



VADYBOS IR EKONOMIKOS
UNIVERSITETAS

ECONOMICS AND DATA ANALYTICS

**REQUIREMENTS FOR FINAL BACHELOR'S THESES
PREPARATION**

Course code	<i>ECO116</i>
Type of course	<i>Compulsory</i>
Study level	<i>1st</i>
Department	<i>Bachelor Studies</i>
Year of study	<i>4th</i>
Semester	<i>Fall</i>
Credits	<i>15 ECTS. 6h lectures (introduction of instructions, topic defense session, public defense session), 4h advise sessions with academic supervisor; 395 val. of self-study and research</i>
Lecturer	<i>Academic supervisor</i>
Study form	<i>Full-time</i>
Courses to have prior to this course	<i>Internship and internship report</i>
Course language	<i>English or Lithuanian</i>

Bachelor's thesis is an independent work, summarizing and deepening the knowledge, skills and abilities, acquired during studies and substantiating the awarded qualification of Bachelor of Social Sciences (Economics). The thesis of bachelor's studies directly and indirectly links various subjects into an entirety in terms of content and analysis methods.

Final bachelor's theses aim to investigate relevant microeconomics, macroeconomics, economic and financial data analysis as well as financial markets and institutions related problems.

It is recommended that a student has an internship in a company or organization that is afterwards further investigated in final bachelor's thesis. However, this is not a necessary condition especially in the following instances:

- a) if a student performs an internship in a finance institution or public institution or consulting company and analyses the information or data relevant for stakeholders or clients of respective organization.
- b) if a student has had an internship in earlier semesters and has no possibility to collect relevant data from the internship company that would fit bachelor's thesis. This is also the case if the internship company has changed its area of activity, stopped existing or went bankrupt. If an alternative company is being researched, then a student must obtain a permission from a company to use its data for research.
- c) if a company profile does not match the problem relevant for research.

Bachelor's thesis is written during the seventh semester of studies and is awarded 15 credits. The thesis can be written in the Lithuanian or English language.

1. STRUCTURE OF BACHELOR'S THESIS

The thesis must be formatted in line with "Formatting and Citing Requirements of Academic Papers" by ISM University of Management and Economics. Structure and volume of individual sections of Bachelor's thesis is presented in Table 1.

Table 1. Structure and volume of Bachelor's thesis

Section	Volume (in pages / number of words)
Title page Summary Contents List of figures List of tables Introduction Literature Review and Theoretical Framework Research Methodology and Empirics Discussion or Proof of Concept Conclusions List of references Total:	1 page (only an English version) 300-500 words 3000-4000 words 2500-4000 words 2000-2500 words 300-500 words 8100-11500 words (counting from Introduction to Conclusions, inclusively)
Annexes	As needed

Summary. The purpose of the summary is to convey very concisely the most important information of the thesis: subject, aim, tasks/objectives, empirical research methodology and key results of the research. Summary is to be written in the Lithuanian and English languages and inserted after the title page. Beneath the text of summary, 3-5 keywords are written in the Lithuanian and English language. Summary must not exceed one page.

On top of the summary page, author and title of the thesis have to be indicated as follows:

Last name. Thesis Title: Bachelor's thesis: Economics and Data Analytics. Vilnius, ISM University of Management and Economics, Year.

Contents. The contents of Bachelor's thesis must correspond to the structure of the thesis (see Table 1). It must contain all sections approved in Bachelor's thesis requirements. In the table of contents the titles of individual structural elements of the thesis and their starting page numbers are indicated. The contents is started with "Introduction" section and ended with "Annexes" section. It is important that headings of sections should not replicate the title of the thesis, and headings of subsections – headings of sections. On the other hand, the main significant conceptions contained in the title of the thesis have to be reflected in one way or another, to be linked with headings of sections, and those of sections – with headings of subsections. Headings of sections, subsections and paragraphs must follow one from another and comprise a whole logical sequence reflecting the main elements and stages of the work.

List of Figures and List of Tables. Both separate lists must refer to the page numbers where graphical material, diagrams and schemes are deployed forming List of Figures as well as page numbers where tables are presented – forming List of Tables.

Introduction. Introduction is an important part of the paper as it describes the key elements such as the research problem, aim and methods employed. It must reveal the core of the thesis, to introduce to the key subjects of the topic under consideration. Structure of introduction is as follows:

- relevance of the topic
- research problem or main research question
- aim of the thesis

- tasks or objectives of the thesis
- methods of research
- theoretical and/or practical implications of the thesis.

Introduction must reveal relevancy and importance of the topic to theory and practice in general as well as to state, region and industry branch or organization(s), which are being examined.

After describing relevancy of the topic, the subject of the Bachelor's thesis must be further substantiated and formulated. Usually, it is formulated in a separate problem statement or research question. Core of the Bachelor's thesis comprises practical solution of the subject, the outcome of which represents attainment of a certain result (for instance, national inflation control plan is drawn up, recommendations for reform of direct taxes are presented, measures are proposed for maximization of profits of a natural monopoly, etc.).

Introduction must contain a concise and specific formulation of the aim and objectives of the thesis. The aim of the thesis must be closely linked with the title (as well as main research question) of the thesis and reflect the result striven for. The aim of the thesis must be formulated concisely, in one sentence. It can be itemized in more detail by objectives, which have to reflect the stages through which the aim will be attained. Usually, objectives are linked to each of the main content sections of the paper. Please note that when eventually developing Conclusions of the thesis, those have to be related to the sequence of the objectives stated in the Introduction.

Introduction has to indicate what methods of research (method of analogies, simulation, method of comparison, data analysis, case study, sensitivity analysis, regression analysis, etc.) were employed when writing the thesis. In cases when the aim and logic of the research stipulate mathematical processing of data, introduction must specify which data analysis, statistical methods, models and software packages were used.

At the end of introduction, contributions to theory and/or practical implications of work to specific state, sector of economy and/or organization are stipulated.

First Section. Literature Review and Theoretical Framework.

Final bachelor thesis must be addressing the issue that is related to economics. The author may decide if the topic is focused on problem area of Economics or if the research is focused more on methodological aspects of problem solving, employing the tools of data analytics. It could also be a mix of both approaches, nevertheless the necessary condition is that the subject addressed falls into the domain of Economics. Below are some indications, on what pattern of Literature Review and Theoretical Framework might include, depending on the chosen research question concentration:

- Economics concentration: detailed analysis of relevant literature that focuses on the analysis of the dependent variable (what does the literature say about a chosen topic, variation in a chosen variance, and what a plausible causal explanation described thematically), introduction and explanation of potential causal mechanisms between a chosen independent and dependent variables backed by existing research. The author may choose a few explanations and describe them in a focused and straightforward manner. Then, information is summarized in a causal graph that shows and explains the relationship between a chosen independent and dependent variables. Further, if applicable hypotheses are developed and grounded based on the literature review. Hypotheses will be tested in the Second Section of work involving the empirical research.
- Data Analytics concentration: detailed analysis of relevant literature that focuses on the chosen area of data science, its problems and promises. Explanation backed by research on how student's chosen area/model helps tackle existing problem and improves on existing models in that area of research. Introduction of hypothesis (e.g., building an alternative model, or using a machine learning model

adopted in medical research to solve economics related issues that performs better than standard econometric models). NOTE: If the student chooses a data analytics topic, such as the development of an index or measurement of their own, and later shows how it can contribute to economics research, the student raises the hypothesis in the proof of context section (unless the student wants to show that their measurement performs better than the alternatives).

This section of the Bachelor's thesis reveals and synthesizes opinions of various researchers, findings of recent research reports closely related to the topic. The section might include personal insights of the author about the issue under consideration. Students must elaborate the topic based on theoretical material, selected and systemized academic articles and publications, monographs as well as other data sources, examining various theoretical aspects of the research problem.

Second Section. Research Methodology and Empirics.

This is the second major part of the three sections of the Bachelor's thesis. This section is based on key takeaways from literature analysis that provide proper grounding for choosing relevant empirical research methodology for the subject. Selection of the method will depend on the aim of the thesis and character of the research question addressed. Conducting the empirical research part, statistical data analysis (regression analysis, factor analysis, multi-factor analysis, correlation analysis, causality analysis, etc.), simulation, case study as well as other methods are generally employed, depending on the focus of the paper. Below are some indications, on what empirical research sequence could be, depending on the chosen research question concentration

- Economics concentration: Introduction and description of data used to test the hypothesis. Discussion of appropriate methods to test the hypothesis. Empirical analysis – equation, empirical tables (results from a regression, generalised linear model, natural experiment or alternative tests) and visualization of the results. Analysis of the results. Robustness checks.
- Data Analytics concentration: Introduction and description of data used for the development and testing of the model, discussion of feature importance (e.g., SHAP method) for the interpretability of the model and visualization, evaluation of the model and its performance. The process towards the chosen model (simulations, trials) explained in detail.

When presenting the results of this section, special attention must be paid to the summarization, presentation, detailed analysis and interpretation of the results.

Third Section. Discussion / Proof of Concept.

The final major section of the thesis is aimed at discussing the research findings and emphasizing the scale and extent of solving the main problem or research question addressed. Here the author has to demonstrate in what aspects the results add value in the specific domain of research, how the results contribute to the existing theory as well as the policies or practical implications for solving the problem stated in the introduction. Depending on the focus of the topic, this section may be referred to as a Discussion or as a Proof of Concept:

- Economics concentration: Discussion of the findings and how they connect to a broader literature. Comparative analysis of findings of previous research and the obtained results based on empirical research.
- Data Analytics concentration: Development of a case study/proof of concept that uses the method discussed and presented in the previous section to test a hypothesis that stems from an Economic theory or relates to a broader Economic context.

Research Limitations. It is highly recommended to describe the main research limitations that cover different aspects both of theory analysis and especially the empirical research. For instance, limitations could be associated with certain data issues or certain methodological challenges or perhaps hypotheses themselves (if applicable).

Policy Implications, Proposals and Recommendations. In this sub-section of the Discussion/Proof of Concept section concrete proposals and recommendations or policy implications are presented for resolving of the analyzed issue. Policy implications, proposals must be specific and reasoned. Argumentation must be based on results obtained throughout the thesis. Sometimes, additional (not presented in the thesis until then) theoretical argumentation might be included to substantiate the proposed solutions.

Conclusions. In this part, results of each section of the thesis are presented in a structured manner. Conclusions must convince that the author achieved the aim formulated in introduction and resolved the set objectives/tasks. It is highly recommended that each set of conclusions refers to each objective/task defined in the Introduction of the thesis. Conclusions must be concrete and emphasise the added value created by the research. Conclusions must be numbered.

List of references. List of references must comply with the standard of bibliographic description, in which publications of national and international level, classics of science and most recent researches must be reflected in a balanced manner. Sources not quoted by the author in the thesis are not included in the list of references. **It is recommended to use at least 15 sources of reference in Bachelor's thesis.**

Annexes. Annexes to Bachelor's thesis are permitted but not required. Statistic, sociologic, supportive data, and other information, explaining thoughts set forth in the text is presented in annexes.

2. BACHELOR'S THESIS PREPARATION PROCESS

Bachelor's thesis is written in stages, at the end of which the student reports to the academic supervisor/advisor the share of the work done. All the meetings of the student and the academic supervisor/advisor should be initiated by the student.

Detailed description of Bachelor's thesis preparation process is presented in Table 2.

Detailed schedule of thesis preparation with the approved dates is presented in Annex 1.

Table 2. Bachelor's thesis preparation process

No	PREPARATION STAGE	REMARKS
1.	Meeting with the IV th year students: Introducing the Requirements of Final Bachelor's Thesis (FBT) preparation	During the meeting, mentors of problem areas present to the students and discuss the preparation process of Bachelor's theses, defence procedure and work assessment criteria, problem areas and subjects of theses, which could be used as topics to write the theses. They also present requirements for Bachelor's theses.
2.	Selection of problem area and subject of the thesis	From the provided list, students choose a problem area and subject of the thesis that they intend to examine and submit to the Studies Department a filled questionnaire by the date stipulated in schedule for preparation of FBT. Students may also indicate name(s) of academic supervisor/advisor they would prefer to collaborate with during thesis development process.
3.	Appointment of advisors for theses	Students are informed about appointed advisors of their theses.

4.	1 st consultation with the research advisor	Research advisor advises the student on the topic formulation, subject and issue of Bachelor's thesis and setting the main aim of the thesis. The meeting of the student and the academic supervisor/advisor should be initiated by the student following the schedule for preparation of FBT.
5.	Presentation of the topic of Bachelor's thesis in the SEMINAR and topic defense.	Seminars are conducted in separate groups of problem areas. In the seminar the mentor of problem area (Program Director), research advisors (optional) and students participate. Students give 5-minute presentations. Participation of students in the seminar is compulsory. Only the topics presented in the seminar will be submitted to the Studies Committee for approval.
6.	Approval of Requirements of Final Bachelor's Thesis	Students approve that they have read and understood the Requirements of Final Bachelor's Thesis.
7.	Developing the First Section of the Final Bachelor's Thesis.	Students design the introduction and write the first section of thesis "Literature Review and Theoretical Framework".
8.	Introduction and Literature Review and Theoretical Framework are presented to academic supervisor/advisor.	Students present the electronic version of their work to academic supervisor/advisor. Electronic version of the work must be uploaded to the e-learning system following the schedule for preparation of FBT.
9.	2 nd consultation with academic supervisor/advisor.	Academic supervisor/advisor consults the student on issues pertaining to theoretical aspects and research methods. The meeting of the student and the academic supervisor/advisor should be initiated by the student following the schedule for preparation of FBT.
10.	Developing the Second Section: Research Methodology and Empirics of the Final Bachelor's Thesis.	Students write the second part of thesis "Research Methodology and Empirics"
11.	Submission of Research Methodology and Empirics section to the academic supervisor/advisor.	Students present the electronic version of their work to academic supervisor/advisor. Electronic version of the work must be uploaded to the e-learning system following the schedule for preparation of FBT.
12.	3 rd consultation with academic supervisor/advisor.	Academic supervisor/advisor comments on the research methodology as well as empirical research results. The meeting of the student and the academic supervisor/advisor should be initiated by the student following the schedule for preparation of FBT.
13.	Thesis Interim Defence SEMINAR: Empirical Research Focus	Interim thesis defence is aimed for inspecting if a selected empirical research method complies with the topic and a key research question/problem addressed. Students give 5-minute presentations. Participation of students in the Interim thesis defence seminar is compulsory.

14.	Developing the Third Section: Discussion / Proof of Concept.	Student writes the third part of FBT. This part must integrate key takeaways from both previous sections of the work: theoretical framework and empirical findings. Discussion or Proof of Concept must address and relate to the solution of the problem or research question defined in the introduction of FBT.
15.	Submission of Bachelor's thesis to academic supervisor/advisor.	Students present the electronic version of their work to academic supervisor/advisor. Electronic version of the work must be uploaded to the e-learning system following the schedule for preparation of FBT.
16.	4 th consultation with academic supervisor/advisor.	Research advisor indicates to the student the possible improvements of the thesis.
17.	The final version of FBT is presented to the academic supervisor/advisor as well as to the Studies Department	Electronic version of the thesis (including the summary, introduction, conclusions, literature list and annexes) is submitted to the academic supervisor/advisor, to the Studies Department and uploaded on the e-learning. The electronic version of FBT must be presented by uploading it to e-learning system in MS Word and PDF format and named following the template below: • Last Name_Name_EDA_Year. By presenting FBT each student must sign and Bachelor Thesis Submission Form (Authorship Declaration; Annex No 1). Presentation and uploading of FBT must meet the deadlines indicated in the schedule for preparation of FBT approved by Studies Committee.
18.	Academic supervisor/advisor writes a review	The academic supervisor/advisor writes the review about the process of thesis preparation as well as about the content of the thesis and compliance of the thesis with the formal requirements. Academic supervisor's/advisor's review is presented to Studies Department.
19.	Reviewing of Final Bachelor Thesis	Reviewer writes the review about the content of the thesis and compliance of the thesis with the formal requirements. Reviewer's review is presented to Studies Department.
20.	Decision regarding public defence of Bachelor's theses	A meeting of Studies Committee is organized, in which a decision on suitability of the theses for public defence is made.
21.	DEFENCE OF BACHELOR'S THESES	Defence of Bachelor's theses takes place according to the schedule announced by Studies Department.

Selection of problem area of the work. One of the first stages of writing a thesis is selection of problem area and subject of the thesis. In this stage, the student has to select a direction of the research only, which will be narrowed down later on together with the research advisor. The student will then specify the problem and formulate the topic of the thesis. The key criterion when selecting the problem area and subject of Bachelor's thesis should be its relevancy. The list of problem areas and subjects of Bachelor's thesis recommended for analysis is presented in Table 3.

Table 3. The list of problem areas and subjects of Bachelor's thesis recommended for analysis

MENTOR OF PROBLEM AREA	PROBLEM AREA	SUBJECT OF THESIS
Dr. Simonas Čepėnas simonas.cepenas@ism.lt	Microeconomic data analysis	Solving company-specific problem Profit maximization Bargaining Market structures (competitive markets, oligopoly, monopoly) Asymmetric information Cost-benefit analysis Other (please specify)
	Macroeconomic analysis	Fiscal policy Monetary policy Public finance Social insurance Inflation GDP Current account deficit International trade Globalization Other macroeconomic indicators Other (please specify)
	Economic / Financial data analysis	Credit rating analysis Price forecasting Investment decision making Currency markets Money and capital markets Real estate property markets Other (please specify)

Formulation of thesis topic

Selection of the topic of the thesis is a responsible process, encompassing several stages. In the initial stage of topic formulation, after consulting with thesis advisor, the students formulate the topic and problem of work, specify the subject, set the main aim and supplementing tasks.

Defence and Approval of thesis topic

In the second stage of topic selection, students are required to prepare a 5 minute presentation, which they must present in the seminar. The aim of the presentation is to convince the members of the seminar about the relevancy of the selected topic of Bachelor's thesis; that it complies with academic requirements for Bachelor's thesis; the student completely understands the aim of the thesis; clear research problem, aim and objectives have been established; it is known what data will be needed to write the thesis; and a vision of methods that are intended for the empirical research part.

Typical structure of presentation:

1. Topic statement

2. Substantiation of topic relevancy
3. Problem description
4. Aim and tasks of the thesis
5. Plan of the thesis
6. Intended research methods
7. Main sources of reference

The key criteria for evaluation of the thesis topic are as follows:

- The topic is practically and/or theoretically relevant in the context of the programme.
- The problem, aim, and objectives are properly formulated
- The causal mechanism is clearly explained and emerges from the literature.
- Preliminary hypotheses are formulated and supported by the literature
- The selected preliminary research method is suitable for the topic.
- Data is available for the empirical research, and a preliminary data file is ready.

In the seminar the Program Director (mentor of the problem area) and an appointed faculty member (optional) as well as thesis advisors (optional) and students writing the theses take part. Evaluation is done by Program Director (mentor of the problem area) and an appointed faculty member (optional). Topics presented in the seminar are submitted for approval to the Studies Committee. Should the Program Director and/or Studies Committee not approve the topic, a student must discuss the issue with thesis advisor and Program Director. If after such discussion a feasible version of the topic is not presented by the student (including the case of student absence for the defence seminar), Studies Committee has a right to terminate the process of final bachelor thesis preparation. Approved lists of students who's topics were confirmed, are allowed to continue thesis development and writing process. Confirmed topics are announced to students by Studies Department

Thesis Interim Defence: Empirical Research Focus

Interim thesis defence is aimed for inspecting if a selected empirical research method complies with the topic and a key research question/problem addressed. Students have to prepare a 5 minute presentation that would include the following:

Typical structure of presentation:

1. Core takeaways from literature review part providing a background for empirical research.
2. Research framework and Hypotheses (if applicable).
3. Variables.
4. Selected empirical research method(s) and arguments for method choice.
5. Data.
6. Validity and limitations.

The key criteria for evaluation of the thesis empirical research section are as follows:

- Selected dependent and independent variables are appropriate, clearly defined, and strongly justified.
- Necessary control variables included, are appropriate, and supported by relevant literature.
- Selected method is appropriate and thoroughly justified.

- The student demonstrates strong methodological understanding.
- Explanatory data analysis conducted; appropriate transformations are considered.
- Robustness checks and limitations are considered.

In the Thesis Interim Defence seminar the Program Director (mentor of the problem area) or other faculty member and an appointed faculty member as well as a research advisors (optional) and students writing the theses take part. Evaluation is done by Program Director (mentor of the problem area) or another faculty member and an appointed faculty member. If a student fails to defend empirical research framework/methodology (including the case of student absence for the defence seminar), Studies Committee has a right to terminate the process of final bachelor thesis preparation.

Submission of the thesis to the Studies Department

Electronic versions of Final Bachelor's Thesis are submitted by the student to the Studies Department: electronic version must be uploaded on the ISM e-learning system. **The deadline for submission of the theses is indicated in the thesis preparation schedule.**

3. DEFENCE OF THESIS

Before the defence final bachelor theses are assessed by academic advisor/supervisor as well as by the reviewer. The suitability of FBT for defence is discussed in the meeting of a Studies Committee.

By decision of the Studies Committee, students may be denied the opportunity to defend a final thesis, **if at least one of the criteria**, listed in ISM Bachelor, International Master And Executive Master Studies' Final Theses Defence And Evaluation Procedure section 12, can be applied to the final thesis or its preparation process:

1. Thesis topic was not approved by the Programme Director.
2. The submitted final thesis is not based on a theme that has been defended and approved.
3. The student did not meet the deadlines for work preparation.
4. The student fails to submit the final thesis in due time (the student loses the right to defend it in the current semester).
5. The work is negatively evaluated by the supervisor and / or reviewer (s).
6. Violations of academic ethics have been identified by the Committee on Ethics.
7. The final thesis does not comply with the formal requirements (structure, scope of the final thesis or its parts, data of the empirical research are not included in the appendices, etc.).

Students who fail to submit their final thesis to the Studies department on time are not permitted to defend the thesis.

Bachelor's theses, acknowledged by Studies Committee as suitable for defence, are defended publicly in the meeting of Defence Committee.

After the meeting begins, the Chairman of Defence Committee invites a candidate to present the thesis, reads the title of the thesis, presents the research advisor and gives the floor to the author.

Author of the thesis makes a short presentation (up to 10 minutes) about his/her research pointing out the relevancy of the thesis, the examined problem, aim and tasks of the thesis, introduces the situation in the country, region, sector or organization and its environment, presents the main theoretical provisions based upon which the thesis was written, describes the methodology of the research and substantiates its selection, presents the obtained research results, proposed solutions and recommendations, and the conclusions of the thesis.

After the candidate's presentation, the advisor delivers a short speech. In case the advisor cannot participate in the defence meeting, his/her review is commented by the Chairman of Defence Committee.

This is followed by the reviewer's assessment. In case he/she is absent, the review is commented by the Chairman of Defence Committee. The author replies to reviewer's remarks or questions.

The author is asked questions by the members of Defence Committee and other persons present during the defence. The author answers their questions.

Student's thesis might receive a negative evaluation or lead to failure of defence if a student fails to answer questions from the reviewer and/or Defence Commission during the public defence session.

4. ASSESSMENT OF THE THESIS

When all defences of that day are over, a decision is made in a closed meeting of Defence Committee regarding the assessment of works. Decision regarding the assessment of works is collegial. During the discussion assessments presented by reviewer, research advisor and Defence Committee are taken into account.

Content of the thesis is assessed according to the following criteria:

1. Clarity and integrity of the topic, aim and tasks of the thesis
2. Focus and depth of the overview of theories and studies
3. Research methodology substantiation and quality of results
4. Concreteness and validity of discussion or proof of concept, solutions, recommendations and conclusions
5. Overall logics and structure of the paper
6. Compliance to the formal Requirements for Final Bachelor's Theses Preparation

Presentation and defence of the thesis is assessed according to the following criteria:

1. Consistency and efficiency of presentation
2. Argumentation of responses
3. Quality of use of economic terms
4. Quality of presentation
5. Quality of answers to all questions asked during the defence session.

All course participants must comply with the ISM University of Management and Economics Artificial Intelligence Policy published on the e-learning platform.

