Time Series Regression and GRS-statistic in EViews

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Objective:

1. Estimation of CAPM in expected return-beta form.

\[ R^{ei} = \alpha_i + \beta_i f_t + \epsilon^i_t \]

for our 10 test assets (size portfolios).

2. Test if all \( \alpha_i \) are jointly equal to zero (\( H_0 : \alpha_1 = \alpha_2 = \ldots = \alpha_N = 0 \)).

Therefore, constructing the asymptotic GRS-Statistic

\[
T \left[ 1 + \left( \frac{E_T(f)}{\hat{\sigma}(f)} \right)^2 \right]^{-1} \hat{\alpha}' \hat{\Sigma}^{-1} \hat{\alpha} \sim \chi^2_N
\]
Implementation in EViews:

1. First, create a new Pool object and name it (e.g. capmts)

2. Provide ‘cross section identifiers’. Write 1-10 in that window

3. Estimate the regressions by specifying as the dependent variable decile? where ? is used as a wildcard for the cross section identifiers. As explanatory variables, specify the three factors and a c as intercept (deactivate the default intercept). Note, that all $\beta_{ij}$ are asset specific.
4. Save the residuals via Proc - Make Residuals in a group and name the group (e.g. residuals)

5. Calculate the mean vector and the standard deviation of the factor and the VC-matrix of the residuals and store them in scalars, respectively matrices (use the functions @mean(), @stdev() and @cov())

scalar e_f=@mean((avewret-avustret))

scalar sigma_f=@stdev((avewret-avustret))

matrix sigm1=@cov(residuals)
6. Store the number of observations and the $\alpha_i$ in a scalar, respectively vector.

scalar t=capmts.@regobs

vector alpha=@subextract(capmts.@coefs,1,1,10,1) (if the $\alpha_i$ are the first ten elements in the coefficient vector)

7. Now, compute the test statistic given above (though the result is a scalar, assign the test as a matrix since matrix operations have to be conducted (@transpose and @inverse)).
matrix grs1=@transpose(alpha)*@inverse(sigm1)*alpha
scalar buff=grs1(1,1)
scalar grs=T*buff/(1+(e_f/sigma_f)^2)

8. Calculate the p-value of the test.
   scalar pval=1-@cchisq(grs,10)