

HOMEWORK *t*-test for *b*

Use StatCenter's StatTool to analyze this data. The data is listed as Regression_5.dat in the dialogue box that appears when you use the drop-down menus under "File," then "Open from File." You can check all the relevant answers for this problem using StatTool.

This homework will build on the work you did in the "t for r" homework.

A shop owner recorded the number of times that consumers bought or asked for a given item. She called this amount the "demand." Each month she had 15 of the items to sell. In addition, the owner recorded the price of the item each month.

Month	Demand	Price	Month	Demand	Price
Jan.	25	\$0.50	July	13	\$0.80
Feb.	10	.90	Aug.	19	.70
Mar.	12	.90	Sept.	18	.72
Apr.	18	.75	Oct.	16	.74
May	11	.85	Nov.	15	.75
June	20	.70	Dec.	15	.75

1. Draw a scatterplot and from it describe the relationship between price and demand.
2. A scientist (who hypothesized that there is a negative relationship between demand and prices) wanted to predict price from demand. Calculate the slope (*b*) and the intercept (*a*) and write out the regression line for predicting price from demand. You can use your work from the "t for r" assignment or from the results of StatTool to make the calculations easy.
3. Test the significance of the *b*. (a) state the Scientific Hypothesis and Skeptical-scientific hypothesis. Also state the PCH of chance. (b) Is the sci hyp directional or non-directional? Why? (c) Translate the sci hyp and the PCH of chance into statistical hypotheses--that is, state H_0 and H_1 . (d) Name the test statistic you will use to decide between the statistical hypotheses. (e) What is the alpha level (level of significance, *p*-value) that you will use? (f) In your own words what does this *p*-value mean? (g) Calculate your *df*. (h) Is H_1 one- or two-tailed? Why? (i) Look up the critical value (or values) in the table in your book. (j) Draw a line representing the range of your test statistic. What is the center value predicted by H_0 ? Draw it on the line. Also draw in the critical value (or values) on the line. Label the "Reject H_0 " region (or regions). Label the "Do not reject H_0 " region. (k) Why does H_0 predict a value of zero

for your test statistic?

NOW FOR THE DATA:

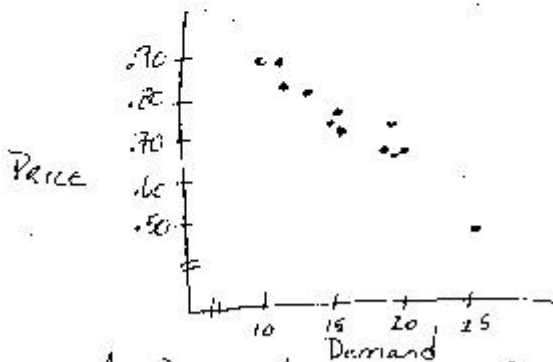
(L) Does the pattern of data favor the scientific or Skeptical-scientific hypothesis? (m) Now calculate the value of your test statistic from the data. Take this calculated value of your test statistic and put on the number line you made in (j). Does it fall in a rejection region? (n) Do you reject H_0 or not? (o) Verbally summarize the issue of statistical conclusion validity (PCH of chance) in this case. That is, do you think this study has statistical conclusion validity or not?

Now for some connections:

4) A) Compare the value of r and the value of b . Are the same or different? B) Compare the value of t for r with the value of t for b ; are they the same or different? C) What's this mean regarding these two t tests? Do they test the same thing or some different thing about the data?

t for b

1.



As Demand increases, Price decreases

$$2. b = r_{xy} \left(\frac{S_y}{S_x} \right)$$

$$= (-.954) \left(\frac{.1025}{4.102} \right)$$

$$= -.0238$$

$$S_y^2 = \frac{\sum Y^2}{n} - M_y^2$$

$$= \frac{6.966}{12} - \left(\frac{9.0}{12} \right)^2$$

$$= .5805 - .570$$

$$= .0105$$

$$S_y = .1025$$

$$S_x^2 = \frac{\sum X^2}{n} - M_x^2$$

$$= \frac{32.74}{12} - \left(\frac{192}{12} \right)^2$$

$$= 272.833 - 256$$

$$= 16.8333$$

$$S_x = 4.102$$

$$a = M_y - b M_x$$

$$= .755 - (-.0238)(16)$$

$$= .755 + .3808$$

$$= 1.1358$$

$$Y' = 1.1358 - .0238X$$

Predicting Price (Y) from
Demand (X)

3. Scientific: As price increases, demand decreases.
 Negative Relationship
 skeptical: There is no relationship between price & demand
 P₀H: Any results that support scientific hypothesis are due to chance

b. Directional: Specific prediction about relationships between variables, negative relationship

$$c. H_0: E(b) = 0$$

$$H_1: E(b) > 0$$

d. t-test for b

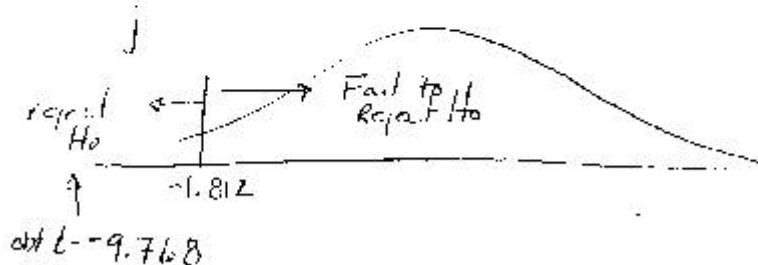
$$e. \alpha = .05$$

f. Probability of rejecting H_0 when it is true.

$$g. df = N - 2 = 10$$

h. one tailed, directional H_1

$$i. t = 8.12$$



K. Predicts there is no relationship between variables;
therefore $b=0$ which means we expect $t=0$.

L. scientific hypothesis - appears to be a negative relationship

$$\begin{aligned}
 \text{N1. } t &= \frac{b S_x \sqrt{N}}{\sqrt{\frac{N S_y^2 - N b^2 S_x^2}{N-2}}} \\
 &= \frac{(-.0238)(4.102) \sqrt{12}}{\sqrt{\frac{(12)(.0105) - (12)(-.0238)^2 (16.8333)}{12-2}}} \\
 &= \frac{-.338}{\sqrt{\frac{.126 - .114}{10}}} \\
 &= \frac{-.338}{\sqrt{\frac{.012}{10}}} \\
 &= \frac{-.338}{\sqrt{.0012}} \\
 &= \frac{-.338}{.0346} \\
 &= -9.768 \\
 &\text{Reject } H_0
 \end{aligned}$$

a. Yes, reject H_0

b. There is less than a 1 in 20 chance of obtaining these results by chance alone, PCH of chance is improbable & therefore implausible.

4. a. $r = -.954$ $b = -.0238$ Different

b. Very close, both ≈ -10

c. Testing the same thing about data

