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DISAGGREGATED RESULTS

AN important test of a model is to estimate it on various bodies of data. Analyzing the behavior of factors of production at the disaggregated level is both interesting and important. Disaggregated estimates throw light on structural changes and possible aggregation biases hidden in the aggregate data. They also provide tests of stability of a model. This chapter contains estimates of model (4.1), using time series data for groupings of Standard Industrial Classification (SIC) two- and three-digit industries, identified by code in the right-hand column of the accompanying table and by name in Appendix A. Our own code numbers, in the left-hand column, are intended for ease of reference, since in many cases, as is evident, our industry groups contain several SIC groups. The data used are quarterly observations, 1954I–1967IV, for individual industries and 1948I–1967IV for total durables and total nondurables. The specification of the variables and sources of the data are the same as those for total manufacturing, discussed in Chapter 3. A summary description of the data underlying estimation of the model for the individual industries is provided in Appendix B. Movements of the variables in the individual industries tend to be similar to those found for total manufacturing, and further discussion is therefore unwarranted.

The chapter is organized in the following way. Industries are grouped into durable and nondurable categories. Structural estimates for all industries are presented in section A. In section B we examine distributed lag responses and implied long-run elasticities of the dependent variables in each industry.

A. STRUCTURAL ESTIMATES

i. Overview

Structural estimates of model (4.1) for all industries are reported in

Tables 6.1–6.17. The goodness-of-fit statistics of the estimated equations, such as R^2, the standard errors of estimate, and the sums of squared residuals are impressive in each case and similar to those noted for the total manufacturing. Goodness of fit and forecasting tests similar to those reported for total manufacturing were also computed for total durables and total nondurables. The results were similar to those for total manufacturing and are therefore not repeated. On the whole, the results conclusively indicate the superiority of the model to alternative specifications based on tests similar to those reported in Chapter 4. Charts of actual and predicted values for each dependent variable in each industry indicate the very good fit of the model during the sample period. They also indicate how well the model tracks turning points of the dependent variables. To save space, only those for total durables (01) and total nondurables (10) are presented here (Charts 6.1–6.12, pages 120 to 131).

There is considerable evidence of serial correlation of residuals in the specification of the model prior to the first-order serial transformation, especially in the stock equations. The values of $\hat{\rho}$ shown indicate generally

Manufacturing Industries Included in Model (4.1)

Nadiri-Rosen Code	*Industry Name*	*SIC Code*
01	Total durables	19, 24, 25, 32–39
02	Primary iron and steel	331–332
03	Primary nonferrous metal	333–339
04	Electrical machinery and equipment	36
05	Machinery except electrical	35
06	Motor vehicles and equipment	371
07	Transportation equipment, excluding motor vehicles	372–379
08	Stone, clay, and glass	32
09	Other durables	19, 24, 25, 34, 38, 39
10	Total nondurables	20–23, 26–31
11	Food and beverages	20
12	Textile mill products	22
13	Paper and allied products	22
14	Chemical and allied products	68
15	Petroleum and coal products	29
16	Rubber products	30
17	Other nondurables	21, 23, 27, 31

TABLE 6.1

ESTIMATED STRUCTURE OF MODEL (4.1) FOR TOTAL DURABLES (01)
(sample period: 1948I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Dependent Variables: Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−2.911	1.165	.2978	2.983	−1.050	−.9400
	(2.582)	(2.703)	(1.285)	(1.126)	(.7102)	(1.373)
Sales	.4094	.1271	.0015	1.069	.0829	.0345
	(12.49)	(9.788)	(.2667)	(13.36)	(2.144)	(2.069)
Trend	−.0041	−.0001	.0005	−.0067	.00005	.0012
	(5.337)	(.5841)	(1.453)	(3.896)	(.0398)	(1.251)
w/c	−.0597	−.0137	.0013	−.2046	−.0085	−.0355
	(2.130)	(1.341)	(.1993)	(3.265)	(.1970)	(1.742)
Y_{1t-1}	.5472	−.0628	.0477	−.4448	.2610	−.0436
	(8.236)	(2.570)	(3.076)	(2.963)	(2.751)	(.9545)
Y_{2t-1}	.6860	.7016	−.0216	−.7688	.3957	.3090
	(2.566)	(6.840)	(.4503)	(1.219)	(1.156)	(2.166)
Y_{3t-1}	.0921	−.0733	.8822	−.3538	−.0240	−.0480
	(1.039)	(2.241)	(24.46)	(1.761)	(.1633)	(.4543)
Y_{4t-1}	−.1186	−.0565	−.0059	.3560	−.0508	.0208
	(4.343)	(5.568)	(1.147)	(5.711)	(1.382)	(1.347)
Y_{5t-1}	−.1180	−.0394	.0186	−.5077	.5980	.0373
	(2.415)	(2.223)	(1.408)	(4.661)	(7.989)	(.9578)
Y_{6t-1}	.1374	.0301	.0444	.6656	.3040	.8126
	(2.693)	(1.668)	(1.594)	(5.999)	(3.197)	(9.972)
R^2	.9827	.9589	.9999	.9199	.9972	.8994
$\hat{\rho}$	.1721	.0003	.9059	−.0069	.5925	.9024
SEE	.0118	.0048	.0020	.0300	.0137	.0059
SSR	.0097	.0016	.0002	.0622	.0131	.0024

NOTE: Figures in parentheses are *t* statistics. *w/c* denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.2

ESTIMATED STRUCTURE OF MODEL (4.1) FOR PRIMARY IRON AND STEEL (02)
(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Dependent Variables: Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−1.004	.9121	.1161	−9.209	1.505	−.9527
	(1.827)	(1.790)	(3.638)	(2.855)	(1.443)	(1.507)
Sales	.4237	.0800	.0033	.5172	.0738	.0614
	(23.88)	(8.130)	(1.232)	(8.256)	(3.220)	(6.009)
Trend	−.0047	.0003	.0006	.0013	.0039	−.0004
	(3.265)	(.6838)	(1.778)	(.3966)	(2.720)	(1.088)
w/c	.0074	−.0404	−.0098	−.3495	.0086	−.0489
	(.1103)	(1.338)	(.9497)	(1.808)	(.1112)	(1.919)
Y_{1t-1}	.1615	−.0962	.0252	.1362	.0820	−.0890
	(2.503)	(3.135)	(2.562)	(.6958)	(1.066)	(3.229)
Y_{2t-1}	.4798	.5922	−.1028	2.848	−.3407	.2753
	(1.876)	(4.587)	(2.758)	(3.461)	(1.075)	(2.283)
Y_{3t-1}	.3901	.0353	.8662	−.3056	−.1593	−.0090
	(1.489)	(.3676)	(15.42)	(.4975)	(.6136)	(.1175)
Y_{4t-1}	−.0459	.0074	.0088	−.2377	−.0614	−.0034
	(1.294)	(.3322)	(1.791)	(1.670)	(1.219)	(.1452)
Y_{5t-1}	−.2387	−.0516	.0163	−.0588	.6278	−.0695
	(2.406)	(1.307)	(1.001)	(.2328)	(5.929)	(2.187)
Y_{6t-1}	.3818	−.2136	.0624	−.2153	.2086	1.051
	(2.585)	(3.858)	(2.219)	(.6082)	(1.411)	(22.61)
R^2	.9438	.9175	.9702	.8708	.9533	.9813
$\hat{\rho}$	.5682	.1050	.8479	.1122	.2793	−.2441
SEE	.0208	.0114	.0031	.0729	.0268	.0119
SSR	.0194	.0059	.0004	.2396	.0325	.0064

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.3

ESTIMATED STRUCTURE OF MODEL (4.1) FOR PRIMARY NONFERROUS METAL (03)
(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

Indepen-dent Variables	Dependent Variables: Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−2.000	2.425	.1024	−.1204	.2801	−1.742
	(2.307)	(4.429)	(1.893)	(.0362)	(.2028)	(3.412)
Sales	.2929	.1021	.0120	1.175	.1518	.0470
	(7.972)	(6.029)	(1.358)	(10.01)	(2.021)	(2.656)
Trend	−.0006	.0010	−.00007	−.0090	−.0009	−.0006
	(.6721)	(2.614)	(.1999)	(2.992)	(.4553)	(1.522)
w/c	−.0244	−.0284	.0144	.1416	−.0915	−.0662
	(.4899)	(1.352)	(1.234)	(.9230)	(.8824)	(2.880)
Y_{1t-1}	.4625	−.0719	.0469	.1824	−.1188	.2047
	(4.557)	(1.690)	(1.801)	(.5899)	(.5522)	(4.418)
Y_{2t-1}	.6449	.3833	−.0297	−.5883	.4127	.3870
	(2.128)	(2.953)	(.4177)	(.6270)	(.6586)	(2.748)
Y_{3t-1}	−.0823	.0016	.9106	.7768	−.1536	.0434
	(.8340)	(.0447)	(21.88)	(2.749)	(.6677)	(1.031)
Y_{4t-1}	−.0545	−.0124	−.0171	−.0749	−.1150	−.0935
	(1.598)	(.7238)	(2.495)	(.6538)	(1.744)	(5.384)
Y_{5t-1}	−.1256	−.1090	.0366	−.4506	.8049	.0094
	(2.491)	(5.421)	(2.333)	(3.017)	(7.227)	(.4219)
Y_{6t-1}	.2400	−.0465	.1017	−.0206	.6635	.7536
	(1.548)	(.7375)	(2.399)	(.0442)	(1.992)	(10.81)
R^2	.9682	.9586	.9927	.9000	.9607	.9943
$\hat{\rho}$	.1984	−.1759	.7842	.0118	.3781	.0111
SEE	.0130	.0064	.0029	.0428	.0259	.0064
SSR	.0076	.0018	.0003	.0827	.0302	.0018

NOTE: Figures in parentheses are *t* statistics. *w/c* denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.4

ESTIMATED STRUCTURE OF MODEL (4.1) FOR ELECTRICAL MACHINERY AND EQUIPMENT (04)

(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
	Dependent Variables					
Constant	−3.242	2.145	.0067	−10.28	−1.880	−.9932
	(2.199)	(4.846)	(.6648)	(1.878)	(.3757)	(3.002)
Sales	.1495	.1020	.0243	1.096	.2668	−.0456
	(1.535)	(2.637)	(1.587)	(4.451)	(1.089)	(.9330)
Trend	.0015	.0008	.0010	−.0154	−.0073	.0012
	(.8807)	(1.004)	(.9272)	(4.107)	(1.916)	(.8997)
w/c	−.1356	−.0456	.0058	−.0980	−.2154	−.0533
	(2.896)	(2.241)	(.5779)	(.9268)	(2.010)	(1.845)
Y_{1t-1}	.7910	−.0330	−.0260	−.8407	.0199	.0552
	(7.050)	(.6740)	(.9268)	(3.258)	(.0764)	(.7630)
Y_{2t-1}	.9794	.1545	−.0253	1.886	.4367	.7451
	(2.441)	(.9411)	(.3554)	(1.946)	(.4495)	(3.447)
Y_{3t-1}	−.0791	−.0800	.8568	.1076	.5777	−.0967
	(.5800)	(1.191)	(13.09)	(.3803)	(1.996)	(.7919)
Y_{4t-1}	−.0763	.0083	.0058	.4870	.1498	−.0164
	(2.100)	(.5751)	(.8756)	(5.338)	(1.649)	(.8627)
Y_{5t-1}	−.0642	−.0445	.0164	−.2760	.7588	.0319
	(1.490)	(2.330)	(1.580)	(2.884)	(7.811)	(1.145)
Y_{6t-1}	−.0841	−.0581	.0891	.6410	−.0690	.9427
	(.8172)	(1.297)	(2.213)	(2.668)	(.2860)	(13.51)
R^2	.9865	.7092	.9375	.9148	.9632	.9930
$\hat{\rho}$	.0662	.3168	.9635	.4399	.3123	.6118
SEE	.0154	.0060	.0027	.0452	.0427	.0079
SSR	.0106	.0016	.0003	.0923	.0822	.0028

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficent of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.5

ESTIMATED STRUCTURE OF MODEL (4.1) FOR MACHINERY EXCEPT ELECTRICAL (05)

(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

	Dependent Variables					
Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod Emp. (Y_{6t})
Constant	−3.285 (4.980)	.6354 (1.538)	.0379 (1.108)	1.249 (.5523)	−.9063 (.2892)	−.8101 (4.033)
Sales	.1916 (4.173)	.0695 (2.544)	.0021 (2.116)	1.213 (7.117)	.1712 (1.191)	.0355 (1.999)
Trend	−.0043 (2.432)	.0002 (.2523)	.0001 (.3125)	.0003 (.0532)	.0032 (.6470)	.0001 (.2535)
w/c	−.0346 (.7349)	−.0349 (1.244)	.0084 (.7948)	−.0773 (.4415)	.1963 (1.349)	−.0541 (2.971)
Y_{1t-1}	.4365 (2.868)	−.0003 (.0041)	.0449 (1.020)	−.0566 (.0984)	−.1562 (.3580)	.0054 (.8842)
Y_{2t-1}	1.416 (4.801)	.7198 (4.158)	−.0208 (.2761)	−.4991 (.4464)	.2078 (.2524)	.4445 (3.682)
Y_{3t-1}	.0837 (1.050)	−.0106 (.2324)	.9102 (25.72)	−.8785 (2.818)	−.1371 (.6773)	.0090 (.2525)
Y_{4t-1}	.0522 (1.782)	.0220 (1.250)	−.0011 (.1893)	−.0470 (.4367)	.1289 (1.261)	.0136 (1.235)
Y_{5t-1}	−.0425 (1.192)	−.0068 (.3279)	.0078 (.7255)	−.3915 (2.861)	.6913 (7.250)	−.0075 (.4971)
Y_{6t-1}	.2455 (1.054)	−.1403 (1.028)	.1060 (1.387)	.3749 (.4228)	.2855 (.4342)	.8433 (8.640)
R^2	.9784	.8788	.9938	.7754	.9888	.9961
$\hat{\rho}$	.3579	.3149	.8654	.4191	.0923	.5214
SEE	.0118	.0070	.0028	.0440	.0416	.0046
SSR	.0063	.0022	.0003	.0871	.0779	.0009

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.6

ESTIMATED STRUCTURE OF MODEL (4.1) FOR MOTOR VEHICLES AND EQUIPMENT (06)

(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

	Dependent Variables					
Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−2.175 (1.673)	2.066 (4.196)	−.0255 (.1988)	−.0559 (.2725)	−.2975 (.2787)	−1.992 (5.270)
Sales	.5006 (12.08)	.2110 (9.909)	.0047 (.6438)	1.001 (34.40)	.2014 (4.601)	.0502 (3.683)
Trend	−.0055 (4.963)	−.0016 (2.418)	−.0011 (4.425)	−.0019 (1.343)	.0039 (2.853)	−.0001 (.3773)
w/c	−.1089 (1.398)	.0736 (1.286)	.0050 (.2342)	−.1842 (2.153)	−.1912 (1.692)	.0310 (1.019)
Y_{1t-1}	.3663 (2.850)	−.2456 (3.342)	−.0551 (2.233)	.0258 (.2850)	.1991 (1.323)	.0690 (1.527)
Y_{2t-1}	.3002 (1.454)	.2196 (1.835)	.1318 (3.097)	−.0988 (.5604)	.4011 (1.656)	.2313 (3.230)
Y_{3t-1}	−.0280 (.3428)	−.0254 (.4023)	.8968 (33.76)	−.6435 (3.874)	−.1036 (.8436)	.0753 (2.342)
Y_{4t-1}	−.1023 (1.465)	.0022 (.0523)	−.0247 (1.622)	.0669 (1.118)	−.0949 (1.082)	−.0010 (.0431)
Y_{5t-1}	.0387 (.4482)	−.0186 (.3100)	.0828 (3.672)	−.2408 (2.571)	.4777 (3.987)	.0227 (.6910)
Y_{6t-1}	.1688 (.7999)	.1758 (1.218)	.1825 (3.425)	−.1890 (.8027)	.2665 (.9258)	.6384 (7.987)
R^2	.9708	.8030	.9923	.9663	.9763	.9860
$\hat{\rho}$	−.3822	.1988	.4352	.7752	.1293	−.0980
SEE	.0327	.0166	.0057	.0231	.0341	.0106
SSR	.0482	.0124	.0014	.0241	.0526	.0050

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.7

ESTIMATED STRUCTURE OF MODEL (4.1) FOR TRANSPORTATION EQUIPMENT EXCLUDING MOTOR VEHICLES (07)

(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−2.560	.8688	−.0942	−4.529	−4.424	−.8302
	(2.842)	(2.165)	(.4819)	(1.848)	(2.166)	(3.585)
Sales	−.0002	.0117	−.0209	1.160	.0556	−.0033
	(.0041)	(.5058)	(1.154)	(8.811)	(.4910)	(.0654)
Trend	.0040	.0015	.0019	−.0090	−.0010	−.0001
	(1.822)	(2.050)	(2.494)	(2.408)	(.2962)	(.0616)
w/c	−.1027	−.0119	−.0346	.0029	.0145	−.0099
	(2.174)	(.7261)	(2.274)	(.0349)	(.1911)	(.2225)
Y_{1t-1}	.9853	.0021	.0336	−.2607	.2564	.1543
	(14.61)	(.0942)	(1.474)	(2.164)	(2.373)	(1.871)
Y_{2t-1}	1.135	.7190	.1363	1.074	1.391	1.120
	(3.213)	(5.861)	(1.218)	(1.702)	(2.445)	(3.631)
Y_{3t-1}	−.2348	−.0773	.8808	−.1262	.1311	.0781
	(1.789)	(1.752)	(19.55)	(.5631)	(.6456)	(.5174)
Y_{4t-1}	−.0872	−.0408	.0076	−.0731	−.1855	.0011
	(2.119)	(2.511)	(.6443)	(.7786)	(2.315)	(.0374)
Y_{5t-1}	−.0125	.0026	−.0059	−.2881	.7465	−.0552
	(.1928)	(.1184)	(.2759)	(2.480)	(7.155)	(.8644)
Y_{6t-1}	−.0072	.0033	.1004	.4596	.0527	.6234
	(.0926)	(.1347)	(3.378)	(3.691)	(.4641)	(5.339)
R^2	.9828	.8852	.9992	.8508	.9689	.8606
$\hat{\rho}$	.3509	.1619	.5597	.0008	.0781	.8133
SEE	.0143	.0056	.0041	.0325	.0277	.0115
SSR	.0092	.0014	.0007	.0476	.0346	.0060

NOTE: Figures in parentheses are t statistics. *w/c* denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.8

ESTIMATED STRUCTURE OF MODEL (4.1) FOR STONE, CLAY, AND GLASS PRODUCTS (08)

(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

	Dependent Variables					
Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−1.172	2.782	.3595	−.8903	1.836	−2.898
	(.7341)	(5.666)	(1.642)	(.7529)	(.8071)	(1.288)
Sales	.1546	.0665	−.0022	.8466	.0175	.2157
	(4.414)	(4.161)	(.2149)	(15.48)	(.2744)	(4.555)
Trend	.0010	.0031	.0005	−.0016	.0006	−.0034
	(.8067)	(4.580)	(1.066)	(.6308)	(.2550)	(1.929)
w/c	−.0916	−.0458	.0051	−.0141	−.0510	.0494
	(2.942)	(2.727)	(.4174)	(.2178)	(.8079)	(1.192)
Y_{1t-1}	.5849	−.0576	.1288	−.1884	.2897	.1151
	(8.479)	(1.473)	(4.303)	(1.186)	(2.012)	(1.257)
Y_{2t-1}	.3523	.1212	−.1354	−.0011	−.3875	.0408
	(1.092)	(.7929)	(1.372)	(.0021)	(.6399)	(.0942)
Y_{3t-1}	−.1588	−.2456	.9706	.5052	.2342	.4172
	(1.380)	(3.778)	(18.79)	(1.846)	(.9815)	(2.726)
Y_{4t-1}	−.0248	.0260	−.0014	−.0149	−.1035	.0255
	(.6779)	(1.427)	(.1211)	(.2325)	(1.453)	(.5215)
Y_{5t-1}	−.1548	−.0990	−.0441	−.6988	.5823	.1498
	(2.397)	(3.050)	(1.931)	(5.752)	(4.655)	(1.729)
Y_{6t-1}	.1332	.0493	.0255	−.0805	.2341	.3334
	(1.393)	(1.098)	(.8849)	(.5237)	(1.312)	(2.590)
R^2	.9471	.8901	.9989	.9105	.9905	.9911
$\hat{\rho}$	−.1797	.2280	.4674	.4608	.0992	−.2341
SEE	.0106	.0048	.0032	.0170	.0191	.0146
SSR	.0051	.0010	.0004	.0131	.0164	.0095

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.9

ESTIMATED STRUCTURE OF MODEL (4.1) FOR OTHER DURABLES (09)
(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

	Dependent Variables					
Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−2.401 (2.024)	2.603 (3.288)	−.0674 (.6310)	.9787 (.8754)	−.4500 (.4669)	−.1921 (.5135)
Sales	.3440 (5.077)	.1761 (5.083)	.0079 (.4350)	.9403 (5.696)	.2320 (2.009)	−.0049 (.1151)
Trend	−.0049 (2.519)	.0017 (1.853)	.0003 (.4985)	.0050 (.9014)	−.0066 (1.747)	.0032 (2.308)
w/c	−.0151 (.6626)	−.0143 (1.332)	.0093 (1.075)	−.1189 (1.554)	.0422 (.8337)	−.0701 (3.766)
Y_{1t-1}	.5346 (5.004)	−.0287 (.5533)	.0434 (1.359)	.4201 (1.453)	.2804 (1.402)	−.0304 (.4096)
Y_{2t-1}	.5818 (1.818)	.4480 (2.754)	.0434 (.5151)	−.4531 (.5893)	.3264 (.6039)	.1211 (.6013)
Y_{3t-1}	.2775 (1.925)	−.1978 (2.803)	.9633 (20.10)	−1.130 (2.674)	.4148 (1.465)	−.1200 (1.149)
Y_{4t-1}	−.0072 (.1553)	−.0446 (1.928)	.0081 (.6155)	−.0871 (.7229)	−.0294 (.3502)	.0269 (.8627)
Y_{5t-1}	−.2024 (2.659)	−.0109 (.3052)	.0118 (.4785)	−.4748 (2.127)	.2756 (1.796)	.0663 (1.167)
Y_{6t-1}	.1873 (1.391)	−.1339 (2.053)	.0014 (.0307)	.0669 (.1620)	.6143 (2.230)	.6626 (6.531)
R^2	.9809	.9527	.9982	.7600	.9434	.9956
$\hat{\rho}$	.0019	.3153	.6582	.6071	.5176	.4972
SEE	.0084	.0048	.0022	.0205	.0141	.0052
SSR	.0032	.0010	.0002	.0190	.0090	.0012

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.10

ESTIMATED STRUCTURE OF MODEL (4.1) FOR TOTAL NONDURABLES (10)
(sample period: 1948I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
	Dependent Variables					
Constant	−2.870	.8273	.2316	−2.599	1.109	−1.352
	(4.894)	(1.817)	(1.145)	(1.461)	(1.135)	(5.089)
Sales	.2657	.2126	−.0095	.9106	−.0537	−.0197
	(4.956)	(4.510)	(.6645)	(4.547)	(.5470)	(.6437)
Trend	−.0024	−.0016	.0001	−.0092	.0021	.0001
	(3.699)	(3.391)	(.4823)	(4.593)	(1.971)	(.5084)
w/c	−.0004	.0115	.00006	.0381	−.0050	−.0060
	(.0273)	(.8776)	(.0106)	(.7786)	(.1756)	(.8415)
Y_{1t-1}	.5936	−.0866	.0582	−.2063	.3971	−.0261
	(9.218)	(1.925)	(2.188)	(1.230)	(4.023)	(1.056)
Y_{2t-1}	.5008	.6033	−.0288	.3704	.0766	.3679
	(3.451)	(4.873)	(.7241)	(.7330)	(.2938)	(4.815)
Y_{3t-1}	.2583	.0316	.9371	−.1982	−.2940	.0359
	(3.540)	(.6764)	(26.65)	(1.156)	(2.824)	(1.419)
Y_{4t-1}	.0098	−.0353	−.0035	.1391	−.0755	−.0007
	(.4254)	(1.602)	(.6141)	(1.389)	(1.682)	(.0447)
Y_{5t-1}	−.0109	−.0299	.0058	−.4459	.6518	.0088
	(.2723)	(.9989)	(.4519)	(3.807)	(10.04)	(.5014)
Y_{6t-1}	−.2268	−.0058	.0645	1.145	.4601	.9385
	(2.654)	(.0951)	(1.480)	(4.635)	(3.465)	(24.95)
R^2	.9634	.8618	.9998	.7928	.9964	.9992
$\hat{\rho}$	.5708	.2780	.8878	.0234	.3532	−.0727
SEE	.0062	.0056	.0017	.0255	.0115	.0040
SSR	.0026	.0021	.0002	.0450	.0092	.0011

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.11

ESTIMATED STRUCTURE OF MODEL (4.1) FOR FOOD AND BEVERAGES (11)
(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

	Dependent Variables					
Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−2.419 (2.957)	.7105 (1.232)	−.0033 (.0637)	−6.739 (2.727)	−1.719 (.4292)	.5968 (2.355)
Sales	.1303 (2.220)	.0402 (1.232)	−.0178 (1.542)	.6121 (4.528)	.8283 (2.080)	.0021 (.0452)
Trend	−.0023 (2.893)	−.0008 (2.056)	.0003 (2.107)	−.0072 (4.109)	−.0024 (.4402)	.0033 (4.743)
w/c	−.0326 (2.169)	.0022 (.2653)	.0058 (1.490)	.1680 (4.773)	.2359 (2.196)	−.0107 (.6714)
Y_{1t-1}	.5338 (5.148)	−.1607 (2.936)	.0308 (1.317)	−.7067 (3.145)	.0884 (.1185)	.2312 (2.373)
Y_{2t-1}	.4407 (2.008)	.7775 (6.372)	−.0038 (.0943)	.8105 (1.607)	.3766 (.2558)	−.2595 (1.490)
Y_{3t-1}	.3349 (2.728)	.1397 (2.147)	1.014 (35.22)	.6747 (2.525)	.1250 (.1428)	−.5815 (4.975)
Y_{4t-1}	.0724 (1.877)	.0174 (.7325)	.0108 (1.513)	.3321 (3.322)	−.4696 (1.923)	.0368 (1.231)
Y_{5t-1}	−.0381 (1.834)	−.0134 (1.161)	.0003 (.0679)	−.2970 (6.192)	.0936 (.6347)	−.0207 (1.080)
Y_{6t-1}	.0646 (.4371)	.0504 (.6473)	−.0010 (.0307)	1.334 (4.180)	1.130 (1.055)	.1001 (.7068)
R^2	.9816	.7568	.9904	.8978	.8276	.9409
$\hat{\rho}$	−.0421	−.3324	.6686	−.3835	.2528	.6194
SEE	.0064	.0040	.0011	.0171	.0399	.0046
SSR	.0018	.0007	.00005	.0132	.0719	.0009

NOTE: Figures in parentheses are *t* statistics. *w/c* denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.12

ESTIMATED STRUCTURE OF MODEL (4.1) FOR TEXTILE MILL PRODUCTS (12)
(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Dependent Variables Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−.3459	2.739	.0033	.4602	1.972	−2.101
	(1.835)	(4.619)	(.0662)	(.5920)	(1.783)	(2.193)
Sales	.1513	.3087	.0044	.9538	.1177	.0260
	(3.323)	(6.415)	(.1705)	(6.259)	(1.354)	(.3933)
Trend	−.0040	−.0032	.0010	−.0060	.0063	.0023
	(5.705)	(4.395)	(2.194)	(2.542)	(4.867)	(2.405)
w/c	−.0468	−.0249	.0155	.0391	.0979	−.0019
	(2.096)	(1.437)	(1.057)	(.5491)	(3.160)	(.0887)
Y_{1t-1}	.3040	−.1223	.1006	.5270	.5398	.2164
	(2.553)	(1.025)	(1.544)	(1.305)	(2.518)	(1.365)
Y_{2t-1}	.3154	.2889	−.0163	−.1821	−.8709	.1109
	(2.148)	(1.674)	(.2027)	(.3619)	(2.788)	(.4665)
Y_{3t-1}	.2816	−.0920	.9267	−.5546	−.0843	.1477
	(4.167)	(1.549)	(20.96)	(2.489)	(.7914)	(1.886)
Y_{4t-1}	.0434	−.0026	−.0023	−.1561	.0146	−.0522
	(1.282)	(.0664)	(.1250)	(1.352)	(.2049)	(.9585)
Y_{5t-1}	−.1047	−.0174	.0034	−.0819	.6070	−.0047
	(1.463)	(.2906)	(.0820)	(.3465)	(5.652)	(.0617)
Y_{6t-1}	.1309	.2550	−.0167	.3034	−.3190	.4199
	(1.392)	(2.361)	(.3203)	(.9463)	(1.633)	(2.833)
R^2	.9247	.9306	.9697	.6605	.9884	.9807
$\hat{\rho}$	.6743	.1401	.8432	.6076	.1153	.0106
SEE	.0065	.0074	.0038	.0220	.0136	.0106
SSR	.0019	.0025	.0006	.0219	.0083	.0051

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.13

ESTIMATED STRUCTURE OF MODEL (4.1) FOR PAPER AND ALLIED PRODUCTS (13)

(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Dependent Variables: Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−1.178	2.154	.0460	1.519	.8068	−.1056
	(2.545)	(5.893)	(2.116)	(1.625)	(1.752)	(.7881)
Sales	.1320	.1692	.0133	.7166	.1519	−.0404
	(5.061)	(6.452)	(.6941)	(5.306)	(1.715)	(.7510)
Trend	−.0012	.0003	−.0005	−.0039	.0042	.0099
	(1.791)	(.5210)	(.6834)	(.9212)	(1.430)	(4.920)
w/c	.0001	−.0385	.0195	−.0864	.0832	−.0610
	(.0094)	(2.592)	(1.935)	(1.152)	(1.710)	(2.122)
Y_{1t-1}	.6870	−.0979	.1647	.1421	.6708	.6189
	(10.36)	(1.421)	(2.827)	(.3557)	(2.496)	(3.762)
Y_{2t-1}	.2060	.1964	−.0612	−.6748	−.9272	−.2500
	(1.682)	(1.632)	(.8454)	(1.148)	(2.474)	(1.181)
Y_{3t-1}	.1272	−.0748	.8987	−.3632	.1872	−.1741
	(2.884)	(1.662)	(17.24)	(1.378)	(1.012)	(1.325)
Y_{4t-1}	.0410	.0065	−.0227	.0174	.1820	−.0127
	(1.442)	(.2316)	(1.370)	(.1265)	(2.089)	(.2622)
Y_{5t-1}	−.0853	−.0359	.0470	−.2999	.3092	−.0650
	(2.884)	(1.143)	(1.694)	(1.620)	(2.473)	(.8351)
Y_{6t-1}	.0135	−.0507	.0881	.5205	−.2786	.0154
	(.2665)	(.9542)	(1.960)	(1.724)	(1.376)	(.1231)
R^2	.9930	.8261	.9808	.5683	.9534	.9189
$\hat{\rho}$	.0509	.2394	.9295	.6137	.7053	.8505
SEE	.0043	.0040	.0025	.0193	.0124	.0073
SSR	.0008	.0007	.0002	.0168	.0069	.0024

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.14

ESTIMATED STRUCTURE OF MODEL (4.1) FOR CHEMICAL AND ALLIED PRODUCTS (14)

(sample period: 1945I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Dependent Variables: Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−2.517	1.784	.0255	−2.222	−.2410	1.147
	(3.225)	(3.897)	(.8365)	(2.186)	(.1906)	(1.207)
Sales	.0310	−.0535	−.0187	.6156	−.1493	.0155
	(.7222)	(2.367)	(.9042)	(5.104)	(1.589)	(.3548)
Trend	.0006	.0028	.0006	−.0061	.0069	.0007
	(.5217)	(4.433)	(.8376)	(2.180)	(2.975)	(.5987)
w/c	−.0344	−.0481	.0107	−.0733	−.1151	−.0340
	(1.413)	(3.737)	(1.035)	(1.224)	(2.275)	(1.367)
Y_{1t-1}	.7126	.0149	.0414	.1661	.7827	.2790
	(8.860)	(.3590)	(.8568)	(.7092)	(4.396)	(3.517)
Y_{2t-1}	.4136	.4573	.0276	1.326	.5309	−.0918
	(1.886)	(4.051)	(.2369)	(2.010)	(1.055)	(.4261)
Y_{3t-1}	.2988	.0273	.8351	.0128	−.0833	−.1309
	(5.494)	(1.011)	(14.34)	(.0692)	(.6162)	(2.598)
Y_{4t-1}	.0772	.0086	.0017	−.0318	−.0782	.0134
	(1.821)	(.3813)	(.1035)	(.3189)	(.8240)	(.3078)
Y_{5t-1}	.0604	−.0172	−.0007	.0835	.4936	−.1035
	(1.053)	(.5994)	(.0239)	(.4647)	(3.617)	(1.929)
Y_{6t-1}	−.3892	−.2270	.1406	−.4476	.0156	1.072
	(3.724)	(4.256)	(2.103)	(1.374)	(.0651)	(10.63)
R^2	.9870	.9185	.9619	.7396	.9936	.9987
$\hat{\rho}$	.1382	.0141	.9409	.6386	.3973	.0731
SEE	.0055	.0030	.0025	.0137	.0112	.0060
SSR	.0014	.0004	.0003	.0084	.0057	.0016

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.15

ESTIMATED STRUCTURE OF MODEL (4.1) FOR PETROLEUM AND COAL PRODUCTS (15)

(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

	Dependent Variables					
Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−3.935	3.468	−.2360	−6.389	.7951	−5.120
	(2.210)	(4.590)	(.7966)	(1.723)	(.3766)	(2.791)
Sales	.0436	.0471	−.0204	.7242	.0952	.00009
	(.5612)	(1.767)	(.5641)	(5.917)	(.4920)	(.0012)
Trend	−.0010	.0009	.0015	−.0053	−.0017	−.0024
	(.9916)	(2.618)	(2.840)	(3.209)	(.6371)	(2.286)
w/c	−.0052	.0254	.0045	.1064	−.0115	−.0594
	(.1608)	(2.286)	(.2507)	(2.086)	(.1235)	(1.755)
Y_{1t-1}	.9423	.0405	.1769	−.2422	−.1483	−.0476
	(12.63)	(1.591)	(4.097)	(2.070)	(.6997)	(.6199)
Y_{2t-1}	1.040	.3114	.2358	.7808	−.8865	.9069
	(2.629)	(2.122)	(1.734)	(1.133)	(1.152)	(2.226)
Y_{3t-1}	−.0972	−.0429	.9236	.0957	.5726	.1411
	(1.103)	(1.446)	(15.98)	(.7060)	(2.113)	(1.555)
Y_{4t-1}	.0109	.0203	.0055	.2293	−.2129	−.0843
	(.1830)	(.9608)	(.2345)	(2.339)	(1.609)	(1.371)
Y_{5t-1}	.0066	−.0192	−.0033	−.1053	.4716	.0366
	(.1232)	(1.043)	(.1220)	(1.240)	(3.309)	(.6629)
Y_{6t-1}	.1039	.0196	−.0352	.0248	−.1590	.6663
	(1.092)	(.6081)	(.6526)	(.1675)	(.5889)	(6.803)
R^2	.9956	.9529	.9750	.7908	.6875	.9416
$\hat{\rho}$	−.1475	−.3175	.4873	−.3781	.3348	−.1482
SEE	.0119	.0045	.0046	.0215	.0251	.0123
SSR	.0064	.0009	.0009	.0208	.0283	.0068

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1

TABLE 6.16

ESTIMATED STRUCTURE OF MODEL (4.1) FOR RUBBER PRODUCTS (16)
(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

Independent Variables	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−4.291	1.922	−.0071	.0830	1.015	−4.057
	(2.038)	(2.531)	(.0408)	(.0615)	(.8503)	(3.626)
Sales	.3240	.2141	.0023	1.074	.0963	.0330
	(4.534)	(6.465)	(.2385)	(11.27)	(1.387)	(.8717)
Trend	−.0012	−.0006	−.0005	−.00005	.0035	.0011
	(1.133)	(1.094)	(2.975)	(.0257)	(2.639)	(2.042)
w/c	.0374	.0256	−.0009	.0484	−.0771	−.0069
	(1.113)	(1.399)	(.1370)	(.6871)	(1.664)	(.3871)
Y_{1t-1}	.6050	−.0390	.0144	.0358	.4509	.1193
	(4.794)	(.6459)	(.7858)	(.2047)	(3.514)	(1.781)
Y_{2t-1}	.7639	.4014	.0916	−.5188	−.4736	.4002
	(2.225)	(2.391)	(1.778)	(1.060)	(1.315)	(2.196)
Y_{3t-1}	.0433	.0466	.9275	−.2772	−.0100	.2467
	(.2238)	(.4970)	(31.19)	(.9345)	(.0483)	(2.401)
Y_{4t-1}	−.1514	−.0262	−.0310	.1221	.0401	−.0621
	(2.261)	(.8126)	(3.128)	(1.285)	(.5788)	(1.749)
Y_{5t-1}	−.1266	−.1289	.0444	−.3562	.5692	.0865
	(1.255)	(2.490)	(2.603)	(2.073)	(4.746)	(1.616)
Y_{6t-1}	.1642	−.0216	.1006	−.4141	−.3722	.3877
	(.5937)	(.1694)	(2.724)	(1.219)	(1.448)	(2.639)
R^2	.9874	.8650	.9995	.8654	.9832	.9971
$\hat{\rho}$	−.3485	−.0026	.2467	.3850	.2609	−.3504
SEE	.0225	.0095	.0027	.0263	.0194	.0119
SSR	.0228	.0041	.0003	.0313	.0169	.0064

NOTE: Figures in parentheses are t statistics. w/c denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For $\hat{\rho}$, see Chapter 4, note 1.

TABLE 6.17

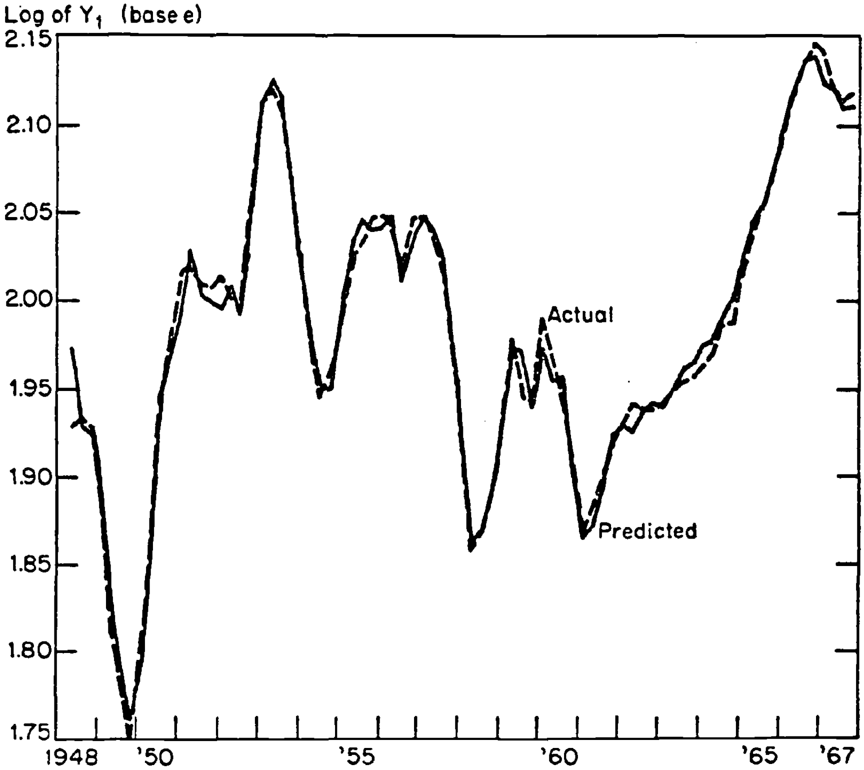
ESTIMATED STRUCTURE OF MODEL (4.1) FOR OTHER NONDURABLES (17)
(sample period: 1954I–1967IV; all variables except trend are in natural logarithms)

	Dependent Variables					
Independent Varaibles	Prod. Emp. (Y_{1t})	Hours (Y_{2t})	Capital (Y_{3t})	Util. (Y_{4t})	Inven. (Y_{5t})	Nonprod. Emp. (Y_{6t})
Constant	−1.684	−.1273	.3086	1.676	3.392	−.8909
	(4.442)	(.2206)	(1.113)	(.9664)	(1.614)	(2.738)
Sales	.0794	.0625	.0373	.8112	.1958	.0468
	(2.233)	(1.548)	(1.574)	(6.886)	(1.128)	(1.788)
Trend	.0002	.00007	−.00006	−.0046	−.0007	.00003
	(.5197)	(.1377)	(.1729)	(2.838)	(.2917)	(.0877)
w/c	−.0346	−.0329	−.0050	−.1030	.0873	−.0197)
	(2.384)	(2.350)	(.5405)	(2.560)	(1.313)	(2.000)
Y_{1t-}	.6144	−.0756	.1667	1.467	.8206	.0820
	(5.413)	(.7249)	(2.340)	(4.920)	(1.618)	(1.094)
Y_{2t-1}	.4900	.8944	−.1665	−1.160	−.9740	.1263
	(3.546)	(6.905)	(1.898)	(3.135)	(1.555)	(1.362)
Y_{3t-1}	.2221	.1487	.9907	.0196	−.2161	.0727
	(4.906)	(3.749)	(35.62)	(.1731)	(1.099)	(2.516)
Y_{t-1}	.0174	−.0299	.0125	.2495	−.0502	.0090
	(.5892)	(.8453)	(.6260)	(2.408)	(.3398)	(.4021)
Y_{5t-1}	−.0343	.0195	.0245	−.1775	.6322	.0109
	(.9353)	(.5034)	(1.015)	(1.587)	(3.604)	(.4160)
Y_{6t-1}	−.3063	−.3427	−.0877	−1.280	.2130	.7555
	(1.947)	(2.292)	(.8793)	(2.991)	(.2987)	(7.142)
R^2	.9804	.8002	.9988	.8166	.9433	.9979
β	.1766	−.3125	.0558	−.3781	0.0	−.0440
SEE	.0052	.0063	.0035	.0187	.0257	.0038
SSR	.0012	.0017	.0005	.0158	.0297	.0006

NOTE: Figures in parentheses are *t* statistics. *w/c* denotes relative prices. R^2 is the coefficient of determination; *SEE*, the standard error of estimate; *SSR*, the sum of squared residuals. For β, see Chapter 4, note 1.

CHART 6.1

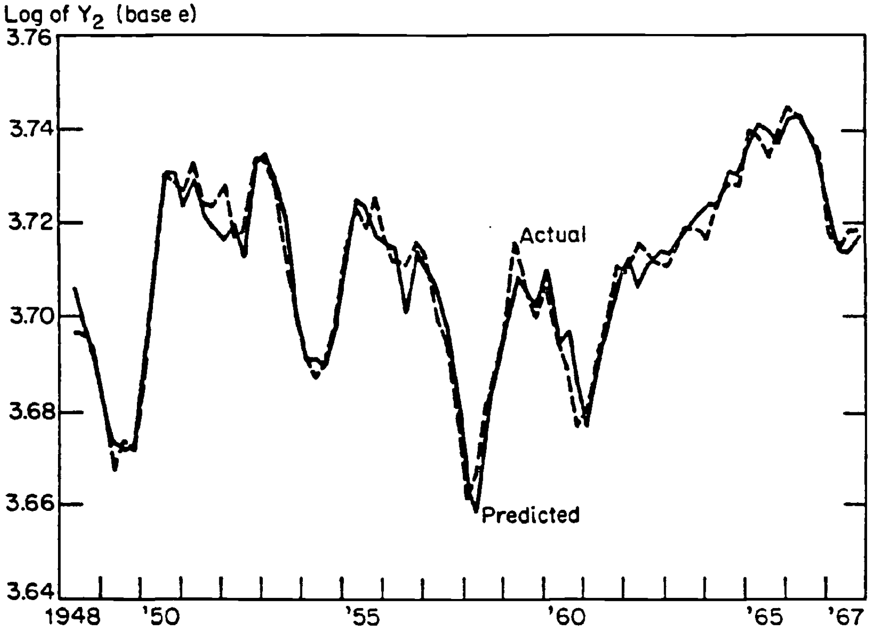
ACTUAL AND ESTIMATED VALUES OF THE STOCK OF PRODUCTION WORKERS (Y_1), TOTAL DURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.2

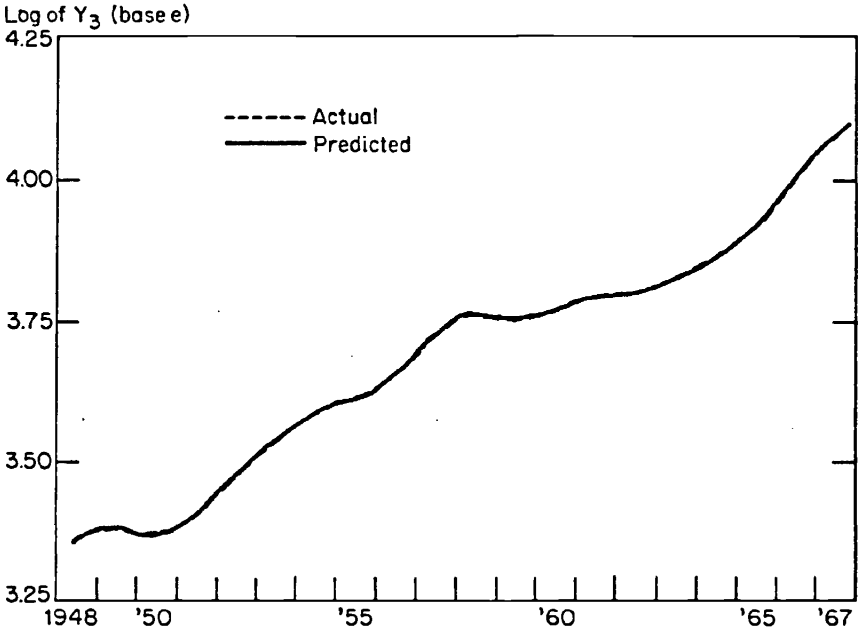
ACTUAL AND ESTIMATED VALUES OF HOURS OF WORK OF PRODUCTION WORKERS (Y_2), TOTAL DURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.3

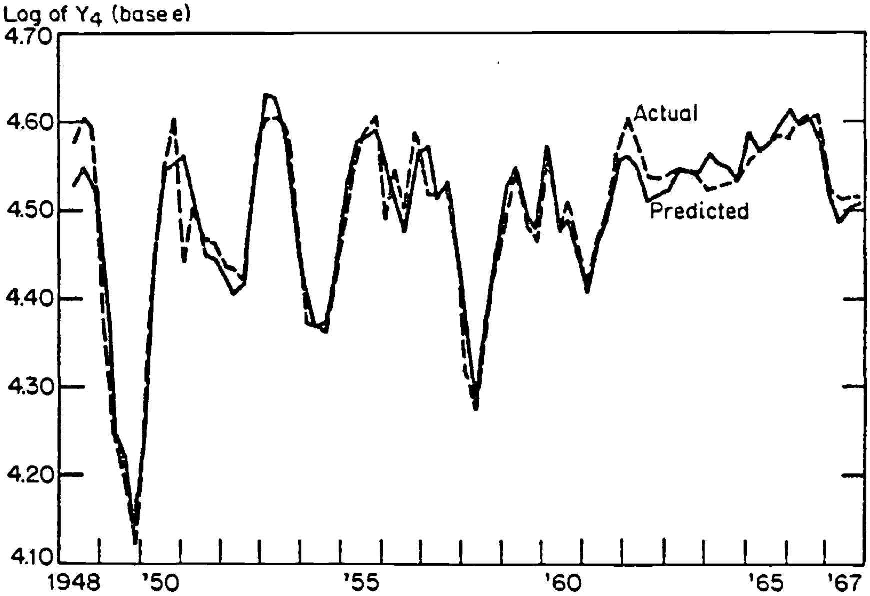
ACTUAL AND ESTIMATED VALUES OF CAPITAL STOCK (Y_3), TOTAL DURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.4

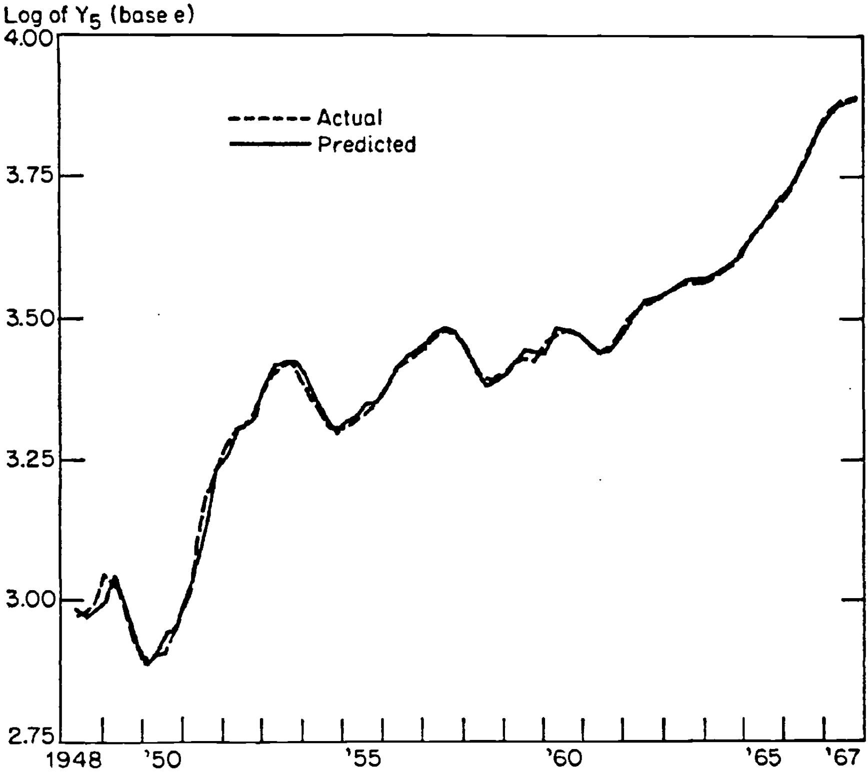
Actual and Estimated Values of the Utilization Rate (Y_4), Total Durables, 1948I–1967IV



Source: Based on model (4.1).

CHART 6.5

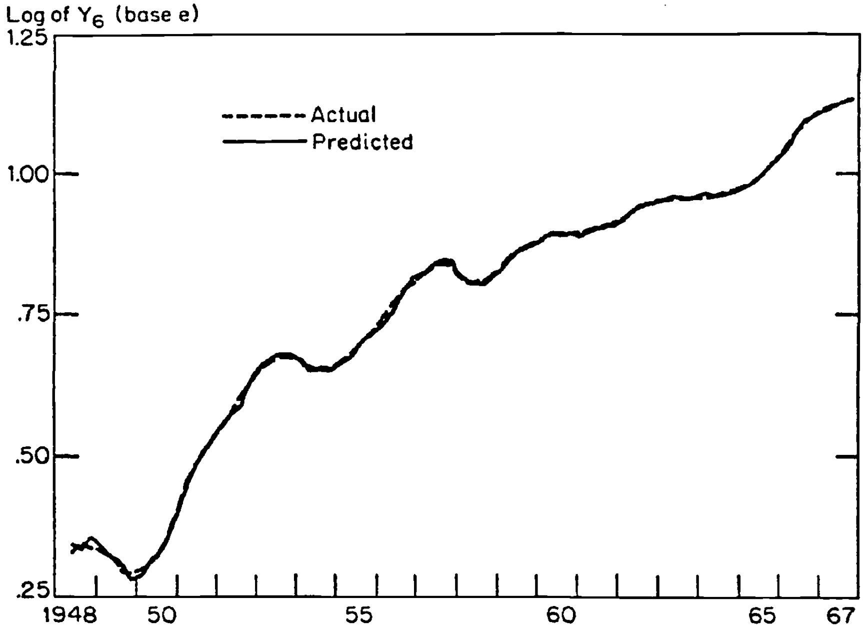
ACTUAL AND ESTIMATED VALUES OF TOTAL INVENTORIES (Y_5),
TOTAL DURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.6

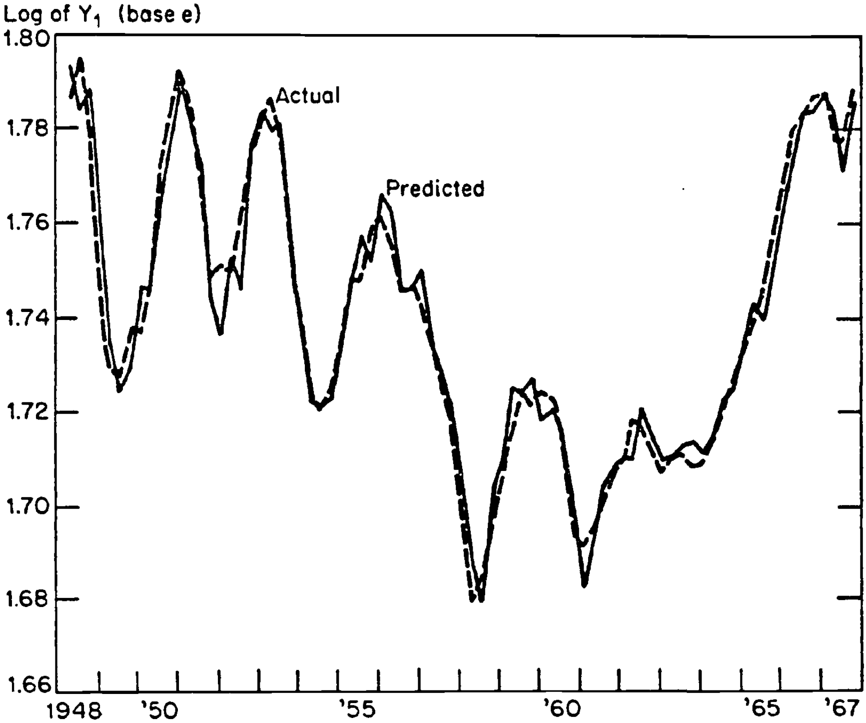
ACTUAL AND ESTIMATED VALUES OF THE STOCK OF NONPRODUCTION WORKERS (Y_6), TOTAL DURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.7

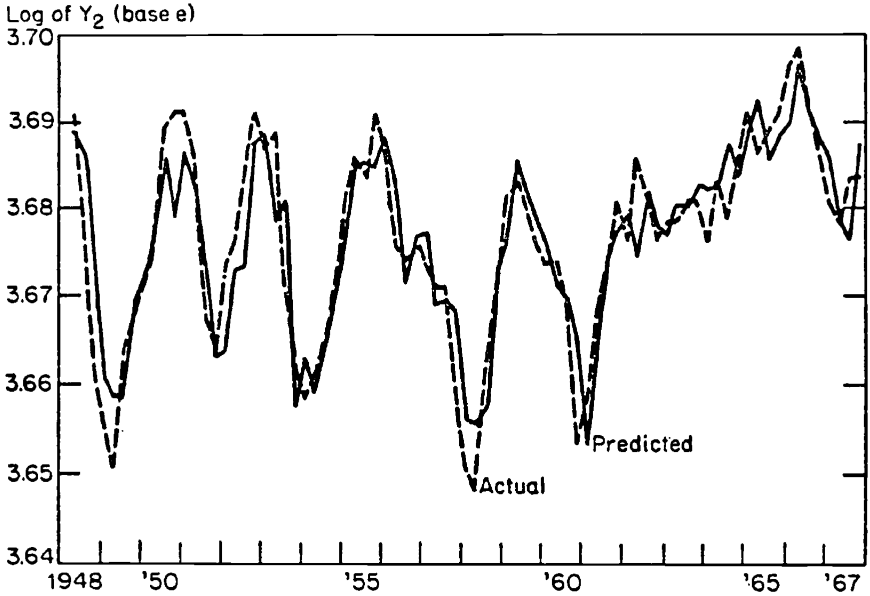
ACTUAL AND ESTIMATED VALUES OF THE STOCK OF PRODUCTION WORKERS (Y_1), TOTAL NONDURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.8

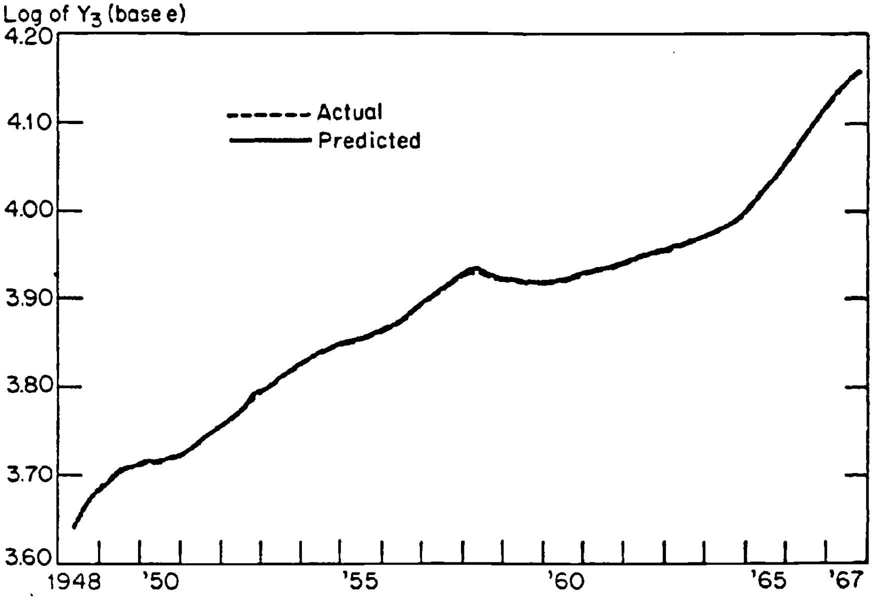
ACTUAL AND ESTIMATED VALUES OF HOURS OF WORK OF PRODUCTION WORKERS (Y_2), TOTAL NONDURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.9

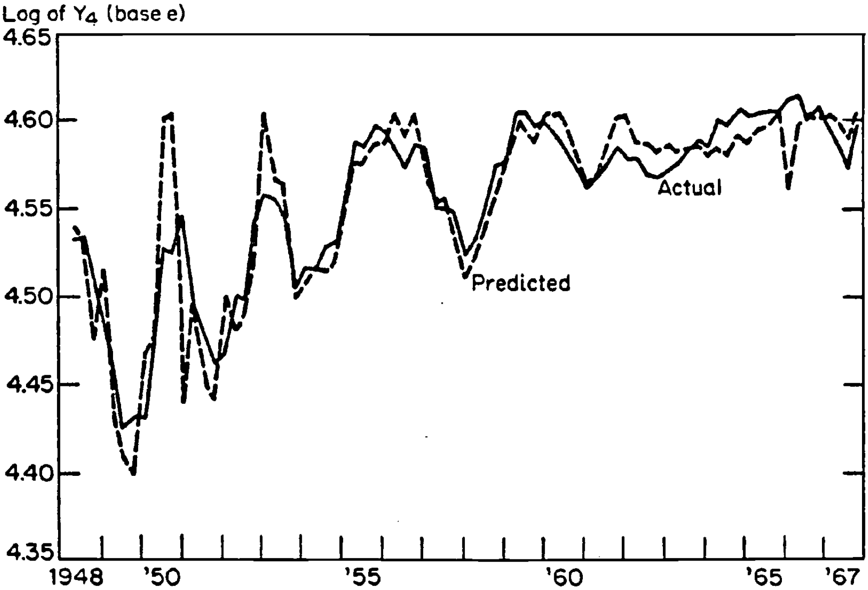
ACTUAL AND ESTIMATED VALUES OF CAPITAL STOCK (Y_3), TOTAL NONDURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.10

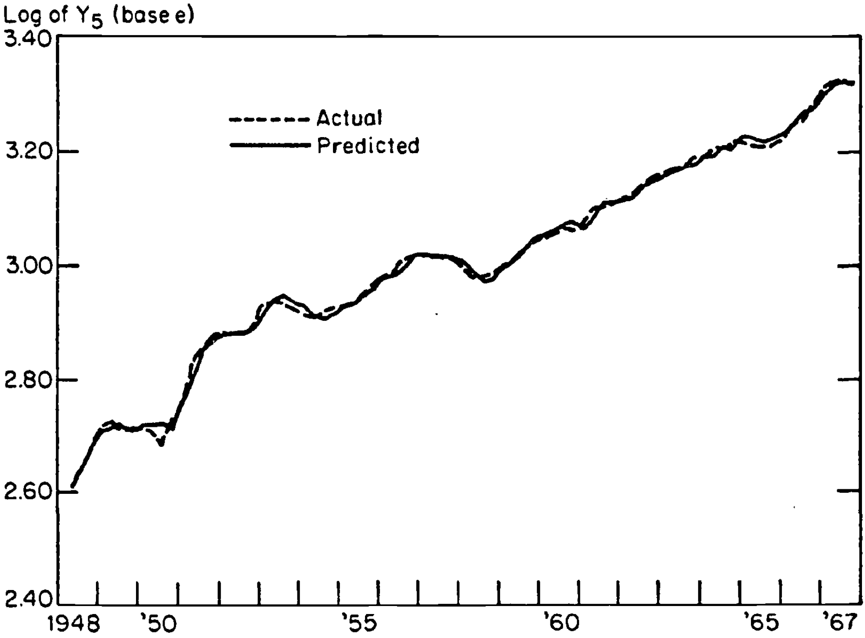
ACTUAL AND ESTIMATED VALUES OF THE UTILIZATION RATE (Y_4), TOTAL NONDURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.11

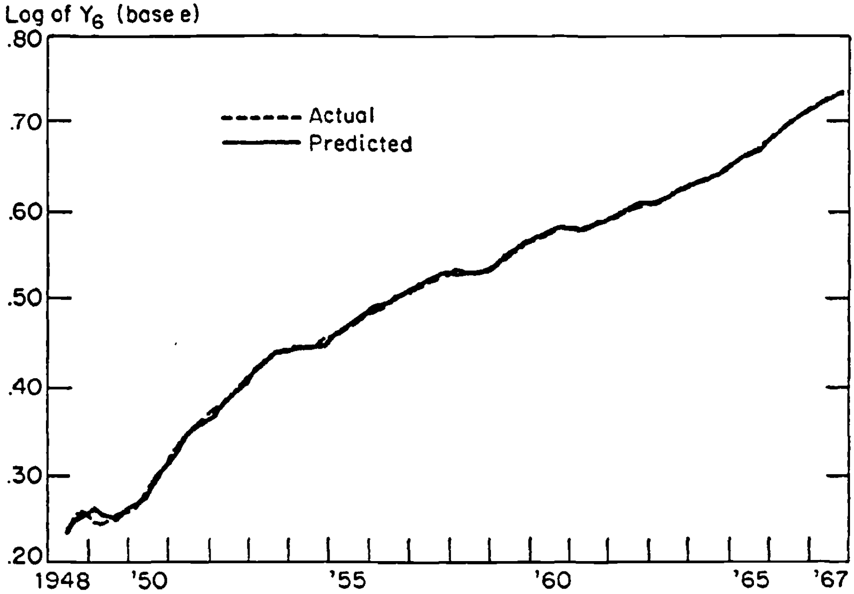
ACTUAL AND ESTIMATED VALUES OF TOTAL INVENTORIES (Y_5), TOTAL NONDURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

CHART 6.12

ACTUAL AND ESTIMATED VALUES OF THE STOCK OF NONPRODUCTION WORKERS (Y_6), TOTAL NONDURABLES, 1948I–1967IV



SOURCE: Based on model (4.1).

high serial correlation in the capital stock variable, Y_3. There is no evidence of any systematic pattern among estimated values of $\hat{\rho}$ for stock equations, though the values are generally higher than those for the flow variables. However, this relation does not always hold, for example, in motor vehicles, other durables, or chemical and allied products. In the nondurable industries, the general rate of utilization, Y_4, shows large values of ρ.

The over-all picture that emerges from consideration of the coefficients of the variables in these tables can be summarized as follows:

a. Short-run elasticities of the dependent variables with respect to the exogenous variables S_t, T, and (w/c) are often statistically significant at the 95 per cent level of confidence. Signs and magnitudes of these elasticities differ, of course, from industry to industry, and the systematic relationships that exist in the pattern of these elasticities will be discussed below.

b. The own-adjustment coefficients are always positive, as expected, and typically statistically significant for each dependent variable in each industry. The main exception to this observation is the coefficient for the generalized utilization rate: The coefficient of Y_{4t-1} is statistically not different from zero in most industries. This implies a very large adjustment coefficient, almost unity, for this variable in every industry; this is the expected pattern. The general rate of utilization is the most highly variable among the inputs. Further discussion of the own-adjustment lags will be taken up below.

c. There is evidence of considerable feedback among the dependent variables. The feedback patterns differ among industries.

On the whole, the evidence reported in Tables 6.1–6.17 is consistent with the a-priori specification of our model. Not only are the underlying data successfully explained, but the adjustment structure postulated by model (4.1) is also borne out by the estimates.

ii. Short-Run Elasticities

Impact elasticities of each dependent variable with respect to the exogenous variables S, (w/c), and T are indicated in the top rows of each table. Specific features and variations from industry to industry can be summarized briefly.

a. Sales elasticities. The short-run elasticities of all dependent variables (except capital stock, Y_3) are positive and often statistically significant.

Their magnitudes in the durable industries are generally larger than in the nondurable industries. Capital stock, Y_3, in most industries has a negative and/or statistically insignificant impact elasticity of sales. In some industries such as 04, 05, 07, 12, 13, and 16, the sales elasticity of non-production workers and inventories is not statistically different from zero. However, this is not as prevalent as in the case of capital stock. In some industries, such as electrical machinery and equipment and transportation equipment among the durables, and in petroleum and coal products among the nondurables, none of the stock variables is responsive, in the short run, to changes in sales. In almost all durable industries short-run sales elasticities of general utilization are about unity or close to it. However, in the nondurable industries, the short-run sales elasticities of Y_4, though very high, are below 1.

The evidence on the sales elasticity of the various inputs precludes any systematic ranking of the strength of the sales effect. In most of the nondurables the sales elasticities of the stock of inventories, Y_5, are fairly large in comparison with Y_1 and Y_2, while in the durable industries, Y_1 seems to be more responsive than the other dependent variables except Y_4. In some industries nonproduction workers, too, have fairly large sales elasticities.

b. Trend effects. Estimated trend coefficients are highly variable and often statistically insignificant. The utilization rate and production worker inputs almost always have negative trends, but no other patterns of trend sign emerge across industries. The magnitudes of trend coefficients are generally smaller in the equations for capital stock and nonproduction worker employment.

c. Price elasticities. Few of the inputs in different industries show substantial price elasticities in the short run. In the durable industries, production worker employment is sensitive to price (w/c) in most cases, and in some durable industries the stocks of inventories and nonproduction worker employment also display statistically significant price elasticity. Hours worked have nonzero short-run price elasticity in electrical machinery (04), stone (08), and other durables (09). On the whole, Y_3, capital stock, shows very little short-run response to changes in relative prices in durable goods industries. Generally, the signs of the price coefficients across the durable industries are negative for labor equations and positive for capital stock equations. The signs of this variable in the general utilization and inventory equations do not follow consistent patterns and are often statistically insignificant. In most of the nondurable industries, production workers, hours, inventories, and utilization rates display significant short-run price responses. Nonproduction workers are also sensitive to changes in prices in some industries—paper (13), chemicals (14), petroleum (15), and other nondurables (17)—while capital stock is relatively price-elastic in industry 13 only. Thus, labor stocks and hours worked often have expected signs and statistically significant price elasticities in individual industries: occasionally inventories and the utilization rate also show some price sensitivity. Capital stock, on the other hand, almost always has a zero price elasticity in the short run. However, in all cases the magnitudes of the price responses are quite small.

iii. Own Adjustments

As noted before, own-adjustment coefficients, i.e., $1 - \hat{b}_{ii}$ in equation (4.1), must be positive and less than 1. Also, we expect own adjustments of utilization rates to be greater than those of stock variables. Table 6.18 indicates estimated own-adjustment coefficients in each industry. Several observations can be made about these estimates.

The generalized utilization rate, Y_4, is truly variable. Its own-adjustment coefficient is very close to unity in all cases. The own adjustment of hours of work, Y_2, varies across industries. On the whole, its adjustment coefficients have fairly high values and are larger than those for the labor stock variables. Also, hours tends to adjust slightly faster in the nondurable than in the durable industries. Capital stock, Y_3, shows the lowest adjustment coefficient, ranging from about 0.04 to 0.14 among the durables and from 0.0 to 0.10 among the nondurables. It is interesting to note that there are no significant differences in magnitude among both groups of industries. In contrast, nonproduction workers, Y_6, shows very high own-adjustment coefficients in most nondurable industries but much lower responses in durable goods industries. No significant pattern of own-adjustment coefficients emerges for production workers, Y_1. However, it should be noted that in nonautomotive transport (07) and petroleum (15) the coefficient of production workers is exceedingly large. Finally, in most industries, but especially in nondurables, the own-adjustment coefficient of the stock of inventories, Y_5, is more rapid than

TABLE 6.18

Own-Adjustment Coefficients of Dependent Variables in Individual Manufacturing Industries[a]

	Industries																
	Durables									Nondurables							
Variables	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Y_1	.47	.84	.54	.21	.52	.64	.02	.42	.41	.40	.47	.70	.31	.29	.06	.40	.39
Y_2	.30	.40	.62	.85	.28	.78	.28	1.0	.56	.40	.32	.71	.80	.54	.69	1.0	.11
Y_3	.12	.13	.09	.14	.09	.10	.12	.13	.04	.07	0.0	.08	.10	.07	.08	.07	.01
Y_4	.64	1.0	1.0	.51	1.0	1.0	1.0	1.0	1.0	.86	.63	1.0	1.0	1.0	.78	1.0	.76
Y_5	.40	.37	.20	.26	.31	.52	.25	.42	.72	.35	.90	.40	.71	.50	.53	.43	.37
Y_6	.19	0.0	.34	.06	.14	.36	.38	.67	.34	.07	.90	.68	1.0	.09	.33	.61	.24

a. These coefficients are calculated, from the own-regression coefficients in Tables 6.1 to 6.17, by deducting the value of the regression coefficients from unity. The industry codes are identified at the beginning of this chapter; the variables, in Table 6.17.

that of production workers. Most goods are made to order in durable goods industries and this result may reflect that practice. This issue will be discussed later on.

iv. Cross Adjustments

The pattern of the cross adjustments among the variables shows evidence of substantial feedbacks in all industries. As must be expected, the magnitudes of these feedbacks differ from one industry to another. However, some regularities in these patterns should be noted. The pattern of cross effects among the variables as a whole suggests that: (a) stock variables tend to be "dynamic complements" in the adjustment process; (b) flow variables respond rapidly to changes in exogenous variables, signaling subsequent changes in stock variables; (c) feedbacks among the stock variables are not always symmetrical; and (d) most of the feedbacks seem to be linked through the stock of production workers.

The following are some salient features of these interrelationships:

a. The disequilibrium effect of excess demand for production workers is mostly channeled through stock variables in various industries. It occurs infrequently. When it does its impact on the flow variables, Y_2 and Y_4, is positive and large, and concentrated mainly on Y_4. Note that the feedbacks between Y_1 and Y_2 are all concentrated among the durables and, except for food and beverages (11), this feedback does not occur among the nondurables.

b. The main effect of disequilibrium in hours worked falls on the demand for production workers, Y_1, in the equation for all industries, on nonproduction workers, Y_6, in durables, and on the level of inventories, Y_5, in nondurables. Disequilibrium in hours worked also has significant impacts, however, on generalized utilization rates, Y_4, and tends to be dynamically complementary with it.

c. Disequilibrium in capital stock, Y_3, affects production workers mainly in nondurables. It has a complementary relationship with non-production workers. Its effect on hours of work is concentrated mostly among the nondurables and on the generalized utilization rate among the durables.

d. Disequilibrium in the generalized utilization rate mainly increases demand for production workers and inventories. There is also some feedback from the excess demand for Y_4 on capital stock in several industries, and very few cases of feedbacks from disequilibrium in Y_4 on the other rate of utilization, Y_2, and the stock of nonproduction workers. The negative feedback from disequilibrium in Y_4 on demand for production workers is concentrated in the nondurables. The effect of excess demand for Y_4 on the level of inventories is mainly positive, suggesting that excess demand for Y_4 increases stocks of inventories. As the rate of capital utilization rises, demand for inventories increases as well. There is no observable effect on capital stock and nonproduction workers. The absence of feedback between Y_4 and Y_2 in most industries suggests that both may be responding to changes in stocks or variations in the exogenous variables.

e. Excess demand for inventories positively affects the demand for production workers and the rate of utilization of capital in almost all industries. The strongest effect falls mainly on demand for Y_4, and then on Y_1. There is evidence of some positive effect, mainly in the durable goods industries, of excess demand for inventories on demand for hours. Only a few cases of feedbacks of disequilibrium in inventory holdings on demand for stocks of capital and nonproduction workers are observed.

f. The cross effects of excess demand for nonproduction workers are mainly centered on demand for capital stock, Y_3, and the rate of utilization, Y_4. Excess demand for Y_6 decreases demand for investment in all industries where significant cross effects are present, durable goods in particular. In half of the durable goods industries, excess demand for nonproduction workers leads to decreases in both stocks of production workers and levels of inventories. In the nondurables this relationship is negative and occurs very infrequently.

The importance of cross adjustments in factor demand functions is summarized in Table 6.19. Entries in the table show the percentage of statistically significant cross effects (i.e., $\hat{b}_i$) of each variable in each industry, derived from Tables 6.1–6.17. Each variable can have a maximum of five statistically significant interactions. The numbers in each cell are the actual number of significant coefficients divided by 5.0. The numbers in the last row give the fraction of significant cross effects of all variables in each industry. The last column indicates the fraction of significant cross effects of each input across industries.

Though the pattern of cross effects varies across industries, the following general observations are warranted: Production worker employment and hours (Y_1 and Y_2) have the highest number of cross effects, while the

TABLE 6.19

FREQUENCY OF STATISTICALLY SIGNIFICANT CROSS EFFECTS OF MODEL (4.1) FOR INDIVIDUAL MANUFACTURING INDUSTRIES[a]

(per cent)

	Industries																
	Durables								Nondurables							Percentage Frequency Across
Variables	02	03	04	05	06	07	08	09	11	12	13	14	15	16	17	All Industries[b]
Y_1	0.6	.6	.2	.2	.8	.8	0.8	.6	.8	.8	.8	.4	.6	.4	0.6	.60
Y_2	1.0	.4	.6	.6	.8	.8	0.2	.2	.6	.4	.4	.4	.6	.8	1.0	.58
Y_3	0.2	.2	.2	.2	.4	.4	0.8	.8	.8	.8	.8	.4	.6	.2	0.6	.49
Y_4	0.2	.8	.4	.2	.4	.6	0.4	.2	.6	.2	.6	.2	.4	.6	0	.38
Y_5	0.4	.6	.8	.2	.4	.2	1.0	.4	.4	.2	.6	.2	0	.6	0.2	.41
Y_6	1.0	.6	.4	.2	.2	.2	0.4	.6	.2	.6	.6	.8	0	.6	0.6	.46
All inputs[c]	0.57	.53	.43	.27	.50	.50	0.60	.47	.57	.50	.63	.40	.37	.53	0.50	

a. The industry codes are identified at the beginning of this chapter; the variables, in Table 6.17.
b. Fraction of significant cross effects of each input across all industries.
c. Fraction of significant cross effects of each industry across inputs.

generalized rate of utilization, Y_4, and inventories, Y_5, have the lowest. In addition, there is no significant difference between the relative frequencies of durable and nondurable industries.

In conclusion, the results of cross-adjustment effects indicate that (i) feedbacks are important; (ii) the model captures them quite well; (iii) their patterns and directions differ, depending on the types of variable and industry characteristics involved; and (iv) there are strong "dynamic" complementarities and substitution relations among the stock variables. The own- and cross-adjustment effects for each industry imply corresponding distributed lag patterns and long-run elasticities for each variable.

B. DYNAMIC PROPERTIES

i. Distributed Lags

Transient response patterns of the variables to a unit of sales input are calculated for each industry in the manner described in Chapters 2 and 3. The distributed lag responses of the variables to changes in relative prices are ignored because the impact coefficients are numerically small and often statistically insignificant. In order to highlight the comparisons, we first concentrate on total durables and total nondurables; then we present the results for the individual industries.

Distributed lag patterns for the two aggregate industry groups are exhibited in Figures 6.1 and 6.2. On the whole, lags in durable and nondurable industries trace the same pictures as described above for total manufacturing. Utilization rates (Y_2 and Y_4) are the first and most rapidly adjusting inputs, particularly the generalized utilization rate. They overshoot their long-run values within three quarters after the shock and resume their most rapid movements back toward stationary values within seven quarters. Among stock variables, production worker employment (Y_1) adjusts most rapidly, followed by nonproduction workers and inventories. Capital stock is the slowest-adjusting input, tracing the characteristic "bell" pattern noted above for total manufacturing. There is no evidence of overshooting for production workers and capital stock, but there is some for nonproduction workers and inventories.

Generally speaking, the response patterns of total nondurables are displaced one or two quarters in time compared with total durables. More specifically, the responses of nondurables production worker

FIGURE 6.1

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: DURABLE GOODS (01)

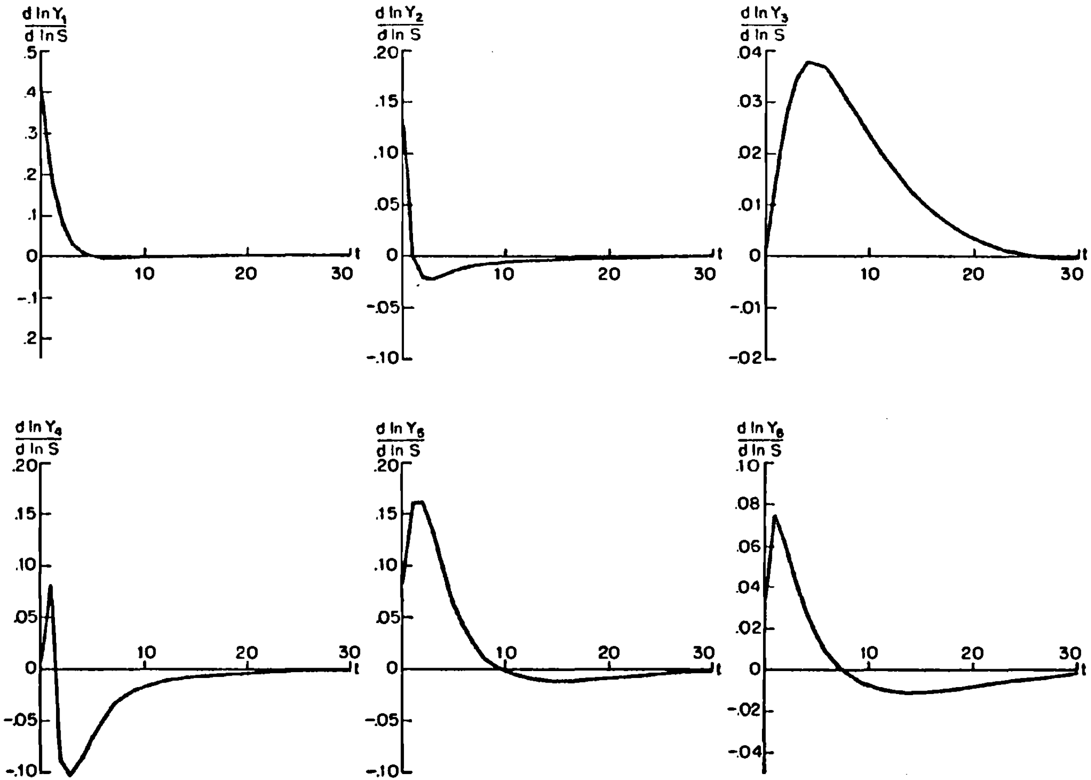
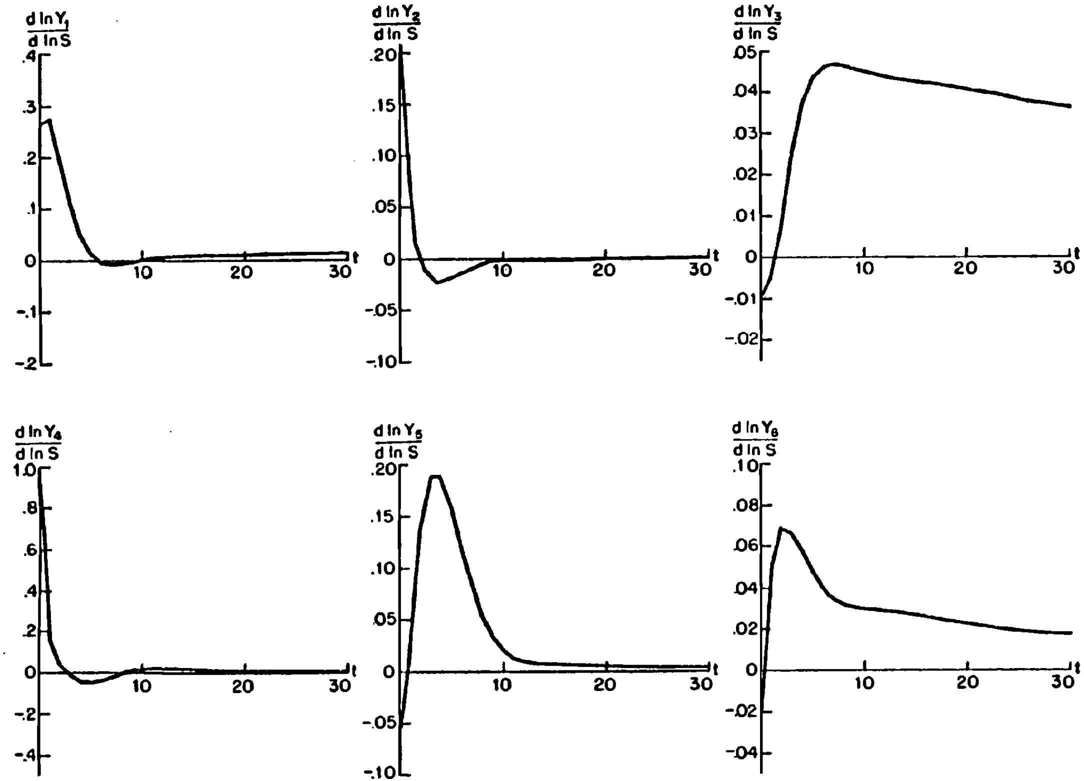


FIGURE 6.2

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: NONDURABLE GOODS (10)



employment and hours worked lag behind the corresponding measures in durables by one quarter. Other stock variables (Y_3, Y_5, Y_6) in nondurables lag behind their counterparts in durables by at least two quarters. Initial responses are most often positive, with the exception of nondurable inventories and nonproduction workers. For all the stock variables, magnitudes of response are greater for durables than for nondurables. Lag patterns of most nondurable stock variables exhibit "thick" tails, accounting for similar patterns in total manufacturing as a whole. This property is most pronounced for capital stock, followed by nonproduction worker employment, and to a lesser extent, production worker employment. An explanation of these differences is related to the inventory decisions in the two types of industries, a subject to which we shall return in the next chapter.

Distributed lag patterns of the individual industries are shown in Figures 6.3–6.13. In contrast to most of the figures above, the response patterns here are not normalized. Hence, long-run elasticity is given by the area under the curve.

In most cases, the production worker distribution shows the greatest responses in the first and second period; the values often overshoot long-run equilibrium values except in four industries, where geometric patterns are traced. The mode of the distribution of hours worked (Y_2) always occurs in the first period, and in almost all cases the curve overshoots its final equilibrium value within a few periods after the impulse. On the other hand, capital stock (Y_3) exhibits a bell-shaped pattern although, in some industries, it is heavily skewed, exhibiting a thick tail. In a few industries, there are oscillatory patterns, especially in petroleum and coal products (15). The generalized utilization rate (Y_4) is the most regularly behaved variable, overshooting equilibrium values within two periods in every case. Inventories (Y_5) display the same pattern as production workers except that they are more dispersed in time. Slight irregularities are present in some cases. Finally, nonproduction worker responses are similar to those of inventories, though somewhat more regular. In most cases there is overshooting eight quarters after the shock.

In four industries, three of them nondurable, the model fails to depict the responses of the variables in a meaningful manner. The industries are transportation equipment excluding motor vehicles (07), chemical and allied products (14), food and beverages (11), and rubber products (16). In the first two, the dynamic system is stable, that is, the largest character-

FIGURE 6.3

Distributed Lag Responses to a Unit Sales Impulse: Primary Iron and Steel (02)

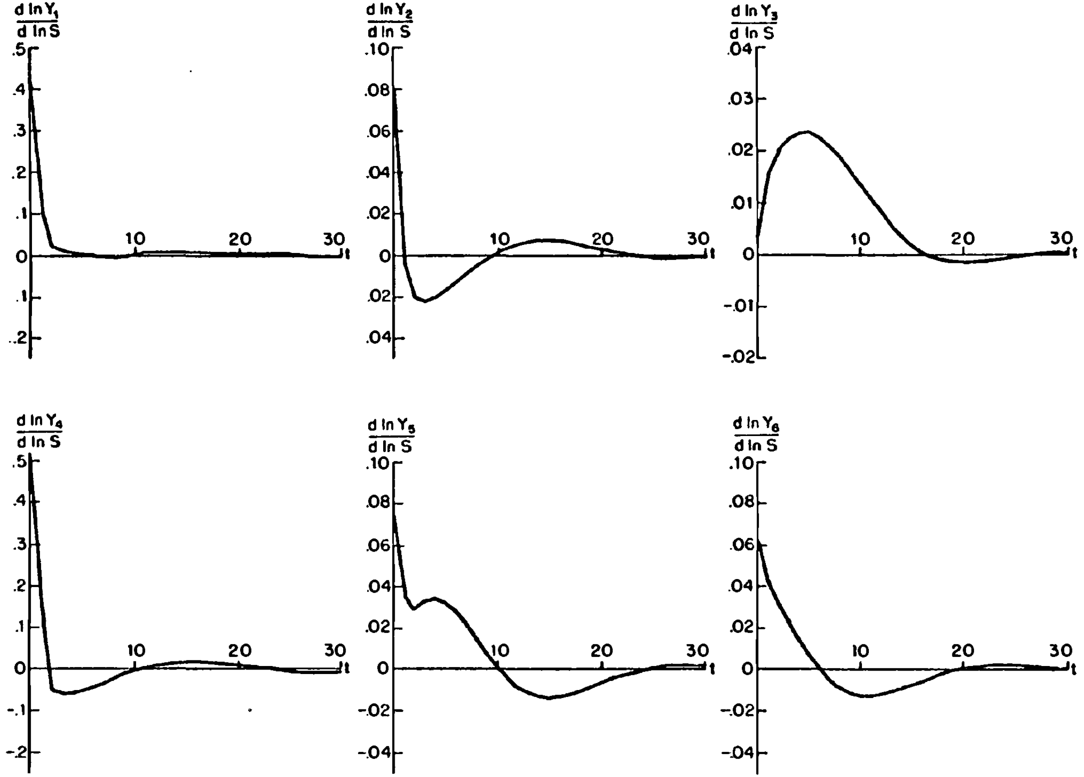


FIGURE 6.4

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: PRIMARY NONFERROUS METAL (03)

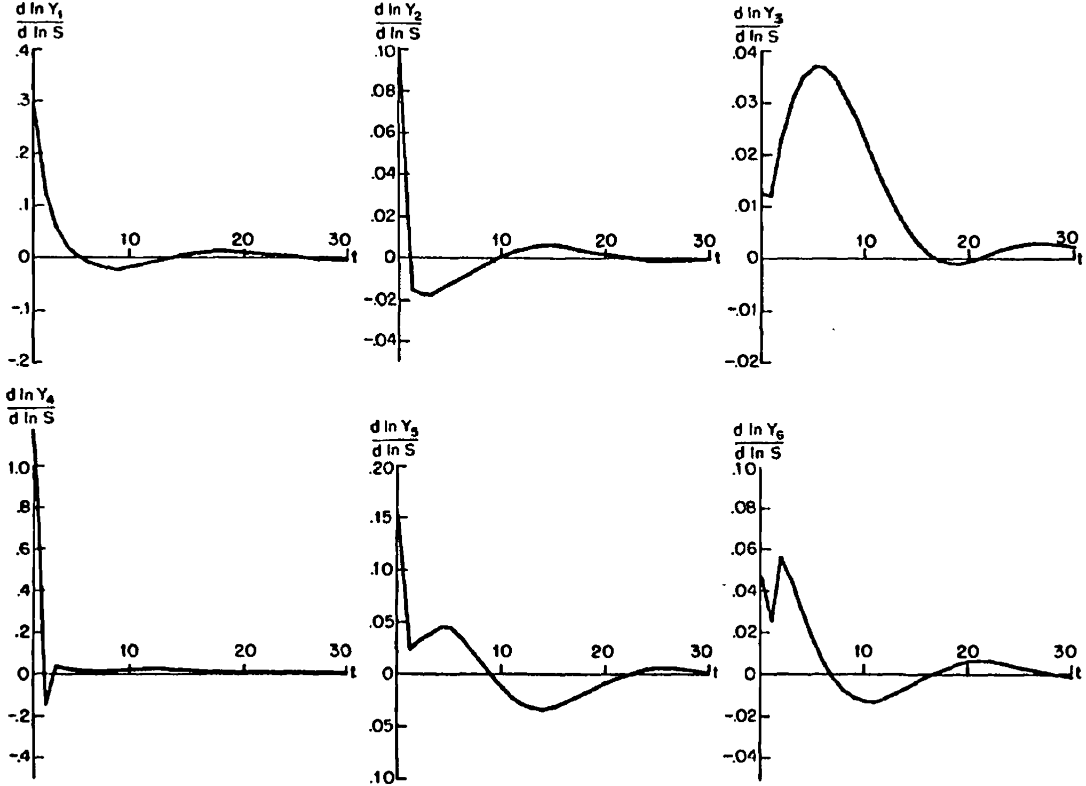


FIGURE 6.5

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: ELECTRICAL MACHINERY AND EQUIPMENT (04)

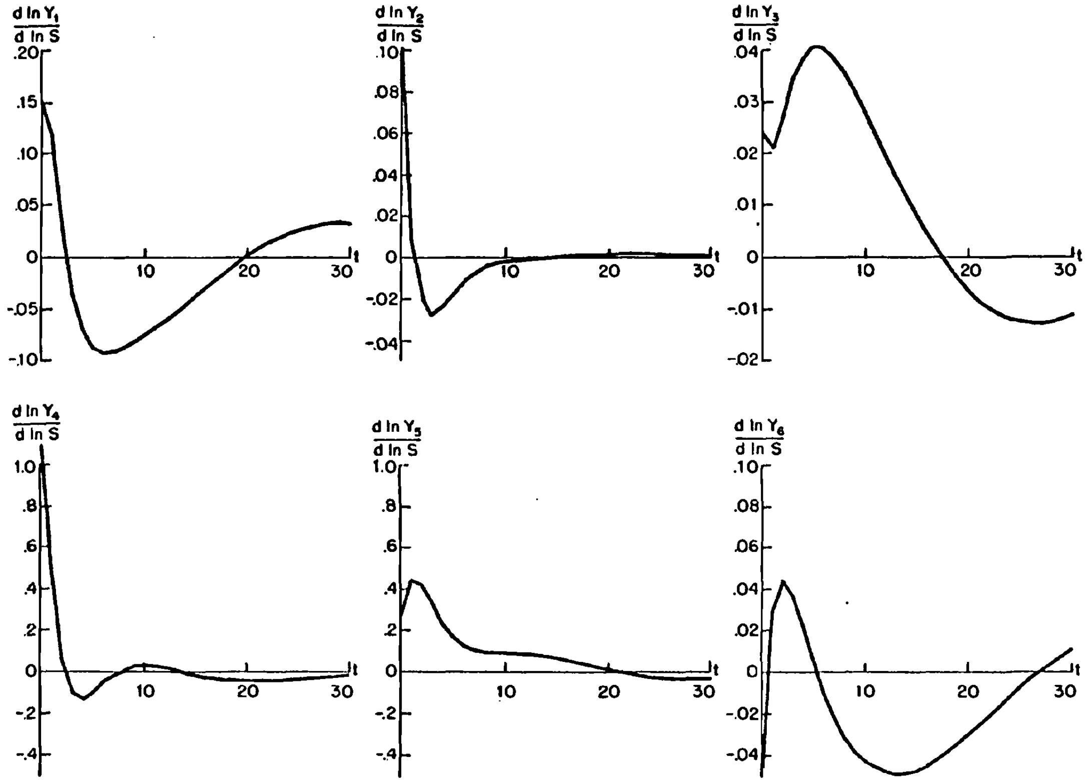


FIGURE 6.6

Distributed Lag Responses to a Unit Sales Impulse: Machinery Except Electrical (05)

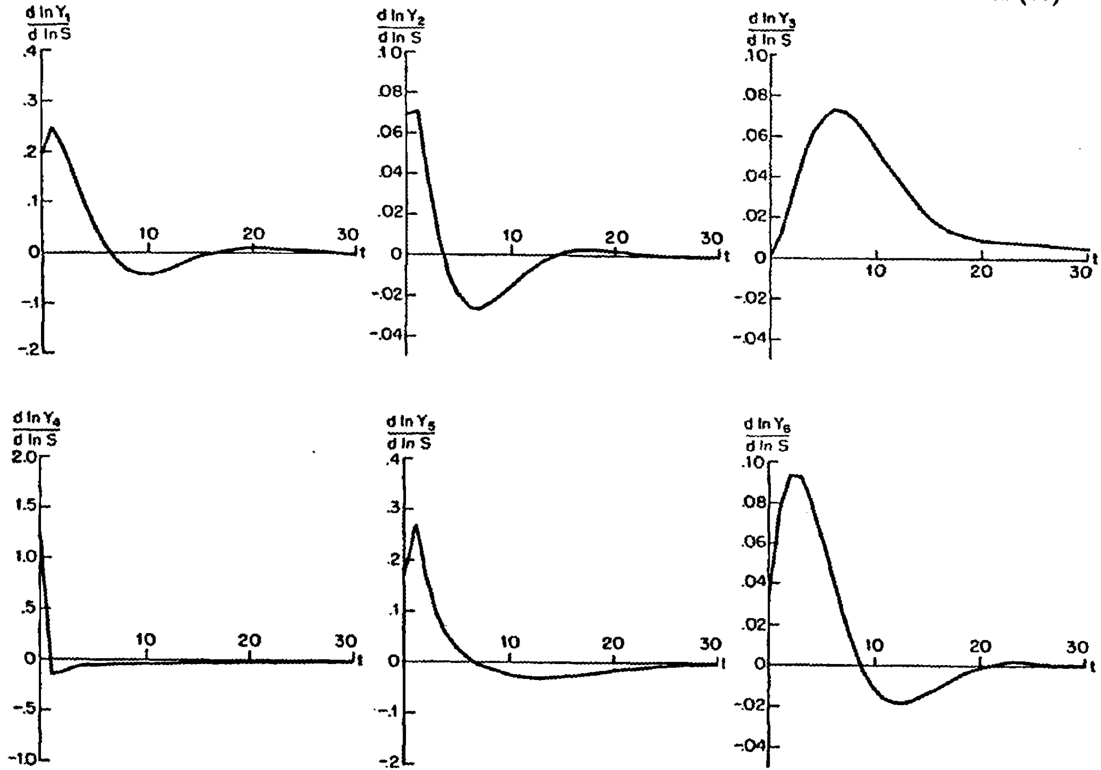


FIGURE 6.7

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: MOTOR VEHICLES AND EQUIPMENT (06)

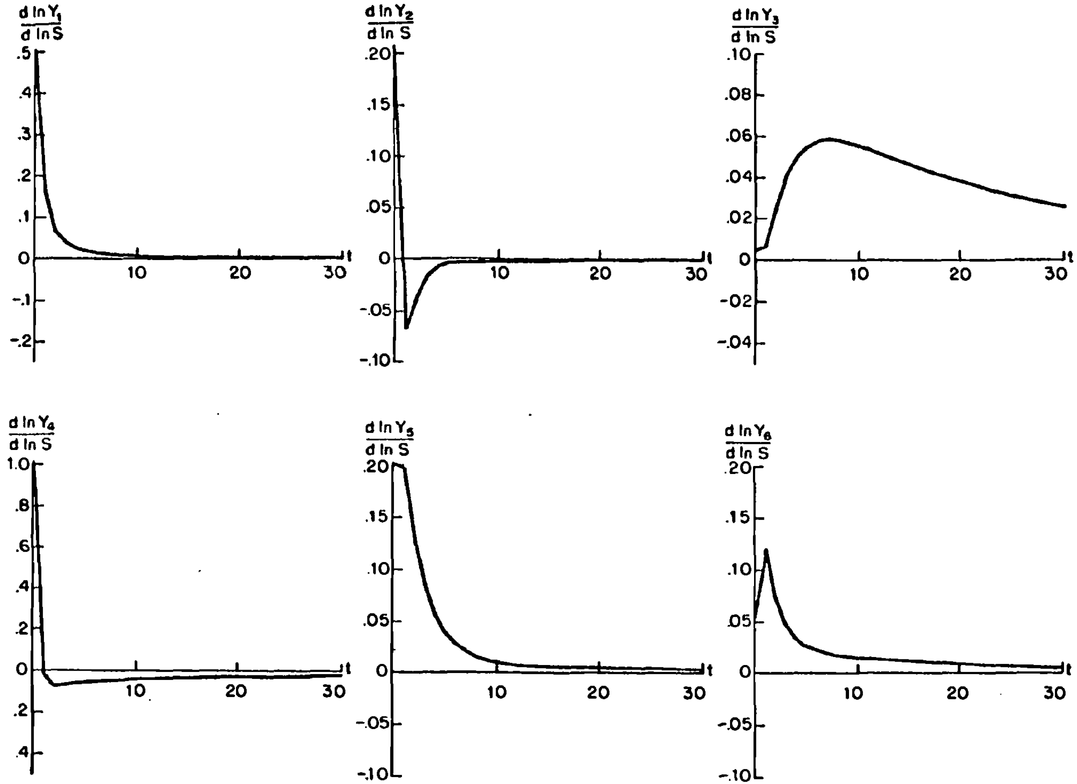


FIGURE 6.8

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: STONE, CLAY, AND GLASS PRODUCTS (08)

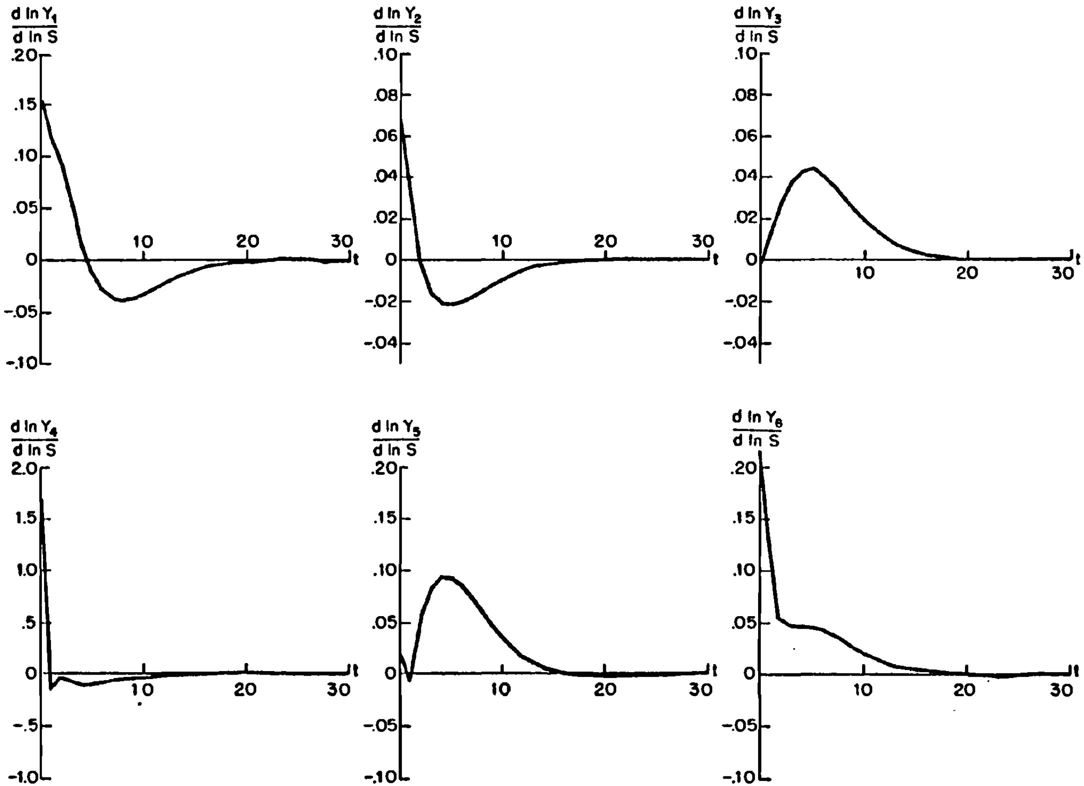


FIGURE 6.9

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: OTHER DURABLES (09)

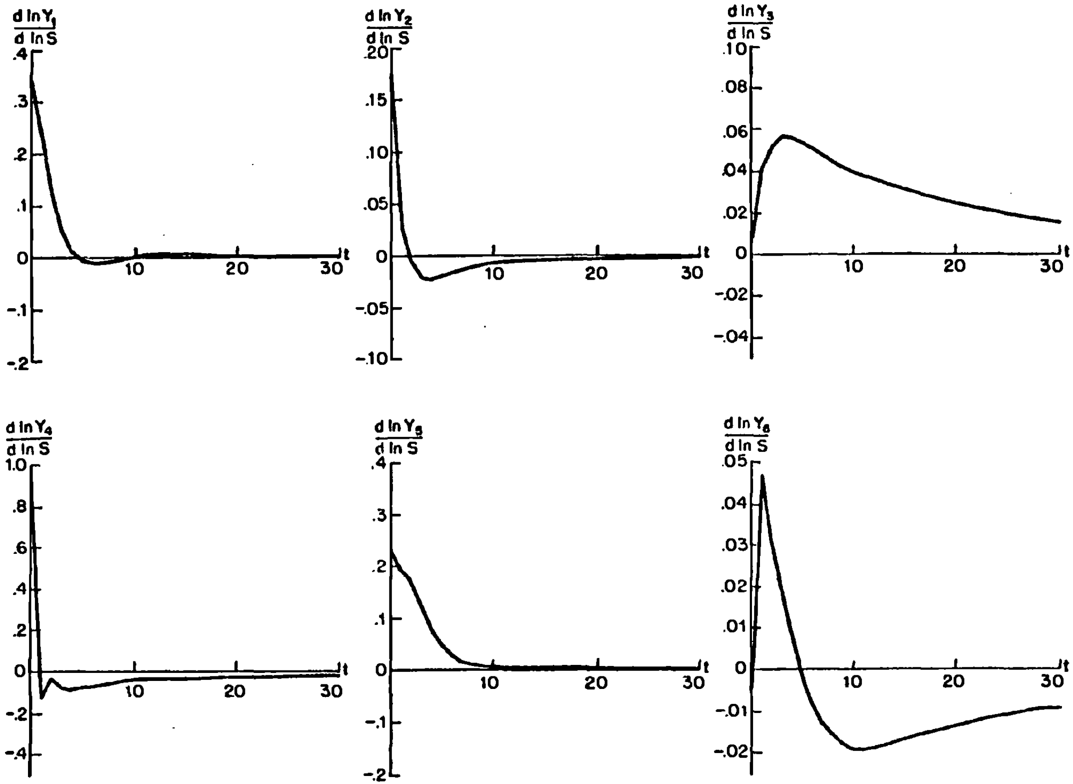


FIGURE 6.10

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: TEXTILE MILL PRODUCTS (12)

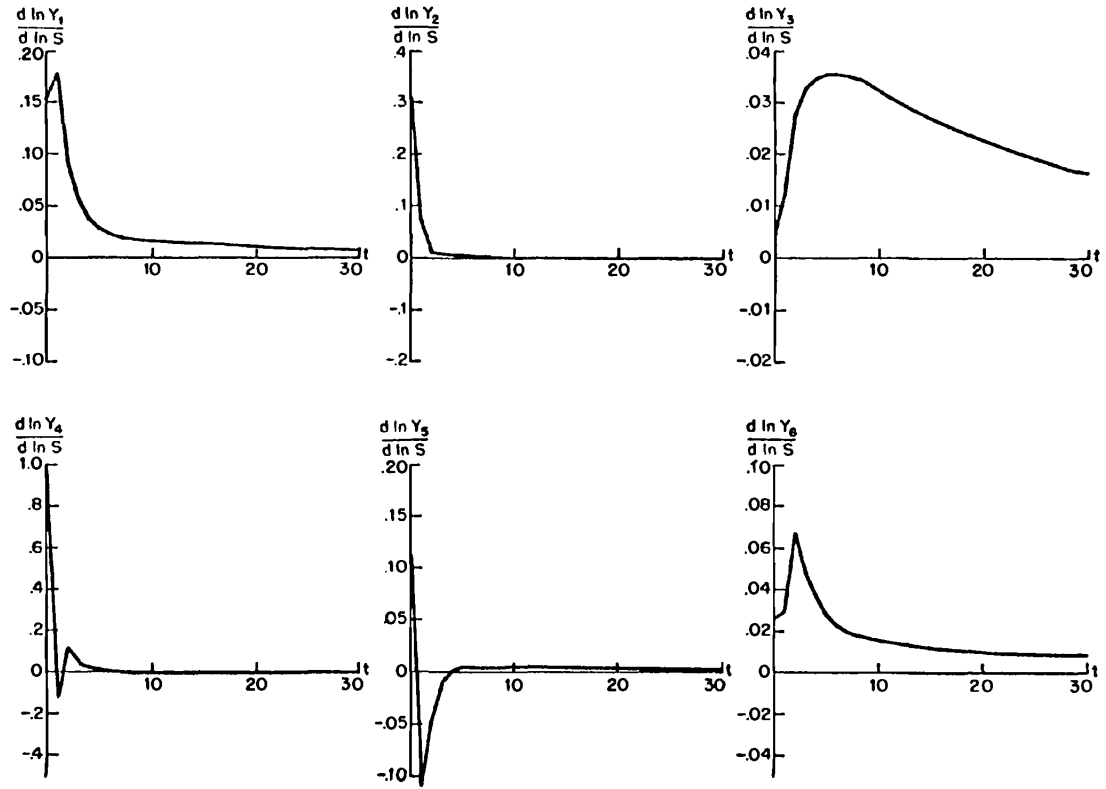


FIGURE 6.11

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: PAPER AND ALLIED PRODUCTS (13)

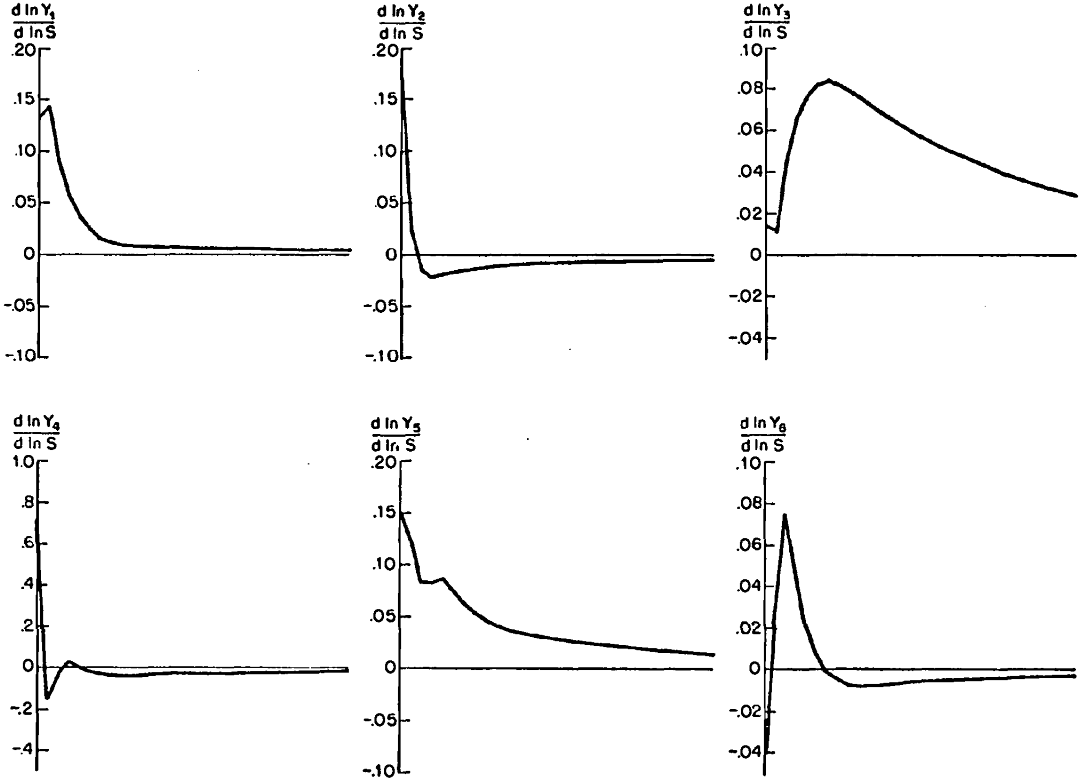


FIGURE 6.12

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: PETROLEUM AND COAL PRODUCTS (15)

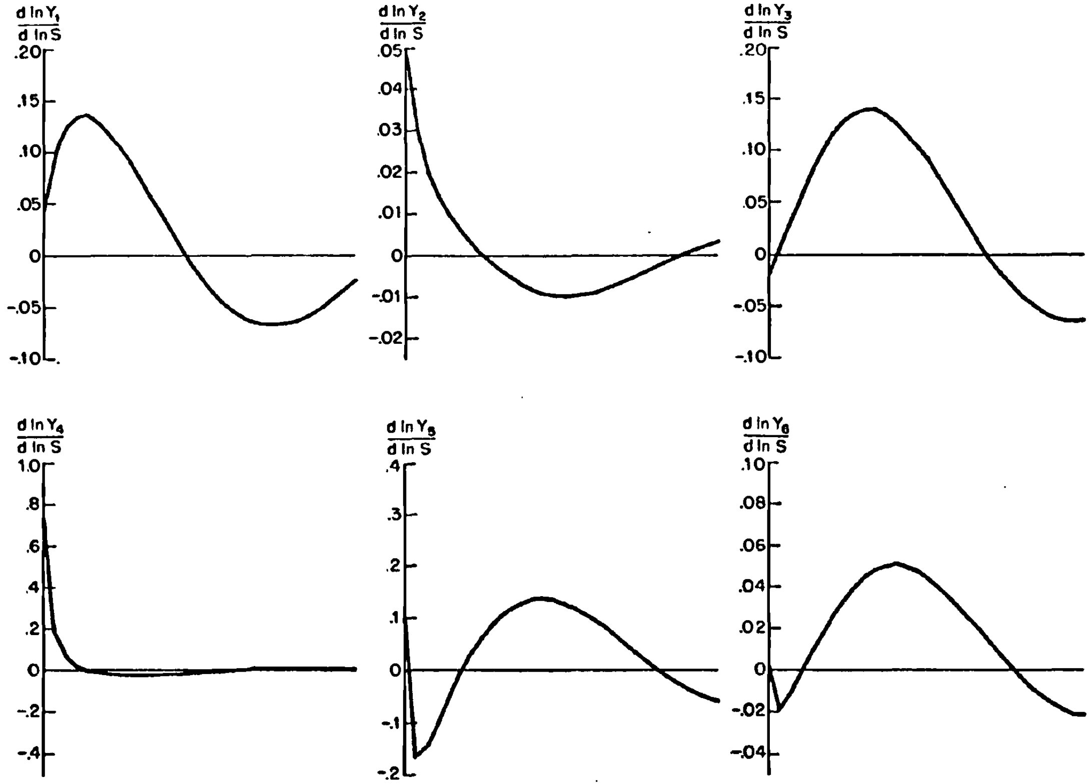
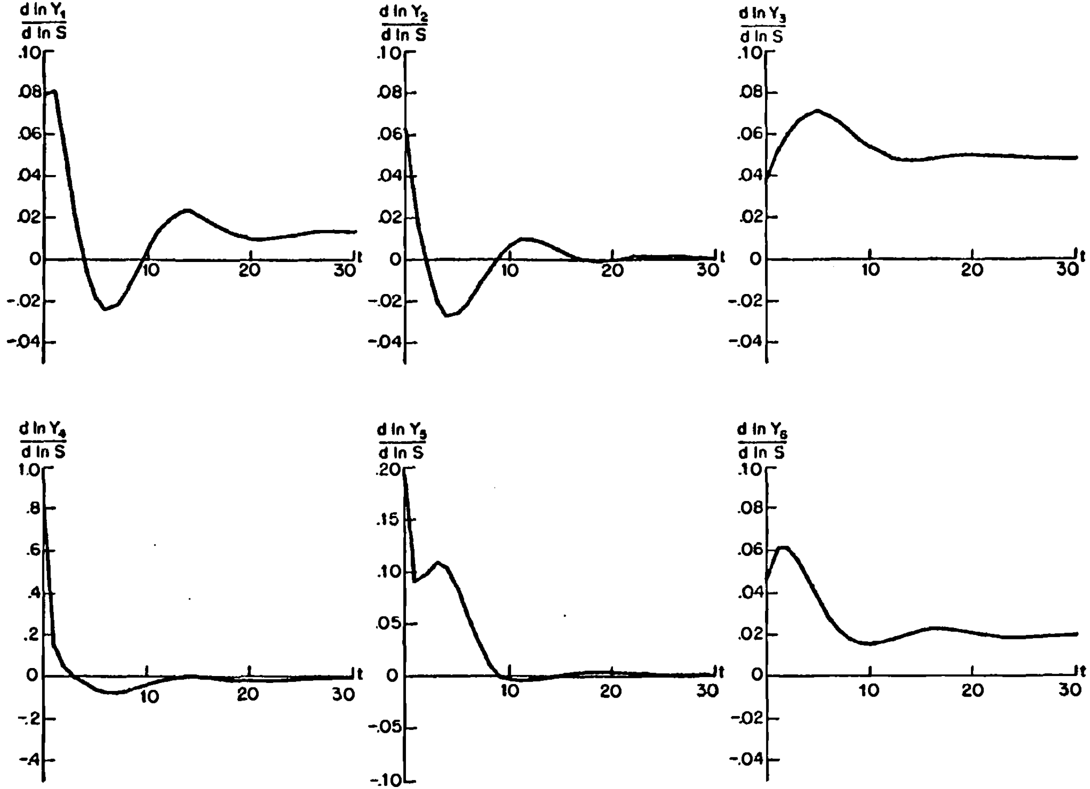


FIGURE 6.13

DISTRIBUTED LAG RESPONSES TO A UNIT SALES IMPULSE: OTHER NONDURABLES (17)



istic root of $(I - \beta)$ is less than 1, but the implied lag patterns are erratic and economically meaningless. In (11) and (16) the system explodes, that is, a characteristic root exceeds unity. In a fifth industry, other non-durables (17), the largest characteristic root is close to unity, leading to slow convergence, but the lag patterns are otherwise sensible.[1]

The largest and smallest characteristic roots of the matrix $(I - \beta)$ for each industry are given in Table 6.20. The largest roots are often near unity, implying that the model is nearly nonstationary and that the responses are in most cases of very long duration.[2] The smallest roots are often near zero, implying that $(I - \beta)$ in many subindustries is close to singular and that the production function constraint is nearly verified.

ii. Long-Run Elasticities

Long-run price, trend, and sales elasticities are shown in Tables 6.21–6.23. Note, first, that underlying production function parameters are overidentified, since the restrictions on the β_{ij} matrix were not imposed on the estimation procedure. Therefore, many alternative estimates of input-sales elasticities (i.e., the α_i terms above) are possible. The long-run price elasticities, indicated in Table 6.21, tend to be small in absolute value and of uncertain sign. Price elasticities for nonproduction labor (Y_6) are often negative, while those for production workers (Y_1) fluctuate in sign. The magnitudes of the price elasticities of the former group tend to be larger than those of the latter. Hours per man (Y_2) displays no long-run price responsiveness. Capital stock (Y_3) displays substantial long-run price elasticity, but often with incorrect signs,

1. In an attempt to overcome this deficiency, we considered a transformation of the system for these cases. It is well known that in nonstationary cases, a first-difference transformation of all the variables often leads to convergence of the system. This is especially called for in (11) and (16), where there is clear evidence of a nonstationary response. Such transformations may also help in the other three cases noted. Our procedure was the following: To begin, first differences of all variables (in logarithms) were obtained. Then a generalized least-squares technique was used to estimate model (4.1), excluding the trend variable. This procedure was performed for industries (07), (11), (14), (16), and (17). In no case was the largest characteristic root of the transformed system greater than 0.8, indicating a stationary response and rapid convergence as expected. However, two main differences between these results and the "stable results" noted earlier were apparent: First, there were more negative real roots in the first-difference estimates than in the untransformed ones; second, the long-run sales elasticities were extremely small and often near zero. This suggests that the first-difference technique to achieve a stationary response removes too much of the common interrelationships among the variables, and that other avenues need exploration.

2. When the model was estimated in the first-difference form for troublesome cases, the nonstationary aspect of the estimates disappeared in all cases.

TABLE 6.20

LARGEST AND SMALLEST CHARACTERISTIC ROOTS[a] OF $(I-\beta)$ MATRIX, BY INDUSTRY

	Industries	Smallest Root	Largest Root
01	Total durables	.1572	.8919
02	Primary iron and steel	.1288	$.8544 \pm .2197i$
03	Primary nonferrous metal	−.1167	$.8625 \pm .2575i$
04	Elect. machinery and equip.	.1513	$.9454 \pm .1309i$
05	Machinery exc. elect.	.0453	.9016
06	Motor vehicles and equip.	.0587	.9608
07	Transport. equip. excl. motor vehicles		$(.7369 \pm .2456i)$
08	Stone, clay, and glass	−.0194	.8631
09	Other durables	−.1516	.9548
10	Total nondurables	.0520	.9827
11	Food and beverages		(.8403)
12	Textile mill products	.1081	.9665
13	Paper and allied products	−.0937	.9546
14	Chemical and allied products		(.7108)
15	Petroleum and coal products	.1049	$.9493 \pm .1536i$
16	Rubber products		(.6154)
17	Other nondurables	.1300	.9970

a. The figures shown in parentheses refer to the largest root of the first-order transformed version of the model.

especially in durable goods industries. The price effects of the general utilization rate are smaller in magnitude and opposite in sign to those for capital stock. Finally, inventories show negative price responses in durables and positive responses in nondurables. In summary, price responses in disaggregated industries exhibit some of the same undesirable features noted for total manufacturing and probably for the same reasons.

The trend elasticities vary in sign and magnitude among the variables and across industries. They have consistent negative signs only for production worker employment. Often, positive signs can be observed for Y_2, Y_3, Y_5, and Y_6, suggesting some misspecification of the trend term as a proxy for technical changes, a phenomenon noted above. Again, overidentification is relevant in this connection.

The sales elasticities are the largest in magnitude of the three exogenous variables. They also vary greatly, both among variables and across different industries. Sales "returns to scale" indicate increasing returns for durables except nonelectrical machinery (05), motor vehicles (06), and other durables (09), and decreasing returns for the nondurables. The long-run effect of sales on hours worked is consistently zero, as expected, but the effect on general utilization rates is highly variable. Long-run scale effects show large variations for stock variables across industries and from one stock input to another. Indeed, some signs are

TABLE 6.21

LONG-RUN PRICE ELASTICITIES, BY INDUSTRY

	Inputs					
Industries[a]	Prod. Emp. (Y_1)	Hours (Y_2)	Capital (Y_3)	Util. (Y_4)	Inven. (Y_5)	Nonprod. Emp. (Y_6)
01	.0186	.0438	−0.0349	−.5215	−.0316	−.1676
02	−.2055	.1175	−0.3721	.1240	−.1787	−.3350
03	.2024	.0820	−0.3158	.2420	−.8256	−.1508
04	.2568	.0572	−0.3159	.0342	−.0144	−.2186
05	−.2364	.0301	−0.3643	−.1075	.5909	−.3264
06	.0953	.1178	1.0156	−.9694	−.0659	.3893
07[b]						
08	−.1354	−.0051	−0.0093	.1924	−.2689	−.0085
09	.0009	.0105	0.1683	−.2696	−.0857	−.3022
10	.0455	.0177	0.0589	.0536	.0125	.0244
11[b]						
12	−.0688	−.0454	0.1391	−.0721	.2208	.0025
13	−.0543	−.0597	0.1725	−.2374	.1805	−.1203
14[b]						
15[b]						
16[b]						
17	−.2840	−.0112	−0.9888	.1266	−.0777	−.4744

a. The industry codes are identified in Table 6.20.
b. Long-run effects could not be computed because the adjustment matrix was not stable (largest root exceeded 1).

TABLE 6.22

LONG-RUN TREND ELASTICITIES, BY INDUSTRY

	Inputs					
Industries[a]	Prod. Emp. (Y_1)	Hours (Y_2)	Capital (Y_3)	Util. (Y_4)	Inven. (Y_5)	Nonprod. Emp. (Y_6)
01	−.0037	.0006	.0062	−.0085	.0042	.0066
02	−.0051	.0015	.0033	.0028	.0062	.0000
03	−.0005	.0006	.0047	−.0079	.0056	.0022
04	.0158	−.0001	.0080	−.0232	.0281	.0129
05[b]						
06	−.0087	.0002	−.0021	−.0003	.0145	−.0001
07[b]						
08	.0002	.0015	.0056	−.0009	.0031	−.0008
09	−.0044	.0001	.0031	.0010	−.0018	.0085
10	−.0158	−.0008	−.0220	−.0132	−.0033	−.0095
11[b]						
12	−.0065	−.0032	.0055	−.0102	.0100	.0032
13	−.0041	.0012	−.0074	.0033	−.0042	.0087
14[b]						
15[b]						
16[b]						
17	−.0189	−.0012	−.0752	−.109	−.0154	−.0296

a. The industry codes are identified in Table 6.20.

b. Long-run effects could not be computed because the adjustment matrix was not stable (largest root exceeded 1).

negative, especially for Y_6, which is certainly unacceptable. Further, the large size of the sales elasticities for other nondurables (17) is undoubtedly due to its nearly nonstationary response.

In attempting to account for these results, the most likely explanation, in addition to overidentification of the relevant parameters, runs as follows: We are trying to make inferences about long-run response patterns on the basis of estimates that reflect one-period changes in (quarterly) data. Thus, the estimates of βA_1 in the computation of long-run elasticity estimates are regression coefficients from *current* values only of the exogenous variables, while the estimates of $[I - (I - \beta)]^{-1}$ stem from *one*-period lags of the dependent variables. Any small variations in the regression estimates can become magnified greatly in computing long-run coefficients. Though such a result is not a *necessary* consequence of estimating the elements of $(I-\beta)$ and βA_1 from current and one-period changes, it does become a very important factor when the convergence of the system is very slow, and that is what the characteristic roots of Table 6.20 indicate.

The homogeneous part of any system of linear difference equations can be expressed in the form

$$Y_{it} = c_{1t}\lambda_1^t + c_{2t}\lambda_2^t + \ldots,$$

where the c_{ij} terms are constants, and the λ's are characteristic roots of $(I - \beta)$. In the estimates above, the largest root is greater than 0.95. Thus, for example, only after about 40 periods (10 years!) does the term in the above expression containing $\lambda > 0.95$ contribute as little as 0.20

TABLE 6.23

LONG-RUN SALES ELASTICITIES, BY INDUSTRY

	Inputs					
Industries[a]	Prod. Emp. (Y_1)	Hours (Y_2)	Capital (Y_3)	Util. (Y_4)	Inven. (Y_5)	Nonprod. Emp. (Y_6)
01	0.7052	.0016	0.4112	0.5442	0.6455	0.1007
02	0.5778	.0101	0.2238	0.4229	0.2052	0.0970
03	0.4514	.0439	0.3846	0.1353	0.1589	0.1959
04	−0.3130	.0073	0.3082	0.9085	2.506	−0.3872
05	0.7363	.0310	0.8899	0.3756	0.3410	0.4071
06	1.091	.0245	1.853	−0.5940	0.9748	0.8116
07[b]						
08	0.1355	−.0583	0.3627	0.4489	0.6995	0.7448
09	0.8344	−.0635	1.308	−0.6239	1.031	−0.4238
10	2.063	.1178	3.474	1.436	1.219	1.694
11[b]						
12	1.049	.3538	1.232	0.8423	0.1229	0.7411
13	0.7144	−.1523	2.191	−0.3914	1.627	−0.0429
14[b]						
15[b]						
16[b]						
17	4.494	0.3701	17.26	−0.0327	3.982	7.080

a. The industry codes are identified in Table 6.20.
b. Long-run effects could not be computed because the adjustment matrix was not stable (largest root exceeded 1).

to the time path of Y_{it} [i.e., $(0.96)^{40} = 0.20$]. Thus, it is the *combination* of factors that makes accurate estimation of long-run elasticities very difficult: First, the regression estimates are computed from very short-run changes; second, the dynamic stability of the estimates is nearly nonstationary (i.e., the absolute value of at least one root is close to unity). Again, errors in computing the tail of the distributed lag are *cumulative* in estimating long-run effects. If, in fact, the system converged more rapidly, such errors would be small, and more reliable inferences about long-run scale and substitution effects could be made.

C. SUMMARY

Though the estimated structural coefficients, distributed lags and long-run elasticities vary from industry to industry and a considerable range of issues has been covered, the main results of our analysis of the individual industries can be summarized.

i. Short-run properties of the model are very satisfactory. The estimates and distributed lag properties confirm the existence of significant feedbacks among the inputs. The fit and forecast properties of the model are excellent.

ii. There are significant differences between the durable goods and nondurable goods industries, with few intragroup differences present.

iii. The long-run elasticity estimates in some industries could not be computed. However, we should underscore the fact that consistency of the short- and long-run elasticities is a difficult test for any model to pass. In most other comparable models, this vexing problem of consistency has been simply assumed away.