

5.3. Consider the following model that relates the percentage of a household's budget spent on alcohol $WALC$ to total expenditure $TOTEXP$, age of the household head AGE , and the number of children in the household NK .

$$WALC = \beta_1 + \beta_2 \ln(TOTEXP) + \beta_3 NK + \beta_4 AGE + e$$

This model was estimated using 1200 observations from London. An incomplete version of this output is provided in Table 5.6.

TABLE 5.6 Output for Exercise 5.3

Dependent Variable: WALC				
Included observations: 1200				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.4515	2.2019		0.5099
$\ln(TOTEXP)$	2.7648		5.7103	0.0000
NK		0.3695	-3.9376	0.0001
AGE	-0.1503	0.0235	-6.4019	0.0000
R-squared		Mean dependent var		6.19434
S.E. of regression		S.D. dependent var		6.39547
Sum squared resid	46221.62			

- Fill in the following blank spaces that appear in this table.
 - The t -statistic for b_1 .
 - The standard error for b_2 .
 - The estimate b_3 .
 - R^2 .
 - $\hat{\sigma}$.
- Interpret each of the estimates b_2 , b_3 , and b_4 .
- Compute a 95% interval estimate for β_4 . What does this interval tell you?
- Are each of the coefficient estimates significant at a 5% level? Why?
- Test the hypothesis that the addition of an extra child decreases the mean budget share of alcohol by 2 percentage points against the alternative that the decrease is not equal to 2 percentage points. Use a 5% significance level.

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a. (i) $t = \frac{\text{coefficient}}{\text{Std.Error}} = \frac{1.4515}{2.2019} \approx 0.659$

(ii) Standard error = $\frac{\text{coefficient}}{t} = \frac{2.7648}{5.7103} \approx 0.4842$

(iii) The estimate $b_3 = t \times SE = -3.9376 \times 0.3695 \approx -1.45494$

(iv) $R^2 = 1 - \frac{SSE}{SST} = 1 - \frac{46221.62}{49041.5418} \approx 0.05750068$

$$SST = (N-1)(S_y)^2 = 1199 \times 6.39547^2 = 49041.5418$$

(v) $\hat{\sigma} = \sqrt{\frac{SSR}{n-k}} = \sqrt{\frac{46221.62}{1200-4}} \approx 6.2166$

$$k=3$$

b. $b_2=2.7648$: If the household's total spending goes up by 1%, the alcohol budget share goes up by about 2.76 percentage points.

$b_3=0.3695$: Each extra child in the family increases the alcohol budget share by about 0.37 percentage points.

$b_4=-0.1503$: If the head of the household gets one year older, the alcohol budget share goes down by about 0.15 percentage points.

c. $b_4 \pm 1.96 \times SE = -0.1503 \pm 1.96 \times 0.0235 = -0.1503 \pm 0.0461$
 $\Rightarrow [-0.1964, -0.1042]$