

Philip Morris Versus the Market.

The table (see Minitab attachment) shows the monthly returns on the common stock of Philip Morris (MO), as the company was then named, and the returns on the Standard & Poor's 500 stock index for the same months. Return is measured in percent. The data are for 83 consecutive months running from mid-1990 to mid-1997, a period chosen to avoid the stock market bubble of the late 1990s. (The time order runs down the columns, but we will ignore trends over time.) We expect a stock to move in concert with the market to some extent, but the strength of the relationship varies greatly among different stocks. We will examine the relationship between MO and market returns in detail.

- (a) Regress the MO returns on the market returns. Make a scatterplot and draw the least-squares line on the plot. Explain carefully what the slope and intercept of this line mean, in terms understandable to an investor. Also give a measure of the strength of the relationship and explain its meaning to an investor.
- (b) Suppose an investor is willing to take these data as a sample of future returns. Explain why we cannot expect future returns (the population) to have exactly the same slope as the least-squares line. Then give a 90% confidence interval for the slope of the population regression line.
- (c) Find the residuals from your regression. (Minitab will do this for you.) Are any of the residuals outliers by the $1.5 \times IQR$ criterion (page 45)? If so, circle the corresponding points on your scatterplot. Is it likely that these points strongly influence the regression? Why? Verify your answer by redoing the regression without the outlier(s) and adding the new line to your plot for easy comparison with the original line.
- (d) Make a Normal quantile plot of the residuals. Aside from any outliers detected in (c) is the distribution approximately Normal?
- (e) An investor believes that a market rally is imminent and that the S&P 500 will rise 7.5% in the next month. Give a 90% confidence interval for the return on MO next month.