4th set GAUSS assignments Financial Econometrics

a) Estimate a CAPM with help of the system environment in EViews. The stochastic discount factor m is specified as:

$$m = a + b(R^m - R^f)$$

Moment conditions result from:

$$E(mR - 1) = 0$$

b) Estimate the famous Fama/French model based on *excess returns*, i.e. using $E(mR^e) = 0$ with the GMM toolbox in GAUSS. The stochastic discount factor m is formulated as a linear function of three factors:

$$m = a + b_1 f_1 + b_2 f_2 + b_3 f_3$$

where

$$\begin{aligned} f_1 &= (R^m - R^f) \\ f_2 &= (R^H - R^L) \\ f_3 &= (R^S - R^B) \end{aligned}$$

R^S denotes the return of a portfolio of *small* firms (in terms of market capitalization). R^B denotes the return of a portfolio of *big* firms. R^H denotes the return of a portfolio of firms with a *high* ratio of book value to market value. R^L denotes the return of a portfolio of firms with a *low* book to market ratio. In order to construct those portfolios, distribution deciles of the respective variable (e.g. book value/market value) are created for a set of assets. Then, portfolios are constructed according to those deciles. Typically, one uses the upper decile and the lower decile for calculating the return difference. Note, that all factors in the Fama/French model are excess returns.

c) Use excess returns $R_t^{ei} = R_t^i - R_t^f$ to conduct a (pooled) time series regression for all assets on the market portfolio as a single factor:

$$R^{ei} = \alpha_i + \beta_i f_t + \epsilon_t^i$$

The moment conditions require that:

$$g_T(b) = \begin{bmatrix} E_T(R^e - \alpha + \beta f_t) \\ E_T[(R^e - \alpha + \beta f_t) f_t] \end{bmatrix} = \begin{bmatrix} E_T(\varepsilon_t) \\ E_T(\varepsilon_t f_t) \end{bmatrix} = 0$$

Further, compute the GRS test statistic for $H_0 : \alpha_1 = \alpha_2 = \ldots = \alpha_{10} = 0$ which is asymptotically the following:

$$T \left[1 + \left(\frac{E_T(f)}{\hat{\sigma}(f)} \right)^2 \right]^{-1} \alpha' \hat{\Sigma}^{-1} \alpha \sim \chi^2_N$$

1. Create a matrix containing the moment conditions

GAUSS procedure:

a), **b)** and **c)**: Write a procedure returning the element wise moment conditions.

2. Call the estimation procedure using the GMM toolbox

GAUSS procedure:

Write a GAUSS procedure (or take the procedure from the 3rd GAUSS assignment) containing all the global settings and the estimation procedure.

3. Load data and call estimation procedure

a), **b)** and **c)**: First, load the factor data and the return data into a GAUSS matrix. Factor data from 2nd quarter 1947 to 4th quarter 1993 are provided in the file `ff_factors.fmt`. The first column contains the market excess return over the T-bill rate. The second column contains the series `SMB` and the third column contains the series `HML`. For task c) you will need the T-bill rate data provided in `tbill.fmt`. Return data for ten portfolios (1st size decile to 10th size decile) from 2nd quarter 1947 to 4th quarter 1993 are provided in the file `ret_dec10_1947Q2_1993Q4.fmt`. You can load those files with the `load` command (look it up in the GAUSS Help).

Call estimation procedure!