CHAPTER V

CONCLUSION

Since the early 1970s, the U.S. Big Three have faced competitive challenges. The first time the Big Three encountered difficulties in international competitiveness, was after the oil shocks in the early 1970s. Competition against imports of small cars restrained price-cost margins in the U.S. automobile market. However, a Voluntary Export Restraint (VER) agreement gave an opportunity for U.S. automakers to earn above-normal profits again, and insulated them from additional pressure to become internationally competitive, especially in terms of car quality.

The above-normal profits in the U.S. auto market and decline in international competitiveness of U.S. automakers gave Japanese competitors an opportunity to take advantage of their superior organizational techniques. They increasingly invested in assembly and parts plants in the U.S. to exploit the above-normal profits. This trend has been aided by a long-run increasing trend of FDI among advanced countries, because the political and economic framework for FDI has been evolving. Thus Japanese automakers have had increasing opportunities to invest in U.S. auto industry. As a result, U.S. firms have faced a serious overcapacity problem, and have been forced to close production plants and to lay off employees. On the other hand, transplants consider the current situation in the U.S. automobile market not as overcapacity, but as an opportunity to earn above-normal profits. They will continue to invest in production facilities in the U.S. until abnormally high profits in the market are eliminated or until the Big Three strengthen their competitive position. It is true that quality differentials between the Big Three and transplant compact cars have narrowed substantially in recent years. If this phenomenon persists, the Japanese transplant position in the U.S. market may not continue to expand.

In the future, the Big Three might fall victim to a more serious problem. Transplants may face a modestly lower price elasticity of demand for compact-sized cars. The price elasticities for Japanese cars are comparable to , or possibly, lower than those of U.S. cars. Along with this trend, Japanese automakers have consolidated brand loyalty for their cars. Based on these advantages, Japanese transplant firms might focus on larger or more luxury car markets in the future. Larger cars are more profitable products and the U.S. automakers have had comparative advantages over those segments throughout the automobile history. However, in 1991 Acura, Infiniti, and Lexus, which are in luxury segmentation, were the only winners among imports and significantly gained their market shares, although sales of autos declined in general.

The issue of larger cars might become another serious problem for the Big Three in the future, in addition to the issue of the overcapacity. Japanese foreign direct investment in the U.S. auto industry might contribute to an establishment of brand loyalty and competitiveness in the larger-car segments. In other words, the ultimate and dynamic impact of Japanese FDI in the U.S. automobile market might be a contribution to the achievement of market power in the larger luxury car segments in the future.

APPENDIX A DEMAND FUNCTIONS FOR AUTO SALES

ESTIMATED BY RUBIN AND HARTMANN

Rubin's estimated demand function is given by:

$$SDOM = 7.254 - 0.0011\ PTR + 0.030\ PUSER - 1.609\ PGASR - 0.089\ REAL + 0.054\ INDEX$$

$R^2 = 0.89$

D.W. = 1.95

Where: SDOM -- Unit sales of domestic autos, in millions, BEA.

PTR -- Average of monthly purchase price, in thousands, BEA.

PUSER -- CPI for used car prices.

PGASR -- NIA dollar price index for gasoline and motor oil.

REAL -- Interest rate charged at commercial banks on auto loans.

INDEX -- Conference Board Index of consumer confidence.

Hartmann's estimated demand equation is given by:

$$SDOM = 2.09*10^6 + 2582.6*GNP - 1.69*10^4*CPINC - 3.96*10^6*AFF + 2.90*10^5*DQ2 + 1.15*10^5*DQ4 - 6.16*10^5*UNRAT25 + 9884.9*UOMCONF + 1.66*10^5*REBATE$$

$R^2 = 0.86$

D.W. = 2.00

Where: SDOM -- Domestic sales.

GNP -- 1972 dollars.

CPINC -- CPI for new cars.

AFF -- New car loan interest rate divided by the term of the loan in months.

DQ2 -- Second quarter dummy.

DQ4 -- Fourth quarter dummy.

UNRAT25 -- Ratio of unemployment rate of men over 25 to same lagged one quarter.

UOMCONF -- U. of Michigan Consumer sentiment index.

REBATE -- Rebate dummy variable.

Sources: Rubin, Laura, 1983, Domestic Automobile Demand, p.6; and Hartmann, John, 1983, Automobile Demand Forecasting Model, p.4.

APPENDIX B PAASCHE PRICE INDEX

I use the Paasche Price Index (PPI) for the price of new compact cars to hold a mix of cars purchased constant. The U.S. PPI is given by:

$PPI_i(US) = sum [w_{ij}(US)*P_{ij}(US)] / sum [w_{(84-I)j}(US)*P_{(84-I)j}(US)]$

Where: $PPI_i(US)$ -- Paasche Price Index for U.S. cars at the period of 'i'.

$w_{ij}(US)$ -- Market share of each model (j) among U.S. compact cars at the period of 'i'.

$P_{ij}(US)$ -- Manufacturers' suggested retail price of each U.S. model (j) at the period of 'i'.

$w_{(84-I)j}(US)$ -- Market share of each model (j) among U.S. compact cars at the first quarter of 1984 as a base.

$P_{(84-I)j}(US)$ -- Manufacturers' suggested retail price of each U.S. model (j) at the first quarter of 1984 as a base.

Note: The first quarter of 1984 is chosen as a base because all of U.S. models in the compact-sized, which I deal with, were in the U.S. market then.

The Japanese PPI is also given in the same way.

Note: The fourth quarter of 1988 is chosen as a base because all of Japanese models, which I handle with, appeared for the first time in the U.S. market then. The following tables show the data on manufacturer's suggested retail prices, and data on market shares of each model of U.S. and Japanese compact cars.

Table 21

Manufacturers' Suggested Retail Prices of Compact Cars ($)
(in nominal terms)

Model Year	84	85	86	87	88	89	90	91	92
Big Three									
Cavalier	6,214	6,606	6,888	7,448	8,195	8,595	7,777	8,270	8,999
Tempo	6,928	7,052	7,508	8,310	8,808	9,207	9,633	8,493	10,137
Sunbird	6,791	7,135	7,495	7,999	8,499	8,949	8,899	8,784	9,720
Topaz	7,469	7,767	8,235	8,814	9,323	9,734	10,164	10,269	10,678
Reliant	6,941	7,039	7,301	7,879	6,995	7,595	7,595		
Aries	6,941	7,039	7,301	7,879	6,995	7,595	7,595		
Skyhawk	7,345	7,734	8,073	8,559	8,884	9,285	9,285		
Firenza	7,293	7,679	8,035	8,499	9,295	9,295			
Citation	7,037	7,232	7,232						
Phoenix	7,156	7,156							
Omega	7,823	7,823							
Skylark	7,707	7,861	7,861						
Transplant									
Accord	8,541	8,845	9,998	10,795	11,570	11,770	12,345	12,725	13,500
Camry						11,488	11,588	12,198	14,798
626							12,459	12,825	13,975
Legacy							11,499	12,924	13,849

Sources: Automotive News, various issues.

Table 22

Market Share of Compact Cars

Model	Cavalier	Tempo	Sunbird	Topaz	Reliant	Aries
84 I	0.228	0.177	0.076	0.051	0.105	0.081
II	0.250	0.139	0.087	0.041	0.097	0.072
III	0.277	0.172	0.093	0.049	0.070	0.058
IV	0.243	0.199	0.078	0.056	0.092	0.086
85 I	0.259	0.231	0.068	0.061	0.091	0.072
II	0.332	0.167	0.093	0.048	0.088	0.074
III	0.322	0.219	0.091	0.052	0.105	0.094
IV	0.338	0.188	0.086	0.045	0.123	0.103
86 I	0.344	0.225	0.090	0.055	0.120	0.084
II	0.336	0.196	0.107	0.054	0.115	0.084
III	0.307	0.252	0.091	0.058	0.093	0.090
IV	0.250	0.265	0.072	0.073	0.130	0.128
87 I	0.365	0.233	0.084	0.067	0.106	0.099
II	0.291	0.265	0.097	0.076	0.107	0.101
III	0.336	0.222	0.094	0.069	0.102	0.098
IV	0.327	0.219	0.065	0.059	0.142	0.130
88 I	0.270	0.273	0.077	0.077	0.139	0.116
II	0.311	0.272	0.090	0.088	0.105	0.100
III	0.317	0.300	0.080	0.102	0.092	0.081
IV	0.309	0.279	0.089	0.099	0.093	0.103
89 I	0.362	0.297	0.101	0.118	0.049	0.048
II	0.370	0.270	0.137	0.107	0.044	0.046
III	0.384	0.271	0.126	0.109	0.046	0.042
IV	0.378	0.321	0.153	0.097	0.024	0.020
90 I	0.408	0.329	0.140	0.106	0.008	0.006
II	0.407	0.307	0.165	0.111	0.004	0.004
III	0.409	0.315	0.169	0.105	0.000	0.000
IV	0.442	0.257	0.228	0.074	0.000	0.000
91 I	0.468	0.312	0.137	0.083	0.000	0.000
II	0.466	0.265	0.165	0.105	0.000	0.000
III	0.410	0.344	0.152	0.093	0.000	0.000
IV	0.379	0.357	0.147	0.117	0.000	0.000
92 I	0.379	0.378	0.126	0.117	0.000	0.000
II	0.373	0.368	0.128	0.132	0.000	0.000
III	0.341	0.376	0.112	0.171	0.000	0.000

Model	Skyhawk	Firenza	Citation	Phoenix	Omega	Skylark
84 I	0.068	0.039	0.071	0.009	0.030	0.065
II	0.089	0.044	0.066	0.011	0.033	0.071
III	0.094	0.042	0.052	0.009	0.018	0.066
IV	0.068	0.040	0.052	0.004	0.005	0.076
85 I	0.057	0.037	0.049	0.002	0.000	0.072
II	0.068	0.041	0.037	0.000	0.000	0.052
III	0.056	0.025	0.024	0.000	0.000	0.012
IV	0.067	0.039	0.005	0.000	0.000	0.005
86 I	0.052	0.029	0.002	0.000	0.000	0.000
II	0.071	0.035	0.001	0.000	0.000	0.000
III	0.077	0.032	0.000	0.000	0.000	0.000
IV	0.061	0.021	0.000	0.000	0.000	0.000
87 I	0.031	0.015	0.000	0.000	0.000	0.000
II	0.044	0.019	0.000	0.000	0.000	0.000
III	0.054	0.025	0.000	0.000	0.000	0.000
IV	0.040	0.019	0.000	0.000	0.000	0.000
88 I	0.033	0.016	0.000	0.000	0.000	0.000
II	0.025	0.009	0.000	0.000	0.000	0.000
III	0.022	0.006	0.000	0.000	0.000	0.000
IV	0.022	0.005	0.000	0.000	0.000	0.000
89 I	0.024	0.000	0.000	0.000	0.000	0.000
II	0.027	0.000	0.000	0.000	0.000	0.000
III	0.022	0.000	0.000	0.000	0.000	0.000
IV	0.007	0.000	0.000	0.000	0.000	0.000
90 I	0.002	0.000	0.000	0.000	0.000	0.000
II	0.001	0.000	0.000	0.000	0.000	0.000
III	0.001	0.000	0.000	0.000	0.000	0.000
IV	0.000	0.000	0.000	0.000	0.000	0.000
91 I	0.000	0.000	0.000	0.000	0.000	0.000
II	0.000	0.000	0.000	0.000	0.000	0.000
III	0.000	0.000	0.000	0.000	0.000	0.000
IV	0.000	0.000	0.000	0.000	0.000	0.000
92 I	0.000	0.000	0.000	0.000	0.000	0.000
II	0.000	0.000	0.000	0.000	0.000	0.000
III	0.000	0.000	0.000	0.000	0.000	0.000

Model	Accord	Camry	626	Legacy
84 I	1.000	0.000	0.000	0.000
II	1.000	0.000	0.000	0.000
III	1.000	0.000	0.000	0.000
IV	1.000	0.000	0.000	0.000
85 I	1.000	0.000	0.000	0.000
II	1.000	0.000	0.000	0.000
III	1.000	0.000	0.000	0.000
IV	1.000	0.000	0.000	0.000
86 I	1.000	0.000	0.000	0.000
II	1.000	0.000	0.000	0.000
III	1.000	0.000	0.000	0.000
IV	1.000	0.000	0.000	0.000
87 I	1.000	0.000	0.000	0.000
II	1.000	0.000	0.000	0.000
III	1.000	0.000	0.000	0.000
IV	1.000	0.000	0.000	0.000
88 I	1.000	0.000	0.000	0.000
II	1.000	0.000	0.000	0.000
III	0.983	0.017	0.000	0.000
IV	0.801	0.199	0.000	0.000
89 I	0.717	0.283	0.000	0.000
II	0.643	0.357	0.000	0.000
III	0.583	0.417	0.000	0.000
IV	0.559	0.416	0.024	0.001
90 I	0.502	0.414	0.080	0.003
II	0.525	0.392	0.064	0.018
III	0.502	0.361	0.100	0.037
IV	0.485	0.388	0.072	0.054
91 I	0.485	0.297	0.144	0.074
II	0.566	0.286	0.071	0.076
III	0.489	0.337	0.079	0.095
IV	0.536	0.313	0.081	0.069
92 I	0.475	0.344	0.092	0.089
II	0.527	0.316	0.071	0.086
III	0.545	0.310	0.074	0.071

Sources: Ward's Automotive Yearbook, various issues.

APPENDIX C VARIABLES

Sources

Variable Name	**Source**
Q	Ward's Automotive Yearbook
PNEW	Automotive News and Appendix A
CPIUSE	Monthly Labor Review (BLS)
CPIGAS	Monthly Labor Review (BLS)
PM	Survey of Current Business (BEA)
CCI	Consumer Confidence Survey (The Conference Board)
RATE	Federal Reserve Statistical Release (Federal Reserve Board)
INCOME	Survey of Current Business (BEA)

Data

The following table has all data that I use in the regression analysis.

Table 23

Data of Variables

Variable		Q(US)	Q(J)	P(US)	P(J)	CPIALL	CPIUSE	CPIGAS
84	I	372,171	29,096	1.000	0.729	305.2	357.3	370.3
	II	447,136	36,574	0.999	0.729	308.8	370.0	374.0
	III	361,569	33,506	0.994	0.729	311.7	383.2	369.8
	IV	332,091	34,425	1.032	0.755	315.3	384.6	370.3
85	I	399,245	41,747	1.029	0.755	316.1	382.8	356.8
	II	389,644	41,304	1.022	0.755	320.1	386.4	373.8
	III	340,010	32,198	1.015	0.755	322.8	376.7	385.3
	IV	262,633	30,727	1.062	0.854	325.5	375.3	374.2
86	I	291,138	43,075	1.061	0.854	328.4	374.1	372.5
	II	319,030	49,355	1.064	0.854	325.3	364.8	278.6
	III	293,898	56,266	1.067	0.854	328.0	360.3	279.8
	IV	238,289	63,541	1.159	0.922	330.5	360.6	262.6
87	I	260,636	51,111	1.146	0.922	333.1	354.6	275.1
	II	246,191	53,899	1.156	0.922	337.7	371.6	296.7
	III	204,468	58,356	1.151	0.922	340.8	385.5	310.8
	IV	218,478	66,719	1.177	0.988	345.3	388.0	314.6
88	I	264,658	65,288	1.187	0.988	346.7	387.2	300.9
	II	275,251	71,243	1.196	0.988	350.8	389.2	299.7
	III	232,229	56,902	1.205	0.987	354.9	393.6	311.5
	IV	245,116	69,328	1.263	1.000	360.1	400.3	308.8
89	I	201,116	63,959	1.282	0.998	362.7	402.3	300.5
	II	221,245	93,373	1.281	0.996	368.8	402.9	348.5
	III	198,111	97,238	1.281	0.995	372.7	404.3	358.0
	IV	172,041	94,084	1.270	1.027	376.2	399.6	336.1
90	I	188,735	123,090	1.272	1.028	381.5	396.9	342.9
	II	182,320	139,781	1.272	1.028	386.2	387.9	344.4
	III	175,249	158,773	1.273	1.029	390.7	394.6	357.3
	IV	163,396	127,645	1.243	1.070	400.0	394.3	449.2
91	I	162,284	137,081	1.240	1.075	403.1	387.6	408.7
	II	161,725	182,511	1.247	1.075	405.1	383.9	362.9
	III	141,628	168,947	1.245	1.073	408.0	401.9	371.6
	IV	132,248	161,572	1.404	1.193	411.5	401.3	371.6
92	I	143,651	142,619	1.405	1.197	413.8	393.2	356.9
	II	166,299	171,783	1.407	1.193	417.9	393.6	358.8
	III	135,149	178,118	1.417	1.192	420.8	416.6	389.4

Variable		DQ1	DQ2	DQ3	PM	CCI	TREND	RATE	INCOME
84	I	1	0	0	12,120	106.2	1	7.46	11,060
	II	0	1	0	12,439	105.7	2	8.20	11,178
	III	0	0	1	12,104	98.2	3	10.82	11,350
	IV	0	0	0	12,752	98.8	4	12.13	11,467
85	I	1	0	0	12,881	103.0	5	12.83	11,584
	II	0	1	0	12,929	101.0	6	7.03	11,919
	III	0	0	1	12,957	101.2	7	10.60	11,882
	IV	0	0	0	12,732	99.3	8	6.27	12,068
86	I	1	0	0	13,226	97.6	9	6.32	12,315
	II	0	1	0	13,514	95.4	10	13.13	12,499
	III	0	0	1	13,974	95.7	11	8.94	12,534
	IV	0	0	0	14,545	89.8	12	5.03	12,629
87	I	1	0	0	14,517	85.4	13	4.40	12,928
	II	0	1	0	14,784	97.4	14	4.38	12,880
	III	0	0	1	14,664	105.8	15	8.05	13,196
	IV	0	0	0	14,443	115.1	16	7.17	13,483
88	I	1	0	0	14,869	109.9	17	8.72	13,765
	II	0	1	0	15,410	115.7	18	6.10	13,982
	III	0	0	1	15,860	113.5	19	7.69	14,271
	IV	0	0	0	16,013	116.9	20	9.09	14,850
89	I	1	0	0	15,825	115.8	21	7.28	15,133
	II	0	1	0	15,844	116.6	22	3.58	15,214
	III	0	0	1	16,147	120.4	23	8.71	15,322
	IV	0	0	0	16,645	117.0	24	7.91	15,558
90	I	1	0	0	16,942	106.5	25	0.25	15,917
	II	0	1	0	17,299	107.3	26	10.03	16,092
	III	0	0	1	17,685	101.7	27	7.75	16,242
	IV	0	0	0	18,320	62.6	28	5.02	16,443
91	I	1	0	0	17,184	55.1	29	6.40	16,433
	II	0	1	0	17,776	79.4	30	10.77	16,604
	III	0	0	1	18,159	77.7	31	10.49	16,706
	IV	0	0	0	17,973	60.1	32	11.06	16,885
92	I	1	0	0	19,614	50.2	33	9.48	17,143
	II	0	1	0	19,925	65.1	34	9.85	17,297
	III	0	0	1	19,912	61.2	35	9.25	17,332

APPENDIX D MODEL SELECTION

Method

Based on the basic model specification, several alternative models are chosen by dropping a variable or variables which has or have t-statistic of less than '1'. Among these alternatives, first I chose the best-fit five models for the joint- and best-version based on goodness of fit. Eight criteria are used to evaluate goodness of fit: SAMASQ, AIC (Akaike information criterion), FPE (finite prediction error), GCV (generalized cross validation), HQ (Hannan and Quinn), RICE, SCHWARZ, and SHIBATA. I use eight criteria instead of one or two criteria to avoid a tendency of each criteria and to find the best-fit estimated model. The best-fit five equations have the five lowest sum of index of each criterion. The index is given by the value of the model divided by that of the best-fit model in each criteria.

Among these best-fit fives, an estimated model is picked in terms of the Durbin-Watson (D.W.) statistic to avoid the autocorrelation problem and invalidity of hypothesis testing. The Table 24-27 show the regression results of the best-fit five models for each joint- and best-version.

For the joint-version, the Model C is chosen because it is the best for the Big Three and the second best for transplants in terms of D.W.

For the best-version, the Model I is selected for the Big Three because it has the highest D.W. and the lowest results of the

Lagrange Multiplier Test (L.M.). For transplants, the Model L is chosen because it has the highest D.W.

Table 24

Regression Results: The Big Three, Joint-Version

Variable	Model A	Model B	Model C	Model D	Model E
CONSTANT	11.844	8.979	5.340	12.507	9.612
	(-1.920) b	(-1.420) a	(-0.810)	(-1.880) b	(-1.710) b
P(US)	-0.867	-0.813	-1.429	-0.970	-0.850
	(-1.440) a	(-1.370) a	(-2.060) b	(-1.500) a	(-1.300)
CPIUSE	3.328	3.109	3.189	2.750	3.320
	(-6.200) c	(-5.700) c	(-6.000) c	(-3.560) c	(-5.800) c
CPIGAS			-0.363		
			(-1.590) a		
DQ1	0.135	0.116	0.109	0.140	0.140
	(-3.190) c	(-2.690) c	(-2.570) c	(-2.870) c	(-2.790) c
DQ2	0.185	0.175	0.162	0.170	0.190
	(-4.590) c	(-4.360) c	(-4.090) c	(-3.390) c	(-3.790) c
DQ3				-0.004	0.003
				(-0.080)	(-0.060)
PM	0.983	1.057	0.893	1.160	0.970
	(-1.290)	(-1.420) a	(-1.220)	(-1.420) a	(-1.200)
CCI				0.150	
				(-1.060)	
TREND		-0.078	-0.111		
		(-1.500) a	(-2.030) b		
RATE	0.002	0.001	0.000		0.002
	(-0.320)	(-0.230)	(-0.010)		(-0.310)
INCOME	-2.317	-1.465	-1.240	-3.010	-2.320
	(-3.260) c	(-1.630) a	(-1.400) a	(-3.190) c	(-3.190) c
ESS	0.25477	0.23454	0.21290	0.24510	0.25474
T	35	35	35	35	35
k	8	9	10	9	9
R*R	0.934	0.940	0.945	0.937	0.934
R'*R'	0.917	0.921	0.926	0.918	0.914
F	55.01	50.63	47.95	48.30	46.35
dw	1.61	1.66	1.86	1.61	1.61
LM	5.797	11.129	14.291	6.231	5.859
SGMASQ	0.009436	0.009021	0.008516	0.009427	0.009798
AIC	0.011498	0.011207	0.010771	0.011712	0.012173
FPE	0.011593	0.011340	0.010949	0.011851	0.012317
HQ	0.012999	0.012866	0.012557	0.013446	0.013975
SCHWARZ	0.016406	0.016718	0.016798	0.017471	0.018158
SHIBATA	0.010607	0.010147	0.009559	0.010604	0.011021
GCV	0.012232	0.012143	0.011922	0.012690	0.013189
RICE	0.013409	0.013796	0.014193	0.014418	0.014985

a = significant (one-tailed test) at 0.10
b = significant (one-tailed test) at 0.05
c = significant (one-tailed test) at 0.01

Table 25

Regression Results: Transplants, Joint-Version

Variale	Model A	Model B	Model C	Model D	Model E
CONSTANT	-17.486	-16.856	-15.478	-17.917	-12.554
	(-2.180) b	(-2.070) b	(-1.830) b	(-2.010) b	(-1.660) a
P(J)	-1.213	-1.477	-1.053	-1.210	-1.160
	(-1.700) a	(-1.830) b	(-1.040)	(-1.540) a	(-1.480) a
CPIUSE	-4.573	-4.394	-4.223	-4.030	-4.580
	(-6.650) c	(-5.960) c	(-5.390) c	(-3.300) c	(-6.520) c
CPIGAS			0.299		
			(-0.700)		
DQ1	-0.090	-0.073	-0.066	-0.100	-0.080
	(-1.270)	(-0.960)	(-0.870)	(-1.150)	(-0.980)
DQ2	0.011	0.018	0.031	0.040	0.020
	(-0.170)	(-0.260)	(-0.420)	(-0.390)	(-0.240)
DQ3				0.030	0.020
				(-0.380)	(-0.190)
PM	0.712	0.769	1.010	0.480	0.650
	(-0.610)	(-0.650)	(-0.810)	(-0.380)	(-0.530)
CCI				-0.160	
				(-0.650)	
TREND		0.073	0.079		
		(-0.720)	(-0.770)		
RATE	0.010	0.010	0.011		0.010
	(-0.900)	(-0.870)	(-0.970)		(-0.860)
INCOME	5.204	4.491	4.543	5.780	5.190
	(-4.380) c	(-2.890) c	(-2.890) c	(-3.540) c	(-4.280) c
ESS	0.7265	0.7122	0.6985	0.7339	0.7254
T	35	35	35	35	35
k	8	9	10	9	9
R*R	0.938	0.940	0.941	0.938	0.939
R'*R'	0.923	0.921	0.920	0.919	0.920
F	58.84	50.63	44.18	49.04	49.65
dw	1.68	1.65	1.67	1.52	1.67
LM	3.193	5.735	6.045	4.836	3.255
SGMASQ	0.026907	0.027392	0.027940	0.028227	0.027900
AIC	0.032787	0.034032	0.035340	0.035069	0.034663
FPE	0.033058	0.034436	0.035923	0.035485	0.035074
HQ	0.037068	0.039070	0.041199	0.040261	0.039794
SCHWARZ	0.046784	0.050767	0.055114	0.052314	0.051708
SHIBATA	0.030246	0.030814	0.031361	0.031752	0.031385
GCV	0.034880	0.036874	0.039116	0.037998	0.037558
RICE	0.038237	0.041894	0.046567	0.043171	0.042671

a = significant (one-tailed test) at 0.10
b = significant (one-tailed test) at 0.05
c = significant (one-tailed test) at 0.01

Table 26

Regression Results: The Big Three, Best-Version

Variale	Model F	Model G	Model H	Model I	Model J
CONSTANT	4.468	5.334	0.348	4.852	8.884
	(-1.300)	(-0.830)	(-0.060)	(-1.390) a	(-1.430) a
P(US)	-1.394	-1.430	-1.659	-1.391	-0.835
	(-2.340) b	(-2.150) b	(-2.530) c	(-2.320) b	(-1.460) a
CPIUSE	3.025	3.189	3.335	3.342	3.104
	(-7.370) c	(-6.120) c	(-6.400) c	(-5.910) c	(-5.800) c
CPIGAS	-0.441	-0.364	-0.416	-0.486	
	(-2.000) b	(-1.640) a	(-1.870) b	(-2.120) b	
DQ1	0.093	0.019	0.100	0.092	0.114
	(-2.340) b	(-2.710) c	(-2.460) b	(-2.280) b	(-2.760) c
DQ2	0.157	0.162	0.157	0.163	0.174
	(-4.010) c	(-4.200) c	(-4.010) c	(-4.070) c	(-4.440) c
DQ3					
PM		0.894	0.691		1.063
		(-1.250)	(-0.970)		(-1.460) a
CCI				-0.092	
				(-0.820)	
TREND	-0.153	-0.111	-0.160	-0.144	-0.078
	(-3.760) c	(-2.090) b	(-3.870) c	(-3.400) c	(-1.540) a
RATE					
INCOME		-1.241			-1.475
		(-1.430)			(-1.670) a
ESS	0.23765	0.21290	0.22970	0.23184	0.23503
T	35	35	35	35	35
k	7	9	8	8	8
R*R	0.939	0.945	0.941	0.940	0.940
R'*R'	0.926	0.928	0.926	0.925	0.924
F	71.68	56.10	61.43	60.83	59.95
dw	1.74	1.86	1.80	1.86	1.68
LM	13.888	14.198	13.082	13.206	11.284
SGMASQ	0.008488	0.008188	0.008507	0.008587	0.008705
AIC	0.010129	0.010173	0.010366	0.010463	0.010607
FPE	0.010185	0.010294	0.010452	0.010549	0.010694
HQ	0.011278	0.011679	0.011720	0.011829	0.011992
SCHWARZ	0.013826	0.015176	0.014792	0.014930	0.015135
SHIBATA	0.009506	0.009211	0.009563	0.009652	0.009785
GCV	0.010609	0.011023	0.011028	0.011131	0.011284
RICE	0.011317	0.012524	0.012089	0.012202	0.012370

a = significant (one-tailed test) at 0.10
b = significant (one-tailed test) at 0.05
c = significant (one-tailed test) at 0.01

Table 27

Regression Results: Transplants, Best-Version

Variale	Model K	Model L	Model M	Model N	Model O
CONSTANT	-14.939	-15.527	-14.285	-14.221	-17.572
	(-2.280) b	(-2.310) b	(-2.100) b	(-2.120) b	(-2.240) b
P(J)	-1.070	-1.071	-1.432	-1.301	-1.228
	(-1.670) a	(-1.630) a	(-1.950) b	(-1.770) b	(-1.770) b
CPIUSE	-4.755	-4.686	-4.478	-4.613	-4.583
	(-7.820) c	(-7.540) c	(-6.900) c	(-7.100) c	(-6.810) c
CPIGAS					
DQ1	-0.100			-0.088	-0.094
	(-1.580) a			(-1.310)	(-1.450) a
DQ2					
DQ3					
PIM					0.721
					(0.620)
CCI					
TREND			0.102	0.065	
			(1.080)	(0.670)	
RATE	0.010	0.014	0.013	0.010	0.010
	(0.920)	(1.300)	(1.170)	(0.880)	(0.900)
INCOME	5.476	5.617	4.622	4.858	5.196
	(5.150) c	(5.170) c	(3.250) c	(3.420) c	(4.460) c
ESS	0.73730	0.80080	0.77000	0.72580	0.72720
T	35	35	35	35	35
k	6	5	6	7	7
R*R	0.938	0.932	0.935	0.939	0.938
R'*R'	0.927	0.923	0.924	0.925	0.925
F	87.09	103.10	83.14	71.26	71.11
dw	1.64	1.74	1.68	1.60	1.68
LM	3.069	1.798	4.743	5.394	3.255
SGMASQ	0.025424	0.026693	0.026552	0.025921	0.025971
AIC	0.029681	0.030447	0.030997	0.030936	0.030996
FPE	0.029783	0.030507	0.031103	0.031106	0.031166
HQ	0.032542	0.032874	0.033986	0.034443	0.034510
SCHWARZ	0.038750	0.038022	0.040469	0.042224	0.042306
SHIBATA	0.028288	0.029417	0.029543	0.029032	0.029088
GCV	0.030684	0.031142	0.032045	0.032402	0.032464
RICE	0.032057	0.032032	0.033478	0.034562	0.034629

a = significant (one-tailed test) at 0.10
b = significant (one-tailed test) at 0.05
c = significant (one-tailed test) at 0.01

APPENDIX E DIFFERENCE IN PRICE ELASTICITIES (DPE)

US (joint) vs US (best), and J (joint) vs J (best)

The price elasticities are not statistically different (at the level of 0.20 for two-tailed test) between the joint- and the best-version for both the US and the transplant equation.

US equation

$$DPE = \{-1.4289-(-1.3909)\}/(0.6924^2+0.5994^2)^{0.5}$$

$$= 0.0415$$

where: estimated price elasticity for US joint-version

= -1.4289

estimated price elasticity for US best-version

= -1.3909

estimated standard deviation for US joint-version

= 0.6924

estimated standard deviation for US best-version

= 0.5994.

Transplant equation

$$DPE = 1.2085$$

where estimated price elasticity for Japan joint-version

= -1.0530

estimated price elasticity for Japan best-version

= -1.0712

estimated standard deviation for Japan joint-version

= 1.0150

estimated standard deviation for Japan best-version

= 0.6559.

US (joint) vs J (joint), and US (best) vs J (best)

Also, there is no statistical difference (at the level of 0.50 for two-tailed test) in price elasticities between the Big Three and transplants for each of the joint- and best-version. The procedure to obtain "DPE" is the same way discussed above.

Joint-version

DPE = -0.3059.

Best-version

DPE = -0.3598.

In conclusion, there are no statistical differences in price elasticities among four estimated formulas.