The data for this assignment are contained in both the Excel file ‘ceosal2.xls’ and the STATA file ‘ceosal2.dta’ available at http://u.arizona.edu/~rlo. These data pertain to a sample of 177 CEO’s in 1990. Be sure to attach the supporting computer print out to the completed assignment, show your work, and make clear where your answers are shown.

The variables of interest for this exercise are salary (annual salary in $1,000’s) and sales (firm sales/revenues in millions).

Some basic STATA commands that might be useful

To obtain the correlation between two variables $x$ and $y$, type the command `correlate x y`.

To obtain the variances and covariance for two variables $x$ and $y$, type the command `correlate x y, covariance`.

To obtain the variances and covariance for two estimators $\hat{\beta}_0$ and $\hat{\beta}_1$, type the command `correlate, covariance _coef` immediately following the regression.

1. Some basic statistics.

   a. Let $\sigma_s^2$ and $\sigma_r^2$ represent the variances of salary and sales. Write out the statistical formulas for $\sigma_s^2$ and $\sigma_r^2$ and estimate their values.

   b. Let $\sigma_{sr} = \sigma_{rs}$ represent the covariance between salary and sales. Write out the statistical formula for $\sigma_{sr}$ (or $\sigma_{rs}$) and estimate its value.

   c. Let $\rho_{sr} = \rho_{rs}$ represent the simple correlation coefficient between salary and sales. Write out the statistical formula for $\rho_{sr}$ (or $\rho_{rs}$) and estimate its value.

2. Use OLS to estimate the simple CEO salary model given by $S_i = \beta_0 + \beta_1 R_i + u_i$, $i = 1, \ldots, 177$ (where $S$ is salary and $R$ is sales).

   a. According to your estimates, what is the incremental effect on salary from an additional million dollars of sales? Explain.

   b. Write out the formula for the OLS estimator of $\beta_1$ and use this formula to verify that you get the same answer as the regression output.

   c. Use the estimated CEO salary model to predict the average salary for a CEO with the sample average sales. How does this predicted value compare with the actual sample mean salary? Explain.
d. Use the *OLS* estimate of $\beta_1$ and the sample mean sales to obtain the *OLS* estimate of $\beta_0$.

e. Use the estimated CEO salary model to obtain the within-sample predicted salaries, $\hat{S}_i$.

(1) Obtain the simple correlation between $\hat{S}_i$ and $S_i$.

(2) Show how the value of your correlation between $\hat{S}_i$ and $S_i$ relates to the $R^2$ from the salary regression model you estimated.

f. Write out the statistical formulas for the estimated variance $\left(\hat{\sigma}^2_{\beta_1}\right)$ and standard error $\left(\hat{\sigma}_{\beta_1}\right)$ for the *OLS* estimator of $\beta_1$. Use these formulas to obtain $\hat{\sigma}^2_{\beta_1}$ and $\hat{\sigma}_{\beta_1}$.

3. Use *OLS* to estimate the double-log salary model $\ln(S_i) = \beta_0 + \beta_1 \ln(R_i) + u_i$, $i = 1, ..., 177$ (where $S$ is salary and $R$ is sales).

a. According to your estimates, what is the percentage effect on salary from a 10% fall in sales? Explain.

b. How much of the variance in the log of salary can be explained by the model? Explain.

c. Compute the estimated standard error of the random variable $\hat{\beta}_1 - 1$ and the associated ‘t’ value for this random variable if you were testing $H_0$: $\hat{\beta}_1 - 1 = 0$, $H_1$: $\hat{\beta}_1 - 1 \neq 0$. 