

ECON 899b: Problem Set 3

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Overview: For this assignment, the goal is to use the BLP algorithm to solve an aggregate demand model with quality differentiation. In this case, we use data on the US car industry between 1985 to 2015.

Program:

The attached code files “helper_functions.jl” contains implements this declares the necessary functions and structs. And then “main_program.jl” uses the defined functions to implement the following steps:

1. Use both (1) contraction mapping and (2) combined contraction mapping and Newton’s method to invert the demand function for the parameter value $\lambda_p = 0.6$ and the first year in the sample (1985).
2. Find the parameter value $\lambda_p \in [0, 1]$ that minimizes the GMM objective function using 2SLS weighting matrix.
3. Implement 2-step GMM with the minimum λ_p from the previous step, using BFGS minimization routine.

Results:

For the first step, Figures 1 and 2 shows the evolution of the norm between the log of market share and log of predicted shares. As expected, the method using only contraction mapping takes double the number of iterations compared to the combined method. Since the Newton method makes step adjustments while accounting for the curvature of the function, it converges more quickly.

For the second step, Figure 3 displays the evolution of the GMM objective function value over the parameter grid between 0 and 1. We find that the GMM objective function is minimized around 0.6.

Finally, the two-step GMM method estimates the optimal $\lambda_p = 0.6194$. Table 1 summarizes the associated variable estimates, including price and other car characteristics.

*I collaborated with Anya Tarascina and Claire Kim on this assignment.

Figure 1: Evolution of Norm for Contraction Mapping Method

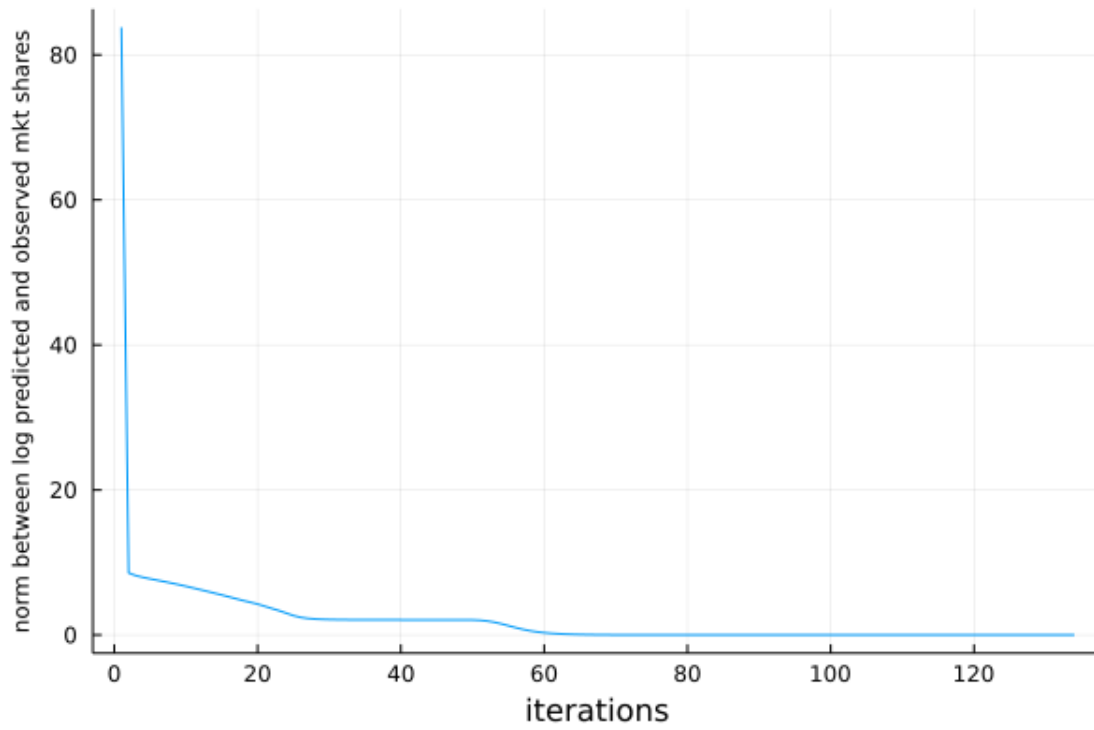


Figure 2: Evolution of Norm for Combined Contraction Mapping Method and Newton

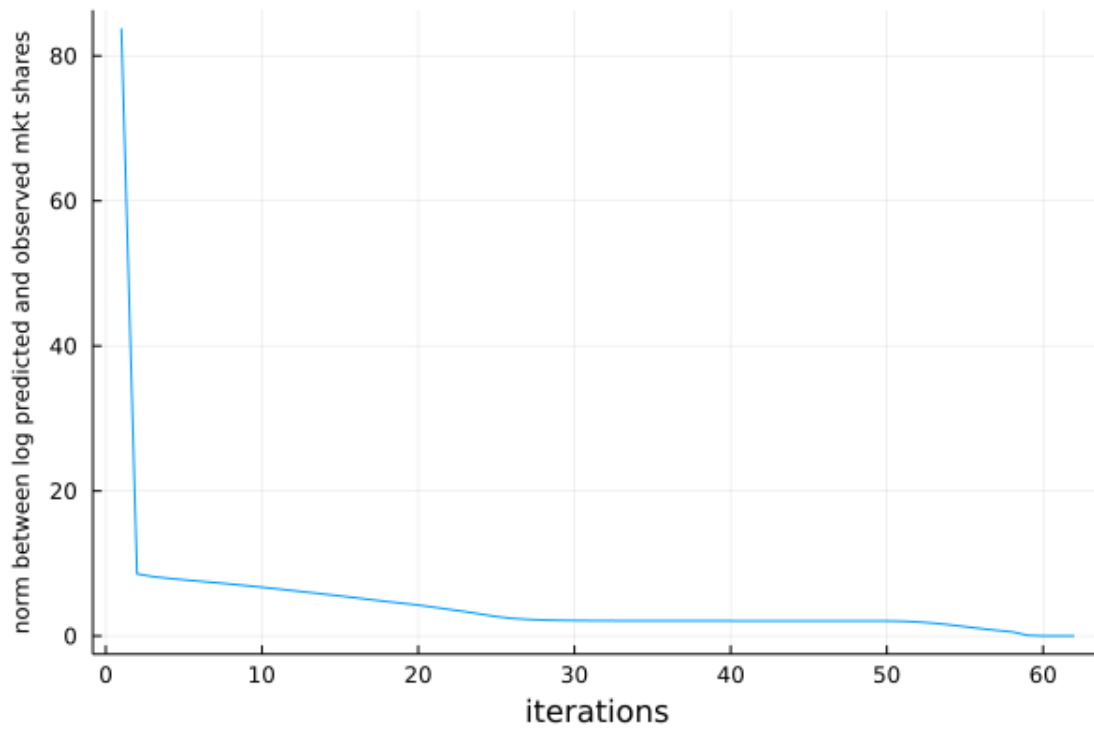


Figure 3: GMM objective function over $\lambda_p \in [0, 1]$

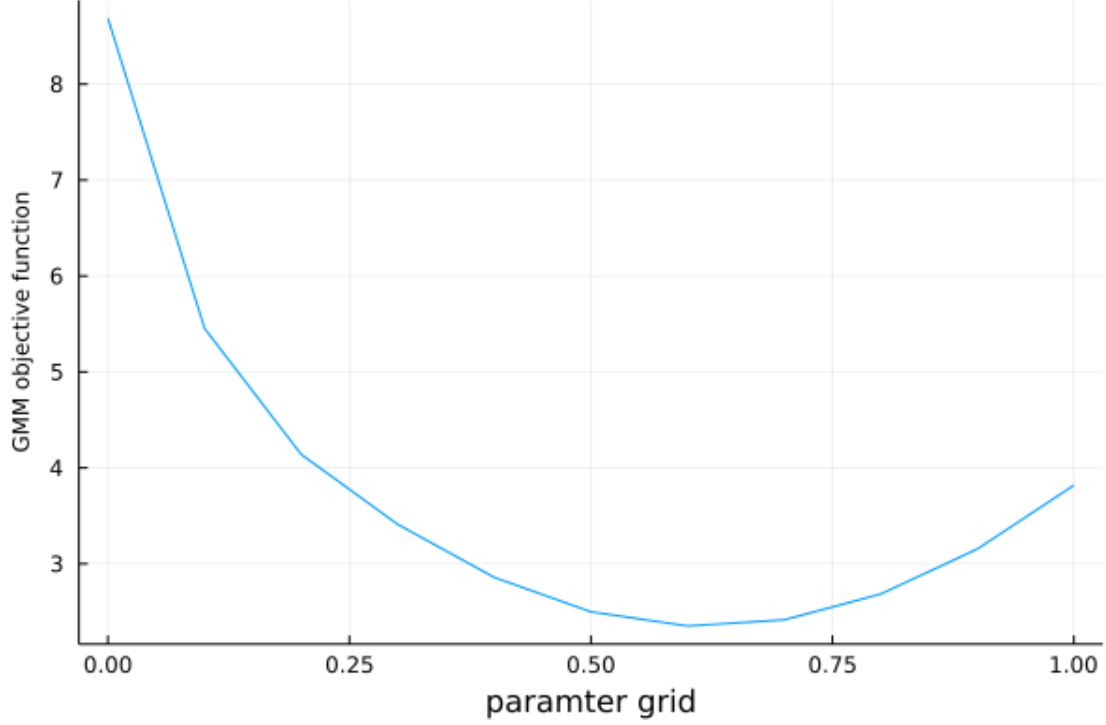


Table 1: Variable Estimates

variables	estimates	variables	estimates
price	-3.264	Year_2004	0.084
dpm	-0.199	Year_2005	0.15
hp2wt	0.302	Year_2006	-0.23
size	4.498	Year_2007	-0.641
turbo	0.533	Year_2008	-1.159
trans	-0.436	Year_2009	-2.654
Year_1986	-0.033	Year_2010	-2.21
Year_1987	-0.139	Year_2011	-1.759
Year_1988	-0.049	Year_2012	-1.26
Year_1989	0.003	Year_2013	-1.005
Year_1990	-0.357	Year_2014	-0.795
Year_1991	-0.644	Year_2015	-0.823
Year_1992	-0.653	model_class_2	-0.788
Year_1993	-0.478	model_class_3	0.392
Year_1994	-0.121	model_class_4	-0.092
Year_1995	-0.013	model_class_5	-0.786
Year_1996	-0.035	cyl_2	-1.311
Year_1997	0.053	cyl_4	-0.852
Year_1998	0.122	cyl_6	0.151
Year_1999	0.393	cyl_8	0.284
Year_2000	0.559	drive_2	0.403
Year_2001	0.117	drive_3	0.26
Year_2002	0.176	Intercept	-2.423
Year_2003	0.158		