Capital University of Economics and Business

ISEM

Financial Econometrics

Assignment 1

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1 True/false questions

State whether each of the following statements is true or false.

Q1. The average return is the mean of past one-period returns.

Q2. If the log return of an asset is constant, then its price will grow linearly.

Q3. Let X be a random variable. The kurtosis of $10X$ is larger than that of X since the dispersion of $10X$ is larger than that of X.

Q4. The log return must not normally distributed, since its lower bound is -1.

Q5. It is possible that the loss of an asset is larger than its value-at-risk.

Q6. The expected shortfall of an asset must be smaller than or equal to the respective value-at-risk.

Q7. If a stochastic process is strictly stationary, then it is also weakly stationary.

Q8. A linear process may not be weakly stationary.

2 Multiple choice questions

Q1. Which of the following gives the highest effective interest rate?

(A) 10% per annum interest rate, compounded annually

(B) 11% per annum interest rate, compounded semi-annually

(C) 8.5% per annum interest rate, compounded monthly

(D) 8% per annum interest rate, compounded daily

Q2. Suppose X is random variable with mean $\mathbb{E}[X] = 1$ and variance $\text{var}(X) = 1$. Find the second moment $\mathbb{E}\left[X^2\right]$.

(A) 1

(B) 0

(C) 4

(D) 2

Q3. If X_t is a weakly stationary stochastic process, then which of the following must be time-invariant?

(A) The joint density function $f_{X_t, X_{t-1}}(x_1, x_2)$.

(B) The kurtosis $K(X_t)$

(C) The expectation of change $\mathbb{E}[X_t - X_{t-1}]$

(D) None of the above

Q4. If$X_t \overset{\text{iid}}{\sim} (\mu, \sigma^2)$, then the following is time-invariant:

(A) Variance of X_t

(B) Kurtosis of X_t

(C) Skewness of X_t

(D) All of the above

3 Short questions

Q1. U-quadratic distribution

Let X be a random variable with density function

$$f(x|b,\alpha,\beta) = \alpha(x-\beta)^2, \qquad x \in [0,b]$$

where $b > 0$ and

$$\alpha = \frac{12}{b^3}, \qquad \beta = \frac{b}{2}.$$

Find the mean and variance of X.

Q2. Linear process

Consider the linear process

$$X_t = \mu + \sum_{j=0}^{\infty} b_j e_{t-j}, \qquad e_t \overset{\text{iid}}{\sim} \left(0, \sigma^2\right).$$

Suppose that

$$b_j = c^j + d^j$$

where $|c| < 1$ and $|d| < 1$. Find the mean, variance and autocovariance of X_t. Is X_t weakly stationary?