Università Commerciale
Luigi Bocconi

MSc. Finance/CLEFIN
2017/2018 Edition

FINANCIAL ECONOMETRICS AND EMPIRICAL FINANCE - MODULE 2

Mock Question 2 (total 17 points, out of 50 from 3 questions)
Time Advised: 24 minutes (for this question)

Question 2.A (14 points)
Consider a bivariate VAR(2) model for S&P 500 returns and the log changes in the VIX volatility index ($R_t^{S\&P}$ and $\Delta lnVIX_t$). Write:

- The structural, unconstrained VAR(2) that includes contemporaneous effects across the two markets.
- The associated unconstrained reduced-form VAR(2).

Explain through which steps it is possible to transform the structural VAR model into the reduced-form one (algebra is not required, unless it helps you provide an efficient answer). How would/could you estimate the structural VAR? How would/could you estimate the reduced-form model? Explain what are the issues/limitations caused by the transformation of a structural VAR into a reduced-form model.

Question 2.B (2 points)

Suppose that the bivariate structural VAR(2) is to be exactly identified by imposing either of the two possible Choleski triangularization schemes:

$$\boldsymbol{B}' = \begin{bmatrix} 1 & 0 \\ b_{21} & 1 \end{bmatrix} \qquad \text{and} \qquad \boldsymbol{B}'' = \begin{bmatrix} 1 & b_{12} \\ 0 & 1 \end{bmatrix}$$

Carefully explain the implications and differences in economic interpretations of the estimated, corresponding reduced-form model deriving from imposing the restriction in $\boldsymbol{B}'$ instead of $\boldsymbol{B}''$. How does your answer change when the restriction

$$\boldsymbol{B}''' = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

is imposed instead?

Question 2.C (1 point)

Suppose that the estimation of a constrained, reduced-form VAR(2) has provided the following ML estimates of the conditional mean function and of the covariance matrix of the reduced-form shocks (p-values are in parentheses):

$$\begin{cases} R_t^{S\&P} = \underset{(0.044)}{0.006} + \underset{(0.093)}{0.053} R_{t-1}^{S\&P} - \underset{(0.003)}{0.473} \Delta lnVIX_{t-1} + \underset{(0.045)}{0.113} \Delta lnVIX_{t-2} + u_t^{S\&P} \\ \Delta lnVIX_t = -\underset{(0.149)}{0.194} - \underset{(0.024)}{0.375} R_{t-1}^{S\&P} + \underset{(0.050)}{0.094} R_{t-2}^{S\&P} + \underset{(0.000)}{0.804} \Delta lnVIX_{t-1} + u_t^{VIX} \end{cases}$$

$$Var\left(\begin{bmatrix} u_t^{S\&P} \\ u_t^{VIX} \end{bmatrix}\right) = \begin{bmatrix} 0.008 & -0.016 \\ (0.000) & (0.007) \\ -0.016 & 0.014 \\ (0.007) & (0.000) \end{bmatrix}$$

You would like to recover the original structural parameters, including the contemporaneous, average impact of both VIX changes on S&P 500 returns and vice-versa. Is there a chance that this may be possible even though you are *not* ready to impose a Choleski ordering on the two variables?