Variation in own-brand penetration across product categories and stores: the role of rivalrous vs industry-expanding advertising

Rachel Griffith\textsuperscript{1,2}, Michal Krol\textsuperscript{2} and Kate Smith\textsuperscript{1}

\textsuperscript{1}The Institute for Fiscal Studies, \textsuperscript{2}The University of Manchester

December 2012
Introduction

What determines retailers’ product selection, specifically the decision whether or not to introduce own brands in place of national brands?

Propose a theoretical model focusing on the role of advertising, specifically:

- the strength of its ‘**intra-store’ rivalrous capture** effect between brands in a product category ($a_{riv}$) vs. its **industry expansion** effect ($a_{ind}$)
  - e.g. *shampoo* - high $a_{riv}$, low $a_{ind}$, vs. *oranges* - low $a_{riv}$, high $a_{ind}$

- the strength of ‘**inter-store’ rivalrous capture** ($a_{ret}$) - extent to which offering heavily advertised brands attracts consumers from other stores

Other factors: consumers’ **willingness-to-pay** ($V$) and **retailer size** ($s$)

⇒ *then take the predictions to UK supermarket data*
Three stages of the game:

1. Two manufacturers simultaneously set levels of effort $e_1^m, e_2^m$ they exert each advertising one distinct variety within the same category.

2. Manufacturers simultaneously set wholesale prices $p_i^m$ at which to offer their products to retailers.

3. Each retailer independently sets retail prices $p_i^r$ of both national brands.

Consumers, with tastes’ characteristic $x$ uniformly distributed on $[0, 1]$, each buy one unit of product $i$ iff:

$$U_i(x) > \max \{U_{-i}(x), 0\}, \text{ where:}$$

$$U_i(x) = V - p_i^r - |x - (i - 1)| + a_{riv} (e_i^m - e_{-i}^m) / 2$$
**Benchmark Case: No Own Brands (2N)**

**Optimal Prices**

Assume:

1. \( V \geq 3 \),
2. no fixed retail costs, no manufacturing costs,
3. retailers do not compete on prices, only on brand selection. Here, the latter is the same across stores, so for every retailer we have equilibrium prices:

\[
\begin{align*}
    p_i^r &= \left[ p_i^m - p_{-i} - 2 + a_{riv} (e_i^m - e_{-i}^m) \right] / 4 + V \\
    p_i^m &= a_{riv} (e_i^m - e_{-i}^m) / 3 + 2
\end{align*}
\]

and the following market shares & profits:

\[
\begin{align*}
    \bar{x}_1^* = \bar{x}_2^* &= \left[ a_{riv} (e_1^m - e_2^m) + 6 \right] / 12 \\
    \pi^r &= V - 5/2 + (e_1^m - e_2^m)^2 a_{riv}^2 / 72
\end{align*}
\]
For manufacturers’ it’s like selling to a monopolistic retailer, and optimal efforts $e_{i}^{m}$ maximize:

$$\Pi_{i}^{m} = \left[1 + a_{ind} \left(e_{1}^{m} + e_{2}^{m}\right)\right] p_{i}^{m*} \left|\bar{x}_{i}^{*} - (i - 1)\right| - \left(e_{i}^{m}\right)^{2}$$

Assuming $a_{riv}$, $a_{ind}$ not too big, a unique equilibrium exists, with efforts:

$$e_{1}^{m*} = e_{2}^{m*} = \frac{(3a_{ind} + a_{riv})}{(6 - 2a_{ind}a_{riv})}$$

So, a symmetric equilibrium, but manufacturers advertise less and charge more than they would if selling directly to consumers.
Introducing Own Brands
A Single Own Brand (ON)

Suppose that, once equilibrium efforts $e_{m_i}^*$ are set, one of the retailers unexpectedly finds itself in a position to introduce their own brand and offer it to consumers instead of an existing national brand (say, brand $i = 1$).

The retailer can then set their own level of advertising effort $e_{r_1}^* \geq 0$ before prices are set.

We assume this is not in order to compete with the remaining national brand within the store, but rather to bring more people into the store via industry-expansion and inter-store rivalrous capture.
Introducing Own Brands
A Single Own Brand (ON)

In particular, the retailer’s total profit is given by:

$$\Pi^r_{ON} = \pi^r_{ON} \times M - (e_1^r)^2$$

where $\pi^r_{ON}$ is the retailer’s profit per unit mass of consumers, obtained by substituting $e_1^m = 0$ and $e_2^m = e_2^m$ in $\pi^r$, i.e.:

$$\pi^r_{ON} = V - 5/2 + (0 - e_2^m)^2 a_{riv}^2 / 72$$

and $M$ is the mass of consumers visiting the store, specified as:

$$M = s[1 + a_{ind} (e_1^r + e_1^m + e_2^m) + a_{ret} (e_1^r - e_1^m)]$$
Introducing Own Brands

Similarly, suppose the manufacturer replaces both national brands with its own brands, thereby eliminating the intra-store rivalrous effect and making both brands equally attractive to consumers at equal prices.

However, it can now advertise both own brands, i.e. set $e_1^r, e_2^r \geq 0$ to attract consumers into the store more effectively.

$$\Pi_{2O}^r = \pi_{2O}^r M - (e_1^r)^2 - (e_2^r)^2$$

where $\pi_{2O}^r$ is obtained by substituting $e_1^m = e_2^m = 0$ in $\pi^r$ and:

$$M = s \left[1 + a_{ind} \left(e_1^r + e_2^r + e_1^m + e_2^m\right)\right] + a_{ret} \left[(e_1^r + e_2^r) - (e_1^m + e_2^m)\right]$$
Results
Optimal Product Selection

We compare equilibrium profits $\Pi_{2N}^r$ (no own brands), with optimal profits $\Pi_{ON}^r$ and $\Pi_{2O}^r$, corresponding to the introduction of one or two own brands and setting advertising efforts $e_i^r$ optimally.

We find a dual motivation to introduce own brands:

- at the intra-store level, having cheap alternatives to national brands helps get the most out of any mass of consumers who visit
- at the inter-store level, having much-advertised own brands helps in getting more people to visit

Having a single own brand is a compromise between the two, while having two means pursuing the second objective.
Larger \( s \) supports both motives: (1) benefits from effective price differentiation are applied to a larger mass of consumers; (2) bigger stores appropriate a larger share of any industry-wide increase in demand.

Larger \( a_{ret} \) discourages own brand introduction, as more consumers follow heavily advertised national brands. But when shopping in many categories on a single visit, they may be less likely to switch retailers if a national brand is removed from any single category (i.e. \( a_{ret} \) may be smaller in this case). Thus, own brands are more likely to penetrate multi-product, concentrated retail sectors, like the supermarket industry.
Consider then the role of two other parameters: $a_{ind}$ and $a_{riv}$, in the context of the UK supermarket industry:

- dominated by a small number of large retailers with market shares around $1/4$, so set $s = 0.25$.
- people consider many product categories on a single visit, so small $a_{ret}$ and $V$ (likely to opt out of one if too expensive); set $V = 3$ (smallest value allowed, market just about covered) and $a_{ret} = 0.005$. 
Results: Large Stores \((s = 0.25)\)

**Three** parameter regions:

**\(2N\)** no own brands - small \(a_{ind}\), large retailers better internalize industry expansion;

**\(ON\)** own brands mixed with national brands - large \(a_{ind}\) and \(a_{riv}\), both price differentiation and attracting new consumers are important;

**\(2O\)** own brands dominate - large \(a_{ind}\), small \(a_{riv}\), market expansion the main objective
Results: Small Stores \((s = 0.05)\)

A *ceteris paribus* \(s \downarrow\) would enlarge ‘2N’, but \(a_{ret} \downarrow\) or \(V \uparrow\) could offset.

(Lidl?) more budget brands & less advertising

(M&S?) more standard own brands, more advertising