

Formal requirements for (Seminar, Bachelor, or Master) theses

Chair of Applied Econometrics
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1 Format of the thesis

While we are not overly concerned that you use any particular format, it is important that you use the same format throughout your thesis. A font size of 11pt or 12pt, margin widths of 2.5-3.5 cm, and line spacing between 1 and 1.5 are plausible choices.

2 Typical structure of a thesis

A typical thesis at our chair uses the following five sections: Introduction, Methodology, Data, Results, and Discussion. Below we provide more information on these sections. Using this structure is not obligatory, though, and you are welcome to modify it if this helps to better develop your ideas.

Introduction

- What is the subject of the study? Describe the economic/econometric problem.
- Motivation: Why is the subject relevant? Possible motivations: Practical relevance (e.g., good forecasts of Y are needed to perform task Z), theoretical relevance (e.g., better understanding of concept A is needed to solve theoretical problem B).
- What do we already know about the subject (literature review)? Use citations, e.g.:
Forecast rationality testing has long been used in economics (Mincer and Zarnowitz, 1969). There are five main types of bibliography items: Published articles such as Andersen et al. (2003), unpublished¹ working papers like Knüppel et al. (2022), books like Levy (2016), articles that appeared in a collection, like Mincer and Zarnowitz (1969), and references to data or software like Eurostat (2020).
- How does the study contribute to the literature? Examples: Analyzes a question that has been ignored by the existing literature; combines two topics that have previously been considered in isolation; applies a new method to an old question; analyzes a new data set.
- Provide an overview of your results.

¹Here ‘unpublished’ means that the paper is available on the internet, but has not been published in a peer-reviewed journal.

- Outline of the thesis:
The thesis is organized as follows. The next section describes the model under investigation. Section 2 describes the data set and Section 2 presents the results. Finally, Section 2 concludes.
- The introduction is typically two to four pages long.

Methodology

- Introduce your methodological setup, including definitions of key terms as well as mathematical notation. Make sure to introduce important concepts in sufficient detail, and try to be consistent in your wording (e.g., avoid using many different terms for the same concept).
- Present your econometric/statistical method and explain why it is suitable to address your research question.
- Please provide consecutive numbers to the mathematical formulas that you refer back to later in the text. If you don't refer back to a formula, there is no need to number it. For example,

$$f(x) = a_0 + a_1x + a_2x^2 \tag{1}$$

Equation (1) specifies a quadratic function of a scalar variable x . It is more flexible than the linear function

$$g(x) = b_0 + b_1x.$$

If an equation is short and not of primary importance, you can also use inline equations, like $h(x) = c_0$.

- Depending on the topic this section can also be split up into separate sections.

Data

- Describe the data and how you obtained it.
- Motivate why and how you chose your data set (e.g. choice of time period, countries, etc.).
- For example:
I consider quarterly time series data on Germany's real gross domestic product (GDP) after the reunification. This choice of time period avoids the complex structural break that would occur when merging data before and after the reunification. In order to obtain stationary data, I use logarithmic growth rates (compared to the previous quarter, in percent). The sample ranges from 1991:Q2 to 2020:Q2, for a total of 117 observations. The data is made available by Eurostat (2020). Figure 1 plots the time series. The final data point corresponds to a real GDP growth rate of -10.19%, reflecting the impact of the COVID-19 pandemic.
- Provide descriptive statistics, such as:
 - mean, median,
 - quantiles at different levels,
 - min, max, standard deviation,
 - time series plots, histogram.

This information should allow the reader to assess basic features of the data that are important for your analysis.

Results

- The goal of this section is to present your results in a clear and coherent way, using text, tables and figures.
- Tables should not include too many entries – if you’re about to include a very large table, ask yourself whether there is a simpler way to communicate its message, either by reducing the table or by producing a figure. Use two or three digits, but not more. There is not much gained by learning that last quarter’s inflation rate was 2.123934 percent, as opposed to 2.12 percent.
- Figures are often more efficient than tables, in that they communicate more information in a simpler way. Schwabish (2014) offers some excellent advice on designing figures. Make sure to use understandable axis labels, and to use a sufficiently large font size for all labels. Some fun advice on how *not* to design figures can be found at https://www.biostat.wisc.edu/~kbroman/topten_worstgraphs/
- When including graphs produced via a statistical program, make sure to use a sufficiently high resolution. In LaTeX, using pdf graphs is often a good idea since they achieve good resolution at a small file size (e.g. when producing pdf graphs via R).
- Integrate your tables and figures into the text, e.g. by providing a short verbal summary:
Table V presents descriptive statistics for the monthly returns of the ten stocks considered in my analysis. The first-order autocorrelation of the returns ranges from -0.07 for stock W to 0.16 for stock X. The first-order autocorrelation of squared returns is much higher, ranging from 0.46 for stock Y to 0.84 for stock Z.
- Include central tables or figures into the main body of your thesis, and put additional material into the appendix. If you have a large number of analogous figures (such as one time series plot for each of ten stocks), it may be a good idea to include a single, illustrative figure into the main text (e.g., the time series plot for stock A), and to put the others into the appendix.
- Discuss results:
 - What are your main findings?
 - Provide an intuition for your results.
 - Compare to previous research.
 - Discuss important caveats (e.g. whether results are sensitive to a certain choice of sample period, or a certain modeling decision).

Discussion

- Give a short summary of what you did and what you found.
- What are the implications of your findings? Examples: policy implications (e.g. policy measure A is effective while B is not), academic implications (e.g., estimator A is reliable while B is not).
- Point out some limitations of study and suggest areas for future research.

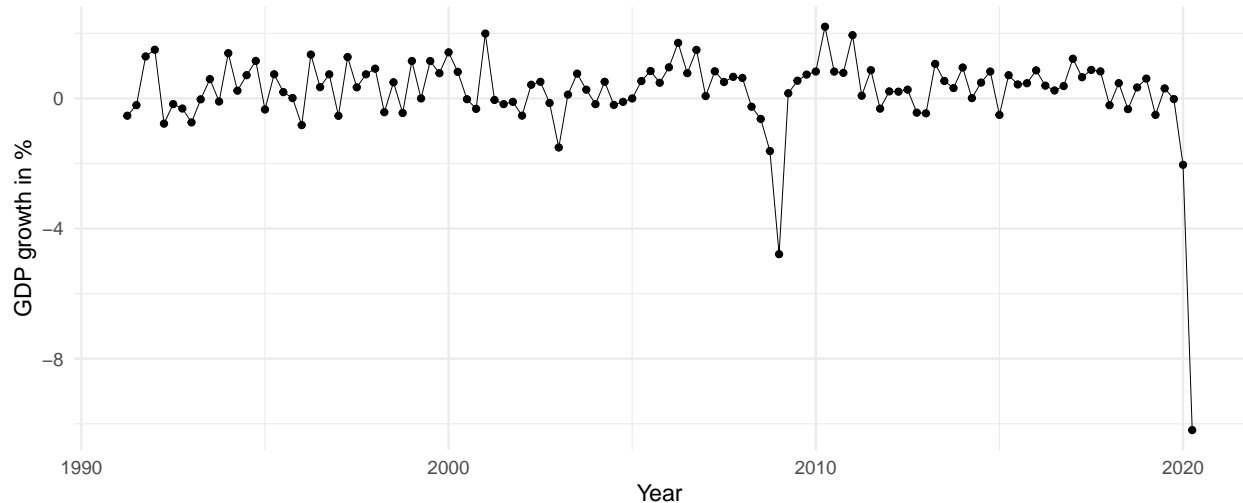


Figure 1: Quarterly log growth rate of German real GDP, 1991:Q2 to 2020:Q2.

3 Handing in the thesis

Please hand in your thesis as a hard copy, and email the underlying pdf file to your advisor. In order to transfer your code and data to your advisor, please choose one of the following options:

1. Hand in a USB stick containing your code and data firmly attached to the hard copy version of the thesis
2. Upload your code and data to Github and mention the link to your folder in the introduction of your thesis. *Note: Please do not use this option in case your data is confidential or subject to copyright restrictions.*

References

- ANDERSEN, T. G., T. BOLLERSLEV, F. X. DIEBOLD, AND P. LABYS (2003): “Modeling and forecasting realized volatility,” *Econometrica*, 71, 579–625.
- EUROSTAT (2020): “Real Gross Domestic Product for Germany,” Retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CLVMNACSCAB1GQDE>, September 26, 2020.
- KNÜPPEL, M., F. KRÜGER, AND M.-O. POHLE (2022): “Score-based calibration testing for multivariate forecast distributions,” Preprint, arXiv:2211.16362.
- LEVY, H. (2016): *Stochastic Dominance: Investment Decision Making Under Uncertainty*, Springer, Heidelberg, 3 ed.
- MINCER, J. A. AND V. ZARNOWITZ (1969): “The evaluation of economic forecasts,” in *Economic Forecasts and Expectations: Analysis of Forecasting Behavior and Performance*, ed. by J. A. Mincer, Columbia University Press, New York, 3–46.
- SCHWABISH, J. A. (2014): “An economist’s guide to visualizing data,” *Journal of Economic Perspectives*, 28, 209–34.

A Appendix

Material for the appendix of a thesis

Typical appendix material includes

- Longer proofs and theoretical derivations.
- Details on data handling (e.g., preprocessing a complex data set).
- Robustness checks for empirical results. Note that there are typically many robustness checks that *could* be done, so it is important to focus on the relevant ones. Please explain and motivate your choice of robustness checks.

Template for declaration of authorship

I hereby confirm that I have authored this thesis independently, and that all ideas and text passages that originate from other sources (either literally or analogously) are marked as such.

[Date and place]

[Your name and signature]