Please answer to all questions
Allowed time 90 minutes

Family Name (Surname)	First Name	Student Number (Matr)

Please refer to the code **exam2018_12.R** that works on the dataset ffdata.csv generated in one of the first session of the course . You will have to run the code, by modifying it or filling some missing parts to answer the questions. The pass level for the exam is 18 points. All marks above 18 will be rescaled to fit the Bocconi benchmark distribution.

Question 1 (12 points)

Consider over the sample 1965:1-2015:12 the monthy returns on portfolio 15 (PR15), the monthly returns on the market portfolio (r_mkt) to construct the value over time one dollar invested with a buy-and-hold strategy in the market(P_MKT) and in portfolio 15 (P_PR15).

1.1 Explain the purpose of the first 12 lines of the code **exam2018_12.R**

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1.2 Indicate the value of P_MKT and P_PR15 in 2015:12

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1.3 From a graphical analysis which of the following series can be considered as stationary : PR15, r_mkt , P_MKT and P_PR15 ?

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1.4 Perform an OLS regression of log(PR15) on log(P_MKT), define the residuals from this regression as RESID= log(PR15)-$\alpha - \beta$log(P_MKT), what are the OLS estimates for α and β ? Plot the residuals and assess their stationarity.

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Question 2 (18 points)

Consider now for the sample 1965:1 2015:12 the excess returns of portfolio 15 on the risk free asset, the excess returns of the market on the rf and the Fama-French Factors SMB, HML, MOM, CMA, RMW.

2.1 Perform a CAPM regression for the excess returns on portfolio 15, indicate the value of the "expected risk adjusted return from holding portfolio 15" and provide a test of the null that this expectation is statistically different form zero. Which percentage of the variance of excess returns from portfolio 15 is explained by the excess returns from the market ?

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2.2 Perform a 6 Factor model regression for the excess return from holding portfolio 15. Provide a test of the joint significant of the 5 additional factors that make this regression different from a CAPM regression. What is the partial R-square of the SMB and the HML factors ? What is the estimate " expected risk adjusted return from holding portfolio 15" in the extended factor model ?

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Question 3 (10 points)

Consider now the sample 1956:1-2000:12.

3.1 Assess via a seasonal plot the presence of seasonality in the returns of portfolio 15 (PR_15) and the returns from holding the market. Describe briefly how the seasonal plot is constructed and comment on the evidence for seasonality

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3.2 Estimate a Constant Expected Return Model for the market and model PR_15 as function of r_mkt , seasonality and the lagged dependent variable. Comment on the significance of the coefficients on all variables

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3.3 Simulate by bootstrap the above model to produce the time-series of the monthly 1 per cent VaR from holding potfolio15. Graph the VaR alongside the observed ex-post returns. How many VaR violations do you observe? Comment on the difference between the VaR derived here and the VaR resulting from omitting seasonality and the lagged dependent variable from the specification for PR_15.

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