

## New Car Data Challenge

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Assuming that aggregate switching is consistent with the standard “switching law”, one finds the following estimate for the switching constant (France, 1989):

$$K = \text{Total switching} / (1 - \text{Sum of the squared market shares}) = .523$$

(see Bass, Jeuland and Wright, 1976, pp 1059). We find the following repeat purchase estimates:

#### France 1989

	Alfa	BMW	Cit	Fiat	Ford	GM	Lada	Mer	Peu	Ren	Rov	Saab	Seat	VW	Volv
Actual	97	163	1811	526	696	362	68	136	2928	4861	115	10	36	772	78
Theory	104	163	1641	637	722	440	89	110	2914	4675	167	11	113	786	81

The brand names are shown in the table “France 1989”. The model underestimates repeat purchase for the national brands (Citroen, Peugeot, Renault). When comparing actual and theoretical purchase for the national brands across the years 1986 to 1988, one finds a similar pattern, except for Peugeot where the “switching law” does not seem to indicate any systematic bias. Note also that the “bias” for Citroen and Renault is fairly small. Despite this “augmented loyalty”, both brands lose share to foreign brands, in particular to US brands (Ford, GM). On the other hand, luxury cars such as BMW or Mercedes seem to cater to an “exclusive segment” of the market; switching between those brands is consistently higher than expected. For the years 1986 to 1988, the actual and predicted repeat rates for the national brands are the following:

	<u>1988 (national brands)</u>			<u>1987 (national brands)</u>			<u>1986 (national brands)</u>		
	Cit	Peu	Ren	Cit	Peu	Ren	Cit	Peu	Ren
Actual	1708	2437	4261	1525	2235	4349	1437	2310	3944
Theory	1681	2560	4169	1354	2270	4211	1259	2305	3836

For the United Kingdom, the actual and theoretical number of repeat buyers of the national brand (Rover) are:

	1986	1987	1988	1989
Actual	1876	1928	1945	2407
Theory	1947	2013	1940	2363

In this case, Rover does not seem to benefit from a “national bend” as Citroen and Renault in France. Results on luxury cars such as BMW, Mercedes and Porsche are consistent with those for France, i.e., they draw buyers of those brands more than in proportion to their shares. Across years, the estimates for K are the following:

Country	1986	1987	1988	1989
France	.541	.549	.539	.523
UK	.495	.474	.469	.501

The estimates for K are about the same over the four-year period for each country. They are somewhat larger for France than for the UK: French car buyers tend to be slightly less brand loyal than British car buyers although slightly more loyal to their national brands. In other words, the preference distributions tend to be more U-shaped (larger variance) in the UK than in France (the difference being slightly less for Citroen and Renault). Overall, the “switching law” does not show significant and systematic errors in the predictions of switching and repeat purchase except in the “luxury brand” market. When one compares the magnitude of the parameter K found for car buying to that obtained for frequently purchased goods, one finds lower K estimates for frequently purchased goods as shown below:

	Bemmar (1978)			Jeuland (1979a)
	Instant Coffee	Regular Coffee	Margarine	Cooking Oil
Estimate for K	.321	.351	.401	.354

Those results are based on French consumer panel data. [Goodhardt, Ehrenberg and Chatfield (1984) found a higher estimate for K ( $\hat{K}=.55$ ) toothpaste purchases; however, their estimation method is based on both brand choice and timing data (brand penetrations) which might induce some biases.] Therefore preference distributions have a larger variance for frequently-purchased goods purchases than for car purchases; in other words, buyers appear more brand loyal for frequently purchased goods than for cars.

In all, what do those results tell a marketing manager?

- i. There is no such thing as “country loyalty”; on the other hand, there seems to be a “luxury car loyalty” for car buying.
- ii. There is no evidence of the existence of a “reservoir” of brand loyalty, or “hard-core” loyal buyers; all consumers are “potential” switchers although models which discriminate between hard-core loyal buyers and “potential” switchers have been shown to fit switching data (Colombo and Morrison 1989). Note that the “switching law” itself is not inconsistent with the existence of hard-core loyalty, as shown below:

Let  $\alpha_A, \dots, \alpha_E$  be the proportion of “hard-core” loyal buyers to Brand A, ..., Brand E (in a five-brand market). Let  $g$  be the sum of the  $\alpha$ 's across brands ( $0 < g < 1$ ). The proportion of “potential” switchers is  $1-g$ . Assume that the “potential” switchers i) are homogeneous in terms of probabilities of choice, ii) have the following vector of choice probabilities:  $\alpha_A/g, \dots, \alpha_E/g$ . Hence we assume independence between brand choice and group belonging (“potential” switchers versus “hard-core” loyal segment). According to this model, the probability of switching between, say, A and E, is:  $(1-g) * (\alpha_A/g) * (\alpha_E/g)$  which is the same as the “switching law” (with  $K=1-g$ )<sup>1</sup>. Therefore, showing that the

<sup>1</sup>The number of independent cells in a NxN switching matrix is  $[N(N+1)/2]-1$ . As the number of independent parameters in the Colombo-Morrison model is  $2N-1$ , the number of degrees of freedom is  $N(N-3)/2$ . In the constrained version, the number of degrees of freedom increases to  $[N(N-1)/2]-1$ .

“switching law” fits the data would support (at least) one of two mutually exclusive premises: i) all consumers are “potential” switchers; those consumers are heterogeneous with respect to their preferences; ii) consumers are broken down into two exhaustive and mutually exclusive groups: the “hard-core” brand loyal segment, and the “potential” switchers; these “potential switchers” are homogeneous with respect to their probabilities of choice, and distribute themselves among brands in the same proportions as the “hard-core” loyal buyers. However, for reasons of parsimony in model building, we contend that “hard-core” loyalty does not exist until shown to exist, and we lean toward i) given the evidence.

- iii. There may be evidence of “brand choice inertia” as defined by Jeuland (1979b), that is, a systematic tendency to repurchase the same brand over two purchase occasions, irrespective of the brand chosen last. However, the “switching law” is consistent with Jeuland’s aggregate switching matrix of the “inertia model”. The parameter  $K$  is analogous to  $(1-\mu)(1-r)$  in the “inertia model” where  $\mu$  is the mean of the inertia parameter across consumers and  $r (=1-K)$  is the common parameter of the Dirichlet model. The switching matrices over two purchase occasions do not allow us to discriminate between Jeuland’s model and a heterogeneous zero-order model.
- iv. When comparing switching patterns across countries, one finds a “country effect” which is relatively small (but consistent) compared to the main “global preference” effect. The lower level of switching in the UK can be due to several factors: a) a higher degree of product differentiation, b) a larger price dispersion, c) a lower renewal rate, d) a larger income dispersion. Such factors need to be investigated further. On the other hand, there is no evidence of a “time period” effect;
- v. When comparing switching patterns across product categories (cars versus frequently purchased goods), the results seem to indicate more brand loyalty for frequently purchased goods. This apparently paradoxical result needs to be explained. Several hypotheses can be generated:
  - (a) the choice for automobiles is highly influenced by present and expected income. We expect consumers to choose “better” models with an increase in their income;
  - (b) the heterogeneity of consumers with respect to the choice for cars reflects the dispersion of their income; such “income effect” biases the preference distribution. One might argue that the variation of brand preferences for durables is the same as that for frequently purchased goods, once the preference distribution has been corrected for the income effect.
  - (c) routinized behavior involving smaller evoked sets and little searching for the purchases of frequently purchased goods “explains” the smaller level of switching.

If hypothesis (b) is correct, one would expect i) a greater spread of the income distribution in the UK than in France<sup>2</sup> and ii) a constant coefficient of variation of the income distribution between 1986 and 1989.

Overall, the “switching law” allows us to assess the magnitude of switching and repeat purchase by controlling for the effect of market shares. One can compare the estimates for  $K$  over time across product categories and across countries. The mere fact that the “switching law” works (or about works) and that the estimates for  $K$  are close to one another does not imply that the switching patterns are (about) the same across countries and over time: many models reduce to

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<sup>2</sup>For some very tentative results in this direction, see World Development Reports, New York : Oxford University Press, 1990 (Table 30 of the Statistical Annex). Unfortunately, such data refer to the year 1979.

the “switching law” when tested over two purchase occasions. The Dirichlet is only one of them. Hence the issue is: Are aggregate switching matrices “good enough” to identify the models generating choices? Clearly not. For consumer durables such as cars, the addition of a single purchase would improve model identification (see, e.g., McCarthy et al. 1992 for a step in this direction: this study expectedly shows that the proportion of “hard-core” loyal consumers is overestimated by one third to a half by a two-choice model relative to a three choice model, except in one “odd” case). Managerial insights can meaningfully be derived from “correct” models only; for example, the existence of a pool of “hard-core” loyal buyers would dramatically shift managerial actions. This question, among others, cannot be addressed from the available data. On the other hand, switching matrices over two purchases can be helpful for rough comparisons of switching patterns across countries and time periods. They are also useful for generating hypotheses. In part thanks to this preliminary analysis, “relevant” questions have been addressed, ...but they remain to be answered.