

Final Examination

Total points: 100

Instructions: (i) Consulting an A4-sized sheet of paper on which you wrote down necessary information is allowed.

(ii) Answers without explanations will have zero points.

- (10 points) Suppose that $\{r_t\}$ are an independent sequence of returns with a zero mean. Show that $\{|r_t|\}$ are uncorrelated over time.
- (10 points) Suppose that we are studying the volatility dynamics of a trivariate time series. Define the DVEC (diagonal VEC) GARCH(1,1) model for this data series.
- (30 points) Comment on the following statements.
 - If the variance ratio calculated by using a stock's return series is less than one, it implies that the stock is safer for long-run investors than for short-run investors.
 - The Sharpe ratio is defined by

$$SR_k = \frac{E(k\text{-period excess return})}{\sigma(k\text{-period excess return})}$$

If SR_k/\sqrt{k} , calculated by using a stock market index, grows with k , we may say that stocks are safer for the long-run.

- A company with a high beta will find it more difficult to invest in a new project out of equity financing than that with a low beta.
- (10 points) Let Z_t be a time series excess return on a portfolio out of N assets and Z_{mt} an excess return on S&P 500 index portfolio. Suppose that we obtained the following time series regression results

$$Z_t = 0.01 + 0.97Z_{mt} + \hat{\varepsilon}_t$$

with standard errors 0.002 and 0.401, respectively. Is CAPM rejected at the 5% level?

- (10 points) A company's expected return calculated by CAPM is 13%, and the cost of borrowing for the company is 8% per annum. A new project will provide cash \$10 million next year, while its cost is \$8 million out of which \$4 million will be financed by equities and \$4 million by debt. Is this project worth pursuing?
- (20 points) Using daily log returns of IBM stock from July 3, 1962 to December 31, 1998 (sample size is 9190), we fitted the following model

$$\sigma_t^2 = 0.97\sigma_{t-1}^2 + 0.03r_{t-1}^2.$$

It is known that $r_{9190} = -0.02$ and $\hat{\sigma}_{9190}^2 = 0.01$.

- (a) Derive the 1-step ahead volatility forecast.
 - (b) Derive the 1-day horizon 5% VaR of a long position of \$10 million.
7. (10 points) Explain why the concept of cointegration is related to that of statistical equilibrium.