8th set GAUSS assignments Financial Econometrics

1. Estimating the Madhavan/Richardson/Roomans(1997) model

i) Write a procedures which returns the moment conditions implied by the MRR model. In the GAUSS files `dcx_tim.fmt` you find trade data for the three stocks over a period from 1st February 2004 to 10th February 2004. Use the procedure `readdata` to read in the data. Have a look at the procedure to get an idea of the data structure.

The estimable equation which can be derived from the theoretical MRR framework reads as:

$$\Delta p_t = \theta(Q_t - \rho Q_{t-1}) + \phi \Delta Q_t + u_t$$

u_t is given by:

$$u_t = \Delta p_t - (\theta + \phi)Q_t - (\phi + \rho\theta)Q_{t-1}$$

and implies the following moment conditions:

$$E \begin{bmatrix} Q_t Q_{t-1} - \rho \\ u_t \\ u_t Q_t \\ u_t Q_{t-1} \end{bmatrix} = 0$$

where Q_t is a trade indicator taking the value 1 if the trade is a buy and -1 if the trade is a sell. Δp_t is the price change from period $t-1$ to t.

Estimate the model parameters.

ii) Write a procedure which returns the standard error for the implied spread $s_E = 2(\phi + \theta)$ and the asymmetric information share $r = \theta/(\theta + \phi)$. Use the delta method to compute the standard errors:

Suppose that $\{\mathbf{x}_n\}$ is a sequence of K-dimensional random vectors such that $\mathbf{x}_n \xrightarrow{p} \boldsymbol{\beta}$ and

$$\sqrt{n}(\mathbf{x}_n - \boldsymbol{\beta}) \xrightarrow{d} N(\mathbf{0}, \boldsymbol{\Sigma})$$

then

$$\sqrt{n}(\mathbf{a}(\mathbf{x}_n) - \mathbf{a}(\boldsymbol{\beta})) \xrightarrow{d} N(\mathbf{0}, \mathbf{A}(\boldsymbol{\beta})\boldsymbol{\Sigma}\mathbf{A}(\boldsymbol{\beta})')$$

where $\mathbf{A}(\boldsymbol{\beta})$ is the matrix of continuous first derivatives of $\mathbf{a}(\boldsymbol{\beta})$ evaluated at $\boldsymbol{\beta}$:

$$\mathbf{A}(\boldsymbol{\beta}) = \frac{\partial \mathbf{a}(\boldsymbol{\beta})}{\partial \boldsymbol{\beta}'}.$$

<u>Hint:</u> Look in the GAUSS help how the `gradp` function works.

iii) Test the hypothesis that the information share r equals 0.5.

This assignment can be handed in for grading until 27th January 2009.
If you want to hand in this assignment for grading, include your program code and a pdf file that shortly describes the procedures. Shortly outline the main features of the MRR model and interpret the estimated parameters and test statistic.
Send your program code and the pdf file to franziska-julia.peter@uni-tuebingen.de

9th set GAUSS assignments Financial Econometrics

Add the new procedures related to the estimation of trade indicator models to the procedure file related to trade indicator models (e.g. `timprocs.src`).

1. Estimating the Huang/Stoll(1997) model

i) Write a procedure which returns the moment conditions implied by the HS model. In the GAUSS files `ads_tim.fmt`, `bmw_tim.fmt` and `dcx_tim.fmt` you find trade data for the three stocks over a period from 1st February 2004 to 10th February 2004. The estimable equation which can be derived from the theoretical HS framework reads as:

$$\Delta P_t = \frac{S}{2} \cdot \Delta Q_t + \upsilon \cdot \frac{S}{2} \cdot Q_{t-1} + u_t$$

and implies the following moment conditions:

$$E \begin{bmatrix} u_t \\ u_t Q_t \\ u_t Q_{t-1} \end{bmatrix} = 0$$

where Q_t is a trade indicator taking the value 1 if the trade is a buy and -1 if the trade is a sell. ΔP_t is the price change from period $t-1$ to t. Note, that the spread S is estimated in this specification.

ii) Write a procedure which returns the moment conditions implied by the HS model taking into account different volume categories. The estimable equation which can be derived from the theoretical HS framework reads as:

$$\Delta P_t = \frac{S^s}{2} D_t^s + (\lambda_s - 1)\frac{S^s}{2} D_{t-1}^s + \frac{S^m}{2} D_t^m + (\lambda_m - 1)\frac{S^m}{2} D_{t-1}^m + \frac{S^l}{2} D_t^l + (\lambda_l - 1)\frac{S^l}{2} D_{t-1}^l + u_t$$

where

$$\begin{aligned}
D_t^s &= Q_t \quad \text{if share volume at } t \leq 1000 \text{ shares} \\
&= 0 \quad \text{otherwise} \\
D_t^m &= Q_t \quad \text{if share volume at } t < 10000 \text{ shares} \\
&= 0 \quad \text{otherwise} \\
D_t^l &= Q_t \quad \text{if share volume at } t \geq 10000 \text{ shares} \\
&= 0 \quad \text{otherwise}
\end{aligned}$$

and implies the following moment conditions:

$$E\begin{bmatrix} u_t \\ u_t D_t^s \\ u_t D_{t-1}^s \\ u_t D_t^m \\ u_t D_{t-1}^m \\ u_t D_t^l \\ u_t D_{t-1}^l \end{bmatrix} = 0$$