

Hard-core Loyal/Potential-Switcher Model

D. G. Morrison and R. A. Colombo

The approach we adopt in looking at brand switching data is to use a model that can account for the "heavy" diagonals almost always seen with these kind of data. Colombo and Morrison (C-M) have proposed a very simple model that assumes

- a) there are two groups of people - switchers and loyals
- b) the loyals always buy the same brand
- c) the switchers are zero-order

Then the conditional probabilities of buying brand j given previously owned brand i are

$$p_{ii} = \alpha_i + (1 - \alpha_i)\pi_i \quad i = j$$

$$p_{ij} = (1 - \alpha_i)\pi_j \quad i \neq j$$

We can easily fit this model by, for example, maximum likelihood. But with large sample sizes we prefer to look at the quality of the fit by examining residuals rather than by formal measures of goodness of fit.

Before showing the results of our analysis we make two remarks. First, the assumption of two groups of people is not as restrictive as it seems. Bordley has shown that the same equations as above can be obtained by allowing arbitrary heterogeneity in the switching probabilities across consumers along with the zero-order assumption. Second, we regard the fitting of the C-M model as a first step. Significant and systematic deviations from the model can be modelled in a more thorough analysis.

We order the France 89 car makes by market share and by type to make the results easier to see and then fit the C-M model. The switcher and loyal parameters are given in Table 2. The parameters seem to reproduce the observed switching matrix quite well with one or two exceptions. The fit can be easily seen by looking at the standardized residuals computed as $(\text{obs} - \text{exp})/\text{sqrt}(\text{exp})$.

Table 1: Standardized Residuals for France 1989

	Ren	Peu	Cit	Ford	VW	Fiat	GM	Rov	Seat	Lada	Alfa	BMW	Merc	Volv	Saab
Ren	0	1	0	0	-1	2	0	-1	1	-1	-1	-2	-1	-1	-1
Peu	3	0	2	-1	-1	-3	0	-1	-1	1	-1	-2	-1	0	-1
Cit	3	5	0	-3	-4	1	-4	-1	-2	0	-2	-2	-1	-1	-1
Ford	-1	-2	-2	0	1	0	5	2	1	0	0	1	0	1	0
VW	-4	2	-2	2	0	0	2	0	2	-2	1	4	1	1	2
Fiat	-2	-2	1	-1	3	0	1	3	0	1	3	-1	-2	0	0
GM	-1	-1	-2	4	2	-1	0	0	1	1	0	1	0	1	-1
Rov	-1	-3	-1	3	-5	2	-3	0	0	2	0	1	-1	0	-1
Seat	0	-3	1	1	1	1	2	0	0	-1	2	-1	-1	-1	0
Lada	-2	0	1	1	-1	2	2	1	0	0	-1	-1	-1	-1	0
Alfa	-1	-2	1	0	1	2	-1	1	1	-1	0	2	1	2	1
BMW	-2	-1	0	-1	3	-2	-2	1	-1	-2	2	0	11	2	5
Merc	-1	-3	-1	0	0	-1	-1	1	0	-1	2	18	0	4	3
Volv	-1	-2	1	-1	4	-1	0	1	1	-1	1	2	2	0	5
Saab	-2	-1	-1	-1	1	0	-1	0	-0	0	4	5	6	3	0

The fit seems good with no very large and obvious patterns in the residuals. We therefore conclude that the model is not a bad first approximation of the data. A closer look shows a few large and positive residuals for the southeast box. To a lesser extent the other block diagonals have mostly positive residuals while the off-diagonal blocks have mostly negative residuals. The overall conclusion then is that the C-M model fits reasonably well but tends to overpredict in the leading block diagonals and under predict in the off-diagonal blocks. There is more switching within broad groups of cars than the model predicts and conversely there is less switching among groups of cars. There does, therefore, seem to be some market structure.

By and large the same story holds for the other years for the French data and also for the UK data (where there are four groups because Japanese cars have a significant presence in the UK). The BMW-Mercedes and Mercedes-BMW residuals are large for both countries and for all four years indicating that there is more switching between these two makes than would be expected if there were no market structure. The switcher and loyal parameters summarize the eight datasets.

Table 2: Switching Probabilities and Proportion of Loyals

	Switchers				Loyals				
	1989	1988	1987	1986	1989	1988	1987	1986	
FRANCE	Ren	25	26	30	26	51	47	49	47
	Peu	23	26	21	22	48	41	41	44
	Cit	9	9	10	10	51	54	51	52
	Ford	8	7	8	9	50	44	50	50
	VW	9	7	7	7	52	50	48	50
	Fiat	8	8	7	7	41	40	40	43
	GM	7	7	6	7	49	50	44	54
	Rov	2	2	2	3	34	33	37	39
	Seat	3	0	2	2	24	*	21	44
	Lada	1	2	1	1	39	29	49	49
	Alfa	1	1	1	1	37	30	35	32
	BMW	1	1	1	2	45	56	46	55
	Merc	1	1	1	1	69	64	63	58
	Volv	1	1	1	1	47	46	43	54
Saab	0	2	0	0	53	*	67	*	
BRITAIN	Ford	25	27	27	24	52	63	62	60
	Rov	13	13	16	24	46	48	44	51
	GM	16	14	15	12	45	56	61	45
	VW	6	5	6	6	51	52	54	51
	Peu	9	9	7	8	48	36	35	41
	Ren	4	5	4	5	44	49	48	48
	Fiat	3	4	4	3	54	52	48	51
	Volv	4	4	4	2	59	60	61	48
	Cit	4	4	3	2	58	61	47	40
	Nis	7	8	7	6	65	50	53	53
	Tov	3	2	2	2	50	60	56	39
	Hon	1	2	1	1	57	49	*	39
	Maz	1	1	0	1	55	50	*	51
	BM	2	2	2	1	51	49	56	49
	Mer	1	1	1	1	65	63	62	54
	Saab	1	0	1	1	51	53	42	55
	Por	0	0	0	0	55	31	*	*

A more refined analysis would fit separate C-M models to each car grouping, but we doubt that we would gain any new insights by doing so.