where r_{annual} is the annual return and $\bar{r}$ is the mean monthly return. A resulting value of .060, for example, corresponds to a 6.0% annual return. Compute annual returns for r_p, r_m, r_f, $r_p - r_f$, and $r_m - r_f$. Do these values appear plausible? Why or why not?

(c) Next plot both the company's and the market's risk premium for the last 36 months in the data series, from January 1985 through December 1987 (make sure months coincide for the two series). Are there any noteworthy aspects of these plots? Do you think that this company's β for this time period will be greater than or less than unity? Why? Does this make intuitive sense?

(d) Finally, calculate the variance and the standard deviation of the company's and market's risk premiums over the same 36-month time period as in part (c), as well as the simple correlation coefficient between them. Using Eq. (2.18) and the above values, calculate the implied β for this company. Is this β roughly equal to what you expected?

EXERCISE 2: Least Squares Estimates of β

From the list of industries on pages 42–43, choose one industry that you think is highly risky and another industry that you think is relatively "safe." Divide your sample into the first half (January 1978–December 1982) and the second half (January 1983–December 1987) and choose the half with which you will work.

(a) Using your computer regression software, the 60 observations you have chosen, and Eq. (2.17), estimate by ordinary least squares the parameters α and β for one firm in each of these two industries. Do the estimates of β correspond well with your prior intuition or beliefs? Why or why not?

(b) For one of these companies, make a time plot of the historical company risk premium, the company risk premium predicted by the regression model, and the associated residuals. Are there any episodes or dates that appear to correspond with unusually large residuals? If so, attempt to interpret them.

(c) For each of the companies, test the null hypothesis that $\alpha = 0$ against the alternative hypothesis that $\alpha \neq 0$, using a significance level of 95%. Would rejection of this null hypothesis imply that the CAPM has been invalidated? Why or why not?

(d) For each company, construct a 95% confidence interval for β. Then test the null hypothesis that the company's risk is the same as the average risk over the entire market, that is, test that $\beta = 1$ against the alternative hypothesis that $\beta \neq 1$. Did you find any surprises?

(e) For each of the two companies, compute the proportion of total risk that is market risk, also called systematic and nondiversifiable. William F. Sharpe [1985, p. 167] states that "Uncertainty about the overall market . . . accounts for only 30% of the uncertainty about the prospects for a typical stock." Does evidence from the two companies you have chosen correspond to Sharpe's typical stock? Why or why not? What is the proportion of total risk that is specific and diversifiable? Do these proportions surprise you? Why?

(f) In your sample, do large estimates of β correspond with higher R^2 values? Would you expect this always to be the case? Why or why not?

EXERCISE 3: Why Gold Is Special

The purpose of this exercise is to acquaint you with features of a rather remarkable asset whose peculiar covariance of returns with the market as a whole often makes it attractive to investors.

(a) There is one asset in the data directory whose data file is named GOLD. The GOLD data file contains series on monthly returns for GOLD, as well as data series for the market (MARK76) and risk-free (RKFR76) variables, all for the January 1976–December 1985 time period. Using the January 1976–December 1979 four-year time period and the CAPM, generate variables measuring the GOLD-specific and market risk premiums, and then estimate the β for GOLD. Compute a 95% confidence interval for β. Do your estimates make sense? Why might such an asset be particularly desirable to an investor who is attempting to reduce risk through diversification? What does this imply concerning the expected return on such an asset?

(b) Now estimate the β for GOLD using data from January 1980–December 1985. Construct a 95% confidence interval for β. Has anything changed? Comment on supply and demand shift factors possibly altering the β of GOLD.

EXERCISE 4: Consequences of Running the Regression Backward

The purpose of this exercise is to explore the consequences of running a regression backwards, that is, of regressing X on Y rather than Y on X, and to discover how one can recover the "correct" estimates from the computer output of the "incorrect" regression.

(a) Using data from January 1983 through December 1987 for Delta Airlines in the data file DELTA, as well as data on r_m in MARKET and on r_f in RKFREE, construct the risk premium for Delta Airlines and for the market as a whole. To simplify notation, now define $Y_t = r_p - r_f$ (the risk premium for Delta Airlines) and $X_t = r_m - r_f$ (the market risk premium), $t = 1, \ldots, 120$.