# **Tools for Modern Macroeconometrics**

**Term paper: Guidelines**

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**The main goal** of the term paper is to deliver forecasts of GDP and inflation and to infer the propagation of a shock of your interest (monetary, fiscal, uncertainty, financial, exchange rate, climate, etc.).

The motivation is straightforward: The methods discussed throughout the course are suited for forecasting, understanding the comovement of time series, and estimating dynamic links across macroeconomic time series. The best way to learn these methods is to apply them to real-world data.

The term paper is supposed to have the following parts:

1. Analysis and forecast of inflation and real GDP of a country of your choice.
2. Identification and estimation of propagation of a shock of your interest using VAR models.
3. Testing, which benefits bring advanced methods of identification and estimation.
4. Unconditional and conditional forecasts based on multivariate models.

**Requirements**

***1. All estimations shall be done in R.***

We recommend using one environment for your analysis and writing the text, such as R markdown notebooks, Quarto documents, or Jupyter notebooks. Then, text, code, and outputs are within one file and can be easily updated and shared as source files, htmls, or even pdfs. They can also be hosted on servers such as RPubs, Github, and others.

These document types allow text formatting using markdown syntax, including mathematical formulas written with latex. Therefore, they can do everything you need.

An introduction to markdown can be found, for example, here: <https://www.markdownguide.org/extended-syntax/>.

R Markdown and Quarto documents can be written within R studio.

R Markdown: <https://rmarkdown.rstudio.com/lesson-1.html>

Quarto with R Studio: <https://quarto.org/docs/tools/rstudio.html>

Jupyter requires Jupyter Notebook or Jupyter Lab; see <https://jupyter.org/>.

***2. Term paper is more than just codes and outputs.***

First of all, we expect a real paper at the end of your course, not a collection of outputs, just with a few words somewhere in between. Therefore, the term paper shall include a reasonable introduction, a main body, and conclusions + references.

Because the time is limited, we do not expect the results will be perfect. We will provide feedback during the intermediate stages, we expect you to try to incorporate our comments, but the final results might still contain some counterintuitive results. Therefore, it is more important and valuable for the term paper to describe your modeling choice carefully and defend their appropriateness. Those choices include a selection of variables and their transformations, identifying assumptions, and model structure. Then, you are supposed to test the robustness of your results on these choices.

***Formalities.***

* **Length:** We expect your text will have around 10 pages, excluding graphics and tables. The main text shall include only the very main results, and supplementary results shall appear in the appendix.
* You are encouraged to **work in pairs**; however, each of you shall have your own estimates for a particular country. The term paper can be written jointly, covering two countries as well. In the case of a joint paper, we expect 15 pages.
* **Zero tolerance for plagiarism.**

**First task: Choice of a country**

You can choose any country of interest (note: euro area is also eligible). We recommend selecting a country whose data you can download directly into R. Then, the source codes can be shared easily, and the results can be easily recalculated when new data arrive.

Several R packages can do the job via API access to data sources. Syntax and data options follow conventions from the source databases.

* pdfetch: Our go-to library can download data from many sources: ECB, Eurostat, WorldBank, Yahoo Finance, and others. More on those sources and syntax: <https://rdrr.io/cran/pdfetch/man/>. The pdfetch library returns xts objects but has somewhat limited options for importing. With the help of the tsbox package, one can quickly transform the data, and the selection of samples, etc., can be made easily within R. Note: Check you have the most up-to-date version of the package, Eurostat didn’t work in version 0.2.7, that was fixed with 0.2.8 update.
* quantmod: returns xts objects, more flexibility than pdfetch; designed mainly for financial series. Macro illustration at https://rodmariscal.com/blog/time-series-in-r-quick-reference/.
* Quandl: flexible options, multiple data sources, also suitable for financial modeling. Introductory information at <https://www.quandl.com/tools/r>. If you plan to use Quandl, register to obtain API. (Note: In 2022, updates of the data from FRED database of U.S. macro data stopped, so we moved to different packages and did not test the current state).
* fredr: returning tibbles compatible with the tidyverse package but requires FRED API key. See <http://sboysel.github.io/fredr/articles/fredr.html>.
* tidyquant: related to tidyverse, the same syntax as in the case of fredr is used.

Feel free to use other packages, such as oecdr, OECD, eurostat, etc.

Check whether the data of your country of interest are available in a database. Your key time series are the real GDP (seasonally adjusted) and the CPI/HICP index (seasonally adjusted). The GDP needs to be on a quarterly frequency and the price index on a monthly frequency. The data need to be up to date. As of March 1, the data till December or the 4th quarter of the last year shall be available.

European countries shall be without problems, like the U.S., but check that you can access the data first for other countries.

**Please, register your selected country here:** <https://forms.gle/CzRHUtcmBHQ7EYL68>.

Insert your first choice and second choice. In the case of more than two people willing to work on the same country, we reserve the right to assign you the second choice.

**Intermediate deadlines:**

There will be several intermediate deadlines. After those deadlines, you'll be asked to present the results during the seminars. If we spot some analysis is conducted incorrectly, we will ask you to revise this part for your term paper explicitly. If there are possibly more important problems with the analysis when incorporating our requests, include a formal response to our request in your final paper as an Appendix in which you explain why you stick with your original specification.

We will post specific tasks for the intermediate deadlines via moodle.