PRINCIPLES OF ECONOMETRICS

5TH EDITION

ANSWERS TO ODD-NUMBERED EXERCISES IN CHAPTER 3

EXERCISE 3.1

(a) The null hypothesis is $H_0 : \beta_2 = 0$ and the alternative hypothesis is $H_1 : \beta_2 > 0$.

(b) The test statistic is $t = b_2 / \text{se}(b_2)$. If the null hypothesis is true then $t \sim t_{(62)}$.

(c) Under the alternative hypothesis the center of the *t*-distribution is pushed to the right.

(d) We will reject the null hypothesis and accept the alternative if $t \geq 2.388$. We fail to reject the null hypothesis if $t < 2.388$.

(e) The calculated value of the test statistic is $t = 6.0884$. We reject the null hypothesis that there is no relationship between the number of medals won and *GDP* and we accept the alternative that there is positive relationship between the number of medals won and *GDP*. The level of significance of a test *is* the probability of committing a Type I error.

EXERCISE 3.3

(a) $E(MEDALS \mid GDPB = 25) = 7.94458$

(b) The standard error is 2.3715401.

(c) The standard error will slightly differ from part (b), due to rounding.

(d) $[3.203939, \quad 12.685221]$

(e) $[7.0558318, \quad 16.032828]$

EXERCISE 3.5

(a) The right tail *p*-value is $p = 1 - \Phi(1.66) = 1 - 0.9515 = 0.0485$. Using the exact *p*-value we would fail to reject the null hypothesis with $\alpha = 0.05$. If the degrees of freedom were 90, the *t*-distribution would be more similar to the standard normal. The exact *p*-value will fall to 0.0501975.

(b) The approximate two tail *p*-value is then 0.0488. For 90 degrees of freedom the exact *t*-distribution is further from the standard normal, so that the normal approximation would become worse.

(c) The approximate two tail *p*-value is then .00988003. For 2000 degrees of freedom the exact *t*-distribution is closer to the standard normal, so that the normal approximation would become better.

(f) For this two-tail test the approximate *p*-value is $p \cong 2\left(1 - \Phi\left(|t|\right)\right)$.

From Statistical Table 1 we find $\Phi(1.39) = 0.9177$ so that

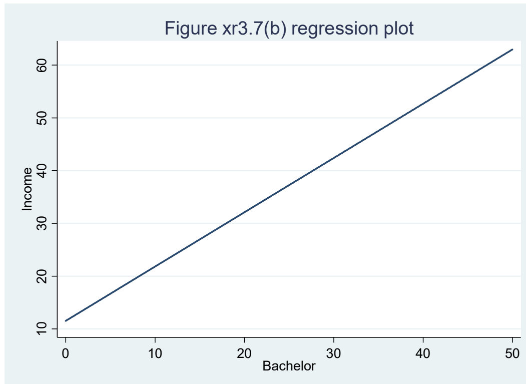
$$p \cong 2\left(1 - \Phi\left(|t|\right)\right) = 2\left(1 - \Phi(1.39)\right) = 2(1 - 0.9177) = 0.165$$

Because the $p > 0.10$ the calculated *t* must fall in the non-rejection region for a two-tail test. We fail to reject the null hypothesis that the elasticity is 0.85 using a two-tail test at the 10% level of significance.

EXERCISE 3.7

(a) $b_1 = 11.51632$

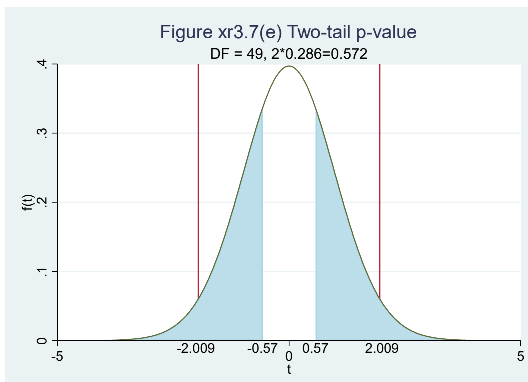
(b) The estimated relationship between *INCOME* and *BACHELOR* is increasing at a constant rate.



(c) $t = 0.0957$

(d) $t = 0.567$

(e) The rejection region for a 5% test are t values greater than or equal to 2.0096 or less than or equal to −2.0096.



(f) $[0.7725, 1.2855]$.

(g) The calculated t-value is $t = 0.303$.
We fail to reject the null hypothesis $H_0 : \beta_2 = 1$.

EXERCISE 3.9

(a) $[0.95, 3.03]$

(b) The rejection region for this two-tail test are values to the left of $t_{(0.05,62)} = -1.67$ and to the right of $t_{(0.95,62)} = 1.67$. The value of the test statistic is $t = -1.14$. It falls in the non-rejection region

(c) $\widehat{WAGE} = \$23.39$

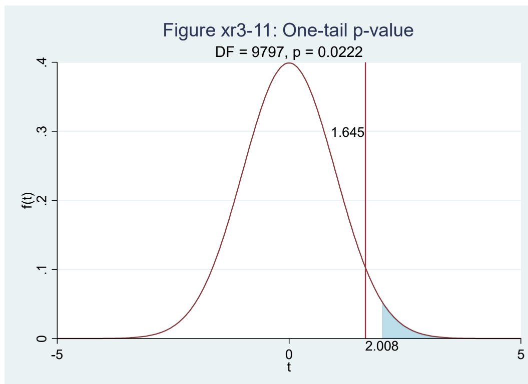
(d) $[19.48, \quad 27.30]$

(e) $t = 0.199$. We fail to reject.

EXERCISE 3.11

(a) $t = 2.008$. We reject the null hypothesis and accept the alternative.

(b) $p = 0.0222$. The sketch is



(c) $[41.62, \quad 41.98]$

(d) It is compatible. We estimated that such individuals would work between 41.62 and 41.98 hours with 95% confidence. The sample data value of 41.68 hours is within this interval.

(e) t = 1.306. We fail to reject a two-tail test at $\alpha = 0.01$ level of significance.

EXERCISE 3.13

(a) The price of sugar cane is on average 114.03% of the price of jute, so about 14% higher. The prices fluctuate with the price of sugar cane reaching a low of 74.9% of the price of jute, and reaching a high of 182.2% of the price of jute.

(b) We estimate that if the price of sugar cane is zero, then the area devoted to sugar cane production is −0.24 thousand hectares. We estimate that each 1% increase in the relative price of sugar cane to jute increases the area of sugar cane planted by 0.50 thousand hectares, or 500 hectares, other factors held constant.

(c) The test of the intercept equaling zero is a logical outcome.

(d) $t = 0.0735$. We fail to reject the null hypothesis that the elasticity is one at the 5% level of significance.

(e) We estimate that a 1% increase in the relative price of sugar cane increases the area of sugar cane planted by about 0.68%, other factors held constant. The 95% interval estimate of the slope is 0.00214 to 0.0115.

(f) $t = -1.40$. Therefore, we fail to reject the null hypothesis that the area response is 1%. The sketch of the rejection region and *p*-value is given below.

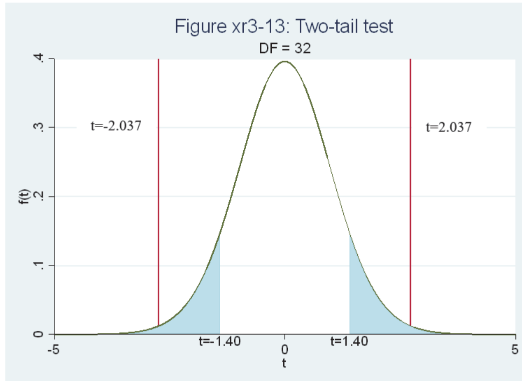


Figure xr3-13 two-tail test

EXERCISE 3.15

(a) The explicit costs would include specifics like feeding and housing a prisoner for life. There are also opportunity costs, for the production and output of this lost individual.

(b) There are the costs that the true criminal might inflict on society if allowed to be free.

EXERCISE 3.17

(a) The calculated value of the *t*-statistic is $t = 4.125$, which falls in the rejection region, so we reject the null hypothesis and accept the alternative.

(b) $[22.287, 25.553]$.

(c) $[27.00, 30.20]$

(d) The calculated value of the *t*-statistic is $t = -2.70$, which falls in the rejection region.

EXERCISE 3.19

(a)

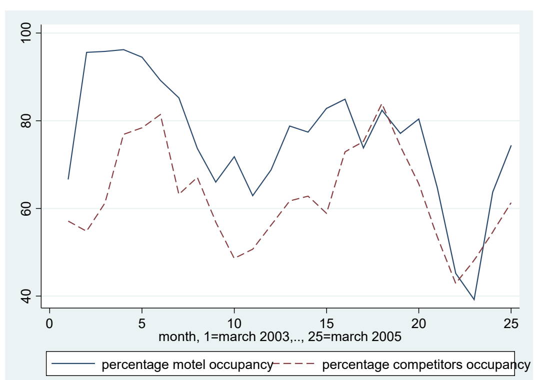


Figure xr3-19(a) motel & competitors occupancy plots

$$\widehat{MOTEL\_PCT} = 21.340 + 0.865 COMP\_PCT$$
$$\text{(se)} \qquad (12.907) \quad (0.203)$$

A 95% interval estimate for β_2 is [0.445, 1.284].

(b) [77.382, 86.467].

(c) $t = 4.27$. This value is in the rejection region.

(d) $t = -0.67$ which is in the non-rejection region.

(e)

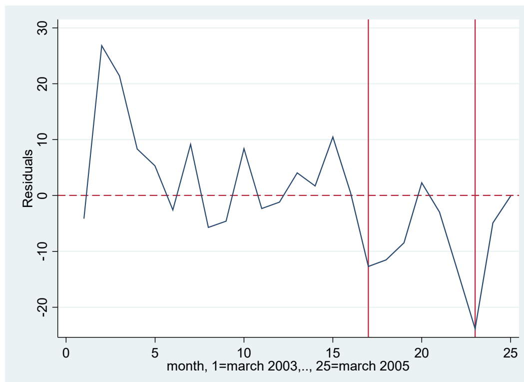


Figure xr3-19(e) residuals plot

For observations 17-23 all the residuals are negative but one.

EXERCISE 3.21

(a) For Exxon-Mobil the 95% interval estimate of “beta” is [0.315, 0.598]. For Microsoft the 95% interval is [0.961, 1.443].

(b) For Ford the calculated *t*-value is 3.20 and two-tail p = 0.0016. For GE the calculated *t*-value is 1.65 and the two-tail *p*-value is 0.100. For Exxon-Mobil the *t*-value is −7.6 with a *p*-value of 0.000.

(c) $t = -7.6$, which is in the rejection region.

(d) $t = 1.65$. A bit of a quandary. Carrying out the calculated *t*-value to more decimals it is 1.6523713 and the test critical value is 1.6534591. The resulting *p*-value is 0.05011087, so that at the 5% level we fail to reject the null hypothesis using a one tail test.

(e) For Ford the calculated *t*-value is 0.37 (p = 0.712), for GE it is −0.22 (p = 0.829) and for XOM it is 1.49 (p = 0.137). In each case we fail to reject the null hypothesis that the intercept parameter is zero.

EXERCISE 3.23

(a) The estimated equation is

$$\widehat{PRICE} = 93.5659 + 0.1845 SQFT^2$$
$$\text{(se)} \quad (6.0722) \quad (0.005256)$$

The calculated t-value is −26.7288. This falls in the non-rejection region.

(b) The calculated t-value is 4.1895. This falls in the rejection region.

(c) The estimated expected price is $\hat{E}\left(PRICE \mid SQFT = 20\right) = 167.3735$. The resulting interval estimate is [158.0481, 176.6988].

(d) In the sample there are 3 houses with 2000 square feet. They sold for $138,000, $169,000 and $183,000. The average is 163.3333 which is inside the interval estimate

EXERCISE 3.25

(a) The interval estimate is [0.8695, 3.2166]

(b) $t = 0.07205297$. We cannot reject the null hypothesis .

(c) $\left[-168.7518, -39.6496\right]$

(d) The calculated t-value is $t = -3.11$. We reject the null hypothesis.

EXERCISE 3.27

(a) This variable is negative for *EXPER* < 30, it is zero when *EXPER* = 0, and is positive for *EXPER* > 30.

(b) The calculated value is t = −5.813, which falls in the rejection region. We reject the null hypothesis.

(c)

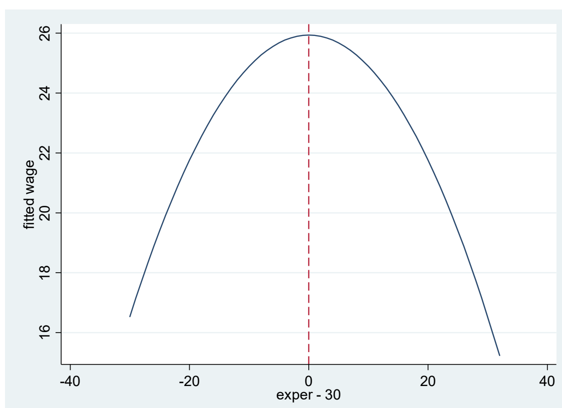


Figure xr3-27(c) Fitted wage-Exper30 plot

Up to 30 years of experience the fitted wage equation is increasing but at a decreasing rate. After 30 years the fitted equation is decreasing at an increasing rate. For 30 years of experience the slope of the fitted relationship is zero.

(d) When $EXPER = 0$ the calculated slope is 0.6267. When $EXPER = 10$ the calculated slope is 0.4178. When $EXPER = 20$ the calculated slope is 0.2089.

(e) In each case the calculated $t = -5.81297$.

EXERCISE 3.29

(a) For the 363 students in small classes the average mathscore is 489.0275 and the standard deviation is 50.2169. For the 412 students in regular classes the average mathscore is 483.7767 with standard deviation 49.2558.

(b) The estimated regression using 775 observations is

$$\widehat{MATHSCORE} = 483.7767 + 5.2508SMALL$$
$$\text{(se)} \qquad (2.4489) \qquad (3.5783)$$

(c) A 95% interval estimate in regular class is $[478.9693, 488.5841]$. A 95% interval estimate in small classes is $[483.906, 494.149]$.

(d) The *t*-value is $t = 1.4674$. This is in the non-rejection region

(e) The value of the test statistic is $t = -2.7245$ which lies in the rejection region.

EXERCISE 3.31

(a)

variable	N	mean	Std. dev.	min	max
SAL1	52	6718.712	6915.083	1762	32820
APR1	52	0.7825	0.0980371	0.61	0.92

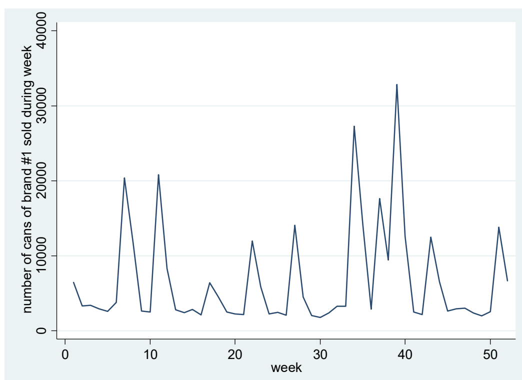


Figure xr3-31(a.1) Sal1-Week plot

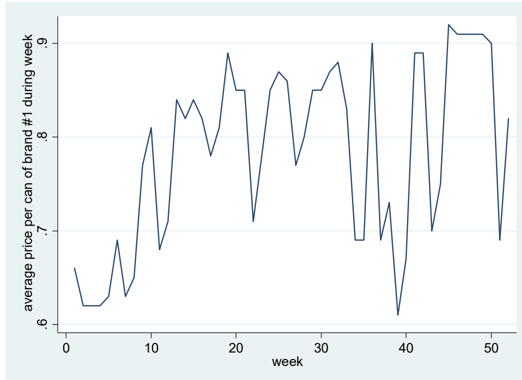


Figure xr3-31(a.2) Apr1-Week plot

(b)

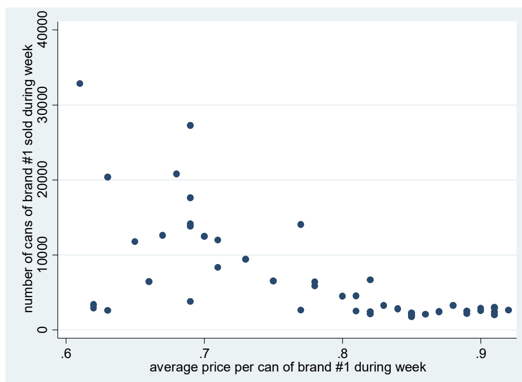


Figure xr3-31(b) Sal1-Apr1 plot

There is an inverse relationship between the weekly sales and weekly price.

(c) We estimate that a one-cent increase in the price of brand one will reduce the expected weekly sales of brand one tuna by 434.45 cans, holding all else constant. A 95% interval estimate is $[-592.2897, \quad -276.6049]$.

(d) $[8624.934, \quad 11980.87]$.

(e) $\hat{\varepsilon} = -5.059825$. The resulting interval estimate is $[-6.898149, \quad -3.221501]$.

(f) $t \cong -2.25$. We reject the null hypothesis.