

Two-stage Least-Squares: Tintner's meat market model

Tintner (1952, pp. 176–179) formulated a model for the American meat market:

$$y_1 = a_1 y_2 + a_2 x_1 + u_1,$$

$$y_1 = b_1 y_2 + b_2 x_2 + b_3 x_3 + u_2,$$

where the dependent variables are

- y_1 = meat consumption per capita (pounds)
- y_2 = meat price (1935-39 = 100)

and the predetermined variables are

- x_1 = disposable income per capita (dollars)
- x_2 = unit cost of meat processing (1935-39 = 100)
- x_3 = cost of agricultural production (1935-39 = 100)

Table: Covariance matrix for variables in Tintner's meat market model

x_1	x_2	x_3	y_1	y_2
3792.439				
164.169	115.218			
554.762	33.217	119.409		
166.905	-24.385	44.721	62.252	
379.754	38.651	56.171	-16.020	71.886

Note that both equations have y_1 on the left side. This is so because the first equation represents the demand for meat and the second equation represents the supply of meat and in a free market these are supposed to be equal. Such a model cannot

be estimated as a LISREL model.¹ The sample covariance matrix based on annual data for United States 1919–1941 ($N = 23$) is given in the table below.

To estimate the equations directly by TSLS one can use the following SIMPLIS command file (see file **TINTNER1.SPL** in the **SIMPLIS Examples** folder):

```

Estimating Tintner's Demand Function
Observed Variables: X1-X3 Y1 Y2
Covariance Matrix
 3792.439
 164.169 115.218
 554.762 33.217 119.409
 166.905 -24.385 44.721 62.252
 379.754 38.651 56.171 -16.020 71.886
Sample Size = 23
Regress Y1 on Y2 and X1 with X1-X3 as Instrumental Variables
Regress Y1 on Y2 X2 and X3 with X1-X3 as Instrumental Variables
End of Problem

```

The output gives the two estimated equations as

Estimated Equations

```

      Y1 = - 1.579*Y2 + 0.202*X1 + Error, R2 = 0.422
Standerr      (0.625)      (0.0662)
Z-values      -2.528       3.052
P-values      0.011       0.002

```

Error Variance = 35.957

Instrumental Variables: X1 X2 X3

```

      Y1 = - 0.321*Y2 - 0.278*X2 + 0.603*X3 + Error, R2 = 0.707
Standerr      (0.293)      (0.114)      (0.152)
Z-values      -1.097      -2.428       3.965
P-values      0.273       0.015       0.000

```

Error Variance = 18.222

Instrumental Variables: X1 X2 X3

Those who want to use a LISREL command file instead of SIMPLIS, can use the following (see file **TINTNER2.LIS**):

Estimating Tintner's Demand and Supply Functions

DA NI=5 NO=23

LA

X1 X2 X3 Y1 Y2

CM

```

 3792.439
 164.169 115.218
 554.762 33.217 119.409
 166.905 -24.385 44.721 62.252

```

¹ To estimate the model as a LISREL model, one would have to rewrite the second equation as $y_2 = c_1y_1 + c_2x_2 + c_3x_3 + u_3$, where $c_1 = 1/b_1$, $c_2 = -b_2/b_1$, $c_3 = -b_3/b_1$, and $u_3 = -(1/b_1)u_2$.

379.754 38.651 56.171 -16.020 71.886
RG Y1 ON Y2 X1 WITH X1 X2 X3
RG Y1 ON Y2 X2 X3 WITH X1 X2 X3
OU