

1. Summary statistics and correlation coefficients.

Name	N	Mean	Std Dev	Minimum	Maximum
P	30	20.9080	6.2412	9.880	35.150
Q	30	18.4583	4.6131	6.370	26.270
S	30	22.0220	4.0772	15.210	28.980
I	30	35.2697	10.408	15.250	51.250
F	30	22.7533	5.3297	10.520	34.010

Correlation Matrix

	P	Q	S	I
P	1.0000			
Q	0.5272	1.0000		
S	0.6661	0.6992	1.0000	
I	0.8506	0.4117	0.5003	1.0000
F	0.7304	-0.1545	0.2145	0.6275

2. Identification Properties

$$D: P_t - \beta_{12} Q_t - \gamma_{11} S_t - \gamma_{12} I_t - \gamma_{10} = u_{1t}$$

$$S: -\beta_{21} P_t + Q_t - \gamma_{21} F_t - \gamma_{20} = u_{2t}$$

Order: $K - k \geq g - 1$

Demand equation is just-identified $(3-2)=(2-1)$.

Supply equation is over-identified $(3-1)>(2-1)$.

Rank: (this is not the formal answer - it's a summary - see G&P)

Demand equation is just-identified if γ_{21} does not equal zero.

Supply equation is over-identified if γ_{11} and γ_{12} do not equal zero.

3. Reduced form models

	Price	Quantity
S	0.5694 (0.1170)	0.6564 (0.1425)
I	0.2534 (0.0575)	0.2167 (0.0701)
F	0.4513 (0.0995)	-0.5070 (0.1213)
Intercept	-10.8375 (2.6614)	7.8951 (3.2434)
R-Squared	0.8887	0.6974
F-Stat	69.19 (0.0001)	19.97 (0.0001)
σ	2.1992	2.6801

4. Demand model results.

Parameters	Method			
	OLS	2SLS	3SLS	I3SLS
β_{12}	0.0504 (0.1663)	-0.8902 (0.3917)	-0.8285 (0.3881)	-0.8295 (0.3751)
γ_{11}	0.4536 (0.1980)	1.1537 (0.3719)	1.0451 (0.3602)	1.0469 (0.3478)
γ_{12}	0.4119 (0.0608)	0.4463 (0.0916)	0.4676 (0.0897)	0.4672 (0.0867)
γ_{10}	-4.5398 (3.0291)	-3.8095 (4.5305)	-3.3072 (4.5103)	-3.3157 (4.3598)
R-Squared	0.8013	0.6672	0.6297	0.6293
F-Statistic (P-value)	34.95 (0.0001)	17.37 (0.0001)	10.59 (0.0001)	11.31 (0.0001)
σ	2.9381	4.3885	4.2403	4.2426

Supply model results.

Parameters	Method			
	OLS	2SLS	3SLS	I3SLS
β_{21}	1.0140 (0.0652)	1.0139 (0.0748)	1.0139 (0.0748)	1.0139 (0.0748)
γ_{21}	-1.0009 (0.0764)	-1.0009 (0.0825)	-1.0009 (0.0825)	-1.0009 (0.0825)
γ_{20}	20.0328 (1.2220)	20.0328 (1.2231)	20.0328 (1.2231)	20.0328 (1.2231)
R-Squared	0.9019	0.8759	0.9019	0.9019
F-Statistic (P-value)	124.08 (0.0001)	95.26 (0.0001)	57.91 (0.0001)	57.82 (0.0001)
σ	1.4976	1.4976	1.4976	1.4976

5. Error Covariance Matrices

3SLS:	D	S	I3SLS:	D	S
D	19.2591		D	18.0004	
S	1.9312	2.2428	S	1.8985	2.2428

Error Correlation Matrices

3SLS:	D	S	I3SLS:	D	S
D	1.0		D	1.0	
S	0.2938	1.0	S	0.2988	1.0

Diagonal elements are error variances and off diagonal elements are cross equation covariances.

6. Economic interpretation. Own price effects. Demand and supply function shifting variables.

7. 2SLS Equilibrium

$$P = -0.8902 (1.0139 P - 1.0009 F + 20.0328) + 1.1537 S + 0.4463 I - 3.8095$$

substitute mean levels for other variables

$$P = -0.8902 (1.0139 P - 1.0009 (22.7533) + 20.0328) + 1.1537 (22.0220) + 0.4463 (35.2697) - 3.8095$$

$$P = -0.9026 P + 39.7782$$

$$P = 20.91 \quad \rightarrow \quad Q = 18.46$$

I3SLS Equilibrium

$$P = -0.8295 (1.0139 P - 1.0009 F + 20.0328) + 1.0469 S + 0.4672 I - 3.3157$$

substitute mean levels for other variables

$$P = -0.8295 (1.0139 P - 1.0009 (22.7533) + 20.0328) + 1.0469 (22.0220) + 0.4672 (35.2697) - 3.3157$$

$$P = -0.8410 P + 38.4908$$

$$P = 20.91 \quad \rightarrow \quad Q = 18.46$$

Higher substitute price and income shift the demand curve to the right. Higher input price shifts the supply curve to the left. The equilibrium price increases. The equilibrium quantity depends on the relative size of the two shifts.

8. Bias and efficiency changes.

Optional. Demand function impacted by simultaneity and the supply function is not.