

Paper F – 3101 – QUANTITATIVE ANALYSIS OF FINANCIAL DECISIONS

Time : 3 Hours

Maximum Marks : 70

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any FIVE questions. All questions carry equal marks.

- The Capital asset pricing model (CAPM) shows that the required rate of return on a given security is related to the level of expected or required rate of return on the market portfolio (such as returns on SP 500 or DJ 30 industrial). How the relationship between the assets return and the market returns can be estimated by the following regression?

$$Y_i = \alpha + \beta X_i + \varepsilon_i$$

Also give the assumptions involved in the above regression model. How do you measure systematic risk? How will you represent total risk, systematic risk and non-systematic risk using a regression equation? What does measure the coefficient of determination R^2 of the regression equation? (14)

- Jet Airways expects to purchase 4 million gallons of jet fuel in one month and decides to use heating oil futures for heading. The following table gives the data on the change in the jet fuel price (ΔS) per gallon and corresponding change in the futures price (ΔF) for the contract on heating oil that would be used for hedging price changes.

Month	Changes in futures price per gallon ΔF	Changes in fuel price per gallon ΔS
1	0.21	0.27
2	0.34	0.22
3	-0.47	-0.41
4	0.05	0.09
5	0.45	0.27
6	-0.24	0.18
7	-0.27	-0.01
8	-0.24	-0.08
9	0.46	0.44
10	-0.07	0.012

Estimate the relationship between change in the jet fuel price (ΔS) per gallon and corresponding change in the futures price (ΔF) using the following regression model:

$$\Delta S = \alpha + \beta \Delta F + \varepsilon$$

If each heating oil contract traded on MCX is on 48000 gallons of heating oil, calculate minimum hedge ratio and optimal number of futures contracts on heating oil to be purchased by Jet Airways to hedge its exposure in price of jet fuel. How will you measure the effectiveness of the hedge? (14)

- Let A be the pre merger, or standalone, value of the acquirer, and T be the premerger (standalone) value of the target. Let S be the value of the synergies created by the merger. If the acquirer has N_A shares outstanding before the merger, and issues x new shares to pay for the target, then show that acquirer's share price will increase if

- 5(a) What is heteroscedasticity and its implications in a regression model? Define model specifications for ARCH, GARCH, TAR and EGARCH to model volatility in asset prices. Given a sample time series of stock returns, how will you diagnose and identify ARCH effects? (10)
- (b) Consider data on Y = the logged stock price of IFCI collected each week for four years. An examination of the data indicates that the change in the stock price in any given week was usually positive, but there were some weeks when the prices fell. In the middle of the period of study (i.e. roughly weeks 90-110), there were large changes (both in positive and negative direction). The stock price in this middle period was much more volatile than in others. In order to investigate the volatility properties of the stock price in more depth the following ARCH(p) models were estimated. The software package produces the following results, interpret the output and give your comments.

Table 1: ARCH (1) model using IFCI stock return data

	Coefficient	Standard error	t-statistic	p-value
ΔY				
Intercept	0.375	0.00197	3.14	0.042
Variance Equation				
ARCH Lag1	0.660	0.252	2.641	0.036
Intercept	0.024	0.004	6.0	0.000

Table 2: ARCH (2) model using stock return data

	Coefficient	Standard error	t-statistic	p-value
ΔY				
Intercept	0.069	0.019	4.3	0.03
Variance Equation				
ARCH Lag1	0.630	0.12	4.4	0.002
ARCH Lag 2	0.213	0.16	1.3	0.862
Intercept	0.0145	4.0	3.6	0.000

(4)

- 6(a) Explain augmented Dickey Fuller (ADF) test for the random walk with drift and stochastic trend. Consider a random walk with drift and stochastic trend, how do you convert it into a stationary time series? (5)
- (b) Explain the Box-Jenkins methodology for the identification, estimation and model adequacy in ARIMA (p,d, q) models. (5)

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- (c) You were asked to develop forecasts for the closing prices of the ISC stock. The stock had been languishing for some time with little growth, and senior management wanted some projections to discuss with the board of directors. Suppose you have selected ARIMA(2,1,0) model for the closing prices of the ISC stock., how do you use this model to forecast the closing price of the ISC stock one period ahead ? (4)
- 7(a) What is co-integration? Explain the Engel- Granger method for testing the presence of co-integration in the financial time series. Give the Granger representation theorem on error correction model (ECM). (7)
- (b) Describe the forecasting methods based on single exponential smoothing and Hot-Winter smoothing in detail. How are the initial values determined in both models? (7)