EXAMPLE 3.1: FRM EXAM 2007—QUESTION 137

What does a hypothesis test at the 5% significance level mean?

a. P(not reject H0 | H0 is true) = 0.05
b. P(not reject H0 | H0 is false) = 0.05
c. P(reject H0 | H0 is true) = 0.05
d. P(reject H0 | H0 is false) = 0.05

EXAMPLE 3.3: FRM EXAM 2009—QUESTION 6

A population has a known mean of 1,000. Suppose 1,600 samples are randomly drawn (with replacement) from this population. The mean of the observed samples is 998.7, and the standard deviation of the observed samples is 100. What is the standard error of the sample mean?

a. 0.025
b. 0.25
c. 2.5
d. 25

EXAMPLE 3.4: FRM EXAM 2004—QUESTION 4

Consider the following linear regression model: $Y = a + b\ X + e$. Suppose $a = 0.05$, $b = 1.2$, $\mathrm{SD}(Y) = 0.26$, and $\mathrm{SD}(e) = 0.1$. What is the correlation between X and Y?

a. 0.923
b. 0.852
c. 0.701
d. 0.462

EXAMPLE 3.5: FRM EXAM 2007—QUESTION 22

Consider two stocks, A and B. Assume their annual returns are jointly normally distributed, the marginal distribution of each stock has mean 2% and standard deviation 10%, and the correlation is 0.9. What is the expected annual return of stock A if the annual return of stock B is 3%?

a. 2%
b. 2.9%
c. 4.7%
d. 1.1%

EXAMPLE 3.6: FRM EXAM 2009—QUESTION 8

A portfolio manager is interested in the systematic risk of a stock portfolio, so he estimates the linear regression: $R_{Pt} - R_F = \alpha_P + \beta_P[R_{Mt} - R_F] + \epsilon_{Pt}$ where R_{Pt} is the return of the portfolio at time t, R_{Mt} is the return of the market portfolio at time t, and R_F is the risk-free rate, which is constant over time. Suppose that $\alpha = 0.008$, $\beta = 0.977$, $\sigma(R_P) = 0.167$, and $\sigma(R_M) = 0.156$.

What is the approximate coefficient of determination in this regression?

a. 0.913
b. 0.834
c. 0.977
d. 0.955

EXAMPLE 3.10: FRM EXAM 1999—QUESTION 2

Under what circumstances could the explanatory power of regression analysis be overstated?

a. The explanatory variables are not correlated with one another.
b. The variance of the error term decreases as the value of the dependent variable increases.
c. The error term is normally distributed.
d. An important explanatory variable is omitted that influences the explanatory variables included and the dependent variable.

3.4 ANSWERS TO CHAPTER EXAMPLES

Example 3.1: FRM Exam 2007—Question 137

c. The significance level is the probability of committing a type 1 error, or rejecting a correct model. This is also P(reject H0 | H0 is true). By contrast, the type 2 error rate is P(not reject H0 | H0 is false).

Example 3.2: FRM Exam 2009—Question 9

a. The significance level is also the probability of making a type 1 error, or to reject the null hypothesis when true, which decreases. This is the opposite of answers b. and c., which are false. This leads to an increase in the likelihood of making a type 2 error, which is to accept a false hypothesis, so answer d. is false.

Example 3.3: FRM Exam 2009—Question 6

c. This is $\sigma/\sqrt{T}$, or $1{,}000/sqrt1{,}600 = 1{,}000/40 = 2.5$. Other numbers are irrelevant.

Example 3.4: FRM Exam 2004—Question 4

a. We can find the volatility of X from the variance decomposition, Equation (3.26). This gives $V(x) = [V(y) - V(e)]/\beta^2 = [0.26^2 - 0.10^2)/1.2^2 = 0.04$. Then $\mathrm{SD}(X) = 0.2$, and $\rho = \beta \mathrm{SD}(X)/\mathrm{SD}(Y) = 1.20.2/0.26 = 0.923$.

Example 3.5: FRM Exam 2007—Question 22

b. The information in this question can be used to construct a regression model of A on B. We have $R_A = 2\% + 0.9(10\%/10\%)(R_B - 2\%) + \epsilon$. Next, replacing R_B by 3% gives $\hat{R}_A = 2\% + 0.9(3\% - 2\%) = 2.9\%$.

Example 3.6: FRM Exam 2009—Question 8

b. Using Equation (3.27), the R-squared is given by $\beta^2\sigma_M^2/\sigma_P^2 = 0.977^2 \times 0.156^2/0.167^2 = 0.83$.

Example 3.7: FRM Exam 2004—Question 23

b. The correlation is given by $\sqrt{0.66} = 0.81$, so answer I. is incorrect. Next, 66% of the variation in Y is explained by the benchmark, so answer II. is incorrect. The portfolio return is indeed the dependent variable Y, so answer III. is correct. Finally, to find the 95% two-tailed confidence interval, we use α from a normal distribution, which covers 95% within plus or minus 1.96, close to 2.00. The interval is then $y - 2\mathrm{SD}(e)$, $y + 2\mathrm{SD}(e)$, or $(7.16 - 16.84)$. So answers III. and IV. are correct.

Example 3.8: FRM Exam 2009—Question 7

d. Age and experience are likely to be highly correlated. Generally, multicollinearity manifests itself when standard errors for coefficients are high, even when the R^2 is high.

Example 3.9: FRM Exam 2004—Question 59

b. Heteroskedasticity indeed occurs when the variance of the residuals is not constant, so a. is correct. This leads to inefficient estimates but otherwise does not cause problems with inference and estimation. Statements c. and d. are correct.

Example 3.10: FRM Exam 1999—Question 2

d. If the true regression includes a third variable z that influences both y and x, the error term will not be conditionally independent of x, which violates one of the assumptions of the OLS model. This will artificially increase the explanatory power of the regression. Intuitively, the variable x will appear to explain more of the variation in y simply because it is correlated with z.