Macroeconometrics
Fall 2022
Problem Set 3

- The problem set is due by **Sunday, November 27th at midnight** (the night before the class in the computer room on November 28th). Please send the material by e-mail to Mahyar Habibi, mahyar.habibi@phd.unibocconi.it).
- Work in groups of maximum 3 people.
- You are expected to follow the same rules as for problem set 1.

1. Choleski identification and monetary policy shocks

In the dataset, in the first sheet of data_ps3.xlsx, you will find the following variables: log(real GDP), log(Price deflator) and Federal Funds Rate for the US from 1960 to 2010 at quarterly frequency. Estimate a VAR on those variables, identify the monetary policy shock with a triangular identification structure with the ordering above, and compute impulse responses and variance decompositions for the monetary policy shock. Compute confidence intervals around the point estimates for the impulse responses using a *bootstrap.*

(Hint: a bootstrap is similar a Monte Carlo, but instead of sampling from a known distribution, you draw from the estimated residuals. The steps are the following:

1. Estimate the VAR and store the coefficients ($\hat{A}$*, of dim* $(N \times N)$*) and the residuals (* $\hat{\varepsilon}$*, of dim* $(T \times N)$*) (here I assume a* $VAR(1)$ *for simplicity, but you may think of* $\hat{A}$ *as the companion form of a VAR with more lags);*

2. Sample ***with replacement*** *from the estimated residuals so to form a new series of residuals* $\tilde{\varepsilon}$ *of dim* $(T \times N)$ *(note 1: sample with replacement; note 2: sample one row (of dim* $(1 \times N)$*) of the matrix* $\tilde{\varepsilon}$*); One way of doing it is to tell Matlab to generate T random integers from 1 to T (for example, call the vector of the integers* `PER`*) and then you set* $\tilde{\varepsilon} = \varepsilon(\texttt{PER}, :)$*; don't use the command* `permute` *(why?).*

3.Use the newly generated residuals and the estimated coefficients to construct new series: $\tilde{y}_t = \hat{A}\tilde{y}_{t-1} + \tilde{\varepsilon}_t$*. The starting values for the difference equation are the first values of* y_t *(in the case of a VAR(1), just* y_1*)).*

4. Estimate a VAR on the new series $\tilde{y}_t$*, identify shocks and compute impulse responses. Store the impulse responses.*

5. Repeat steps 2 to 4 K times (say, $K = 1000$*);*

6. At the end you have a set of 1000 impulse responses and you plot the 2.5% and 97.5% percentile of that empirical distribution. This is your 95% confidence interval.

2. Long-run identification.

Read the paper "Technology, employment, and the business cycle: do technology shocks explain aggregate fluctuations?" by Jordi Gali, *The American Economic Review*, Vol. 89, No. 1 (Mar., 1999), pp. 249-271.

Using the dataset in the second sheet of data_ps3.xlsx, replicate Figure 2 in the paper and compute *bootstrapped* confidence bands *(warning: results may slightly differ from those in the paper, as the data are not exactly the same).*