

MatLab code and Test data

Three MatLab files are provided with the article.

bootstrap_ci_mGK.m The file contains the function `bootstrap_ci_mGK` that implements the mGK method to evaluate 95% confidence intervals for the correlation between two time series sampled (evenly or unevenly) at different time points.

Function inputs : x , values of the first time series ($N \times 1$); y values of the second time series ($M \times 1$); tx time points associated with x ($N \times 1$); ty time points associated with y ($M \times 1$).

Function output : 95% confidence intervals for the correlation between the two time series.

The same function can also be used to produce 95% confidence intervals for the cross-correlation at lag h (i.e., for $Corr[X_{t+h}, Y_t]$). To this end, it is sufficient to replace the input ty for $ty - h$, that is:

- `bootstrap_ci_mGK(x,y,tx,ty)` \rightarrow 95% CI for $Corr[X_t, Y_t]$;
- `bootstrap_ci_mGK(x,y,tx,ty-h)` \rightarrow 95% CI for $Corr[X_{t+h}, Y_t]$.

The function is an adaptation of the `bootstrap_ci` function that implements the GK method of Roberts et al. (2017). The main difference between `bootstrap_ci_mGK` and `bootstrap_ci` functions is the subroutine that builds the time sequences for the X and Y series. For a detailed discussion the interested reader can refer to the Online Resource 1 of the manuscript.

The function `bootstrap_ci_mGK` requires the following functions developed by Roberts et al. (2017) and available at <https://github.com/jlr581/correlation/tree/master/MATLAB>:

- `cpdf.m`
- `icpdf.m`
- `joint_sort.m`
- `correlated_gaussian.m`

CI_examples.m Contains the MatLab code to produce the 95% confidence intervals for the correlation and the cross-correlation at lag 1 (i.e., for $Corr[X_t, Y_t]$ and $Corr[X_{t+1}, Y_t]$) between two unevenly spaced non-coevally time series using the mGK method. The two time series correspond to the simulation scenario considered in the Monte Carlo experiments in Sect. 3 of the manuscript where: $\rho_{XY} = 0.2$, $n = 200$, $sk = 0.1$ and $\tau = 2$. Code and relevant data are stored in the folder `CI_examples`.

Coverage_example.m Contains the MatLab code to obtain the empirical coverage and average length of the mGK method for the simulation scenario considered in the Monte Carlo experiments in Sect. 3 of the paper corresponding to the scenario where: $\rho_{XY} = 0.2$, $n = 200$, $sk = 0.1$ and $\tau = 2$. The empirical coverage is calculated as the fraction of the 1000 simulations for which the confidence intervals contain the known theoretical value of the correlation. Code and relevant data are stored in the folder `Coverage_example`.

In order to obtain empirical coverage and average length of the GK method one just needs to replace in the script of the `Coverage_example.m` file the `bootstrap_ci_mGK` function for the `bootstrap_ci` function of Roberts et al. (2017).