Homework 5: Industrial Organisation

Dhananjay Ghei

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N.B. The code for this exercise was written in `R` *and is available on my Github account.* `www.github.com/dhananjayghei/io_estimation`.
Problems 1 and 2 use the automobile data from Berry-Levinsohn-Pakes (1995). This data already accounts for the outside good (sum shares in any year and they will be less than one.)

Question 1

Replicate as closely as you can column 1-3 from GKP. Produce a table that looks similar and fill in with the results that you find. For column 3 do not worry about correcting standard errors for first two stages of estimation (i.e. just use results from non-linear least squares search). They will differ from results reported in the paper which are corrected for the first two stages of estimation.

Note that, columns I and II from [Gandhi et al., 2011](GKP, hereafter) are the same as the ones in BLP homework. I construct the instruments in the same way as in the previous homework. Once again, note that the instruments are constructed correctly. Table 1 shows the results of OLS and 2SLS regression on the automobile data set. These columns are the same as in Table I of BLP.

Next, I construct the ξ variable and use these to construct $\xi_{(1)}$ and $\xi_{(2)}$ in the same way as in GKP by refining the ξ similar to the instruments. Following this, I construct the controls as follows:

$$
\begin{aligned}
V_1 &= \xi & V_2 &= \xi^2 - E[\xi^2|Z_j] & V_3 &= \xi^3 - E[\xi^3|Z_j] \\
V_4 &= \xi_{(1)} & V_5 &= \xi^2_{(1)} - E[\xi^2_{(1)}|Z_j] & V_6 &= \xi^3_{(1)} - E[\xi^3_{(1)}|Z_j] \\
V_7 &= \xi_{(2)} & V_8 &= \xi^2_{(2)} - E[\xi^2_{(2)}|Z_j] & V_9 &= \xi^3_{(2)} - E[\xi^3_{(2)}|Z_j]
\end{aligned}
$$

Using these controls and the income means, I run the regression as in CMRCF using the non-linear least squares search.

Question 2

Reproduce Table 2 using your preferred estimates from column 3 of Table 1 of your results.

Table 3 shows the results of elasticity from OLS, 2SLS and CMRCF as in Table II of GKP. In the OLS case, I was able to replicate the median and the percent of inelastic demands for OLS from the full data set. In the data set for the year 1990, I was able to replicate the median and the percent of inelastic demand as well. Moving to the 2SLS case, I was able to replicate the median, mean, standard deviation from the GKP paper for both the fill data set and the data set from 1990s. Finally, moving to the CMRCF case, I was able to replicate similar numbers for the median and mean for the full data set. The other numbers are slightly off but in the same ballpark as the estimates of GKP (except for the percent of inelastic demands, which turns out to be pretty low in my case). Table 3 also reports the elasticities for the 1990 Models

Table 1 Estimated Parameters for Automobile Demand (OLS, 2SLS)

The table shows the results from OLS and 2SLS estimation on BLP data set. These tables replicate the columns I and II of Table I from GKP.

	Dependent variable:	
	OLS	2SLS
	(1)	(2)
Constant	-10.072^{***}	-9.915^{***}
	(0.253)	(0.263)
HP/Weight	-0.124	1.226^{***}
	(0.277)	(0.404)
Air	-0.034	0.486^{***}
	(0.073)	(0.133)
MPD	0.265^{***}	0.172^{***}
	(0.043)	(0.049)
Size	2.342^{***}	2.292^{***}
	(0.125)	(0.129)
Price	-0.089^{***}	-0.136^{***}
	(0.004)	(0.011)
Observations	2,217	2,217
R^2	0.387	0.349
Adjusted R^2	0.386	0.348
Residual Std. Error (df = 2211)	1.083	1.116
F Statistic	279.243^{***} (df = 5; 2211)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 2 Estimated Parameters for Automobile Demand (CMRCF)

The table shows the results from the CMRCF estimation on BLP data set. This table replicate the columns III of Table I from GKP.

Variable	Estimate
Constant	-9.65786
	(0.253)
HP/Weight	2.80874
	(0.42091)
Air	1.38517
	(0.1481)
MPD	0.10522
	(0.04745)
Size	2.36624
	(0.12804)
Price	-0.23246
	(0.01605)
V1	0.04876
	(0.06625)
V2	-0.00051
	(0.00096)
V3	0
	(1e-05)
V4	-0.00235
	(0.00316)
V5	0
	(0)
V6	0
	(0)
V7	-0.00019
	(0.00035)
V8	0
	(0)
V9	0
	(0)
HP/Wt ξ	0.07519
	(0.19024)
Air ξ	0.03456
	(0.07138)
MPD ξ	-0.00901
	(0.01357)
Size ξ	0.01641
	(0.07537)
(y-p) ξ	-0.00327
	(0.00602)

Table 3 Automobile elasticities: OLS, 2SLS, CMRCF (with interactions)

Elasticities	OLS	IV	CMRCF
Interactions	No	No	Yes
Median	-0.77	-1.18	-2.03
Mean	-1.04	-1.59	-2.73
Standard Deviation	0.77	1.17	2.01
Percent of Inelastic Demands	67.75	33.65	0.36
Elasticities from 1990			
Median	-0.94	-1.43	-2.45
Mean	-1.24	-1.9	-3.26
Standard Deviation	0.84	1.28	2.2
Percent of Inelastic Demands	52.67	19.85	0.76
1990 Models (from BLP)			
Acura Legend	-1.68	-2.57	-4.4
BMW 735i	-3.32	-5.09	-8.71
Honda Accord	-0.82	-1.26	-2.15
Mazda 323	-0.45	-0.69	-1.17

as in BLP Table VI. I was able to replicate the correct elasticities for these cars from the OLS and 2SLS regressions.

References

Amit Gandhi, Kyoo il Kim, and Amil Petrin. Identification and estimation in discrete choice demand models when endogenous variables interact with the error. Working Paper 16894, National Bureau of Economic Research, March 2011. URL http://www.nber.org/papers/w16894.