FINA4380 Stock Return Model

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1 Our model

We model return of stock i as

$$r_i = \beta_{i0} + \beta_{i1}PC_1 + \beta_{i2}PC_2 + \beta_{i3}PC_3 + \beta_{i4}PC_4 + \beta_{i5}PC_5 + \varepsilon_i$$

where PC_i is the ith principal component obtained by PCA, β_i are state variables that follow random walk and we assume that $Cov(\varepsilon_i, \varepsilon_j) = 0$ for $i \neq j$.

2 Principal Components

We select the first n (not necessarily 5) principal components such that the proportion of variance explained exceeds 0.8.
We assume that

$$y_{it} = \mu + \sum_{j=1}^{p} a_{ij} y_{t-j} + \sum_{j=1}^{q} b_{ij} \varepsilon_{t-j} + \varepsilon_{it}$$

$$\varepsilon_{it} = \sigma_{it}\epsilon_{it}, \quad \sigma_{it}^2 = \alpha_{i0} + \sum_{j=1}^{m} \alpha_{ij}\varepsilon_{it}^2 + \sum_{j=1}^{s} \beta_{ij}\sigma_{i,t-j}^2$$

$$epsilon$$

And the correlation matrix between error terms (and hence stock return) is given by DCC.

3 Betas

We assume that betas change over time and can be modeled by

$$\beta_{\mathbf{t}} = I\beta_{\mathbf{t}} + \epsilon_{\mathbf{t}}$$

$$where \quad \epsilon_{\mathbf{t}} \sim N(0, \mathbf{Q})$$

We obtain the forecast for β and $\mathbf{Q}$ by Kalman filter.

4 Covariance matrix of stock return

when $m = n$,

$$Cov$$