

## Assignment 6: Factor Models

Using the French Databases introduced in the lectures

1. Estimate over the sample 1962:1 2014:6 the CAPM for the 25 FF portfolios and plot the Securities Market Line
2. Test the CAPM by using
  - (a) a second stage OLS regression
  - (b) a second stage regression with heteroscedasticity consistent estimates of the parameters variance-covariance matrix
3. Over the sample 1962:1 2014:6 apply the Fama MacBeth approach to the four factors model (MKT, SMB, HML, MOM) for the 25 FF portfolios and provide a test for its validity
4. Analysis
  - (a) Describe carefully what the code famamacb.rmd does.
  - (b) Can we say that the Security Market Line is observable after the first step of the Fama MacBeth procedure
  - (c) Explain why you need heteroscedasticity and correlation adjusted standard errors in the second step of the FamaMacbeth procedure and how you use them to construct the relevant wald test
  - (d) What are the dimension of the matrix "returns", "ex\_returns" and "factors" in the R code famamacb ?
  - (e) what does the following line of R code do ?

```
gamma_vcov <- solve(t(X2) %*% X2) %*% t(X2) %*% diag(TT/(TT-k)*c(resid2)) %*% X2 %*%  
solve(t(X2) %*% X2)
```

1. (f) if gamma\_vcov is not the variance covariance matrix of the OLS estimators derive it and compare it with gamma\_vcov
- (g) consider lines 85-87 of the code famamacb.rmd. What do you obtain by running these lines ?
- (h) consider line 106 of the famamacb.rmd code and explain the output of this line and its interpretation. In particular explain what are the dimension of the vector H0 and what are the values attributed to each element of this vector.