

**Master of Science
Econometrics and Operations Research
Vrije Universiteit Amsterdam**

*Report of the limited programme assessment
16 – 18 November 2022*

Utrecht, The Netherlands

March 2023

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Assessment Agency for Higher Education

Colophon

MSc Econometrics and Operations Research

VU Amsterdam

Academic Master (wo-ma)

Location: Amsterdam

Mode of study: full-time

CROHO: 66833

Result of institutional assessment: positive (June 2020)

Panel

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The panel was presented to the NVAO for approval.

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Summary

From 16 to 18 November 2022 an assessment committee of AeQui visited the School of Business and Economics (SBE) at VU Amsterdam to perform a quality assessment of 11 degree programmes in Economics. This document reports on the committee's assessment of the Master of Science (MSc) in Econometrics and Operations Research (EOR) according to the 2018 NVAO framework for limited programme assessment. The MSc EOR is a one-year full-time 60 ECTS programme, which is offered in English. Right from the start students choose either the Econometrics or the Operations Research track and tailor their curriculum throughout the year towards one of eleven specialisations. The assessment committee has established that the MSc EOR programme meets all four NVAO standards under consideration: intended learning outcomes, teaching-learning environment, assessment and achieved learning outcomes. As a result, the committee's overall assessment of the quality of the MSc programme Econometrics and Operations Research is **positive**.

Intended learning outcomes

The MSc EOR has a specific profile, which is rooted in the vision on education of both VU and SBE and is adequately reflected in the learning outcomes and curriculum of the programme. Moreover, the programme stands out for its core training in econometrics or operations research and for its numerous specialisations and optional courses. This results in a strong research oriented programme featuring up-to-date tracks in econometrics and operations research. Since the previous accreditation, the intended learning outcomes have been restructured and reformulated: the current formulation is adequate and reflects properly the domain, level and orientation of the programme. The programme pays considerable attention to the professional component in the curriculum. Because EOR students are trained to bridge theory and practice, the programme seeks input from external stakeholders to keep its curriculum up-to-date. The recently adjusted advisory board constitutes an important and useful instrument in this respect. The assessment committee judges that the MSc EOR **meets this standard**.

Teaching-learning environment

The teaching-learning environment for the MSc EOR is well developed. The programme has a coherent structure and students can choose among many different high quality courses. The tracks and specialisations correspond with the research interests of the departments, which means that the latest scientific developments find their way into the teaching pro-

gramme. The course learning goals and the programme learning outcomes are well attuned and thus ensure that by the time of graduation, EOR students will have achieved all intended learning outcomes. The committee endorses the choice of the school and the programme to offer the MSc EOR programme in English. In terms of didactics, the learning environment reflects the priorities and vision of both VU and SBE. There is a clear move in the school and the EOR programme towards more activating forms of learning: qualified and motivated educational innovators are taking the lead in introducing active blended learning in courses. Their work now needs to be picked up and streamlined across programmes. There is also room for implementing the mixed classroom as an educational principle in the programme. This is all the more important given that with the current (dis)balance between Dutch and international students, there is a risk for segregation in the cohorts. The student intake in the MSc EOR has increased considerably but this growth has neither affected the quality of education, nor the highly appreciated guidance system. Both local and international students feel welcome at VU and praised the attention of the university services to student wellbeing, notably, but not exclusively, during the COVID-19 pandemic. The MSc EOR is attracting a heterogenous student audience while keeping the drop-out rate low. Although the programme tracks and specialisations are very ambitious, the curriculum is feasible in one year if students would commit to this goal. The number and quality of staff involved in the EOR programme is good: recent hirings have ensured that the growing number of students can be taught and tutored in

adequate conditions and by a sufficient number of properly qualified staff. The committee also thinks highly of the professional development opportunities for staff, and in particular of the fact that they also use these opportunities. The assessment committee judges that the MSc EOR **meets this standard**.

Assessment

The assessment at EOR is robust. This appreciation is based first and foremost on the fact that both course and thesis assessment are embedded in well-established policies and frameworks at the level of the university and the school. The sample of assessment formats shows that the assessment principles and policies are properly implemented in the course assessments. The EOR assessment plan demonstrates that course learning goals are assessed adequately, which in turn ensures that all learning outcomes at programme level are covered. Since the previous accreditation visit, both school and programme have made considerable efforts to bring assessment quality up to par. The Examination Board has grown in capacity and competency, as is demonstrated by the variety of assessments tasks it has been assuming, and is capable to assure the assessment quality of the EOR programme. Thesis assessment is organised adequately. The programme can rely on a solid thesis procedure and policy. It is using a relevant evaluation form with adequate criteria, an extensive assessment matrix and space for individual appreciations and feedback of the supervisor and the second reader. Moreover, the sample of thesis assessments reviewed by the committee showed that in almost all cases, the final grade was in line with the committee's appreciation and that most assessors had provided clear, insightful and constructively critical information in the summary

In view of its positive assessment of the programme quality as a whole and its judgement on each of the four accreditation standards, the committee issues a **positive recommendation** to NVAO regarding the accreditation of the MSc Econometrics and Operations Research at the School of Business and Economics of VU Amsterdam.

On behalf of the entire assessment committee, Utrecht, March 2023

Hans van Ees
Chair

Mark Delmartino
Secretary

feedback. The assessment committee judges that the MSc EOR **meets this standard**.

Achieved learning outcomes

In order to establish whether the EOR programme learning outcomes have been achieved, the committee reviewed a sample of master theses and checked what graduates were doing after they finished the programme. The thesis sample and the discussions on-site revealed that upon graduation, MSc EOR students have definitely achieved all programme learning outcomes. The thesis review has shown that students are capable of writing good quality final products, with some of the best theses leading to scientific publications. The discussion with alumni confirmed that the MSc EOR programme prepares students for a relevant professional career. The assessment committee judges that the MSc EOR **meets this standard**.

Recommendations

The assessment committee has issued a positive judgement on the MSc EOR programme and on the quality of each individual accreditation standard. Nonetheless, the committee also sees room for improvement in a number of areas. The following suggestions constitute no formal recommendations, but points for attention the committee picked up during the visit and reported in the respective assessment standards. The committee advises the programme to:

- streamline the (results of the) work on educational innovation / active blended learning across programmes;
- make use of the geographically diverse student intake to implement the mixed classroom as an educational principle in the courses.

Introduction

The School of Business and Economics at Vrije Universiteit Amsterdam offers a one-year full-time MSc programme in Econometrics and Operations Research. The programme consists of two tracks – Econometrics and Operations Research – with seven and four specialisations, respectively. Over the years, the student intake has quadrupled to around 250 students, 15% of whom are international. The external assessment of the MSc EOR programme is part of a wider cluster assessment covering degree programmes at Erasmus University Rotterdam, VU Amsterdam, the University of Utrecht and Wageningen University.

Institution

Vrije Universiteit (VU) Amsterdam is a university with nine faculties in Humanities, STEM, Social and Medical Sciences. Since its foundation in 1880, VU Amsterdam has stood for scientific and value-driven education, research and knowledge transfer. Its education and research are closely linked and have a strong social orientation. All education is provided on one campus in the heart of the Zuidas Knowledge District.

The School of Business and Economics (SBE) is one of VU's faculties and offers four BSc, ten MSc and 15 postgraduate programmes in economics and business administration. Since its establishment in 1948, SBE has evolved into a school with more than 8,000 students and over 500 academic and non-academic staff members.

The school is governed by the SBE faculty board under the leadership of the dean. The academic staff is divided in departments; each head of department assigns the teaching, research and administrative tasks. SBE has a well-established system of quality assurance of teaching and assessment, which is based on the VU Manual for quality assurance of teaching and learning and to which all programmes adhere. SBE has two examination boards in the economics cluster: one governing all government-funded programmes, and one for accredited postgraduate programmes.

Programme

Each degree programme has a dedicated programme director who is responsible for content, organisation and quality assurance. The director

ensures that the curriculum is adjusted to the intended learning outcomes and that the learning environment meets the quality requirements of SBE. In the bachelor and larger master programmes, one or more programme coordinators assist the director. Each degree programme has a programme committee comprising of an equal number of students and lecturers, appointed by the SBE faculty board.

The Master of Science (MSc) in Econometrics and Operations Research (EOR) is a one-year full-time 60 ECTS programme offered in English. Since the previous accreditation visit, the programme has been restructured and now consists of two tracks – Econometrics and Operations Research – with seven and four specialisations, respectively. Over the years the student intake has continuously grown from 61 students (in 2016-2017) to 247 students (in 2021-2022). Most students opt for one of the Econometrics specialisations and about 15% of the students is non-Dutch.

Assessment

This assessment is part of a wider cluster assessment Economics group 1, which consists of the Erasmus University Rotterdam, VU Amsterdam, Utrecht University and Wageningen University. The group assigned AeQui to perform a quality assessment of its bachelor, master and research master programmes in Economics. Together with the cluster group and its individual schools/faculties, AeQui convened an independent and competent assessment committee. The committee members are shortly presented in attachment 1. At VU Amsterdam, the cluster assessment features 11 bachelor, master and post-experience

(executive) master programmes. In the run-up to the visit, a preparatory meeting was held with representatives of SBE to exchange information and plan the dates and programme of the site visit. The visit was carried out from 16 until 18 November 2022 according to the programme presented in attachment 2.

In so far as the Master of Science (MSc) Econometrics and Operations Research (EOR) is concerned, the assessment committee members studied the programme's self-evaluation report and reviewed a sample of 15 MSc EOR theses. Their first impressions on the report and the thesis (evaluations) formed the basis for discussion during an online preparatory meeting on 8 November 2022, and guided the committee's questions during the site visit.

Prior to the visit, the committee held an Open Consultation Hour for students, teaching and support staff; eventually nobody used the opportunity to speak individually and confidentially with the committee. Initiated by the programmes, the visit also featured a Development Dialogue. The results of this dialogue have no influence on the assessment in this report.

Furthermore, the programme put at disposition many relevant materials, which served as background information for the assessment committee before and during the visit. An overview of these materials is listed in attachment 3.

The committee has assessed the programme in an independent manner; in relation to, and in consideration of, the cluster of programmes in which this programme is placed. The contextualisation of the programme within its cluster was conducted by the complete committee during the preliminary meeting and the final deliberations. At the end of the visit, the chair of the assessment committee presented the initial findings of the committee to representatives of the programmes and the school.

In the underlying document, the committee is reporting on its findings, considerations and conclusions according to the NVAO framework 2018 for limited programme assessment. A draft version of the report was sent to the programme management at the end of January 2023; its reactions have led to this final version of the report.

1. Intended learning outcomes

The Master of Science (MSc) in Econometrics and Operations Research (EOR) is designed in the belief that a strong theoretical foundation, combined with plenty of opportunities for application, prepares students for a professional career in which they will use econometrics, mathematics, statistics and computer-based methods for the quantitative analysis of problems in business, finance and economics. The MSc EOR has a specific profile, which is rooted in the vision on education of both University and School and 'translated' in the learning outcomes and curriculum of the programme. The MSc EOR at VU stands out among similar programmes for its core training in econometrics or operations research and for its numerous specialisations and optional courses. This results in a strong research oriented programme featuring up-to-date tracks in econometrics and operations research and with a large number of students. The formulation of the intended learning outcomes is adequate and reflects properly the domain, level and orientation of the programme. The MSc EOR pays good attention to the professional component in the curriculum and seeks input from external stakeholders - including an advisory board - to keep its curriculum up to date. According to the committee, the MSc EOR programme **meets this standard**.

Findings

Purpose

The Master of Science (MSc) in Econometrics and Operations Research (EOR) addresses the methodological aspects of the economics domain by offering a scientific programme to pursue a professional career that uses econometrics, mathematics, statistics and computer-based methods for the quantitative analysis of problems in business, finance and economics. The programme wants students to attain a master level in Econometrics or Operations Research with an emphasis on the mathematical, statistical and analytical tools underlying these two fields. Moreover, it provides the knowledge and skills for a professional career in (among others) the financial, logistics and consulting industry. The programme is designed in the belief that a strong theoretical foundation, combined with plenty of opportunities for students to apply the theory, gives students the best starting position in pursuing their professional career. Hence, the programme has a clear emphasis on academic training, yet also teaches students to apply what they have learned by solving complex scientific problems and questions through case-directed projects, by working on assignments and by conducting empirical research.

The assessment committee gathered from the written materials and the discussions that the objective of this master programme aligns with the vision of both VU and SBE, which is formulated along two axes: (1) the behavioural component is firmly embedded in the core values responsible, personal and open of the VU; and (2) the content component consists of the roles academic, professional and citizen. These elements have guided the elaboration of education in the MSc EOR and are reflected in the learning outcomes of the programme and the course learning goals. The committee endorses that integrating the academic, professional and citizen roles with the behavioural components responsible, personal and open creates a unique profile for both SBE and for the master students that graduate from the EOR programme. Moreover, it is the vision of VU, SBE and EOR that there should be ample opportunities for students to personalise their programme by optional courses and in this way intensify one or more of the three roles.

The committee noticed furthermore that the structure, level and contents of the MSc EOR programme at VU are comparable to other econometrics programmes in the Netherlands. However, the MSc EOR at VU distinguishes itself from these programmes by (i) a strong core pro-

gramme in either econometrics or operations research, (ii) different specializations within both tracks, and (iii) ample opportunities to choose optional courses to give a personal character to the study programme, orienting more into economics, finance, mathematics or other directions. The committee gathered from the discussions on-site that students are aware of these distinctive features.

Intended Learning Outcomes

The programme's intended learning outcomes consist of learning goals and learning objectives: the goals refer to what graduates are or have and are set SBE-wide; the objectives refer to what graduates can do or make and are specific to the EOR programme. The committee observed that there is a direct link between the respective goals and objectives, and that both goals and objectives are clustered around five dimensions: academic and research skills, bridging theory and practice, social skills, broadening horizons, and self-awareness.

The MSc EOR programme features five learning goals and six learning objectives. Compared to the previous accreditation visit, the intended learning outcomes have been reformulated to reflect the AACSB format: the Association to Advance Collegiate Schools of Business is a highly reputed accreditation body whose international quality standard SBE managed to obtain since the previous accreditation visit. The current assessment committee has studied the intended learning outcomes and noticed that they are formulated at the appropriate master level and reflect the academic orientation of the programme. Furthermore, the committee gathered from the materials and discussions that there is alignment between the EOR learning outcomes, the European-wide Dublin Descriptors and the disciplinary objectives pursued by other national and international degree programmes in the domain of econometrics and operations research.

The committee appreciates the broadening horizon dimension in the learning outcomes. It finds the objective that graduates "can formulate their

own opinion of the ethical and social implications of the outcome of their analysis" highly relevant for MSc students. The required domain-specific knowledge reflects the double focus of the programme on theory and real-world application. By the end of the MSc programme, EOR students should "demonstrate and apply state-of-the-art theory in the fields of econometrics and operations research" and "develop solutions for complex real-life problems by applying relevant econometrics and operations research techniques and methodologies." The committee understands that it is a conscious choice of SBE and the programme to keep the formulation of the programme learning outcomes at a fairly abstract level, among others, because of the numerous specialisations in the programme. Nonetheless, the learning outcomes do indicate what the programme and its specialisation stand for. Anticipating on what will be covered in the next section, there is a clearly demonstrated link between the course learning goals and the learning outcomes at programme level.

Professional Field

In line with the vision of both VU and SBE, the EOR programme aims to educate its students to become responsible professional practitioners. The committee noticed that there is ample attention to the professional component in both learning outcomes and curriculum. In order to keep the curriculum up-to-date, the programme obtains useful input from internship supervisors, from staff that is also active in the professional field and from organisations who eventually employ EOR graduates.

Moreover, the MSc EOR programme has an advisory board together with the bachelor's programme Econometrics and Operations Research. In 2022 the composition of the board has been adjusted to better suit the choices of students in their third bachelor's year and their master. The committee has studied the composition of the advisory board and thinks that the current members indeed cover the breadth of the MSc EOR programme.

Considerations

Based on the written materials and the discussions on site, the assessment committee considers that the MSc EOR has a specific profile, which is rooted in the vision on education of both VU and SBE and is adequately reflected in the learning outcomes and curriculum of the programme. Moreover, the MSc EOR at VU stands out among similar programmes for its core training in econometrics or operations research and for its numerous specialisations and optional courses. This results in a strong research oriented programme featuring up-to-date tracks in econometrics and operations research and with a large number of students.

The committee thinks highly of the clear vision of the programme (and SBE departments involved) with regard to the graduates they want to deliver: quantitative specialists with a strongly developed research attitude, communicative capacities, and awareness of the applicability of the acquired knowledge, and (societal and personal) consequences of this knowledge and its application. In this regard, the attention in the programme for applications of theory that will serve graduates

when entering the labour market, is very relevant. Hence, the committee supports the approach of the programme to prepare students for both the job market and for research.

The committee endorses the way the intended learning outcomes have been restructured and reformulated since the previous visit; their formulation is adequate and reflects the domain (econometrics, operations research), the level (master) and orientation (academic) of the programme.

The committee appreciates the attention of the programme to the professional component in the curriculum. As MSc EOR students are trained to bridge theory and practice, the programme seeks input from external stakeholders to keep its curriculum up-to-date. According to the committee, the recently adjusted advisory board constitutes an important and useful instrument in this respect.

In view of the above findings and considerations, the assessment committee judges that **the MSc EOR programme meets standard 1, intended learning outcomes.**

2. Teaching-learning environment

The programme's teaching and learning environment is well developed. The curriculum structure is coherent for both tracks and their respective specialisations. The course learning goals, the curriculum learning lines and the characteristics of the programme learning outcomes are well attuned. The tracks and specialisations correspond closely to the research interests of the departments, which means that many of the latest scientific developments find their way into the teaching programme. Both the School and the programme are developing activating forms of learning and educational innovators are introducing blended learning in courses. Their work now needs to be picked up and streamlined within and across programmes. Moreover, the mixed classroom as an educational principle can be embedded more strongly in the programme. The steady growth in student numbers has led to additional staff recruitment but has affected neither the quality of education nor the highly appreciated guidance, support and mentor system. Both national and international students feel welcome at VU and praised the attention of the university services to student wellbeing, notably but not exclusively during the COVID-19 pandemic. The number and quality of staff involved in the MSc EOR programme is good. Faculty brings extensive research experience to the courses and share hands-on professional and academic expertise to bridge theory and practice. According to the committee, the MSc EOR programme **meets this standard**.

Findings

Programme

The MSc EOR is a one-year full-time master programme that amounts to 60 ECTS. Since the academic year 2017-2018, the programme offers two tracks with several specializations. Students choose right from the start for either econometrics or operations research. Each track consists of three mandatory core courses (18 ECTS). The specialisations are packages of electives grouped around compulsory fundamental courses. Each specialisation comes with a variable number of obligatory and optional courses. The Econometrics track offers six specializations: Climate Econometrics, Econometrics and Data Science, Econometric Theory, Financial Econometrics, Marketing Data Science and Quantitative Economics. The Operations Research track has three specializations: Financial Engineering, Quantitative Logistics, and Quantitative Research Theory. Students can also opt for the so-called Open Specialization in either track. All students carry out a specialisation-specific case study (in period 3) and finish with a master thesis (18 ECTS) in their field of specialisation. The committee learned that not every track and specialisation is equally 'popular': about 75% of the students enrol for the econo-

metrics track, where 50% follow Financial Econometrics and 25% specialise in Econometrics and Data Science.

The committee learned that there is a link between the course learning goals and the programme learning outcomes, which is not only visible on paper – the committee studied the curriculum map, the assessment plan and the study guide – but is also implemented in the day-to-day teaching and assessment practice of the courses. The committee gathered from the extensive description in the self-evaluation report that the respective programme learning objectives are addressed throughout the curriculum and that each course has formulated specific course objectives that contribute to an overall programme objective and is assessed explicitly.

The relationship between course-level objectives and programme-level intended learning outcomes is made clear to students in the course descriptions in the study guide. Moreover, the learning objectives and their related course objectives are presented in the Assessment Plan, which also indicates the forms of assessment used in each course in relation to the course-level learning ob-

jectives. The committee also observed in the assessment plan that irrespective of the specialisation, the required courses and the thesis together ensure that all learning outcomes are covered in the curriculum.

Ambitious students can join an Honours Programme to broaden and deepen their knowledge on state-of-the-art methods. Econometrics students follow three extra courses (18 ECTS) and produce an extended thesis (18 + 6 ECTS), featuring an empirical application within 14 months. Operations Research students take three extra courses (18 ECTS) to broaden and deepen their knowledge on OR techniques and are expected to finish within the nominal duration of one year.

During the on-site visit, the committee discussed the viability of the programme and its specialisations. According to the programme team, the programme structure allows for a lot of freedom provided students follow the core mandatory courses. The specialisations constitute pre-packaged elective courses with a common label that help students structure their study programme. Several electives are offered to students outside EOR and are organised by other MSc programmes. Students did not feel pushed to choose for one or other specialisation; in fact, only about 10% of every cohort opts for the open specialisation.

Currently, the programme team is looking in particular at the Econometrics and Data Science specialisation, an interdisciplinary field that uses methods and tools from different areas to process data and extract knowledge from data. The committee gathered from the self-evaluation report and the discussions on-site that students have different expectations when they opt for this specialisation. Students reported that the courses are not very coherent and that they would like to have a more data science oriented course and/or a course in machine learning.

Finally, the committee discussed the opportunities in the programme for an internship. According to the programme team, the chances for a (compulsory/structural) internship period are limited in this one-year programme. Nonetheless, every year at least a few students do a specialisation internship organised by one of the research departments. In these cases students often combine the internship with the thesis and spend additional time (six months in total) to complete both.

Language of instruction

For a long time now, the language of instruction in the MSc EOR is English. The committee understood that it was a conscious choice of SBE to offer this master programme in English as it is the leading language in both academia and the business world. Although many graduates will join Dutch firms or international firms in the Netherlands, these organizations have an international workforce and also operate outside the Netherlands. The language of instruction therefore aligns with the international orientation of the programme and is consistent with comparable degree programmes in the Netherlands. An English-language programme offers students a better preparation for a professional career, for example by offering them the opportunity to work with international teams already during their study. Based on the materials in the report and the discussions on-site, the assessment committee endorses the motivation of SBE and the programme team to offer the MSc EOR in English.

Didactics

In terms of didactics, the MSc EOR is aligned with the educational vision of VU and the teaching methods at SBE: most courses and staff make intensive use of activating teaching formats and interactive tools to involve students as much as possible and to check whether they have understood the course materials. The committee was informed that such teaching formats are explicitly promoted by VU and SBE because it helps students to understand the materials in greater depth, it enhances their analytical and problem-

solving skills, and it develops an attitude towards self-reflection.

The educational concept of the MSc EOR is based on three objectives: (i) the development of core professional knowledge, which is reached by introducing students to state-of-the-art techniques in the lectures and by letting them work on exercises related to these techniques before and during the tutorials. The role of the lecturer is that of an instructor and motivator who is responsible for competently organising and presenting the study material in an interactive way; (ii) the development of knowledge about an application field, which is achieved through specialisation-specific cases studies and a careful selection of specialisation and optional courses; (iii) conducting research independently, which is trained in the case study and demonstrated in the master thesis. In order to achieve these objectives and the accompanying intended learning outcomes, a variety of teaching methods are offered, such as lectures, tutorials, home assignments, presentations, essays, case studies and the master thesis.

The core courses are usually offered through lectures and tutorials. In all courses students are also graded based on home assignments and written reports, paying attention to the skills of students in applying theory and presenting their results.

The committee gathered from the written materials and the discussions on site that the implications of the COVID-19 pandemic have accelerated the need for - and the possibilities of - new ways of teaching. SBE is using the lessons learned during the lockdown to develop its education vision on and implementation of promising online teaching tools and techniques that are relevant beyond a single course. In this regard, the committee noticed that the Faculty Board promotes blended learning as an important instrument for teaching innovation, yet leaves a lot of discretion to the individual programmes for implementing such forms of educational innovation. The EOR programme is discussed with the Task Force Active Blended Learning set up by the SBE. As a re-

sult an EOR working group “active blended learning” was started and has in the meantime reached all staff involved in the programme. Currently, the course Big Data Statistics is used as a pilot case for active blended learning. The committee noticed during the visit that the individual lecturers and staff in the Task Force have not only adequate expertise but also a clear vision on active blended learning in the SBE programmes; the committee welcomes this expertise and vision, and encourages the innovators to continue disseminating the good practices to their colleagues. At some point, however, these good practices should also be shared across programmes at the level of the school, which according to the committee has not yet been realised.

Furthermore, the committee noticed in the written materials that SBE in general, and EOR in particular, often refer to the concept of the Mixed Classroom. This concept is not meant in a descriptive way (in reference to an international classroom with a certain level of diversity) but is the name of VU’s educational model: by applying this model, students learn how to open up to differences, to co-create an inclusive environment and to capitalise on different perspectives in order to create value. During the visit, several stakeholders indicated that the number of international students has grown, which in turn has led to a more mixed composition of the MSc EOR cohorts and thus to classrooms featuring students from different nationalities. However, students mentioned that the international composition of the class does not automatically entail a mixed or international classroom in didactic terms. While students welcome the presence of geographically diverse fellow students in class, from an educational point of view a lot more can be done with such mixed groups. The committee heard that one possible explanation for this limited use of the mixed classroom is that there is still an imbalance (5:1) between the majority of Dutch students and the minority of non-Dutch students. The committee encourages the programme team and the individual course coordinators to make optimal use of the mixed composition of the cohorts and implement

teaching formats that do justice to the international classroom.

Students

The committee read in the self-evaluation report and the detailed appendix on student data that since the previous accreditation visit, the yearly intake has grown from 61 in 2016 to 247 in 2021. The share of students from abroad is now about 15%, while the male-female ratio fluctuates around 2:1. Since the introduction of the two tracks, many more students opt for Econometrics (75% in 2021).

The MSc EOR programme does not operate a competitive selection procedure or a *numerus fixus*. Students with a BSc EOR from the VU or another Dutch university are admitted directly to the master programme. The track Econometrics is designed for students with a bachelor's degree in (a field closely related to) econometrics; the Operations Research track targets students with a BSc Econometrics and Operations Research, but it is also interesting for students with a background in other quantitative fields like mathematics. The programme attracts a heterogeneous group of students, several of whom do not satisfy the admission requirements right away. In these cases, students can follow a personalized deficiency programme with courses from the BSc EOR. Once students are enrolled, their study progress is monitored closely by the programme team. During the first period staff and teaching assistants look into the background of students who experience problems during the foundational courses. Several students indicated to the committee that they had appreciated the Econometric Summer Workshop as it refreshes the knowledge needed to start the MSc EOR.

The drop-out rate of the programme is rather low: student data indicate that about 8% of the student intake does not graduate. The average study duration is 19 months. Recent information on the success rate of entire cohorts was quite limited: the available data shows that about 20% of the

MSc EOR students finish within the nominal duration of one year, while more than 70% does so in two years. These figures seem to be comparable to similar programmes elsewhere in the Netherlands. Students and staff mentioned that the programme is feasible in one year; however, many students do not want to finish their study right away, but prefer to extend their thesis period, add an internship after the study programme, or combine two master programmes. The committee noticed that there is no (social) pressure on students to finish in time. On the contrary, several students and alumni indicated that they felt more fit for purpose after an internship. As the MSc EOR programme prepares students for the labour market, an internship is making their position only stronger.

During the previous accreditation visit, the panel advised the programme to continue the policy and measures in place to raise the student success rates. The assessment committee noticed that over the past few years, the programme team has worked in particular on the student guidance before and during the programme. This has paid off as the programme is attracting a heterogeneous student audience, while keeping the drop-out rate low. The success rate figures have not changed much, though, for the above-mentioned reasons which the panel acknowledges.

During the session with students, the committee was informed that students appreciate the attention of VU, SBE and EOR for both student guidance and student wellbeing: students shared positive personal experiences of how student wellbeing is taken very seriously at VU, and how they felt included and not left behind during the lockdown.

Students indicated that SBE and EOR make international students feel included at programme level. Nonetheless, a few students did mention that there still is some degree of separation between Dutch and international students, because the number of international students in the courses is still relatively limited.

Staff

The committee gathered from the self-evaluation report that most of the teaching and the coordination is performed by staff belonging to the Econometrics and the Operation Analytics Departments of SBE. All staff members are active in research, hence they can guide students to the current academic research frontiers, help shape their conceptual skills, and prepare them to engage in research. The different elements in the master programme correspond closely with the research interests of the departments running the programme, which means that many of the latest scientific developments in areas like financial econometrics, statistical data science, network analysis, logistics and optimisation find their way directly into the teaching programme. Moreover, several staff members participate in faculty research programmes such as 'Strategic and Cooperative Decision Making', 'Time Series Econometrics: methods, computations and applications', and 'Combinatorial and Stochastic Optimization'. In addition, there are several lecturers who hold positions at both SBE and in the industry. These staff members are well-placed to support students in building bridges between science and practice. During the visit the committee established that staff dedicated to the EOR programme has relevant credentials.

According to the overview in the appendix to the report, the MSc EOR programme features 27 academic staff who have an average 0.9 FTE appointment with SBE. About 60% of the staff is international and 41% is female. The steady growth in student numbers has led to additional staff recruitment. The discussions on-site have convinced the committee that, also in view of recent hirings, the number of staff is sufficient to deliver the EOR programme in good quality.

Furthermore, the committee noticed that staff development is well organised at EOR as it is embedded in policies and documents including 'SBE HRM educational policy', 'SBE BKO policy', and 'SBE Tenure Track procedure'. All academic staff members are expected to have English language

proficiency at level C1. Permanent staff members can pursue continuing education in specific fields such as active blended learning, mixed classroom, activating work formats, examinations and assessments. Currently, 87% of the SBE academic staff involved in EOR holds a university teaching qualification (BKO) while two staff also obtained the senior qualification (SKO). The latter group is particularly active in course innovation, notably with regard to active blended learning in both teaching and assessment. Several lecturers also joined KnowVU, the knowledge network on teaching operated by the university and dedicated to educational innovation and improvement. Asked about career opportunities, the committee was informed that tenure track staff who engage in programme/course design and innovation also have opportunities to make promotion.

Students indicated both in their contribution to the report and in the discussion on site that they are satisfied with the staff members teaching in the programme. They mentioned that course coordinators and support staff are dedicated to the programme and to the students. Teachers tend to be very approachable, try their very best to provide answers and are open for improvements to their courses and teaching style. While courses are a mixture of lectures and interactive tutorials, staff is increasingly living up to the expectation that courses should become engaging, hence their focus is shifting from mere information transmission to making students understand and use theory. Teaching staff also plays a role in the overall guidance and student support structure: students appreciate that both faculty and teaching assistants are available for students and can be approached to solve course-related problems.

Considerations

Based on the written materials and the discussions on-site, the assessment committee considers that the teaching-learning environment at the MSc EOR is strongly developed. The committee appreciates the coherent programme structure

for both tracks and their respective specialisations. Overall, the programme looks very good and students can choose among a wealth of high-quality courses. The different elements in the master programme correspond closely with the research interests of the departments, which means that many of the latest scientific developments find their way into the teaching programme.

The information provided on-site on the course learning goals, the curriculum learning lines and the characteristics of the programme learning outcomes have convinced the committee that by the time of graduation, EOR students will have achieved all intended learning outcomes. Moreover, the committee endorses the choice of the school and the programme to offer the MSc EOR programme in English.

In terms of didactics, the committee considers that the learning environment at EOR reflects the priorities and vision of both VU and SBE. There is a move towards more activating forms of learning, which the committee appreciates. In terms of blended learning, a lot is going on at individual course level. While there are qualified and motivated educational innovators among EOR staff, their work needs to be picked up and streamlined at programme (and school) level. Moreover, the committee sees room for implementing the mixed classroom as an educational principle in the programme. This is all the more important, given that with the current (dis)balance between Dutch and international students, there is a risk for segregation in the cohorts. All in all, the committee recommends swift action on both active

blended learning and the international/mixed classroom.

The committee considers that the growth in student numbers has not affected the quality of education. Since the previous accreditation visit, the programme team has worked on student guidance before and during the programme. This has paid off as the programme is attracting a heterogeneous student audience while keeping the dropout rate low. Although the programme tracks and specialisations are very ambitious, the curriculum is feasible in one year if students would commit to this goal. However, the committee understands that there are different reasons why students want to postpone their graduation.

The number and quality of staff involved in the EOR programme is good: recent hirings have ensured that the growing number of students can be taught and tutored in adequate conditions and by a sufficient number of properly qualified staff. The committee also thinks highly of the professional development opportunities for staff, and in particular of the fact that they also use these opportunities.

In view of the above findings and considerations, the assessment committee judges that **the MSc EOR programme meets standard 2, teaching-learning environment.**

3. Assessment

The MSc EOR features a robust system of student assessment, which is embedded in the central policies and procedures of the University and the School. The assessment principles are properly implemented in the course assessments. The EOR assessment plan monitors – and demonstrates – that course learning goals are assessed adequately, which in turn ensures that all learning outcomes at programme level are covered. The current assessment committee recognises that since the previous accreditation visit, both School and programme have made considerable efforts to bring assessment quality up to par. The Examination Board has grown in capacity and competency, and assures the assessment quality of the MSc EOR programme. The programme is using a relevant thesis evaluation form and an extensive assessment matrix. The sample of thesis assessments reviewed by the committee showed that in almost all cases, the final grade was in line with the committee's appreciation and that most assessors had provided clear, insightful and constructively critical information in the summary feedback. According to the committee, the MSc EOR programme **meets this standard**.

Findings

System of assessment

The committee gathers from the written materials and the discussions on site that the MSc EOR programme operates an assessment system that complies with the assessment policy and procedures of SBE, which in turn are based on a university-wide policy on assessment quality. The programme has put at disposition both policy documents, the *Handboek Onderwijskwaliteit - VU Toetskader* and the *SBE Beleidsplan – Toetsbeleid*.

Moreover, the committee noticed that the MSc EOR has its own programme-specific Assessment Plan with a vision on education and on assessment, a curriculum map, and an overview of course learning objectives and assessment types. The assessment plan describes the forms of testing; in this way both programme director and examination board have an instrument to control the relationship between the programme's intended learning outcomes and course-level objectives and assessment.

Furthermore, each course coordinator creates an assessment file. This file contains, among other things, a test blueprint, the exam, resit exam and/or assignments, a model answer plus scoring guide, a test and item analysis, the results of the course evaluation, and a short reflection report by the examiner. According to the committee, next

to good quality policy documents, the MSc EOR also developed a relevant assessment plan that does justice to both central policies and the specificity of the Econometrics and Operations Research degree programme.

Courses

At the level of individual courses, coordinators select the most appropriate assessment methods for testing the learning goals. They do so in close collaboration with the programme director who ensures that across the programme a variety of assessment methods is used. Course coordinators are free to tailor the different exam components to the requirements of their course, provided they inform the programme management accordingly. Teaching staff is encouraged to experiment with innovative forms of teaching and testing; in every course, however, the individual student performance should be the decisive factor in the assessment. The committee agrees to the emphasis on individual exam components and to the promotion of diversity and innovation in assessment formats.

The committee noticed that SBE and EOR uphold the four eyes principle: when constructing the exam, the examiner – who very often is also the course coordinator – takes the course objectives into account and the extent to which these are as-

essed by the exam. Every course coordinator appoints a co-reader with content knowledge to check the contents of the exam, thus ensuring that all draft exams are reviewed by at least one other member of staff. The committee welcomes this approach.

In the run-up to the site visit, the MSc EOR programme put at disposition a few individual courses and their assessments. According to the committee, these materials reflected the overall provisions for assessment and were in line with what one can expect of exams in a master programme of academic orientation.

Thesis evaluation

The master thesis is the culmination of the one-year EOR programme. The thesis process is governed by clear rules and procedures, which are explained in an information session to students and in the thesis manual. The master thesis is conceived as a course with learning goals and a detailed assessment grid. The programme has two thesis coordinators – one per track – who manage the thesis process in close consultation with each other and the programme director to ensure coherent procedures and decision-making. This approach has resulted in a shared thesis policy with one dedicated thesis assessment form, which is completed by the supervisor and the second assessor separately before they reach a final assessment on each criterion. In addition to scoring grids, the evaluation form also features boxes for summary feedback by the respective assessors. The extensive and informative information manual on the master thesis contains an assessment matrix: each of the nine evaluation criteria has rubrics per score (below 5, 6, 7, 8, 9 or 10). Compared to the evaluation form of the BSc EOR, master students are also scored on deadlines and oral presentation. According to the committee, the EOR programme has a solid master thesis policy and procedure.

As part of its external assessment, the committee reviewed a sample of 15 master theses and their

evaluation forms. Reporting on their review, committee members appreciated that the evaluation form addressed all relevant criteria and allowed for (extensive) feedback. Overall, the committee had a very positive impression on the way the theses were evaluated: in almost all cases, the final grade was in line with their own appreciation while most assessors had provided clear, insightful and constructively-critical information in the summary feedback.

In line with its findings for the BSc EOR thesis evaluation, the committee noticed that the consensus process between assessors was not always clear and that there seems to be no weighing among the nine criteria. According to the programme team, it is up to the assessors to weigh the different criteria and students are aware of this. The criteria and rubrics constitute the overall framework for assessment, while there is some room for discretion. During the thesis trajectory students can ask / be instructed where there is room/need for improvement.

During the discussion on-site, the programme team indicated – and alumni confirmed – that students do get extensive and constructive feedback orally or by e-mail during the thesis trajectory and again after the final presentation. The committee was also informed that SBE and EOR are awaiting the introduction of a VU-wide online thesis trajectory platform. This initiative was put temporarily on hold during the COVID-19 pandemic and should facilitate among others consistent qualitative feedback by the assessors.

The committee's overall positive impression on thesis evaluation seems to confirm that the efforts of the programme and the Examination Board since the previous accreditation visit are paying off. The Examination Board investigated a sample of completed thesis forms in the year 2019–2020, while an external assessor reviewed some MSc EOR theses as part of the programme's mid-term review. In both cases the results were positive, i.e. in line with the original assessment.

Quality assurance

The committee gathered from the written materials that different stakeholders are involved in assuring the quality of assessment: there is first and foremost the Examination Board, but also the programme director and individual examiners play a role. The Examination Board supervises the examination process and carries final responsibility for safeguarding the quality control of assessment and examinations. It investigates systematically whether the process of assessment within SBE is carried out according to predefined criteria. These criteria are well established and include the reliability and validity of the tests. In the event that tests are not up to standard, the Examination Board reports to the programme director and the examiner and issues interventions for improvement.

During the site visit, the committee met with representatives of the Examination Boards. It gathered from the written materials and the discussion that these Boards – there is one for all publicly funded degrees and another one for privately funded programmes – fulfil their legal tasks adequately and have relevant expertise regarding assessment, fraud and legal issues. The external member has extensive assessment expertise. It is a conscious decision of SBE to have several programmes supervised by one Examination Board as this leads to greater uniformity, clarity and authority.

The committee noticed, moreover, that since the previous accreditation visit, the Examination Boards have grown in capacity and competence, taking on board the recommendations of the previous NVAO report. In terms of assessment quality assurance, the examination board currently does not only guard the quality of assessment, but also looks into assessment policy, assessment plans, assessment construction, and organization. The committee also established with satisfaction that over the past few years the Examination Boards have stepped up the inspections of course examinations and theses.

The Examination Board for publicly funded degree programmes is in charge of assuring the assessment in the EOR programme. The committee noticed from the materials and discussions that the Examination Board follows-up attentively any issue that may pop up in the programme and that the EOR programme has been served with similar intensity as all other publicly funded degree programmes. Just as for other programmes, the Examination Board has paid considerable attention to online assessment recently and informed students and staff about plagiarism. According to the committee the quality assurance of EOR assessment is in competent hands with the Examination Board.

Considerations

Based on the written materials and the discussions on-site, the assessment committee considers that assessment at the MSc EOR is robust. This appreciation is based first and foremost on the fact that both course and thesis assessment are embedded in well-established policies and frameworks at the level of the university and the school. The sample of assessment formats the committee has reviewed shows that the assessment principles and policies are properly implemented in the course assessments. The EOR assessment plan, moreover, demonstrates that course learning goals are assessed adequately. This, in turn, ensures that the learning outcomes at programme level are covered.

Furthermore, the committee considers that both school and programme have made considerable efforts since the previous accreditation to bring assessment quality up to par. Similarly, the Examination Board has grown in capacity and competency, as demonstrated by the variety of assessments tasks it has been assuming over time. The committee welcomes these developments and is convinced that the Examination Board is very capable to assure the assessment quality of the MSc EOR programme.

The committee considers that thesis assessment is organised adequately. The MSc EOR programme can rely on a solid thesis procedure and policy. It is using a relevant evaluation form with adequate criteria, an extensive assessment matrix, and space for individual appreciations and feedback of the supervisor and the second reader. Moreover, the sample of thesis assessments reviewed by the committee showed that in almost all cases, the final grade was in line with the committee's appreciation and that most assessors had

provided clear, insightful and constructively critical information in the summary feedback.

In view of the above findings and considerations, the assessment committee judges that **the MSc EOR programme meets standard 3, assessment.**

4. Achieved learning outcomes

The MSc EOR programme is set up in such a way that students, irrespective of the track and specialisation they chose, achieve the intended learning outcomes. This was confirmed by the committee when it established through its review of a sample of master theses that the thesis quality in the EOR programme is good. Some theses even led to publications or PhD trajectories. The discussion with alumni confirmed that the programme prepares students for a relevant professional – and sometimes academic – career and that after their study, MSc EOR graduates are high in demand on the labour market and have good career perspectives in a variety of sectors. According to the committee, **the MSc EOR programme meets this standard.**

Findings

There are two ways to establish whether the programme learning outcomes have been achieved – through a quality review of the final products and through checking what graduates are doing after they finished the programme. The committee has looked at both elements when assessing the end level qualifications of the MSc EOR programme.

Thesis quality

The master thesis is seen as the ultimate test whether students have achieved the EOR programme learning outcomes. In the EOR thesis all learning outcomes are addressed. As part of their external assessment, committee members reviewed a sample of 15 MSc EOR theses. The sample selection was based on a list featuring 178 students who graduated in the academic year 2021-22. The selection was representative in terms of scoring, tracks and specialisations, and the theses had been assessed by a variety of supervisors and second readers.

According to the committee, all theses were clearly of sufficient quality to pass. Hence, none of the theses was reallocated internally for a second opinion. The committee found that overall, the thesis quality in the MSc EOR programme was good. EOR students invariably demonstrate through their master thesis that they have achieved the programme learning outcomes. In view of the quality of the thesis sample, it comes as no surprise to the committee that some theses

led to scientific publications and that some students were invited to apply for PhD positions.

Graduate performance

The committee gathered from the written materials that the MSc EOR programme opens up various career opportunities. Irrespective of the track or specialisation, students who complete the MSc Econometrics and Operations Research have good labour market prospects in a variety of sectors. EOR graduates are high in demand and it takes on average less than three months to find a relevant job with a decent salary.

During the programme, the interaction with the business community is for a large part organized through the SBE Career Services, which facilitates both contact between students and the business world and between faculty and alumni. EOR alumni indicated to the committee that the programme did prepare them adequately for the labour market. Both current and past students referred in positive terms to the role of individual lecturers, as well as to the SBE Career Services, the study association Krakket and the alumni association Extrie.

Considerations

Based on the written materials, the thesis sample and the discussions on site, the committee considers that upon graduation, MSc EOR students have achieved all programme learning outcomes. The thesis review has shown that students are capable of writing good quality final products. Irre-

spective of the track or specialisation, EOR students are high in demand on the labour market. The discussion with alumni confirmed the committee's finding that the MSc EOR programme at VU prepares students for a relevant professional – and sometimes academic - career.

In view of the above findings and considerations, the assessment committee judges that **the MSc EOR programme meets standard 4, achieved learning outcomes.**

Attachments

Attachment 1 Assessment committee

Hans van Ees, chair

Prof. dr. van Ees is emeritus professor Corporate Governance and Institutions at the University of Groningen and former Dean of the University College Groningen. His research deals with corporate governance, board of directors and sustainable corporate performance. Hans has extensive accreditation experience.

Niels Hermes, member

Prof. dr. Hermes is professor International Finance at the University of Groningen. His expertise lies in the fields of corporate governance, microfinance, international finance, financial systems and economic growth. Niels has extensive accreditation experience.

Eelke de Jong, member

Prof. dr. de Jong is emeritus professor of International Economics at Radboud University in Nijmegen. His research focuses on the role of culture, in the sense of norms and values, in economic behaviour. Eelke has extensive accreditation experience.

Alain Hecq, member

Prof. dr. Hecq is professor of Applied Econometrics at Maastricht University. His research focus is on applied time series analysis with a particular focus on the investigation of co-movements, mixed frequency data and non-causal models.

Judith Kikkert, student-member

Ms Kikkert is a master student MSc Management, Economics and Consumer Studies at Wageningen University and student-member of the university-wide Board of Education. Judith holds a bachelor's degree *Economie en Beleid* from Wageningen.

Mark Delmartino, external secretary

Mark Delmartino is owner of the Antwerp-based company MDM CONSULTANCY. As certified NVAO secretary he regularly supports assessment committees.

All committee members and the secretary have signed a declaration of independence. The assessment committee has been submitted to, and validated by, NVAO prior to the site visit.

Attachment 2 Site visit programme

Venue: VU Amsterdam, De Boelelaan, Amsterdam

Wednesday 16 November 2022

- 08.30 Arrival of the committee and set-up
- 09.00 Session with Faculty Board
- 10.00 Session with Management BSc EBE, BSc EOR & MSc EOR
- 11.00 Session with Students and Alumni BSc EBE, BSc EOR & MSc EOR
- 12.00 Session with Staff BSc EBE, BSc EOR & MSc EOR
- 13.00 Lunch and internal meeting
- 14.00 Session with Management MSc RMFI
- 14.40 Session with Students and Alumni MSc RMFI
- 15.20 Session with Staff MSc RMFI
- 16.00 Break and internal deliberation
- 16.30 Return meeting with Management MSc RMFI
- 17.00 Internal deliberation
- 17.30 End of day 1

Thursday 17 November 2022

- 08.30 Arrival of the committee and internal meeting
- 09.00 Session with Examination Board
- 10.00 Session with Management MSc ECO & MSc STEE
- 10.50 Session with Students and Alumni MSc ECO & MSc STEE
- 11.40 Session with Staff MSc ECO & MSc STEE
- 12.30 Lunch and internal meeting
- 13.30 Session with Management MSc Marketing FT + PT
- 14.20 Session with Students and Alumni MSc Marketing FT + PT
- 15.10 Session with Staff MSc Marketing FT + PT
- 16.00 Break and internal deliberation
- 16.30 Return meeting with Management MSc ECO & MSc STEE
- 17.00 Internal deliberation
- 17.30 End of day 2

Friday 18 November 2022

- 08.30 Arrival of the committee and internal meeting
- 09.00 Session with Management MSc FIN, MSc AC & MSc ITACA
- 10.15 Session with Students and Alumni MSc FIN, MSc AC & MSc ITACA
- 11.30 Session with Staff MSc FIN, MSc AC & MSc ITACA
- 12.45 Lunch and internal deliberation

14.00 Return meeting with Management MSc ITACA
14.30 Internal deliberation
15.30 Preliminary feedback
16.00 Development Dialogue Executive Programmes
17.00 Development Dialogue Funded Programmes
18.00 End of site visit

A list with the names of the participants is available at AeQui.

Attachment 3 Overview of materials

Information materials

Self-evaluation report MSc Econometrics and Operations Research, VU School of Business and Economics, 2022.

Appendices to the self-evaluation report

- Intended Learning Outcomes
- Programme 2021-2022
- Course descriptions 2021-2022
- Assessment plan 2021-2022
- Thesis Manual and thesis assessment form 2021-2022
- Teaching and Examination regulations 2021-2022
- Regulations and Guidelines regarding examinations SBE 2021-2022
- Overview of academic staff including quality
- List of all graduates in academic years 2020-2021 & 2021-2022
- Intake, drop out and success rates
- AACSB Memorandum

Additional materials

Following materials were made available online for the committee:

- VU Assessment Policy
- SBE Assessment Policy
- Annual Reports Examination Committees
- Annual Reports Programme Committees

Graduation products

For every programme under review, the assessment committee studied a sample of graduation projects. In case of the MSc EOR programme, the committee reviewed 15 master theses which had been successfully submitted by students in the academic year 2021-2022. The selection was representative in terms of scoring and specialisation, and supervised by a variety of staff.

A list with student numbers is available at AeQui.