VU UNIVERSITY AMSTERDAM

Faculty of Economics and Business Administration

Empirical Finance 3.2

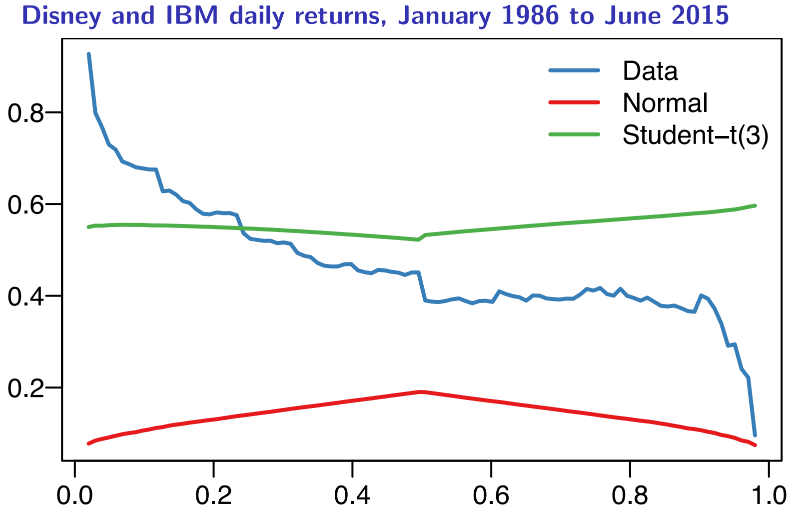
– Final Exam –

Name: ______________________ Student Id No: ________________ Exam No: _____

1. Data Analysis (12 Points)

(a) We have used S&P 500 and single stock data to demonstrate three stylized facts of financial returns. What are the three stylized facts and how can those stylized facts be detected using the data? (6 points)

(b) The following graph depicts a relationship between the Disney and IBM stock. A) What type of graph is shown here? B) Interpret the line in the graph which starts in the upper left corner and goes down to the right lower corner. (6 points)



2. **Factor Models** **(22 Points)**

(a) What is A) the basic economic concept used to derive the CAPM model and what is B) the basic concept used to derive the APT model? (6 points)

(b) Describe how the CAPM model can be tested by means of a two-stage testing procedure. (10 points)

(c) Consider the following multifactor (APT) model of security returns for a particular stock. If T-bills currently offer a 6% yield, find the expected rate of return on this stock if the market views the stock as fairly priced. (6 points)

Factor	**Factor Beta**	**Factor Risk Premium**
Inflation	1.2	6%
Industrial production	0.5	8
Oil price	0.3	3

3. **Volatility Modeling** **(24 Points)**

(a) Give the model equations for an AR(1) model with non-zero drift for returns and a GARCH(1,1) model for the variance of the return residuals. State the interpretation of the GARCH parameters and give the necessary restrictions for the parameters (12 points)

(b) State the steps of an appropriate approach to test for 'ARCH effects' in a time series of a risk factor? (6 points)

(c) Assume that you have estimated a GJR model of monthly stock returns and you obtain the following equations:

$$y_t = 0.125 + u_t$$
$$\sigma_t^2 = 1.102 + 0.115u_{t-1}^2 + 0.641\sigma_{t-1}^2 + 0.175u_{t-1}^2 I_{t-1}$$

Suppose that $\sigma_{t-1}^2 = 0.721$, what would be the fitted conditional variance for time t if $\hat{u}_{t-1} = 0.5$ and then if $\hat{u}_{t-1} = -0.5$? (6 points)

4. **VaR and Historical Simulation** **(16 Points)**

(a) Define the terms: estimation window, testing window, VaR violation and violation ratio. (8 points)

(b) Explain how historical simulation can be used to calculate a one-day ahead VaR forecast. (8 points)

5. **Programming** **(25 Points)**

(a) Using matlab code define a function ("sumOneToTen") that calculates the sum of the integer numbers from 1 to 10. (5 points)

(b) The following code snippets stem from the problems we discussed in the tutorials. For each snippet state A) in which software they are produced, and B) the overall analysis they are used for, and C) what the lines of code calculate specifically in the context of the overall analysis.

i. Snippet 1 (6 points)

```
gen abnormal_return=ret-predicted_return if event_window==1
by id: egen cumulative_abnormal_return = sum(abnormal_return)
by id: egen ar_sd = sd(abnormal_return)
gen test =(1/sqrt(5)) * ( cumulative_abnormal_return /ar_sd)
list company_id cumulative_abnormal_return test if dif==0
```

ii. Snippet 2 (6 points)

```
arch rjpy, arch(1/4) garch(1/1)
estimates store garch41
arch rjpy, arch(1/1) garch(1/1)
estimates store garch11
arch rjpy, arch(1/1) garch(1/1) distribution(t 6)
estimates store tgarch11
estimates table arch1 arch4 garch41 garch11 tgarch11, stats(r2 ll)
lrtest garch41 garch11
lrtest garch11 tgarch11
```

iii. Snippet 3 (8 points)

```
function mcOptPrice=mcSimPricer(startS, K, r, tauYears, sigma, numSim, optionType)
simPathSum = 0;
    for itCount=1:numSim
      simPriceT=simPathFunc(startS,r,tauYears,sigma);
      if strcmp(optionType,'C')
         simPathSum = simPathSum + exp((-tauYears) * r) * max(simPriceT - K, 0);
      elseif strcmp(optionType,'P')
         simPathSum = simPathSum + Exp((-tauYears) * r) * max(K - simPath, 0);
      end
    end
   mcOptPrice = simPathSum / numSim;
end
```

6. **Multiple Choice.** **(21 Points)**

Give the correct answer to every stated multiple choice problem. Every correct answer earns you 3 points.

(a) Which number of degrees of freedom for a Student-t distribution implies a standard normal distribution?

(i) df=3
(ii) df=0
(iii) df=1
(iv) df=∞

(b) Volatility clustering is

(i) The tendency for financial asset returns to have distributions that exhibit fat tails
(ii) The tendency for financial asset return volatility to appear in bunches
(iii) The tendency for volatility to rise more following a large price fall than following a price rise of the same magnitude
(iv) All of the above

(c) The general arbitrage pricing theory (APT) differs from the single-factor capital asset pricing model (CAPM) because the APT:

(i) Places more emphasis on market risk.
(ii) Minimizes the importance of diversification.
(iii) Recognizes multiple unsystematic risk factors.
(iv) Recognizes multiple systematic risk factors.

(d) In contrast to the capital asset pricing model, arbitrage pricing theory:

(i) Requires that markets be in equilibrium.
(ii) Uses risk premiums based on micro variables.
(iii) Specifies the number and identifies specific factors that determine expected returns.
(iv) Does not require the restrictive assumptions concerning the market portfolio.

(e) Which statement holds true in an event study setup:

(I) The estimation window consists of more data observations than the event window

(II) The variance estimator of the absolute returns is calculated as the squared returns of the estimation window

(III) Event studies are joint test of non-zero abnormal returns and whether the model to construct expected returns is correct.

(IV) Recognizes multiple systematic risk factors.

(i) I only

(ii) I and II only

(iii) I, II and III only

(iv) I, II, III and IV

(f) Which of the following is true about ARCH and GARCH models?

I They are used for modelling and forecasting volatility

II They are non-linear models

III They can both be estimated using OLS

IV Series estimated using these models must have a unit root process

(i) I only

(ii) I and II only

(iii) I, II and III only

(iv) I, II, III and IV

(g) Which of the following methods is not a way to increase the precision of an Monte Carlo simulation estimator?

(i) Increasing number of simulations

(ii) Standard errors

(iii) Antithetic variate technique

(iv) Control variate technique

(h) Which method cannot be used to calculate the expected market return in an event study?

(i) Using a market model

(ii) Average return over the estimation window

(iii) Average return over the event window

(iv) Using a return of a market portfolio

(i) Observing a violation ratio that is less than 1 implies that a risk forecasting model

(i) overforecasts the risk

(ii) underforecasts the risk

(iii) correctly forecasts the risk

(iv) does not forecast the risk

(j) Which of the following statements holds for the Bernoulli coverage test:

I Tests the accuracy of the VaR forecast

II Has much statistical power for small sample sizes

III Tests independence of VaR forecast violations

IV makes use of the likelihood ration test method

(i) I only

(ii) I and II only

(iii) I, II and III only

(iv) I, II, III and IV

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