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e-companion

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Electronic Companion—"Should Price Increases Be Targeted?—Pricing Power and Selective vs. Across-the-Board Price Increases" by Aradhna Krishna, Fred M. Feinberg, and Z. John Zhang, *Management Science*, DOI 10.1287/mnsc.1060.0695.

Online Appendix

This appendix presents details of an alternative model specification in which combinations of two separate effects—those for the (Others, You), (Others, Others), and (Others, All) cells—appear additively instead of multiplicatively.

EC.1. "Multiplicative" and "Additive" Models

As discussed in the main paper, the model's core effects operate as in Table EC.1.

There are various ways of combining these into probabilities to be used in a Markovian framework. The model analyzed in the main paper—henceforth referred to as "multiplicative"—takes the form that is shown in Table EC.2.

In Table EC.2, many cells involve two separate effects. In some cells with two such effects—e.g., (You, You) and (You, Others)—one effect impacts the focal firm's consumers (those who bought from you in the last period) and, hence, its base repurchase probability, whereas the other effect impacts the other firm's customers (those who bought from the other firm in the last period) and, hence, the other firm's repurchase probability. In such cases, the two effects can be simply accounted for via addition without jeopardizing logical consistency.

However, in other cells with two effects, e.g. (Others, You) and (Others, Others), both effects impact your customers, and, hence, your base repurchase probability. The multiplicative model adopted a convention assuring both logical consistency and lack of imposed estimation constraints whereby effects enter multiplicatively. Taking the example of the (Others, You) cell, such a "multiplicative" probability is $\alpha(1-b)(1-s)$. By contrast, an "additive" model would suggest a corresponding repurchase probability of $\alpha(1-b-s)$; this, in turn, requires an exogenous constraint that $b+s\leq 1$, a constraint that would need to be imposed throughout Table EC.2, even in cells with single effects. So long as such constraints are imposed, it is quite possible to estimate a model where these dual effects do appear additively. Specifically, three cells' specifications need to be altered, those for (Others, You), (Others, Others), and (Others, All). The resulting probabilities are shown in Table EC.3.

Estimation results—that is, the parameters $\{s_I, l_I, b_I, j_I, s'_I, l'_I\}$; as usual, an I subscript denotes the "increase" scenario—for this alternative, "additive" model are presented next. Note that when $b_I=0$, the additive and multiplicative specifications agree exactly, and estimated parameters should be identical. Note as well that a multiplicative specification of the form $(1-x)(1-y)$ is merely $[(1-x-y)+xy]$, that is, the additive form with an additional xy term. When estimated values for x and y are relatively small (say, less than 0.3 or so), xy will be small compared with $(1-x)(1-y)$, and so the additive and multiplicative specifications should yield broadly similar estimates, fit measures, and overall implications.

EC.2. Estimation Results for Both Models

Table EC.4 again presents the estimation results for the original, multiplicative model given as in Table EC.2.

These can be contrasted with parameter estimates corresponding to the additive model given as in Table EC.3.

As suggested earlier, several of the estimates (i.e., for the full set $\{s_I, l_I, b_I, j_I, s'_I, l'_I\}$) are unaltered if one compares corresponding columns of Tables EC.4 and EC.5. For example, this is so for the Betrayal

Table EC.1 Core Model Effects

	Other firm favors			
Your firm favors [Price increases to]	No One, N [All]	You, S [Others]	Others, L [You]	All, A [No One]
No One, N [All]	(Baseline)	Switching, s	Jealousy, j	Switching, s'
You, L [Others]	Loyalty, l	l and s	l and j	l and s'
Others, S [You]	Betrayal, b	b and s	b and j	b and s'
All, A [No One]	Loyalty, l'	l' and s	l' and j	l' and s'

Table EC.2 Multiplicative Model

	Other firm favors			
Your firm favors	No One, N	You, S	Others, L	All, A
No One, N	α	$\alpha(1-s)$	$\alpha(1-j)$	$\alpha(1-s')$
You, L	$\alpha+l(1-\alpha)$	$\alpha(1-s)+(1-\alpha)l$	$\alpha(1-j)+(1-\alpha)l$	$\alpha(1-s')+(1-\alpha)l$
Others, S	$\alpha(1-b)$	$\alpha(1-b)(1-s)$	$\alpha(1-b)(1-j)$	$\alpha(1-b)(1-s')$
All, A	$\alpha+l'(1-\alpha)$	$\alpha(1-s)+(1-\alpha)l'$	$\alpha(1-j)+(1-\alpha)l'$	$\alpha(1-s')+(1-\alpha)l'$

Table EC.3 Additive Model

	Other firm favors			
Your firm favors	No One, N	You, S	Others, L	All, A
No One, N	α	$\alpha(1-s)$	$\alpha(1-j)$	$\alpha(1-s')$
You, L	$\alpha+l(1-\alpha)$	$\alpha(1-s)+(1-\alpha)l$	$\alpha(1-j)+(1-\alpha)l$	$\alpha(1-s')+(1-\alpha)l$
Others, S	$\alpha(1-b)$	$\alpha(1-b-s)$	$\alpha(1-b-j)$	$\alpha(1-b-s')$
All, A	$\alpha+l'(1-\alpha)$	$\alpha(1-s)+(1-\alpha)l'$	$\alpha(1-j)+(1-\alpha)l'$	$\alpha(1-s')+(1-\alpha)l'$

Table EC.4 Estimated Parameters and Tests for Multiplicative Model

	"Full"	Switching $s_l, s'_l = 0$	Betrayal $b_l = 0$	Loyalty $l_l, l'_l = 0$	Jealousy $j_l = 0$	"Strong" $b_l, j_l = 0$
s_l	0.206	—	0.247	0.069	0.173	0.216
b_l	0.162	0.297	—	0.248	0.207	—
l_l	0.378	0.137	0.425	—	0.312	0.347
j_l	0.139	0.024	0.186	0.001	—	—
s'_l	0.287	—	0.327	0.159	0.257	0.301
l'_l	0.321	0.085	0.371	—	0.239	0.272
Parameters	6	4	5	4	5	4
$F_{[6-Params], 554}$	—	85.4	28.8	63.2	26.6	40.8
p vs. Full	—	$<10^{-32}$	$<10^{-6}$	$<10^{-24}$	$<10^{-6}$	$<10^{-16}$

Table EC.5 Estimated Parameters and Tests for Additive Model

	"Full"	Switching $s_l, s'_l = 0$	Betrayal $b_l = 0$	Loyalty $l_l, l'_l = 0$	Jealousy $j_l = 0$	"Strong" $b_l, j_l = 0$
s_l	0.199	—	0.247	0.065	0.165	0.216
b_l	0.137	0.295	—	0.235	0.186	—
l_l	0.375	0.137	0.425	—	0.309	0.347
j_l	0.134	0.022	0.186	0.001	—	—
s'_l	0.277	—	0.327	0.150	0.245	0.301
l'_l	0.317	0.085	0.371	—	0.237	0.272
Parameters	6	4	5	4	5	4
$F_{[6-Params], 554}$	—	79.0	17.7	57.3	24.7	34.9
p vs. Full	—	$<10^{-31}$	$<10^{-4}$	$<10^{-23}$	$<10^{-6}$	$<10^{-14}$

Table EC.6 Fit Comparison for Multiplicative and Additive Models

	"Full"	Switching $s_I, s_I' = 0$	Betrayal $b_I = 0$	Loyalty $l_I, l_I' = 0$	Jealousy $j_I = 0$	"Strong" $b_I, j_I = 0$
Parameters	6	4	5	4	5	4
Multiplicative	16.59	20.35	17.23	19.37	17.18	18.39
Additive	16.83	20.35	17.23	19.39	17.38	18.39

and "Strong" models (because $b_I = 0$ in both) and very nearly so for the Switching model (because only the (Others, Others) differs in specification).

EC.2.1. Comparing Model Fit and Hit Rate

Finally, it is useful to compare the overall fit of the additive and the multiplicative models. Because these are non-nested, such comparisons are informal, involving the (non-normalized) likelihood values on which the F tests are based. These are given in Table EC.6.

The original, multiplicative model produces superior results, particularly so for the crucial "full" case. Some sense of the degree of this superiority can be gleaned from the hit rate for the multiplicative model in the "Full" case, which is listed in Table 4 (in the main paper) as 88.3%. The corresponding value for the additive formulation is 87.9%, a modest but nonetheless nontrivial drop relative to other values listed in Table 4.

Given this overall pattern of results, the multiplicative specification was adopted.