CHAIR OF ECONOMETRICS
DER FREIEN UNIVERSITÄT BERLIN

Seminar Paper in Applied Time Series Econometrics

Insert title
which can be stretched over three
lines if necessary

Forename Surname

Supervisor:	Prof. Dr. Dieter Nautz
Semester:	Summer Term 2023
Author:	Forename Surname
Matriculation-Nrs.:	1234567
Email:	mail@mail.de
Subject:	Bachelor Economics
Submission:	31. August 2023

1   Introduction

This is a template for the seminar paper. Right now, the template contains different examples that you might find helpful once you write down your results in LaTeX, a software system for document preparation. A lot of useful information can be found at the **Overleaf**-Homepage. Overleaf also provides a convenient online editor that is ideal to collaborate on joint projects and access your project from different devices. Feel free to use it in your group! Other open source editors to work on your device offline are available on the internet as well. An easy way to get started is the MikTeX-distribution. Once you installed MikTeX, a nice open source editor is TeXstudio.

LaTeXis widely used in academia. It is especially common in quantitative fields because writing and formatting equations, graphs and tables is very convenient. It is also easy to insert graphs, create tables and (most importantly!) correctly cite your sources.

To help you get a feeling for LaTeX, this template is structured in the following way: Section 2 will introduce how to write equations while graphs, tables and citations are discussed in 3 and 4. Like any scientific paper the last section 5 is the conclusion that provides a high level summary of the most important findings of the paper!

2   Methodology

The mathmode allows to easily write equations, using various mathematical operators, greek letters, symbols and formatting environments. In the following paragraphs will introduce the most important commands and functions based on different examples. This is done using **math mode**.[1]

2.1   Some examples for math mode

To include mathematical expressions like $x = 7$ in the written text use one $-sign to start and close the . Two $-signs indent the expression on a new line

$$a^2 + b^2 = c^2.$$

Greek letters can be written using a \ and the greek letter spelled out. For example, the change of a variable ζ_t is often denoted as

$$\Delta\zeta_t = \zeta_t - \zeta_{t-1}$$

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[1]to highlight words or phrases, it is also possible to write text in *italic*, **bold** or sans serif.

Equations can also be numerated and labeled using the command `\begin{equation}` and `\end{equation}` For example equation (1) shows the distribution function $F(x)$ of a normal distributed random variable $x \sim \mathcal{N}(\mu, \sigma^2)$ that is given as

$$F(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \int_{-\infty}^{x} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \tag{1}$$

Using `equation*` suppresses the numbering.

$$x_t = \mu_t + \sum_{i=0}^{\infty} \psi_i u_{t-i}$$

The same holds for `\begin{align}` and `\end{align}` which can be used to align several expressions (note that `align` numbers every line).

$$
\begin{aligned}
x_t &= c + \alpha x_{t-1} + u_t \\
x_t &= c + \alpha L x_t + u_t \\
(1 - \alpha L) x_t &= c + u_t \\
x_t &= \frac{c}{1-\alpha} + \sum_{i=0}^{\infty} \alpha^i x_{t-i} \quad (\longrightarrow \text{Wold Representation})
\end{aligned}
$$

The `&`-sign indicates where the expressions should be aligned and `\\` marks the line breaks. Adjusting the size of brackets works with the commands `\left` and `\right` in front of the brackets. For example, for a Cobb-Douglas function $f(L, K) = L^\alpha K^{(1-\alpha)}$ it holds that

$$\frac{\partial f(L,K)}{\partial L} = \alpha \left[\frac{K}{L}\right]^{(1-\alpha)} \quad \text{and} \quad \frac{\partial f(L,K)}{\partial K} = (1-\alpha)\left[\frac{L}{K}\right]^{\alpha} \quad \forall \, 0 < \alpha < 1 \tag{2}$$

3 Data

It is always useful to illustrate your data or results using figures and plots. This section shows how to include and refer to them in your text in LaTeX.

3.1 Figures

Figure 1 on the following page is an example of how an image file can be included in the text. It is important that the relevant file is stored in the folder Graphics. The size of the figures can be controlled using the argument `width` or alternatively with the argument `scale`. Similar to equations, figure can be labled using the command `\label{fig:fig_name}` and later referred to in the text using `\reffig:fig_name`. Possible file types include but are

Figure 1: Example how to insert graphics

not limited to PDF, JPG, PNG.

4 Results

LaTeXalso provides an environment to create tables, for example to create customized regression outputs or summary statistics. Additionally, it provides an easy and efficient way to cite other sources using BibTeX. Examples for both features are given in the next subsections.

4.1 Example: Figures and Tables

Table 1 is an example of how a table is generated and can be included in the text. To draw

Left	Middle	Right
text	text	text
in these	in these	in these
cells	cells	cells
will be	will be	will be
left aligned	centered	right aligned

Table 1: Example how to create and insert tables

vertical lines use | in the `\begin{}` command. For horizontal lines use `\hline`. The `&`-signs

indicate cells and \\ marks a line break. For complicated or large tables, there are also convenient **websites** that can help you generate the appropriate LATEX-Code.

4.2 Example: Citations

To include citations, LATEXuses the BibTeX tool. Before a source can be cited in a document, it has to be stored in the Bibtex-file called `sources.bib`. The file is saved in the folder `Literature` and should not be moved or renamed. Once the relevant information about the source is entered and saved in the BibTeX-file, the command `\cite{}` can be used to include the citation in the document. Furthermore, the source will then automatically be displayed in the section **References** at the end of the document. Some examples that are already saved in the `sources.bib` file are Brink (2005), Gopen & Swan (1990) and Johnson et al. (1993). Note that many scientific journals provide the information about the articles in BibTeX format on their homepages so it is easy to copy and include them. Looking up sources in Google Scholar is also an easy way to find the information in BibTeX format as can be seen in Figure 2.
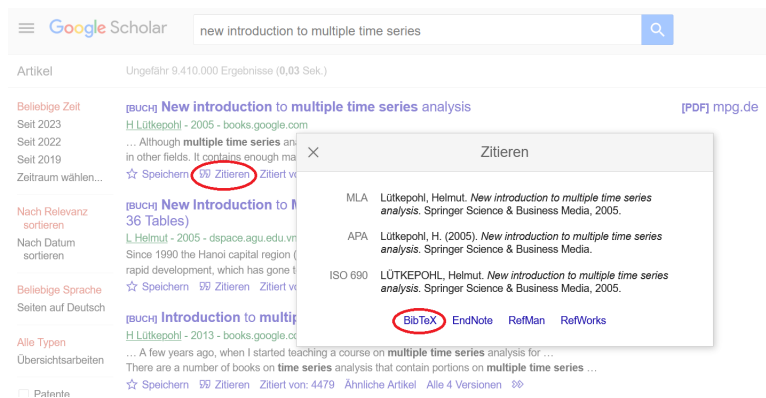

Figure 2: Citations in BibTeX-format can easily be obtained from Google Scholar.

5 Conclusion

This document provides an overview of the most important concepts and functions to work in LATEX, a common software system to prepare academic texts. Based on different examples, this templates illustrates how to write equations, insert graphs, create tables and consistently cite your references. However, while LATEXis a powerful tool, it requires time to familiarize with the commands and debugging your code can frequently slow you down. Consequently, this can make working in LATEXtedious and slow in the beginning so it is important to start writing down projects early enough!

References

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I declare that I have authored this thesis independently, that I have not used other than the declared sources / resources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.

Berlin, August 31, 2023

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(Signature of the author)