Exam
Advanced Macroeconomics
Winter 2022/2023

General Remarks:

- This document contains all problem sets for the exam in winter 2023.
- Each student is assigned a specific problem set. You have to work exactly on the problem set that is assigned to you. You find the allocation of student ID numbers to problem sets at the end of the document.
- Please read the exercises carefully.
- For producing your data set with raw data you can use R. In this case add the respective code to the zip container. But please note that other software than Octave or Matlab is only allowed for loading and cleaning data, not for calculations.
- All numerical calculations and all graphical expositions have to be produced with Octave (or Matlab) and Dynare. Do not use other statistical or econometric software.
- You need to combine techniques from several Octave and Dynare programs that have been provided via Stud.IP during the semester. Screen all programs and think about how to use parts of them for your task. Include a table in your pdf which lists all Octave and Dynare programs that you are using together with a short description what a program does. Add a data section in which you explain in detail the data that you use and its exact source.

- Cite all the literature that you are using (including the lecture slides, the Dynare manual, and Dynare itself, see www.dynare.org). If you receive support from another person (including fellow students) do not forget to acknowledge this. It is important that you explain your code in the answers, otherwise we cannot assess your own contribution. Code without explicit written explanation is not sufficient to pass the exam.
- The grading criteria are:
  - Does the Octave/Dynare code work and does it answer the specific question? (30%)
  - Is the computer code well documented and explained? (30%)
  - Are the economic explanations complete and correct? (30%)
  - Are the results well presented in the pdf file? (10%)

Good luck!

Problem Set #n

1. Download the following monthly inflation data from table `PRC_HICP_MIDX` of the Eurostat database for the country which is assigned to your student ID:

   - All-items HICP (`CP00`)
   - Energy (`NRG`)
   - Overall index excluding energy (`TOT_X_NRG`)

   Choose periods from 2012.M1 to the latest available month and index 2015=100. Comment the way you get the data.
   Hint: When you download the data with `R` you can use the package `eurostat`.

2. Calculate inflation rates for all three variables:

   - month-on-month
   - annualized month-on-month
   - year-on-year per month

   Explain how you define the variables.

3. Do all following data calculations with year-on-year inflation per month. Use the *Hodrick-Prescott filter* for computing the inflation gap and trend inflation (HICP, energy, non-energy). Set a reasonable value for the smoothing parameter λ and explain your choice.

4. Show time series plots of inflation rates (HICP, energy, non-energy). Plot also trend inflation to each inflation measure. Add the respective average inflation over all periods. Describe the development of inflation and explain differences between HICP, energy price and non-energy inflation.

5. Plot the cyclical component and describe in your own words the behaviour of inflation (HICP, energy, non-energy). Provide a possible explanation for fluctuations in the inflation rates. Is total inflation mainly driven by energy prices or are there other thinkable factors?

6. Calculate the standard deviations of all monthly year-on-year inflation measures.

7. Imagine the *One-Period Model* from the lecture with utility function

   $$u = (1 - \omega) \ln c_1 + \omega \ln c_2$$

   and price p for good c_2 while the price for good c_1 is normalized to 1.

   - Derive analytically a formula for optimal c_i, $i = 1, 2$.
   - Solve for equilibirum values c_i and display the values. Assume $r = 0.3$, $w = 0.6$, $p = 1$ and $\omega = 0.5$.

- Solve for equilibirum values c_i for a reasonable range of p and ω in steps which are small enough to plot the consumption levels as continous functions $c_i(p)$ and $c_i(\omega)$ of the varying factors. Plot and interprete the functions.

8. Consider the *New-Keynesian Model* with rigid prices from the lecture. Add cost-push shocks with persistency of $\eta_\pi = 0.7$ and standard deviation $\sigma_\pi = 0.1$ of ϵ_π to the *Phillips curve*. Run a stochastic model simulation with a positive inflation shock. Plot and explain the impulse response functions of each variable. Also refer to the role of monetary policy in the model.

9. Do a sensitivity analysis and consider different persistency of the inflation shock as well as different reactivity of monetary policy by varying the inflation reaction parameter. Plot the impulse responses of output and inflation gap with different parameter values of a reasonable range in one subplot and explain the differences.
   Hint: See section on for loops in the Dynare manual.