4th set GAUSS assignments Financial Econometrics

1. CAPM estimation
Use the GMM toolbox to estimate the parameters of the CAPM. The stochastic discount factor m is specified as:

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

Moment conditions result from:

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

R^m denotes the market return and R^f the risk free rate. The first column of the data set `ff_factor.fmt` contains the time series of the market excess return over the T-bill rate. Return data for ten portfolios are given in `ret_dec10_1947Q2_1993Q4`.

2.1 Fama/French three Factor Model
Estimate the famous Fama/French model using the GMM toolbox. The moment condition is again

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

The stochastic discount factor, however, is derived as a linear function of three factors:

$$m = a + b_1 exmret + b_2 SMB + b_3 HML$$

where

$$\begin{aligned} exmret &= (R^m - R^f) \\ SMB &= (R^S - R^B) \\ HML &= (R^H - R^L) \end{aligned}$$

R^m and R^f are described in 1.. 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. Note, that all factors in the Fama/French model are excess returns. 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 (`exmret`). The second column contains the series `SMB` and the third column contains the series `HML`. Again, return data for ten portfolios from 2nd quarter 1947 to 4th quarter 1993 are provided in the file `ret_dec10_1947Q2_1993Q4.fmt`.

2.2 Test for joint significance

Test, whether the estimated coefficients of the Fama/French factors are jointly statistically significant. Use the estimated variance covariance matrix (global output variable of the GMM toolbox: `_gmmout_bcov`) to compute an F-statistic for joint significance of the coefficients:

$$F \equiv (\mathbf{Rb} - \mathbf{r})'[\mathbf{R}\widehat{Var(\mathbf{b}|\mathbf{X})}\mathbf{R}']^{-1}(\mathbf{Rb} - \mathbf{r})/\#\mathbf{r}$$

where $\#\mathbf{r}$ is the dimension of $\mathbf{r}$ (number of restrictions).

Example: For the construction of the matrix $\mathbf{R}$ and the vector $\mathbf{r}$, suppose you have estimated the parameter vector $\mathbf{b} = (\ b_1 \quad b_2 \quad b_3 \quad b_4\ )'$ and want to test the joint hypotheses whether the true parameter $\beta_2 = \beta_3$ and $\beta_1 = 0$. Then, you can write the null hypotheses as a system of linear equations:

$$H_0 : \mathbf{R}\boldsymbol{\beta} = \mathbf{r}$$

In this example, it follows for $\mathbf{R}$ and $\mathbf{r}$:

$$\mathbf{R} = \begin{bmatrix} 0 & 1 & -1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}, \qquad \mathbf{r} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

Hint: The null of the F-test for the Fama/French factors is $b_1 = b_2 = b_3 = 0$.
After calculating the F-test, use the Gauss command `cdffc` (look it up in the help reference) to get the corresponding p-value.

This assignment can be handed in for grading until 15th Nov. 2008.
If you want to hand in this assignment for grading, include a pdf file (beside your program code) that shortly describes the procedures. explain the main features of the CAPM and the Fama/French three factor model. Interpret the estimated parameters and the F-test.
Send your program code and the pdf file to franziska-julia.peter@uni-tuebingen.de