Programs for Running the Examples in Müller and Wang 2018

This note describes the supplementary material to "Nearly Weighted Risk Minimal Unbiased Estimation", Müller and Wang (2018).

The supplementary material consists of:

1. There is a _lam.csv file, which contains the values of unknown parameter and corresponding Lagrange multipliers.
2. In those examples where we look for an exactly median unbiased estimator, there is a _mf.csv file, which contains the median function used to inverse to obtain exactly median unbiasedness.
3. There is a _para.csv file, which contains the values of different sample size, used to find the corresponding Lagrange multipliers.
4. There is a _est.m file, which constructs the corresponding estimator.
5. Many of the programs use the function lgwt.m which computes the weights for Gauss-Legendre quadrature. This function is written by Greg von Winckel and downloaded from MATLAB website.
6. The function simu_main.m generates Monte Carlo draws and simulates different estimators.

For the AR median unbiased problems, we use the additional function "bspline_basismatrix" written by Levente Hunyadi to calculate the b-spline function. For the MA problem, (Degree of Parameter Time Variation problem), we use an additional function: the getdens.m computes log-likelihood of data $\{y_t\}_{t=1}^T$ defined in the paper with specified value of the coefficient. For the quantile forecast problem, we construct the functions mytdf.m and mytpdf.m to compute the cdf and pdf of student t distribution. This is to avoid overflow.

1 Mean Unbiased Estimator for AR(1) with Known Zero Mean and Unit Variance

ARnoconst_mean_est.m

This program requires time series data and returns a mean unbiased estimator for the AR(1) coefficient. Note that the numerical integration is undertaken in MATLAB using Gauss-Legendre quadrature with weights provided by function lgwt.m. We use normalization $n(\theta) = \sqrt{(1-\theta^2)/T + 8\theta^2/T^2}$.

2 Mean Unbiased Estimator for AR(1) with Unknown Mean and Variance

ARconst_mean_est.m

This program requires pre-normalized time series data and returns a mean unbiased estimator for the AR(1) coefficient. We use normalization $n(\rho) = \sqrt{(1-\rho^2)/T + 8(\rho+0.4)^2/T^2}$.

3 Median Unbiased Estimator for AR(1) with Known Zero Mean and Unit Variance

ARnoconst_med_est.m

This program requires time series data and returns an exactly median unbiased estimator for the AR(1) coefficient. Note that we numerically inverse the median function by linear interpolation, which is implemented in MATLAB by build-in function interp1.m. We use normalization $n(\theta) = \sqrt{(1-\theta^2)/T + 8\theta^2/T^2}$.

4 Median Unbiased Estimator for AR(1) with Unknown Mean and Variance

ARconst_med_est.m

This program requires pre-normalized time series data and returns an exactly median unbiased estimator for the AR(1) coefficient. We use normalization $n(\rho) = \sqrt{(1-\rho^2)/T + 8(\rho+0.4)^2/T^2}$.

5 Degree of Parameter Time Variation

MA_est.m

We denote the problem as MA, as discussed in the paper. This program takes the original $\{y_t\}_{t=1}^T$ time series and computes an exactly median unbiased estimator. We use normalization $n(\eta) = \sqrt{(1-\eta^2)/T + 6\eta^2/T^2}$.

gendens.m

This program computes the likelihood at a given η, and is used by the numerical integration procedure in MA.m. There is no need to change anything in this program.

6 Quantile Long-range Forecast

forg_est.m

This program requires time series data and returns a nearly quantile unbiased forecast. We use normalization $n(\rho) = \sqrt{(1-\rho^{2\tau})/(1-\rho^2)}$.

mytdf

This program computes the cdf of student t distribution.

mytpdf

This program computes the pdf of student t distribution.