Replication of Berry et al. (1995)

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This document describes our MATLAB implementation of Berry et al.'s (1995) model of automobile demand (henceforth BLP).

We obtained BLP (1995)'s data from the GAUSS code for BLP (1999), which we downloaded from the Internet Archive's April 2005 web capture of James Levinsohn's (now defunct) website at the University of Michigan. Table 1 of BLP (1995) and table 2 of BLP (1999) imply that the two papers use the same dataset.

We re-implemented BLP's (1995) estimator using BLP's (1999) code as a guide. We used code from Petrin (2002), Dubé et al. (2012), and Knittel and Metaxoglou (2014) as additional references.

The tables below reproduce the corresponding tables from BLP (1995) alongside analogous results from our implementation.

We reproduce the descriptive statistics in tables 1, 2, and 3 very closely, matching exactly or almost exactly in most cases. Model parameter estimates in table 4 are similar in general, but our estimated parameters produce somewhat lower price elasticities (table 5), leading to somewhat higher estimated markups (table 8).

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Table 1: Descriptive statistics

(a) Berry et al. (1995)

Year	No. of models	Quantity	Price	Domestic	Japan	European	HP / weight	Size	Air	MPG	MP$
1971	92	86.892	7.868	0.866	0.057	0.077	0.490	1.496	0.000	1.662	1.850
1972	89	91.763	7.979	0.892	0.042	0.066	0.391	1.510	0.014	1.619	1.875
1973	86	92.785	7.535	0.932	0.040	0.028	0.364	1.529	0.022	1.589	1.819
1974	72	105.119	7.506	0.887	0.050	0.064	0.347	1.510	0.026	1.568	1.453
1975	93	84.775	7.821	0.853	0.083	0.064	0.337	1.479	0.054	1.584	1.503
1976	99	93.382	7.787	0.876	0.081	0.043	0.338	1.508	0.059	1.759	1.696
1977	95	97.727	7.651	0.837	0.112	0.051	0.340	1.467	0.032	1.947	1.835
1978	95	99.444	7.645	0.855	0.107	0.039	0.346	1.405	0.034	1.982	1.929
1979	102	82.742	7.599	0.803	0.158	0.038	0.348	1.343	0.047	2.061	1.657
1980	103	71.567	7.718	0.773	0.191	0.036	0.350	1.296	0.078	2.215	1.466
1981	116	62.030	8.349	0.741	0.213	0.046	0.349	1.286	0.094	2.363	1.559
1982	110	61.893	8.831	0.714	0.235	0.051	0.347	1.277	0.134	2.440	1.817
1983	115	67.878	8.821	0.734	0.215	0.051	0.351	1.276	0.126	2.601	2.087
1984	113	85.933	8.870	0.783	0.179	0.038	0.361	1.293	0.129	2.469	2.117
1985	136	78.143	8.938	0.761	0.191	0.048	0.372	1.265	0.140	2.261	2.024
1986	130	83.756	9.382	0.733	0.216	0.050	0.379	1.249	0.176	2.416	2.856
1987	143	67.667	9.965	0.702	0.245	0.052	0.395	1.246	0.229	2.327	2.789
1988	150	67.078	10.069	0.717	0.237	0.045	0.396	1.251	0.237	2.334	2.919
1989	147	62.914	10.321	0.690	0.261	0.049	0.406	1.259	0.289	2.310	2.806
1990	131	66.377	10.337	0.682	0.276	0.043	0.419	1.270	0.308	2.270	2.852
All	2217	78.804	8.604	0.790	0.161	0.049	0.372	1.357	0.116	2.099	2.086

(b) Replication

Year	No. of models	Quantity	Price	Domestic	Japan	European	HP / weight	Size	Air	MPG	MP$
1971	92	86.892	7.868	0.866	0.057	0.077	0.490	1.496	0.000	1.662	1.849
1972	89	98.623	7.979	0.892	0.042	0.066	0.391	1.510	0.014	1.619	1.875
1973	86	92.785	7.535	0.932	0.040	0.028	0.364	1.529	0.022	1.589	1.818
1974	72	105.119	7.506	0.887	0.050	0.064	0.347	1.510	0.026	1.567	1.452
1975	93	84.775	7.821	0.853	0.083	0.064	0.337	1.479	0.054	1.584	1.503
1976	99	93.382	7.787	0.876	0.081	0.043	0.338	1.508	0.059	1.759	1.696
1977	95	97.727	7.651	0.837	0.112	0.051	0.340	1.467	0.032	1.947	1.835
1978	95	99.444	7.645	0.855	0.107	0.039	0.346	1.405	0.034	1.982	1.929
1979	102	82.742	7.599	0.803	0.158	0.038	0.348	1.343	0.047	2.061	1.657
1980	103	71.567	7.718	0.773	0.191	0.036	0.350	1.296	0.078	2.215	1.466
1981	116	62.030	8.349	0.741	0.213	0.046	0.349	1.286	0.094	2.363	1.559
1982	110	61.893	8.831	0.714	0.235	0.051	0.347	1.277	0.134	2.440	1.817
1983	115	67.878	8.821	0.734	0.215	0.051	0.351	1.276	0.126	2.601	2.087
1984	113	85.933	8.870	0.783	0.179	0.038	0.361	1.293	0.129	2.469	2.117
1985	136	78.143	8.938	0.761	0.191	0.048	0.372	1.265	0.140	2.261	2.024
1986	130	83.756	9.382	0.733	0.216	0.050	0.379	1.249	0.176	2.416	2.856
1987	143	67.667	9.965	0.702	0.245	0.052	0.395	1.246	0.229	2.327	2.789
1988	150	67.078	10.069	0.717	0.237	0.045	0.396	1.251	0.237	2.334	2.919
1989	147	62.914	10.321	0.690	0.261	0.049	0.406	1.259	0.289	2.310	2.806
1990	131	66.377	10.337	0.682	0.276	0.043	0.419	1.270	0.308	2.270	2.852
All	2217	78.804	8.604	0.790	0.161	0.049	0.372	1.357	0.116	2.099	2.086

Table 2: The range of continuous demand characteristics (and associated models)

(a) Berry et al. (1995)

	Percentile				
Variable	0	25	50	75	100
Price	3.393	6.711	8.728	13.074	68.597
Sales	0.049	15.479	47.345	109.002	577.313
HP / weight	0.170	0.337	0.375	0.428	0.948
Size	0.756	1.131	1.270	1.453	1.888
MP$	8.46	15.57	20.10	24.86	64.37
MPG	9	17	20	25	53

(b) Replication

	Percentile				
Variable	0	25	50	75	100
Price	3.393	6.714	8.729	13.074	68.597
Sales	0.049	15.603	47.350	109.002	646.526
HP / weight	0.170	0.337	0.375	0.428	0.948
Size	0.756	1.131	1.270	1.453	1.888
MP$	8.46	15.57	20.10	24.83	64.37
MPG	9	17	20	25	53

Table 3: Results with logit demand and marginal cost pricing (2217 observations)

(a) Berry et al. (1995)

Variable	OLS logit demand	IV logit demand	OLS $\ln(price)$ on w
Constant	-10.068	-9.273	1.882
	(0.253)	(0.493)	(0.119)
HP / weight	-0.121	1.965	0.520
	(0.277)	(0.909)	(0.035)
Air	-0.035	1.289	0.680
	(0.073)	(0.248)	(0.019)
MP$	0.263	0.052	—
	(0.043)	(0.086)	
MPG	—	—	-0.471
			(0.049)
Size	2.341	2.355	0.125
	(0.125)	(0.247)	(0.063)
Trend	—	—	0.013
			(0.002)
Price	-0.089	-0.216	—
	(0.004)	(0.123)	
No. inelastic demands	1494	22	n.a.
(+ / - 2 s.e.'s)	(1429-1617)	(7-101)	
R^2	0.387	n.a.	0.656

(b) Replication

Variable	OLS logit demand	IV logit demand	OLS $\ln(price)$ on w
Constant	-10.069	-9.274	1.882
	(0.253)	(0.493)	(0.119)
HP / weight	-0.121	1.965	0.520
	(0.277)	(0.909)	(0.035)
Air	-0.035	1.289	0.680
	(0.073)	(0.248)	(0.019)
MP$	0.263	0.052	—
	(0.043)	(0.086)	
MPG	—	—	-0.471
			(0.049)
Size	2.341	2.355	0.125
	(0.125)	(0.247)	(0.063)
Trend	—	—	0.013
			(0.002)
Price	-0.089	-0.216	—
	(0.004)	(0.023)	
No. inelastic demands	1494	22	n.a.
(+ / - 2 s.e.'s)	(1429-1617)	(6-294)	
R^2	0.387	n.a.	0.656

Table 4: Estimated parameters of the demand and pricing equations: BLP specification (2217 observations)

(a) Berry et al. (1995)

Demand side parameters	Variable	Parameter estimate	Standard error
Means ($\overline{\beta}$'s)	Constant	-7.061	0.941
	HP / weight	2.883	2.019
	Air	1.521	0.891
	MP$	-0.122	0.320
	Size	3.460	0.610
Std. Deviations (σ_β's)	Constant	3.612	1.485
	HP / weight	4.628	1.885
	Air	1.818	1.695
	MP$	1.050	0.272
	Size	2.056	0.585
Term on price (α)	$\ln(y-p)$	43.501	6.427
Cost side parameters	Constant	0.952	0.194
	ln(HP / weight)	0.477	0.056
	Air	0.619	0.038
	ln(MPG)	-0.415	0.055
	ln(size)	-0.046	0.081
	Trend	0.019	0.002

(b) Replication

Demand side parameters	Variable	Parameter estimate	Standard error
Means ($\overline{\beta}$'s)	Constant	-7.728	1.722
	HP / weight	4.620	1.682
	Air	-1.226	2.059
	MP$	0.293	0.233
	Size	3.992	0.527
Std. Deviations (σ_β's)	Constant	2.522	3.779
	HP / weight	3.525	4.236
	Air	4.166	2.106
	MP$	0.393	0.419
	Size	1.937	0.889
Term on price (α)	$\ln(y-p)$	42.870	8.280
Cost side parameters	Constant	2.751	0.125
	ln(HP / weight)	0.812	0.089
	Air	0.430	0.079
	ln(MPG)	-0.610	0.073
	ln(size)	-0.352	0.164
	Trend	0.027	0.002

Notes: Table focuses on the main BLP specification and omits two columns from an auxiliary specification.

Table 5: A sample from 1990 of estimated demand elasticities with respect to attributes and price (based on table 4 estimates)

(a) Berry et al. (1995)

	Value of attribute / price				
	Elasticity of demand with respect to:				
Model	HP / weight	Air	MP$	Size	Price
Mazda 323	0.366	0.000	3.645	1.075	5.049
	0.458	0.000	1.010	1.338	6.358
Sentra	0.391	0.000	3.645	1.092	5.661
	0.440	0.000	0.905	1.194	6.528
Escort	0.401	0.000	4.022	1.116	5.663
	0.449	0.000	1.132	1.176	6.031
Cavalier	0.385	0.000	3.142	1.179	5.797
	0.423	0.000	0.524	1.360	6.433
Accord	0.457	0.000	3.016	1.255	9.292
	0.282	0.000	0.126	0.873	4.798
Taurus	0.304	0.000	2.262	1.334	9.671
	0.180	0.000	-0.139	1.304	4.220
Century	0.387	1.000	2.890	1.312	10.138
	0.326	0.701	0.077	1.123	6.755
Maxima	0.518	1.000	2.513	1.300	13.695
	0.322	0.396	-0.136	0.932	4.845
Legend	0.510	1.000	2.388	1.292	18.944
	0.167	0.237	-0.070	0.596	4.134
TownCar	0.373	1.000	2.136	1.720	21.412
	0.089	0.211	-0.122	0.883	4.320
Seville	0.517	1.000	2.011	1.374	24.353
	0.092	0.116	-0.053	0.416	3.973
LS400	0.665	1.000	2.262	1.410	27.544
	0.073	0.037	-0.007	0.149	3.085
BMW 735i	0.542	1.000	1.885	1.403	37.490
	0.061	0.011	-0.016	0.174	3.515

(b) Replication

	Value of attribute / price				
	Elasticity of demand with respect to:				
Model	HP / weight	Air	MP$	Size	Price
Mazda 323	0.366	0.000	3.645	1.075	5.049
	0.682	-0.000	0.516	1.717	4.033
Sentra	0.391	0.000	3.645	1.092	5.661
	0.623	-0.000	0.447	1.476	4.009
Escort	0.401	0.000	4.022	1.116	5.663
	0.624	-0.000	0.528	1.453	3.872
Cavalier	0.385	0.000	3.142	1.179	5.797
	0.609	-0.000	0.315	1.681	3.933
Accord	0.457	0.000	3.016	1.255	9.292
	0.325	-0.000	0.152	0.715	3.310
Taurus	0.304	0.000	2.262	1.334	9.671
	0.159	-0.000	0.075	0.787	3.150
Century	0.387	1.000	2.890	1.312	10.138
	0.368	0.624	0.155	0.842	6.128
Maxima	0.518	1.000	2.513	1.300	13.695
	0.232	0.238	0.075	0.283	4.972
Legend	0.510	1.000	2.388	1.292	18.944
	0.117	0.103	0.032	0.139	3.668
TownCar	0.373	1.000	2.136	1.720	21.412
	0.022	0.020	0.016	0.151	3.185
Seville	0.517	1.000	2.011	1.374	24.353
	0.061	0.034	0.013	0.116	2.981
LS400	0.665	1.000	2.262	1.410	27.544
	0.063	0.020	0.012	0.094	3.039
BMW 735i	0.542	1.000	1.885	1.403	37.490
	0.056	-0.006	0.021	0.153	2.872

Notes (BLP 1995): The value of the attribute or, in the case of the last column, price, is the top number and the number below it is the elasticity of demand with respect to the attribute (or, in the last column, price.)

Table 8: A sample from 1990 of estimated price-marginal cost markups and variable profits (based on table 4 estimates)

(a) Berry et al. (1995)

Model	Price	Markup over MC $(p-MC)$	Variable profits (in $'000's) $q(p-MC)$
Mazda 323	$5,049	$801	$18,407
Sentra	$5,661	$880	$43,554
Escort	$5,663	$1,077	$311,068
Cavalier	$5,797	$1,302	$384,263
Accord	$9,292	$1,992	$830,842
Taurus	$9,671	$2,577	$807,212
Century	$10,138	$2,420	$271,446
Maxima	$13,695	$2,881	$288,291
Legend	$18,944	$4,671	$250,695
TownCar	$21,412	$5,596	$832,082
Seville	$24,353	$7,500	$249,195
LS400	$27,544	$9,030	$371,123
BMW 735i	$37,490	$10,975	$114,802

(b) Replication

Model	Price	Markup over MC $(p-MC)$	Variable profits (in $'000's) $q(p-MC)$
Mazda 323	$5,049	$1,269	$29,158
Sentra	$5,661	$1,442	$71,371
Escort	$5,663	$1,717	$495,787
Cavalier	$5,797	$2,082	$614,302
Accord	$9,292	$2,889	$1,205,400
Taurus	$9,671	$3,427	$1,073,448
Century	$10,138	$2,966	$332,782
Maxima	$13,695	$2,812	$281,343
Legend	$18,944	$5,239	$281,156
TownCar	$21,412	$7,582	$1,127,369
Seville	$24,353	$10,294	$342,044
LS400	$27,544	$9,184	$377,478
BMW 735i	$37,490	$13,368	$139,829