

Chapter 11 Problems

11.2

$$\widehat{\text{Var}}(b_2 + b_3 + b_4 + b_5) = (0.57141 + 0.31377 + 0.006351 + 0.17265) + 2(-0.058721 - 0.007871 - 0.010922 + 0.004369 - 0.10199 - 0.055405) = 0.549912 + 2(0.23054) = 0.549912 - 0.46108 = 0.088832$$

11.3

a) Model becomes $y = \beta_1(x_1 + x_2 + x_3) + e$ Let $z = (x_1 + x_2 + x_3)$

$$\hat{\beta}_1 = \sum zy / \sum z^2 = 24 / 26 = 12 / 13$$

b)

$$\text{SSER} = 11.85$$

$$c) F_6^2 = \frac{(\text{SSER} - \text{SSEUR}) / 2}{\hat{\sigma}^2} = \frac{(11.85 - 9.16) / 2}{1.47} = 1.345 / 1.47 = 0.915 < 1 \quad \text{fail to reject}$$

Ho.

d)

Standard error unrestricted $b_1 = 0.54$

Standard error restricted $b_1 = 0.24$

The restriction reduced the variability of the estimate.

11.4

a)

i) $y_t = \beta_1 + \beta_2 x_{t2} + \beta_4 x_{t4} + e_t$

ii) $y_t - x_{t2} = \beta_1 + \beta_3(x_{t3} - x_{t2}) + \beta_4(x_{t4} - x_{t2}) + e_t$

iii) $y_t = \beta_1(1 + x_{t4}) + \beta_3(x_{t4} + 3x_{t2}) + e_t$

iv) $y_t + 2x_{t3} - 6x_{t4} = \beta_2(3 + x_{t2} + x_{t3}) + e_t$

b)

i) $R = (0010), r = (0)$

ii) $R = (0111), r = (1)$

iii) $R = \begin{bmatrix} 1 & 0 & 0 & -1 \\ 0 & 1 & -3 & 0 \end{bmatrix}, r = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

iv) $R = \begin{bmatrix} 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & -3 & 0 & 0 \end{bmatrix}, r = \begin{bmatrix} 2 \\ 6 \\ 0 \end{bmatrix}$

SHAZAM OUTPUT

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Hello/Bonjour/Aloha/Howdy/G Day/Kia Ora/Konnichiwa/Buenos Dias/Nee Hau/Ciao
Welcome to SHAZAM - Version 10.0 - JUL 2004 SYSTEM=LINUX   PAR= 781
|_ sample 1 25
|_ read y m i
   3 VARIABLES AND          25 OBSERVATIONS STARTING AT OBS      1

|_ sample 1 24

|_ ols m y i

REQUIRED MEMORY IS PAR=          2 CURRENT PAR=          781
OLS ESTIMATION
   24 OBSERVATIONS      DEPENDENT VARIABLE= M
...NOTE..SAMPLE RANGE SET TO:      1,      24

R-SQUARE =      0.9953      R-SQUARE ADJUSTED =      0.9949
VARIANCE OF THE ESTIMATE-SIGMA**2 =      66.123
STANDARD ERROR OF THE ESTIMATE-SIGMA =      8.1316
SUM OF SQUARED ERRORS-SSE=      1388.6
MEAN OF DEPENDENT VARIABLE =      269.71
LOG OF THE LIKELIHOOD FUNCTION = -82.7504

VARIABLE   ESTIMATED   STANDARD   T-RATIO   PARTIAL STANDARDIZED ELASTICITY
NAME       COEFFICIENT   ERROR     21 DF    P-VALUE CORR. COEFFICIENT AT MEANS
Y          0.13594    0.3959E-02  34.33    0.000 0.991    1.0554    0.7276
I         -2.5771     1.189      -2.167    0.042-0.427  -0.0666   -0.0605
CONSTANT  89.777       4.104      21.88     0.000 0.979    0.0000    0.3329

|_ fc / list beg=25 end=25

REQUIRED MEMORY IS PAR=          1 CURRENT PAR=          781
DEPENDENT VARIABLE = M          1 OBSERVATIONS
REGRESSION COEFFICIENTS
   0.135940256320      -2.57707198602      89.7773541337

```

OBS. NO.	OBSERVED VALUE	PREDICTED VALUE	CALCULATED RESIDUAL	STD. ERROR
25	600.00	471.83	128.17	8.881

I *
 SUM OF ABSOLUTE ERRORS= 128.17
 R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.0000
 MEAN ERROR = 128.17
 SUM-SQUARED ERRORS = 16428.
 MEAN SQUARE ERROR = 16428.
 MEAN ABSOLUTE ERROR= 128.17
 ROOT MEAN SQUARE ERROR = 128.17
 MEAN SQUARED PERCENTAGE ERROR= 456.34
 THEIL INEQUALITY COEFFICIENT U = 0.000
 DECOMPOSITION
 PROPORTION DUE TO BIAS = 1.0000
 PROPORTION DUE TO VARIANCE = 0.24740E-15
 PROPORTION DUE TO COVARIANCE = -0.24741E-15
 DECOMPOSITION
 PROPORTION DUE TO BIAS = 1.0000
 PROPORTION DUE TO REGRESSION = 0.24740E-15
 PROPORTION DUE TO DISTURBANCE = -0.24741E-15
 |_ end
 |_ STOP

Note there is 21.36% error in the prediction. That is too big for what we are interested in forecasting.

11.16

a) Y contains $\ln(L/K)$

X contains a column of 1s, a column of $\ln(W/R)$ and a column of $\ln(y)$

b) Expect coefficient of $\ln(W/R)$ to be negative and coefficient of $\ln(y)$ to be any sign as the ratio may increase as Y expands, decrease as Y expands or not change at all if we have a homothetic production function.

SHAZAM OUTPUT

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Welcome to SHAZAM - Version 10.0 - JUL 2004 SYSTEM=LINUX PAR= 781
|_ sample 1 32
  
```

```
|_ read year Y R K W L
6 VARIABLES AND          32 OBSERVATIONS STARTING AT OBS      1
```

```
|_ genr lnLK = log(L/K)
|_ genr lnWR = log(W/R)
|_ genr lny = log(y)
```

```
|_ ols lnLK lnWR lny
```

```
REQUIRED MEMORY IS PAR=      4 CURRENT PAR=      781
OLS ESTIMATION
32 OBSERVATIONS      DEPENDENT VARIABLE= LNLK
...NOTE...SAMPLE RANGE SET TO:      1,      32
```

```
R-SQUARE =      0.9300      R-SQUARE ADJUSTED =      0.9252
VARIANCE OF THE ESTIMATE-SIGMA**2 =      0.25117E-01
STANDARD ERROR OF THE ESTIMATE-SIGMA =      0.15848
SUM OF SQUARED ERRORS-SSE=      0.72838
MEAN OF DEPENDENT VARIABLE =      0.38301
LOG OF THE LIKELIHOOD FUNCTION =      15.1166
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO	P-VALUE	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELASTICITY AT MEANS
LNWR	-0.58018	0.7285E-01	-7.964	0.000	-0.828	-0.6404	-0.8251
LNK	-0.23792	0.5109E-01	-4.657	0.000	-0.654	-0.3744	-1.2236
CONSTANT	1.1677	0.7852E-01	14.87	0.000	0.940	0.0000	3.0487

C) Labor-capital ratio is negatively related to the relative cost of labor to the cost of capital. As output expands, the airline industry is able to decrease the ratio of labor to capital.

D) The standard errors are in the table above.

```
|_ confid lny
USING 95% AND 90% CONFIDENCE INTERVALS
```

```
CONFIDENCE INTERVALS BASED ON T-DISTRIBUTION WITH 29 D.F.
- T CRITICAL VALUES = 2.045 AND 1.699
NAME LOWER 2.5% LOWER 5% COEFFICIENT UPPER 5% UPPER 2.5% STD. ERROR
LNK -0.3424 -0.3247 -0.23792 -0.1511 -0.1334 0.051
```

E) No because the entire confidence interval is in the negative range. It does not cover zero which is what is needed for a straight line expansion path.

```
|_ test
|_ test lnWR = 1
|_ test lny = 0
|_ end
F STATISTIC =      873.63560      WITH      2 AND      29 D.F. P-VALUE= 0.00000
WALD CHI-SQUARE STATISTIC =      1747.2712      WITH      2 D.F. P-VALUE= 0.00000
UPPER BOUND ON P-VALUE BY CHEBYCHEV INEQUALITY = 0.00114
|_ STOP
```

F) We reject H_0 . We don't expand labor capital ratio when labor cost go up relative to capital and we can reject the straight line expansion path.

G) $R^2 = 0.93$ 93% of variation is explained by the two variables.