EViews Assignment: MRR and HR Model

In the EViews file `data_microstructure.WF1` you find trade data for the two stocks (ADS, BMW) over a period from 1st February 2004 to 10th February 2004. The work file contains the following variables for both stocks:

..._deltap	ΔP_t
..._deltaq	ΔQ_t
..._q	Q_t
..._q1	Q_{t-1}
..._ds	D_t^s
..._ds1	D_{t-1}^s
..._dm	D_t^m
..._dm1	D_{t-1}^m
..._dl	D_t^l
..._dl1	D_{t-1}^l

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

i) Use the object `SYSTEM` in EViews to estimate the moment conditions implied by the MRR model. The estimable equation, which can be derived from the theoretical MRR framework, reads as:

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

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 and ΔQ_t is the change in the trade indicator.

ii) Compute the standard error for the estimated implied spread $\widehat{s_E} = 2(\hat{\phi} + \hat{\theta})$ and the estimated asymmetric information share $\hat{r} = \hat{\theta}/(\hat{\theta} + \hat{\phi})$. Use the delta method to compute the standard errors:

Hint: Delta Method
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

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

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

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

EViews-Hint:
In EViews you can use the "Wald Coefficient Test" button. For example type in the restriction $\hat{\theta}/(\hat{\theta} + \hat{\phi}) = 0$. Then EViews will in addition to the Wald Test provide the value and standard error of $\hat{r}$ using the delta method.

2. Estimating the Huang/Stoll(1997) model

i) Use the object `SYSTEM` in EViews to estimate the moment conditions implied by the HS model. 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 and ΔQ_t is the change in the trade indicator. Note, that the spread S is estimated in this specification.

ii) Estimate 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:

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