

TIØ4317

Empirical and Quantitative Methods in Finance

Exercise 2

Instructions

Solutions to the problems will be posted on BlackBoard after the deadline. You can use either Excel or a high-level programming language, e.g., R or Python, to solve the programming exercises. We suggest that you write your solutions using MS Word or L^AT_EX. Also, hand in all code and/or Excel files.

Deadline: Monday February 10th, 2025, 23:59. **Grading:** Passed/Failed.

Tasks

For questions 1–3, assume that the econometric model is of the form

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + \beta_5 x_{5t} + u_t$$

1. Which of the following hypotheses about the coefficients can be tested using a t -test? Which of them can be tested using an F -test? In each case, state the number of restrictions.
 - (a) $H_0 : \beta_3 = 2$
 - (b) $H_0 : \beta_3 + \beta_4 = 1$
 - (c) $H_0 : \beta_3 + \beta_4 = 1$ and $\beta_5 = 1$
 - (d) $H_0 : \beta_2 = 0, \beta_3 = 0, \beta_4 = 0, \text{ and } \beta_5 = 0$
 - (e) $H_0 : \beta_2 \beta_3 = 1$
2. Which would you expect to be bigger—the unrestricted residual sum of squares or the restricted residual sum of squares, and why?
3. You decide to investigate the relationship given in the null hypothesis of question 1, part (c). What would constitute the restricted regression? The regressions are carried out on a sample of 96 quarterly observations, and the residual sums of squares for the restricted and unrestricted regressions are 102.87 and 91.41, respectively. Perform the test. What is your conclusion?
4. You estimate a regression of the form

$$r_i = \beta_0 + \beta_1 S_i + \beta_2 MB_i + \beta_3 PE_i + \beta_4 BET A_i + u_i$$

where:

- r_i is the percentage annual return for the stock.
- S_i is the size of firm i measured in terms of sales revenue.
- MB_i is the market-to-book ratio of the firm.
- PE_i is the price/earnings (P/E) ratio of the firm.
- $BETA_i$ is the stock's CAPM beta coefficient.

You obtain the following results (with standard errors in parentheses):

$$\hat{r}_i = 0.080 + 0.801S_i + 0.321MB_i + 0.164PE_i - 0.084BETA_i$$

(0.064) (0.147) (0.136) (0.420) (0.120)

- Calculate the t -ratios. What do you conclude about the effect of each variable on the returns of the security?
 - On the basis of your results, what variables would you consider deleting from the regression?
 - If a stock's beta increased from 1 to 1.2, what would be the expected effect on the stock's return?
 - Is the sign on beta as you would have expected? Explain your answers in each case.
- Perform a multiple regression on the data in `Dataset_Multiple_Regression.xlsx`, where `Education`, `Age`, and `Sex` are explanatory variables and `Yearly Earnings` is the dependent variable.
 - Perform a t -ratio test for the estimated model parameters (i.e., betas and intercept). When doing the test, write down the null and alternative hypotheses.
 - State which of the parameters are statistically significant at the 5% level and provide an intuitive interpretation for them.
 - Set up the expression for the regression model (prediction model) for the salary. What salary would the model predict for a 23-year-old female with 15 years of education?
 - An important assumption that we talked about is that the error terms must be uncorrelated with the explanatory variables. Why could this assumption be violated here? Think of at least two variables that, when added to the model, can help to address this issue.
 - Discuss briefly the meaning of R^2 . Calculate R^2 in the salary model regression and comment on its value. What are the disadvantages of this metric and how can we counter them?