g <u>Test for significance of quadratic regression</u>

H_0: The quadratic regression is not significant.

$$F = \frac{\text{Regression MS}(X, X^2)}{\text{Residual MS}(X, X^2)} = \frac{(12.7054 + 3.9051)/2}{(0.5145 + 0.2325)/15} = \frac{8.3053}{0.0498} = 166.77$$

(2, 15 df) $\quad P < 0.001$

At $\alpha = 0.05$ we reject H_0 and conclude that the quadratic regression is significant.

<u>Test for addition of X^2 term</u>

H_0: The addition of X^2 to a model already containing X is not significant.

$$F(X^2 \mid X) = \frac{3.9051}{0.0498} = 78.42 \qquad (1, 15 \text{ df}) \qquad P < 0.001$$

At $\alpha = 0.05$ we reject H_0 and conclude that the addition of X^2 is significant.

<u>Test for adequacy of quadratic model</u>

H_0: The quadratic model is adequate.

$$F = \frac{\text{MS l.o.f.}(X, X^2)}{\text{MS P.E}(X, X^2)} = \frac{0.1713}{0.0194} = 8.83 \qquad (3, 12 \text{ df}) \quad P = 0.002$$

At $\alpha = 0.05$ we reject H_0 and conclude that the quadratic model is not adequate.

h <u>Test for significance of straight line regression of $\ln Y$ on X</u>

H_0: The straight line regression is not significant.

$$F = \frac{\text{Regression MS}(X)}{\text{Residual MS}(X)} = \frac{42.745786}{0.009394} = 4550.33, \qquad (1, 16 \text{ df}) \qquad P < 0.001$$

At $\alpha = 0.05$ we reject H_0 and conclude that the straight line regression is significant.

<u>Test for adequacy of straight line model of $\ln Y$ on X</u>

H_0: The straight line model is adequate.

$$F = \frac{\text{MS l.o.f.}(X)}{\text{MS P.E.}(X)} = \frac{0.006959}{0.010206} = 0.68, \qquad (4, 12 \text{ df}) \qquad P > 0.25$$

At $\alpha = 0.05$ we do not reject H_0 and conclude that the straight line model is adequate.

i R^2 (straight line regression of $\ln Y$ on X) = 0.9965

R^2 (quadratic regression of Y on X) = 0.957

A comparison of the above two R^2 values shows that the straight line model of $\ln Y$ regressed on X provides a better fit to the data than the quadratic regression of Y on X.

j **(1)** Homoscedasticity assumption appears to be much more reasonable when using $\ln Y$ on X than when using Y on X.

(2) The straight line regression of $\ln Y$ on X is preferred since it results in a higher R^2, the model is accurate, satisfies the assumption of homoscedasticity, and provides a better graphical fit.

k The independence assumption is violated.