IO2 PS2 Bresnahan and Reiss (1991)

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Problem 1 :

Reproduce the results for the tire dealers reported in Table 4 of the paper. Note that Bresnahan and Reiss (1991) estimate the model imposing the constraints $\alpha_n \geq 0$ and $\gamma_n \geq 0$. You should impose the same constraints.

Reproducing Figure 2 to get to know the data

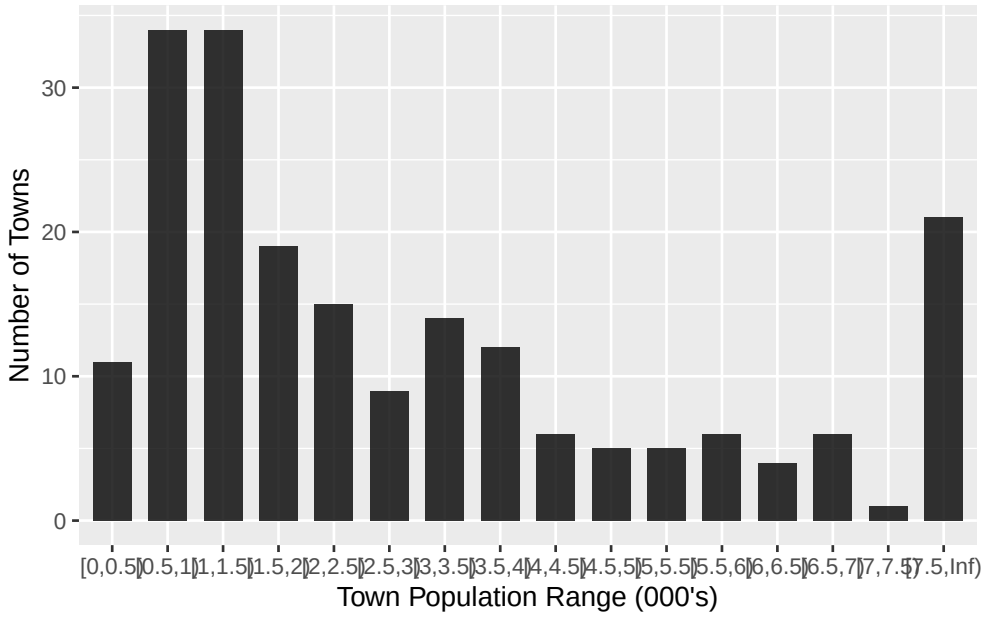

Figure 1: Number of towns by town population

Reproducing Table 3 to get to know the data

Table 1: Replication of Table 3

	Unique	Missing Pct.	Mean	SD	Min	Median	Max
ID	202	0	328090.8	143299.0	40013.0	320014.0	560045.0
TIRE	14	0	2.6	2.6	0.0	2.0	13.0
TPOP	195	0	3.7	5.4	0.1	2.1	45.1
NGRW	58	0	-0.1	0.1	-1.3	0.0	0.0
PGRW	119	0	0.5	1.1	0.0	0.1	7.2
OCTY	160	0	0.3	0.7	0.0	0.2	8.4
OPOP	178	0	0.4	0.7	0.0	0.1	5.8
LANDV	166	0	0.3	0.2	0.1	0.2	1.6
ELD	198	0	0.1	0.0	0.0	0.1	0.3
FFRAC	174	0	0.7	0.4	0.0	0.8	1.3
PINC	191	0	5.9	1.1	3.2	5.9	10.5
LNHDD	62	0	8.6	0.5	6.8	8.7	9.2

Main Task: Replication of Table 4

I found that the results obtained from the optimization are highly dependent on the starting values:

1. Starting far from the results found from BR1991, the optimizer finds a set of parameters that has a lower Likelihood than the true parameters (using the same likelihood function), despite the BR1991 parameters being in the support.
2. Starting a the vector of estimates shown in BR19991, I get results that appear correct.

This take me to believe the R optimizer I am using is the root to the discrepancy.

Table 2: MLE Parameter Estimates

Parameter	Estimate (Far Start)	Estimate (BR1991 Start)	BR1991 Estimate
lambda1	-0.57227	-0.53072	-0.530
lambda2	0.60978	2.25000	2.250
lambda3	0.61129	0.33997	0.340
lambda4	0.08496	0.22938	0.230
beta1	-0.25757	-0.49006	-0.490
beta2	-0.01488	-0.03051	-0.030
beta3	-0.03657	0.00401	0.004
beta4	-0.01784	-0.02064	-0.020

Parameter	Estimate (Far Start)	Estimate (BR1991 Start)	BR1991 Estimate
alpha1	0.95743	0.85959	0.860
alpha2	0.00032	0.03294	0.030
alpha3	0.06695	0.15162	0.150
alpha4	0.00351	0.00000	0.000
alpha5	0.08293	0.08057	0.080
gamma1	0.42810	0.52970	0.530
gamma2	0.76995	0.75979	0.760
gamma3	0.64751	0.46127	0.460
gamma4	0.55471	0.59872	0.600
gamma5	0.10361	0.12015	0.120
gamma_L	-0.82611	-0.73968	-0.740
Log Likelihood	-264.76586	-263.09143	-263.158