3rd set GAUSS assignments Financial Econometrics

Take the examples of the 1st and 2nd assignment and optimize the objective with help of the GAUSS GMM Toolbox.

1. Create a matrix containing the moment conditions

GAUSS procedure:

Generate a t- distributed variable with $n = 1000$ observations. Write a procedure (modify the procedure of assignment 1) which returns the matrix

$$u = \begin{bmatrix} y_1^2 - \frac{\nu}{\nu-2} & y_1^4 - \frac{3v^2}{(v-2)(v-4)} \\ y_2^2 - \frac{\nu}{\nu-2} & y_2^4 - \frac{3v^2}{(v-2)(v-4)} \\ \vdots & \vdots \\ y_n^2 - \frac{\nu}{\nu-2} & y_n^4 - \frac{3v^2}{(v-2)(v-4)} \end{bmatrix}$$

Generally, the GMM toolbox needs as input a procedure that returns the raw matrix of moment conditions (u) without taking sample means of the respective moment conditions.

2. Call the estimation procedure using the GMM toolbox

Add the following commands at the head of your program:

```
library optmum;
#include gmmtb.src;
gmmset;
```

The library `optmum` includes optimization routines needed for optimization of the objective function. With `#include` you can include source files or programs into your current Gauss program file. Here, we include the GMM toolbox, which contains procedures written for GMM estimation. Download the toolbox from the course homepage, unzip it and save it into your working directory. The command `gmmset` initializes GMM settings.
GMM estimation can now be done by the following command:

```
gmm(initial,model,matrix1,matrix2,matrix3);
```

where `initial` is a column vector of initial values for your parameters, `model` is a reference to the procedure written in 1. (e.g. if your procedure creating the moment matrix is called

t_moments, then model would be &t_moments). For the last three arguments matrix1 to matrix3 assign an empty matrix and plug it in.
Before we call the procedure gmm(.), we should set some globals:

```
_opalgr=2;
```

_opalgr is a Optmum global: indicator for optimization method:
= 1 SD (steepest descent - default)
= 2 BFGS (Broyden, Fletcher, Goldfarb, Shanno)
= 3 Scaled BFGS
= 4 Self-Scaling DFP (Davidon, Fletcher, Powell)
= 5 NEWTON (Newton-Raphson)
= 6 Polak-Ribiere Conjugate Gradient

Note:
5 should always be a good choice, try 2 if the algorithm bogs down.

```
_opgtol=0.00001;
```

_opgtol is a Optmum global: convergence tolerance for gradient of estimated coefficients. Default = 1e-5. When this criterion has been satisifed OPTMUM will exit the iterations. Important: Some applications in asset pricing demand a small value in order to prevent convergence to a local minimum!

```
_gmmopt_gmmit=1;
```

This is a GMM global. It gives the number of GMM iterations: 1 reports only first stage estimates.

_gmmopt_w0="I";

This is a GMM global. It defines the weighting matrix used in the first step iteration. In our case we use the identity matrix!

Now call the procedure (gmm(.))! GMM estimation results are stored in global variables. For this assignment we only need the following: _gmmout_b, which returns the estimated parameter(s), _gmmout_f, which gives the value of the objective function at the optimum, and _gmmout_se, which returns the standard error(s) of the estimated parameter(s). Print those results into the output window.

3. Write a procedure for GMM estimation

In a last step, write a procedure which does the GMM estimation and includes the global GMM and optmum options. Simply write a procedure around your code from step 2. Input arguments are the initial parameter values and the procedure that returns the moment conditions. Output arguments are the estimated parameters, their standard errors and the minimum value of the objective function.

Call the procedure for the example from the first assignment (t-distribution) as well as for the example from the second assignment (Consumption based model). For the CBM you need to modify the procedure returning the moment conditions first!

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. What is the general idea behind GMM estimation? If you are not sure whether your estimated parameters result from a local or global optimum, what can you do to check that in Gauss? Hint: Think about starting values and the global options you can set!
Send your program code and the pdf file to franziska-julia.peter@uni-tuebingen.de