

Assessment report
Limited Programme Assessment

Master Econometrics and Operations Research

Vrije Universiteit Amsterdam

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1. Executive summary

In this executive summary, the panel presents the main considerations which have led to the assessment of the quality of the programme Master Econometrics and Operations Research of Vrije Universiteit Amsterdam, which has been assessed according to the NVAO Assessment Framework.

The panel observed programme management has taken up the recommendations made in the previous assessment in 2010. Programme management, among others, separated the master programme more clearly from the corresponding bachelor programme, shifted the balance in the curriculum more towards economics subjects and clarified the organisation.

The panel is positive about the Faculty's objectives to educate students not only in academic and professional knowledge and skills but also to train them to become responsibly thinking and acting professionals or academics. The latter is a distinct and valuable characteristic of the Vrije Universiteit economics programmes.

The panel approves of the broadness and the depth of the programme objectives, allowing students to gain knowledge and understanding of quantitative methods for analysing and solving problems in various fields and training them to become quantitative experts. The panel observed the students are prepared to enter the labour market and may be employed in a number of different industries.

The programme intended learning outcomes meet these objectives, exhibiting, among others, knowledge of econometrics, operations research and mathematical economics, research skills and societal and ethical awareness. The learning outcomes are consistent with the domain-specific reference framework, which has been drafted by this Faculty and the economics programmes of Erasmus University Rotterdam and Wageningen University. In addition, they correspond to master level requirements.

Programme management conducted a sound comparison to other econometrics and operations research master programmes in the Netherlands. From this comparison, this programme emerges as a broad programme, offering econometrics, operations research, mathematical economics and a wide array of optional courses.

The panel supports the policies of programme management to align the programme with trends in the professional field.

In the panel's view, the admission requirements and processes are adequate for this programme. The panel approves of the deficiency programme.

The curriculum reflects all of the programme intended learning outcomes adequately and evenly. The panel regards the curriculum to be very well designed, being an adequate mix of core and optional courses. Students are in-depth educated in either econometrics or operations research and in mathematical economics and are amply trained in academic and research skills. The panel is positive about the options offered to the students to specialise or to choose from the optional courses offered. The panel noted corresponding views on the principles governing the curriculum among the Faculty Board, programme management, lecturers and students and regards this to be effective for the quality of the programme.

The panel is satisfied about the educational principles and the study methods of the programme, as these are conducive to the students' learning processes. The number of contact hours is adequate. The policies regarding the introduction and deployment of new and innovative study methods are satisfactory. The panel regards the programme to be demanding but feels programme management has taken important measures to keep the student success rates at the current, satisfactory levels and encourages programme management to continue along this path.

The panel approves of the lecturers deployment and evaluation procedures, as these procedures ensure qualified lecturers to teach in the programme. The panel regards the lecturers to be very good researchers, working in the forefront of their field of expertise. In addition, the panel is especially positive about the educational capabilities of the lecturers, and their interaction with the students, which may be regarded as intensive and effective.

The examination and assessment rules and regulations of the programme are adequate. They conform to the Vrije Universiteit and Faculty of Economics and Business Administration policy statements and include, among others, measures to assure the examinations' validity, the reliability of assessments and the competencies and expertise of examiners.

The examination methods in the programme are in line with the course contents to be assessed. The diversity of examination methods in courses and across courses allows for the assessment of knowledge and skills, relevant to the programme.

The panel observed programme management having drafted a comprehensive thesis manual in which the timeline of the thesis process has been explained clearly. The supervision of the thesis is well organised. The thesis assessment process is a reliable process, as at least two examiners are involved and sound assessment forms are used. The panel welcomes the transition process from assessment forms to scoring models or rubrics, as these may raise the quality of the assessments further.

The panel regards the Examination Board to have the responsibilities and to work along the lines, as intended by Dutch applicable law. The Board monitors the examination and assessment processes and inspects examinations. The panel recommends to step up these inspections and to include theses in the quality assurance checks, as the Examination Board plans to do.

The panel found the examinations of the courses to be of adequate quality and to be challenging. All of the theses the panel studied, have been assessed by the panel to be at least satisfactory and some of them very good. The panel regards the grades, given by the examiners to be systematically somewhat too low. The panel would have given somewhat higher grades for the theses. Taking this observation into account, the panel would rate the theses to have an average grade of up to or more than 8.0.

The panel is very positive about the positions the graduates have been able to obtain.

The panel assesses the programme Master Econometrics and Operations Research of Vrije Universiteit Amsterdam to be good and recommends NVAO to grant re-accreditation to this programme.

Rotterdam, 6 March 2017

Panel chair
Prof. dr. T.J. Wansbeek

Secretary
drs. W. Vercouteren RC

2. Assessment process

Certiked VBI received a request to conduct a limited programme assessment for the re-accreditation of the academic degree programme Master Econometrics and Operations Research. This request was submitted by Vrije Universiteit Amsterdam.

Certiked requested the approval by NVAO of the proposed panel of experts to conduct this assessment. NVAO have given their approval. The panel composition was as follows (for more detailed information please refer to Annex 4: Assessment panel composition):

- Prof. dr. T.J. Wansbeek, Emeritus Professor of Statistics and Econometrics, University of Groningen (panel chair);
- Prof. dr. J. Hartog, Emeritus Professor of Microeconomics with visiting scholar position, University of Amsterdam (panel member);
- Prof. dr. R. Kabir, Professor and Chair of Corporate Finance and Risk Management, University of Twente (panel member);
- S.M. van den Hoek, student Bachelor programme Tax Economics, University of Amsterdam (student member).

On behalf of Certiked, drs. W. Vercouteren RC was responsible for the process coordination and for drafting the panel's report. All panel members and the secretary signed a statement of independence and confidentiality.

The panel conducted this assessment on the basis of the NVAO Assessment Framework of 19 December 2014 (Staatscourant nr. 36791). Regarding the selection of the theses, the panel proceeded in line with the NVAO Guidelines for the assessment of final projects during external assessments of 18 February 2015. On 19 September 2016, NVAO determined the number of theses to be studied by the panel in this particular case.

The following procedure was adopted. The panel members of the panel studied the documents presented beforehand by programme management, including a number of theses (please refer to Annex 2 and 3: Documents reviewed and Theses reviewed).

Before the date of the site visit, the panel chair and the panel secretary met to discuss the assessment procedures. On 9 November 2016, the panel had a meeting to discuss the preliminary findings concerning the quality of the programme. Beforehand, the panel members had sent a number of questions to be put to the programme representatives during the site visit.

During the meeting on 9 November 2016, the findings of the panel members, including those concerning the theses, were discussed. On the basis of the input of the panel, the secretary summarised the questions, which served as a starting point for the discussions with the programme representatives during the site visit.

On 10 November 2016 and 11 November 2016, the panel conducted the site visit on the Vrije Universiteit Amsterdam campus. The site visit was conducted in accordance with the schedule drawn up beforehand (please refer to Annex 1: Site visit schedule). Prior to the site visit, programme management communicated the open office hours to the students in the programme and the staff. No one called on the panel.

A draft version of this report was finalised by the secretary, having taken into account the information presented as well as the findings and considerations of the panel. The panel members studied the draft report and made a number of changes. Thereupon, the secretary drew up the final report. This report was presented to programme management to be corrected for factual inaccuracies. After having been corrected for these factual inaccuracies, the report was sent to the institution's Board to accompany their request for re-accreditation.

3. Overview of the programme

3.1 Basic information about the programme

Administrative information about the programme:

Name programme in CROHO: Master Econometrics and Operations Research
 Orientation, level programme: Academic Master
 Grade: MSc
 Number of credits: 60.0 EC
 Specialisations: Generic Programme (no specialisation), Econometrics and Mathematical Economics, Operations Research and Business Econometrics
 Location: Amsterdam
 Mode of study: Full-time (English-taught programme)
 Registration in CROHO: 66833

Administrative information about the institution:

Name of institution: Vrije Universiteit Amsterdam
 Status of institution: Government-funded university
 Institution's quality assurance: Approved

Quantitative data about the programme

Percentage of students who completed the programme in two years (n+1)

Cohort	2011	2012	2013
Percentage of students	82 %	85 %	77 %

Lecturers' qualifications

Qualification	MSc	PhD	BKO*
Percentage of lecturers	100 %	90 %	50 %

*BKO means having obtained Dutch University Teaching Qualification. Of full-time staff 60 % have the BKO.

Student-to-staff ratio

The student-to-staff ratio is 50 : 1 (study year 2015 – 2016)

Contact hours

In regular periods, the contact hours are 12 hours per week. In period 3, the contact hours are 8 hours per week. In periods 5 and 6, students are supervised individually for 6 hours, while preparing and completing the master thesis.

3.2 Main facts about the institution

The degree programme Master Econometrics and Operations Research is a programme of the Faculty of Economics and Business Administration of Vrije Universiteit Amsterdam.

Vrije Universiteit Amsterdam (VU) was founded in 1880. According to the website, the university aspires to be an open organisation, strongly linked to people and society. For the University, what matters is not just the acquisition of a greater depth of knowledge, but also the pursuit of a wider scope. VU expects students, researchers, PhD candidates and employees to look beyond their own interests and their own field.

The aim of Vrije Universiteit Amsterdam is to offer academic research and education at a high level of ambition, and to encourage free and open ideas and communication. In its own words, VU stands for universal university values such as academic freedom and independence. The basic philosophy of the university is expressed in three core values: responsibility, openness and personal engagement.

The Faculties of Vrije Universiteit Amsterdam are the Faculties of Dentistry, Earth and Life Sciences, Economics and Business Administration, Behavioural and Movement Sciences, Humanities, Law, Medicine, Sciences, Social Sciences and Theology. Nearly 25,000 students are enrolled in the programmes of the university. About 10,000 staff is employed by the university and by the affiliated VU Medical Center.

The Faculty of Economics and Business Administration offers four bachelor programmes, seven master programmes and 17 postgraduate programmes. Approximately 4,000 bachelor and master students and about 1,700 postgraduate students study at the Faculty and over 500 academic and non-academic staff are employed by the Faculty. The Faculty of Economics and Business Administration is the largest faculty of Vrije Universiteit Amsterdam.

In 2012, the Faculty of Economics and Business Administration started the process of reorganising all of the bachelor and master programmes, beginning with the bachelor programmes. The objectives of this process were to raise the quality of the programmes. Measures which have been taken, are more strict selection of incoming students, raising the education capabilities of the lecturers, restating the intended learning outcomes of the programmes and redesigning the curricula. In 2014, the Faculty offered these reorganised bachelor programmes for the first time.

At the time of this assessment process, the first two years of the bachelor programmes had been renewed, whereas the third and last year still was traditionally organised. The master programmes had not yet been renewed but will, in the coming years, starting in 2017, follow the bachelor programmes. The panel has taken this process of transition into account, when assessing this and the other programmes of the Faculty.

3.3 Intended learning outcomes

The intended learning outcomes of the programme are as follows.

- Students have a thorough and practical knowledge of modern econometrics.
- Students have a sound grasp of the development of modern econometrics, operations research and mathematical economics, and have gained experience with research in at least one subfield.
- Students are able to gain knowledge on other subfields within a reasonable period.
- Students are able to formulate an action plan based on a broad question.
- Students are able to analyse and formulate research results and draw conclusions.
- Students are able to draw up a report and participate in a debate on a professional subject.
- Students are able to consult and make use of international professional literature on relevant subfields.
- Students are able to apply knowledge in econometrics, operations research or mathematical economics in a broad, multidisciplinary context and are experienced in modelling problems from other scientific fields.
- Students are employable in positions which require knowledge and research skills taken from modern econometrics.
- Students have extensive knowledge and understanding of the use of modern econometrics, operations research or mathematical economics in society and can make sound decisions with regard to career possibilities.
- Students have a wide sense of a social responsibility and an eye for ethical aspects of the scientific and professional practice.

3.4 Outline of the curriculum

In the table below, the programme curriculum is presented. Optional courses (*) are offered in a number of periods in the curriculum and include a wide array of subjects in the disciplines economics, mathematics, computer science, econometrics, mathematical economics, operations research or business econometrics. Students who do not opt for one of the specialisations mentioned in the table, may select courses from the total list of optional courses.

Courses	Credits
Advanced Econometrics	6.0 EC
Strategic and Cooperative Decision Making	6.0 EC
Case Study	6.0 EC
Time Series Econometrics	6.0 EC
Optional courses*	18.0 EC
Thesis and Thesis Seminar	18.0 EC
Total credits of Specialisation Econometrics and Mathematical Economics	60.0 EC
Advanced Algorithms	6.0 EC
Strategic and Cooperative Decision Making	6.0 EC
Case Study	6.0 EC
Simulation and Stochastic Systems	6.0 EC
Optional courses*	18.0 EC
Thesis and Thesis Seminar	18.0 EC
Total credits of Specialisation Operations Research and Business Econometrics	60.0 EC

4. Overview of assessments

Standard	Assessment
Standard 1. Intended learning outcomes	Satisfactory
Standard 2: Teaching-learning environment	Good
Standard 3: Assessment	Satisfactory
Standard 4: Achieved learning outcomes	Good
Programme	Good

5. Findings, considerations and assessments per standard

5.1 Standard 1: Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to contents, level and orientation; they meet international requirements.

Findings

As the Dean of the Faculty of Economics and Business Administration explained to the panel, the main objectives of the Faculty are not only to train students to become experts in their field, but also to educate students to handle subjects and problems in a responsible way. So, students are not only trained content-wise but also with respect to their attitudes. These objectives are condensed in the values expressed in the Vrije Universiteit's mission statement, namely responsibility, openness and personal engagement. These values have been translated into the main objectives of the programme, which are to train the students as academics, professionals and citizens.

In preparation of this external assessment, the Faculty of Economics and Business Administration of Vrije Universiteit in collaboration with the management of the economics programmes of Erasmus University Rotterdam and Wageningen University updated the domain-specific reference framework for economics. The current reference framework is an update on a number of non-essential points of the 2009 edition, which was approved by the Deans of all Economics Faculties in the Netherlands. The major change has been the removal of sections referring to business administration.

The objectives of the programme are to educate students to become quantitative specialists, who have in-depth knowledge and understanding of quantitative methods for analysing and solving problems of general, economic, business or financial nature. To that effect, students gain thorough knowledge about mathematics, statistics and computer science. In addition, students are trained in research skills, communication skills and are acquainted with the societal effects of the application of the knowledge and skills, they have acquired. In the programme, students are prepared to enter the labour market, applying for positions in the financial, logistics and ICT industries.

Programme management drafted the programme intended learning outcomes. These intended learning outcomes specify, among others, thorough and practical knowledge of modern econometrics, operations research and mathematical economics, skills to apply this knowledge in broad, multidisciplinary contexts, research skills, written and oral skills and a sense of social responsibility and of ethical consideration. Two specialisations *Econometrics and Mathematical Economics* and *Operations Research and Business Econometrics* are offered. As these may be regarded to rather distinct, programme management considers offering two separate degree programmes.

Programme management drafted a table, to show the correspondence of the intended learning outcomes of the programme to the Dublin-descriptors for master programmes. From this table may be deduced the programme intended learning outcomes match these Dublin-descriptors.

The programme intended learning outcomes have been compared to master programmes in econometrics and operations research in the Netherlands. Programmes, which have been considered in this respect, are programmes of, among others, Erasmus University Rotterdam, University of Amsterdam, University of Groningen and Tilburg University. Abroad, no econometrics programmes are offered. Although the programmes in the Netherlands are very similar in contents and level, this programme may be said to distinguish itself by offering core courses in both econometrics and operations research, by offering a compulsory course in mathematical economics, ensuring a satisfactory level of theoretical economics and by offering students a wide variety of optional courses in, among others, economics and mathematics to choose from and design the programme of their preference.

Programme management maintains relations with the professional field, in order to align the programme with the professional field trends. An Advisory Board with representatives of the professional field has been installed and meets with programme management twice per year.

Considerations

The panel is positive about the Faculty of Economics and Business Administration objectives to train the students not only in terms of academic and professional knowledge and skills but to train them equally to become responsibly thinking and acting professionals or academics in the economics field. The panel holds the opinion the latter to be a distinct and valuable characteristic of the Vrije Universiteit economics programmes.

The panel welcomes the efforts of this Faculty and of the economics programmes of Erasmus University Rotterdam and of Wageningen University to update the 2009 domain-specific reference framework.

The panel is positive about the broadness and the depth of the programme objectives, allowing students to gain knowledge and understanding of quantitative methods for analysing and solving problems in various fields and training them to become quantitative experts. The panel observed the students are prepared to enter the labour market and may be employed in a number of different industries.

The panel studied the programme intended learning outcomes and observed these to meet the programme objectives, exhibiting, among others, knowledge of econometrics, operations research and mathematical economics, research skills, communication skills and societal and ethical awareness.

The panel finds the intended learning outcomes of the programme to match the Dublin-descriptors for master programmes and, therefore, to meet the requirements of a master level programme.

Programme management conducted a sound comparison to other econometrics and operations research master programmes in the Netherlands. From this comparison, this programme emerges as a broad programme, offering econometrics, operations research, theoretical economics and a wide array of optional courses.

The panel supports the policies of programme management to align the programme with trends in the professional field.

Assessment of this standard

These considerations have led the assessment panel to assess standard 1, *Intended learning outcomes* to be satisfactory.

5.2 Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Findings

The responsibility for the programmes of the Faculty of Economics and Business Administration rests with the Dean of the Faculty, and the Faculty Board. Programme management, being the programme director or, in the Faculty's larger programmes, the programme director assisted by the programme coordinator, is responsible for the organisation and the contents of the programme and for assuring and maintaining the quality thereof. Programme management is advised on the programme quality by the Programme Committee, composed of an equal number of lecturers and students. As will be elaborated under standard 3, an Examination Board has been put in place, monitoring the examinations and assessments of the programme.

The number of students enrolling in the programme increased gradually but unmistakably in the last six years, going from an influx of 19 students in 2010 via 27 students in 2012 to an influx of 40 students in 2015. The majority of the incoming students, some 70 %, are from the Vrije Universiteit econometrics bachelor programme, whereas about 20 % are from other Dutch universities.

The admission procedures and admission requirements are subject to the Faculty-wide regulations for master programmes. The programme Admission Board decides on admissions. Students having a bachelor degree in econometrics and operations research from Dutch universities may be admitted without condition. Other applicants have to meet specific prerequisites. Applications are checked to see if applicants have the knowledge and skills required. For some of the students who are admitted, (online) Summer courses are offered. Students with deficiencies are to take a deficiency programme, which will be tailored to their individual background and which will take about one year to two years, in most cases one year. Students having completed a vocational bachelor programme (hbo) are not admitted, but have to start in the bachelor programme, provided they meet the prerequisites of this programme.

In the curriculum students may opt for one of two specialisations, being *Econometrics and Mathematical Economics* and *Operations Research and Business Econometrics*, or may combine courses without choosing a specialisation. In principle, students may study both specialisations in parallel, but this is considered to be very demanding. For both specialisations, three compulsory courses are offered, two on either econometrics or operations research and one on mathematical economics. In addition, students select three optional courses in the fields of economics, mathematics, computer science, econometrics, mathematical economics, operations research or business econometrics. The *Case Study* course at the end of the first semester is a small-scale research project for small groups of students, with the aim to apply the knowledge and understanding acquired and to practice research skills and academic skills. Students with whom the panel met, confirmed having been taught theoretical as well as applied or empirical econometrics. In the master thesis, students are to conduct academic research individually. Students may take an internship, preparing for their thesis. Although no credits are awarded, programme management encourages students to take internships because of the learning effects.

The quality and the coherence of the curriculum are discussed twice per year between programme management and the lecturers.

Programme management presented a table in which the relations between the intended learning outcomes and the curriculum components for all of the specialisations have been specified. From this table, it may be deduced that for all of the specialisations all of the intended learning outcomes are addressed in one or more courses.

The programme educational principle is to teach students fundamental knowledge, to train them in practical application and to teach them research skills. Study methods in the programme are lectures, tutorials, assignments and presentations. In the lectures and tutorials, primarily knowledge is conveyed. In the assignments, practical application is one of the main goals. The *Case Study* and the master thesis are, in addition, explicitly geared towards research.

To foster the introduction of new, innovative study methods, the Faculty of Economics and Business Administration has set up the Innovation Center. Lecturers are encouraged to suggest new study methods and may be granted financial support by the Faculty to develop or test their method. All innovations will be presented in the Innovation Center, with the purpose of other lecturers being informed about these methods, seeing the benefits and adopting these in their own classes.

The programme is considered by students to be demanding but doable. Programme management monitors the study load of the individual students. In addition, programme management has taken a number of measures to promote the students' study pace and the study success rates. Deficiency courses are offered in the deficiency programme. Before the start of the programme, (on line) Summer courses are offered. In the programme, lecturers supervise and assist students. The students with whom the panel met, expressed being very content about their lecturers in this respect. The proportion of students completing the programme within one year was for the last five cohorts on average about 23 %, whereas the figure for completion within two years ranged from 68 % to 85 %, based on figures for the last four cohorts.

Lecturers are employed as researchers in one of the departments of the Faculty. The programme director is responsible for the deployment of the lecturers, discussing this with the department head. In the deployment process, the research and/or the professional track records of the lecturers are being taken into account. Underperformance by lecturers will be signalled by the programme director and the Programme Committee. Unfavourable scores in students evaluations may adversely affect tenure track prospects. The number of staff in the programme is 30 in total, 25 lecturers being full-time employed by VU Amsterdam and 5 of them having a part-time position. Of the lecturers 90 % have obtained a PhD and 50 % are in possession of the BKO-certificate, testifying to their capabilities in education. The proportion of BKO-certified full-time lecturers is 60 %. The students with whom the panel met, described the lecturers as being good and stimulating teachers and being approachable and helpful.

Considerations

The admission requirements and processes are adequate for this programme, as only students having a fair chance of completing the programme are admitted. The panel approves of the deficiency programme.

The curriculum reflects all of the intended learning outcomes of the programme adequately and evenly. The panel regards the curriculum to be very well designed, being a very appropriate mix of core courses and optional courses. Students are in-depth educated in either econometrics or operations research and in mathematical economics and are amply trained in academic and research skills. The panel is positive about the options offered to the students to specialise or to choose from the optional courses offered. The panel noted corresponding views on the principles governing the curriculum among the Faculty Board, programme management, lecturers and students and regards this to be effective for the quality of the programme.

The panel is satisfied about the educational principles and the study methods of the programme, as these are conducive to the students' learning processes. The number of contact hours is adequate. The policies regarding the introduction and deployment of new and innovative study methods are satisfactory.

The panel recognises the programme is demanding but feels programme management has taken important measures to keep the student success rates at the current, satisfactory levels and encourages programme management to continue along this path.

The panel approves of the lecturers deployment and evaluation procedures, as these procedures ensure qualified lecturers to teach in the programme. The panel regards the lecturers to be very good researchers, working in the forefront of their field of expertise. In addition, the panel is especially positive about the educational capabilities of the lecturers, and their interaction with the students, which may be regarded as intensive and effective.

Assessment of this standard

These considerations have led the assessment panel to assess standard 2, *Teaching-learning environment* to be good.

5.3 Standard 3: Assessment

The programme has an adequate assessment system in place.

Findings

The examinations and assessments of this programme, as of all the other programmes of the Faculty of Economics and Business Administration, are governed by the Vrije Universiteit Assessment Policy, this being part of the VU Quality Assurance Handbook, as well as by the Faculty Assessment Policy, which has been derived from this VU Assessment Policy. The examination and assessment rules and regulations of this and the other programmes of the Faculty are in line with these University and Faculty policy statements.

For this programme as well as for each of the other Faculty of Economics and Business Administration programmes, rules and regulations for the examinations and assessments have been specified and have been implemented. Firstly, programme management drafted an assessment plan, in which the courses' learning objectives are shown to cover the programme intended learning outcomes. This plan allows to verify whether the examinations of the courses comply with the intended learning outcomes of the programme. Secondly, programme management took a number of measures to promote the validity, reliability and transparency of examinations and assessments. To enhance the validity of the examinations, each of the examinations is prepared by one of the lecturers and is presented to another lecturer for review. The examiners ensure examinations to meet the course objectives and to conform to the intended learning outcomes of the programme. To foster the reliability of the assessments, answer models are being used by the examiners. This way, a degree of objectivity is introduced in the assessments. To promote the transparency of the examinations, students may inspect the grading of their work and examiners will explain the grading to students upon request. Thirdly, programme management ensures the examiners to have adequate expertise and competencies to fulfil their tasks. To this effect, examiners are formally appointed by the Examination Board, following the recommendation of the programme director. Fourthly, the examination methods or assessment types of the courses are to be consistent with the courses' learning objectives and study methods. In the assessment plan, these examination methods have been listed. Examination methods include written examinations with open questions, individual cases/papers, group cases/papers, computer assignments and presentations. In most courses, multiple examinations are to be taken by the students and the final grade of the courses is a composite grade, this being the weighed outcome of the grades of the course components.

At the end of the programme, students are required to complete their master thesis. In the thesis manual, the procedures and the timeline for the thesis have been stipulated. Students receive supervision of the thesis writing process by a supervisor, and take part in intermediate thesis seminars. Students are required to submit their thesis and to present and defend the thesis in a final presentation before the examiners and before their fellow students. Theses are assessed by both the thesis supervisor and the second reader. These two examiners assess and grade the thesis independently and meet to arrive at the final grade. In case they cannot agree, a third examiner will be asked to grade the thesis. For the thesis assessment, the examiners use assessment forms, showing the criteria to be assessed. The programmes of the Faculty are in the transition process from these forms to scoring models or rubrics, specifying the assessment criteria and statements per criterion to support the grading. Theses are checked for plagiarism and plagiarism scores are mentioned on the assessment forms or scoring models.

For the programmes of the Faculty of Economics and Business Administration, two Examination Boards have been installed, one for all of the regular bachelor and master programmes of the Faculty and one for all of the accredited postgraduate programmes. As this programme is one of the regular bachelor and master programmes of the Faculty, the first mentioned Examination Board has the authority. The Examination Board consists of a number of members of the Faculty as well as an external expert on examinations and assessments. The Board monitors examinations and assessments processes, in accordance with the Faculty Regulations and Guidelines regarding Examinations. In addition, the Examination Board ensures examinations, including final examinations, to conform to quality standards. In recent years, the Board scheduled training sessions for examiners and analysed multiple-choice examinations. The Examination Board studies assessment plans to verify the contents thereof. In 2016 – 2017, written examinations with open questions are analysed as well. The Board inspects examinations on an at random basis and has the intention to inspect examinations and theses more systematically in the coming years.

Considerations

The panel is positive about the examination and assessment rules and regulations of the programme. They not only conform to the Vrije Universiteit and Faculty of Economics and Business Administration policy statements but also address subjects which are relevant for assuring the examinations and assessments quality. These rules and regulations include, among others, measures to assure the examinations' validity, the reliability of assessments and the competencies and expertise of examiners.

The panel approves of the examination methods, that programme management has selected. They are in line with the course contents to be assessed. The diversity of examination methods in courses and across courses allows for the assessment of both knowledge and skills, relevant to the programme.

Programme management drafted a comprehensive thesis manual, in which the timeline of the thesis writing process is explained clearly. The supervision and assessment of the thesis are well organised. The assessment of the theses is a reliable process, as at least two examiners are involved and sound assessment forms are used. The panel welcomes the transition process from assessment forms to scoring models or rubrics, as these may raise the quality of the assessments further.

The panel ascertained the Examination Board to have the responsibilities and to work along the lines, as intended by Dutch applicable law. The Board monitors the examination and assessment processes and inspects examinations. The panel recommends to step up these inspections and to include theses in the quality assurance checks, as is intended by the Examination Board.

Assessment of this standard

The considerations have led the assessment panel to assess standard 3, *Assessment* to be satisfactory.

5.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

In the two most recent years, 2014 – 2015 and 2015 – 2016, the average grades for the master theses as estimations for the learning outcomes achieved by the graduates, were 7.9 and 7.7.

The graduates of the programme are trained to enter the labour market. Graduates tend to find positions very easily, with relatively high salaries. The graduates' cognitive skills, such as analytical reasoning, problem solving and quantitative skills are highly appreciated in the labour market. Communication skills and job-hunting skills may be improved somewhat, in the students' view.

Students who want to pursue an academic career and who want to start a PhD-trajectory, will have to enrol in the research master programmes of Tinbergen Institute or Amsterdam Business Research Institute. Programme management would like to be able to extend the current programme into a research master programme, in order to accommodate these students.

Considerations

The panel studied examinations of a number of courses in the programme. The panel establishes these examinations to be of adequate quality and of an appropriate level, meeting the courses' learning goals. The examinations are considered by the panel to be challenging and to address up-to-date subjects.

The panel studied four theses of students in the programme. All of the theses have been assessed to be at least satisfactory by the panel. The panel rated some of the theses to be very good. The panel regards the grades, given by the examiners for the theses to be systematically somewhat too low. The panel would have given higher grades for these master theses. Taking this observation into account, the panel would rate the theses to have an average grade of up to or more than 8.0.

The panel is very positive about the positions the graduates have been able to obtain.

Assessment of this standard

The considerations have led the assessment panel to assess standard 4, *Achieved learning outcomes* to be good.

6. Recommendations

In this report, recommendations have been listed. For the sake of clarity, these recommendations are reproduced here.

- To continue the policy and measures by programme management, already in place, to raise the student success rates.
- To step up the inspections of examinations by the Examination Board and to include the theses in these quality assurance checks, as the Examination Board is already planning to do.

Annex 1: Site visit schedule

The site visit was conducted in Amsterdam on 10 November 2016. On 11 November 2016, the panel met with the Examination Board.

Site visit schedule for 10 November 2016.

08.30 h. – 09.00 h.	Arrival and deliberations panel (closed session)
09.00 h. – 09.45 h.	Faculty Board Prof. dr. W. Verschoor (Dean of Faculty Economics and Business Administration), drs. R. de Crom (Faculty Director of Education), M. Eigenhuis (Student Assessor Faculty Board)
09.45 h. – 10.45 h.	Programme management Bachelor Economics and Business Economics Programme management Bachelor Econometrics and Operations Research Prof. dr. H. de Groot (programme director, Bachelor Economics and Business Economics), dr. M. Schauten (programme coordinator, Bachelor Economics and Business Economics), dr. R. Heijungs (associate professor, Bachelor Economics and Business Economics), prof. dr. B. Heidergott (programme director, Bachelor Econometrics and Operations Research), dr. C. Bos (programme coordinator, Bachelor Econometrics and Operations Research), dr. R. van den Brink (associate professor, Bachelor Econometrics and Operations Research)
11.00 h. – 12.00 h.	Lecturers and examiners Bachelor Economics and Business Economics Lecturers and examiners Bachelor Econometrics and Operations Research Dr. T. Budding (assistant professor, chair Programme Committee, Bachelor Economics and Business Economics), dr. H. Bloemen (associate professor, Bachelor Economics and Business Economics), prof. dr. M. Hofkes (Professor of Environmental Economics, Bachelor Economics and Business Economics), dr. H. Houba (associate professor, member Programme Committee, Bachelor Econometrics and Operations Research), dr. A. Estevez Fernandez (assistant professor, Bachelor Econometrics and Operations Research), dr. L. Hoogerheide (associate professor, Bachelor Econometrics and Operations Research)
12.00 h. – 12.45 h.	Students and alumni Bachelor Economics and Business Economics Students and alumni Bachelor Econometrics and Operations Research S. Plaul (second year student, member Programme Committee, Bachelor Economics and Business Economics), O. Papôt (third year student, Bachelor Economics and Business Economics), Q. Wiersma (third year student, Bachelor Economics and Business Economics), J. Koster (third year student, Bachelor Economics and Business Economics), E. Hoogenboom BSc (alumna, Bachelor Economics and Business Economics), J. Rutgers (first year student, member Programme Committee, Bachelor Econometrics and Operations Research), R. Rasiawan (second year student, member Programme Committee, Bachelor Econometrics and Operations Research), A. Mohazzab (second year student, Bachelor Econometrics and Operations Research), T. Dilaver MSc (alumnus, Bachelor Econometrics and Operations Research), R. Wulffraat BSc (alumnus, Bachelor Econometrics and Operations Research)

- 12.45 h. – 13.45 h. Lunch panel (closed session), open office hours 12.45 h. – 13.15 h.
- 13.45 h. – 14.45 h. Programme management Master Economics
Programme management Master Econometrics and Operations Research
Prof. dr. B. van der Klaauw (programme director, Master Economics), prof. dr. P. Gautier (Professor of Macro Labor Economics, Master Economics), prof. dr. M. Lindeboom (Professor of Economics, head of Department Economics, Master Economics), prof. dr. B. Heidergott (programme director, Master Econometrics and Operations Research), dr. R. van den Brink (associate professor, Master Econometrics and Operations Research), dr. A. Ridder (associate professor, Master Econometrics and Operations Research)
- 14.45 h. – 15.30 h. Lecturers and examiners Master Economics
Lecturers and examiners Master Econometrics and Operations Research
Dr. R. Oostendorp (Professor of International Economics, member Programme Committee, Master Economics), dr. S. Dobbelaere (associate professor Master Economics), prof. dr. J. Moraga Gonzales (Professor of Microeconomics. Master Economics), dr. ir. R. Sitters (assistant professor, Master Econometrics and Operations Research), dr. C. Bos (associate professor, Master Econometrics and Operations Research), dr. I. Lindner (associate professor, Master Econometrics and Operations Research)
- 15.45 h. – 16.15 h. Students and alumni Master Economics
Students and alumni Master Econometrics and Operations Research
N. Stoelinga MSc (alumna, Master Economics), A. Slavin BSc (student, member Programme Committee, Master Economics), M. Konings MSc (alumnus, Master Economics), N. Nguyen BSc (student, member Programme Committee, Master Econometrics and Operations Research), Y. Weesie BSc (student, Master Econometrics and Operations Research), J. van Brummelen BSc (student, Master Econometrics and Operations Research), K. Fontijn BSc (student, Master Econometrics and Operations Research), V. Rensink MSc (alumna, Master Econometrics and Operations Research), E. Blanken MSc (alumna, Master Econometrics and Operations Research)
- 16.15 h. – 17.30 h. Deliberations panel (closed session)
- Site visit schedule for 11 November 2016.
- 08.45 h. – 09.45 h. Examination Board regular bachelor programmes and master programmes
Examination Board postgraduate programmes
Prof. dr. B. van den Hooff (chair Examination Board regular programmes), prof. dr. H. van Herk (member Examination Board regular programmes), mr. drs. H. Welling (secretary Examination Board regular programmes), L. Spoor RA (chair Examination Board postgraduate programmes), prof. dr. F. Roozen (former chair Examination Board postgraduate programmes), B. de Graaff MSc (secretary Examination Board postgraduate programmes)

Annex 2: Documents reviewed

The panel studied the following documents, presented prior to the site visit

- Critical Reflection Report Limited Programme Assessment Master Econometrics and Operations Research
- Redesign Faculty of Economics and Business Administration programmes
- Domain-specific frame of reference
- Intended learning outcomes
- Programme overview 2015 – 2016
- Course descriptions 2015 – 2016
- Assessment plan 2016 – 2017
- Thesis manual and assessment form 2015 – 2016
- Academic and Examination Regulations 2015 – 2016
- Rules and Regulations regarding examinations 2015 – 2016
- Overview of academic staff, including quality
- List of graduates in academic years 2014 – 2015 and 2015 – 2016
- Intake, drop out and success rates
- Staff/student ratio
- Average number of contact hours

On the day of the site visit, programme management presented the following documents

- Applications and enrolments figures
- Course material of a number of selected courses of the programme
- Examinations of a number of selected courses of the programme
- Programme management annual reports
- Programme Committee annual reports
- Examination Board annual reports

Annex 3: Theses reviewed

The theses of the following four students have been selected for review by the panel

- 2534995
- 2519924
- 2550743
- 2504964

Annex 4: Assessment panel composition

The assessment panel had the following composition:

- Prof. dr. T.J. Wansbeek, Emeritus Professor of Statistics and Econometrics, University of Groningen (panel chair);
- Prof. dr. J. Hartog, Emeritus Professor of Microeconomics with visiting scholar position, University of Amsterdam (panel member);
- Prof. dr. R. Kabir, Professor and Chair of Corporate Finance and Risk Management, University of Twente (panel member);
- S.M. van den Hoek, student Bachelor programme Tax Economics, University of Amsterdam (student member).

Prof. dr. T.J. Wansbeek, panel chair

Mr. Wansbeek is Emeritus Professor of Statistics and Econometrics at University of Groningen. He took his doctorate from University of Leiden. Among others, he held positions as Professor of Microeconomics at University of Amsterdam, as the Dean of the Faculty of Economics and Business of University of Amsterdam and as the Dean of the Faculty of Economics of University of Groningen. He was and is an editorial board member of a series of academic journals, such as *Journal of Econometrics*. Mr. Wansbeek held and holds a number of visiting scholar positions at, among others, University of Southern California, United States and Zhejiang University, China.

Prof. dr. J. Hartog, panel member

Mr. Hartog is Emeritus Professor of Microeconomics at University of Amsterdam, holding a visiting scholar position at this university. He took his doctorate from Erasmus University Rotterdam. At this university, he held the position of researcher and associate professor, subsequently becoming Professor of Microeconomics at University of Amsterdam. He held a number of visiting positions at universities in countries Europe, the United States and Asia. He also was an editor and referee for a number of international academic journals. Mr. Hartog is a member of the Royal Netherlands Academy of Sciences.

Prof. dr. R. Kabir, panel member

Mr. Kabir is Professor and Chair of Corporate Finance and Risk Management at University of Twente and Head of the Department of Finance and Accounting. He took his doctorate from Maastricht University. He held visiting scholar positions at, among others, Central University of Finance and Economics, Beijing, China, New York University, United States and University of Melbourne, Australia. Before becoming Professor at University of Twente, Mr. Kabir was Associate Professor of Finance at Tilburg University and Professor of Finance at University of Stirling, United Kingdom.

S.M. van den Hoek, student member

Ms. Van den Hoek is a student in the Bachelor programme Tax Economics of University of Amsterdam. She has taken on a number of extra-curricular activities, such as being the chair of the Student Association of her programme and being a member and the chair of the Student Council of the Faculty of Economics and Business of University of Amsterdam. In addition, Ms. Van den Hoek is employed by Canal Company as a guide and a host.