

MASTER IN FINANCIAL ENGINEERING

How to write a Master Thesis

EPFL



How to Write a Thesis

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The purpose of this note is to give you some hints about writing a master thesis in Finance at EPFL. The note does not intend to be comprehensive. However, some theses have received low marks because their authors made mistakes that are entirely avoidable. Please note that this document does not replace or alter the official guidelines of EPFL; it is meant to be an additional help geared towards writing a thesis in Finance.

General

When you write your thesis, please have in mind the “informed reader” who is familiar with standard methods and has reasonable background knowledge in Finance. As a guideline, you can assume knowledge of standard textbooks you have used in your coursework. Equivalently, assume the typical knowledge of one of your classmates. So, you do not need to be very detailed about describing methods like Ito’s lemma or discounted cash flow analysis or research original sources about the capital asset pricing model. On the other hand, you should discuss methods that are idiosyncratic, e. g. methods you had to learn to address the topic your thesis or methods you did not know but were used by employees of the sponsoring firm. The whole thesis should read as one self-contained piece and should be accessible.

Structure

You should spend a significant amount of time thinking about how you want to organize the content of your thesis. Ask yourself what belongs together and which parts naturally relate to each other. Weak theses typically try to just organize the material into subheadings and then lose sight of the relationships between different parts of the thesis. Also, if related discussions appear in separate parts of the thesis, then this is often a case of poor structure. Please keep in mind the following when structuring your thesis:

- **Structure follows content**, not the other way around! In particular, do not aim for a detailed table of contents and then proceed to fill little boxes. Rather, write an essay with a clear *logical* structure. As you revise your argument, you will probably also want to change the way you arrange your argument into sections and subsections. Generally, avoid a structure with many section headings and an elaborate hierarchy of subsections. On the other hand, having more than five pages without a (sub)section heading will make the text inaccessible and difficult to read.
- **Introduction.** The introduction should typically be in the 2-4 page range and should tell the reader the main topic and finding of your thesis (hence, write it at the end!). Do not try to just give a long summary. The reader needs to know what to expect and where to find it in your document. Do not try to write a thriller where the plot is kept secret until the end. It is much easier to read a long document when you already know what the punch line is.

- **Related literature.** Your thesis should contain a literature review that puts your thesis into perspective. Even if you write about work you carried out in a company, you need to show that you have read the relevant literature. How can you otherwise claim to have made a contribution? Your professor may give you some articles to get started, after this you have to research the literature yourself. The contribution of your literature review comes from the structure you generate and the links between the articles and books that you survey. The worst type of literature review is a long sequence of unstructured summary of the type “he said this, they said that.” The reader does not learn anything from that and simply gives up. It is always a good idea to start with a survey article on the subject or a handbook article in order to get a grasp of the subject. But it may also be important to go beyond overview articles and to find more specialized information that relates to your thesis subject. Keyword searches in specialized databases (e. g. EconLit, www.jstor.org) are useful for this. Some recent work that is not yet published – the publication gap is often as long as 5 years – can be found at www.ssrn.com.
- **Background information.** Whether you write a technical thesis, a case study or describe your assignment within the company, you probably need one or two chapters in the beginning where you provide the reader with the required background information. This should not be an opportunity to fill many pages with everything you know. The purpose is not to entertain the reader. However, everything that is required to understand the argument and the points you are trying to make should be here.
- **Analysis.** Aim for a concise, in-depth analysis. In particular, do not just reproduce facts and figures. The difference between a mediocre thesis and a good or even an excellent thesis rests ultimately on the quality of your original contribution. It is easy to be overly impressed with glossy brochures, company websites, and annual reports that are provided to you by your thesis sponsor. However, credit is given for *your* analysis. You should see through these veils and show independent judgment. Hence, while you read you should be alert to conflicts of interest and reporting biases that may influence the quality of your sources.
- **Mathematics.** If you write a more technical thesis (e.g., a thesis on the pricing of complex structured products), you should clearly state and discuss model assumptions, model specifications and derivations. Sentences like “under standard conditions...” are not informative and should be avoided. You will get a lot of credit for concisely discussing the assumptions you make and their limitations, because it shows how well you understand a particular model. Remember that you write a thesis in finance, and not in mathematics. If you use less standard mathematical or statistical methods (say, you obtain model estimates through the Efficient Method of Moments method rather than OLS), it is a good idea to discuss them in the text, but to document the details of the estimation procedure in the appendix. Similarly, lengthy mathematical proofs belong in the appendix.
- **Conclusion.** The purpose of the conclusion is twofold. First, you want to bring all the threads of your argument together. Generally, there should not be too many of these (more than three gives the impression that you do not focus). Second, put your work into

perspective. What are the limitations of your argument? Which questions did you not address? Are there additional comments that did not quite fit in any of the chapters because they cut across chapters and sections? However, a conclusion should never be long (say, more than five pages), otherwise you probably need an additional chapter.

- **Appendix and Supplements.** The thesis should be complete in that it does not rely on materials or arguments outside of the thesis that cannot be checked by the reader on the basis of publicly available information. The reader should have access to all documents, so you have to provide access to those that are not publicly available. Similarly, spreadsheet models, computer programs, or data need to be available, either from a public source, in the appendix, or the electronic archive that you have to include (see below for details). The ultimate standard of what you should include is reproducibility: with your written guidelines and on the basis of the materials included, the reader should be able to follow your argument and reproduce your results. However, the appendix should not contain tables with a significant amount of text, flow-charts, diagrams and other information that forms an integral part of the text.
- **Tables, figures, index.** Tables and figures must have short captions that tell the reader what the content is. Figures and tables should also be self-contained so that you understand the information they provide without having to scan the text for necessary information, like what is on the axis of a graph, or what are the units of measurement. There should be a table of contents *in the front*, and an index to all the tables and figures (use titles here, not just “table 1,” “figure 3,” etc., otherwise the reader does not know how to find information in your text). Figures must be intelligible when printed in *black and white*. When two or more variables are plotted in the same graph they should be represented, e.g., with solid and dashed lines, not just two different colors.
- **Length, format.** All formatting should aim at generating clarity and transparency. The reader has only a limited amount of time to spend on your document, and should not spend it searching for information because of a poor organization of your text. The document should be around 50 pages long and the page limit for the main text of the master thesis is 60 pages on A4, 1.5- spaced, 12pt proportional width fonts (e.g. Times New Roman, Arial, but not Arial Narrow), with at least 2.5 centimeters margins on all sides (this does not include the title page, appendix, index, and the table of contents). You may add up to 20 pages of numerical tables (simulations, spreadsheet calculations, balance sheets, profit and loss accounts, table of contents for the electronic archive, etc., see the section “appendix” below). The appendix may not be used for information that belongs into the text in order to circumvent the page limit. You can overrun the page limit for good reasons. If you exceed the page limit without justifying this with the inclusion of relevant content, then you will receive a lower grade, so you do this at your own risk. All appendices and tables to which you refer in your text must be contained in the printed version of the thesis.
- **Materials.** You probably have access to some materials that are either not publicly available or at least not known to the hypothetical “knowledgeable reader.” You want to make your thesis self-contained, so you need to cite these and give meaningful

summaries (see “background information” above). In some cases, you may want to include extensive summaries or even reproduce some of this in the appendix (see below). Also, please make clear where you rely on materials available to you, and where your own analysis starts. Separate facts and comments.

Appendix

Your thesis is likely to include an appendix with tables, the numeric part of your analysis as well as the proofs of the results which cannot be found in the literature. Please adhere to the following guidelines:

- The appendix should be numbered consecutively using Arabic numerals, continuing the pagination of the main text.
- Every part of the appendix should have a clear role in supporting the argument in the main text. The appendix should never contain the argument itself, this belongs into the main text. The role of the appendix is entirely supportive.
- Figures and graphs should be in the main text, not in the appendix.

Include an Electronic Archive

Upon submitting your thesis you should provide the section with an electronic archive containing:

- **Your thesis.** You should include the thesis both as pdf and in a format that can be altered (e.g. word document or LaTeX source code).
- **Materials downloaded from the internet.** Experience shows that companies frequently change the location of electronic documents, so any document that you refer to should be cited and an electronic copy should be included.
- **Simulations and computer code.** The computations you carry out in your thesis should be included and need to be transparent. This is often a weak point of the thesis as spreadsheet models / computer code start out simple and then grow and authors become oblivious to their structure. It is typically not easy to understand somebody else’s spreadsheet model / code if it contains a lot of direct cell-references, possibly across several tables, so you have to make use of as many structuring devices to ensure readability as possible. If the model is central to your argument, this discussion (including choice of assumptions, interpretation of main results) should be in the main text and not hidden in some appendix. However, an additional appendix may be useful as a manual to understand some details of the structure the reader may need in order to work with your model. The quality and usability of your spreadsheet / simulation / computer code counts towards your grade, so you should pay attention to this aspect.

- **Data.** If you perform a statistical analysis (e.g., event study, performance evaluations and/or model estimations) then you need data. These data or at the very least a snapshot if the databases are very large should also be included with a clear identification of variables and observations. The method of data collection and definitions of the main variables belong into the text.
- **Material that is not publicly accessible.** If materials are not publicly accessible and if they are important to your argument, then you may want to scan them to give the reader access to these materials. You need to apply some judgment here. Companies may give you access to many folders of irrelevant papers and you need to screen those. Also, some of the materials or computer code may be copyrighted and you may not have permission to scan them. In this case you should include a statement to that effect. In some cases, shorter extracts or central documents may also be included in the appendix (see below).

Plagiarism and cheating

Plagiarism is the representation of another's work or ideas as one's own; it includes the unacknowledged word-for-word use and/or paraphrasing of another person's work, and/or the inappropriate unacknowledged use of another person's ideas. It is imperative that you not plagiarize. Sophisticated software exists that is very good at identifying plagiarism (e.g., turnitin.com). Plagiarism and cheating, defined as falsification, fabrication, or dishonesty in creating or reporting research results, will result in an automatic failing grade.

How to get a good grade

You definitely get a better grade if you adhere to all the ground rules laid down in this document, but that in itself is not enough. You also need to make a contribution with your thesis and provide a well-reasoned analysis of your topic. The difference between a satisfactory thesis (in terms of Swiss grades, a 4.0) and a good thesis (4.5-5.0) is basically whether your thesis has significant analytic content or not. The distinguishing feature of a very good thesis (5.5-6.0) is that you really exceed expectations. As a base rule, a thesis that is good without major errors or problems and which deals satisfactorily with all the tasks that were agreed at the beginning without going into much depth would be a 4.0.

This is where you should seek your contribution:

- **Case studies.** Aim for some analytic content and a thoughtful quantitative analysis. This could be a valuation, an event study to analyze stock market reactions, a Monte Carlo analysis of an important new strategy, etc. A purely verbal analysis of a company's strategy and carefully collected excerpts from company reports supported by light commentary do not qualify as analysis.

- **Empirical studies.** Try to understand your dataset and carefully collect your data. Apply statistical methods thoughtfully and interpret your results. Intelligent commentary of results is more important than many tables.
- **Mathematical studies.** Develop a new model or use new mathematical/statistical methods, it will contribute significantly towards a good grade. Theoretical contributions which are unrelated to the thesis do not count towards the grade.

Other comments

- Please use footnotes, not endnotes. Your footnotes should make clear if you are referring to another document, or another location in your thesis. Try to limit the number of footnotes. You need to write your thesis in English.
- All information you have used needs to be cited. Please reference information from the internet and include the website. Include the *exact title* of the document: by the time the reader checks your sources the owner of the website may have moved the document somewhere else, so it has to be found with a search engine.
- Please avoid old-fashioned formats for citations. Rather, have a table of references at the end of the main text, and sort it by author last names, date and title. Then reference by author and date (e. g., Black and Scholes (1973) develop a formula...) in the main text. If you cite from longer works, you need to include page numbers.
- The following sample reference list shows you how to reference journal articles, books, and articles in an edited book :

References:

Aït-Sahalia, Y., 2004. Disentangling diffusion from jumps. *Journal of Financial Economics* 74, 487-528.

Black, F., Scholes, M., 1973. The pricing of options and corporate liabilities. *Journal of Political Economy* 81, 637-654.

Feller, W., 1971. *An introduction to probability theory and its applications*, vol. II. Wiley, New York.

Smith, C., 1979. Application of option pricing analysis. In: Bicksler, J. (Ed.), *Handbook of Financial Economics*. North Holland, Amsterdam, pp. 80-121.

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