

Bachelor's / Master's Thesis

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# Thesis Title

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Institut für Statistik  
Ludwig-Maximilians-Universität München

Your Name Here

Munich, dd.mm.yyyy  
Submitted in partial fulfillment of the requirements for the degree of B.Sc./M. Sc.  
Supervised by Prof. Dr. Eссор Person

# Acknowledgements

I want to thank a few people.

# Abstract

The preface pretty much says it all.  
Second paragraph of abstract starts here.

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## List of Abbreviations

CPI	Consumer Price Index	ETF	Equity Traded Funds
ETH	Eat the Horse	XLM	Xetra Liquidity

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# About this Thesis Template

Welcome to the thesis template. This template is based on (and in many places copied directly from) the HU Berlin School of Business and Economics LaTeX template, but hopefully it will provide a nicer interface for those that have never used LaTeX before.

**Note that this source file must be saved as `index.Rmd`.**

## Why use R Markdown?

*R Markdown* creates a simple and straightforward way to interface with the beauty of LaTeX. Packages have been written in **R** to work directly with LaTeX to produce nicely formatting tables and paragraphs.

*R Markdown* also allows you to read in your data, to analyze it and to visualize it using **R** functions, and also to provide the documentation and commentary on the results of your project. Using *R Markdown* will also allow you to easily keep track of your analyses in **R** chunks of code, with the resulting plots and output included as well.

Examples for *R Markdown* formatting of citations, cross-references, maths equations, etc. can be found in the `/sections` folder.

An example bibliography file used for the references is in the `\bib` folder.

## 1 Introduction

- What is the subject of the study? Describe the economic/econometric problem.
- What is the purpose of the study (working hypothesis)?
- What do we already know about the subject (literature review)? Use citations. For example, see Angel (2000).
- What is the innovation of the study?
- Provide an overview of your results.
- Outline of the paper:  
*The paper is organized as follows. The next section describes the model under investigation. Section “Data” describes the data set and Section “Results” presents the results. Finally, Section “Conclusion” concludes.*
- The introduction should not be longer than 4 pages.



## 2 Methodology

- How was the data analyzed ?
- Present the underlying economic model/theory and give reasons why it is suitable to answer the given problem<sup>1</sup>.
- Present econometric/statistical estimation method and give reasons why it is suitable to answer the given problem.
- Allows the reader to judge the validity of the study and its findings.
- Depending on the topic this section can also be split up into separate sections.

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<sup>1</sup> Here is an example of a footnote.

### 3 Data

- Describe the data and its quality.
- How was the data sample selected?
- Provide descriptive statistics such as:
  - time period,
  - item number of observations, data frequency,
  - item mean, median,
  - item min, max, standard deviation,
  - item skewness, kurtosis, Jarque–Bera statistic,
  - item time series plots, histogram.
- For example:

Attaching package: 'dplyr'

The following object is masked from 'package:kableExtra':

group\_rows

The following objects are masked from 'package:stats':

filter, lag

The following objects are masked from 'package:base':

intersect, setdiff, setequal, union

	3m	6m	1yr	2yr	3yr	5yr	7yr	10yr	12yr	15yr
Mean	3.138	3.191	3.307	3.544	3.756	4.093	4.354	4.621	4.741	4.878
StD	0.915	0.919	0.935	0.910	0.876	0.825	0.803	0.776	0.768	0.762

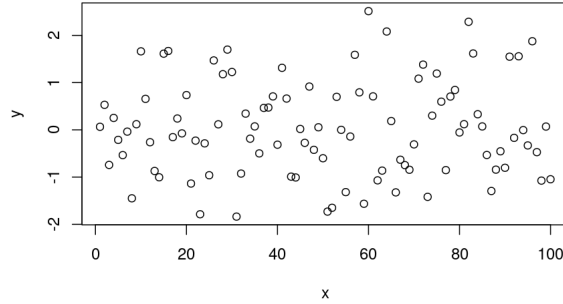
**Table 1:** Detailed descriptive statistics of location and dispersion for 2100 observed swap rates for the period from February 15, 1999 to March 2, 2007. Swap rates measured as 3.12 (instead of 0.0312).

- Allows the reader to judge whether the sample is biased or to evaluate possible impacts of outliers, for example.

- Here tables can be easily integrated using the `kable()` function in the `knitr` package (with perhaps some additional help from the `kableExtra` package). `kable()` will automatically generate a label for the table environment. That way you don't have to manually enter in the table in LaTeX, you can embed tables from R code.
- Tables can be referenced using `\@cref{label}`, where `label` is `tab:<name>`, where `<name>` is the code chunk label.
- The appearance may look different to tables directly typed with LaTeX, due to limitations in `kable()`. To compare:

	3m	6m	1yr	2yr	3yr	5yr	7yr	10yr	12yr	15yr
Mean	3.138	3.191	3.307	3.544	3.756	4.093	4.354	4.621	4.741	4.878
StD	0.915	0.919	0.935	0.910	0.876	0.825	0.803	0.776	0.768	0.762

**Table 2:** This table was handwritten with LaTeX.



**Figure 1:** Estimated residuals from model XXX. ...

## 4 Results

- Organize material and present results.
- Use tables, figures (but prefer visual presentation):
  - Tables and figures should supplement (and not duplicate) the text.
  - Tables and figures should be provided with legends.
  - *Figure 1 shows how to include and reference graphics. The graphic must be labelled before. Files must be in .eps format. You can do this really easily in R Markdown with `knitr::include_graphics()`!*
  - Figures can be referenced with `\@ref(fig:<name>)`, where `<name>` is the name of the code chunk.
- Tables and graphics may appear in the text or in the appendix, especially if there are many simulation results tabulated, but is also depends on the study and number of tables resp. figures. The key graphs and tables must appear in the text!
- R Markdown can also supports math equations just like *LaTeX*!
  - *Equation (1) represents the ACs of a stationary stochastic process:*

$$f_y(\lambda) = (2\pi)^{-1} \sum_{j=-\infty}^{\infty} \gamma_j e^{-i\lambda j} = (2\pi)^{-1} \left( \gamma_0 + 2 \sum_{j=1}^{\infty} \gamma_j \cos(\lambda j) \right) \quad (1)$$

where  $i = \sqrt{-1}$  is the imaginary unit,  $\lambda \in [-\pi, \pi]$  is the frequency and the  $\gamma_j$  are the autocovariances of  $y_t$ .

- Equations can be referenced with `\@ref(eq:<name>)`, where name is defined by adding (`\#eq:<name>`) in the line immediately before `\end{equation}`.

## 4.1 Review of Results

- Do the results support or do they contradict economic theory ?
- What does the reader learn from the results?
- Try to give an intuition for your results.
- Provide robustness checks.
- Compare to previous research.

## 5 Conclusion

- Give a short summary of what has been done and what has been found.
- Expose results concisely.
- Draw conclusions about the problem studied. What are the implications of your findings?
- Point out some limitations of study (assist reader in judging validity of findings).
- Suggest issues for future research.

# A Appendix

Here goes the appendix!

## A.1 Code Supplement

A code and data supplement for this work is available at [my URL](#). It contains the following files and folders:

## A.2 Additional Figures

Put a figure

## A.3 Additional Tables

	3m	6m	1yr	2yr	3yr	5yr	7yr	10yr	12yr	15yr
Mean	3.138	3.191	3.307	3.544	3.756	4.093	4.354	4.621	4.741	4.878
Median	3.013	3.109	3.228	3.490	3.680	3.906	4.117	4.420	4.575	4.759
Min	1.984	1.950	1.956	2.010	2.240	2.615	2.850	3.120	3.250	3.395
Max	5.211	5.274	5.415	5.583	5.698	5.805	5.900	6.031	6.150	6.295
StD	0.915	0.919	0.935	0.910	0.876	0.825	0.803	0.776	0.768	0.762

**Table 3:** Detailed descriptive statistics of location and dispersion for 2100 observed swap rates for the period from February 15, 1999 to March 2, 2007. Swap rates measured as 3.12 (instead of 0.0312).

## References

Angel, E. (2000). *Interactive Computer Graphics : A Top-Down Approach with OpenGL*, Addison Wesley Longman, Boston, MA.



## Declaration of authorship

I hereby declare that the report submitted is my own unaided work. All direct or indirect sources used are acknowledged as references. I am aware that the thesis in digital form can be examined for the use of unauthorized aid and in order to determine whether the report as a whole or parts incorporated in it may be deemed as plagiarism. For the comparison of my work with existing sources I agree that it shall be entered in a database where it shall also remain after examination, to enable comparison with future theses submitted. Further rights of reproduction and usage, however, are not granted here. This work was not previously presented to another examination board and has not been published.

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