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Students with a sufficient background in statistics and econometrics (see Section 3.6) can replace Statistics, Econometrics I and Econometrics II with:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI015</td>
<td>Advanced Econometrics I</td>
<td>Bos</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI016</td>
<td>Advanced Econometrics II</td>
<td>Van Garderen</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI017</td>
<td>Advanced Econometrics III</td>
<td>Koopman</td>
<td>4</td>
<td>IV</td>
</tr>
</tbody>
</table>

Students who are interested in finance can substitute the first-year courses Macroeconomics II and Macroeconomics III with:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI099</td>
<td>Asset Pricing</td>
<td>Laeven</td>
<td>4</td>
<td>III</td>
</tr>
</tbody>
</table>
In block V one core course is compulsory and students choose two field courses out of the following list:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI044</td>
<td>Experimental Economics</td>
<td>Schram/V.d. Ven</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI119</td>
<td>Behavioral Finance</td>
<td>V.d. Assem/Peters/Zwinkels</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI034</td>
<td>International Economics</td>
<td>Klaassen/Bosker</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI138</td>
<td>Topics in Organization and Markets</td>
<td>Swank/Hinloopen</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI119</td>
<td>Behavioral Finance</td>
<td>V.d. Assem/Peters/Zwinkels</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI138</td>
<td>Topics in Organization and Markets</td>
<td>Swank/Hinloopen</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI134</td>
<td>Spatial Economics</td>
<td>De Groot/V.d. Ploeg/Verhoef</td>
<td>3</td>
<td>V</td>
</tr>
</tbody>
</table>

In both of the selected field courses, students will have to write a field paper. The economic content of the paper will be judged by the lecturer(s), whereas the writing skills part will receive feedback from the writing skills teacher (Mrs Jeanne Bovenberg).

On top of the above field courses, students are recommended to take one of the following TI lectures (if not for credits, attendance is highly recommended):

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI131</td>
<td>TI Economics Lectures</td>
<td>Reis</td>
<td>V</td>
</tr>
<tr>
<td>TI136</td>
<td>TI Econometrics Lectures</td>
<td>Sims</td>
<td>V</td>
</tr>
</tbody>
</table>

Section 4.1 provides course details. Section 4.1 does not explicitly state the core courses’ entrance requirements. However, later course blocks often build on earlier course blocks within, and occasionally across, each of the four core sequences: Microeconomics, Macroeconomics, Econometrics, and Advanced Econometrics. See also Section 3.6 on academic preparations for the core.

Chronologically, by eight-week course blocks, this gives:

<table>
<thead>
<tr>
<th>Block</th>
<th>Microeconomics</th>
<th>Macroeconomics/Finance</th>
<th>Econometrics or Advanced Econometrics</th>
<th>Seminar</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>Principles of Programming</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Micro I (Ind. Decision and General Equilibrium)</td>
<td>Math I or Measure Theory Math II</td>
<td>Research Sem</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Micro II (Game Theory)</td>
<td>Macro I (DSGE Models)</td>
<td>Statistics or Adv. Ectr. I</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Micro III (Information and Contract Theory)</td>
<td>Macro II (Policy) or Asset Pricing</td>
<td>Ectr. I or Adv. Ectr. II</td>
<td>Research Sem</td>
</tr>
<tr>
<td>IV</td>
<td>Micro IV (Behavioral Economics)</td>
<td>Macro III (Frictions) or Corporate Finance</td>
<td>Ectr. II or Adv. Ectr. III</td>
<td>Research Sem + Writing Skills</td>
</tr>
<tr>
<td>V</td>
<td>Field course I</td>
<td>Macro IV (Financial Frictions)</td>
<td>Field course II</td>
<td>Research Sem + Writing Skills</td>
</tr>
</tbody>
</table>

15
### 3.3.2 MPhil track in Econometrics

The first-year MPhil track in Econometrics consists of the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI140</td>
<td>Microeconomics I (Individual Decision Making and General Equilibrium)</td>
<td>Karamychev/Van der Laan</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>TI002</td>
<td>Microeconomics II (Game Theory)</td>
<td>Wakker/Moraga</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI141</td>
<td>Microeconomics III (Information and Contract Theory)</td>
<td>Sloof/Visser</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI142</td>
<td>Microeconomics IV (Behavioral Economics)</td>
<td>Wakker/Offerman</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>TI007</td>
<td>Macroeconomics I (Dynamic Stochastic General Equilibrium Models)</td>
<td>Brügemann</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI008</td>
<td>Macroeconomics II (Macroeconomic Policy)</td>
<td>Stoltenberg</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI009</td>
<td>Macroeconomics III (Frictions and Resource Allocation)</td>
<td>Bartelsman/Gautier</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>TI098</td>
<td>Macroeconomics IV (Financial Frictions in Macroeconomics)</td>
<td>Van Wijnbergen</td>
<td>4</td>
<td>V</td>
</tr>
<tr>
<td>TI083</td>
<td>Measure Theory and Stochastic Processes</td>
<td>Spreij</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>TI082</td>
<td>Mathematics II</td>
<td>Brinkhuis</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>TI15</td>
<td>Advanced Econometrics I</td>
<td>Bos</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI16</td>
<td>Advanced Econometrics II</td>
<td>V. Garderen</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI17</td>
<td>Advanced Econometrics III</td>
<td>Koopman</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>TI143</td>
<td>Principles of Programming in Econometrics</td>
<td>Bos</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Students who are interested in finance can substitute the first-year courses Macroeconomics II and Macroeconomics III with:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI099</td>
<td>Asset Pricing</td>
<td>Laeven</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI100</td>
<td>Corporate Finance Theory</td>
<td>Vladimirov</td>
<td>4</td>
<td>IV</td>
</tr>
</tbody>
</table>

In block V one core course is compulsory and students choose two field courses out of the following list:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI044</td>
<td>Experimental Economics</td>
<td>Schram/V.d. Ven</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI127</td>
<td>Complexity and Behavior</td>
<td>Hommes/Houba</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI119</td>
<td>Behavioral Finance</td>
<td>V.d. Assem/Peters/ Zwinkels</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI034</td>
<td>International Economics</td>
<td>Klaassen/Bosker</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI080</td>
<td>Public Finance</td>
<td>Jacobs</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI138</td>
<td>Topics in Organization and Markets</td>
<td>Swank/Hinloopen</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>TI134</td>
<td>Spatial Economics</td>
<td>De Groot/V.d. Ploeg/ Verhoef</td>
<td>3</td>
<td>V</td>
</tr>
</tbody>
</table>
In both of the selected field courses, students will have to write a field paper. The economic content of the paper will be judged by the lecturer(s), whereas the writing skills part will receive feedback from the writing skills teacher (Mrs Jeanne Bovenberg).

On top of the above field courses, students are recommended to take one of the following TI lectures (if not for credits, attendance is highly recommended):

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1131</td>
<td>TI Economics Lectures</td>
<td>Ricardo Reis</td>
<td>V</td>
</tr>
<tr>
<td>T1136</td>
<td>TI Econometrics Lectures</td>
<td>Chris Sims</td>
<td>V</td>
</tr>
</tbody>
</table>

Section 4.1 provides course details. Section 4.1 does not explicitly state the core courses’ entrance requirements. However, later course blocks often build on earlier course blocks within, and occasionally across, each of the four core sequences: Microeconomics, Macroeconomics, and Advanced Econometrics. See also Section 3.6 on academic preparations for the core.

Chronologically, by eight-week course blocks, this gives:

<table>
<thead>
<tr>
<th>Block</th>
<th>Microeconomics</th>
<th>Macroeconomics/Finance</th>
<th>Econometrics or Advanced Econometrics</th>
<th>Seminar</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Micro I (Ind. Decision and General Equilibrium)</td>
<td>Macro I (DSGE Models)</td>
<td>Measure Theory Math II</td>
<td>Research Sem</td>
</tr>
<tr>
<td>II</td>
<td>Micro II (Game Theory)</td>
<td>Macro II (Policy or Asset Pricing)</td>
<td>Adv. Ecrt. I</td>
<td>Research Sem</td>
</tr>
<tr>
<td>III</td>
<td>Micro III (Information and Contract Theory)</td>
<td>Macro III (Frictions) or Corporate Finance</td>
<td>Adv. Ecrt. II</td>
<td>Research Sem + Writing Skills</td>
</tr>
<tr>
<td>IV</td>
<td>Micro IV (Behavioral Economics)</td>
<td>Macro IV (Financial Frictions)</td>
<td>Field course II</td>
<td>Research Sem + Writing Skills</td>
</tr>
<tr>
<td>V</td>
<td>Field course I</td>
<td>Macro IV (Financial Frictions)</td>
<td>Field course II</td>
<td>Research Sem + Writing Skills</td>
</tr>
</tbody>
</table>

### 3.3.3 MPhil track in Finance

The first-year MPhil track in Finance consists of the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1140</td>
<td>Microeconomics I (Individual Decision Making and General Equilibrium)</td>
<td>Karamychev/Van der Laan</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>T1002</td>
<td>Microeconomics II (Game Theory)</td>
<td>Wakker/Moraga</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>T1141</td>
<td>Microeconomics III (Information and Contract Theory)</td>
<td>Sloof/Visser</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>T1142</td>
<td>Microeconomics IV (Behavioral Economics)</td>
<td>Wakker/Offerman</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>T1007</td>
<td>Macroeconomics I (Dynamic Stochastic General Equilibrium Models)</td>
<td>Brügemann</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>T1099</td>
<td>Asset Pricing</td>
<td>Laeven</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>T1100</td>
<td>Corporate Finance Theory</td>
<td>Vladimirov</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>T1098</td>
<td>Macroeconomics IV (Financial</td>
<td>Van Wijnbergen</td>
<td>4</td>
<td>V</td>
</tr>
</tbody>
</table>
Frictions in Macroeconomics

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI010</td>
<td>Mathematics I</td>
<td>Wagener</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>TI082</td>
<td>Mathematics II</td>
<td>Brinkhuis</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>TI12</td>
<td>Statistics</td>
<td>Spreij</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI13</td>
<td>Econometrics I</td>
<td>Fok</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI14</td>
<td>Econometrics II</td>
<td>Hoogerheide</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>TI143</td>
<td>Principles of Programming in Econometrics</td>
<td>Bos</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Students with a sufficient background in statistics and econometrics (see Section 3.6) can replace Statistics, Econometrics I and Econometrics II with:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI015</td>
<td>Advanced Econometrics I</td>
<td>Bos</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>TI016</td>
<td>Advanced Econometrics II</td>
<td>Van Garderen</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>TI017</td>
<td>Advanced Econometrics III</td>
<td>Koopman</td>
<td>4</td>
<td>IV</td>
</tr>
</tbody>
</table>

Students with a sufficient background in mathematics (see Section 3.6) have the option to replace Mathematics I with:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI083</td>
<td>Measure Theory and Stochastic Processes</td>
<td>Spreij</td>
<td>4</td>
<td>I</td>
</tr>
</tbody>
</table>

In block V one core course is compulsory and students choose two field courses out of the following list:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI044</td>
<td>Experimental Economics</td>
<td>Schram/V.d. Ven</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI127</td>
<td>Complexity and Behavior</td>
<td>Hommes/Houba</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI119</td>
<td>Behavioral Finance</td>
<td>V.d. Assem/Peters/ Zwinkels</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI034</td>
<td>International Economics</td>
<td>Klaassen/Bosker</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI080</td>
<td>Public Finance</td>
<td>Jacobs</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI138</td>
<td>Topics in Organization and Markets</td>
<td>Swank/Hinloopen</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI134</td>
<td>Spatial Economics</td>
<td>De Groot/V.d. Ploeg/ Verhoef</td>
<td>3</td>
<td>V</td>
</tr>
</tbody>
</table>

In both of the selected field courses, students will have to write a field paper. The economic content of the paper will be judged by the lecturer(s), whereas the writing skills part will receive feedback from the writing skills teacher (Mrs Jeanne Bovenberg).

On top of the above field courses, students are recommended to take one of the following TI lectures (if not for credits, attendance is highly recommended):

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI131</td>
<td>TI Economics Lectures</td>
<td>Ricardo Reis</td>
<td>V</td>
</tr>
<tr>
<td>TI136</td>
<td>TI Econometrics Lectures</td>
<td>Chris Sims</td>
<td>V</td>
</tr>
</tbody>
</table>

Section 4.1 provides course details. Section 4.1 does not explicitly state the core courses’ entrance requirements. However, later course blocks often build on earlier course blocks within, and occasionally across, each of the four core sequences: Microeconomics, Macroeconomics,
Econometrics, and Advanced Econometrics. See also Section 3.6 on academic preparations for the core.

Chronologically, by eight-week course blocks, this gives:

<table>
<thead>
<tr>
<th>Block</th>
<th>Microeconomics</th>
<th>Macroeconomics/Finance</th>
<th>Econometrics or Advanced Econometrics</th>
<th>Seminar</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>Principles of Programming</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Micro I (Ind. Decision and General Equilibrium)</td>
<td></td>
<td>Math I or Measure Theory Math II</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Micro II (Game Theory)</td>
<td>Macro I (DSGE Models)</td>
<td>Statistics or Adv. Ectr. I</td>
<td>Research Sem</td>
</tr>
<tr>
<td>IV</td>
<td>Micro IV (Behavioral Economics)</td>
<td>Corporate Finance</td>
<td>Ectr. II or Adv. Ectr. III</td>
<td>Research Sem + Writing Skills</td>
</tr>
<tr>
<td>V</td>
<td>Field course I</td>
<td>Macro IV (Financial Frictions)</td>
<td>Field course II</td>
<td>Research Sem + Writing Skills</td>
</tr>
</tbody>
</table>

### 3.3.4 MPhil research seminar series

Tinbergen Institute organizes the MPhil research seminar series. In these seminars TI fellows will introduce themselves, give a short overview of their research interests, and provide a short description of some ongoing key projects. The seminar aims to (a) raise the visibility of all fellows, not only the visibility of those that teach in the first year; (b) bring students into contact with research topics where TI fellows are active and (c) improve the matching process between student and prospective supervisor, as students get a better perspective of what TI fellows do. The seminars are mandatory for all first year students. Participation will be checked through participation lists. Signing off for fellow students is considered fraud and will disqualify the signee for the 1 ECTS.

### 3.3.5 Grading, credits, and retakes in the core

All core courses are graded on a 1-10 scale, where 1 indicates very poor performance, 6 is the lowest passing grade, and 10 refers to outstanding performance. The final grade for a course block is round off to one decimal as .0 or .5, with the exception of 5.5 which is round off to 6. Grades for homework or midterm examinations do not have to be full or half grades.

All core course blocks will be concluded by a sit-in examination. Apart from the sit-in examination, results of homework assignments form part of the examination and contribute to the final grade for a course block. The final grade for the course block is composed of the average grade for the homework assignments (15%) and the grade for the sit-in examination (85%).

Exams are typically graded within 15 days, and before July 1. Students can review their graded exam papers at the local TI secretariat for up to four weeks after receiving their grade.

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5 Dutch grades are supposed to reflect performance according to some external standard and are not fully calibrated to reflect relative performance in the class. Therefore, Dutch grades do not correspond directly to ECTS grades (which are defined in terms of class percentiles). This being said, it is not uncommon to grade in two rounds and partially adjust first-round grades if these are considered to be too low.
Students obtain 4 ECTS credits for each core course block that they have passed (grade 6 or higher). Within each core course sequence, students may compensate at most one 5 with a 7 (or higher) in another course of the same sequence.

First-year core and field exams cannot be retaken in the same year. Students should retake, in their second year, all course blocks for which they have not obtained credits in their first year. The compensation rule does not apply across years for students who have not earned at least 48 ECTS of first year’s credits by July 1 of the first year and/or have not completed the seminar series and the writing course. For other students, the compensation rule applies across years: Students can compensate a 5 in one year with a 7 in another year. Students cannot resit any examination that they have already passed.

All credits expire 29 months after the date of the exam in which they were earned.

3.4 Second year of the MPhil program

This section focuses on the second year of the MPhil program.

Students should comply with the field-course requirements of the academic year that coincides with their second year in the program. Thus, the rules in this section apply to the 2013 cohort of MPhil students.

In the MPhil program’s second year, students have to choose a research major (i.e. pass 4 field courses within the same research major). The research majors (corresponding to the the TI research groups) are the following:

1. Behavioral and Experimental Economics (BEE)
2. Cooperative Behavior, Strategic Interaction, and Complex Systems (CSC)
3. Econometrics and Operations Research (ECTOR)
4. Finance (FIN)
5. Macroeconomics and International Economics (MIE)
6. Labor, Health, Education and Development (LHED)
7. Organizations and Markets (OM)
8. Spatial, Transport, and Environmental Economics (STEE)

Students who wish to graduate in the Econometrics track should choose the Econometrics track in the first year (see above) and take their research major in Econometrics (ECTOR); students who wish to graduate in the Finance track should choose the Finance track in the first year (see above) and take their research major in Finance (FIN).

In principle, all major options are open as long as students meet the entrance requirements determined for field courses within that major.

In the second year, students have to

(i) complete 30 ECTS of specialized coursework, taking at least 4 courses in their research major field (the “field requirement”).

Courses in each of the eight fields that count towards the fields requirement (field courses) are listed in Section 3.4.1. The remaining course credits can be obtained by following any other field courses listed in Section 3.4.1 or external courses and workshops not listed in Section 3.4.1 (see Section 3.4.4).

Field courses may be cancelled if less than five (internal and external) students sign up.

To limit uncertainty about field-course offerings to a minimum, there are strict rules for registration by TI students (Section 3.2.1). MPhil students are only allowed to register for a field course if they have completed at least 48 ECTS of first year’s credits by July 1 of the
first year and have completed the seminar series. Furthermore they have to meet the specific entrance requirements for that field course (see Section 4.3). At a minimum, students should register for a full program of field courses, that is a program that satisfies the requirements stated above. Students should register for 10 field courses plus two optional field courses, which can be chosen if one of their selected courses will be cancelled. Students need approval from the Director of Graduate Studies to sign up for or withdraw from field courses after the initial registration.

The number of TI credits (typically 3 ECTS) allocated to a (field) course may not coincide with the number of credits allocated to the same course in external programs. This holds, for example, for courses shared with the Duisenberg program and with the EUR/UV/A/VU programs. This also holds for TI core courses followed as field courses by students for whom this course was not part of their standard core: the course load in these cases is 3 ECTS.

The philosophy underlying this is that we require students to take 10 different courses in their second year to specialize in their areas of interest as well as to broaden their perspective. To avoid any discussion about the relative load of different credits in different programs, we adopt a simple uniform policy of allocating 3 ECTS to every field course.

(ii) write and publicly defend an MPhil thesis.

The MPhil thesis (30 ECTS; see Section 3.4.6) is the final examination of the MPhil program.

The thesis can only be defended if all other course work has been completed.

Students who are not able to finish the MPhil program before the end of their second year can register with their university for a third year to complete the MPhil program. However, students are strongly advised to avoid such an extension, because it complicates the matching to PhD employment positions and requires the payment of tuition fees for a third year (see Section 2.1.3). In any case, all students are advised to complete the program within 30 months after enrolment (before February 28, 2016, for the 2013 cohort). It is impossible to complete the program later, because all credits expire 29 months after the corresponding exam.

TI organizes one graduation ceremony each year, usually in November.

3.4.1 Field courses

Course codes marked by "**" refer to intensive courses. This means a course given in a different format (for instance 3 continuous days of two lectures a day). See the field course schedule for details.

1. Behavioral and Experimental Economics (BEE)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI044</td>
<td>Experimental Economics</td>
<td>Schram/Van de Ven</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI043</td>
<td>Risk and Rationality</td>
<td>Wakker</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>TI105</td>
<td>Evolutionary Game Theory</td>
<td>Van Veelen</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>TI132*</td>
<td>Putting Behavioral Economics to Work</td>
<td>Gneezy</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI130</td>
<td>Mechanism Design and Market Institutions</td>
<td>Onderstal/Hu</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>TI119</td>
<td>Behavioral Finance</td>
<td>Peters/V.d. Assem/ Zwinkels</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>TI128</td>
<td>Economics of Networks</td>
<td>Van der Leij/Lindner</td>
<td>3</td>
<td>II</td>
</tr>
</tbody>
</table>
2. **Cooperative Behavior, Strategic Interaction, and Complex Systems (CSC)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1126</td>
<td>Behavioral Macroeconomics</td>
<td>Hommes</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1127</td>
<td>Complexity and Behavior</td>
<td>Hommes/Houba</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1128</td>
<td>Economics of Networks</td>
<td>Van der Leij/Lindner</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>T1104</td>
<td>Advanced Game Theory: Applications of Bargaining and Network Theory</td>
<td>Houba/Van der Brink</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>T1119</td>
<td>Behavioral Finance</td>
<td>V. d. Assem/Peters/Zwinkels</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1044</td>
<td>Experimental Economics</td>
<td>Schram/Van de Ven</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1105</td>
<td>Evolutionary Game Theory</td>
<td>Van Veelen</td>
<td>3</td>
<td>III</td>
</tr>
</tbody>
</table>

3. **Econometrics and Operations Research (ECTOR)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1022</td>
<td>Advanced Time Series Econometrics</td>
<td>Boswijk/D. van Dijk/Franses</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>T1023</td>
<td>Computational Econometrics</td>
<td>Paap</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>T1136*</td>
<td>TI Econometrics Lectures 2015</td>
<td>Sims/H.K. van Dijk/Fok</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1015</td>
<td>Advanced Econometrics I</td>
<td>Bos</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>T1016</td>
<td>Advanced Econometrics II</td>
<td>Van Garderen</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>T1017</td>
<td>Advanced Econometrics III</td>
<td>Koopman</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>T1101</td>
<td>Applied Microeconometrics I: Basic Techniques</td>
<td>Van Vuuren</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1102</td>
<td>Applied Microeconometrics II: Empirical Treatment Evaluation</td>
<td>Van der Klaauw</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>T1116</td>
<td>Applied Macroeconometrics</td>
<td>Giuliodori/Mavromatis/Pozzi</td>
<td>3</td>
<td>I</td>
</tr>
</tbody>
</table>

4. **Finance (FIN)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1119</td>
<td>Behavioral Finance</td>
<td>Peters/V. d. Assem/Zwinkels</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1078</td>
<td>Institutions and Financial Structure</td>
<td>Perotti</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>T106</td>
<td>Dynamic Corporate Finance</td>
<td>Gryglewicz</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1055</td>
<td>Financial Crises</td>
<td>Van Wijnbergen</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>T107</td>
<td>Banking</td>
<td>Perotti</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1135*</td>
<td>Systemic Risk and Financial Crises (TI Finance Lectures 2014)</td>
<td>Allen</td>
<td>3</td>
<td>I</td>
</tr>
</tbody>
</table>
### 5. Macroeconomics and International Economics (MIE)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1117*</td>
<td>Numerical Methods</td>
<td>Den Haan</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>T1034</td>
<td>International Economics</td>
<td>Bosker/Klaassen</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1036</td>
<td>Advanced Monetary Economics</td>
<td>De Vries</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1137</td>
<td>Topics in Advanced Macroeconomics</td>
<td>Stoltenberg/Brugemann</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>T1103</td>
<td>The Macroeconomics of Pensions and Ageing</td>
<td>Beetsma/Romp</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>T1116</td>
<td>Applied Macroeconometrics</td>
<td>Giuliodori/Mavromatis/Pozzi</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1080</td>
<td>Public Finance</td>
<td>Jacobs</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1108</td>
<td>The History of Modern Economics</td>
<td>Boumans</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>T1131*</td>
<td>New Style Central Banking (TI Economics Lectures 2015)</td>
<td>Reis</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1055</td>
<td>Financial Crises</td>
<td>Van Wijnbergen</td>
<td>3</td>
<td>II</td>
</tr>
</tbody>
</table>

### 6. Labor, Health, Education and Development (LHED)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1101</td>
<td>Applied Microeconometrics I: Basic Techniques</td>
<td>Van Vuuren</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1102</td>
<td>Applied Microeconometrics II: Empirical Treatment Evaluation</td>
<td>Van der Klaauw</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>T1032</td>
<td>Development Economics</td>
<td>Ebers</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>T1029</td>
<td>Labor Economics</td>
<td>Bloemen/Hochguertel</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1031</td>
<td>Health Economics</td>
<td>O’Donnell/Van Eijk/Lindeboom</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>T1030</td>
<td>Economics of Education</td>
<td>Plug</td>
<td>3</td>
<td>IV</td>
</tr>
</tbody>
</table>

### 7. Organizations and Markets (OM)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer(s)</th>
<th>ECTS</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1138</td>
<td>Topics in Organization and Markets</td>
<td>Hinloopen/Swank</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>T1038</td>
<td>Industrial Organization</td>
<td>Moraga</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1039</td>
<td>Applied Industrial Organization</td>
<td>Fershtman/Hinloopen</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>T1041</td>
<td>Law and Economics</td>
<td>Dari-Mattiacci</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>T1130</td>
<td>Mechanism Design and Market Institutions</td>
<td>Onderstal/Hu</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>T1129*</td>
<td>Genoeconomics</td>
<td>Koellinger</td>
<td>3</td>
<td>IV</td>
</tr>
</tbody>
</table>

*Course organized by Duisenberg school of finance and scheduled independently from TI.
Students in the second year of the program may also choose core courses as field courses that they did not take in their first year. The course load for each course will be 3 ECTS. This offers students ample flexibility to engage in a PhD in the intersection between fields. For example, a finance student interested in macro-finance can choose to take the core courses of macro from the Economics track into his/her menu of field courses.

### 3.4.2 Field papers

Regular TI field courses are assessed by an exam and/or take home assignments, but not full papers. Instead, second-year MPhil students have the option to write a short field paper for 3 ECTS field course credits. A field paper is an original theoretical or empirical contribution (size 15-20 pages). The paper is connected to a field course that the student has passed, but stands on its own and is an extension of material taught in the course. The lecturer of the field course grades the field paper. The field paper does not count towards the major field requirements.

Students should register for a field paper at the start of the year, but do not have to commit to a topic or course for the paper. Instead, students should contact the lecturer during the course to agree on a paper topic and deadline. Students should report the course and lecturer for which they write their field paper to Carine Horbach (courses@tinbergen.nl) as soon as possible, and never later than block IV, so that the institute can arrange the registration of the field paper's grade.

Papers can only be written for field courses. For practical reasons, field papers cannot be written for courses taught by external lecturers.
3.4.3 Seminars

Apart from the MPhil seminar series organized for first year students, the institute’s fellows and students organize a wide variety of seminar series. Student participation in seminars is highly recommended, but not rewarded with course credits. Seminar schedules can be found at www.tinbergen.nl.

3.4.4 Other courses and workshops

Courses organized by other graduate schools or by inter-university networks may qualify for field credits in the MPhil program. Students who want to follow courses that are not listed in Section 3.4.1 for credits should contact the Director of Graduate Studies in advance. Furthermore, they need approval from the Examination Board.

Some courses and workshops involve fees, substantial travel, and other costs. Note that costs are reimbursed according to the regulations and procedures outlined in the separate brochure “Facilities - Funding – Refunding. Information for MPhil and PhD students” that is available from the institute’s intranet.

3.4.5 Matching to an MPhil thesis and possible PhD thesis supervisor

Ideally, second-year students match up with an MPhil thesis supervisor before the end of December.

To support the matching process, the institute complements the first year’s seminar series (see Section 3.3.4) with information about existing PhD proposals that are originally granted for four-year PhD positions.

MPhil students should bear in mind that the MPhil thesis is a first step towards a PhD thesis. Students are advised to check with their prospective MPhil thesis supervisor under what conditions they can transfer to a paid PhD position with that same supervisor. Together, the three faculties have a number of three-year PhD employment positions available to offer to students who successfully complete the MPhil program. However, this does not guarantee that all students find a match with a supervisor. Also, for distributional reasons it may be harder to transfer with one supervisor in one departmental research group than with another supervisor in another group. Formalities concerning the possible transfer to a PhD position will be arranged in the MPhil Thesis Workshop, to be scheduled at the beginning of block IV (see Section 3.4.6).

Students should inform TI as soon as they have found an MPhil thesis supervisor by sending an email to mphilthesis@tinbergen.nl. Students who have not found a supervisor by December 1 will be contacted by the Director of Graduate Studies. Of course, students should contact the Director of Graduate Studies before December 1 if they need help in finding a supervisor.

3.4.6 MPhil thesis

Half of the second year of the MPhil program is devoted to writing a first major research paper, the MPhil thesis. The thesis is written under supervision of one of the institute’s research fellows. It should be defended in a public one-hour seminar at the institute before a thesis committee consisting of the MPhil supervisor and two other research fellows of the institute. A grade is awarded to the MPhil thesis at the end of the seminar. The thesis should have the format and size of a research paper that can be submitted to an international, peer-reviewed journal in economics. However, the committee should bear in mind that students only have half a year (30 ECTS) to work on their thesis. Therefore, the committee should expect a good first, but not a final, draft of

\footnote{In exceptional cases, the committee may include members who are not research fellows of the institute.}
such a paper. The draft should have sufficient quality to be publishable in such a journal after further polishing.

The MPhil thesis procedure is the following:

I. Supervisor and commitment (December)

1. Second-year students should have found a thesis supervisor before the end of December 2014.
2. Students and supervisors are requested to fill out the PhD proposal form and email the form to mphilthesis@tinbergen.nl. The PhD transfer form and the student’s grade list will be submitted to the supervisor’s department.

II. MPhil thesis workshops (February/March)

3. The MPhil thesis workshop will be scheduled at the beginning of block IV. All second-year students will get 15 minutes (including question-time) to present their MPhil thesis plans. The workshop is intended to help the student to get going with the thesis but is also used by TI to coordinate the allocation of the PhD positions available for TI MPhil students at the three university faculties. Departmental representatives may attend the MPhil Thesis Workshop to meet the PhD candidates. The university faculties will take tentative PhD funding decisions in the period following the Workshop. This may involve interviews with the students.

III. Defense (July/August)

4. As soon as the supervisor considers the thesis ready to be defended the supervisor informs TI by sending an email to mphilthesis@tinbergen.nl. The Director of Graduate Studies will ask the supervisor to suggest possible committee members. At least one of the committee members should be affiliated to a different university than the supervisor. The DGS establishes the committee.
5. The student sets a date for the defense seminar (after consultation with the supervisor and other committee members). The student is responsible too for booking a room at TIA or TIR and informing TI about date/time/location of the seminar. TI confirms the data concerning the seminar to the student and the committee, informs about the further procedure and announces the seminar on the website.
6. The student must send a final PDF of the thesis and a word document of the abstract to mphilthesis@tinbergen.nl and to the committee members well before the defense.
7. The thesis can only be defended if all other course work has been completed and graded.
8. The seminar itself takes one hour:
   0-45” Presentation by the student (possibly interrupted by discussion);
   45-55” Comments and questions (by the committee in particular);
   55” All except the committee members leave the room;
   55-60” The committee decides upon the grade and completes the gradeform;
   60” The student is called back in and the grade is discussed.
9. All students should defend their thesis before September 1, 2015. The implication of not meeting this deadline is that you have to re-enrol at your host university.

3.4.7 Grading, credits, and retakes in the fields

All field courses and the MPhil thesis are graded on a 1-10 scale (see also Section 3.3.5). The final grade for a field course is round off to one decimal as .0 or .5, with the exception of 5.5 which is round off to 6. Grades for homework or midterm examinations do not have to be full or half grades. This new stipulation applies to all students registered for the academic year 2014/15, without a transition period. The results on core courses for the 2013-2015 cohort remain unchanged, so rounded off to the nearest integer on a scale from 1-10.

Performance in field courses is assessed by a final (oral, take-home, or written sit-in) exam. Oral and written sit-in exams take place in the exam week; a take-home exam should have a deadline
no later than three weeks after the course’s final lecture. Home work assignments and class participation may contribute to the grade. See the individual courses’ descriptions in Section 4.3 for details.

Exams are typically graded within 15 days, and before July 1. Students can review their graded exam papers at the local TI secretariat up to four weeks after receiving their grade.

Credits are obtained for a field course block or the MPhil thesis only if it is completed with a final grade of 6 or up. Failing grades cannot be compensated.

There are no scheduled retakes for exams for field courses with a TI code.

All credits expire 29 months after the date of the exam in which they were earned. Students cannot resit any examination that they have already passed.

3.5 The Academic and Examination Regulations and the MPhil’s boards

The MPhil’s Academic and Examination Regulations provide details on the program’s admission and examination procedures and can be downloaded from the institute’s intranet.

Here, we will provide some additional information on the Admission Board (Section 3.5.1), the Examination Board (Section 3.5.2), and the Educational Board (Section 3.5.3).

3.5.1 Admission Board

The Admission Board consists of representatives of the three faculties. The Admission Board decides on admissions to the program and on funding.

Current students will only have to deal with the Admission Board when it decides on second-year funding. At the end of the first year, the DGS will discuss second-year funding with all first-year students and propose funding arrangements to the Admission Board. Students should not contact the Admission Board directly.

3.5.2 Examination Board

The Examination Board consists of representatives of the three faculties. The responsibilities and tasks of the Examination Board are explained in the Academic and Examination Regulations.

There are two reasons why a student may contact the Examination Board:

1. The Examination Board decides on deviations from the curriculum that may have a bearing on the diploma. Therefore, any request for replacement of parts of the curriculum through education provided by third parties, exemptions, postponement of deadlines, etcetera, should be sent to the Examination Board.
2. Students should try to settle disputes about examinations with the lecturer first, and contact the DGS if the dispute remains. Students may submit disputes that cannot be solved this way to the Examination Board for arbitration.

In both cases, an email to examinationboard@tinbergen.nl suffices.

Reversely, the Examination Board will provide the student with formal study advice (see Section 3.3) and may take measures against a student in the case of fraud or misbehavior. Appeals

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8 This brochure explains some of these regulations and also serves as an appendix to these regulations (that is, it is the “Study Guide” referred to in the regulations). In case of conflicts between this brochure and the Academic and Examination Regulations, the text of the Academic and Examination Regulations is binding.
against such decisions should be sent in writing to

Examination Board
Tinbergen Institute
Burg. Oudlaan 50
3062 PA Rotterdam
The Netherlands

To speed up this process, students should also send their appeal by email to examinationboard@tinbergen.nl.

3.5.3 Educational Board

The Educational Board consists of three MPhil students and three TI fellows. The Director of Graduate Studies is secretary to, but not member of, the Educational Board. The Educational Board provides advice, both solicited and unsolicited, to the Board of the Tinbergen Institute, the Faculty Boards and to the Faculty Councils on all matters concerning the educational program. It meets twice a year or more often if considered necessary by one or more of the members.

The Educational Board has decided to organize its two regular meetings around the half-yearly MPhil evaluation meetings organized by the Students’ Council. This provides students with a channel to voice their concerns about the MPhil program. Students may also contact the Educational Board directly with general concerns about the educational program. Students should not contact the Educational Board to solve individual disputes that are in the domain of the Examination Board.

3.6 Academic preparations

Depending on their educational background, students may want to prepare academically for one or more core sequences before they come to TI.

3.6.1 Microeconomics

Students lacking a strong background in economics will benefit from studying some undergraduate text book in intermediate microeconomics before they come to TI, such as

- Perloff, J.M. (2008), *Microeconomics* (Fifth Edition), Addison Wesley
- Pindyck, R. and D. Rubinfeld (2008), *Microeconomics* (Seventh Edition), Prentice Hall

3.6.2 Macroeconomics

Students without a strong background in economics are advised to study some undergraduate macroeconomics texts before the start of Macroeconomics I in November, such as

- Mankiw, N.G. (2010), *Macroeconomics* (Seventh Edition), Worth
and ideally also


### 3.6.3 Asset Pricing and Corporate Finance

Students without a strong background in finance that want to specialise in finance are advised to study the following undergraduate finance texts in Corporate Finance, Financial Economics, and Financial markets:


and ideally also


### 3.6.4 Mathematics

Mathematics I is an ambitious math refreshment course. This course should be useful to most students, but those with a very strong math background may be exempted from Mathematics I class attendance and home works (but not the exam). Mathematics II treats some methods of optimization and computer programming in econometrics.

All incoming students are supposed to be familiar with the basics of the usual maths courses for undergraduate students in economics:

- a. Functions of one variable: linear functions, quadratic functions, polynomial functions, power functions, exponential functions, logarithmic functions, inverse functions.
- b. Differentiation: relation with tangent, rules for differentiation (including product rule, quotient rule, chain rule), linear approximation, Taylor approximation.
- c. Integration: indefinite and definite integrals, primitive of a function, relation with area.
- d. Linear equations: matrix and vector notation, Gaussian elimination, matrix multiplication, transpose.

Students lacking a strong math background should prepare before they come to TI, using any textbook on mathematics for economists that treats these topics, such as


or the textbooks on Calculus and Linear Algebra used for Mathematics I (see Section 4.2). One source of many useful exercises is:

- Van de Craats, J. and R. Bosch (2009), *Basisboek Wiskunde* (2e editie), Pearson
  (staff.science.uva.nl/~craats/)

This Dutch-language book is useful for all who need to prepare for Math, including those who cannot read Dutch. It is very compact and the left-hand pages of this book give many exercises, mostly in terms of mathematical symbols so that there is no need to understand the accompanying Dutch text. However, this book does not contain exercises on vectors and matrices. Schaum’s Outline books on *Calculus and on Linear Algebra (Vectors and Matrices)*, published by McGraw-Hill, contain many useful exercises as well.
3.6.5 Econometrics

Students in the standard track should read Chapter 1 of the book used in this track’s first course (TI1304),


before the start of Statistics and Econometrics in November.

The advanced track aims at students who already master econometrics at the level of the standard track.

3.6.6 Principles of Programming in Econometrics

Students are expected to have prepared for the course, by studying in advance the basics of the syntax of Matlab, as summarized in ppectr_syntax.pdf, available on the TI blackboard page (www.eur.edu).

Details about the general programming techniques will follow in the course, but we will assume you are able to fill in the details on the syntax yourself.

Optionally, as further background material, you could work through "Matlab(r) 7, Getting started guide" (http://www.mathworks.com/help/pdf_doc/matlab/getstart.pdf) before the start of the course Principles of Programming in Econometrics.
4. Course descriptions

4.1 Core courses

This section does not explicitly state the core courses’ entrance requirements. However, all students in core courses should have the academic background expected from a successful MPhil applicant (see Section 2.1.2) and, if necessary, prepare as suggested in Section 3.6. Moreover, note that later core course blocks often build on earlier course blocks within, and occasionally across, each of the core sequences.

A core course block consists of 2.5 hours of weekly lectures with regular homework assignments and 1 hour tutorial, during 7 weeks. A teaching assistant (TA) gives the weekly tutorials and has a weekly office hour (time and place are announced in the first lecture).

4.1.1 Micro Sequence

TI140 MICROECONOMICS I (Individual Decision Making and General Equilibrium)

Lecturers: Dr V. Karamychev (EUR) and Prof. G. van der Laan (VU)

Short subject description:
The course “Microeconomics I” is the fundamental microeconomics course which studies individual decision-making and its relation to market clearing price formation. It builds on classical consumer choice theory. Then, individual behaviours are further integrated into a closed and interrelated system in which the equilibrium values of all variables are simultaneously determined. This is in contrast to the partial equilibrium approach, where all variables, which are not directly related to the problem at hand, are taken to be given. Thus, the course develops a theory that attempts to predict the complete vector of individual final consumptions and individual productions from the fundamentals of the economy.

Course content:

Course objective:
After completing the course students will be able to:
1. Identify and explain economic concepts from the theory of individual decision making.
2. Compute individually rational behavior of an economic agent in any economic environment.
3. Identify potential links between different elements of individual behavior that follow from the theory.
4. Apply the theory of individual decision making to general equilibrium theory
5. Identify the necessary conditions for market efficiency and the factors that lead to inefficiencies.
6.Identify potential pitfalls for using applied general equilibrium models in complex economic environments.


TI002 MICROECONOMICS II (Game Theory)

Lecturers: Prof. P.P. Wakker (EUR) and Prof. J.L. Moraga-Gonzalez (VU)
**Short subject description:**
Classical game theory to analyze, mostly mathematically, strategic interactions, cooperatively or not, between two or more rational parties, mostly leading to equilibria.

**Course contents:**
Since the 1970s, questions about material supply and demand have become less central in economics, and questions about human interactions and information have become more central. Game theory provides the basic tools for investigating the societal inefficiencies due to selfish strategic behavior of individuals, and ways to minimize those inefficiencies. In its first years, game theory was purely theoretical, so as to develop its basic concepts. It was later extended to experimental economics, and nowadays its tools are used in virtually every economic discipline.

**Course objective:**
After having completed the course students:
- can use general techniques to determine outcomes, usually equilibria, in many strategic situations,
- can see through conflicts, incredible threats, possibilities for cooperation, bargaining, voting, proper incentives, moral hazard, evolutionary stability, optimal choice of spouse (!), and adverse selection.
- learn the subtle counterfactual reasoning typical of strategic interactions between two or more rational beings.

**Literature:**
Compulsory:
Recommended (optional):
- Tadelis, Steven (2013). *Game Theory: An Introduction*, Princeton University Press, Princeton, NJ. (Very didactical, but too elementary for this course. Good background if this course is difficult)

**TI141 MICROECONOMICS III (Information and Contract Theory)**

**Lecturers:** Prof. R. Sloof (UvA) and Prof. B. Visser (EUR)

**Short subject description:**
Contract theory deals with the question of how economic agents (optimally) structure contractual relationships in the presence of asymmetric information.

**Course contents:**
Economics is about the creation of value through markets, organizations and other institutions. Asymmetric information and bounded rationality may get in the way of value creation. This course presents a number of insights from contract theory for dealing with these twin problems. It starts with moral hazard, and adverse selection in elementary settings, then turns to multidimensional incentive problems, contracts for teams, relational contracts, incomplete contracts, decision rights and authority, and asset ownership. It ends with a discussion of cheap talk and communication. These topics are approached by applying contract theory to problems in labour economics, organizational economics, and corporate finance.

**Course objective:**
After this course students are:
- Familiar with basic models and techniques used within contract theory
- Able to solve for the optimal contract in some standard contractual settings studied in the literature using game-theoretic techniques.
- Aware of the implications and limitations of contract theory for making sound empirical predictions

**Literature:**

**Compulsory:**
- Selected papers

**Recommended (optional):**
- Selected papers

**T142 MICROECONOMICS IV (Behavioral Economics)**

**Lecturers:** Prof. P.P. Wakker (EUR) and Prof. T.J.S. Offerman (UvA)

**Short subject description:**
Behavioral economics (increasing empirical realism using psychology).

**Course contents:**
This course consists of two parts. One part deals with the behavioral revolution in economics, where differences between homo sapiens and homo economicus ask for a rewriting of individual risk behavior, individual intertemporal behavior, individual utility, and, thus, of virtually all economic models. The other part considers the path-breaking insights of behavioral economics for interactive decision making. Special attention will be dedicated to how behavioral economics changed the thinking on learning, equilibrium, social preferences, strategic communication and markets.

**Course objective:**
Students can carry out empirical measurements, quantitative predictions, and economic applications of psychological insights (changing homo economicus into homo sapiens) into the area of their own research interest.

**Literature:**

**Offerman:**
- Reader: TBA

**Wakker:**

**4.1.2 Macro Sequence**

**T1007 MACROECONOMICS I (Dynamic Stochastic General Equilibrium Models)**

**Lecturer:** Dr B. Brügemann (VU)

**Short subject description:** This course provides an introduction to stochastic neoclassical growth models. Mainstream macroeconomics builds on this class of models for many applications, including business cycles and growth.
Course contents:
This course introduces you to stochastic neoclassical growth models. These are basic models of the macroeconomy which build on general equilibrium theory. Standard consumer and producer theory is used to model the behaviour of households and firms. Markets are perfectly competitive and complete in these models, and typically bring about an efficient allocation of resources. In this sense there are no frictions or market failures. This class of models has been used to study a large variety of issues in macroeconomics, including business cycles, growth, and asset pricing. These models are useful for several reasons. First, they are useful in understanding the efficient allocation of resources. Second, if in the context of a particular application the relevant empirical evidence appears inconsistent with an efficient allocation of resources, then the precise nature of the discrepancy can indicate what type of frictions ought to be included in the model. Third, elements of the neoclassical growth model are important building blocks of macroeconomic models with frictions. For example, so-called Dynamic Stochastic General Equilibrium (DSGE) models are a class of models that is widely used to study monetary and fiscal policy, and they are constructed by introducing a variety of frictions into basic stochastic neoclassical growth models. We will start by studying elements of general equilibrium theory needed for macroeconomics, with a focus on modelling dynamics and uncertainty. Having covered these basics, we will study different versions of the neoclassical growth model, specifically a version with infinitely-lived households and a version with overlapping generations of finitely-lived households. We will use these models to take a first pass at applications to business cycles, growth, and asset pricing. To study quantitative implications we need to solve the models numerically. You will practice basic techniques for doing so in problem sets, specifically dynamic programming and linearization. Mainstream macroeconomics has used neoclassical growth models as a starting point to investigate a large variety of research questions. This reliance on neoclassical growth models has sometimes prompted criticism. We will briefly examine such criticisms and proposed alternatives. The goal here is not to present alternatives in detail, but to use the perspective of critics to obtain a better appreciation of the strengths and limitations of the mainstream approach.

Course Objective:
After the course students are:

- familiar with elements of general equilibrium theory needed for macroeconomics;
- familiar with stochastic neoclassical growth models;
- able to numerically solve basic stochastic neoclassical growth models using dynamic programming or linearisation;
- aware of the strengths and limitations of the mainstream approach of using neoclassical growth models as a starting point for investigating a variety of research questions.

Literature:

- Lecture notes, to be published on blackboard

TI008  MACROECONOMICS II (Macroeconomic Policy)

Lecturer: Dr C.A. Stoltenberg (UvA)

Short course description:
In Macroeconomic Policy, we study the optimality of fiscal and monetary policies in a general equilibrium context.

Course contents:
The course builds on Macroeconomics I and applies dynamic stochastic general equilibrium models to the analysis of monetary and fiscal policy. It consists of four main parts. In the first part, a basic competitive equilibrium framework is developed which serves as the main building block for the course. The second part focuses on the role of fiscal policy. Here, effects of government spending, the role of public debt, and optimal taxation under commitment will be discussed. The third part introduces money into the framework and derives principles for optimal monetary policy...
under perfectly flexible prices. Further, the issues of monetary policy implementation and the
determination of the price level will be addressed. The last part extends monetary policy analysis
to the case where prices are imperfectly flexible. Within this framework optimal monetary policy
under commitment and discretion will be examined, and interactions between monetary and fiscal
policy will be discussed

Course objectives:
In this class, students learn how to:

- solve dynamic stochastic general equilibrium models
- show whether a long-run equilibrium exists and is unique
- derive conditions for a unique set of stable equilibria
- formally compute optimal tax and monetary policies in general equilibrium models
- understand the economic mechanism why a certain policy is optimal.

Literature:
  Cambridge Massachusetts: The MIT Press
  Massachusetts: The MIT Press

TI009 MACROECONOMICS III (Frictions and Resource Allocation)

Lecturers: Prof. E.J. Bartelsman (VU) and Prof. P. Gautier (VU)

Short subject description:
This course extends macro models to analyze the effects of frictions in hiring and investment on
firm dynamics and labor market outcomes.

Course contents:
Key macro indicators—unemployment, GDP, and productivity growth—may not follow the optimal
paths determined in a frictionless economy. Recent models are much more careful in dealing with
frictions agents face in reality, such as entry and exit fees, delays in finding transaction partners,
information asymmetries, and limited contract enforcement. In this course, we explore the
implications of heterogeneous agents facing various frictions that frustrate the allocation of
resources in labor, capital and product markets.

By studying these models, students not only learn key aspects of three important topics in
macroeconomics, namely labor market developments, business cycle analysis, and long-run
growth, but also key building blocks that are useful by themselves.

We briefly discuss empirical regularities observed in the data regarding labor markets, firm
demographics and productivity growth. After highlighting the difficulties of standard models to
explain these regularities, we explore recent modifications. We start with growth models of
heterogeneous firms and study the implications of frictions for static and dynamic efficiency.

Special attention will be paid to frictions in capital investment. Next, we turn to the labor market
and discuss different ways to model how agents search, match, and bargain over prices. More
specific examples are wage posting, Nash bargaining, and directed search.

Course objective:
- Understand and use the tools (game theory, dynamic programming) that are used in this
  literature.
- Learn how to formulate models that are rich in terms of the factors necessary to
  understand the key mechanisms for the questions at hand and abstract from irrelevant
details.

Literature:
  937X.2006.00389.x

**T1098 MACROECONOMICS IV (Financial Frictions in Macroeconomics)**

*Lecturer:* Prof. S.J.G. van Wijnbergen (UvA)

*Short subject description:*
This course focuses on why finance and financial structure matters for macroeconomics.

*Course contents:*
We draw on recent developments in microeconomic research on information asymmetries to introduce financial frictions in macroeconomics. We pay special attention to the concept of financial fragility and to the macroeconomic causes and consequences of financial crises.

*Course objective:*
The course intends to introduce students to currently ongoing research on financial frictions and macroeconomics; after this course students should be able to actively take part in this research agenda.

*Literature:*
• Tirole, J. (2011). *ILLiquidity and all its Friends*, JEL
• Philipon, Th. (2010). *Debt overhang and Recapitalization in Closed and Open Economies*, IMF ER
• Myers (1977). Determinants of Corporate Borrowing, JFE
• Benmelech, E. and N. Bergman (2012). *Credit traps*, AER
• Lecture Notes

4.1.3 Econometrics Sequence

**TI010 MATHEMATICS I**

*Lecturer:* Dr ir F.O.O. Wagener (UvA)

*Short subject description:* Mathematics I is a fast-paced refresher course of fundamental mathematical notions and techniques that are used ubiquitously in economics and finance.

*Course contents:*
Week 1: Linear equations, matrices and their determinants (ELA, chapters 1 and 2)
Week 2: Vector spaces and linear transformations (ELA, chapters 3, 4 and 8)
Week 3: Eigenvalues, eigenvectors and diagonalisation (ELA, chapters 5 and 7)
Week 4: Functions of several variables (CCM, chapters 3 and 5)
Week 5: Inverse and implicit functions and differentials (CCM, chapters 7, 8 and 9)
Week 6: Integration (CCM, chapters 10 and 11)
Week 7: Complex numbers and differential equations (CCM, chapters 12, 13 and 14)

ELA: Anton & Rorres, “Elementary Linear Algebra”
CCM: Binmore & Davies, “Calculus: Concept and Methods”

*Course objective:* After this course, students are familiar with the basic notions of Linear Algebra – vector spaces, linear transformations and their matrices, as well as their most important properties – and their application to Multivariate Analysis. In particular, they are able to evaluate integrals of functions of several variables, manipulate implicitly defined functions and solve linear differential equations.

*Literature:*
• Howard Anton and Chris Rorres (2010). *Elementary Linear Algebra with Applications* (10th edition), Wiley

**TI082 MATHEMATICS II**

*Lecturer:* Dr J. Brinkhuis (EUR)

*Short course description:* Mathematics II studies all optimization methods.

*Course contents:* This course starts with a brief review of finite dimensional optimization: necessary and sufficient conditions of optimization (stationary, Lagrange, KKT), existence of solutions (Weierstrass) and sensitivity analysis (shadow price). Then indefinite dimensional optimization is discussed: the three methods of dynamic optimization: 1) Calculus of Variation (Euler-Lagrange, transversality), 2)
Optimal Control (Pontryagin’s Maximum Principle, Hamiltonians), 3) Dynamic Programming (Bellman). Finally an introduction is given to stochastic dynamic optimization and to dynamic and stochastic games.

Course objectives:
The course intends to teach the students what are the standard methods of optimization (static/dynamic, discrete/continuous, deterministic/stochastic) and how to use these.

Literature:
- Syllabus

**TI012  STATISTICS**

*Lecturer:* Dr P.J.C. Spreij (UvA)

*Short subject description:*
The course starts off with the very first principles of probability and quickly passes on to essential statistical techniques. Estimation and testing theory will be reviewed, including maximum likelihood estimators, likelihood ratio test and (least squares) regression.

*Course contents:*
In the course we treat the following topics.
Sample spaces, probability measures, distribution functions, random variables with discrete and continuous distributions, functions of random variables, multivariate distributions, random vectors, independent random variables, conditional distributions, functions of random vectors and their distributions, expectation and variance, covariance and correlation, the law of large numbers, central limit theorem, chi-square and t-distributions, estimation, method of moments, maximum likelihood, large sample theory, confidence intervals, Cramer-Rao bound, hypothesis testing, Neyman-Pearson paradigm, likelihood ratio tests, confidence intervals, linear regression, least squares estimation of regression parameters, testing regression hypotheses.

*Course objective:*
After the course students will be able to apply fundamental techniques needed for statistical inference. They will also be in the position to continue study and research on a more advanced level.

Information will also become available on [staff.science.uva.nl/~spreij/onderwijs/TI/statistics.html](http://staff.science.uva.nl/~spreij/onderwijs/TI/statistics.html)


**TI013  ECONOMETRICS I**

*Lecturer:* Prof. D. Fok (EUR)

*Short subject description:*
This course provides knowledge on the quantitative analysis of economic data.

*Course contents:*
In this course we provide an understanding of basic econometric methods. Knowledge of these methods allows one to understand modern empirical economic literature and to perform one’s own analysis of economic and business data. The technique of regression is discussed, as well as various extensions that are needed in concrete applications to deal with, for example, heteroskedasticity, autocorrelation, endogeneity, and non-linearities. Furthermore an introduction to discrete choice modeling is given. The main emphasis of the course is on the interpretation of
models and outcomes of estimation and testing procedures. The students practice this themselves by analyzing economic and business data by means of the econometric software package EViews and by interpreting and extending formulas for basic models and concepts.

**Course objectives:**
After this course students will be able to apply econometric techniques to answer empirical questions and will be able to critically evaluate econometric models.

**Literature:**
**Compulsory:**

**Recommended:**

**TI014 ECONOMETRICS II**

**Lecturer:** Dr L. Hoogerheide (VU, part II)

**Short subject description:**
This course provides knowledge on the quantitative analysis of economic time series.

**Course contents:**
In this course we provide an understanding of basic econometric methods for the analysis of time series. Knowledge of these methods allows one to understand modern empirical economic literature and to perform one's own analysis of economic and business time series data. Autoregressive Moving-Average (ARMA) models are considered for stationary time series. Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models are discussed for describing the time-varying volatility of time series. Models (and tests) for deterministic and stochastic trends are addressed. It is discussed how forecasts are computed and assessed. Further, multivariate time series models are considered: the Vector Autoregression (VAR) and cointegration. The main emphasis of the course is on the interpretation of models and outcomes of estimation and testing procedures. The students practice this themselves by analyzing economic and business time series by means of the econometric software package EViews and by interpreting and extending formulae for basic models and concepts.

**Course objectives:**
After this course students will be able to apply time series models to answer empirical questions and will be able to critically evaluate such models.

**Literature:**
**Compulsory:**

**Recommended:**

**TI015 ADVANCED ECONOMETRICS I**

**Lecturer:** Dr C.S. Bos (VU)
**Short subject description:**
Advanced Econometrics I covers numerical and inferential aspects of least-squares estimation of the regression model.

**Course contents:**
The course considers chapters 1-7 of Davidson & MacKinnon’s textbook. First, ordinary least squares estimation of the simple linear regression model is examined in detail from a numerical as well as a statistical point of view. Hypothesis testing, both asymptotic and simulation-based, is also considered in this context. Subsequently, the setting is generalised to non-linear least squares and generalised least squares to accommodate the non-linear regression model and the generalised linear regression model, respectively. Theoretical exercises are discussed throughout this course. Concepts are illustrated by means of simulations and empirical applications, using the Ox programming environment.

**Course objective:**
The regression model is the workhorse of modern econometrics and, by the end of this course, students will have gained a thorough understanding of the theory behind least squares estimation and inference in all its facets. This will have set the scene for the more general models and estimators to be covered in Advanced Econometrics II.

**Literature:**

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**TI016 ADVANCED ECONOMETRICS II**

**Lecturer:** Dr K.J. van Garderen (UvA)

**Short subject description:**
Advanced Econometrics II develops the necessary theory for understanding core econometric techniques based on regression, GMM and likelihood methods.

**Course contents:**
The course considers chapters 8-12 of Davidson & MacKinnon’s textbook dealing with Instrumental Variables, Generalized Method of Moments and Likelihood based techniques. Modeling approaches, estimation and testing methods are developed and asymptotic techniques and finite sample properties are discussed.

**Course objective:**
Obtaining a deep understanding of econometric theory and the practice of producing econometric inference especially with respect to the specification, estimation, and testing of models for linear and nonlinear relationships by least-squares, instrumental variables and GMM or likelihood based techniques.

**Literature:**
Recommended: Additional reading from books and papers

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**TI017 ADVANCED ECONOMETRICS III**

**Lecturer:** Prof. S.J. Koopman (VU)

**Short subject description:**
This course discusses advanced models and methods for the econometric dynamic analysis of economic and financial time series and panels of time series.

**Course contents:**
Several major advances in time series econometrics and likelihood-based inference have occurred in the past years. These advances have provided a major breakthrough in the modeling of time
series using advanced up-to-date econometric methodologies. The first part of the course aims to provide a thorough understanding of linear time series models, unobserved components, state space, the Kalman filter, signal extraction and forecasting. It further discusses how these innovative econometric time series methods can be implemented in studies relevant for macroeconomics, microeconomics and finance. The course also pays attention to multivariate and dynamic factor models. The second part of the course extends the methodologies to nonlinear and non-Gaussian time series models. It requires additional concepts such as observation driven and parameter driven models. Various empirical illustrations are discussed in economics and finance.

**Course objective:**
Students will receive a good training in dynamic econometrics, the modeling of economic and financial time series using advanced techniques.

**Literature:**
- Compulsory:
- Recommended:

**T1083 MEASURE THEORY AND STOCHASTIC PROCESSES**

**Lecturer:** Dr P.J.C. Spreij (UvA)

**Short subject description:**
The course aims at making students familiar with the mathematical fundamentals of measure theory, stochastic processes and stochastic integrals. This is a crash course, highlighting the main principles, not an in depth treatment of the theory.

**Course contents:**
Sigma-algebras, measure, integration w.r.t. a measure, limit theorems, product measure and integration, change of measure, conditional expectation; Heuristic construction of Brownian motion, martingale property and quadratic variation; construction of the Itô integral, fundamental properties (Itô isometry); Itô rule (in one and more dimensions), stochastic product rule, Lévy's characterization of Brownian motion; absolutely continuous change of measure, Girsanov's theorem, martingale representation theorem; and if time permits stochastic differential equations, diffusions and partial differential equations, Feynman-Kaç formula.

**Course objective:**
After the course students will be familiar with elements of measure theory, stochastic processes and stochastic integrals at a basic level and ready to apply these for instance to models used for derivative pricing.

Information will also become available on http://staff.science.uva.nl/~spreij/onderwijs/TI/mtsp.html


**T1143 PRINCIPLES OF PROGRAMMING IN ECONOMETRICS**

**Lecturer:** Dr C.S. Bos (VU)
Short subject description:
This course provides a primer to students on how to tackle in general a programming problem in Econometrics.

Course contents:
During three consecutive days, the basics of programming in Econometrics are explained. This course discusses general concepts of programming, how to proceed from a set of equations via an algorithm to a valid program, robustness of programming, and other more practical topics related to Econometrics. The course is split between a theoretical and a practical part. The theoretical part assumes a matrix-oriented programming language. It is not immediately related to a specific programming environment, though examples will be given in Matlab. The practical part of the course necessarily focuses more on the syntax of Matlab itself. Students are expected to have read the 'Matlab Primer' before the start of the course, or otherwise have familiarized themselves with the basic syntax of Matlab.

Course objective:
After the course students are able to analyze the programming problem they have at hand, to split the task into smaller subtasks and define clearly the dependencies between the tasks. They have learned how to structure their program, and how to choose wisely the data structure that is helpful in solving the problem.


Assessment:
Students will receive an exercise at the end of the course which they can solve at home, in groups of two. The exercise will involve an econometric problem, though the econometrics will be spelled out such that students can concentrate on obtaining the estimates with their own code. Both a program and an accompanying report have to be handed in. The hand-in will be evaluated, and students receive a pass/fail score. Students receive comments/advice on the programming style, robustness, cleanliness of their work.

4.1.4 Finance Sequence

TI099 ASSET PRICING

Lecturer: Prof. R.J.A. Laeven (UvA)

Short subject description:
Asset Pricing is concerned with determining the value of uncertain future payoffs.

Course contents:
This course provides an introductory yet comprehensive and rigorous treatment of both the theory and related empirical evidence of modern asset pricing. It covers the following topics:
1. Expected utility, risk aversion and single period portfolio choice;
2. Mean-variance analysis and CAPM;
3. Empirical evidence and testing the CAPM;
4. Multifactor pricing models;
5. Discount factors, mean-variance and Hansen-Jagannathan frontiers and multi period consumption and portfolio choice;
6. Stochastic discount factors and no arbitrage;
7. Derivatives and utility indifference pricing.
Course objective:
Students who successfully complete this course will have an in-depth overview of both the theory and related empirical evidence of modern asset pricing and will be able to address asset pricing issues from a broad perspective.

Literature:
- Selected chapters from:
- Selected articles
- Lecture notes and other material, to be made available via Blackboard

TI100 CORPORATE FINANCE THEORY

Lecturer: Dr V. Vladimirov (UvA)

Short subject description:
Corporate finance is the area of finance dealing with monetary decisions made by business enterprises and the tools and analysis used to make these decisions.

Course contents:
This course covers core and new topics in corporate finance theory with an emphasis on introducing the microeconomic tools needed to address open research questions and discussing. Students are expected to be familiar with basic notions in finance and game theory. Some basic knowledge of contract theory is an advantage, but the course will be largely self-contained in this respect. The main focus of the lectures will be on financial contracting in the presence of agency problems, asymmetric information, and incomplete contracting. Further topics may include real options and dynamic financial contracting. For each topic there will be some recommended and/or required literature to accompany the lectures. The textbook closest to the material covered in class is Tirole "The Theory of Corporate Finance", Princeton University Press, 2006. However, readings will be based mostly on articles. A detailed list of reading assignments will be available at the start of the course.

Course objective:
Students will become aware of the basic principles and issues in corporate finance as well as of the tools needed to address these issues. This should give them first basis to do own research in the field, both theoretical as well as empirical.

Literature:
Core readings are marked with an (*).

Basic tools of financial contracting and security design:
• Fudenberg and Tirole (1992). Game Theory, MIT Press, Chapter 11.2
• Nachman and Noe (1994). Optimal design of securities under asymmetric information, Review of Financial Studies 7, 1-44.

Incomplete Contracting:
• Gertner, Scharfstein and Stein (1994). Internal vs. external capital markets, Quarterly Journal of Economics 109, 1211-1230
4.2 Field courses

Note that, in addition to the specific entrance requirements for each field course, all courses require that students have completed at least 48 ECTS of the first year’s credits by July 1 of the first year (see Section 3.3) and have completed the MPhil seminar series and the writing course.

Field courses consist of 2.5 hours of weekly lectures in small groups, where students and lecturers closely interact.

**TI104 ADVANCED GAME THEORY: APPLICATIONS OF BARGAINING AND NETWORK THEORY**

*Lecturers:* Dr J.R. van den Brink (VU) and Dr H.E.D. Houba (VU)

*Short subject description:* This course studies some frontier topics in game theory with a focus on its applications to economic theory.

*Course contents:* Based on classic and recent articles, we discuss the development of game theoretic tools to analyze economic issues related to bargaining and network analysis. In that part on bargaining, strategic bargaining models of bilateral negotiations and endogenous threats (e.g. strikes or trade wars) are discussed. Several strategic bargaining models support well-known solutions in cooperative or axiomatic bargaining theory. The extension to multilateral negotiations of coalition formation with externalities is made to study endogenous coalition formation and the division of the gains from cooperation. Time permitting, experimental studies of bargaining models are discussed. Cooperative solution concepts are also applied to explain endogenous coalition formation. In the part on network theory, game theoretic tools to analyze economic and social networks are introduced. We discuss allocation rules for various types of networks. Main attention will be given to communication networks and hierarchies. Finally, we apply these allocation rules to economic allocation problems with an implicit or explicit network structure such as water allocation, sequencing, assignment and auction games.

*Course objective:* This course intents the students to teach the students recent developments in game theory, and how to apply these to analyze economic problems. In particular, we focus on bargaining and network models.

*Literature:* Selected papers (will be announced during the course).

*Course entrance requirements:*
- Required: Microeconomics I + II
- Recommended (optional): Microeconomics I, Mathematics I + II

*Assessment:* Take home exam (75%) and homework assignments (25%).

**TI036 ADVANCED MONETARY ECONOMICS**

*Lecturer:* Prof. C.G. de Vries (EUR)

*Short subject description:* The focus of monetary economics is on the theory and evidence about money and the business cycle, growth, inflation, monetary policy, foreign exchange rates, the yield curve, capital markets and monetary integration. Monetary macro economics has come to the center stage once again due to the credit crisis and the second round effects.
Course contents:
After an introduction, the course starts with a rigorous treatment of the modern micro underpinnings of money demand. Subsequently money supply, targeting policies and operating procedures are covered. To introduce the monetary macro issues an eclectic presentation of the major theories and policy issues is given. Rational expectations and information asymmetries provide the methodological skeleton for the course. Theories and policy prescriptions are confronted with the data. Special attention is paid to the question of causality and the inference problem in VAR analysis. Special topics are the relation between money and financial markets and the role of money in the international arena and the current stage of the credit crisis. An important issue is how to integrate financial developments into standard macro business cycle models.

Program:
I. Introduction
   1. Facts
   2. VAR analysis and causality
   3. Expectations in a macro model
II. Money Supply
   1. Operating procedures
   2. Transmission channels
   3. In a monetary union: The ECB and how it operates
III. Money Demand
   1. Theory of fiat money
   2. Quantity equation
   3. European money demand
   4. Monetary policy without money
IV. Money and the Macro Economy
   1. Targeting procedures, Taylor rule
   2. Policy invariance
   3. Time inconsistency
   4. Empirical evidence
V. Monetary Policy
   1. Short run Poole analysis
   2. Price and wage rigidities
   3. Endogenous market segmentation
   4. Empirical evidence
VI. Money and Asset Markets
   1. The yield curve
   2. Equity markets and inflation
   3. Intermediation theory of money
   4. Empirical evidence
   5. Equity premium puzzle from a macro perspective
VII. International Money
   1. The forex market
   2. The monetary model of exchange rates
   3. Evidence and interpretation
   4. Gold standard and EURO monetary union
   5. An RBC based model
VIII. Credit Crisis
   1. Current developments
   2. Systemic risk
   3. The long and short of NKE models
   4. Methodological issues concerning DSGE and NKE models
   5. Financial sector and business cycle models

Course objective:
- Learn the standard Monetary Macro paradigms and analyses
- Understand the policy relevance of the issues
- Become acquainted with the empirical issues
- Being able to give a critical assessment of papers in the area
Develop a view on future research in the area

**Literature:**

Compulsory:
- Selected papers. A reader will be made available on the net

Recommended:

Students are expected to actively participate and present part of the material.

**Course entrance requirements:**

Required: Microeconomics- and Macroeconomics sequences

Recommended: Econometrics I and II

**Assessment:** Presentations and homework (30%) and take-home exam (70%), which consists in part of doing an empirical project and partly writing a referee report.

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**T1022 ADVANCED TIME SERIES ECONOMETRICS**

**Lecturers:** Prof. H.P. Boswijk (UvA), Prof. D.J. van Dijk (EUR) and Prof. P.H.B.F. Franses (EUR)

**Short subject description:**
This course focuses on modern techniques in time series econometrics, with applications in macroeconomics, finance and marketing.

**Course contents:**
The following topics will be covered: GARCH modelling, realized volatility, nonlinear regime-switching models, large-scale factor models, and forecast combination and evaluation. For each topic, theoretical aspects of the time series models and techniques are discussed. The application of these models in different areas is illustrated by means of recent journal articles and working papers, and a number of practical homework assignments.

**Course objective:**
After the course, students will be able to understand the main time series models and techniques, to critically assess articles and working papers that use such techniques, and to apply and extend them in their own research.

**Literature:**
- Selected articles and working papers

**Course entrance requirements:**

Required: Statistics and Econometrics I + II

Recommended: Advanced Econometrics

**Assessment:** Sit-in written exam (75%) and homework assignments (25%).

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**T1039 APPLIED INDUSTRIAL ORGANIZATION**

**Lecturers:** Prof. Ch. Fershtman (EUR/Tel Aviv University) and Prof. J. Hinlooopen (UvA)
Short subject description:
This course consists of two parts. In the first part the course focuses on the dynamics of markets as reflected in R&D races and oligopolistic interaction. In the second part the course deals with recent experimental studies within the field of Industrial Organization.

Course objective:
The first part of the course intends to teach the student how to set up a dynamic model of strategic interaction, how to set up an algorithm to analyze it and how to understand and analyze dynamic strategic interactions in oligopolistic markets. The second part of the course provides an overview of the field of Behavioural Industrial Organization; it discusses a number of key findings of experimental economics for our understanding of Industrial Organization and it discusses several recent experimental IO papers (including ongoing research).

Literature:
Compulsory:
- Selected papers

Recommended (optional):
- Selected papers

Course entrance requirements: Microeconomics I to IV

Assessment: The first part of the course is assessed with a take home exam that counts for 50% of the final grade. The second part of the course is assessed through the presentation and discussion, by students, of particular papers that can be chosen from a pre-specified list of experimental IO papers.

TI116 APPLIED MACROECONOMETRICS

Lecturers: Prof. M. Giuliodori (UvA), Dr K. Macromatis (UvA) and Dr L.C.G. Pozzi (EUR)

Short subject description:
This is a ‘hands on’ course in which students will familiarize with standard econometric methods typically used in applied macroeconomics and international economics, and have the chance to apply them and gain experience in dealing with macro data.

Course contents:
The first part of the course will introduce vector auto regressive (VAR) models addressing issues such as VAR specification and estimation, impulse response functions and variance decompositions, identification and structural decomposition (recursive and non-recursive short-run restrictions, long-run restrictions, sign restrictions, etc). The second part of the course will cover cointegration and error-correction models and non-linear time series models. The third part of the course will focus on static and dynamic homogeneous macro panels with large T (Within Group estimation), endogeneity, cross-sectional dependence (SUR, CCE estimation), heterogeneity (Mean Group approach), and heterogeneous dynamic panels with cross-sectional dependence.

Course objective:
The key objective of the course is applying these techniques rather than deriving econometric and statistical properties of estimators. Each session will be structured as follows. First the specific econometric topics will be introduced and their key elements outlined. Then, a critical discussion of the key empirical papers applying those methods will be provided. Finally, we will conclude each session providing information on the datasets, econometric package/commands, and research questions that students will be asked to address in the take-home assignments.

Literature: Lecture notes and selected papers.

Entrance requirements: Statistics and Econometrics I + II
**TI101  APPLIED MICROECONOMETRICS I: BASIC TECHNIQUES**

*Lecturer:* Dr. A.P. van Vuuren (VU)

**Short subject description:**
This course focuses on drawing inference from cross-sectional, panel and longitudinal data using techniques that are frequently used in applied econometric research.

**Course contents:**
We consider limited dependent variable models, maximum likelihood estimation, quantile regression, panel data models and duration analysis. The limited dependent variable models discussed during the course are binary choice models, Tobit models, sample selection models, and switching regression models. Furthermore, we consider random and fixed effects linear models, dynamic panel data model, GMM estimation and fixed-effect logit estimation. The final lectures of the course are devoted to introducing duration models and discussing the specification, identification and estimation of these models. In particular, we consider both single-spell and multiple-spell duration models. With respect to the latter we discuss stratified partial likelihood estimation and other fixed-effect techniques. During the course applications of the different methods are discussed, mainly in the fields of labor economics, health economics, and the economics of education.

**Course objective:**
The key objective of the course is applying microeconometric techniques rather than deriving econometric and statistical properties of estimators. After the course student should be able to decide about the appropriate model, apply the estimation method correctly, and they should be able to interpret the estimation results.

**Literature:**
During the lectures slides will be provided and papers will be discussed.

**Course entrance requirements:** Statistics and Econometrics I and II

**Assessment:** Sit-in written exam (75%) and three take-home assignment (25%). The take-home assignments will involve related empirical exercises.

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**TI102  APPLIED MICROECONOMETRICS II: EMPIRICAL TREATMENT EVALUATION**

*Lecturer:* Prof. B. van der Klaauw (VU)

**Short subject description:**
This course focuses on estimating causal effects using econometric techniques that are frequently applied in treatment evaluation literature.

**Course contents:**
Many empirical questions in economics depend on causal effects of programs or policies. Estimation of treatment effects using social experiments, natural experiments, and field experiments will be discussed. We introduce the potential outcome model and discuss the definition of different treatment effects such as average treatment effect, average treatment effect on the treated, quantile treatment effects and local average treatment effects. We consider
instrumental variable estimation, regression discontinuity designs, difference-in-differences, methods to estimate dynamic treatment effects and partial identification methods. The emphasis of the course is on identification, estimation and interpretation rather than a thorough treatment of the asymptotic properties of the estimators. During the course applications of the different methods are discussed, mainly in the fields of labor economics, health economics, and the economics of education.

Course objective:
The key objective of the course is to learn student how to estimate causal effects from micro data. Student should understand the consequences of various identifying assumptions and should be able to decide about the appropriate evaluation approach.

Literature:
During the lectures slides will be provided and papers will be discussed.

Course entrance requirements:
Required: Statistics and Econometrics I and II

Assessment: Sit-in written exam (75%) and three take-home assignments (25%). The take-home assignments will involve related empirical exercises.

TI107 BANKING

Lecturer: Prof. E.C. Perotti (UvA)

Short subject description:
The course reviews the literature on financial intermediation, focusing on recent work complementing the contractual approach with a view of system-wide risk creation and risk shifting. It is relevant for students interested in finance, macroeconomics and governance issues.

Course contents:
Topics include debt optimality, moral hazard in risk choices, external effects of bank funding and asset choices, maturity and liquidity risk transformation, capital and liquidity regulation, shadow banking, microeconomic foundations for macroprudential policy.

Course objective:
This course teaches models of credit choice and risk incentives in individual banks, and derives implications for aggregate financial system behavior. Drawing from the lesson of the crisis, it focuses on the risk transformation role of banks and shadow banks, and the sources of endogenous credit cycles and instability. It will review the new foundations for regulatory policy and identify several areas where more conceptual and empirical work is needed.

Literature:
Required: Selected papers
Recommended textbook (optional): Bengt Holmstrom Jean Tirole. Inside and Outside Liquidity

Course entrance requirements:
Required: Contract Theory
Recommended (optional): Corporate Finance Theory

Assessment: The course has a sit-in final examination plus some homework assignments. The final grade will be a weighted average of the final exam (75%) and the take-home assignments (25%). Intelligent class participation will contribute at the margin. As an option, students can reduce the weight of the final exam by writing a review paper on a theme less covered in the
course.

**TI119  BEHAVIORAL FINANCE**

*Lecturers:* Dr M.J. van den Assem (VU; coordinator), Dr F. Peters (UvA), and Dr R.C.J. Zwinkels (VU)

*Short subject description:*
The objective of this course is to provide a comprehensive introduction to Behavioral Finance. This relatively new field integrates insights from Psychology into Finance to better understand and predict the behavior of individual investors, decision making in firms, and the dynamics of financial markets.

*Course contents:*
Behavioral Finance extends the traditional Finance framework with three important building blocks:
- Non-standard beliefs. Individuals are subject to distortions or biases in their beliefs and expectations such as overconfidence and optimism.
- Non-standard preferences. Individuals can have risk preferences that are not understood in a normatively acceptable framework, and exhibit for example loss aversion and narrow framing.
- Limits to arbitrage. Financial market participants are subject to certain costs and risks that prevent full arbitrage. As a result, market anomalies can occur.

The lectures will describe the original evidence from Psychology, discuss the related empirical evidence in Finance and Economics, and explain how these findings can be incorporated into models of financial decision making and financial markets.

*Course objective:*
At the end of this course, students are aware of the main elements of Behavioral Finance. They understand how these elements help to explain empirical regularities that are puzzling within the traditional framework of rational economics, and how these elements can be integrated into economic models.

*Literature:* Selected papers.

*Assessment:* Sit-in exam (80%) + written essay (20%).

**TI126  BEHAVIORAL MACROECONOMICS**

*Lecturers:* Prof. C.H. Hommes (UvA)

*Short subject description:*
The leading paradigm in macroeconomics assumes that economic agents (households, firms, investors) are perfectly rational in making their decisions. Experimental evidence and common sense indicate that this assumption is often too demanding. This course focuses on the analysis of macroeconomic models under “bounded” rationality, where agents violate full rationality but behave more in accordance with experimental evidence.

*Course content:*
- Animal spirits and boom and bust cycles
- Bounded rationality and adaptive learning
- Complex dynamics, chaos and bifurcations
- Heterogeneous expectations and evolution in asset pricing and macroeconomic models
- Macro laboratory experiments
- Monetary policy and asset prices under bounded rationality

*Course objective:*
After the course students should be familiar with bounded rationality, adaptive learning and
heterogeneous expectations and be able to apply these concepts to macroeconomic modeling and be able to develop behavioural macroeconomic models.

**Literature:**
- Selected papers

**Course entrance requirements:**
Recommended: Mathematics I + II

**Assessment:** $F = 2/3\cdot E + 1/3\cdot A$, under the constraints $E \geq 5$ and $A \geq 5$, where $E$= mark final exam and $A$=average mark for the 2 assignments.

**TI127 COMPLEXITY AND BEHAVIOR**

**Lecturer:** Prof. C.H. Hommes (UvA) and Dr. H. Houba (VU)

**Short subject description:**
The leading paradigm in economic theory assumes that all economic agents (households, firms, investors) are perfectly rational in making their decisions. This leads to the standard representative rational agent model. In this course we consider the economy as a complex system with interacting boundedly rational heterogeneous agents. A central question will be: which emerging aggregate macro behavior arises through the interactions of individual decisions of boundedly rational heterogeneous agents at the micro level?

**Course content:**
- Introduction to complex dynamics, chaos and bifurcations
- Animal spirits and boom and bust cycles
- Adaptive expectations, learning and heterogeneous expectations
- Contagion and the evolution of trust
- Agent-based models
- Macro laboratory experiments

**Course objective:**
After the course students will be familiar with some basic concepts of complexity, bounded rationality and heterogeneous agents and they will be familiar with some applications in macroeconomics, and finance.

**Literature:**
- Selected papers

**Course entrance requirements:**
Recommended: Mathematics I + II

**Assessment:** $F = 1/2\cdot EX + 1/4 \cdot A + 1/4 \cdot ES$, under the constraints $EX \geq 5$, $A \geq 5$ and $ES \geq 5$, where $EX$= mark final exam, $A$=average mark for the 2 assignments and $ES$=mark final essay.
TI023 COMPUTATIONAL ECONOMETRICS

Lecturer: Prof. R. Paap (EUR)

Short subject description:
It is important for advanced econometric and applied economic researchers to have basic knowledge of simulation methods. This course is to provide a practical introduction into the use of advanced simulation methods.

Course description:
The course will start with a simple introduction into the basics of simulation methods, including standard sampling techniques and the constructing of a data generating process. In the remainder of the course we will deal with topics like, simulation of critical values of non-standard tests, the design of power studies, construction of the small sample distribution of an estimator using bootstrap, impulse/response analysis, the simulation of forecast densities and forecasts and simulated maximum likelihood and related techniques. Finally, we consider Markov Chain Monte Carlo methods including the Gibbs sampler, the Metropolis-Hasting algorithm and data augmentation techniques.

Course objective:
After the course the students are able to interpret the results of simulation based inference and to apply simulation methods in applied economic research.

Literature:
• Slides
• Selected papers

Course entrance requirements: Econometrics I + II

Assessment: Sit-in written examination (100%).

TI032 DEVELOPMENT ECONOMICS

Lecturers: Prof. C. Elbers (VU)

Short subject description:
This course provides an advanced treatment of a number of core issues in Development Economics.

Course contents:
In the course the following topics are covered: 1) welfare, poverty and worldwide inequality, (2) development and risk, (3) development and informality, (4) the use of randomized trials in development, and (5) the search for the drivers of development – institutions, human capital, foreign aid, poverty traps and chance.

Course objective:
This course familiarizes students with a number of core issues in Development Economics. After the course, students should demonstrate knowledge and understanding of the economic principles underlying these core issues. Also they should have developed a good understanding of available empirical strategies to analyze these issues in practice and to have the ability to derive the policy implications from the theoretical and empirical analyses.

Literature: Selected papers.
Course entrance requirements: Microeconomics I, Macroeconomics I, Statistics and Econometrics I + II

Assessment: Oral exam or sit-in written examination (depending on student numbers, 75%) and class participation and student assignments/presentations (25%).

**TI106 DYNAMIC CORPORATE FINANCE**

**Lecturer:** Dr S. Gryglewicz (EUR)

**Short subject description:**
This course provides an advanced introduction to the methods and results of dynamic corporate finance theory.

**Course contents:**
The course introduces students to fundamental models of corporate finance in a dynamic world. To provide some essential background, the course will start with an applied introduction to stochastic processes and stochastic calculus. Topics that will be covered include investment, capital structure, dividend policy, and agency conflicts. In later parts, we will study how these dynamic corporate finance models can be linked to valuation and asset returns. Finally, the course will discuss empirical estimation of structural models in corporate finance.

**Course objective:**
After the course students can critically analyze and develop dynamic models of corporate finance and understand the methods for empirical estimation of these models.

**Literature:** Selected papers.

**Course entrance requirements:**
Required: none
Recommended: Microeconomics I – III and Corporate Finance Theory

**Assessment:** Sit-in written exam (3 hours; 60%, at least 5,0 required), discussion points (10%), active participation in classes (10%), written research proposal (20%).

**TI128 ECONOMICS OF NETWORKS**

**Lecturers:** Dr M.J. van der Leij (UvA) and Dr I.D. Lindner (VU)

**Short subject description:**
This course extends standard economic theory by introducing an explicit role for social and economic networks and social interactions in explaining economic behavior.

**Course contents:**
1. Introduction & Network Concepts (Dr. Van der Leij, Ch. 1-3)
2. Complex Network Models (Dr. Lindner, Ch. 4-5)
3. Strategic Network Formation (Dr. Van der Leij, Ch. 6, 11)
4. Diffusion through Networks (Dr. Lindner, Ch. 7, 10)
5. Learning and Networks (Dr. Lindner, Ch. 8)
6. Decisions, Behavior and Games on Networks (Dr. Lindner, Ch. 9, 10)
7. Observing and Measuring Social Interaction (Dr. Van der Leij, Ch. 13)

The course starts with an introduction to network economics, and a discussion of its two main analytical approaches: statistical mechanics and game theory. Next, these approaches are applied to the formation of networks. Network models, such as the 'Small World Model', 'Scale-Free Model' and 'Connections Model' are discussed. We then treat information and innovation diffusion,
learning, games and behavior on a given network. The last lecture is on the econometric estimation of local network effects.

**Course objective:**
After the course students are able to incorporate local interaction (network) effects in their economic analysis, simulate simple dynamic processes of behavior on network and network formation on a computer, and have a basic understanding of the difficulties in identifying network effects empirically.

**Literature:**

**Course entrance requirements:**
Required: Mathematics I
Recommended (optional): Microeconomics II, Statistics, Econometrics I + II

**Assessment:** Sit-in written exam (2 hours; 50%) and 2 additional take-home assignments (numerical computer work; 50%)

**TI030 ECONOMICS OF EDUCATION**

**Lecturers:** Prof. E.J.S. Plug (UvA)

**Short subject description:**
This course discusses recent developments in the empirical analysis of economics of education.

**Course contents:**
Papers on various topics including the demand for education, returns to education, school choice and competitions, intergenerational mobility and peer effects.

**Course objective:**
After the course students have up-to-date knowledge of important research issues in the economics of education and they are aware of the importance of identifying assumptions.

**Literature:** Selected papers.

**Course entrance requirements:**
Required: Applied Microeconometrics I
Recommended: Labor Economics

**Assessment:** Participation in class (50%), final paper (50%).

**TI105 EVOLUTIONARY GAME THEORY**

**Lecturer:** Prof. C.M. van Veelen (UvA)

**Short subject description:**
The goal of this course is to understand the basic principles of evolutionary dynamics and evolutionary game theory, and to be able to apply that in order to understand how evolution shapes human behavior in general and behavior in economic situations in particular.

**Course contents:**
We will learn to use static equilibrium concepts, such as the evolutionary stable strategy (ESS), dynamic concepts, such as the replicator dynamics, and the relation between the two. In finite
population settings, we also learn what the Moran process is, and get accustomed to evolutionary graph theory. We will also encounter kin selection, group selection and sexual selection – both Zahavi’s handicap principle and Fisher’s runaway process – in order to understand possible explanations for pro-social behavior. Also behavior in repeated games and the evolution of reciprocity will be discussed in order to understand laboratory findings concerning human behavior.

Course objective:
The course is meant to teach the student both mathematical techniques for evolutionary dynamics as well as ways in which those can help formulate predictions for human behavior.

Literature:

Course entrance requirements: none.

Assessment: Sit-in written exam (50%) and an assignment / project (50%).

**T1044 EXPERIMENTAL ECONOMICS**

*Lecturer:* Prof. A.J.H.C. Schram (UvA) and Dr J. van de Ven (UvA)

*Short subject description:*
Experimental Economics studies economic behavior in a controlled, laboratory or field environment.

*Course objective:*
This course intends to teach the student how to design an experiment aimed at answering a self-developed research question. In addition, it gives an overview of recent trends in Experimental Economics. The course will focus around a set of recent experimental papers and on experimental designs developed by the students.

*Literature:* Selected papers.

*Course entrance requirements:* Microeconomics III and IV

*Assessment:* Each student is expected to actively participate in classes by presenting and discussing papers selected by the instructor (40%) and to develop an experimental design of his/her own (60%).

**T1055 FINANCIAL CRISSES**

*Lecturer:* Prof. S.J.G. van Wijnbergen (UvA)

*Short subject description:*
We use an analysis of the recent subprime crisis as a stepping stone towards a more general analysis of financial crises.

*Course contents:*
Overview of the subprime crisis; how a relatively small problem in the US mortgage market triggered a worldwide financial meltdown. Key words: Financial innovation and the fragility of the international banking system; theory of banking crises, optimal bank intervention; regulatory reform; macroeconomics and financial fragility, macroeconomic impact of tighter financial regulation; financial crises and growth. Macropolicy during the great recession (fiscal deficits,
Quantitative Easing).

Course objective:
Students are introduced to current research and new insights in the economics of financial crises.

Literature: Selected papers.

Course entrance requirements:
Recommended: Asset Pricing, Corporate Finance Theory, Macroeconomics IV

Assessment: Take home exam, mandatory class attendance.

TI129 GENOECONOMICS

Lecturer: Prof. P.D. Koellinger (UvA)

Short subject description:
Genoeconomics is a newly emerging research field that investigates if and how genetic factors may influence economic behaviors and outcomes. The overall aim of this new interdisciplinary research field is to address the following questions:
- Can particular genetic markers associated with social-science traits be identified?
- To what extent can genetic data be informative about an individual’s traits?
- How does the environment moderate genetic effects?
- How can genetic insights be integrated into the social sciences?
- How can medical research benefit from insights about the genetics of social-science traits?

The course provides students with a structured overview of key concepts and methods in genoeconomics, discusses typical pitfalls, and outlines possibilities for applying genetic insights to classic questions in economics. It also emphasizes methodological issues in genetics research more generally, including study design, multiple testing, power analyses, calculation of effect sizes, accuracy of polygenic scores, and identification strategies to isolate causal effects. The course combines lectures and demonstrations of suitable software tools with student assignments and a short research essay.

The course is directed at PhD students in economics, behavioral genetics, and genetic epidemiology. It is complementary to courses taught in the NIHES summer program at the Erasmus Medical Center and to “Complex trait genetics (aka Quantitative Genetics)” taught at the Free University Amsterdam.

Course contents:
1. Session – Introduction (week 1)
   - Terminology
   - Promises and pitfalls
   - Possible applications in the social sciences
   - Possible applications in the medical sciences
   - PLINK

2. Session – Heritability (week 1)
   - Broad- vs. narrow-sense heritability
   - Interpreting heritability estimates
   - Estimating heritability in twin and family studies
   - Potential biases
   - Estimating heritability using molecular genetic data
   - Potential biases
   - Bivariate analyses
   - GCTA
   - Distribution of essay topics
3. Session – Molecular genetic basics (week 2)
   - DNA
   - Meiosis
   - Mendel’s laws
   - Exceptions to Mendel’s laws
   - Common and rare variants
   - SNPs and structural variants
   - Genetically complex traits
   - Changes in gene frequency
   - Expression of genes
   - Pleiotropic effects
   - Epigenetics

4. Session – Genetic discovery (week 2)
   - Genetic data and quality control
   - Imputation
   - Candidate gene studies
   - Genome-wide association studies
   - Power analysis
   - Controlling for population stratification

5. Session – Genetic discovery (week 2)
   - Credibility of findings (Bayes’ rule)
   - Winner’s curse
   - Interpretation of findings
   - Examples

6. Session – Investigating causal pathways (week 3)
   - What do genetic discoveries mean?
   - The endo- and proxy-phenotype approach
   - Genetic fine-mapping
   - Biological annotation
   - Links between genoeconomics and medicine
   - Student presentations on their essay topics and feedback

7. Session – Prediction (week 3)
   - Single genetic variants vs. polygenic scores
   - What influences prediction accuracy?
   - Unbiased vs. biased estimators
   - Relationships between prediction accuracy and heritability
   - Student presentations on their essay topics & feedback

Course objective:
To economics students, the course will give a structured introduction to the methods, data, and research questions in genoeconomics. To students in genetic epidemiology and behavioural genetics, the course will provide an advanced treatment of core statistical methods in their field of study.

Literature:
Compulsory: a selection of academic articles
Recommended (optional): a selection of academic articles (to be announced)

Course entrance requirements:
Required: Statistics and Econometrics I + II
Recommended (optional): Microeconomics I

Assessment: 2 assignments (based on PLINK and GCTA) – 40% and 1 essay (with student
presentations and feedback after first draft in sessions 6 & 7) – 60%

**TI031 HEALTH ECONOMICS**

*Lecturers:* Prof. O.A. O’Donnell (EUR), Dr R.J.G. van Ewijk (University of Mainz) and Prof. M. Lindeboom (VU)

*Short subject description:*
Health is strongly correlated with socioeconomic characteristics such as education, income and wealth. Understanding these correlations is a major challenge for economics and other social sciences. This course explores the nature, causes and consequences of the association between health and socioeconomic factors.

*Course Contents:*
The course starts with the description of health inequalities and the normative distinction between fair and unfair health inequality drawing on models of equality of opportunity in health. Causality in the direction from socioeconomic factors to health is considered within the framework of the Grossman model of health capital. Exploring causality from health to income involves examination of the role of health in employment and retirement decisions, while allowing for the possibility that work impacts on health. The hypothesis that health and socioeconomic outcomes in adult life and old age result from long run mechanisms that originate very early in life is explored before turning attention to socioeconomic differences in health behaviour, such as smoking.

*Course objective:*
The intention is to familiarise students with the core economic literature on the causes and consequences of socioeconomic differences in health. On completion of the course, students should have the ability to evaluate both normative approaches to the distribution of health and positive models of health behaviour. They should be able to appraise the validity of evidence on the causal relationships between health and socioeconomic factors. A further objective is to improve students’ ability to present a concise, clear written argument or critique of literature.

*Literature:* Selected papers.

*Course entrance requirements:* Microeconomics I to IV, Applied Microeconometrics I + II

*Assessment:* Take-home exam.

**TI038 INDUSTRIAL ORGANIZATION**

*Lecturer:* Prof. J.L. Moraga-Gonzalez (VU)

*Short subject description:*
Many markets of interest are dominated by a few firms. These firms not only choose their prices but also the quality and the design of their products. They engage in advertising campaigns and make investments in R&D. They also decide to enter or exit markets, to merge or not with other firms, to vertically integrate or not with other firms in the value chain, to collude with rival firms etc. These choices have far-reaching effects on the markets in which they operate and these effects may 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.

*Course contents:*
1. Models of imperfectly competitive markets
   1.1 Homogeneous product markets
   1.2 Differentiated product markets
   1.3 Information issues: imperfect price information and private cost information
2 Collusion and leniency programs
2.1 Recent cartel cases
2.2 Main mechanisms behind collusion
2.3 Formal game theoretical models of collusion
2.4 Factors that facilitate collusion and their impact on sustainability of collusion
2.5 Impact of Antitrust Policy instruments (e.g. Leniency Programs) on incentives to collude

3 Price discrimination
3.1 First degree price discrimination
3.2 Third degree price discrimination
3.3 Second degree price discrimination
3.4 Other discriminatory practices (intertemporal price discrimination, damaged goods, obfuscation strategies, etc.)

4 Research and Development
4.1 Market Structure and Technological Innovation
4.2 Collaboration and cooperation
4.3 R&D Networks

5 Advertising
5.1 Persuasive advertising
5.2 Informative advertising
5.3 Advertising as a signal
5.4 Application: internet platform advertising

6 Consumer search
6.1 Search in homogeneous product markets
6.2 Search in differentiated product markets
6.3 Applications

7 Vertical relations
7.1 Double marginalization
7.2 Vertical mergers and foreclosure

Course objective:
The objective of the course is to familiarize the student with the workhorse models employed in Industrial Organization to address strategic interaction in oligopolistic markets.

Literature:
Compulsory:

Recommended (optional):
• Pepall, Richards and Norman (2005). Industrial Organization: Contemporary Theory and Practice, South-Western
• Scherer and Ross (1990). Industrial Market Structure and Economic Performance

Course entrance requirements: Microeconomics I and II

Assessment: Sit-in written exam (50%) and problem sets (50%)

TI078 INSTITUTIONS AND FINANCIAL STRUCTURE

Lecturer: Prof. E.C. Perotti (UvA)

Short subject description:
This course reviews selectively the novel literature on comparative financial systems.

Course contents:
It covers theoretical and empirical explanations for the time series and cross country variation in
the structure of governance, regulation and access across financial systems. The recent literature on institutional development recognizes that financial contracting and governance depends on “the rules of the game” and the nature of their enforcement. As these are shaped by political, legal and cultural institutions, disentangling their specific channels is a fine scientific challenge. While the topics are broad, the course seeks a rigorous approach based on structural models to explain both the cross country variation in financial structure as well as their historical evolution. The intent is to build a framework drawn from the literature in institutions and growth, grounded in modern corporate finance and governance methodology.

**Course objective:**
The course will make students aware of the literature on institutions and its methodology. At the end of the course students should be able to use models of political economy and incomplete contracting as microfoundations for work on development and growth, financial development and macroeconomic stability.

**Literature:**
Compulsory: Selected papers
Recommended: Selected papers

**Course entrance requirements:**
Required: Microeconomics I + II
Recommended: Microeconomics III and Corporate Finance Theory

**Assessment:** Sit-in written examination (75%) and homework assignments (25%).
empirical models. The course also develops the students’ academic writing skills.

*Literature: to be announced*

*Course entrance requirements: None*

*Assessment: Sit-in written examination (about 80%) and homework assignments (about 20%)*.

**TI029 LABOR ECONOMICS**

*Lecturers: Dr H.G. Bloemen (VU) and Dr S. Hochguertel (VU)*

*Short subject description:*

Part I covers empirical applications (with, where appropriate, theoretical foundations) of microeconomic models of labor supply.

Part II focuses on the empirical implementation and estimation of structural job search models.

*Course content:*

Understanding the mechanisms and assessing the empirical importance of features of the labor market is of eminent importance to economists.

The first part (Hochguertel) covers various models of labor supply, ranging from individual to household, from static to intertemporal models. Interactions with tax and benefit systems will be emphasized. The second part (Bloemen) deals with structural microeconomic applications of job search models. It covers the classical job search model, models with on-the-job search, matching-bargaining, and equilibrium search models.

Both parts also pay attention to methods of estimation for various models. The outcomes of several empirical studies will be discussed.

*Course Objective:*

Overall objective of the course is to introduce the student to a couple of selected and important strands in the vast empirical microeconomic literatures on labor economics. We focus on salient aspects of labor supply and job search.

Upon completion of the course, the student will:

- Have gained substantive insights in the economic motivation and modeling of labor supply responses to changes in wages, taxes, policies, and to income shocks
- Know of important subareas in the domain of the labor supply literature (among which, female labor supply or household labor supply) and some of the main empirical and theoretical issues
- Know of pertinent approaches to structural econometric work to estimate various labor supply elasticities, and be able to discuss alternative identification strategies in natural experiment settings
- Be able to understand the link between theory and empirical implementation and appreciate some of the challenges in bringing theoretical reasoning to bear on economic data.
- Be able to recognize the specific econometric problems that emerge in implementing structural job search models.
- Be able to express the tight relationship between the economic model and the likelihood function.
- Be familiar with the implementation of specific extensions, for instance endogenous search intensity or non-wage characteristics
- Be able to extend the standard job search model with on-the-job search, estimation with unobserved heterogeneity and multiple spell data.
- Be aware of the empirical implications of including firm and worker heterogeneity in equilibrium search models.

*Literature: Selected papers.*
Course entrance requirements:
Required: Microeconomics I, Macroeconomics III, Statistics and Econometrics I + II

Assessment: Sit-in written examination (75%), participation and homework assignments (25%).

TI041 LAW AND ECONOMICS

Lecturer: Prof. G. Dari-Mattiacci (UvA)

Short subject description:
Law & Economics studies the economic effects of legal rules and legal institutions and their evolution over time.

Course contents:
This course covers the fundamental contributions in the economic analysis of law from the classics to very recent findings. The first part (classes 1-3) introduces the students to some fundamental legal notions—such as those of entitlement, remedy, property, contract and tort—and covers models of torts and litigation, where parties come before the court in order to assess their rights and claim compensation for wrong doings. An important feature of litigation is that it develops precedents that than can be used in future cases and hence can shape the law. The second part (classes 4-7) builds on these insights to introduce the students to a political economy approach to the emergence of laws, moral norms, and institutions.

Course objective:
This course introduces the students to some of the classic works in Law & Economics, explains them fundamental legal notions and introduces them to the most used models of law and legal evolution. The students are expected to learn how to approach a legal problem from an economics perspective and how to build law into a model. Some of the most used models of law are examined in detail and students will learn how to work with them. Finally, additional material is presented during the course in order to illustrate recent advances, open problems and the frontier of the research in Law & Economics. A primary goal of this course is to provide the student theoretical and empirical tools to identify and analyze interesting open problems concerning the legal system and its impact on the economy.

Literature:
Selected papers.

Course requirements:
Recommended (optional): first year courses

Assessment: Each student is expected to write a research plan for a law & economics analysis on a problem chosen by the student. The proposal should include motivation, research questions, basic legal background, details of the methodological approach (theoretical, empirical or both), and expected contribution to the literature. In addition, in each of the classes 2-6, a student will give a short presentation on an article assigned by the instructor. All students are expected to give at least one presentation. In the last class students will present their research proposal. These presentations are a condition for passing the course but do not count for the grade.

TI086 MARKET & SYSTEMIC RISK MANAGEMENT (DSF)

Lecturer: Prof. C.G. de Vries (EUR)

Course objectives:
The main objective of this course is to develop and analyze a coherent framework for evaluating market risk at the level of the individual institution or portfolio and at the macro systemic level. The main tool that we exploit in devising this framework is the statistical theory about tail risk from Extreme Value Theory (EVT) in combination with standard concepts from finance and macro
economics. More in particular, the course offers different methods to measure and manage financial risk and performance with special emphasis on downside risk measures such as Value-at-Risk (VAR), semi-variance, CvaR, Stress tests, worst case and scenario analysis, etc. Various statistical techniques are studied which are specifically designed to measure breakdown probabilities. Most asset returns turn out to be heavy tailed. That is to say, very bad outcomes occur more frequently than the normal distribution predicts. Therefore, heavy tailed distributions are studied in detail, especially their additive properties. Subsequently we investigate the EVT for the sake of stress testing and scenario analysis. These and other techniques are used to estimate and manage the VAR, both at the individual asset level and the portfolio level. The pc lab session implements the techniques. Given the link between proper risk management and stability of the financial system, we also pay attention to various aspects of risk management from a supervisory point of view. The inherent fragility of the financial system is explained and a scale for the system’s stability is developed. The rigorous treatment of some of the techniques enables the student to independently analyze market risks and develop systemic risk indicators.

Learning outcomes:
At the end of this course students are able to:
- Identify the more rigorous and quantitative techniques available to analyze and manage market risk and to evaluate systemic risk
- Use various statistical techniques specifically designed to measure breakdown probabilities and shortfall Identify and handle the additive properties of heavy tailed distributions both over time and cross sectionally
- Select and use appropriate techniques to estimate and manage VAR (at individual asset and portfolio level), portfolio management and systemic risk
- Develop a scale for evaluating the stability of the financial system
- Apply EVT to real life case

**TI130 MECHANISM DESIGN AND MARKET INSTITUTIONS**

_Lecturers:_ Dr S. Onderstal (UvA) and Dr A. Hu (UvA)

**Short subject description:**
Mechanism Design concerns establishing institutional rules that maximize the designer’s objective under the constraint that the involved parties or individuals possess private information and may take private actions in their own interests. The objective of the mechanism designer can be to maximize social welfare, efficiency, or any kind of monopoly rent. Because of its practical importance, mechanism design theory has been on the top research agenda for almost half of a century. It is arguably one of the most successful areas in Applied Micro-economics witnessing the Nobel Prizes that were awarded to William Vickrey and Jim Mirrlees in 1996, Leonid Hurwicz, Roger Myerson, and Eric Maskin in 2007, and Lloyd Shapley and Al Roth in 2012.

**Course contents:**
1. Introduction, Revenue Maximizing Mechanisms
2. Auctions with Interdependent Values
3. Efficient Mechanisms
4. Risk Aversion, Bidding Rings, Budget Constraints, Entry Costs
5. Contest Architecture, Procurement Design, Securities
6. Vickrey-Clarke-Groves Mechanisms, Multi-object Auctions
7. Matching Markets

**Course objective:**
The objective of this course is two-fold. Firstly, students will sharpen their knowledge about the basic notions of mechanism design theory such as the revelation principle, incentive compatibility, and individual rationality constraints, as well as second-best solution as a fundamental result under incomplete information. Secondly, students will be exposed to several applications of mechanism design, namely, auctions, procurement, contests, partnership dissolution, and matching markets. After this course, students will be equipped with up-to-date knowledge and a more profound understanding of how and why some standard market institutions prevail in practice, while being
able to discern possible causes for market failures in other situations.

Literature:
- Selected papers

Assessment: take-home assignments (30%) + essay (30%) + closed-book exam (40%). Students write the essay about pre-selected practical market design problems.

**TI131 NEW STYLE CENTRAL BANKING (TI Economics Lectures 2015)**

*Lecturer:* Prof. R. Reis (Columbia University)

*Course description:*
The Lectures will focus on monetary and fiscal policy. Following the recent economic crisis on both sides of the Atlantic, there have been permanent changes to the design of monetary policy and the constraints faced by central banks. These six lectures will cover some of the main ones from the perspective both of understanding future policy as well as uncovering exciting research topics. In particular, we will cover: (i) the determination of inflation when interest is paid on reserves; (ii) the fiscal capacity of a central bank; (iii) can a central bank become insolvent? (iv) the room for inflating away the public debt; (v) the ECB and the euro crisis.; (vi) the impact of monetary policy on inequality.

Remarks: These lectures will take place May 18-20, 2015

*Literature:* Selected papers.

*Entrance requirements:* none

*Assessment:* to be announced.

**TI117 NUMERICAL METHODS**

*Lecturer:* Prof. W.J. den Haan (LSE)

*Short subject description:*
This course focuses on numerical solution techniques to solve dynamic stochastic general equilibrium models.

*Course content:*
Key numerical tools such as function approximation and numerical integration are discussed. Several simple numerical techniques such as linearization and parameterized expectations will be used to get started. After this two more general frameworks are developed. Those are perturbation and projection methods. Finally, we develop algorithms to solve models with heterogeneous agents. The techniques taught are useful in many branches of our profession not just in macroeconomics. Matlab programming exercises are an essential part of this course.

*Course objective:*
After the course students are able to solve and analyze dynamic stochastic general equilibrium models.

*Literature:*
Compulsory: Selected papers
Recommended: Selected papers

*Course entrance requirements:*
Required: Macroeconomics I
Recommended: Some rudimentary knowledge of Matlab

Assessment: Take-home assignments.

**TI080 PUBLIC FINANCE**

*Lecturer:* Prof. B. Jacobs (EUR)

*Short subject description:* This course gives an in-depth introduction into normative welfare economics, including optimal taxation, optimal income redistribution, optimal public-good provision and optimal corrective taxation.

*Course contents:* We will discuss the Ramsey principles for optimal commodity taxation and Mirrlees' (1971) non-linear income tax. The main theorems of public finance will be covered: the Atkinson-Stiglitz theorem on the desirability of commodity/capital taxation and the Diamond-Mirrlees production efficiency theorem. The Samuelson-rule for the optimal provision of public goods in second-best settings with distortionary taxes will be discussed. Main principles will then be applied to various topics: optimal income redistribution, environmental taxation and the double dividend, capital income taxation, education policies and redistribution, government debt and fiscal policy, and the marginal cost of public funds.

*Course objective:* The aim of this course is to give students a thorough background in the principles of public finance and to apply these principles to questions like: How progressive should the income tax be? Should the government employ indirect taxes besides the income tax? Should labour participation be subsidized? Should the government subsidize education? How does taxation affect human capital investment and how does this affect the progression of the income tax? How should the government set the optimal capital tax? How much public goods should the government provide and should less public goods be provided if taxation is more distortionary? How should the government internalize externalities, for example in the environment? After this course students should be able to understand

- the optimal non-linear income tax
- the optimal participation tax
- the optimal commodity tax and the debate on direct vs. indirect taxation
- the optimal tax on capital income
- the optimal taxation of human capital
- the optimal provision of public goods and the marginal cost of public funds
- the optimal corrective tax on externalities

*Literature:* The main text is the book by Bas Jacobs (2014), *Principles of Public Finance*. A pdf of the book, additional reading and class materials will be made available on Blackboard.

*Entrance requirements:* Microeconomics I

*Assessment:* Sit-in written examination (75%) and written assignments (25%).

**TI132 PUTTING BEHAVIORAL ECONOMICS TO WORK**

*Lecturer:* Prof. U. Gneezy (UCSD/UvA)

*Short subject description:* The class will have two goals. First, we will discuss ways to translate scientific findings from behavioral economics into the real world. We will discuss small changes that can make big differences in business and policy. The second goal is to learn how to design simple field
experiments to measure the impact of changes correctly, and the importance of understanding causality in behavioral interventions

**Course contents:**
- Incentives and behavior change
- Behavioral pricing
- Field experiments in business and in policy
- Shared Social Responsibility

**Course objective:**
Students should be familiar with ways to use behavioral economics findings in business and policy. A focus would be put on using field experiments in such behavioral interventions, and ways to make these experiments compatible with scientific publications. That is—how to use behavioral economics to influence the world while producing meaningful research.

**Literature:**
- Gneezy, U. and J.A. List. *The Why Axis*

**Course entrance requirements:** Experimal Economics

**Assessment:** Class participation, presentation at the end of class and a research paper after the class.

**TI133 REGIONAL AND ENVIRONMENTAL ECONOMICS**

**Lecturer:** Prof. H.L.F. de Groot (VU) and Dr S. Poelhekke (VU)

**Short subject description:**
The course combines trade theory and empirical methods to shed light on current real economic issues such as natural resource wealth, pollution havens, the natural resource curse, and climate policies and their impact on competitiveness.

**Course contents:**
Three main topics are covered in the lectures: the impact of environmental policies on location behavior and competitiveness, the economics of natural resource-rich countries, and trade and the environment. The first series of classes address the issue of regional economics with special emphasis on the interplay between environmental policies, location behavior and the allocation of economic activity across the globe. Building on this approach, we will examine the pollution haven hypothesis and discuss whether trade is good or bad for the environment, touching upon environmental policy making. Finally, we will examine trade in natural resources and the diverse economic outcomes in resource-rich economies. Mainstream explanations of a possible ‘resource curse’ such as Dutch disease will be presented. But how strong is the evidence for a ‘curse’ and what are other competing explanations for unfavorable economic development? Finally, these lectures cover the latest state-of-the-art research which has moved from cross-country to within-country analysis of resource-rich economies.
Course objective:
After the course students are have a good understanding about the linkages between production technology, location behavior, natural resources, and sustainability; are able to work with 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.
The course brings students to the forefront of research in these fields and discusses methods and ideas that will help students develop research of their own.

Literature:
Compulsory:
- Frederick van der Ploeg and Steven Poelhekke, The pungent smell of "red herrings": Subsoil assets, rents, volatility and the resource curse, Journal of Environmental Economics and Management, Volume 60, Issue 1, July 2010, Pages 44-55. http://dx.doi.org/10.1016/j.jeem.2010.03.003
- Hunt Allcott and Daniel Keniston, Dutch Disease or Agglomeration? The Local Economic Effects of Natural Resource Booms in Modern America, mimeo. https://files.nyu.edu/ha32/public/research/Allcott_and_Keniston_Natural_Resource_Booms.pdf

Non-mandatory background reading:
http://www.oxcarre.ox.ac.uk/files/OxCarreRP2013116.pdf

Course entrance requirements: Econometrics I, Microeconomics I, Macroeconomics I

Assessment: Two take home Assignments (30%), referee report on paper from a selected list (20%), written exam (3 hours; 50%, at least 5.0 required)

TI043 RISK AND RATIONALITY

Lecturer: Prof. P.P. Wakker (EUR)

Short subject description:
A behavioral approach (using psychological insights to improve economics) to decision under risk and uncertainty (ambiguity); the rational and classical expected utility; descriptive and psychological, Nobel-awarded, prospect theory; modern ambiguity theories.

Course contents:
Risk and uncertainty are important in many decisions. They play a central role in many fields including insurance, game theory, health economics, game theory, business, and finance. Psychologists have discovered many irrationalities in human behavior, such as those underlying the equity premium puzzle. Kahneman and Tversky (1979) introduced prospect theory, which provides analytical tools for integrating empirical psychological findings with economic models. The theory provided a rational model of irrational behavior, something considered impossible up to that point. An important advance was made in 1992, when the theory was extended to also deal with ambiguity (unknown probabilities), which is the common case in economics and in our everyday decisions.
In experiments, the risk attitudes of the participants will be measured, and the best-fitting model will be determined for each. Financial advises will be given, based on theoretical foundations, such as, in general: do not insure low-cost risks such as bike-theft; (b) invest pension-savings in stocks and not in bonds. In summary, this course shows how to incorporate irrational psychological behavior in economic models. At the end of the course, participants will be able to apply the modern models for risk and uncertainty to economic problems.

Course objective:
Prescribe, predict, and describe decisions under risk and uncertainty. Analyze them theoretically, measure them empirically, apply them in the student’s research area, and improve private decisions. Learn about modern models of ambiguity. Learn about general behavioral principles relevant in many areas beyond risk (framing, riskless choices, intertemporal decisions, interpersonal decisions).

Literature:
Compulsory:

Recommended:

Course entrance requirements:
Elementary probability calculus; quantitative aptitude.
Recommended (optional): Microeconomics I

**Assessment:** Oral exam (100%); 1 take-home assignment & presenting some homework exercises are required to get access to oral exam. Class-performance plays no role. Students can take course as a-student (empirically oriented; fits well with psychologists), c-student (theoretically oriented; fits well with mathematicians), or b-student (in between; fits well with economists).

**TI134 SPATIAL ECONOMICS**

**Lecturers:** Prof. H.L.F. de Groot (VU), Prof. F. van der Ploeg (VU) and Prof. E.T. Verhoef (VU)

**Short subject description:**
This course focuses on the economic analysis of urban, regional, environmental and transport phenomena, including topics such as agglomeration, sorting and spatial interaction; exhaustible resources and global warming; and equilibrium, competition and optima in physical transport network markets.

**Course contents:**
This course covers advanced topics in theoretical and empirical research on spatial, environmental and transport economics. Key issues in the “spatial block” are location and potential reasons for clustering of economic activity, the role of geographic factors in explaining regional economic growth performance, urban size and growth, and the functioning of regional labour markets. Next, the “environmental block” will consider the optimal climate policies in the global economy, paying attention to the social cost of carbon, stranded assets, and renewable subsidies, using an integrated assessment model of growth and climate damages with tipping points. Finally, topics to be addressed in the “transport block” include market failures stemming from external effects and market power in dynamic network markets; and first-best and second-best regulation of such market failures. The course seeks a balance between theory and empirics, between analytical methodologies and policy analysis, and aims to integrate applied microeconomics and spatial, environmental and transport science.

**Literature:**
Compulsory:


**Course entrance requirements:** Microeconomics I, Macroeconomics I

**Assessment:** Sit-in written exam (3 hours; 80%, at least 5.0 required) and a written essay (20%).
TI135 SYSTEMIC RISK AND FINANCIAL CRISIS (TI Finance Lectures 2014)

Lecturer: Prof. F. Allen (University of Pennsylvania/ Imperial College London)

Course description:

- Lecture 1: What is Systemic Risk?
The lecture series will start with an overview of the different types of systemic risk and how they lead to financial crises. The subsequent lectures will focus on the different types of systemic risk and policies to avoid them or lessen their impact.

- Lecture 2: Panics – banking crises due to multiple equilibria
The traditional view of financial crises was that they were due to panics. The famous multiple equilibria models of Bryant (1980) and Diamond and Dybvig (1983) and subsequent developments will be considered.

- Lecture 3: Banking crises due to asset price falls
Another important type of systemic risk is that due to asset price falls. There can be many reasons for this and these will be discussed in this lecture. They include: (a) the bursting of real estate bubbles; (b) the bursting of other asset price bubbles; (c) a rise in interest rates; (d) sovereign default; (e) mispricing due to limits to arbitrage; (f) business cycle; (g) mispricing due to “flash crashes”; (h) politics.

- Lecture 4: Contagion
This lecture will focus on different models of contagion. The first type looks at how networks of claims can lead to a meltdown in the financial system. The second type looks at other kinds of interconnectedness arising from informational links.

- Lecture 5: Financial architecture and foreign exchange mismatches in the banking system
Many effects of the recent financial crisis were amplified by failures in the functioning of the financial architecture. Although in the recent crisis, foreign exchange mismatches did not play a large role, in previous ones such as the Asian Crisis of 1997, they have done. This lecture will consider both these types of systemic risk.

- Lecture 6: Money and financial crises
Most models of financial crises involve real analyses and ignore the role of money. In practice though, many policies to counter the effects of financial crises such as quantitative easing involve printing money. This lecture will consider these types of policy and their effects on the real economy.

Note: These lectures will take place on September 29, October 6 and October 27, 2014.

Literature: will be announced on the TI website.

Assessment: to be announced.

TI108 THE HISTORY OF MODERN ECONOMICS

Lecturer: Dr ir M.J. Boumans (UvA)

Short subject description:
The historian and philosopher of economics, Mary S. Morgan characterizes 20th century economics in comparison with 19th century economics as a more technocratic, tool-based, science, using mathematics and statistics embedded in various kinds of analytical techniques, a science in the mould of engineering. The economist Robert E. Lucas expected main developments in economics to arise from two quite different kinds of sources outside economics. Of these sources the most important consists of purely technical developments. that is, improvements in mathematical methods and improvements in computational capacity. The second source is changes in the questions we want models to answer, or in the phenomena we wish to understand or explain.
The research practice of the modern economists can be typified by design and application of so-called epistemic mediators, such as models and experimental set-ups. From this perspective we will discuss the dominant developments of 20th century economic science which led to new
research practices, such as econometrics, experimental economics and macroeconomics; practices which did not exist in the 19th century. The aim is to understand these developments by considering answers to questions like: Which tools, techniques or technology have been developed with what purpose?

**Course contents:**
The course is built around the history of these developments. Each more or less chronologically ordered section addresses one such a development: graphical analysis, analogue machines, mathematical models, econometrics, the computer, the laboratory.
In this course we analyze primary sources in historical context. In particular, we will examine the historical economic articles in which these new developments were introduced, and, using commentaries and secondary sources from the history of economics and the history of science, we will develop an understanding of the scientific and economic situations to which these new developments responded. The principal sections are:
1. 19th century views on economics
2. Graphs and diagrams
3. Mechanical reasoning
4. Mathematical models
5. Econometrics
6. Simulations
7. Experiments

**Course objective:**
The goal will be to understand how modern economics came into being as an interaction between problems to be solved – both policy and scientific problems – and the available tools, techniques and technology.

**Literature:** Selected papers and lecture notes.

**Course entrance requirements:** none

**Assessment:** Two written summaries and oral presentation thereof (30%), final paper (40%) and oral exam (30%).

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**TI103 THE MACROECONOMICS OF PENSIONS AND AGEING**

**Lecturers:** Prof. R.M.W.J. Beetsma (UvA) and Dr W. Romp (UvA)

**Short subject description:**
This course explores the macroeconomic consequences of different pension arrangements and population ageing.

**Course contents:**
Driven by the ongoing ageing process, many countries (re)design their pension system. Changes in the roles of the public and private pension pillars and the government’s tax-transfer system impact both the distribution of resources and the way risks are shared among groups (such as various generations or income classes). Redistribution involves predictable shifts in resources, while risk sharing refers to unanticipated changes in the distribution of resources. Redistribution and risk sharing implied by the pension system generate important feedback effects on the economy as a whole. In this course we will analyse the macroeconomic aspects of ageing and differences in pension systems. Particular attention will also be paid to the financial and political sustainability of specific pension arrangements.
This course is offered as a reading group consisting of seven sessions. Each session two of the participants will one or more papers. This presentation should highlight the paper’s scientific contribution, the research methodology and results. It should also provide a critical assessment of the paper. Such an assessment could focus on relevance, whether important elements in the analysis are missing, etcetera. All participants are required to have read the papers before the session! The first week will be prepared by Beetsma and Romp.
Course objective:

- By the end of this course, students can identify the main causes and quantitative demographic effects of the ageing process in the Western World.
- Students understand the pros and cons of various types of pension design and how these pension systems help to absorb and share ageing and financial shocks.
- Finally they can use the various overlapping generations models to provide a formal qualitative analysis of the various transmission channels through which ageing and pensions affect the government budget constraint, economic performance and labor market performance.

Literature:

Compulsory (preliminary – subject to potential changes):


Entrance requirements:

Required: Microeconomics I and Macroeconomics I

Recommended (optional): Macroeconomics II

Assessment: The final grade is a weighted average of the quality of the participation (20%), the presentations (30%) and a take home test (50%).
TI136  TI ECONOMETRICS LECTURES 2015

Lecturers: Prof. C.A. Sims (Princeton University), Prof. H.K. van Dijk (EUR) and Prof. D. Fok (EUR)

Course description:
Annual PhD lectures organized by the Tinbergen Institute and the Econometric Institute at EUR, in cooperation with Princeton University Press. These lectures will take place from June 17-19, 2015. Further course details will be published on the TI website.

TI137  TOPICS IN ADVANCED MACROECONOMICS

Lecturers: Dr C.A. Stoltenberg (UvA) and Dr B. Brügemann (VU)

Short subject description:
The course discusses hot topics picked from the research frontier in macroeconomics. The course aims at Tinbergen students in the second year who like to learn more about cutting-the edge research in macroeconomics. It builds on the macro sequence from the first year and introduces additional tools and techniques when needed.

Course contents:
The content of the course is adjusted annually to pick up new topics from the macroeconomic research frontier. A tentative plan for the first year is that Christian Stoltenberg teaches on heterogeneous households, inequality and insurance in macroeconomics. Björn Brügemann will focus on hot topics in macro labor, devoting one week to financial intermediation, liquidity, and money.

• Week 1: Data, puzzles and complete markets
• Week 2: The standard incomplete markets (SIM) model
• Week 3: Limited commitment
• Week 4: Optimal Unemployment Insurance over the Business Cycle
• Week 5: Aggregate Demand and Unemployment
• Week 6: Labor Supply and Business Cycles
• Week 7: Financial Intermediation, Liquidity, and Money

Course objective:
The course aims at providing an in-depth overview on selected topics and methods currently discussed in macroeconomics research. During the course, students learn about avenues for future research, facilitating students to develop their own research ideas on the knowledge basis presented in class.

Literature: Selected papers

Course entrance requirements: Macroeconomics I to IV

Assessment: Two homework group assignments and an individual closed-book exam. The final grade is the weighted average of the homework assignments (20%) and the exam (80%). The exam has to be passed to receive credits for this class.

TI138  TOPICS IN ORGANIZATION AND MARKETS

Coordinators: Prof. J. Hinloopen (UvA) and Prof. O. Swank (EUR)

Short subject description:
The course discusses topics from the research frontier in both Industrial Organisation and Organization Economics. The course aims at Tinbergen students at the end of their first year and that have to decide on their specialization major in the second year.
Course contents:
In each of four weeks one topic will be discussed in detail. This discussion will be representative for both the type of research questions that are addressed in these fields as well as for the methods of study (theoretical, empirical, experimental).

Week 1: 2 x 2 hours lecture. Instructor: José-Luis Moraga
Week 2: 2 x 2 hours lecture. Instructor: Jeroen Hinloopen
Week 3: essay writing, including personal feedback from instructors
Week 4: presentations first essays
Week 5: 2 x 2 hours lecture. Instructor: Robert Dur and Sasha Kapoor
Week 6: 2 x 2 hours lecture. Instructor: Benoite Crutzen and Josse Delfgaauw
Week 7: essay writing, including feedback from instructors, plus presentations second essays

Note that we envisage learning-by-doing: the second essay should be written in a slightly shorter period than the first essay.

Literature:

Week 1 (Industrial Organization) – Moraga

Week 2 (Industrial Organization) – Hinloopen

Week 5 (Organization Economics ) – Robert Dur and Sasha Kapoor

Week 6 (Organization Economics) – Crutzen and Delfgaauw

Assessment: participants have to write two short essays; one within the field of Industrial Organization, and another within the field of Organization Economics. All papers are presented and subsequently discussed. Essays, presentations, and discussions are all graded separately. The content of each essay is more or less fixed: a well-defined research proposal for follow-research based on a thorough discussion of a seminal paper.

TI139 URBAN AND TRANSPORT ECONOMICS

Lecturers: Prof. van Ommeren (VU) and Dr J. Rouwendal (VU)

Short subject description:
This course aims to explain economic behaviour of households and firms within a spatial setting, where the roles of transport cost and cities come to the fore.

Course contents:
We introduce and apply the key concept of spatial equilibrium, where distance between agents, i.e. transport costs, play a fundamental role in their behaviour (location choice, labour supply, productivity). For example, we explain the role of agglomeration, the role of residential amenities, and the value of time of travel. Conceptual theoretical models are introduced and examined which are the basis for empirical work and are used as a guidance for welfare and policy analysis. Theoretical concepts are backed up with empirical studies.

Travel costs (notably the value of time) are key for understanding the spatial equilibrium of workers and firms within the city. In the transport lectures we discuss the dominant empirical approaches to estimate this value (including discrete choice analysis). We also pay attention to the impact of transport infrastructure on urban development.

Social interaction within cities and neighborhood effects as well as urban policy will receive due attention. We will, for instance, discuss the welfare impacts of place-based policies.

The course schedule will be as follows:
1. Introduction: Equilibrium within cities (including the monocentric model)
2. Equilibrium across cities (Roback model)
3. Agglomeration economies
4. Urban transport economics I (value of time, reliability)
5. Urban transport economics II (urban road and public transport infrastructure)
6. Urban distress (crime, neighborhood effects)
7. Cities and public policy

This follows the chapters in Glaeser,E (2008)

Course objective:
After the course students are able to understand the role of transport costs on location behaviour of firms and households within cities as well as across cities (and reversely) and why firms and households agglomerate. They have become familiar with the dominant conceptual models and empirical approaches within the transport and urban economic literature.

Literature:
Compulsory:
• D. Schroeder (2010). *Discrete choice models,* book chapter

**Course entrance requirements:** Microeconomics I, Mathematics I, Statistics and Econometrics I

**Assessment:** Sit-in written exam (3 hours; 80%) and oral presentation (20%).
Appendix I  Information for 4-year PhD students directly hired by the faculties

TI Research Qualification

As of September 1, 2012, Tinbergen Institute awards the TI Research Qualification to PhD students who meet TI’s educational requirements. The educational requirements are given in detail below. For PhD students appointed on or after September 1, 2012, the TI Research Qualification is a condition for access to additional facilities e.g. support on the job market in the final phase of the PhD period including an additional budget to participate in international job market activities.

Students who have completed TI’s MPhil program and students who have completed another, comparable high level research master program (to be assessed by the Directors of Graduate Studies) already fulfill TI’s educational requirement and have access to the same additional facilities as students with the TI Research Qualification. All other students need to complete one of the educational paths, composed of TI courses, in the first 32 months of their PhD appointment.

Students who complete an educational path (40-52 ECTS, details below) will be awarded a TI Research Qualification.

Four educational paths

Four educational paths lead to the TI Research Qualification. The objective of offering four different paths is to give individual PhD students the opportunity to participate in a limited program of PhD courses that is tailor-made to their needs and educational background, while maintaining some of the key characteristics of the full-fledged MPhil program:

- have an understanding of the core of economics by taking rigorous and common training in one or more of the core subjects and tools of economics,
- have a sufficiently deep understanding of one field of economic research by choosing a major field in which at least 4 field courses are taken.

One of the following paths (I-IV) may be chosen, depending on the student’s background and interest:

<table>
<thead>
<tr>
<th>Path</th>
<th>Core Requirement</th>
<th>ECTS</th>
<th>Field requirement</th>
<th>ECTS</th>
<th>ECTS</th>
<th>TOTAL ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Econometrics or Advanced Econometrics</td>
<td>20</td>
<td>at least 4 courses in a chosen major field</td>
<td>12</td>
<td>3 other field courses or 2 additional core courses</td>
<td>8-9</td>
</tr>
<tr>
<td>II</td>
<td>Microeconomics, Macroeconomics or Finance</td>
<td>16</td>
<td>at least 4 courses in a chosen major field</td>
<td>12</td>
<td>4 other field courses or 3 additional core courses</td>
<td>12</td>
</tr>
<tr>
<td>III</td>
<td>2 core sequences</td>
<td>32-40</td>
<td>at least 4 courses in a chosen major field</td>
<td>12</td>
<td></td>
<td>44-52</td>
</tr>
<tr>
<td>IV</td>
<td>3 core courses*</td>
<td>12</td>
<td>at least 4 courses in a chosen major field</td>
<td>12</td>
<td>7 other field courses</td>
<td>21</td>
</tr>
</tbody>
</table>

* one or more of these core courses may be replaced by field courses
PhD students, who wish to receive rigorous training in the core of microeconomics, macroeconomics, econometrics or finance, choose either path I or II. Students who start their PhD without a firm background in economics may decide to focus their educational program at TI even more at the core principles by choosing path III. Compared to the other paths, this path gives more opportunities to catch-up, which is reflected in the somewhat higher number of ECTS involved. Students with a firm background in economics may decide to start immediately with taking specialized courses. Path IV is the path catered to the interests of these students. To deviate from one of the paths, students need official and written consent of the Examination Board.

At the end of the first full academic year after they were appointed as a PhD student, students need to have fulfilled at least 24 ECTS of their chosen path. 32 months after the start of their PhD, students should have fulfilled all educational requirements of their chosen path. Core or field courses are never exempted for PhD students who wish to qualify for the TI research qualification by taking one of the educational paths.

The DGS assesses whether the student meets the entrance requirements for the field courses. The Annual Study Guide stipulates the fields in which the field courses have been classified. Courses within one field count towards the field requirement. Students who have fulfilled the field requirement may take a single core course block which was not part of their core requirement, to replace a single field course. The number of credits awarded for a core course block is then 3 ECTS. Students have the option to substitute a field course which forms part of the field requirement for a field paper (3 ECTS). The paper should be connected to one of the taken field courses and is supervised by the lecturer of that course.

With the official written consent of the Examination Board, students may substitute TI field courses for PhD level courses organized by other graduate schools or by inter-university networks. The number of ECTS as determined by the school offering the course applies.

Students can pass core courses consisting of 4 or 5 blocks and obtain all ECTS for this core course either by passing all course blocks within this course with a grade 6 or higher, or by obtaining a grade 5 for one course block in the course, a grade 7 or up for one other course block in the course, and a grade 6 or up for the remaining course blocks in the course. A 4 or lower for one course block and/or a 5 for more than one course block in the course cannot be compensated and mean that the student did not pass the course. This compensation rule does not apply if students follow a selection of course blocks instead of the complete core course. The compensation rule applies across academic years.

Students are required to register for courses through the TI website. They have the right to withdraw from a course without costs for their department/faculty during the first course week, before the Monday of the second course week.

For detailed information on the educational requirement, we refer to the Academic and Examination Regulations for the TI Research Qualification on the Intranet.

How to proceed

At the start of the PhD track, the student selects in consultation with his/her supervisor one of the educational paths described above and selects courses accordingly (see paragraphs 3.3 and 3.4.1 of this brochure for the list of courses and chapter 4 for all the course descriptions). Both the TI Director of Graduate Studies (DGS) or the ESE DGS (for EUR students) and the supervisor need to give approval to the selected course package. The DGS will decide if a student meets the entrance requirements for the selected courses. The path and course package chosen are explicitly stated in the Plan for PhD training and guidance which forms part of the PhD student’s employment contract. PhD students should register for TI courses in the usual way, so by means of the the online registration form on TI's website.

Fees are charged to the three TI faculties for participation of their PhD students in TI courses.
Indirectly, these fees are paid back to the faculties as lecturer compensation.

**TI PhD students hired before September 1, 2012 and the TI Research Qualification**

TI PhD students hired before September 1, 2012, and at this date active as TI PhD student and employed as a PhD student at the economics faculty of EUR, UvA or VU, who meet the educational requirements for the TI Research Qualification, are entitled to the TI Research Qualification.

**PhD students appointed at the economics faculties of EUR, UvA and VU**

PhD students appointed directly by the faculties on four-year employment positions, no matter if they are affiliated to Tinbergen Institute, may take single courses from TI's MPhil program. These students can participate in all courses for which they meet the entrance requirements, subject to capacity constraints.

Fees are charged to the three TI faculties for participation of their PhD students in TI courses. Internal fees (75% of external fees i.e. € 1.125 for a core course and € 937.50 for a field course) apply only if a TI faculty is billed. Indirectly, these fees are paid back to the faculties as lecturer compensation.

**Registration for and withdrawal from courses**

PhD students should register for courses using the online course registration form before August 15, 2014. TI PhD students use the course registration form that is available on TI’s intranet. PhD students not affiliated to TI use the course registration form for external students (www.tinbergen.nl/online-registration-form/).

PhD students will only be admitted if they meet some equivalent of the TI course entrance criteria. Capacity restrictions apply to all courses, and are particularly relevant for core courses.

PhD students who would like to withdraw from courses should notify Carine Horbach by email (courses@tinbergen.nl) no later than Sunday after the first lecture (all TI courses except intensive field courses) or the day of the first lecture (intensive TI field courses, marked with **“** in Section 3.4.1, only). Fees will be charged in case of late withdrawal.

**Job market training**

PhD students appointed directly by the TI faculties on four-year PhD contracts with as starting date September 1st 2012 or later need to obtain their TI Research Qualification in order to be entitled to TI facilities as training for the job market and an additional travel budget to participate in an international job market event (usually the AEA meetings in the US).
Appendix II  Information for TI PhD students and external participants in TI MPhil courses

TI MPhil graduates

PhD students who completed the TI MPhil program are most welcome to participate in additional field courses during the later years of their studies at the institute. PhD students should register for courses using the online registration form available on TI’s intranet. No costs will be charged for PhD students who have transferred from the MPhil program.

External participants in MPhil courses

Under certain conditions and subject to approval by the Director of Graduate Studies, individuals not affiliated to the Tinbergen Institute are allowed to attend MPhil courses. External participants pay €1,500 for a core course (one block of 8 weeks including one exam week) and €1,250 for a field course (one block of 8 weeks including one exam week).

Prospective external participants should register for courses (only the courses with a TI course code) using the online course registration form for external students, and follow further instructions given there. External applicants will only be admitted if they meet some equivalent of the TI course entrance criteria. Capacity restrictions apply to all courses, and are particularly relevant for core courses. To ensure course availability, external applicants should register for MPhil courses as early as possible (and preferably respect the August 15, 2014, deadline for MPhil and PhD students), but ultimately two weeks before the start of the block in which the course takes place.

External participants who would like to withdraw from courses should notify Carine Horbach by email (courses@tinbergen.nl) no later than Sunday after the first lecture (all TI courses except intensive field courses) or the day of the first lecture (intensive TI field courses, marked with ** in Section 3.4.1, only). Fees will be charged in case of late withdrawal.

TI also offers tailor-made course packages to selected partners. Please contact Carine Horbach at courses@tinbergen.nl for details.
Appendix III  Teaching associates 2014/2015

Prof. E.J. Bartelsman (VU)  e.j.bartelsman@vu.nl
Prof. R.M.W.J. Beetsma (UvA)  r.m.w.j.beetsma@uva.nl
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Dr P.J.C. Spreej (UvA)  p.j.c.spreej@uva.nl
Dr C.A. Stoltenberg (UvA)  c.a.stoltenberg@uva.nl
Prof. O. Swank (EUR)  swank@ese.eur.nl
Dr M.J. van den Assem (VU)  vandenassem@ese.eur.nl (will move to VU)
Tinbergen Institute Economics Lectures 2015:
Professor Ricardo Reis (Columbia University)

Tinbergen Institute Econometrics Lectures 2015:
Professor Chris Sims (Princeton University)

Tinbergen Institute Finance Lectures 2014:
Professor Franklin Allen (University of Pennsylvania/Imperial College London)
Appendix IV  Addresses and directions

**Tinbergen Institute Amsterdam (TIA)**
Gustav Mahlerplein 117  
1082 MS Amsterdam  
Tel.: +31 (0)20-5251600  
E-mail: tinbergen@tinbergen.nl  
www.tinbergen.nl  
(_PUBLIC transport: From Amsterdam Central Station: Tram line 5 stop: Station Amsterdam Zuid WTC or metro 51, stop: Station Amsterdam Zuid WTC:)

**Tinbergen Institute Rotterdam (TIR)**
Burg. Oudlaan 50  
3062 PA Rotterdam  
Tel.: +31 (0)10-4088900  
E-mail: tinbergen@tinbergen.nl  
www.tinbergen.nl  
(_PUBLIC transport: From Rotterdam Central Station: tram line 7, direction Woudenstein campus/Erasmus University. TI is located in the H-building)

**Erasmus University Rotterdam (EUR)**
Erasmus School of Economics  
Burg. Oudlaan 50  
3062 PA Rotterdam  
www.eur.nl/ese  
(Directions: see TIR)

**University of Amsterdam (UvA)**
Faculty of Economics and Business  
Roetersstraat 11  
1018 WB Amsterdam  
www.feb.uva.nl  
(Directions: from Amsterdam Central Station, Amstel Station, or Zuid-WTC Station take a metro to Weesperplein: alternatively, exploit that trams 6, 7, and 10 have stops nearby)

**VU University Amsterdam (VU)**
Faculty of Economics and Business Administration  
De Boelelaan 1105  
1081 HV Amsterdam  
www.feweb.vu.nl  
(Directions: the VU is a short walk from Amsterdam Zuid-WTC Station; alternatively, take tram 5 or metro 51 and exit at VU)

**Duisenberg school of finance**
Gustav Mahlerplein 117  
1082 MS Amsterdam  
www.dsf.nl  
(Directions: see TIA)