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By Raj Sethuraman and Jagmohan Raju

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# The Competition between National Brands and Store Brands: Models, Insights, Implications, and Future Research Directions

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## Abstract

In this article, we provide a comprehensive review of the literature on economic models of national brand — store brand competition and address three questions: (i) What types of economic models have been used to analyze the competition between national brands and store brands? (ii) What insights and implications have they generated? (iii) What are some useful future directions for modelers of national brand — store brand competition? We review 47 articles published or written during the period 1966–2011, present the model characteristics of the key articles, and develop over 160 results pertaining to national brand and store brand decisions. Then, we discuss the implications of these results and suggest directions for future research.

# 1

# Introduction

Private labels or store brands are generally brands marketed by the retailer using the retailer's own name (e.g., *Kroger, Safeway select*) or a brand name associated with the retailer (e.g., *Great Value* and *Sam's Choice* of Wal-Mart). Private labels have experienced considerable growth during the period 1980–2010, often at the expense of national brands. During the year 2011, overall supermarket sales of store brands in the United States increased 5.1%, pushing private label dollar share up half a point to 19.5%, a record high, according to data collected by The Nielsen Company (*www.plma.com*). By comparison, sales of national brands gained 2%. U.S. Private label unit share in 2011 rose to 23.6%, another record, and a significant increase compared to about 15% in the 1980s. Store brand shares are even higher in Europe and are also growing in Asia and Australia (Kumar and Steenkamp, 2007).

Because of this high private label growth, understanding the competition between national brands and store brands has become important for both the national brand manufacturers and the retailers. Several researchers have contributed to the literature by analyzing economic models that incorporate the competition between the two types

of brands. This article provides a comprehensive review of the literature on economic models of national brand–store brand competition and addresses three relevant questions:

1. What types of economic models have been used to analyze the competition between national brands and store brands?
2. What insights and implications have they generated?
3. What are some useful directions for future research by modelers of national brand–store brand competition?

Berges-Sennou et al. (2004) provide a brief review of the literature on the economics of private labels focused on the antecedents and consequences of private labels. Subsequently, Sayman and Raju (2007) and Kumar and Steenkamp (2007) provide more extensive reviews of the literature but their focus is not on analytical, economic models of national brand–store brand competition. Recently, Sethuraman (2009) has reviewed the analytical models of national brand–store brand competition and discussed several key results. However, his focus was on the external validity of analytical results. In particular, he proposes three measures for external validity — Robustness, Empirical support, and Credibility, and assesses the validity of 44 analytical results from 22 studies on these criteria. This article can be deemed as an extension of the work by Sethuraman (2009) with some important differences. We review 47 studies published between 1966 and 2011 and report over 160 results. More importantly, while Sethuraman (2009) focuses on external validity of the results, our focus is exclusively on the analytical models that give rise to those results. Thus we do not discuss any empirical or managerial literature.

The organization of the article is as follows. First, we present a framework that is conducive for classifying the extant literature on national brand–store brand competition. Second, we compile pertinent articles and available working papers and classify them using the framework referenced above. Third, we trace the development of the analytical models starting from the simple model with one national brand manufacturer and one retailer and progressing to models with multiple manufacturers and retailers. Finally, we discuss the insights obtained from them and provide future research directions.

# 2

## Framework for Classifying Research Studies

The conceptual framework used to study the competition between national brands and store brands is presented in Figure 2.1. Because store brand is generally a brand marketed by the retailer using its own brand name, the presence of a manufacturer and a retailer is essential. The manufacturer sells the national brand. The focal manufacturer may compete with other national brand manufacturers in the market, while selling its own brand through other retailers. The focal retailer sells the national brands to consumers and may choose to also sell a store brand. The store brand may be produced by the retailer, or procured from a national brand manufacturer or a third party supplier. Consumers then choose the quantities of national brands and store brand to buy. This framework can be represented mathematically as follows:

*Notations*

$n$ = national brand(s) − NB; $s$ = store brand(s) − SB.

$i$ = subscript for national brand and its manufacturer, $i = 1, 2, \ldots, I$

$j$ = subscript for store brand and its retailer, $j = 1, 2, \ldots, J$

Note that for convenience and ease of reading, we assume each manufacturer is associated with a particular national brand and use the same notation; same way, each retailer is associated with a particular store brand.

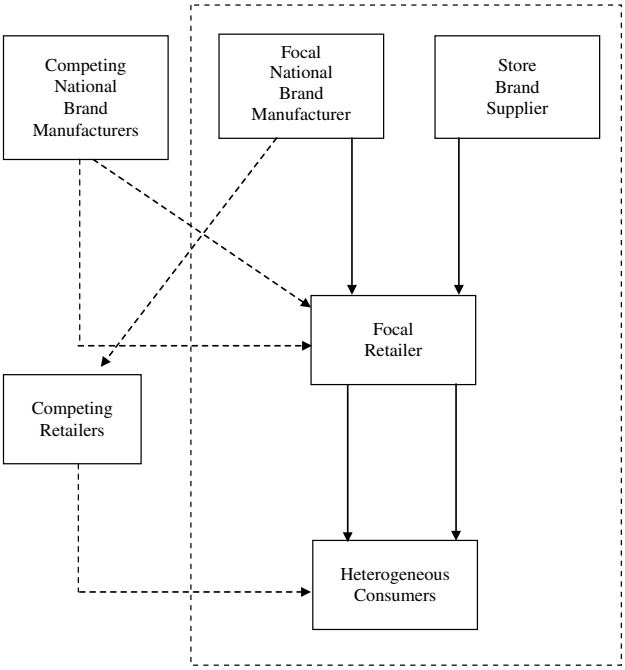


Fig. 2.1 Framework.

D: Demand in unit volume

$\Omega_{ij}$: All uncontrollable (exogenous, non-decision) factors that can influence demand for national brand $i$ in retail outlet $j$

$\Omega_{sj}$: All uncontrollable (exogenous, non-decision) factors that can influence demand for store brand $s$ in retailer $j$

$\theta^m_{ij}$: All (endogenous, decision) factors that can influence demand that are controlled by manufacturer $i$ with respect to national brand $i$ in retailer $j$.

$\theta^m_{isj}$: All (endogenous, decision) factors that can influence demand that are controlled by manufacturer $i$ with respect to store brand $s$ in retailer $j$.

$\theta^r_{ij}$: All (endogenous, decision) factors (including retail price) that can influence demand that are controlled by retailer $j$ with respect to national brand $i$.

$\theta^r_{sj}$: All (endogenous, decision) factors that can influence demand that are controlled by retailer $j$ with respect to its store brand $s$.

Based on these notations, we can write demand for national brand $i$ in retail outlet $j$ and store brand $s$ in retail outlet $j$ as a function of exogenous environmental factors and endogenous decision variables:

$$D_{ij} = f'[\Omega_{ij}, \theta^m_{ij}, \theta^m_{sj}, \theta^r_{ij}, \theta^r_{sj}] \tag{2.1}$$

$$D_{sj} = f''[\Omega_{sj}, \theta^m_{ij}, \theta^m_{sj}, \theta^r_{ij}, \theta^r_{sj}] \tag{2.2}$$

The exogenous factors ($\Omega$s) are typically category demand, brand competition, store competition, and consumer price sensitivity; endogenous decision factors ($\theta$s) are variables such as price and advertising. We now incorporate costs in the framework with the following notations:

$C^m_{ij}$: Costs incurred by manufacturer $i$ with respect to selling of national brand $i$ in retailer $j$.

$C^m_{isj}$: Costs incurred by NB manufacturer $i$ with respect to selling store brand in retailer $j$.

$C^r_{ij}$: Costs incurred by retailer $j$ with respect to national brand $i$.

$C^r_{sj}$: Costs incurred by retailer $j$ with respect to store brand $s$.

Given these notations, the manufacturer $i$s objective (e.g., profits) can be written as:

$$obj^m_i = g'[D_{ij}, D_{sj}, \theta^m_{ij}, \theta^m_{isj}, \theta^r_{ij}, \theta^r_{sj}, C^m_{ij}, C^m_{isj}] \tag{2.3}$$

for all $i$, $j$, and $s$.

The retailer $j$s objective (e.g., profits) can be written as:

$$obj^r_j = g''[D_{ij}, D_{sj}, \theta^m_{ij}, \theta^m_{sj}, \theta^r_{ij}, \theta^r_{sj}, C^r_{ij}, C^r_{sj}] \tag{2.4}$$

for all $i$, $j$, and $s$ with $f'$, $f''$, $g'$, $g''$ being some general functions.

The objective is generally to maximize absolute monetary profits but there can be other objectives such as increasing share of profits, total channel profits, store traffic or market share. Retailers and manufacturers set their decision variables ($\theta^m$ and $\theta^r$) to achieve their respective objectives given a certain sequencing of decisions often called the game structure (GS).

Economic models vary in their consideration of or assumptions related to number of manufacturers ($I$), number of retailers ($J$), exogenous factors ($\Omega$), endogenous factors ($\theta$), cost factors ($C$), functional form ($f$) and game structure ($GS$). Together, we call these *Model*

*Characteristics.* A list of model characteristics representing key considerations in analyzing the competition between national brands and store brands is presented in Table 2.1.

The analysis of the model yields equilibrium results that generally relate endogenous decision variables to exogenous environmental factors. These results provide insights into managerial questions related to national brand and store brand strategies. We call these questions

Table 2.1. List of model characteristics and their codes.

| # | Model Characteristics | Variations in model characteristics | | | |
|---|---|---|---|---|---|
| 1 | Number of NB manufacturers (NM) | Nonstrategic (N) | Monopolist (M) | Duopoly (D) | Oligopoly (O) |
| 2 | Number of Retailers(NR) | Nonstrategic (N) | Monopolist (M) | Duopoly (D) | Oligopoly (O) |
| 3 | Competition among national brands (CM) | None(N) | Symmetric (S) | Asymmetric (A) | |
| 4 | Competition among retailers (CR) | None(N) | Symmetric (S) | Asymmetric (A) | |
| 5 | SB Supplier characteristics (SS) | Third party non strategic (N) | Third party strategic Excluding NB mfr. (E) | Third party strategic including NB mfr. (I) | |
| 6 | Demand base (DB) | Aggregate market (A) | Individual consumer (C) | | |
| 7 | Demand Function (DF) | Linear in price(L) | Nonlinear (N) | | |
| 8 | Category demand (CD) | Fixed (F) | Variable (V) | Other (O) | |
| 9 | NB Marginal cost (NC) | Zero (Z) | Constant (C) | Variable (V) | |
| 10 | SB Marginal cost (SC) | Zero (Z) | Constant (C) | Variable (V) | |
| 11 | NB & SB relative cost (RC) | Equal (E) | Unequal (U) | | |
| 12 | Game structure (GS) | Stackelberg (S) | Nash (N) | Other (O) | |
| 13 | Time period (TP) | Static One period (O) | Dynamic Two period (T) | Dynamic Multi periods (M) | Infinite periods (I) |

Table 2.2. List of model outcomes and their codes.

| Code | Strategy | Decisions |
|---|---|---|
| *National Brand Decisions — Manufacturer (NM)* | | |
| NM1 | Product | A. What features/characteristics should the national brand possess vis-á-vis store brands?<br>B. Which consumers should the national brand target?<br>C. What positioning strategy should be adopted for national brands vis-á-vis store brands? |
| NM2 | Price | A. What wholesale price to charge for the national brand?<br>B. What kind of discounts (nonlinear pricing) should be offered? |
| NM3 | Place | A. Which stores should carry the national brands? |
| NM4 | Promotion | A. What type of promotions to adopt when competing with store brands — advertising, trade discounts, coupons, co-op promotions?<br>B. What should be the timing and extent of such promotions — promotion frequency, promotion depth etc. |
| *National Brand Decisions — Retailer (NR)* | | |
| NR1 | Price | A. What retail price to charge for the national brand?<br>B. What kind of discounts should be offered? |
| NR2 | Place | A. Which stores should carry the national brands?<br>B. What shelf space and type of shelf positioning should be given to them? |
| NR3 | Promotion | A. Should national brand be promoted at the retail level?<br>B. If so, how should it be promoted — price discount, advertising, display, feature, or in other ways?<br>C. What should be the timing and extent of promotion — promotion frequency, promotion depth, etc. |
| *Store Brand Decisions — Retailer (SR)* | | |
| SR1 | Introduction | A. Should a store brand be introduced? If so, in which categories?<br>B. Should retailers market more than one store brand in a category?<br>C. Where should the store brand(s) be sourced from? |
| SR2 | Product | A. What features/characteristics should the store brand possess?<br>B. Which consumers should the store brand target?<br>C. What positioning strategy should be adopted for store brands? |
| SR3 | Price | A. What price to charge for the store brand?<br>B. What kind of discounts should be offered? |
| SR4 | Place | A. Which stores should carry the private labels?<br>B. What shelf space and shelf positioning should be given to them? |
| SR5 | Promotion | A. Should store brand be promoted?<br>B. If so, how should it be promoted — price discount, advertising, display, feature, or in other ways?<br>C. What should be the timing and extent of promotion — promotion frequency, promotion depth, etc. |
| *Store Brand Decisions — Manufacturer (SM)* | | |
| SM1 | Introduction | A. To produce private label or not.<br>B. If so, at what price and quality? |

and their related insights as *Model Outcomes*. A list of questions addressed by way of model outcomes representing key manufacturer and retailer decisions is presented in Table 2.2.

Each article or research study can be viewed as a mapping of a subset of Model Characteristics (MC) to a subset of Model Outcomes (MO), or MC $\longrightarrow$ MO.

We now use the framework to compile and review the relevant literature on economic models of national brand–store brand competition.

# 3

# Compilation and Classification of Research Studies

We selected published articles and available working papers that satisfied the following criteria: (i) incorporated the competition between national brand and store brand directly or indirectly; (ii) provided results or insights related to national brand and/or store brand marketing; (iii) arrived at those results or insights using economic models; and (iv) were published between 1966 and 2011 (this review was conducted in Summer 2012). We identified relevant literature through a combination of online searches (e.g., Web of Science) and manual searches. There are 47 published journal articles and working papers that satisfy the above four criteria. They are listed in Table 3.1 (detailed citations are in the reference section).

The most common model characteristics assumed in the literature are:

- One manufacturer — 24/47 or 51% of studies
- One retailer — 31/47 or 66% of studies
- SB supplier third party non-strategic — 32/47 or 68% of studies
- Demand function linear in price — 28/47 or 60% of studies

Table 3.1. List of studies reviewed and their details.

| | | | Model Characteristics (MC) | | | | | | | | | | | | | Model Outcomes (MO) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # | First author | Year | NM | NR | CM | CR | SS | DB | DF | CD | NC | SC | RC | GS | TP | NM | NR | SR | SM |
| 1 | Abe | 1995 | M | N | N | N | N | C | N | F | V | V | U | O | O | 1, 2, 4 | | | |
| 2 | Amrouche | 2008a | M | M | N | N | N | A | L | V | V | C | U | S | I | 2, 4 | 1 | 3, 5 | |
| 3 | Amrouche | 2012 | M | M | N | N | N | A | L | V | V | C | U | N | I | 2, 4 | 1 | 3, 5 | |
| 4 | Amrouche | 2007 | M | M | N | N | N | A | L | V | Z | Z | E | S | O | 2 | 1, 2 | 3, 4 | |
| 5 | Amrouche | 2009 | M | M | N | N | N | A | L | V | Z | Z | E | S | O | 3 | 1 | 1, 3 | |
| 6 | Amrouche | 2008b | M | M | N | N | N | A | L | V | C | Z | U | N,S | O | 2, 4 | 1 | 4, 3 | |
| 7 | Bergess | 2002 | M | D | S | N | I | C | N | F | Z | V | U | S | O | 2 | 1 | 3 | 1 |
| 8 | Bontems | 1999 | M | M | N | N | N | C | N | V | C | V | U | S | O | 2 | 1 | 2, 3 | |
| 9 | Chen | 2010 | M | M | N | N | E | C | N | V | C | C | U | S | O | 2 | 1, 2, 3 | 1 | |
| 10 | Choi S | 2006 | M | D | S | N | N | A | L | V | Z | Z | E | O | O | 2 | 1 | 3 | |
| 11 | Choi Chan | 2006 | D | M | A | N | N | A | L | V | C | V | U | S | O | 1, 2 | 1 | 2 | 1 |
| 12 | Cohen | 2011 | O | O | A | A | N | C | N | V | C | C | U | S+ | O | 2 | 1 | 3 | |
| 13 | Connor | 1992 | O | N | A | A | N | A | N | V | V | C | U | O | O | 2 | 1 | | |
| 14 | Corstjens | 2000 | D | D | A | S | N | C | N | V | V | V | U | N | T | | 1, 3 | 1, 2, 3, 5 | |
| 15 | Draganska | 2010 | O | O | A | A | N | C | N | V | C | C | U | O | O | 1, 2 | 1 | 3 | |
| 16 | Dunne | 1992 | D | M | S | N | I | A | L | V | C | C | U | S | O | 2 | 1 | 1 | 1 |
| 17 | Gomez | 2008 | D | M | A | N | I | C | L | V | V | V | E | S | O | 2 | 1 | 1, 2, 3, | 1 |
| 18 | Groznik | 2010b | M | D | N | S | N | C | L | V | C | C | U | S | O | 2 | 1 | 1, 2, 3 | |
| 19 | Groznik | 2010a | M | M | N | N | N | C | L | V | C | C | U | S | O | 2 | 1, 2 | 1, 3 | |
| 20 | Horowitz | 2000 | N | M | N | N | N | A | N | V | V | V | U | O | M | | | 1 | |
| 21 | Karray | 2008 | D | M | S | N | N | A | L | V | Z | Z | E | S | O | 2, 4 | 1 | 3, 5 | |
| 22 | Karray | 2009 | M | M | N | N | N | A | L | V | Z | Z | E | S | I | 2, 4 | 1 | 3, 5 | |
| 23 | Karray | 2006 | M | M | N | N | N | A | L | V | Z | Z | E | S | O | 2, 4 | 1, 3 | 3 | |

(*Continued*)

Table 3.1. (*Continued*)

| # | First author | Year | Model Characteristics (MC) | | | | | | | | | | | | | Model Outcomes (MO) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | NM | NR | CM | CR | SS | DB | DF | CD | NC | SC | RC | GS | TP | NM | NR | SR | SM |
| 25 | Kurata | 2007 | M | D | N | S | N | A | L | | C | C | U | N | O | 2 | 1 | 3 | |
| 26 | Lal | 1990 | D | M | A | N | E | C | L | V | Z | Z | Z | E | I | 2, 4 | 1, 3 | 3, 5 | |
| 27 | Mills | 1995 | M | M | N | N | N | C | L | V | C | C | C | E | O | 2 | 1 | 1, 2, 3 | |
| 28 | Mills | 1999 | M | M | N | N | N | C | L | V | C | C | C | E | O | 1, 2, 4 | 1, 3 | 3 | 1 |
| 29 | Morris | 1980 | M | N | N | N | I | A | N | V | C | C | C | U | O | 1, 2 | | | 1 |
| 30 | Narasimhan | 1988 | D | N | N | N | E | C | N | F | Z | Z | Z | E | O | 1, 2, 4 | | 2, 3, 5 | |
| 31 | Narasimhan | 1998 | M | M | N | N | N | C | N | F | Z | Z | C | U | O | 1, 2 | 1 | 1, 2, 3 | |
| 32 | Peles | 1972 | O | N | N | N | I | A | N | V | V | V | V | U | O | | | | 1 |
| 33 | Raju | 1995a | O | M | S | N | N | A | L | V | Z | Z | Z | E | O | 2 | 1 | 1, 2, 3 | |
| 34 | Raju | 1995b | O | M | S | N | N | A | L | V | Z | Z | Z | E | O | 2 | 1 | 3 | |
| 35 | Raju | 1990 | D | N | A | N | E | C | N | F | Z | Z | Z | E | O | 2, 4, 1 | | 2, 3, 5 | |
| 36 | Rao | 1991 | D | N | A | N | E | C | N | F | C | C | C | U | O | 2, 4, 1 | | 2, 3, 5 | |
| 37 | Sayman | 2004 | D | M | A | N | N | A | L | V | Z | Z | Z | E | O | 2 | 1 | 1, 2, 3 | |
| 38 | Sayman | 2002 | D | M | A | N | N | A | L | V | Z | Z | Z | E | O | 2 | 1 | 1, 2, 3 | |
| 39 | Schmalensee | 1978 | O | N | S | N | N | C | N | V | V | V | V | U | O | 1, 2, 4 | | | |
| 40 | Scott-Morton | 2004 | D | M | A | N | N | C | N | V | Z | Z | Z | E | O | 1, 2 | 1, 2 | 1, 2, 3 | |
| 41 | Sethuraman | 1991 | M | M | N | N | N | A | L | V | Z | Z | Z | E | O | 2, 4 | 1 | 1, 2, 3 | |
| 42 | Sethuraman | 2002 | M | M | N | N | N | A | L | V | Z | Z | Z | E | O | 2 | 1 | 2, 3 | |
| 43 | Soberman | 2004 | M | M | N | N | I | C | L | F | Z | Z | Z | E | O | 1, 2, 4 | 1 | 2, 3 | 1 |
| 44 | Soberman | 2006 | M | M | N | N | I | C | L | V | Z | Z | Z | E | O | 1, 2, 4 | 1 | 2, 3 | 1 |
| 45 | Tyagi | 2006 | O | M | S | N | N | A | L | V | Z | Z | Z | E | I | 2 | 1 | 3 | |
| 46 | Wolinsky | 1987 | D | N | S | N | E | C | N | V | C | C | C | E | O | 1, 2 | 1 | 1, 3 | 1 |
| 47 | Wu | 2005 | D | M | S | N | I | C | L | V | C | V | V | U | T | 4, 2 | 1, 3 | 1, 5 | 1 |

*Note*: Please refer to Tables 2.1 and 2.2 for the codes related to Model Characteristics and Model Outcomes.

- NB & SB marginal costs equal and constant or zero — 23/47 or 49% of studies
- Manufacturer as Stackelberg leader — 27/47 or 57% of studies
- Single period static model — 39/47 or 83% of studies

These assumptions make the model analytically tractable. They yield closed form solutions that enable researchers to derive results analytically instead of using numerical simulations or other methods. They also help gain insights that may be hard to infer from complex models. We use these assumptions to derive baseline results in the next section.

We now discuss the various models of national brand–store brand competition in the following sequence. Models with (i) one national brand manufacturer and one retailer; (ii) two or more manufacturers and one retailer; (iii) one manufacturer and two or more retailers; (iv) multiple manufacturers and retailers. In each section, we present the structure of the models and the results for key studies. Our focus is only on the structure of the model and the model outcomes and not on how the results are derived. We discuss the key results after presenting all the models.

# 4

# Models with One Manufacturer and One Retailer

We start with a base model and then discuss other models that relax some of the assumptions in the base model.

## 4.1 Base Model

The assumptions and tenets of the baseline model are[1]:

A1. There is one national brand sold by a manufacturer through one retailer.
A2. In addition to selling the national brand, the retailer may also sell its own store brand.
A3. The store brand is acquired by the retailer at cost from a supplier in the competitive fringe.
A4. Marginal costs of manufacturing national and store brand are constant and equal, and set to zero (without loss of generality in this linear model).
A5. There are no other costs of selling the national brand or the store brand

[1] We use notation A to number assumptions (A1, A2, etc.) and R for results.

A6. The manufacturer charges a wholesale price ($w_n$) to the retailer to maximize its profits.
A7. The retailer charges retail prices of national brand ($p_n$) and store brand ($p_s$), if it chooses to also sell a store brand.
A8. The retailer maximizes its category profits from national brand and store brand.
A9. Manufacturer is the Stackelberg leader, that is he sets the wholesale price first but knows how the retailer will react to his decision in advance and incorporates that information into his decision making.[2]

Demand function for the base model in the case where the retailer carries only the national brand (no store brand) is:

$$q_n = 1 - p_n. \tag{4.1}$$

Demand functions for the base model in the case where the retailer carries both the national brand and the store brand is:

$$q_n = 1 - p_n - \theta(p_n - p_s) \tag{4.2}$$

$$q_s = 1 - p_s + \theta(p_n - p_s). \tag{4.3}$$

The demand functions represented by Equations (4.2) and (4.3) are useful and popular for many reasons: (i) They are linear in prices and hence yield closed form equilibrium values. (ii) It has been shown that such a linear demand function that is a function of own price and price differential with competitors is consistent with a quadratic utility model (Shubik and Levitan, 1980; McGuire and Staelin, 1983). (iii) This price differential model is especially appropriate in the context of national brand vs. store brand competition because retailers are said to attract customers to store brand by setting the price differential. (iv) The model permits focused analysis on just one parameter ($\theta$). In this demand function, $\theta$ represents the price substitutability between national brands and store brands, which in turn is influenced through quality differential between them and the price sensitivity of consumers in that product market.

[2] For convenience, we refer to the manufacturer as "he" and retailer as "she."

Given the above demand functions and model assumptions, the manufacturer's profit maximization problems can be written as

$$\underset{w_n}{\text{Max}}\,\Pi_m = w_n q_n. \tag{4.4}$$

Retailer's profit maximization problem with no store brand is:

$$\underset{p_n}{\text{Max}}\,\Pi_{rn} = (p_n - w_n)q_n. \tag{4.5}$$

Retailer's profit maximization problem with store brand is:

$$\underset{p_n,p_s}{\text{Max}}\,\Pi_{rns} = (p_n - w_n)q_n + p_s q_s. \tag{4.6}$$

The equilibrium prices, quantities and profits for the case with and without store brand are given in Table 4.1. The following are the results from the analysis.

When is it profitable for a retailer to introduce a store brand? The retailer profits with no store brand is 0.0625. Retailer always obtains profits higher than 0.0625 when he also carries a store brand. We state this finding formally in the following result:

R1. *Given zero cost of store brand introduction, the retailer always introduces a store brand in equilibrium.*

What happens to prices, margins and profits when a store brand is introduced?

From inspecting the corresponding equilibrium values in Table 4.1 and from Figures 4.1A–4.1M, it is easy to infer the following results. *When a store brand is introduced*:

R2. *Manufacturer wholesale price of national brand decreases*
R3. *Retail price of national brand decreases*
R4. *Retail margin on national brand increases*
R5. *Quantity of national brand sold remains the same*
R6. *Manufacturer profits on national brand decreases*
R7. *Retailer profits on national brand increases*
R8. *Retailer share of channel profits increases*

What happens when the lone key parameter $\theta$ the cross-price sensitivity increases? From equilibrium values and Figure 4.1A–4.1M, the

Table 4.1. Equilibrium values.

| | Retailer NB only | Retailer NB + SB | Retailer NB + NB |
|---|---|---|---|
| NB wholesale price, $w_n$ | $\frac{1}{2}$ | $\frac{1}{2(1+\theta)}$ | $\frac{1}{2+\theta}$ |
| NB retailer price, $p_n$ | $\frac{3}{4}$ | $\frac{3+2\theta}{4(1+\theta)}$ | $\frac{3+2\theta}{2(3+\theta)}$ |
| NB retail margin, $rmar_n$ | $\frac{1}{4}$ | $\frac{1+2\theta}{4(1+\theta)}$ | $\frac{1+\theta}{2(2+\theta)}$ |
| NB quantity sold, $q_n$ | $\frac{1}{4}$ | $\frac{1}{4}$ | $\frac{1+\theta}{2(2+\theta)}$ |
| NB retailer profits, $rpro_n$ | $\frac{1}{16}$ | $\frac{1+2\theta}{16(1+\theta)}$ | $\frac{(1+\theta)^2}{4(2+\theta)^2}$ |
| NB manufacturer profits, $mpro_n$ | $\frac{1}{8}$ | $\frac{1}{8(1+\theta)}$ | $\frac{1+\theta}{2(2+\theta)}$ |
| SB price, $p_s$ | | $\frac{1}{2}$ | $\frac{3+\theta}{2(2+\theta)}$ |
| NB-SB price differential, *pdif* | | $\frac{1}{4(1+\theta)}$ | 0 |
| SB quantity sold, $q_s$ | | $\frac{2+3\theta}{4(1+\theta)}$ | $\frac{1+\theta}{2(2+\theta)}$ |
| SB retailer profits, $rpro_s$ | | $\frac{2+3\theta}{8(1+\theta)}$ | $\frac{(1+\theta)^2}{4(2+\theta)^2}$ |
| Total retailer profits, $rpro_t$ | | $\frac{5+8\theta}{16(1+\theta)}$ | $\frac{(1+\theta)^2}{2(2+\theta)^2}$ |
| Total channel profits, $tpro_t$ | | $\frac{7+8\theta}{16(1+\theta)}$ | $\frac{3+4\theta+\theta^2}{2(2+\theta)^2}$ |
| Retailer share of profits, $rsha_r$ | | $\frac{100(5+8\theta)}{7+8\theta}$ | $\frac{100(1+8\theta)}{3+8\theta}$ |

following results can be inferred. *As $\theta$ increases*,

R9. *Manufacturer wholesale price of national brand decreases*
R10. *Retail price of national brand decreases*
R11. *Retail price of store band decreases*
R12. *Retail price differential between national brand and store brand decreases.*
R13. *Quantity of national brand sold remains the same*

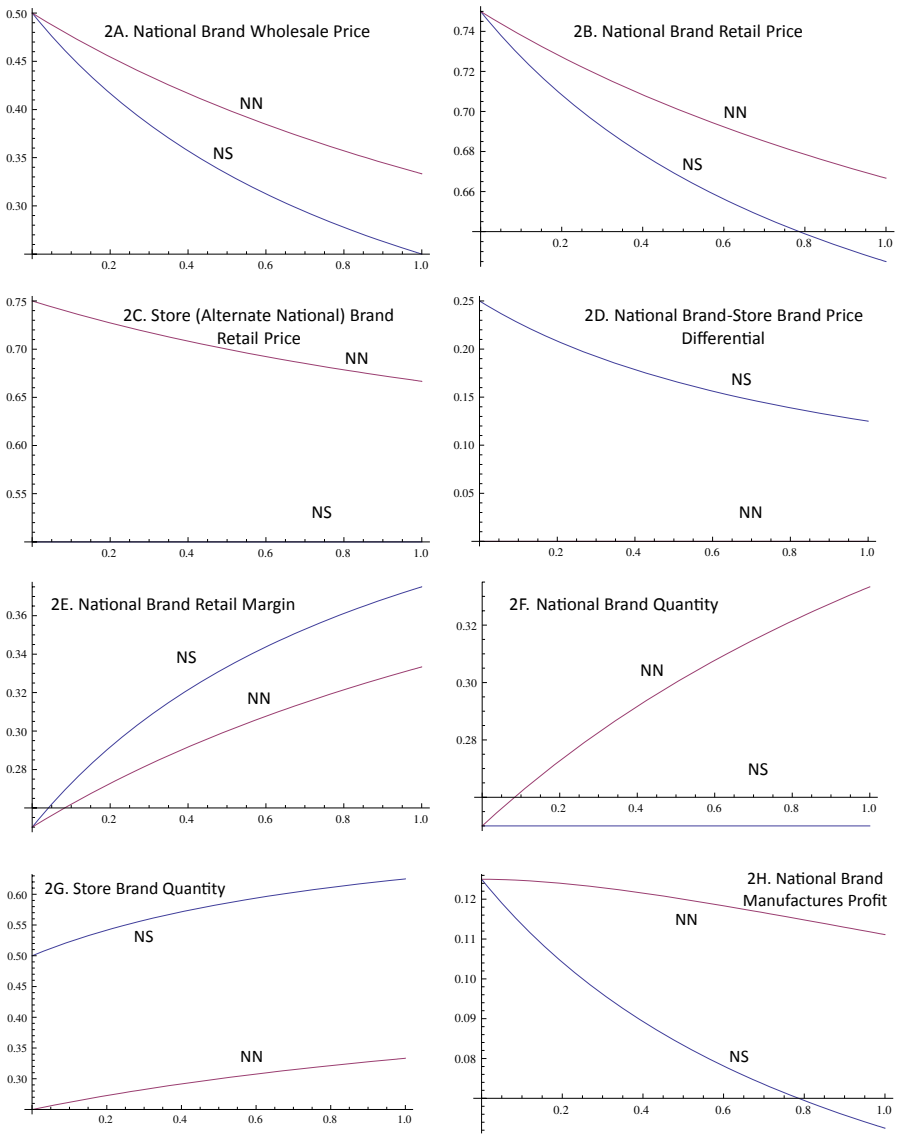


Fig. 4.1 Movement of equilibrium values with cross-price sensitivity ($\theta$).

*Note*:

- $X$-axes in all figures represent $\theta$ from 0 to 1, $\theta = 0$ is the case with no national brand
- $Y$ axes represent equilibrium values.
- NS = Case where one NB and one SB sold by retailer
- NN = Case where two NBs sold by retailer instead of one NB and one SB

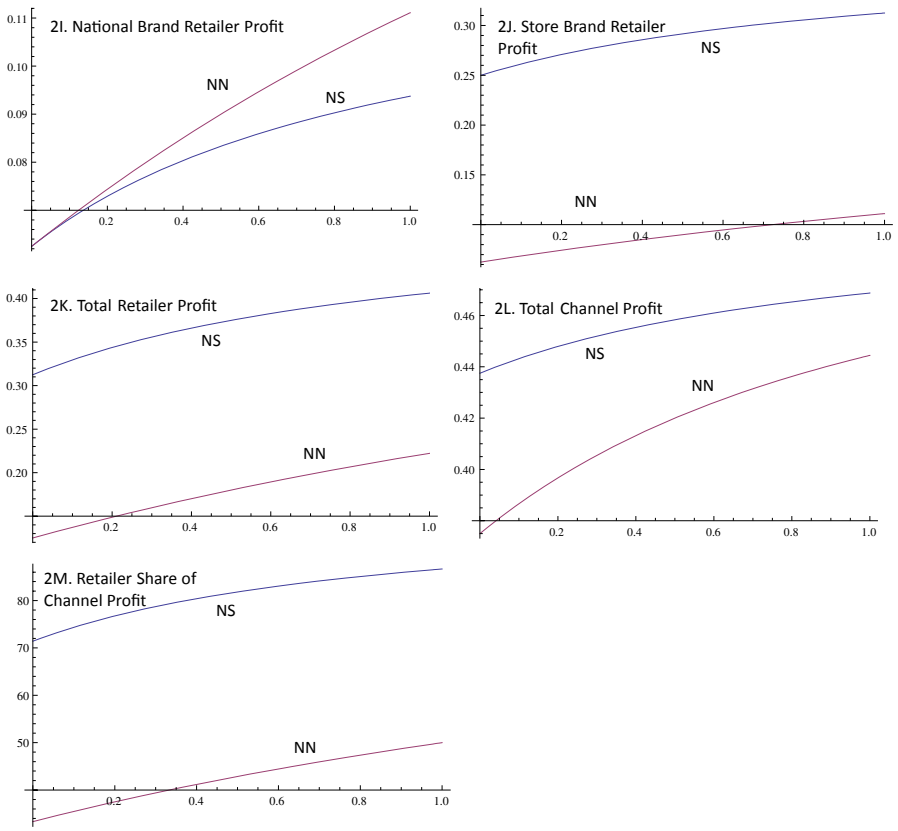


Fig. 4.1 (*Continued*)

R14. *Quantity and share of store brand sold increases*
R15. *Retail margin on national brand increases*
R16. *Manufacturer profits on national brand decreases*
R17. *Retailer profits on national brand increases*
R18. *Retailer profits on store brand increases*
R19. *Total retailer profits increases*
R20. *Total channel profits increases*
R21. *Retailer share of channel profits increases.*

We denote results R1–R21 as baseline results. These results essentially state, not surprisingly, that the introduction of a competitive store brand by the retailer increases retailer margins and profits while

decreasing manufacturer margins and profits. However, quantity sold of national brand remains the same with store brand introduction, which is an artifact of the specific linear model used in this base model. In the rest of the paper, we refine these results and supplement them with several additional results drawn from different models. We will discuss the robustness, insights and implication of all the results later in the article.

An interesting supplemental question is whether the results differ if the retailer carries another national brand as opposed to its own store brand. That is, what is different or unique about a store brand in comparison to the retailer carrying another national brand? In this case, the retailer does not carry a store brand but carries another national brand sold by another strategic manufacturer. The objective functions change as follows:.

Each manufacturer $i(i = 1, 2)$ sets its wholesale price to maximize its national brand profits

$$\underset{w_{ni}}{\text{Max}}\, \Pi_{mi} = w_{ni} q_{ni} (i = 1, 2). \tag{4.7}$$

Retailer sets the retail prices to maximize the total profits from the two national brands

$$\underset{p_{n1}, p_{n2}}{\text{Max}}\ \Pi_r = (p_{n1} - w_{n1}) q_{n1} + (p_{n2} - w_{n2}) q_{n2}. \tag{4.8}$$

Expressions for equilibrium values are in Table 4.1. Directionally, all results pertaining to national brand in R1–R21 hold whether the retailer carries its own store brand or a second national brand. The following additional results are pertinent:

R22. *When the retailer carries its own store brand instead of a second national brand, the price, quantity sold and profits of the first national brand is lower.*

R23. *The retail price of the store brand is lower than that of a second national brand.*

R24. *But the quantity sold, and retailer profits from the store brand is higher than if it carried a second national brand.*

R25. *Retailer profits are higher but original national brand manufacturer profits are lower when the retailer carries a store brand instead of a second national brand.*
R26. *Interestingly, total channel profits are higher with the store brand.*

In short, when the retailer manages its own store brand insead of a second national brand, the retailer is better off but the original national brand manufacturer is worse off. But it is a more efficient way of selling goods in terms of total channel profits because double marginalization is avoided for store brands.

## 4.2 Incorporating Store Brand Strength

In the above demand functions (4.2–4.3), both national brand and store brand demand are symmetric and the demand intercepts are 1. By changing the intercept term for store brand, we can incorporate asymmetry and investigate the effect of store brand strength. The modified demand functions are:

$$q_n = 1 - p_n - \theta(p_n - p_s) \tag{4.9}$$

$$q_s = \alpha - p_s + \theta(p_n - p_s). \tag{4.10}$$

The term $\alpha(1 \leq \alpha \leq 0)$ represents store brand strength or store brand equity. If all prices were set to zero, national brand will sell one unit while the store brand sells $\alpha$ unit. The objective functions are the same as in the base model. The basic results pertaining to $\theta$ for a given permissible value of $\alpha$ (R2–R21) generally holds in this model as well. The following results pertain to the additional parameter — store brand strength ($\alpha$). As $\alpha$ increases,

R27. *Manufacturer wholesale price of national brand decreases*
R28. *Retail price of national brand increases*
R29. *Retail price of store band increases*
R30. *Retail price differential between national brand and store brand decreases.*
R31. *Quantity of national brand sold increases*
R32. *Quantity and share of store brand sold increases*
R33. *Retail margin on national brand increases*

R34. *Manufacturer profits on national brand increases*
R35. *Retailer profits on national brand increases*
R36. *Retailer profits on store brand increases*
R37. *Total retailer profits increases*
R38. *Total channel profits increases*
R39. *Retailer share of channel profits increases.*

In other words, increase in cross-price sensitivity ($\theta$) and store brand strength ($\alpha$) increase store brand and channel profits. But, in the above models an increase in store brand strength may benefit both the retailer and the manufacturer, because it increases category demand and prices of both national and store brands, while an increase in price substitutability helps the retailer at the expense of the manufacturer.

So far, we constructed and analyzed simple models and obtained numerous "baseline" results. Henceforth in this section, we consider models actually published in the literature and enumerate results that either confirm the above baseline results, refute them or add to those results. For each model, for the sake of brevity, we present only the key aspects of the model and results.

## 4.3 Incorporating Costs

In the base model, we assumed zero fixed cost and that the variable cost of national brand and store brand are equal. In this case, we can set them to zero without loss of generality when analyzing linear demand functions. However, even if they are equal, what happens when cost of production for both national brands and store brand increases — does it favor the national brand or the store brand. These and other questions are answered by what is considered one of the seminal papers in this area by Mills (1995).[3]

### 4.3.1 Mills (1995, 1999)

Mills (1995) starts with a simple consumer utility function for the national brand $U_n(p_n) = \theta - p_n$ and $U_s(p_s) = \alpha\theta - p_s$, where $\theta$ is

[3] When discussing models from the literature, where possible, we use the same notations as in the original paper for easy reference to the cited article.

national brand non-price utility and $\alpha$ can be deemed as the substitutability between national and store brand. If $\theta$ is assumed to be uniformly distributed $U[0,a]$ with density $1/b$, this utility model leads to the following linear demand functions for national brand ($n$) and store brand($s$):

$$q_n(p_n,p_s) = \frac{a}{b} - \frac{(p_n - p_s)}{b(1-\alpha)} \tag{4.11}$$

$$q_s(p_n,p_s) = \frac{(p_n - p_s)}{b(1-\alpha)} - \frac{p_s}{b\alpha}. \tag{4.12}$$

Mills incorporates a constant marginal variable cost (c) for both national brand and store brand. Other assumptions are the same as in the base model.

Given the above demand functions and model assumptions, the manufacturer's profit maximization problems can be written as

$$\underset{w_n}{\text{Max}}\Pi_m = (w_n - c)\, q_n. \tag{4.13}$$

Retailer's profit maximization problem with no store brand is:

$$\underset{p_n}{\text{Max}}\Pi_{rn} = (p_n - w_n)q_n \tag{4.14}$$

Retailer's profit maximization problem with store brand is:

$$\underset{p_n,p_s}{\text{Max}}\Pi_{rns} = (p_n - w_n)q_n + (p_s - c)q_s. \tag{4.15}$$

In this model, result R1 which assumes zero cost can be modified as follows:

R1a. *For a given cost of store brand (c), when $\alpha$ the price substitutability is high, retailer will introduce a store brand.*

Most of the other baseline results R2–R21 appear to hold in this model as well. In addition, Mills (1995) provides other interesting results

R40. *The retailer's gross margin on store brand is higher than the retailer margin on national brand.*

R41. *There is an inverse relationship between store brand share and national brand–store brand price differential. That is, store brand shares are higher in categories where store brands are priced closer to the national brand.*

R42. *There is an inverse relationship between category price elasticity and private label share. That is, in categories where consumers are price elastic with respect to purchases in the category, private label share will be lower.*

Result R40 is not surprising since there is no double marginalization for the store brand. However, Result R42 is somewhat surprising. While within a category, higher price differential between national brand and store brand leads to higher store brand share, the relationship is reversed across categories. This finding, first proposed by Sethuraman (1991), is due to the mediating effect of cross-price senstivity (reflected through quality differential) between national and store brand.

With respect to cost, Mills (1995) provides the following result:

R43. *An increase in common cost component reduces private label share. Private label share decreases with cost (c).*

Thus inflation and consequent increase of raw material prices can help national brand manufacturers because the retailer finds it difficult to sustain a lower price and get high margins on the store brand because of higher costs. Therefore she increases prices and gets lower share.

In another important paper, Mills (1999) uses the same model to explore what counterstrategies are effective for the national brand manufacturer when faced with the private label. In this model, as is standard in the literature, he assumes that consumer utility $\theta$ is uniformly distributed $U[0,1]$ instead of $U[a,b]$. Then, the demand functions simplify to:

$$q_n(p_n,p_s) = 1 - \frac{(p_n - p_s)}{(1-\alpha)} \tag{4.16}$$

$$q_s(p_n,p_s) = \frac{(p_n - p_s)}{(1-\alpha)} - \frac{p_s}{\alpha}. \tag{4.17}$$

Using this model, Mills (1999) investigates several counter strategies for the national brand manufacturer, as listed below:

a. Increasing quality of national brand through innovation and better processes thus increasing quality differential (decreasing $\alpha$)
b. Producing for private label (called dual branding) — in this scenario, Mills assumes that cost of store brand if produced by a third party to be $c$ (same as national brand) but $c - \delta(\delta \geq 0)$ if produced by the national brand manufacturer.
c. Nonlinear pricing in the form of two-part tariff or quantity discount where the manufacturer sells the national brand at w to the retailer if it buys a certain quantity and at a lower price if the retailer buys a larger quantity that would preempt or sell less of store brand.
d. A lump sum fixed payment (similar to a slotting allowance) made by the manufacturer to the retailer as an incentive for not carrying a private label.
e. A manufacturer distributed coupon that entitles customers to a small discount $h$ per unit distributed to g% of consumers either randomly or selectively.

Mills (1999) evaluates these counterstrategies in terms of their ability to increase manufacturer profits. He find the following results:

R44. *Manufacturer profits is inversely proportional to $\alpha$, hence increasing national brand quality may be an "effective" counterstrategy.*
R45. *If the manufacturer has a cost advantage over a third party manufacturer in producing the store brand ($\delta > 0$), then he should supply the private label for the retailer (profits increase with dual branding); if not ($\delta = 0$), he should not produce the private label.*
R46. *Nonlinear, two-part tariff pricing or giving a fixed lump sum as incentive for not selling the store brand will not be effective counterstrategies for the national brand manufacturer.*
R47. *While randomly distributed manufacturer coupons will not increase manufacturer profits, selectively distributed coupons targeted at store brand consumers will increase profits and is an effective counter strategy.*

In addition, Mills finds that any effective counterstrategy that increases manufacturer profits also increase the vertical total channel profits, thus offering potential for channel coordination in the context of one manufacturer — one retailer channel structure.

### 4.3.2 Narasimhan and Wilcox (1998)

A widely cited paper that incorporates cost differential and derives demand based on consumer segments is Narasimhan and Wilcox (1998). Their assumptions for the consumer based demand model are as follows:

A10. Consumers purchase one unit of either good — national brand or store brand

A11. At equal prices, consumers prefer the national brand over store brand

A12. Consumers are divided into two exhausting, non-overlapping groups. One group of consumers ($\alpha$) is perfectly loyal to the national brand and will never purchase store brand.

A13. Another group of consumers ($\beta$) are heterogeneous brand switchers who will switch to store brand if the price differential between national and store brand is greater than $\iota$ (reservation price differential)

A14. Each person has a unique reservation price differential ($k$) which is distributed with some CDF F($\cdot$). A uniform $k$ distribution leads to a linear aggregate demand function for national and store brands.

With these assumptions, the demand for national brand and store brand are $q_n = \alpha + \beta\theta$ and $q_s = \beta(1-\theta)$, where $\theta$ is the fraction of switching segment who will buy the national brand, which depends on $F(k)$. If $k$ were distributed $U[0, L]$. Then for a given actual price differential $K(= p_n - p_s)$, the demand functions are:

$$q_n = \alpha + \left(1 - \frac{K}{L}\right)\beta \tag{4.18}$$

$$q_s = \frac{K}{L}\beta. \tag{4.19}$$

Unlike in the base model Narasimhan and Wilcox assume that the marginal costs of national brand is zero but the cost of store brand is

$w_s$, so that the profits for manufacturer ($\Pi^m$) and retailer ($\Pi^r$) are:

$$\Pi^m = \alpha w_n + \beta(1 - F(K))w_n \tag{4.20}$$

$$\Pi^r = \alpha(P_n - w_n) + \beta(1 - F(K))(P_n - w_n) + \beta F(K)(P_n - K - w_s). \tag{4.21}$$

Other assumptions are along the lines of the baseline model.

Many of the results from the baseline model (R2–R21) hold here as well even in the case of unequal brand costs. Other key results from the linear demand model are as follows:

R48. *Private label introduction is more profitable for the retailer when the size of switching segment* (*a measure of cross-price sensitivity*) *is large.*
R49. *If reservation price for national brand is large, that is consumers are willing to pay a higher price for the national brand, other things equal, private label introduction is more profitable.*

However, contrary to baseline results, they find that as size of switching segment (a potential measure of cross-price substitutability) increases.

R50. *Retail margin on national brand increases*
R51. *Private label share decreases*

The reason R50/R51 differs from baseline results is because $\beta$ the size of swithcing segment affects both the intercept and the slope (cross-price effect) of the national brand demand function in the above Equation (4.18). An increase in intercept increases retail margin on national brand while an increase in slope decreases it.

A parameter in Narasimhan and Wilcox (1998) model not considered in the models discussed above is the dispersion of reservation price differential ($L$), which can be deemed as a measure of heterogeneity of consumers. As the dispersion or consumer heterogeneity increases:

R52. *Private label introduction is less profitable*
R53. *National brand wholesale price will be higher*
R54. *Retail category margin will be higher, but*
R55. *Private label share will be lower.*

Because of these factors,

R56. *There is a negative relationship between category margin and private label share. In categories with high private label shares, category margins will be lower.*

### 4.3.3 Bontems, Dilhan, and Requillart (1999)

Bontems et al. (1999) considered how cost differential between national brand and store brand would influence store brand introduction and related strategies. Like Mills (1995), they start with a consumer level utility model, $U(\theta,p,g) = \theta g - p$, where $g$ is quality and $\theta$ is the taste parameter or quality sensitivity, that is assumed to be uniformly distributed, $U[\theta_L,\theta_H)$ where $(\theta_H - \theta_L)$ can be deemed as a measure of consumer taste heterogeneity. This utility function leads to the demand function: for the high quality national brand ($H$) and low quality store brand ($L$) as:

$$D_H(p_H,p_L) = \frac{\theta_H - [(p_H - p_L)/(g_H - g_L)]}{\theta_H} \tag{4.22}$$

$$D_L(p_H,p_L) = \frac{[(p_H - p_L)/(g_H - g_L)] - \theta_L}{\theta_H}. \tag{4.23}$$

National brand manufacturer provides a brand of high quality $g_H$ at constant marginal cost $c_H$. The retailer buys $q_H$ units of the national brand and sells at retail price $p_H$. The retailer also has the option to produce a private label of quality $g_L \in [0,g_H]$ at price $p_L$. The cost of store brand is a function of the quality, $C(g_L) = k\frac{g_L^2}{2}$, where $C(Sg_H) = k\frac{g2}{2} > c_H$. That is, national brand manufacturer has a cost advantage over a third party store brand provider.

The sequence of decisions are as follows: (i) Retailer chooses quality of private label; (ii) Manufacturer chooses wholesale price of national brand, (iii) Retailer chooses whether to carry national brand, whether or not to introduce private label, and the prices.

The retailer objective function is to maximize its profits

$$\underset{p_H,p_L}{\text{Max}}\, \Pi^r = (p_H - w)D_H(p_H,p_L) + (p_L - c_L)D_L(p_H,p_L). \tag{4.24}$$

The manufacturer maximizes its profits:

$$\underset{w}{\text{Max}}\,\Pi^m = (w - c_H)D_H(p_H, p_L). \tag{4.25}$$

Some pertinent results especially as it pertains to quality of store brand and cost are:

R57. *The higher the cost disadvantage for the retailer, the less the incentive for the retailer to produce high quality private label.*
R58. *Wholesale price of national brand first decreases with store brand quality and then increases with store brand quality. That is introduction of low (high) quality private label reduces (increases) wholesale price*
R59. *Retail margin on private label is greater than retail margin on national brand but the difference in margin reduces with store brand quality.*
R60. *As consumer heterogeneity increases, the difference between national brand and store brand quality decreases.*

Bontems et al. (1999) were one of the first to study the impact of cost and quality of store brand on store brand introduction and prices. Their results are particularly insightful in that they show that national brand prices can decrease or increase with store brand introduction depending on the quality of store brand and the cost to produce the same.

### 4.3.4 Kumar, Radhakrishnan, and Rao (2010)

Kumar et al. also incorporate quality and cost but with a view to investigating the role of dual branding on prices and thus the national brand manufacturer's decision to produce private label, in a heterogeneous two-segment consumer market.

Consumers buy one unit of a product that comes in two quality levels. There are two consumer segments — the high type ($h$) and the low type ($\ell$). The utility of a consumer in segment $i$ ($i = h, \ell$) is $U_i = \theta_i g - p$, where $g$ is quality, $p$ is price, and $\theta$ is the quality sensitivity such that $\theta_h > \theta_\ell$. That is the high type are more quality sensitive than

the low type. The proportion of consumers in each segment are $\phi_h$ and $\phi_\ell$.

The retailer purchases and targets the national brand for the high type consumer and the store brand for the low type consumer. She may purchase the store brand either from the national brand manufacturer or a third party supplier. Thus there are two regimes $j$ where $j = 1$ represents purchase from national brand manufacturer and $j = 2$ implies purchase of store brand from third party. The retailer's category profits are

$$\pi_{rj} = \pi_{rnj} + \pi_{rsj} = [p_{nj} - w_{nj}]\phi_h + [p_{sj} - w_{sj}]\phi_\ell. \tag{4.26}$$

The manufacturer incurs a marginal cost of production that depends on quality ($g$) and is given by $C(g)$ which is assumed to be quadratic in quality $= C(g) = 0.5\,g^2$. Hence, the manufacturer profits are:

$$\pi_{mj} = \pi_{mnj} + \pi_{ms1} = [w_{nj} - C(g_{nj})]\phi_h + Z[w_{s1} - C(g_{s1})]\phi_\ell, \tag{4.27}$$

where $Z = 1$ if manufacturer produces the store brand and 0 otherwise. The game structure or the decision sequences are as follows:

(1) Retailer decides who will produce private label — national brand manufacturer or independent supplier. (2) Manufacturer and retailer agree upon the wholesale price and quality. (3) Retailer sets retail price. (4) Consumers buy one of the products. In addition, retailers require a minimum margin from the store brand.

Kumar et al. use a constrained optimization approach to obtain equilibrium values. The key result pertains to when retailer will buy from the national brand manufacturer:

Retailer will prefer to buy from the national brand manufacturer and manufacturer will supply the private label when:

R61. *high type consumers are relatively larger than low type consumers*
R62. *heterogeneity or the difference in quality valuation between high type and low type is large*
R63. *retailer's minimum margin requirement from store brand is sufficiently small.*

Basically, manufacturers will produce private label if there is a clear separation between more quality sensitive (national brand) consumers

and less quality sensitive (store brand) consumers so that they can facilitate selling of both brands without concern for cannibalization.

Two models have incorporated cost of store brand and national brand to understand the competition between the two brands from a supply chain coordination perspective.

### 4.3.5 Groznik and Heese (2010a,b)

Groznik and Heese (2010a,b) study the competition between national brand and store brand from a supply chain perspective. In particular, they address the issue of whether a wholesale price commitment by the manufacturer will deter the retailer from introducing a store brand. They use the standard consumer utility model with value parameter uniformly distributed, as in Mills (1995, 1999) and derive the following demand functions:

$$q_n = 1 - \frac{p_n - p_s}{1 - \alpha} \tag{4.28}$$

$$q_s = \frac{p_n - p_s}{1 - \alpha} - \frac{p_s}{\alpha}. \tag{4.29}$$

Retailer and manufacturer maximize their respective profits as in the baseline model. But the profits include the following costs — manufacturer marginal cost of national brand is $c$, marginal cost of store brand incurred by retailer is $c\beta$, and retailer incurs additional fixed cost of introducing store brand ($F$). So, the respective profits are:

$$\pi_M = (w - c)q_n \tag{4.30}$$

$$\pi_R = (p_n - w)q_n + \tau((p_s - c\beta)q_s - F). \tag{4.31}$$

In addition, Groznik and Heese assume that the national brand manufacturer can precommit to a wholesale price and explores the role of cost competitiveness $\beta$. If $\beta$ is low, then retailers cost of store brand is much lower than the manufacturer cost of producing national brand, and vice versa.

R64. *When store brand cost is relatively low, then only store brand is sold; if store brand relative cost is high, only national brand is sold; when relative cost is moderate, both national and store brands will be sold.*

R65. *When both brands are sold — manufacturer reduces wholesale price, retailer margin on national brand increases and is greater than retailer margin on store brand.*

In addition, Groznik and Heese consider the case where the manufacturer can credibly commit to a wholesale price (such as through a long-term contract). They find that the manufacturer's ability to prevent private label introduction through wholesale price commitment depends on the fixed cost that retailer incurs for introducing the store brand. In particular, they find:

R66. *When the fixed cost of store brand introduction is moderate (neither too high, nor too low), manufacturer can prevent the retailer from introducing a store brand by credibly committing to a wholesale price.*

### 4.3.6 Chen, Gilbert, and Xia (2011)

Chen et al. (2011) consider a cost structure for the retailer that includes a fixed development cost for the private label as well as a per-unit production cost that may be either higher or lower than the national brand. Although both the retailer and the manufacturer are assumed to act entirely in their self interest, they explore when those self interests would benefit or harm supply chain coordination. They start with a standard consumer utility for national brand, $U_n = \theta - p_n$ and $U_s = \theta g - p_s$ for the store brand where $g(0 < g < 1)$ is the store brand quality relative to national brand quality set as 1. $\theta$ is the value parameter that is distributed with CDF, $F(\theta, K) = 1 - (1-\theta)^K$ and pdf, $f(\theta, K) = K(1-\theta)^{K-1}$, $K \in (0, \infty)$. This distributional assumption includes the uniform distribution and several other distributions and thus is more general. Each consumer maximizes the utility given prices $p_n$ and $p_s$. This leads to

$$q_n(p_n, p_s) = \begin{cases} 1 - F(p_n) & \text{if } p_n \geq p_s g \\ 1 - F\left(\frac{p_n - p_s}{1-g}\right) & \text{if } p_n - 1 + g < p_s < p_n g \\ 0 & \text{otherwise} \end{cases} \tag{4.32}$$

$$q_{sn}(p_n, p_s) = \begin{cases} 1 - F\left(\frac{p_n}{g}\right) & \text{if } p_s < p_n - 1 + g \\ F\left(\frac{p_n - p_s}{1-g}\right) & \text{if } p_n - 1 + g < p_s < p_n g \\ 0 & \text{otherwise} \end{cases} \tag{4.33}$$

The game is played in the following three stages. In the first stage, the retailer decides whether to develop private label capability. If she decides to, then she incurs a fixed cost, $k$. In the second stage, the manufacturer observes retailer's decision and sets wholesale price, $w$ for the national brand. In the third stage, the retailer responds by setting retail prices $p_n$, $p_s$. Both manufacturer and retailer maximize their respective profits.

$$\Pi^m(w, p_n, p_s) = q_n(w - c_n) \tag{4.34}$$

$$\Pi^r(w, p_n, p_s) = q_n(p_n - w) + q_s(p_s - c_s) - k \tag{4.35}$$

if retailer introduces a store brand.

$$\Pi^r(w, p_n, p_s) = q_n(p_n - w), \tag{4.36}$$

if retailer does not introduce a store brand.

First, Chen et al. show, not surprisingly, that the retailer will develop a private label when fixed development cost is lower. In this case, whether the national brand is also sold along with the private label or not depends on the relative margins. In particular, Chen et al. (2011) define a variable called Ratio of Potential Margin (RPM) = $\frac{g-c}{1-C}$, which is the ratio of potential store brand margin to national brand margin.

R67. *Below a threshold development cost $\hat{g}$, the retailer will carry only the store brand if RPM $> 1$ and will also carry the national brand if RPM $< 1$. When the retailer sells a private label with the national brand,*

R68. *The manufacturer wholesale price is lower with store brand introduction at the optimum*

R69. *Quantity of national brand may increase under certain conditions and decrease under other conditions in the presence of store brand.*

R70. *Manufacturer profits always decreases but the retailer and the supply chain (total channel) profits generally increase with store brand.*

Chen et al.s model differs from earlier models differ from many earlier models in that it assumes store brands are introduced first and then the retailer decides whether to carry the national brand. Even in this model. baseline results conintue to hold (R68, R70). Result R67 highlights the importance of potential (maximum) margins and thus the costs of national brand and store brand in the decision to carry one or both national and store brands.

Chen et al. also extend their basic model to incorporate promotion of the store brand that increase the consumer base of purchasers of the brand.

R71. *If the relative potential margin is high, the capability to expand market through promotions increases the propensity of the retailer to develop the private label.*

## 4.4 Incorporating Advertising

Most of the economic models of national brand–store brand competition focus only on prices. This consideration is because, at the retail outlet, the choice that consumers face is generally between the higher-priced national brand and the lower priced store brand. National brands are generally widely advertised while store brands are seldom advertised. Therefore the national brand manufacturer can influence consumers' perceptions and increase demand for its brand through advertising. This aspect is captured in a number of models described in this section.

### 4.4.1 Sethuraman (1991, 2002)

Sethuraman (1991) was one of the first to incorporate national brand advertising in a model of national brand–store brand competition and thus serves as a base model for the advertising case. The demand

functions in Sethuraman (1991) are:

$$q_n = \alpha - \beta p_n - \theta(p_n - p_s) + \gamma\sqrt{A} \tag{4.37}$$

$$q_s = \theta(p_n - p_s). \tag{4.38}$$

In this demand function, $\alpha$ can be deemed as the national brand strength, $\beta$ the own price sensitivity and $\theta$ is the cross-price sensitivity. $A$ is advertising and $\gamma$ is the advertising sensitivity. The use of square root advertising is common in the literature as it leads to closed form solution for equilibrium advertising.

The profit maximizing objective functions for the manufacturer and retailer are:

$$\underset{w_n,A}{\text{Max}}\, w_n q_n(p_n^R(w_n,A), p_s^R(w_n,A), A) - A - F_n' \tag{4.39}$$

$$\underset{p_n,p_s}{\text{Max}}\, (p_n - w_n) q_n(p_{1n}, p_s, A) + p_s q_s(p_n, p_s) - F_n - F_s. \tag{4.40}$$

Superscript $R$ denotes retailer's reaction function since manufacturer is the Stackelberg leader, $F$'s represent fixed costs, and other notations are standard. Sethuraman (1991) makes almost the same assumptions as in the baseline model (A1–A9). Most of the baseline results (R1–R21) also hold in this case. The results that provide addition insights are reported below:

R72. *There exists a threshold level of advertising sensitivity above which the retailer should never introduce a store brand.*

R73. *Retailer is more likely to introduce a store brand in markets characterized by higher price sensitivity and lower advertising sensitivity.*

R74. *When the above conditions hold and a retailer introduces a store brand, equilibrium wholesale price and manufacturer advertising are reduced.*

In addition, this was one of the first papers to identify the inverse relationship between national brand–store brand price differential and store brand share (R41) reported in Mills (1995).

Sethuraman (2002) uses a similar model incorporating advertising but focuses on deriving results related to positioning of the store brand

vis-a-vis national brand. The baseline results and those from other models such as Mills (1995) suggest that the retailer's store brand profits increase with cross-price sensitivity between national and store brand. Therefore, in marketing parlance, it is in the best interest of the retailer to position the store brand close to the national brand through reducing quality differential, similar packaging, compare and save shelf talkers, placing the brands next to each other on shelves, and so on. Sethuraman (2002) refines this conventional wisdom by incorporating advertising and unserved market in the model. He derives the following demand function

$$q_n = 1 - p_n - \theta(p_n - p_s) + \beta\sqrt{A} \tag{4.41}$$

$$q_s = (\theta + \alpha)(p_n - p_s) - \gamma\sqrt{A}. \tag{4.42}$$

This is similar to demand functions (4.37) and (4.38) except that the intercept term and the own price sensitivity are set to 1 and there is an added $\alpha$ term in store brand demand in (4.42). Only the national brand is advertised and the role of advertising is to increase national brand demand and decrease store brand demand. When $\theta$ is high, for a given price differential, store brand demand increases at the expense of the national brand. When $\alpha$ is high, store brand demand increases but not at the expense of national brand but by catering to a market unserved by the national brand. $\theta$-positioning is the competitive positioning discussed in the literature. Sethuraman models another positioning called $\alpha$-positioning which is aimed at targeting a new set of consumers not catered by the national brand. Sethuraman (2002) analyzes when $\theta$ positioning is profitable and when $\alpha$ positioning is profitable for the retailer and obtains the following results:

R75. *When there is no unserved market* ($\alpha$ *low*) *and when advertising does not significantly impact sales* ($\beta$, $\gamma$ *low*), *positioning a store brand close to national brand* (*increasing* $\theta$) *will increase retailer profits.*

R76. *When there is no available unserved market for the store brand and the primary role of advertising is to increase national brand demand* ($\beta$ *high*) *but not harm store brand demand* ($\gamma$ *low*),

*positioning a store brand close to the national brand can decrease retailer profits especially when $\beta$ is high.*

R77. *When there is no unserved market ($\alpha$ low) and when national brand advertising can significantly impact sales of store brand ($\beta$, $\gamma$ high), positioning a store brand close to national brand (increasing $\theta$) will increase retailer profits.*

R78. *When available unserved market is high ($\alpha$ high) and advertising sensitivities are low, positioning store brand to the unserved market ($\alpha$-positioning) is more profitable for the retailer.*

Essentially, Sethuraman (2002) shows that close positioning of store brand can hinder national brand investments in category demand enhancing efforts such as advertising and hence the positioning strategy may not be optimal in growth categories.

### 4.4.2 Soberman and Parker (2004, 2006)

Soberman and Parker (2004) also provide insights into the role of national brand advertising in a segmentations framework. They consider two segments of consumers — the brand seekers who will pay a premium for the advertised national brand and product seekers, who simply want a lower priced brand. Assuming that both consumer segments exhibit linear downward sloping demand function with slope and intercept equal to 1, we get national brand and store brand demand as

$$q_n = \lambda(1 - p_n + A) \tag{4.43}$$

$$q_s = (1 - \lambda)(1 - p_s), \tag{4.44}$$

where $\lambda$ is the proportion of brand seekers. Soberman and Parker assumes manufacturer and retailer set prices to maximize channel profits as reflected in the following equation, where

$$\pi = p_n(\lambda(A + 1 - p_n) + (1 - \lambda)(1 - p_s)) - \gamma A^2 - k_s, \tag{4.45}$$

where $k_s$ is the fixed cost of providing the store brand and $\gamma$ is the advertising cost parameter. As can be seen from Sethuraman (1991) and Soberman and Parker (2004), advertising can be incorporated as affecting demand through an advertising sensitivity to demand parameter as in Sethuraman (1991) or through advertising sensitivity to cost

as in Soberman and Parker (2004). If advertising sensitivity is incorporated in demand, then advertising enters as a square root term; if sensitivity is incorporated in the cost term, then advertising enters as a squared term. Both versions yield linear first order conditions and thus closed form solutions for equilibrium advertising.

Soberman and Parker (2004) show the following pertinent results:

R79. *When the cost of advertising is low* (*or advertising is effective*), *then it may be profitable for the channel to only sell the national brand.*

R80. *When a store brand is introduced, equilibrium national brand advertising generally increases.*

R81. *Average category prices increase when the channel adds an unadvertised store brand to the product line, if the proportion of brand seekers* ($\lambda$) *is high; otherwise average category price decreases.*

Using a similar consumer and demand structure, Soberman and Parker (2006) address the issue of dual branding in the presence of brand and product seekers. Their game consists of four stages:

In the first stage, the retailer decides whether to request the supply of a store brand from the manufacturer. If the retailer has made the request, the manufacturer decides whether or not to say yes. After the product line decision, the second stage entails the manufacturer making a decision about the level of advertising for the national brand. In the third stage, the manufacturer sets wholesale prices for the national brand and the store brand (contingent on the outcome of the first stage). In the final stage, the retailer sets retail prices for the products it carries. Key insightful results are as follows:

R82. *When advertising is effective in attracting brand seekers, it is profitable for both the manufacturer to offer a store brand and for the retailer to sell a store brand because the provision of a second store brand allows the national brand manufacturer to charge a higher price for NB and thus increase its profits and retailer profits.*

R83. *Under such conditions, average category price may actually increase with store brand introduction.*

In the context of national brand–store brand competition, the unadvertised private label allows firm to discriminate between brand seekers who will pay a premium for the advertised national brand and the product seekers who simply want to pay a lower price. This ability to price discriminate between the two segments of consumers is particularly facilitated by the manufacturer having control over both national brand and store brand retail prices, allowing him to obtain a higher average category price.

### 4.4.3 Karray and Zaccour (2007)

Karray and Zaccour assess the profitability of private label introduction in the context where the national brand demand depends on local advertising by the retailer. The manufacturer can incent the retailer to advertise the national brand by giving cooperative advertising allowance. In the process, Karray and Zaccour assess if cooperative advertising can be an effective manufacturer counter strategy. They use conventional linear demand function to reflect the price ($p$) and manufacturer advertising ($a$) effects on demand:

$$Q_n = \alpha - p_n + \gamma p_s + \delta\sqrt{a} \tag{4.46}$$

$$Q_s = \beta - p_s + \psi(p_n - \delta\sqrt{a}). \tag{4.47}$$

In this demand models, advertising effect enters demand function in the typical square root form (reflecting concave decreasing returns to scale) and the cross-price sensitivity is asymmetric, i.e., effect of national brand price on store brand demand ($\psi$) is different from effect of store brand price on national brand ($\gamma$). Also, only the national brand is advertised; the store brand is not advertised. In the cooperative advertising case, the manufacturer pays a portion ($d$) of advertising and the retailer pays the remaining portion ($1 - d$). In this scenario, the retailer and manufacturer objectives are:

$$\max_{p_n,p_s,a} \prod_{r}^{C} = p_s Q_s + (p_n - \omega)Q_n - (1 - d)a \tag{4.48}$$

$$\max_{\omega,d} \prod_{m}^{C} = \omega Q_n - da. \tag{4.49}$$

The manufacturer decides on the wholesale price and the proportion of co-op advertising it will pay to the retailer. The retailer decides on retail advertising for national brand and prices. Manufacturer is the Stackelberg leader as in earlier models.

In this slightly more complex model compared to the baseline advertising model (Sethuraman, 1991), Karray and Zaccour find some results that are different from the baseline results.

R84. *If the store brand strength as reflected in cross-price sensitivity ($\gamma > \psi$) is high, then manufacturer can actually increase his wholesale price.*
R85. *The manufacturer profits also increase with store brand introduction if ($\gamma > \psi$), that is if the private label is strong or has high quality.*

Other pertinent results are:

R86. *Both manufacturer and retailer prices and margins on the national brand increase with co-op advertising.*
R87. *Manufacturer profits increase with co-op advertising*
R88. *Retailer sales of store brands and total profits decrease with co-op advertising*
R89. *Co-op advertising can not generally be implemented because the decrease in profits for the retailer cannot be made up by the advertising allowance (d) provided by the manufacturer without the manufacturer losing profits.*

It appears from the above analysis that co-op advertising is not sustainable in a linear model with decreasing returns to advertising. Whether this result is robust is an interesting avenue for future research.

### 4.4.4 Amrouche, Hernan, and Zaccour (2008a,b)

Amrouche et al. (2008a,b) were one of the first to study the effect of national brand–store brand advertising in a dynamic framework. In dynamic models of advertising, the short-and long-term effects of advertising are generally captured through a composite term usually

called goodwill. The change in goodwill at any given time (goodwill evolution) can be a function of current goodwill as well as own and, possibly, competitor advertising. Demand is influenced by current goodwill of own brand and possibly competitor brands. Manufacturers and retailers maximize discounted profits over an infinite time horizon or finite time horizon in sequential (Stackelberg) or simutaneous (Nash) game. The game can also be open loop, where players cannot observe the past play of their opponents, or closed loop where past play is common knowledge across all players.

Dynamic advertising models proposed in the literature on national brand–store brand competition differ in the nature of demand function, goodwill evoultion function and profit maximization (game structure). Difference in model structure can lead to different results and insights.

In Amrouche et al. (2008a), the demand for each brand is assumed to be linear and given by

$$D_n(t) = \beta_n + G_n(t) - p_n(t) + \psi p_s(t), \tag{4.50}$$

$$D_s(t) = \beta_s + G_s(t) - p_s(t) + \psi p_n(t), \tag{4.51}$$

where $G_n$ and $G_s$ denote the national brand's and the store brand's goodwill (or brand equity), respectively. Parameter $\psi$ measures the degree of substitutability between the two brands. Goodwill for brand $i$ at time $t$ is a function of own advertising, competitor advertising, and past goodwill, whose evolution (rate of change) is given by

$$\dot{G}_n(t) = A_n(t) - \delta G_n(t) - k_n A_s(t) \tag{4.52}$$

$$\dot{G}_s(t) = A_s(t) - \delta G_s(t) - k_s A_n(t) \tag{4.53}$$

$\delta$ is the decay factor over time and $k$ is the competitive advertising effect, which influences demand by reducing goodwill for the focal brand. Cost of advertising is assumed to be a quadratic convex function of advertising. Assuming profit-maximization behavior over an infinite time horizon, the manufacturer and retailer optimization problems read as follows:

$$\max_{w,A_n} \pi_M = \int_0^\infty e^{-\rho t} \left\{ (\omega - d_n)[D_n(t)] - \left( c_{n1} + \frac{c_{n2}}{2} A_n \right) A_n \right\} dt, \tag{4.54}$$

$$\underset{A_s,p_n,p_s}{\text{Max}}\ \pi_R = \int_0^\infty e^{-\rho t}\Big\{(p_n-\omega)[D_n(t)] + (p_s-d_s)[D_s(t)] - \Big(c_{s1}+\frac{c_{s2}}{2}A_s\Big)A_s\Big\}dt \tag{4.55}$$

subject to the dynamic constraints describing the time evolution of the brands' goodwill, and where $\rho$ denotes the common discount rate. Profits are maximized over an infinite time horizon in a Stackelberg differential game with manufacturer as the leader. Closed form expressions are not obtainable for equilibrium advertising or prices. so the authors resort to numerical analysis. Some pertinent results are:

R90. *An increase in Goodwill of either brand increases differentiation and hence total demand and each brand's demand, so advertising by either party is potentially profitable for both parties.*

R91. *Higher the current goodwill of the brand, higher is the equilibrium advertising.*

Amrouche et al. (2008b) use a slightly different demand model in their analysis

$$D_n(t) = \alpha_n G_n(t) - p_n(t) + \psi_n p_s(t), \tag{4.56}$$

$$D_s(t) = \alpha_s G_s(t) - p_s(t) + \psi_s p_n(t). \tag{4.57}$$

In these models, national brand and store brand are impacted differently by their respective goodwill and cross-price effects are also different. The profit functions and the optimization problem are the same as in Amrouche et al. (2008a) but they adopt a feedback Nash equilibrium instead of Stackelberg approach. Again, they find that an increase in any firm's goodwill helps differentiate and increase retail prices of both brands. They also consider what they call a myopic strategy where each party considers the evolution in own goodwill but ignores the evolution of competitor's goodwill when deciding on its strategy. Under such conditions, the higher the brand equity or goodwill of the store brand, the more the retailer invests in advertising (R90).

### 4.4.5 Karray and Herran (2009)

Like Amrouche et al., Karray and Martin-Herran (2009) also allow for both national brand and store brand to accumulate goodwill through

their respective advertising. The demand functions are:

$$Q_N(t) = a + \psi G_N(t) + \theta G_S(t) - p_N(t) + \alpha[p_S(t) - p_N(t)], \quad (4.58)$$

$$Q_S(t) = b + \phi_S G_S(t) + \phi G_N(t) - p_S(t) + \alpha[p_N(t) - p_S(t)], \quad (4.59)$$

where $G_n$ and $G_s$ are goodwill for national brand and store brand accumulated over time through advertising, which can positively affect own demand and negatively impact competitor's demand. The evolution of goodwill over time is captured by the following equations:

$\frac{dG_n}{dt}(t) = \delta\sqrt{A_N(t)} - \lambda G_N(t)$ where $G_N(0) > 0$ and $\lambda$ is the depreciation rate.

$\frac{dG_S}{dt}(t) = \delta\sqrt{A_S(t)} - \lambda G_S(t)$ where $G_S(0) > 0$ and $\lambda$ is the depreciation rate.

The manufacturer is the Stackelberg leader and sets the wholesale price and advertising for the national brand to maximize its infinite period discounted profits:

$$\max_{w_N, A_N} \int_0^\infty \exp(-rt)\left[w_N Q_N - \frac{\mu}{2}A_N\right]dt \quad (4.60)$$

$$s.t.: \frac{dG_N}{dt} = \delta\sqrt{A_N} - \lambda G_N, G_{N(0)} = G_{N0} > 0$$

The retailer sets the retail prices of both national and store brand price and its own advertising to maximize its discounted category profits:

$$\max_{A_S, p_N, p_S} \int_0^\infty \exp(-rt)\left[(p_N - w_N)Q_N + p_S Q_S - \frac{\mu}{2}A_S\right]dt \quad (4.61)$$

$$s.t.: \frac{dG_R}{dt} = \sqrt[\delta]{A_S} - \lambda G_S,\ G_{S(0)} = G_{S0} > 0.$$

Consistent with Amrouche et al. (2008a,b), Karray and Martin-Herran (2009) also find a positive relationship between a brand's current goodwill and equilibrium advertising. The retail prices for national brands and store brands can increase or decrease depending on the extent of price and advertising competition. Additionally, Karray and Herran investigate the movement of prices and advertising when national brand and store brand are competitive ($\theta, \phi < 0$) or complementary ($\theta, \phi > 0$). The following are some key results.

R92. *If advertising is complementary* (*competitive*)*, there is a positive* (*negative*) *relationship between manufacturer advertising and retailer advertising.*

R93. *If advertising is complementary* (*competitive*)*, national brand wholesale price and advertising are higher* (*lower*) *in equilibrium than if it is competitive (complementary).*

While the above three dynamic models do differ somewhat in their model structure, they yield two robust results — (i) Higher the current goodwill of a brand, higher is the equilibrium advertising; (ii) complementary advertising can promote differentiation and help both manufacturer and retailer.

### 4.4.6 Other Models on Advertising — Abe (1999)

A few articles have provided some insights about national brand–store brand advertising decisions but focused mainly on a monopoly manufacturer who sells the national brand and/or the store brand but the retailer is passive or non-strategic. For example, Abe (1995) uses the concept of separating equilibrium in a signaling model and shows:

R94. *If the national brand quality is higher than the quality of store brand clone, then national brand manufacturer can use advertising as a credible signal of quality.*

## 4.5 Incorporating Price Promotions

Price promotions are temporary discounts from regular prices offered by the national brand and/or the store brand marketer. Following Varian (1980), a group of researchers contended that an important reason for the existence of price promotions is competition between the "strong" (national) brands and the "weak" (store) brands for the brand switching segment of the market. In particular, at any given price of one player, the rival has the incentive to get more of the brand switching segment through a price reduction. This battle for the price sensitive segment manifests in the form of price promotions. However, both national brand and store brand sellers face a tradeoff when fighting

for this segment. When national brands cut price to attract the brand switchers, they lose profits from its loyal segment that would pay a higher (reservation) price. When store brands cut price to attract more of the switching segment by increasing the price differential, they lose profits from the price shoppers who would buy the store brand even when the price differential is small. Hence, a possible equilibrium strategy is for both national brands and store brands to charge a (high) regular price and a (low) promoted price with some probabilities (as in Varian 1980) or to set a regular price first and occasionally cut prices in a sequential decision framework. The actual equilibrium strategy would depend on the parameters of the demand model, the nature of manufacturer and retail competition, and cost structure. A few modelers in the 1980s and 1990s provided insights into the price promotions of national brands and store brands by considering brand loyal and brand switcher segments. Let $\delta_{ns}$ represent the consumers' reservation price differential or the price premium consumers are willing to pay for the national brand over store brand. Broadly, we can classify consumers based on their $\delta_{ns}$ values as:

(i) national brand loyal ($\delta_{ns} \ggg 0$ or large and positive);
(ii) national brand preferrers ($\delta_{ns} > 0$);
(iii) brand switchers or price shoppers ($\delta_{ns} = 0$);
(iv) store brand preferrers ($\delta_{ns} < 0$);
(v) store brand loyal ($\delta_{ns} \lll 0$ or large and negative).

A few researchers have considered two or more of these consumer segments in theorizing about national brand and store brand promotions. The questions addressed generally relate to conditions favoring price promotion and frequency and depth of price cuts. Three articles are particularly noteworthy. While they do not explicitly consider the role of the retailer, they do offer insights into price promotion when one ("strong") national brand competes with a ("weak") store brand.

### 4.5.1 Narasimhan (1988)

Narasimhan (1988) considers three of the five segments listed above — the national brand loyal segment who will buy only the national brand

(proportion $\alpha_n$); the store brand loyal segment who will buy only the store brand (proportion $\alpha_s$). A third segment of switchers (proportion $\beta = 1 - \alpha_n - \alpha_s$) has finite reservation price differential $\delta_{ns}$. The reservation price or the maximum price consumers are willing to pay for either brand is $r$. If $\delta_{ns}$ has a continuous distribution between $(-b, a)$, then there exists pure equilibrium strategy such that each brand selects a fixed price that is the best response to rival's strategy. There is no price promotion. However, if all switchers are identical and, in particular, all switchers have $\delta_{ns} = 0$, then there is no pure strategy equilibrium, but a mixed strategy equilibrium exists. The profit function, assuming zero cost, for national and store brand can be written as:

$$\Pi_n(p_n, p_s) = \alpha_n p_n + \lambda_{ns}\beta p_n \tag{4.62}$$

$$\lambda_{ns} = \begin{cases} 1 & \text{if } p_n < p_s \\ 0.5 & \text{if } p_n = p_s \\ 0 & \text{if } p_n \geq p_s \end{cases}$$

The profit function is similar for the store brand.

In this case, both brand firms (there is no retailer in this model) maximize their respective profits. Narasimhan (1988) first shows there is no pure strategy equilibrium. He seeks a mixed strategy equilibrium which is a probability distribution over all possible prices that maximizes expected payoff given a certain probability distribution over permissible prices for the competitor. The expected pay off for the national brand manufacturer for any given probabilistically determined prices $p_n$ and $p_s$ is

$$\Pi_n(p_n) = \alpha_n p_n + \text{Prob}(p_n > p_s)\beta p_n + \text{Prob}(p_n = p_s)\frac{\beta}{2}p_n. \tag{4.63}$$

Expected profit

$$E\Pi_n(p_n) = \int^{p_n} \Pi_n(p_n) dF_n(p_n), \tag{4.64}$$

where $F_n(p_n)$ is the cumulative probability distribution across prices for the national brand.

Similar profit function obtains for the store brand.

Each player maximizes expected payoff and sets the distribution of prices. The characteristics of the equilibrium price distribution are given in the following results. If the switchers are price shoppers ($\delta_{ns} = 0$) and the loyal consumers for national and store brands have same reservation price ($r$),

R95. *National brand with the larger loyal segment will charge a higher regular price would discount less often and offer the same discount size* (*price cut*).

However, if the switchers are not indifferent but are national brand preferrers with reservation price differential ($\delta_{ns} > 0$), then Narasimhan (1988) gets the following result:

R96. *National brand with the larger loyal segment is promoted more often with the lower average discount than the store brand with the lower loyal segment size.*

If the reservation price or maximum price willing to pay for the national brand is greater than that for the store brand ($r_n > r_s$), then Narasimhan gets the following results:

R97. *If switchers are willing to pay a premium for the national brand and the national brand commands a higher reservation price, then the premium-priced national brand will offer a higher average discount and promote more often than the store brand, unless the share of national brand loyal segment is very large.*

R98. *In categories with intense rivalry, the store brand with less loyalty is better off keeping a permanent lower price and not price promoting.*

### 4.5.2 Raju, Srinivasan, and Lal (1990)

Raju et al. (1990) assume two firms each with one brand that can be deemed to be national brand and store brand but they also do not consider the role of the retailer. Raju et al. operationalize loyalty as the price differential needed to make consumers who prefer that brand to

switch to the competing brand. Let $\ell_n$ be the price differential needed to switch store brand consumer to the national brand and $\ell_s$ be the price differential needed to switch national brand consumer to store brand. Raju et al. (1990) assume just two consumers in the market, so that the demand and profit functions for the national brand can be written as:

$$q_n(p_n,p_s) = \begin{cases} 0 & \text{if } p_s < p_n - \ell_n \\ 1 & \text{if } p_s - \ell_s \le p_n \le p_s + \ell_n \\ 2 & \text{if } p_n < p_s - \ell_s \end{cases} \tag{4.65}$$

$$\pi_n(p_n,p_s) = \begin{cases} 0 & \text{if } p_s < p_n - \ell_n \\ p_n & \text{if } p_s - \ell_s \le p_n \le p_s + \ell_n \\ 2p_n & \text{if } p_n < p_s - \ell_s \end{cases} \tag{4.66}$$

First, they show that if the loyalty for national brand and store brand are sufficiently large, i.e., $\ell_n,\ell_s > r/2$, then there is a pure strategy equilibrium where both firms charge reservation price ($r$). In other cases, a mixed strategy equilibrium may exist in the form of a probability distribution of prices. The central hypothesis of Raju et al. is that, in a market with two brands, differences in brand loyalty are related to variations in the size and frequency of price promotions. They characterize the mixed equilibrium strategies following expected profit maximization approach similar to that of Narasimhan (1988). Results offering potential insights into national brand–store brand promotions are:

R99. *Stronger national brand promotes less often than the weaker store brand.*

R100. *The average discount offered by the stronger national brand is larger than the average discount offered by the weaker store brand.*

R101. *As the loyalty of the weaker store brand increases, the frequency of discount of either brand decreases.*

### 4.5.3 Rao (1991)

Rao (1991) also models two firms (with no strategic retailer) selling differentiated products. The total market consists of D consumers who

compose of two segments — segment A (proportion = $\alpha$) consisting of price shoppers with no brand preferences ($\delta_{ns} = 0$). Segment B (proportion = $1 - \alpha$) consists of switchers (national brand preferrers) who would pay a price premium for the national brand $\delta_{ns}$ which is distributed across consumers between $\ell$ and $u$. $(\ell, u > 0)$. Thus for a given price differential $x = p_n - p_s$, $F(x) = \int_l^x f(\delta)d\delta, f(x) > 0$; $l < x < u$; $F(l) = 0, F(u) = 1$. The demand for the national brand and store brand are given by

$$D_n = D[(1 - \alpha)(1 - F(x)) + \alpha I(x)], \tag{4.67}$$

$$D_s = D[(1 - \alpha)F(x) + \alpha(1 - I(x))] \tag{4.68}$$

$$I(x) = \begin{cases} 1 & \text{if } x \leq 0 \\ 0 & \text{otherwise} \end{cases}$$

That is, the national (store) brand gets all of the price shoppers if $p_n < (>) p_s$.

Each firm maximizes its respective profits, $\pi_i = (p_i - c_i)$ $D_i (i = n, s)$ since there is no retailer in the model.

Rao assumes all consumers have same reservation price $(r)$ for either brand but the cost of national brand is less than that for store brand $(c_n < c_s)$. Rao (1991) does not use the Varian approach of viewing price promotion as a mixed equilibrium strategy. Instead he assumes a sequential model to show the existence and characteristics of price promotions. In his model, first the two firms decide on their regular prices $p_n$ and $p_s$. In the second stage, they both determine depth of promotion and in the third stage they determine promotion frequencies. Rao derives the subgame perfect equilibrium and the key result is the following:

R102. *Private label or store brand generally does not promote in equilibrium*

Differences in the equilibrium strategies across the four price promotion models are discussed later in Sections 8.4 and 10.5 under model outcomes and implications.

## 4.6 Incorporating Shelf Space

### 4.6.1 Amrouche and Zaccour (2007, 2009)

There are two models that consider the role of shelf space. The demand functions in Amrouche and Zaccour's (2007) model are:

$$D_n = (\alpha_n - p_n + \psi_n p_s)S, \tag{4.69}$$

$$D_s = (\alpha_s - p_s + \psi_s p_n)(1 - S), \tag{4.70}$$

With a further assumption that $p_n = \gamma p_s$ $(\gamma < 1)$ and setting $\alpha_n$ to 1 without loss of generality, they derive the following simpler demand functions:

$$D_n = (1 - \beta_n p_n)S, \tag{4.71}$$

$$D_s = (\alpha_s + \beta_s p_n)(1 - S), \tag{4.72}$$

Here $\alpha_s$ represents store brand base demand or brand equity and $\beta_s$ is said to represent store brand quality. Note that shelf space proportion allocated to national brand $(S)$ enters the demand in multiplicative form, so that realized demand at given prices is directly proportional to shelf space allocated. Assuming that the manufacturer and the retailer are profit maximizers and costs are zero, their objectives read as follows:

$$\max_{w} \pi_M = w(1 - \beta_n p_n)S, \tag{4.73}$$

$$\max_{S, p_n} \pi_R = (p_n - w)(1 - \beta_n p_n)S + \gamma p_n(\alpha_s + \beta_s p_n)(1 - S). \tag{4.74}$$

Amrouche and Zaccour (2007) use numerical analysis techniques to offer the following results:

R103. *A retailer generally devotes smaller (larger) shelf space to store brand if it is of lower (higher) brand equity and/or of it is of lower (higher) quality.*

R104. *When private label quality increases, retail price of both brands increases.*

Amrouche and Zaccour (2009) extend their work on shelf space using a slightly different demand model

$$D_n = \left\{ \left( \frac{1}{1+\alpha_s} \right) [1 - p_n + \psi(p_s - p_n) + (2S - 1)] \quad \text{if } S \neq 0 \right. \tag{4.75}$$

$$D_s = \left\{ \left( \frac{1}{1+\alpha_s} \right) [\alpha_s - p_s + \psi(p_n - p_s) + (1 - 2S)] \quad \text{if } (1 - S) \neq 0 \, . \right. \tag{4.76}$$

Note that here, shelf space $S$ is considered like advertising (in Karray and Zaccour, 2007), disucssed in Section 4.4.3, and enters as an additive component in the demand model. $S$ is the space allocated to national brand and $1 - S$ is the space allocated to store brand. The relevant objective functions are:

$$\max_{p_n, p_s, S} \pi_R = (p_n - \omega_n) D_n + p_s D_s \tag{4.77}$$

$$\max_{\omega_n} \pi_M = (\omega_n - c) D_n. \tag{4.78}$$

The main question investigated in this paper was whether the manufacturer should offer the retailer an incentive to give more shelf space to national brand. In the benchmark case without shelf space incentive, both manufacturer and retailer play the Nash profit maximizing game with retailer setting retail prices and shelf space. Equilibrium from this case gives the benchmark wholesale price ($w^B$) and shelf space allocation for national brand ($S^B$). In the game with incentive, manufacturer is the Stackelberg leader and sets the wholesale pricing policy as:

$$w_n = w^B - b(S - S^B), \quad b > 0, \tag{4.79}$$

where $b$ is the manufacturer's decision variable, which can be deemed as an incentive for additional shelf space ($S - S^B$). Retailer then maximizes her profits (4.73). Pertinent results are as follows:

R105. *Manufacturer need not offer shelf space incentive if retailer offers me too private label that is not differentiated from the national brand.*

R106. *Manufacturer can offer incentive if retailer offers a differentiated private label — i.e., high quality PL catering to a distinct segment*

Comparing result R89 related to advertising incentive with R101 related to manufacturer offering shelf-space incentive, it appears offering shelf space incentive is a more sustainable equilibrium strategy for the manufacturer, especially if the store brand is catering to a distinct segment.

## 4.7 Incorporating Additional Channel

### 4.7.1 Kurata et al. (2007)

Kurata et al. (2007) were one of the first to investigate marketing of national brand and store brand when the national brand manufacturer can also sell through a direct e-channel in addition to the conventional chain store. The demand function in this two-channel market are as follows:

The demand function for the NB at a direct store is

$$d_0 = a_0 - b_0 p_0 + \beta_0 p_1 + \beta_1 p_2. \tag{4.80}$$

The demand function for the NB at a chain store is

$$d_1 = a_1 - b_1 p_1 + \beta_0 p_0 + \beta_2 p_2. \tag{4.81}$$

The demand function for the SB is

$$d_2 = a_2 - b_2 p_2 + \beta_1 p_0 + \beta_2 p_1, \tag{4.82}$$

where $p_0$ and $p_1$ are national brand prices at direct store and chain store respectively, $p_2$ is price of store brand. $a$s represent brand equity, $b$s are own price sensitivities, and $\beta$s are cross-price sensitivities.

The objective function for the national brand manufacturer is

$$\max_{p_0} \pi_1 | p_1, p_2 = (p_0 - c_1) d_0 + (w_1 - c_1) d_1. \tag{4.83}$$

The objective function for the retailer is

$$\max_{p_1, p_2} \pi_2 | p_0 = (p_1 - w_1) d_1 + (p_2 - c_2) d_2. \tag{4.84}$$

The wholesale price ($w_1$) is fixed. The national brand manufacturer determines the retail price for the direct channel, while the retailer decides on the retail prices of both national and store brands in a static

Nash equilibrium framework. Kurata et al. specify strategies related to changing the parameters ($a$, $b$, and $\beta$), in particular brand loyalty or equity ($a$) as a result of two channel competition. In the general case where there is both brand and channel competition, they find:

R107. *It is profitable for the conventional retailer to develop loyalty for both national brand and store brand but not build channel loyalty.*
R108. *It is profitable for the manufacturer to build channel loyalty to its direct channel.*

When the channels are completely distinct and only brand competition exists

R109. *It is profitable for conventional retailer to build channel loyalty*
R110. *It is profitable for manufacturer to build brand loyalty*

Kurata et al. also address the issue of supply chain coordination defined as maximizing the total profits of the vertically integrated distribution system. He finds that:

R111. *The manufacturer offering a reduced wholesale price will not coordinate the channel.*
R112. *However, a mark-up to retail price of the national brand in the chain store or retail price adjustments to either national brand in the direct store or store brand in the chain store can achieve channel coordination.*

### 4.7.2 Amrouche and Ruliang (2012)

Amrouche and Ruiliang (2012) also analyze the possibility of manufacturer selling national brand through an additional online store. The demand functions are linear as shown below:

$$D_n = \frac{1}{2}[(1-\alpha) - p_n + \psi_1 p_s + \psi_2 p_o] \tag{4.85}$$

$$D_s = \frac{1}{2}[\alpha - p_s + \psi_1 p_n + \psi_3 p_o] \tag{4.86}$$

$$D_o = \frac{1}{2}[1 - p_o + \psi_2 p_n + \psi_3 p_s], \tag{4.87}$$

where $q_n, q_s$ are demand for national brand and store brand in the retail outlet and $q_O$ is the demand for national brand in the online store. The retailer and the manufacturer maximize profits as shown below.

$$\max_{p_n,p_s} \pi_R^D = (p_n - \omega)D_n + p_s D_s \tag{4.88}$$

$$\max_{\omega,p_o} \pi_M^D = \omega D_n + p_o D_o. \tag{4.89}$$

Other assumptions are the same as in the baseline model. Some results are:

R113. *When the private label potential* $(\alpha)$ *is high, both manufacturer and traditional retailer can benefit from private label introduction. In that case, introducing an online store can further increase total channel profits.*

R114. *When the private label potential* $(\alpha)$ *is low, manufacturer profits reduce with private label introduction. In that case, introducing an online store can increase manufacturer profits if the cross-price sensitivity between online national brand and private label* $(\psi_3)$ *is high.*

# 5

# Two or More National Brands and One Retailer

Models in this section consider at least three brands — two national brands each sold by a manufacturer and a retailer selling store brand. Many multi-brand models consider a single retailer since the analytics are easier with one retailer than with competing retailers. These models are able to incorporate the competition between national brands and thus provide additional insights compared to the models in Section 4.

## 5.1 Base Model with Prices Only

These models only consider prices as decision variables and provide insights into store brand introduction and how prices change with store brand introduction and market conditions.

### 5.1.1 Raju, Sethuraman, and Dhar (1995a,b)

Raju et al. (1995a) was one of the seminal papers to analyze the competition between national brands and store brands by incorporating multiple national brands. The demand functions for the two national

brands (1 & 2) can be represented as:

$$q_1 = \frac{1}{2}[1 - p_1 + \theta(p_2 - p_1)] \tag{5.1}$$

$$q_s = \frac{1}{2}[1 - p_2 + \theta(p_1 - p_2)]. \tag{5.2}$$

As in the baseline model in Section 4.1, demand is a function of own price and price differential with competing brand. $\theta$ represents the competition between the two national brands. Note that when prices are zero, the total demand equals 1. The demand functions with the store brand are

$$q_1 = \frac{1}{2+\alpha}\left[1 - p_1 + \frac{1}{2}[\theta(p_2 - p_1) + \delta_1(p_s - p_1)]\right] \tag{5.3}$$

$$q_2 = \frac{1}{2+\alpha}\left[1 - p_2 + \frac{1}{2}[\theta(p_1 - p_2) + \delta_2(p_s - p_2)]\right] \tag{5.4}$$

$$q_s = \frac{1}{2+\alpha}\left[\alpha - p_s + \frac{1}{2}[\delta(p_1 - p_s) + \delta_2(p_2 - p_s)]\right] \tag{5.5}$$

$\alpha$ represents store brand strength and $\delta_1$ and $\delta_2$ represent cross-price sensitivities between the two national brands and the store brand. Note that the demand function is "normalized" so that when the store brand is introduced and all prices are zero, the total category demand is unchanged at 1.

When the retailer carries a store brand, the retailer and the manufacturers maximize the following objective functions, respectively:

$$\max_{p_1,p_2,p_s} \sum_{i=1}^{2}[(p_i - \omega_i)q_i] + p_s q_s \tag{5.6}$$

$$\max_{\omega_i}[\omega_i \hat{q}_i(\omega_1, \omega_2)] \tag{5.7}$$

Many of the assumptions in the base model in Section 4.1 — zero cost, manufacturer Stackelberg leader — hold here as well. Raju et al. compare the incremental profits from store brand introduction to yield insights on store brand entry as well as provide other insights into store brand pricing and market share.

R115. *Store brand introduction is more profitable for the retailer when store brand strength (intercept) is higher*

R116. *Store brand introduction is more profitable when cross-price sensitivity between national and store brands is higher*

R117. *Store brand introduction is more profitable when cross-price sensitivity among national brands is lower*

R118. *When conditions are conducive, profitability from store brand introduction increases with category sales volume.*

R119. *When conditions are conducive for store brands, introduction of store brand decreases national brand wholesale and retail prices.*

R120. *Store brand introduction reduces retail margin, sales and profits from the national brands*

R121. *Equilibrium store brand share is higher when* (*i*) *the store brand strength is higher;* (*ii*) *cross-price sensitivity between national and store brands is higher and* (*iii*) *when cross price sensitivity among national brands is smaller.*

Raju et al. further extend this model to $k$ brands with the following demand functions:

$$q_i = \frac{1}{k+\alpha}\left[1 - p_i + \frac{1}{k}\sum_{j\neq i}\theta(p_j - p_i) + \delta(p_s - p_i)\right] \tag{5.8}$$

$$q_s = \frac{1}{k+\alpha}\left[\alpha - p_s + \frac{1}{k}\left[\sum_{i}\delta(p_i - p_s)\right]\right]. \tag{5.9}$$

The manufacturer profit function is the same as before. The retailer's objective function is modified as follows:

$$\max_{p_1,p_2,\ldots,p_k,p_l} \sum_{i\neq l}^{k}[(p_i - \omega_i)q_i] + p_s q_s. \tag{5.10}$$

All applicable baseline results R2–R21 obtained with one national brand and one store brand holds in the above model with multiple national brands. In addition, equilibrium analyses in Raju et al. (1995a,b) reveal the following additional results:

R122. *The incremental profits from store brand introduction is higher when the number of national brands* ($k$) *is large.*

R123. *In categories characterized by high cross-price sensitivity between national brand and store brand (less perceived quality differential), price differential between national brand and store brand is lower, but share of store brand is higher. Hence, national brand-store brand price differential and store brand share are negatively related across categories.*

The negative relationship between national brand-store brand price differential and store brand share found in Sethuraman (1991) and Mills (1995) with one national brand also holds in models with multiple national brands.

## 5.2 Incorporating Store Brand Positioning

### 5.2.1 Sayman, Hoch, and Raju (2002) and Sayman and Raju (2004)

In the above model of Raju et al. (1995a), cross-price sensitivities between national brand and store brand ($\delta_1$ and $\delta_2$) are exogenous. These sensitivities can be deemed as parameters reflecting the positioning of store brand vis-a-vis the national brand, the closer the positioning the higher the cross-price sensitivities. Sayman et al. (2002) use the same modeling approach as Raju et al. (1995a) but incorporate the positioning parameters ($\delta_1$ and $\delta_2$) as endogenous variables in addition to prices. They also assume linear demand functions but allow for national brands to have different brand strengths $(a_1, a_2)$.

$$q_1 = \frac{1}{a_1 + a_2 + a_s}\left[a_1 - p_1 + \frac{1}{2}\{\theta(p_2 - p_1) + \delta_1(p_s - p_1)\}\right] \quad (5.11)$$

$$q_2 = \frac{1}{a_1 + a_2 + a_s}\left[a_2 - p_2 + \frac{1}{2}\{\theta(p_1 - p_2) + \delta_2(p_s - p_2)\}\right] \quad (5.12)$$

$$q_s = \frac{1}{a_1 + a_2 + a_s}\left[a_s - p_s + \frac{1}{2}\{\delta_1(p_1 - p_s) + \delta_2(p_2 - p_s)\}\right]. \quad (5.13)$$

The profit maximizing objective functions are the same as in Raju et al. (1995a). The sequence of decisions are as follows. In Stage 1, retailer positions the store brand ($\delta_1$ and $\delta_2$ are determined); in Stage 2, national brand manufacturers choose their wholesale prices

($w_1$ and $w_2$); and in Stage 3 — retailer sets prices of national and store brands ($p_1, p_2, p_s$). Pertinent results are:

R124. *In the case of symmetric national brands* ($a_1 = a_2$), *it is better for the store brand to be positioned closer to one of the national brands than in the middle.*

R125. *In the case of asymmetric national brands* ($a_1 > a_2$), *it is optimal to position closer to the leading national brand* (1).

R126. *Targeting the leading national brand is more profitable if the leading brand has higher relative market share.*

Sayman and Raju (2004) further extend the above model with the retailer carrying two national brands and the possibility of carrying two store brands instead of just one. The corresponding demand functions with two national brands and two store brands are:

$$q_1 = \frac{1}{a_1 + a_2 + 2a_{s2}} \left[ a_1 - p_1 + \frac{1}{3}\{\theta(p_2 - p_1) + \delta_{11}(p_{s1} - p_1) + \delta_{21}(p_{s2} - p_1)\} \right] \tag{5.14}$$

$$q_2 = \frac{1}{a_1 + a_2 + 2a_{s2}} \left[ a_1 - p_1 + \frac{1}{3}\{\theta(p_2 - p_1) + \delta_{12}(p_{s1} - p_2) + \delta_{22}(p_{s2} - p_2)\} \right] \tag{5.15}$$

$$q_{s1} = \frac{1}{a_1 + a_2 + 2a_{s2}} \left[ a_{s2} - p_{s1} + \frac{1}{3}\{\delta_{11}(p_1 - p_{s1}) + \delta_{12}(p_2 - p_{s1}) + \delta(p_{s2} - p_{s1})\} \right] \tag{5.16}$$

$$q_{s2} = \frac{1}{a_1 + a_2 + 2a_{s2}} \left[ a_{s2} - p_{s2} + \frac{1}{3}\{\delta_{21}(p_1 - p_{s2}) + \delta_{22}(p_2 - p_{s2}) + \delta(p_{s1} - p_{s2})\} \right]. \tag{5.17}$$

Note that in this set of demand functions, the two potential store brands are symmetric in that they have the same intercept term and cross-price sensitivity between them. However, they can be positioned differently with the national brand by changing cross-price sensitivities

between the national brand and store brand. The profit function for the retailer with two store brands is given by

$$\Pi_{r2} = (p_1 - w_1)q_1 + (p_2 - w_2)q_2 + p_{s1}q_{s1} + p_{s2}q_{s2}. \tag{5.18}$$

In this case, retailer decision variables are store brand positioning $(\delta_{11}, \delta_{12}, \delta_{21}, \delta_{22})$ and retail prices $(p_1, p_2, p_{s1}, p_{s2})$.

Sequence of decisions is the same as in Sayman et al. (2002). They find the following results:

R127. *When brands are symmetric* $(a_1 = a_2 = a_{s1} = a_{s2})$*, it is optimal for store brand to target different national brands.*

R128. *It is optimal for store brand to introduce two store brands if the base demand for the second national brand is also high (secondary brand is also big) and the cross-price sensitivity between the two national brands is low.*

Essentially, R128 says introduce two store brands targeted at each national brand if the top two brands are strong but distinct.

### 5.2.2 Scott-Morton and Zettelmeyer (2004)

In analyzing store brand introduction, Scott-Morton and Zettelmeyer (2004) incorporate the notion of replacing one of two national brands with store brand because of shelf space constraints and use a bargaining model in a segmented market of heterogeneous preferences. In particular, there are two segments (1 & 2) of consumers with proportion $\alpha$ and $1 - \alpha$. Segment 1 (2) consumers have utility $\theta$ for national brand 1 (2) positioned at their segment, $\tau\theta$ for national brand 2 (1) positioned at the other segment, $s\theta$ for store brand positioned at their segment and $\tau s\theta$ for store brand positioned at the other segment where $\tau$ and $s$ are fixed numbers between 0 and 1, while $\theta$ is distributed uniformly between 0 and 1. Consumers are served by a monopolistic retailer who can carry at most two brands (two national brands or one national and one store brand) and has to decide which option to go for and what she should pay. The game structure is as follows. In Stage 1, retailer decides whether to introduce store brand and if so which national brand to replace and whether to position against segment 1 or segment 2. In

Stage 2, each manufacturer whose product is chosen to be on the shelf decides on a take it or leave it contract payment for their brands that specifies the amount to be paid as a function of quantity purchased by retailer. In Stage 3, retailers decides how much of national brand and store brand to buy and sell.

In this model, marginal cost of national brand and store brand production are assumed to be equal and set to zero. However, in this model, manufacturers do not determine a fixed price but a contracted pricing schedule that can be nonlinear in quantity. Thus this model can allow for some implicit negotiation between manufacturer and retailer in pricing and store brand positioning. In particular, Scott-Morton and Zettelmeyer (2004) show that the Stage 2 and 3 subgame perfect equilibrium boils down to consideration of the following equilibrium profits for national brand manufacturer $i$, $j$, and retailer profits, respectively:

$$\pi_i^*(i,j) = \Pi(i,j) - \Pi(j) \tag{5.19}$$

$$\pi_j^*(i,j) = \Pi(i,j) - \Pi(i) \tag{5.20}$$

$$\pi_r^*(i,j) = \Pi(i,j) - \pi_i^*(i,j) - \pi_j^*(i,j), \tag{5.21}$$

where $\Pi(i,j)$ is the (maximum) profits that a retailer can earn if she were fully vertically and horizontally integrated and sell both national brands. $\Pi(i)$, $\Pi(j)$ are the profits that the retailer gets if she were vertically integrated and if she sold only $i$ (or $j$). The result implies that, in equilibrium, each manufacturer earns the incremental profit contributed by the introduction of its brand (added value). The total channel profits $\Pi(i,j)$ is split among the two manufacturers and retailer where the manufacturers get their incremental value and the retailer gets the rest.

Now when a store brand replaces one of the national brands, the profits can be rewritten. For instance, retailer profit when s/he carries a national brand targeted at segment 1 ($x_1$) and positions the store brand at segment 1 ($s_1$) is:

$$\pi_r^*(x_1,s_1) = \Pi(x_1,s_1) - \pi_x^*(x_1,s_1) - \pi_s^*(x_1,s_1). \tag{5.22}$$

These profits can be computed for the different combinations of national brand replacement and store brand positioning ($x_1$, $s_1$),

$(x_1, s_2)$, $(x_2, s_1)$, $(x_2, s_2)$ and the one with the maximum profit for retailer can be chosen. These profits depend in turn on parameter values, in particular, segment proportion $\alpha$. Their analysis yields the following results:

R129. *Retailer will replace a national brand with a store brand if and only if the incremental contribution of the leading national brand to total channel profits is lower when the retailer carries the store brand than when the retailer carries the other national brand.*

R130. *Suppose the retailer introduces a store brand. then, she should replace the lower market share (brand focused on segment with lower $\alpha$) national brand*

R131. *Retailer should position the store brand to imitate the higher share national brand (one targeted at segment with higher $\alpha$).*

R132. *Retailer's profitability of store brand introduction increases with store brand utility or quality (s) and decreases with alternate national brand utility ($\tau$).*

Many of the results from Scott-Morton and Zettelmeyer (2004) are similar to those from Sayman et al. (2002) even though the former use Nash bargaining solution while the latter uses Bertrand-Nash price setting equilibrium. In particular, R125 and R131 both state that retailers are better off imitating or positioning close to the higher share national brand.

### 5.2.3 Choi and Coughlan (2006)

To capture the demand for the three brands — two national brands and one store brand, Choi and Coughlan start with a quadratic utility structure for a triopoly:

$$\begin{aligned} &U(q_1, q_2, q_s) \\ &\quad = (\alpha_1 - p_1)q_1 + (\alpha_2 - p_2)q_2 + (\alpha_s - p_s)q_s \\ &\qquad - \frac{1}{2}(\beta_1 q_1^2 + \beta_2 q_2^2 + \beta_s q_s^2 + 2\gamma_{12}q_1q_2 + 2\gamma_{1s}q_1q_s + 2\gamma_{2s}q_2q_s). \end{aligned} \quad (5.23)$$

In this model, according to Choi and Coughlan (2006), $\alpha_s$ the marginal utility of store brand represents quality differentiation

between national brand and store brand and $\gamma_{1s}, \gamma_{2s}$ represent feature differentiation of national brand 1 and 2 with store brand.

Taking the derivative with respect to $q_1$, $q_2$, $q_s$, setting them to zero and solving the three equations, we get

$$q_1 = \frac{1}{T}[A_1 - B_1 p_1 + C_1 p_2 + D_1 p_s] \tag{5.24}$$

$$q_2 = \frac{1}{T}[A_2 - B_2 p_2 + C_2 p_1 + D_2 p_s] \tag{5.25}$$

$$q_s = \frac{1}{T}[A_3 - B_3 p_s + C_3 p_1 + D_3 p_2], \tag{5.26}$$

where $T$, $A$, $B$, $C$, $D$ are all functions of the utility parameters $\alpha, \beta, \gamma$. Thus Choi and Coughlan are able to link the demand parameters to the utility parameters and thus quality and feature differentiation. The profit functions for the retailer and manufacturer are:

$$\pi_R = (p_1 - \omega_1)q_1 + (p_2 - \omega_2)q_2 + (p_s - v_s)q_s \tag{5.27}$$

$$\pi_{mi} = (w_i - v_i)q_i, \tag{5.28}$$

where $v_i, v_s$ are constant marginal costs for national brand $(i)$ and store brand respectively such that $v_i > v_s$.

National brand manufacturers determine their wholesale prices $w_i$ for a given quality level $(\alpha_i)$ of their brands. Retailer chooses quality differentiation of the store brand $(\alpha_s)$, degree of feature differentiation as reflected in $(\gamma_{1s}, \gamma_{2s})$ and the retail prices of national and store brands $(p_1, p_2, p_s)$. The closed-form equilibrium expression are quite messy and therefore they resort to numerical analysis with some simplifying assumptions: $\beta_1 = \beta_2 = \beta$; $\alpha_1 \geq \alpha_2 \geq \alpha_s$; $v_s = 0$. Thus (1) is the stronger national brand and (2) is the weaker national brand. They derive several results related to quality differentiation and feature differentiation:

R133. *If it does not cost much to increase quality of private label, then the retailer should seek minimum quality differentiation with the national brand. That is, improve private label quality to the extent possible.*

R134. *A higher quality private label is better off positioning closer to the stronger national brand while the lower quality private label is better off positioning closer to the weaker national brand.*

R135. *When two national brands are undifferentiated in the feature dimension, it is optimal for the private label to feature differentiate from national brands; the higher the private label's quality, the more it can feature differentiate.*

## 5.3 Incorporating Advertising

### 5.3.1 Karray and Herran (2008)

Karray and Martín-Herrán (2008) incorporate advertising by both manufacturer and retailer and investigate how they may change national brand and private label prices and how equilibrium advertising strategies depend on price and advertising competition. There are two national brand manufacturers and one retailer who sells the store brand. Karray and Martín-Herrán (2008) use the standard demand function, where quantity demanded is a linear function of price differential with advertising effect represented as a square root function with decreasing returns to scale.

$$Q_i = a + \psi\sqrt{A_i} + \theta\sqrt{A_R} + \rho\sqrt{A_j} - p_i + \alpha(p_j - p_i) + \beta(p_S - p_i), \tag{5.29}$$

$$Q_S = b + \psi_S\sqrt{A_R} + \phi(\sqrt{A_1} + \sqrt{A_2}) - p_S + \beta(p_1 - p_S) + \beta(p_2 - p_S). \tag{5.30}$$

Marginal costs of national and store brand are set to zero and cost of national brand ($i$) advertising is linear in advertising ($\frac{\mu_1}{2}A_i$). while cost of store brand retailer advertising is ($\frac{\mu_2}{2}A_R$). These parameters have some interesting meanings. $A_R$ is retailer advertising not specific to brands, it merely draws traffic to the store, thus helps both national and store brand. The private label carries the store name and thus benefits directly from retailer advertising ($\psi_s$ positive); it also helps national brand demand ($\theta$ positive). On the other hand, $\rho$ and $\phi$ can be negative or positive depending on whether advertising is competitive (persuasive) or complementary (informing about product attributes).

The game is played as follows. First, manufacturer and retailer simultaneously determine their advertising. Second, manufacturer decides wholesale prices. Third, retailer decides all three retail prices. Manufacturer ($i$) and retailer profits are given by:

$$\pi_i = w_i Q_i - \frac{\mu_1}{2} A_i, \tag{5.31}$$

$$\pi_R = \sum_{i=1}^{2} (p_i - w_i) Q_i + p_S Q_S - \frac{\mu_2}{2} A_R. \tag{5.32}$$

The following are some results arising from the subgame-perfect equilibrium analysis.

R136. *When the competition between national brand and store brand is high, i.e., store brand is positioned closer to the national brand, national brand decreases its advertising.*

R137. *As the cross-price sensitivity between national and store brand increases, wholesale and retail price of national brand decrease.*

R138. *If advertising is complementary (national brand advertising helps store brand), then retailer can lower its advertising and charge a lower price of private label when store brand is positioned closer to the national brand.*

R139. *If advertising is competitive (national brand advertising harms store brand), then retailer can increase its advertising and charge a higher price for private label when store brand is positioned closer to the national brand.*

R140. *When cross-advertising effects are higher, manufacturer and retailer advertising are higher.*

R141. *When cross-advertising effects are higher, national brand and store brand wholesale and retail prices are higher.*

R142. *When advertising is complementary, higher investment in advertising by own or competing national brand manufacturer leads to higher wholesale and retail prices.*

R143. *For any level of retailer advertising, an increase in retailer advertising increases retail prices for all brands.*

## 5.4 Incorporating Price Promotion

Lal (1990) is one of few models that has studied price promotions of national brands and store brands using a game theory model that explicitly incorporates a strategic retailer. Demand side is represented by two segments of consumers — loyals and switchers. The loyal consumers (numbering $\alpha$) always buy their preferred national brand as long as it is available at or below the reservation price ($r$). The switchers (numbering $\beta$) base their decision on relative prices of the two national brands ($p_a, p_b$) and local store brand $p_c$. In particular, the $i$th switcher prefers the store brand to its national brand if the price differential is below $x$, where $x$ is assumed to be uniformly distributed between 0 and 1. Hence, the proportion of the people who use store brand is $D = \frac{p_b - p_c}{x}$ if $p_b - x \leq p_c < p_b$, where $p_b$ is the price of the preferred national brand.

On the firm side, they model the competition in a repeated game framework. Each manufacturer sells its brand through the retailer who decides on the retail price of these products. Retailers will carry the national brands so long as they get a minimum margin $\delta$. If $p_a < p_b$, retailer profits can be written as:

$$\prod_r = (p_b - w_b)\alpha + (p_a - w_a)\left(\alpha + \beta\left(1 - \frac{p_a - p_c}{x}\right)\right) + (p_c - w_c)\beta\left\{\frac{p_a - p_c}{x}\right\} \tag{5.33}$$

Manufacturer (a)'s profits is

$$\prod_m^a = w_a\left(\alpha + \beta\left(1 - \frac{p_a - p_c}{x}\right)\right). \tag{5.34}$$

The manufacturers and the retailer are assumed to maximize discounted value of profits over an infinite horizon, with discount factor $\rho$. Results yield insights on manufacturer trade deals and store brand promotions:

R144. *If the relative number of switchers is large enough, the margin required by the retailer is small enough and the discount factor*

*is not that high, the two national brand manufacturers will offer trade deal (reduce wholesale price) in alternate periods.*

R145. *Retailer does not promote its private label.*

R146. *Presence of a store brand owned by the retailer instead of a third national brand increases size of trade deal offered by national brand, reduces retail promotional price and thus reduces retail pass-through of trade deal*

## 5.5 Incorporating Dual Branding

### 5.5.1 Wu and Wang (2005)

Wu and Wang (2005) propose that a private brand offered by a national brand manufacturer may be a way to mitigate promotion competition between two national brands (A and B). They model two manufacturers selling through one retailer with one manufacturer having the ability to supply private label. $N$ consumers are uniformly distributed on a continuum $[0,1]$ as in the conventional Hotelling model. The two national brands are positioned on either end of the taste continuum. Consumers with taste $x$ from the A-end will incur utility:

$$U_S = \begin{cases} \nu - p_A - tx & \text{if he/she buys brand A} \\ \nu_B - p_B - t(1-x) & \text{if he/she buys brand B} \\ 0 & \text{if he/she does not buy} \end{cases} \tag{5.35}$$

$\nu$ represents the maximum price consumers are willing to pay for either national brand A or B. They further assume only the dominant national brands can produce private label and it can do so by producing a private label of quality $q$ at unit cost $c(q)$ which is a convex function of quality, $c'(q) > 0$ and $c''(q) > 0$. Consumer's reservation price for the private label of quality $q$ is $r(q)$. When the private label is introduced a proportion $\alpha(q)$ of consumers switch from national brand(s) to the store brand if national brands do not promote and a proportion $y\alpha(q)(y < 1)$ if the national brand engages in promotion. Both national brands can promote to increase their reservation price from $v$ to $v + \Delta$ by incurring a fixed expense $C$ for promotions. Finally, they assume that manufacturer and retailer share the profit from the private label in the proportion $\delta$ and $1 - \delta$. Thus the manufacturer profits can be

written as:

$$\pi_i = (w_i - c_i)D_i + \alpha_1\delta[r(q) - c(q)]D_{pl} - \alpha_2 C \tag{5.36}$$

$\alpha_1$ is 1 if manufacturer introduces private label and $\alpha_2$ is 1 if manufacturer promotes (0 otherwise). Retailer profits can be written as:

$$\pi_r = (p_1 - w_1)D_1 + (p_2 - w_2)D_2 + \alpha_1(1 - \delta)[r(q) - c(q)]D_{pl}. \tag{5.37}$$

The game is played as follows: First period manufacturer decides whether to supply private label to retailer (dual brand). If it decides to offer then it determines private label quality. Second period manufacturers 1 and 2 simultaneously choose whether to promote and also set their wholesale prices. Third period, retailer decides on retail prices of the two national brands. Some results are:

R147. *Dual branding by a national brand manufacturer can mitigate promotional spending. That is, when the national brand manufacturer offers a private label to the retailer, it may act as a disincentive for either manufacturer to increase promotional spending.*

R148. *Under certain conditions, dual branding can mitigate promotion competition among national brand manufacturers and thus increase profits for both national brand manufacturers and retailers.*

# 6

# Model with One Manufacturer and Two Retailers

In this model with one national brand, one or both retailers can carry the national brand and introduce a store brand so that the competition is among three brands at the brand level and among two retailers at the retail level. Demand for the brands at the retail level can be captured with an aggregate demand function or using individual consumer utility functions.

## 6.1 Base Model with Prices only

### 6.1.1 Choi and Fredj (2006)

The closest paper representing a base model in this scenario is a working paper by Choi and Fredj (2006). They extend the demand function of Raju et al. (1995a) for the two retailer case as follows: Demand for manufacturer brand ($m$) in retailer $i$ ($i = 1.2$) s given as:

$$q_{im} = \frac{1}{2(1+\lambda)}(1 - p_{im} + \gamma(p_{jm} - p_{im}) + \beta(p_{is} - p_{im})). \tag{6.1}$$

The demand for store brand in retailer $i$ is represented as

$$q_{is} = \frac{1}{2(1+\lambda)}(\lambda - p_{is} + \beta(p_{im} - p_{is})). \tag{6.2}$$

As before, $\lambda$ is store brand strength, $\gamma$ is cross-price sensitivity between national brand in the two stores, $\beta$ is the cross-price sensitivity between national brand and store brand within a store. Note that in this demand model, the store brand competes only with national brand in that store, while the national brand in both stores compete with each other. Assuming zero marginal costs, the profit function for the manufacturer is the sum of profits from the two retailers.

$$\pi_m = \sum_{i=1,2} (w_m q_{im}) = w_m \sum_{i=1,2} q_{im}. \tag{6.3}$$

The profit function for each retailer is

$$\pi_{R_i} = (p_{im} - w_{im})\, q_{im} + p_{is} q_{is}. \tag{6.4}$$

Both manufacturer and retailer maximize profits with respect to their prices. In addition to the traditional manufacturer as Stackelberg leader assumption, Choi and Fredj (2006) consider a number of other game structures including Retailer Stackelberg and Vertical Nash. Closed-form expressions are obtained for equilibrium prices but given the complex nature of the price expressions, the authors resort to numerical analysis to obtain results. Some results from their analysis are:

R149. *Store competition or cross-price sensitivity between the national brand in the two stores increases national brand wholesale price but decreases retailer price and margin.*

R150. *Higher store competition results in higher profits for the national brand manufacturer and lower profits for the retailer.*

R151. *Stackelberg channel leader (whether manufacturer or retailer) gets higher unit margin and generally higher profits.*

### 6.1.2 Corstjens and Lal (2000)

While Choi and Fredj consider a linear aggregate model to capture demand, other modelers use consumer distribution and Hotelling location model to capture consumer demand in the case of two retailers. Corstjens and Lal (2000) assume the two retailers are located at the two

ends of a line of unit length. Consumers are located uniformly between the end points on this line. Each retailer carries the same national brand and has the option to carry an additional store brand of similar quality. The retailers make decisions over a two time period. In each period, the two retailer decides which one brand (national or store brand) to advertise and prices of brands they carry. Consumers are of two types ones with high brand inertia ($\Delta$) and others with low brand inertia ($\delta$), which measure the price differential that needs to be overcome compared to the consumer's previous brand choice. Consumers first decide which store to visit based on their expected consumer surplus, which depends on their transportation cost. Again, there are two segments of consumers, one with high transportation cost ($c$) and the other with low transportation cost ($\epsilon c$). Once they are in the store, consumers make brand choice based on price of national brand and store brand in that store. This consumer structure is somewhat similar to Wu and Wang (2005), and is discussed in Section 5.5.1.

Consumers are familiar with national brand quality but get to know about store brand quality after inspecting it in the store. Then they purchase a store brand or national brand depending on the brand inertia ($\delta$ or $\triangle$). After trying out the store brand, a fraction $\beta$ of those consumers find the product to be acceptable while others do not. Thus $\beta$ is an indicator of store brand quality. If a brand is not advertised, consumers must form expectations of the price if they visited the store. In this model, the authors assume that the store brand does not have a cost or margin advantage over the national brands. Corstjens and Lal (2000) adopt rational expectations equilibrium approach such that firms find it profitable to set prices equal to the price expected by the consumers. The profit functions are relatively complex and depend both on observed prices and expected prices. For example, the profit for store 1 in period 2 is represented as follows:

$$\pi^1 = (P_m^1 - m_m)\left[\frac{1-\gamma}{2c}(c + EP_m^2 - EP_m^1) + \frac{\gamma(1-\beta)}{2\epsilon c}(\epsilon c + EP_m^2 - EP_m^1)\right] + \gamma\beta(P_s^1 - m_s)F \quad (6.5)$$

Corstjens and Lal's analysis reveals the following insights:

R152. *Store brand will not be introduced unless it is above a certain threshold quality.*

R153. *If the quality of store brand is sufficiently high, under most conditions, profits to store increases with increase in store brand quality.*

R154. *If consumers display no inertia in brand switching, then stores would never benefit from introducing a store brand.*

In summary, even if store brand has no cost or margin advantage and even if national brand can cater to the needs of the homogeneous segment, the store makes higher profits (over the two periods) by carrying a store brand, so long as the fraction of consumers who buy the national brand in Period 2 is within an acceptable range and the store brand is of sufficiently high quality.

### 6.1.3 Groznik and Heese (2010a,b)

In representing demand for national and store brands across two retailers, Groznik and Heese (2010a,b) also assume a Hotelling type model where consumers are distributed uniformly on a segment of length 1 and retailers are located on either ends of the segment. Customers incur a traveling cost $t$ to get to the store. Customers also differ in the valuation of their product $b$ in retailer $i$. Specifically, a customer of type $r$ has reservation price $r$. $R_i^b$, where $R_i^b$ is the maximum reservation price for brand b in retailer $i$ and r is distributed uniformly between 0 and 1. Thus for a customer of type $r$ at a distance $d_i$ from retailer $i$ ($i = 1, 2$), utility for brand $b$ ($b$ = national brand, store brand) is:

$$U_i^b(d_1, r) = R_i^b r - p_i^b - t d_i. \tag{6.6}$$

From this utility function, solving for indifferent consumers between any two brands of the four combination (NB1–NB2; NB1–SB1; NB2–SB1; NB2–SB2), we can derive the demand function for each national brand and store brand in each store. Then, the manufacturer and retailer profits can be written $a$, respectively:

$$\pi_M = (w - c_M)(q_1^{\mathrm{NB}} + q_2^{\mathrm{NB}}), \tag{6.7}$$

$$\pi_{Ri} = (p_i^{\mathrm{NB}} - w)q_i^{\mathrm{NB}} + \tau_i((p_i^{\mathrm{SB}} - c_i)q_i^{\mathrm{SB}} - F_i, \tag{6.8}$$

where $\tau_i$ is one if retailer $i$ introduces a store brand and $F_i$ is fixed cost. Closed form solutions are not generally possible for this analysis, therefore they resort to numerical analysis and obtain the following results relating to retail competition and store brand introduction.

R155. *Store brand introduction by retailers in the presence of retail competition can increase retailer bargaining power inducing national brand manufacturer to cut wholesale prices.*

R156. *Under store competition, one retailer's store brand introduction decision is dependent on what other retailer may be doing. At times they may play "chicken" — not introduce if the other retailer has already introduced a store brand or both retailers may randomize their store brand introduction strategy.*

# 7

# Multiple Manufacturers and Multiple Retailers

A few economists have analyzed models with multiple national brands that can be sold through many retailers on the market. They have provided insights on dual branding (Peles, 1972), national brand proliferation as barrier to store brand entry (Schmalensee, 1978), and other issues. However, they seldom considered the role of the retailer. Analyzing a game-theoretic model with multiple (more than two) national brands and multiple retailers is quite difficult. It is also not clear how much additional insights can be derived from them beyond the two manufacturer — two retailer model.

## 7.1 Models with Prices Only

Two recent articles have analyzed the case of multiple manufacturers and retailers using empirical industrial organization methods. The empirical results in these papers shed some light on some key assumptions used in economic models. For example, Cohen and Cotterill (2011) supports the assumption that manufacturers being Stackleberg leaders is consistent with their data.

### 7.1.1 Draganska, Klapper, and Villas Boas (2010)

On the demand side, consumers select a brand to maximize their utility. The utility for consumer $i$ for brand $b$ in retailer $r$ at time $t$ is given by:

$$U_{ibrt} = \alpha_{br} - \beta_i p_{brt} + \gamma X_{brt} + \xi_{brt} + \varepsilon_{ibrt}, \tag{7.1}$$

where $\alpha$ represents intrinsic brand preference, $\beta$ represents price sensitivity, $\gamma$ represents advertising or promotion sensitivity, $\xi$ is unobserved heterogeneity and $\varepsilon$ is random error, which is assumed iid extreme value distributed. The probability of consumer purchasing brand b at retailer $r$ can be computed using the logit model $\exp(U_{ibrt}/\sum_b U_{ibrt})$ for all brands sold in that retail outlet. The aggregate market share for brand $b$ in retailer $r$ $[\mathrm{MS}_j(p)]$ is obtained by integrating the above probability across all consumers. Then, the retailer and manufacturer profits for each brand-retailer combination $(j)$ can be written as:

$$\pi_j^r(w_j) = (p_j - w_j - c_j^r)\mathrm{MS}_j(p), \tag{7.2}$$

$$\pi_j^m(w_j) = (w_j^m - c_j^m)\mathrm{MS}_j(p). \tag{7.3}$$

The retail prices are determined by maximizing overall profits. The manufacturer wholesale prices are determined by generalized Nash bargaining solution by maximizing the Nash product:

$$\pi_j^r(w_j) - d_j(r))^{\lambda}(\pi_j^m(w_j) - d_j(m))^{1-\lambda}, \tag{7.4}$$

where $d$ is the respective disagreement payoff and $\lambda$ is the retailer's bargaining power. The first order conditions of the model lead to a structural equation system from which parameters of the utility model can be estimated with actual data. While the focus of this paper is empirical, some insights can be obtained about store brand introduction based on the estimated parameters.

R157. *The mere presence of a store brand does not lead to higher retailer bargaining power.*

R158. *However, store brand positioned close to the national brand can lead to higher retailer bargaining power*

### 7.1.2 Cohen and Cotterill (2011)

Like Draganska et al. (2010), Cohen and Cotterill also use a logit demand model derived from consumer utility function to obtain aggregate demand. There are $m$ brands and $n$ retailers. The utility for consumer $i$ for brand $j$ is given by:

$$V_{ij} = C_j\beta^i - \alpha^i p_j + \eta_j + \varepsilon_{ij}. \tag{7.5}$$

Here $i$ indexes individual, $j$ indexes brand in a particular retail outlet, $\beta$ is consumer-specific marginal utility for product characteristics $C_j$, $\alpha$ is marginal utility of income, $\eta$ is product-specific demand shock unobserved by researcher and $\varepsilon$ is the id extreme value distributed random error. As in Draganska et al. (2010), market share can be computed for each individual consumer using the logit model and integrated over all consumers in the market to obtain product level market share at given time $t(s_{jt})$. The retailer and the manufacturer profits can be written as shown below and maximized over their respective prices.

$$\pi_{rt} = \max_{p_{jt}} \sum_{j \in G_{rt}} [p_{jt} - p^w_{jt} - c^r_{jt}] s_{jt}(p). \tag{7.6}$$

$$\pi_{wt} = \max_{p^w_t} \sum_{j \in G_{wt}} [p^w_{jt} - c^w_{jt}] s_{jt}(p(p^w)). \tag{7.7}$$

The first-order conditions yield structural demand model reflecting prices and shares as a function of utility parameters. These parameters are estimated using actual data from the Milk market in Boston.[1] From the estimates, the authors perform a counterfactual simulation analysis with and without store brand to obtain the impact of retail store brand products on prices, profitability and consumer welfare. Some results are:

R159. *A strong store brand can lead to higher national brand retail margins and prices, while a weak store brand can result in lower national brand prices and margins.*

[1] The empirical estimation procedure is beyond the scope of this paper.

R160. *In general, store brands can increase profits for retailer by reducing double marginalization*

R161. *Store brands can also generally increase consumer surplus*

Cohen and Cotterill (2011) also find that manufacturer being a Stackelberg leader is most consistent with actual data.

We now discuss the implication of the key results enunciated above. While the discussion of analytical models were organized by key model structure (number of manufacturers and retailers), the discussion of the analytical results is organized by model outcomes. In particular, we discuss the results in the following order: (i) National brand decisions–manufacturer; (ii) National brand decisions–retailer; (iii) Store brand decisions–retailer ; (iv) Store brand decisions–manufacturer.

# 8

# National Brand Decisions — Manufacturer

## 8.1 National Brand Product Decisions

### 8.1.1 Product Features

What features/characteristics should the national brand possess vis-á-vis store brands? While not explicitly studying feature characteristics for the national brand, many studies have alluded to it by discussing cross-price sensitivity between national brand and store brand. Higher price substitutability favors store brand introduction and store brand penetration while lower price substitutability deters it and increases manufacturer profits (Result R16, R44). So, to prevent store brand introduction and/or protect national brand market share, national brand manufacturers ought to differentiate in the face of store brand competition. They can do so through innovation and adding new features, or by increasing quality and quality differential with store brand. Of course, this result is not surprising but the consistency of results from analytical models reinforces this fairly well accepted notion.

### 8.1.2 National Brand Targeting and Positioning

What segments of consumers should national brands target and how should the brand be positioned to consumers vis-a-vis store brands? Again, because store brand strategies have been the focus of most analytical models, these questions have not been explicitly addressed. However, many modelers have considered multiple segments of consumers in their analysis. In the process, they have alluded to the segments that the national brands would be catering to in equilibrium. Traditionally, national brands are higher-priced, advertised brands while store brands are generally lower-priced, unadvertised brands. So, a natural way to segment the market is based on their loyalty (premium willing to pay for brands) and price or advertising sensitivity.

Sethuraman (1991, R72) finds that if national brand advertising is effective, store brand should not be introduced, suggesting that it is best to target the national brands at the advertising sensitive segment. Along the same lines, Soberman and Parker (2006, R82) and Wolinksy (1983), in the context of modeling private label as a price discrimination mechanism, state that national brands are best targeted at the high advertising sensitive and quality sensitive consumers. When discussing promotion models involving multiple segments of consumers (Rao, 1991; Narasimhan, 1988) suggest national brands target the loyal segment who are willing to pay a premium for the national brand and occasionally make forays into the price sensitive segment through temporary price cuts. Abe (1995, R94) show that through advertising the high quality national brand, firms can separate the quality sensitive from price sensitive segments. To target these consumers, national brands ought to be positioned as a high quality premium brand vis-a-vis store brand.

## 8.2 National Brand Wholesale Price

What wholesale price to charge for the national brand when a store brand is introduced? Should the manufacturer reduce or increase its wholesale price in equilibrium? The answer to the question is it depends! Conventional economic view holds that the introduction of a store brand increases price competition for the incumbent national

brand. The increased price competition depresses the wholesale price for the national brand, as reflected in baseline result R2, Raju et al. (1995a) and many other studies. Along the same lines, the bargaining model of Scott-Morton and Zettelmeyer (2004) implies that retailers will be able to extract lower prices from the manufacturer by introducing (or threatening to introduce) a store brand of similar quality. Thus, like the conventional price competition models, the bargaining model predicts a dip in wholesale price.

Soberman and Parker (2006) offer a price discrimination view of store brands. They theorize that national brand manufacturers increase advertising and wholesale price when a store brand is introduced (R82), because advertising allows retailers to better price discriminate across two segments (national brand seekers vs. product seekers at whom the private labels can be targeted). Bontems et al. (1999) cost-based argument suggests that if obtaining a high-quality private label is costly for the retailer, the national brand manufacturer need not accommodate store brand entry by lowering its wholesale price, instead may actually increase wholesale price (R58). These analytical models provide multiple (price competition, bargaining, price discrimination, and cost) perspectives on the movement of national brand prices in response to store brand introduction. One perspective may dominate the others depending on the market conditions. For example, the price competition perspective may dominate in mature/commodity products while the price discrimination argument may apply in advertising sensitive (hedonistic) product categories.

In summary, when (i) the cost of procuring the store brand equals (or is less than) the cost of manufacturing the national brand, (ii) the store brand and national brand are competing for the same set of consumers, and (iii) advertising does not play a significant role in altering demand, wholesale and retail price of the national brand decrease with store brand introduction. However, when the cost of procuring the store brand is higher or advertising plays a significant role in discriminating among advertising sensitive and price sensitive consumers, wholesale price of the national brand may increase with store brand introduction.

Regarding adopting a nonlinear pricing scheme where the manufacturer sets wholesale price for different quantities purchased by the

retailer, Mills (1995, Result R46) states that such nonlinear pricing or two-part tariffs do not theoretically work to counter private label threat. This is because the retailer gets higher margins on the store brand. To make up for the higher margin, manufacturer has to offer a high enough quantity discount that it reduces the manufacturer's profits. Therefore two part tariff is not a viable strategy.

## 8.3 National Brand Distribution

When a store brand is introduced and marketed by a particular retailer, what distribution outlets should the national brand seek? This question has not been studied much in the literature partly because it is not an important consideration for national brands given the coverage and power of the retailers in grocery products, and partly because retail competition itself has not been studied adequately in the literature. However, national brand manufacturers could resort to additional distribution through specialty stores or online stores. Some modeling work by Amrouche and Ruiliang (2012, R113, 114) suggests that when private label comes with high additional market potential, selling national brand through an additional online store can further increase profits for both manufacturer and retailer. This is because the strong store brand enables both manufacturer and retailer to earn higher margins while at the same time the online store allows for additional profits by seeking an outlet that does not compete with the store brand. On the other hand, if the store brand does not have high market potential, additional online store is profitable for the manufacturer if the national brand in online store has high cross-price sensitivity with the store brand in the traditional store (R114).

## 8.4 National Brand Promotions

### 8.4.1 National Brand Advertising

National brand advertising has been considered an important non-price promotion element for competing with store brands. When a store brand is introduced, should the national brand advertising be increased or decreased? As with wholesale price, the answer to this question is

that it depends! A few studies have explicitly incorporated national brand advertising in their model. Sethuraman (1991) parametrizes advertising sensitivity in a linear demand model and shows that when price sensitivity is high and advertising sensitivity is low, retailers should introduce the store brand. Under such conditions, when a store brand is introduced, manufacturer should decrease advertising to compete with the store brand (R74). However, when advertising sensitivity is high, i.e., national brands can switch store brand consumers or increase category demand, then store brands would not be introduced and an increase in national brand advertising serves as a deterrent to store brand entry (Sethuraman, 1991; Morton and Zettlemyer, 2004). Soberman and Parker (2004, 2006) suggest that a store brand can serve to segment and discriminate among consumers who are brand seekers and willing to pay premium for high quality brand and product seekers who simply want a lower-priced brand. In this case, advertising will serve as a tool for attracting the brand seekers to pay a higher premium for the national brand (R80). Along the same lines, Abe (1995), using a signaling equilibrium model, finds that advertising can be a credible signal of the high quality of national brands, if the advertising effectiveness of the high quality (national) brand is higher than that for the low quality store brand (R94).

Amrouche et al. (2008a,b) incorporate advertising in a dynamic setting through good will or brand equity and thus incorporate long-term effects of advertising, Their main result is that an increase in goodwill generated through advertising can increase differentiation and total demand and thus favor both manufacturer and retailer (R90). In a sense, advertising can be a coordinating tool between manufacturer and retailer. Furthermore, they find that the firm that has higher current goodwill would advertise more in equilibrium (R91). That is, advertising favors the large-share, high equity brand.

Karray and Martin-Herran (2009) was one of the few studies that allowed for both national brand advertising (by manufacturer) and store brand advertising (by retailer) in their demand model. They find that if advertising between national brand and store brand is complementary, that is, both advertising increase each other's demand as well, then there is a positive relationship between manufacturer advertising

and retailer advertising. In this scenario, manufacturer increases it wholesale price and advertising. If advertising between national brand and store brand is competitive, that is, advertising by one brand decreases the other brand's demand, then there is a negative relationship between manufacturer advertising and retailer advertising. In this scenario, manufacturer decreases it wholesale price and advertising in equilibrium (R93).

In summary, if advertising is not effective in influencing sales or attracting store brand consumers, a situation found in mature markets (Sethuraman et al., 2011), it is best not to increase advertising, and even cut advertising, when faced with store brand competition, However, if advertising can increase category demand or increase goodwill in the long term, or enable firms to segment the price sensitive and advertising sensitive consumers, then manufacturer can increase national brand advertising,

### 8.4.2 National Brand Price Discounts and Coupons

When competing with store brands, should a national brand resort to price discounts? Should it discount more frequently or less frequently than store brands? Offer larger discounts or smaller discounts? When consumers are homogeneous (one segment), there is little incentive for either brands to price promote. When consumers are heterogeneous and, in particular, some are brand loyal and some are brand switchers based on the price premium they are willing to pay for their favorite brand, then there is scope for price promotion.

A few studies have incorporated these segments while investigating price discount strategies, though only one study has explicitly incorporated the retailer (Lal, 1990). All the studies have shown that when the national brand is positioned to capture its loyal segment with their regular price, if the other switcher segment is large enough, then it must offer temporary price discount in equilibrium to attract switchers occasionally. Whether they should promote more often or less often than store brands is not that clear and the result depends on the relative sizes of the loyal and switcher segments (R95, R97, R99), though most studies appear to suggest that national brands should be price

promoted more often. What appears to be a more consistent result from present analytical models is that the average discount offered by the stronger national brand should be greater than the size of discount offered by the store brand (R100). This result is because national brand manufacturers charge a high regular price for their brand to extract the consumer surplus from the loyal consumers who would be willing to pay a high price for the national brand. To attract the switchers who are willing to pay zero or small price differential for the national brand, they may need to discount significantly to obtain price parity with store brand. Store brands are already targeting the price shoppers, so they do not need to discount by a large amount. Another interesting result by Lal (1990) is that when faced with store brand competition, in equilibrium, each national brand manufacturer will offer trade deals during alternate periods to encourage switching by some of the store brand consumers (R144). They are not going to reap the benefits of promotion if they promote during the same period.

With respect to price-off coupons, only Mills (1999) has studied the profitability of coupons as a counter strategy to meet the private label threat. His result (R47) states that randomly distributed coupons will not be profitable for manufacturer because both store brand shoppers and national brand loyals will avail of the coupon discount. However, coupons selectively distributed to store brand shoppers would increase profits for the manufacturer.

# 9

# National Brand Decisions — Retailer (NR)

## 9.1 National Brand Retail Price

As with the discussion on national brand wholesale price in Section 8.2, the pertinent question is whether national brand retail price is reduced or increased in equilibrium in response to store brand introduction. By and large the direction of change in the national brand retail price is expected to mirror the change in national brand wholesale price — both decrease or both increase. That is, wholesale price and retail price are strategic complements. In particular, in mature non-advertising sensitive product categories, national brand wholesale and retail price decrease with store brand introduction. In segmented, advertising sensitive markets, store brand introduction may result in an increase in national brand retail price. A related question is whether the reduction in wholesale price is higher or lower than the reduction in retail price. This affects retailer margin on national brand (retail price–wholesale price). There is mixed findings on this question. Result R3 from base model, corroborated by Raju et al. (1995a), states that national brand retail margin decreases (i.e, reduction of retail price is more than reduction in wholesale price). Others (e.g., Narasimhan and Wilcox, 1998)

have found that retail margin increases under certain conditions of heterogeneity; in fact, national brand wholesale price may go down but retail prices may even go up when a store brand is introduced.

## 9.2 National Brand Distribution by Retailers

The issue of whether a retailer should carry a national brand has generally been a moot question because presence of a national brand is a given in most models and often the case in grocery products distribution. However, Horowitz (2000) has used an option value model to see whether the option of replacing a national brand with a private label is profitable. Scott-Morton and Zettelmeyer (2004) have considered the replacement of a second national brand with a store brand since the retailer is constrained by shelf space to carry only two brands. They find (R130) that a retailer would more likely replace the lower share brand. This result is consistent with the notion of replacing fringe national brands with the store brand.

Distribution decision includes the allocation of shelf space to national brands and store brands. Shelf space has been incorporated in their model both multiplicatively (Amrouche and Zaccour, 2007) and additively (Amrouche and Zaccour, 2009). In the multiplicative model demand for product is multiplied by shelf space ($s$) so that demand for national brand is $[q_n(p)](s)$; in the additive model, demand for national brand is $[q_n(p)] + [f(s)]$. While it is true that when $s = 0$, no national brand is sold, demand is not really exactly proportional to shelf facing. An additive model may be a better representation of shelf space effect, where shelf facing is deemed a form of promotion (like end of aisle display). Amrouche et al. find that the higher the relative quality or brand equity of national brands, the more the shelf space allocated to them in equilibrium (R100).

## 9.3 National Brand Promotions

Local (retailer) advertising of national brand and price discounts are the two promotional elements considered by analytical modelers. On the topic of retailer advertising of national brand, Karray and Zaccour

(2009), model retailer's advertising of national brand based on a cooperative advertising allowance obtained from the manufacturer. They find that co-op advertising of national brand increases margins and profits for both manufacturer and retailer. However, if the retailer's advertising were to significantly impact (hurt) the sales of store brand, then the retailer would not accept the co-op advertising allowance that the manufacturer would be willing to give (R86–R89), so the strategy may not be viable.

In regard to national brand price discount decisions by retailer, most promotion models (Raju et al., 1990; Rao, 1991) treat the retailer as being non-strategic so it is difficult to draw implications for retailer. In general, retailer is expected to pass on some or all of the trade deal offered by the manufacturer as discount to consumer. So, a related question is about retail pass-through. Lal (1990, R146) finds that presence of a store brand increases manufacturer trade deal, reduces retail price cut, and thus reduces retail pass-through.

# 10

# Store Brand Decisions — Retailer

## 10.1 Store Brand Introduction

In what product categories and under what market conditions should a retailer introduce a store brand. This question has been extensively analyzed by analytical modelers of national brand–store brand competition. A number of product and market characteristics have been studied as factors influencing store brand introduction and results related to some key characteristics are discussed below.

### 10.1.1 Price Substitutability Between National Brand and Store Brand

Many studies show a positive relationship between national brand–store brand price substitutability and incremental profits from store brand introduction (baseline result R19) using multiple indicators of the price substitutability construct: (i) cross-price sensitivity parameter (e.g., Raju et al., 1995a,b); (ii) size of switching segment (e.g., Narasimhan and Wilcox, 1998); (iii) store brand utility as a fraction of national

brand utility (Mills, 1995); and (iv) cost of exercising a call option on the national brand (Horowitz, 2000). Multiple operationalizations strengthen the robustness of the result. There are two explanations for this result. One rationale, offered by Raju et al. (1995a) and related studies, points to the high margins obtained from store brands. In their model, in equilibrium, the retail margin on the store brand is greater than the corresponding margin on the national brand. High price substitutability increases the quantity of private labels sold. Therefore, switching consumers to higher margin private labels increases total retailer profits. A second explanation, forwarded by Mills (1995) and Scott-Morton and Zettelmeyer (2004), states that high price substitutability makes national brands less indispensable, i.e., reduces the incremental contribution of national brands to channel profits, thus eroding manufacturers' bargaining power. Hence, retailers can extract higher profits and a higher share of channel profit if there is a store brand that resembles the national brand.

Despite strong support for this result, there are some caveats that limit its generalizability of the result. The first limitation is the cost factor. The implicit assumption in most analytical models is that the cost of supplying a private label that is a close substitute of the national brand will not exceed the cost of the national brand. However, as Bontems et al. (1999) show and Sayman et al. (2002) point out, if the cost of providing a substitutable store brand is high, retailer profits from a store brand introduction may not increase (R57). A second limiting condition relates to national brand innovation and marketing and its role in category expansion. The above result probably holds for many products in the mature stage of the life cycle (category demand is fixed and the market is price driven) such as grocery products, but it may not hold for products in the early stage of the life cycle. The reason is that when a highly substitutable store brand is introduced at lower prices, the national brand manufacturer is forced to compete on the basis of price. This predicament could reduce the manufacturer's incentive to invest in category expansion activities such as advertising and product innovation, a situation that may be unprofitable to both the manufacturer and the retailer (see R76, R78).

### 10.1.2 Store Brand Strength and Store Brand Quality

A high quality store brand has the potential to increase the price substitutability between national brand and store brand (discussed above) as well as increase store brand image, loyalty, strength. In this subsection, we considers the role of quality beyond its ability to influence price substitutability. Raju et al. (1995a,b) and related studies capture this role through an intercept term in the store brand demand function, representing store brand strength. Corstjens and Lal (2000) operationalize the quality of a store brand in terms of the fraction of consumers who try the store brand and find it "acceptable." They show that under certain broad parametric conditions, total retailer profits are increasing in store brand quality even if the store brand does not have a cost or margin advantage. The basic intuition behind the results of Corstjens and Lal (2000) is that a high-quality store brand differentiates stores from each other and increases store loyalty (R153). Hence, even when a high quality store brand is not profitable, the optimal strategy might be to introduce the high-quality brand because ancillary benefits derived through the purchase of goods elsewhere in the store by the loyal consumer may be greater. The extensions to the base model (R37, R38) as well as all other models which have studied this aspect have validated the positive relationship between store brand quality (strength) and retailer profits (so long as the cost of producing high quality private label is not high).

### 10.1.3 Price Substitutability Among National Brands

Result R117 from Raju et al. (1995a) states that a high level of price competition among national brands decreases retailers' profits from store brand introduction. When price competition among national brands is high, the average national brand retail price decreases. The lower national brand price in turn depresses the price and retail margins for the store brand, resulting in lower category profits. For example, if Coke and Pepsi compete with each other aggressively on price, there may be little room for a store brand to enter the market and be profitable. We believe this result is not so obvious and has important implications for retailers because it draws attention to both the

price competition between national brand and store brand and the price competition among national brands. The two types of price competition have opposing effects on profitability from store brand introduction.

### 10.1.4 Number of National Brands

Common belief would indicate that there is no place for a store brand when there is already a large number of national brands. Contrary to this common belief, Raju et al. (1995a) show analytically that retailers would find it more profitable to introduce a store brand in categories with a large number of national brands (R122). They reason that it is easy to "sneak in" a store brand without affecting the profits of the existing brands when the number of existing national brands is large. Although they do not explicitly model the number of national brands, Scott-Morton and Zettelmeyer (2004) argue that more manufacturers actively producing national brands indicates fewer barriers to entry; hence, the retailer can easily find a supplier for its store brand.

### 10.1.5 Category Size

Should store brand be introduced in large categories or small categories? Intuition would suggest that large categories yield large sales for store brands, hence should be attractive candidates for store brand introduction. We can capture category volume in the aggregate model by multiplying by category size ($S$), as indicated in Raju et al. (1995a) or in the consumer model by the number of consumers in the market ($N$). When conditions are conducive for store brands, the higher the category sales, the greater the profit incentive for a retailer to introduce a store brand. Retailers gain profits from the sale of their store brands. Store brand gross profit equals category sales (times) SB market share (times) SB gross margin. For given SB margins and SB shares, higher category sales implies higher profitability for the retailer to cover fixed costs and earn profits. However, the operative phrase is conducive conditions. Factors such as price substitutability, store brand strength discussed in earlier subsections, should be such that store brand introduction increases incremental profits. In that case, higher category size offers potential for greater profits.

### 10.1.6 Preference Heterogeneity

For the same average preference for a store brand in a market, according to Narasimhan and Wilcox (R52), the greater the consumer heterogeneity (variation) around the mean preference, the lower the incentive to introduce a store brand. If the market is more homogeneous in terms of preferences, then the consumers are concentrated. Retailers can position the store brand to the homogeneous market and get large sales and profits. If the preferences are widely dispersed, it is difficult for the retailer to position the store brand in one particular concentrated segment and gain high profits.

## 10.2 Store Brand Product

### 10.2.1 Store Brand Product Features

As discussed in Section 10.1.2, store brand quality is an important determinant of store brand success and store brand profitability. Beyond this basic result, Choi and Coughlan (2006) propose a strategy of minimum quality differentiation and maximum feature differentiation with national brands (R133–R135). If quality is not costly, then store brands should minimize the difference in quality with national brands. However, if two national brands are undifferentiated on features, then it is best for retailer to maximally feature differentiate from them. For example, if the national brands are offering low fat yogurt in large sizes, then it may be best for the store brand to offer nonfat yogurt or low fat yogurt in smaller package sizes.

### 10.2.2 Store Brand Targeting and Positioning

When one store brand is competing with one national brand, the conventional view is that store brand should be positioned as close to the national brand as possible, i.e., maximize price substitutability between the two brands (R19) through shelf placement, packaging, compare and save slogans. This result, as discussed in Section 3.1.1, probably holds for most mature grocery products. However, when category is expandable with store brand or when store brand can target the price sensitive market, while national brand can segment the advertising or quality

sensitive market, then retailer may be better off positioning the store brand away from the national brand (R76, R78).

What happens if a store brand is to be positioned against two national brands. Sayman et al. (2002) offer some insights (R124-126). First, if two national brands are symmetric, it is better to position against one of the brands rather than in the middle. That is, middle-of-the-road positioning does not work. This is because, if the store brand is farther away from a national brand, then its ability to switch consumers from either of the brands is reduced. It is better to go after one of the national brands. Second, it is better to position against the leading brand with higher market share because then the store brand is able to target a larger segment. Third, the higher the relative market share, the more profitable it is to target that national brand.

Only one study has investigated the possibility of the retailer introducing more than one store brand when competing with more than one national brands. Sayman and Raju (2004) show in R121 that it is optimal for retailer to introduce two store brands if the base demand for the second store brand is also high and the cross-price sensitivity between the two national brands is low. That is, retailer should introduce two store brands targeted at each national brand if the top two national brands have high market shares and they are also differentiated.

## 10.3 Store Brand Price

Since store brands sell on the basis of lower price and higher value, the conventional belief is that they should be priced as low as possible relative to the national brand. Analytical results question this conventional wisdom. It is conducive for the retailer to introduce a store brand if the price substitutability between national brand and store brand is higher. When the price substitutability increases or quality differential between national brand and store brand decreases, several studies have reported that price differential also decreases in equilibrium or store brand should be priced closer to the national brand (R12). The intuition for this result is that when national and store brands are perceived to be closer to each other, the higher substitutability between the national brand and store brand means that for the same price

differential between the national brand and store brand, the store brand can draw more national brand consumers. Hence, the retailer is able to increase the store brand prices, keep the price differential between the two brands low, and still maintain healthy sales and profits.

## 10.4 Store Brand Distribution

Since store brands are owned and marketed by the retailer, the question of whether to distribute the store brand boils down to in which categories should the retailer introduce a store brand. This question is addressed in Section 10.1. Another question is what shelf space to allocate for store brand vis-a-vis national brand. The main pertinent result from Amrouche et al. (R103) is that the retailer devotes smaller (larger) shelf space to store brand if it is of relatively lower (higher) quality.

## 10.5 Store Brand Promotion

The promotion options for these brands are primarily price promotions (shelf price discounts), coupons, and features/displays. Of these, price promotion is most common. There are two aspects to price promotions: discount frequency and discount depth. Theoretical assertions are mixed for discount frequency. A number of analytical models (Lal, 1990; Narasimhan, 1988; Rao, 1991) recommend that private labels not promote in equilibrium (R98, R102, R145). The general intuition for the above result is as follows. The incentive for national brands to price promote stems from having to charge a regular price to cater to its loyal customer base and occasionally make forays into the switcher segment through price cuts. Because store brands are primarily viewed as brands with little loyalty and which cater mainly to the price-sensitive (switcher) segment, this incentive does not arise. The pricing role of store brands is to simply protect its switcher segment from encroachment. In this situation, store brands do not price promote, unless their switcher base is significantly threatened. The exception to the above theoretical result comes from Raju et al. (1990), which states that the weak store brand (with lower loyalty) should promote more

often because the retailer can offer smaller discounts than the strong national brand (R99). One way to reconcile the two opposong results is that while Rao and Lal results suggest no promotions, they can also mean promotions at 100% frequency. There is greater consensus on discount depth. All four game-theory models (Lal, 1990; Rao, 1991; Narasimhan, 1988; Raju et al., 1990) directly or indirectly state that the average discount of higher-priced national brands is greater than the average discount of lower-priced private labels (R97, R100).

# 11

# Store brand Decisions — Manufacturer

## 11.1 Dual Branding

Store brand decisions on the part of the national brand manufacturer have to do primarily with dual branding — whether to produce the private label and, if so, at what price and quality. When selecting a store brand supplier, the retailer has three options: (i) procure from an independent (fringe) manufacturer, (ii) obtain from a national brand manufacturer (dual branding), or (iii) produce its own store brands. There are broadly three reasons given for dual branding from the manufacturer perspective: (i) cost, (ii) price discrimination, (iii) strategic. These are also the same three reasons why a retailer would procure a store brand from the national brand manufacturer.

The cost reason is advanced by Peles (1972), Morris and Nightingale (1980), Mills (1999). Mills (1999) and others show that when there is no cost advantage to the national brand manufacturer of producing the private label, relative to other competitive suppliers, there is nothing to be gained by dual branding. The reason is that because of competitive availability, the retailer will drive private label price from the national brand manufacturer to its marginal cost. Therefore, the manufacturer

can do no better than break even on private label sales. However, if there is cost advantage, manufacturer can foreclose supplies from independent manufacturer and the brand manufacturer makes more profits than it would selling just its own premium brand (R45). Cost advantage can arise through economies of scale or scope or excess capacity (Quelch and Harding, 1996; Hoch and Banerji, 1993; Peles, 1972; Morris and Nightingale, 1980).

The price discrimination argument is advanced by Wolinsky (1987) and Soberman and Parker (2006). Wolinsky shows that the observed phenomenon that manufacturing firms market both labeled and unlabeled products can be explained as a form of price discrimination which is made possible due to the fact that consumes are imperfectly informed about the characteristic on which the product is differentiated and differ in the intensity of their preferences. Soberman and Parker (2006) argue that if consumers are clearly segmented as product seekers — buy only based on price and not advertising sensitive, and brand seekers — prefer national brands and are advertising sensitive, and if the manufacturer can determine the wholesale price of both the national brand and the private label, then the manufacturer should always be willing to supply private labels (R79). In their model, private labels is a gift from the retailer to the manufacturer because they allow manufacturers to discriminate between brand seekers and product seekers.

There are three strategic reasons for dual branding discussed in the literature — bargaining power, store competition, and quality assurance. First, if the bargaining power of the national brand manufacturer is greater than that of the retailer, then the retailer should procure the private label from an independent supplier (Kumar et al., 2010). The intuition is that when the retailer entrusts PL production to the national brand manufacturer, the gains s/he makes on the store brand becomes a part of the negotiation and the manufacturer is likely to use his/her bargaining power to garner a share of private label profits as well. Second, when the proportion of store switchers is higher, the greater is the likelihood of supply sourced from the national brand manufacturer because the store competition puts the retailer at a disadvantage and she/he agrees to source from the manufacturer so that she/he can get good deals on the national brand (Sennou, 2002). Kumar et al.

(2010) show that when the manufacturer determines both whether to supply private label and if so, what quality to choose for the private label, in retail markets with large quality sensitive segment, the retailer would choose the national brand manufacturer as the supplier; in retail markets with small quality sensitive segment, she/he would choose an independent supplier. Their reasoning is that when the national brand supplies both the national brand and the private label, the quality of private label is lower than that supplied by independent manufacturer. This private label quality distortion is higher when the quality sensitive segment is higher.

Thus from a manufacturer's vantage point, there are three considerations for engaging in dual branding: (i) Cost: When the national brand manufacturer has clear cost advantage over competing suppliers for producing the private label; (ii) segmentation — if the market is divided into price sensitive and advertising sensitive consumers, and the national brand can be targeted at advertising sensitive consumers and store brand targeted at price sensitive consumers; (iii) strategic — when the bargaining power of manufacturer is lower, there are fewer store switchers, and the market consists of more quality sensitive consumers.

# 12

# Future Research

We discuss future research in two sections — Future Research on Model Structure and Future Research on Model Outcomes.

## 12.1 Future Research on Model Structure

An ideal analytical model for studying the competition between national brands and store brands should incorporate the following key model structure characteristics:

- Multiple (at least two) asymmetric national brands
- Multiple (at least two) asymmetric retailers
- Multiple consumer segments
- National brand advertising
- National brand and store brand price promotions
- National brand and store brand non-price promotions
- Cost of manufacturing national brand and store brand
- Nonlinear (in price) demand function
- Store brand quality as a decision variable
- Store brand supplier as a strategic player

First, we believe consumer segments based demand models are more appropriate than aggregate demand models for researching many problems. Brand competition within stores can be captured through a representation of loyal customers and brand switchers. Lal (1990) comes close to such a representation with two national brands and one store brand. Consumers are defined by two parameters, their reservation price for the brands and their reservation price differential between competing brands in their consideration set. Most researchers have assumed that the distribution of reservation price differential between national brands and store brands is uniform, leading to a linear (in price) demand function. Future researchers should attempt to incorporate non-uniform (e.g., normal) distribution for the brand switching segment. This will lead to nonlinear in price demand functions and the ensuing analysis would be a strong test of the robustness of various analytical results. Analogous to brand competition, retail competition can be captured through representation of store loyals and store switchers (e.g., Corstjens and Lal, 2000), or using a Hotelling model (e.g., Soberman and Parker, 2002). The different roles of national brand advertising can be captured through their influence on reservation price and reservation price differential (Sethuraman, 2003). Possibility of price promotions can be evaluated though consideration of mixed equilibrium strategies (Raju et al., 1990) or successive equilibrium strategies (Rao, 1991). Store brand quality, costs and store brand supplier as a strategic player can be easily incorporated (e.g., Bontems et al., 1999; Kumar et al., 2010). Of course, an analytical model that incorporates all the above characteristics may not be tractable; one may need to resort to numerical techniques for obtaining insights, or use sophisticated analytical approaches, the development of which is, by itself, an important research topic. An alternate approach for gaining some insights into complex models is through Empirical Industrial Organization (IO) approach (e.g., Draganska et al., 2010; Cohen and Cotterill, 2011).

## 12.2 Future Research on Model Outcomes

We believe the following research topics are important from the perspective of model outcomes in the context of national brand–store

brand competition:

- Effect of retail competition on national brand and store brand marketing.
- Store brand strategies in different stages of the product life cycle.
- Dynamics of store brand competition with leading and secondary national brands.
- Cost and strategic considerations for dual branding.
- Conditions conducive for premium private labels.
- Market characteristics that influence store brand prices and margins relative to national brands.
- Reasons for private label price promotion.
- Manufacturer strategies — especially those benefiting both manufacturers and retailers.

We expand on some of these topics with future research potential.

Does store competition encourage or discourage store brand introduction? How would inter-store competition affect store brand prices and promotions? Analytical models have generally ignored store competition partly due to the intractability of the problem. Store competition predominantly manifests in the form of price competition among national brands. Two competing stores may attract consumers to its stores by charging a low price for high-profile national brands (e.g., traffic builders), possibly resulting in low profits (or losses) for the retailer. In this case, can retailers increase their category profits by introducing a store brand?

While most of the analysis is based on one store brand per category, some retailers may follow a two-tier or three-tier store brand strategy (Steiner, 2004). For example, Wal-Mart has two apple juices, the low-priced Great Value and the premium Sam's American Choice. Some retailers may introduce multiple store brands that target different national brands — possibly for better trade terms from both brands (Sayman and Raju, 2004). In particular, Kumar and Steenkamp (2007) say premium private labels is perhaps the hottest trend in private label retailing. However, we have little understanding through analytical models of what such private labels represent, what

the right conditions are for introducing premium labels, or their profitability. More work is needed in this area.

Managers believe that the manner in which private labels react to national brands and the manner in which national brands strategize against private labels depend on the nature of #1, #2, and #3 national brands. Hence, incorporating multiple, asymmetric national brands would better reflect real-world market conditions. Some researchers (e.g., Sayman et al., 2002) have studied private label strategies in the presence of multiple non-equivalent national brands, but more work is needed.

While conventional wisdom suggests that retailers should not price promote their private labels, they do in fact promote. The reasons for promoting private labels, as stated by retailers, include: (i) the need to protect store brand turf; (ii) the need to generate trial and repeat of store brand; and (iii) the desire to simply promote what customers want (Sethuraman, 2009). We need better understanding of these motivations and more detailed analysis of the profitability of private label discounts.

Non-price promotions include in-store promotions such as displays and features, as well as coupons, free samples, and gifts. There is mixed evidence on the effect of non-price promotions on private label sales. However, analytical research on non-price promotions is too limited to draw any meaningful recommendations.

Analytical models have predominantly focused on retailer's store brand strategies. More work is needed on manufacturer counter-strategies, especially those strategies that can benefit both manufacturers and retailers (e.g., Mills, 1999).

Finally, our review pertains mainly to grocery products, because there is little or no research on non-grocery products such as appliances and apparel. Private labels are a major force in these markets as well. Would the results for non-grocery products be different from the ones specified above? Future research could study market structures in non-grocery settings.

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# References


Abe, M. (1995), 'Price and advertising strategy of a national brand against its private-label clone: A signaling game approach'. *Journal of Business Research* **33**, 241–250.

Amrouche, N., G. Martin-Herran, and G. Zaccour (2008a), 'Feedback Stackelberg equilibrium strategies when the private label competes with the national brand'. *Annals of Operations Research* **164**(1), 79–95.

Amrouche, N., G. Martin-Herran, and G. Zaccour (2008b), 'Pricing and advertising of private and national brands in a dynamic marketing channel'. *Journal of Optimization Theory and Applications* **137**(3), 465–483.

Amrouche, N. and R. L. Yan (2012), 'Implementing online store for national brand competing against private label'. *Journal of Business Research* **65**(3), 325–332.

Amrouche, N. and G. Zaccour (2007), 'Shelf-space allocation of national and private brands'. *European Journal of Operational Research* **180**(2), 648–663.

Amrouche, N. and G. Zaccour (2009), 'A shelf-space-dependent wholesale price when manufacturer and Retailer brands compete'. *Or Spectrum* **31**(2), 361–383.

Berges-Sennou, F. (2002), 'Who will produce the private label?'. Conference paper.

Berges-Sennou, F., P. Bontems, and V. Requillart (2004), 'Economics of private labels: A survey of literature'. *Journal of Agricultural Food Industrial Organization* **2**(3), 1–23.

Bontems, P., S. Monier-Dilhan, and V. Requillart (1999), 'Strategic effects of private labels'. *European Review of Agricultural Economics* **26**(2), 147–165.

Chen, L., S. Gilbert, and Y. Xia (2011), 'Private labels: Facilitators or impediments to supply chain coordination'. *Decision Sciences* **42**(3), 689–720.

Choi, C. S. and A. T. Coughlan (2006), 'Private label positioning: Quality versus feature differentiation from national brand'. *Journal of Retailing* **82**(2), 79–93.

Choi, S. and K. Fredj (2006), 'Store brands and store competition'. Working Paper.

Cohen, M. A. and R. W. Cotterill (2011), 'Assessing the impact of retailer store brand presence on manufacturer brands in an equilibrium framework'. *Journal of Industrial Economics*.

Corstjens, M. and R. Lal (2000), 'Building store loyalty through store brands'. *Journal of Marketing Research* **37**(3), 281–291.

Draganska, M., D. Klapper, and S. B. Villas-Boas (2010), 'A larger slice or a larger pie? An empirical investigation of bargaining power in the distribution channel'. *Marketing Science* **29**(1), 57–74.

Dunne, D. and L. Khai (1992), 'A model of private label contracting'. Working Paper.

Gomez-Arias, J. T. and L. Bello-Acebron (2008), 'Why do leading manufacturers supply private labels?'. *Journal of Business and Industrial Marketing* **23**(4), 273–278.

Groznik, A. and H. S. Heese (2010a), 'Supply chain conflict due to store brands: The value of wholesale price commitment in a retail supply chain'. *Decision Sciences* **41**(2), 203–230.

Groznik, A. and H. S. Heese (2010b), 'Supply chain interactions due to store brand introductions: The impact of retail competition'. *European Journal of Operational Research* **203**(3), 575–582.

Horowitz, I. (2000), 'An option-pricing look at the introduction of private labels'. *Journal of the Operational Research Society* **51**, 221–230.

Karray, S. and G. Martín-Herrán (2008), 'Investigating the relationship between advertising and pricing in a channel with private label offering: A theoretic model'. *Review of Marketing Science* **6**(1).

Karray, S. and G. Martin-Herran (2009), 'A dynamic model for advertising and pricing competition between National and store brands'. *European Journal of Operational Research* **193**(2), 451–467.

Karray, S. and G. Zaccour (2006), 'Could co-op advertising be a manufacturer's counterstrategy to store brands?'. *Journal of Business Research* **59**(9), 1008–1015.

Kumar, N., S. Radhakrishnan, and R. C. Rao (2010), 'Private label vendor selection in a supply chain: Quality and clientele effects'. *Journal of retailing* **86**(2), 148–158.

Kumar, N. and J.-B. E. M. Steenkamp (2007), *Private Labels Strategy*. Boston, MA: Harvard Business School Press.

Kurata, H., D.-Q. Yao, and J. J. Liu (2007), 'Pricing policies under direct vs. indirect channel competition and national vs. store brand competition'. *European Journal of Operations Research* **180**(1), 262–281.

Lal, R. (1990), 'Manufacturer trade deals and retail price promotions'. *Journal of Marketing Research* **27**, 428–444.

Mills, D. E. (1995), 'Why retailers sell private labels'. *Journal of Economics and Management Strategy* **4**(3), 509–528.

Mills, D. E. (1999), 'Private labels and manufacturer counter strategies'. *European Review of Agricultural Economics* **26**(7), 125–145.

Morris, D. and J. Nightingale (1980), 'Why should firms manufacture retailer brands?'. *Managerial and Decision Economics* **1**(3), 132–137.

Narasimhan, C. (1988), 'Competitive promotional strategies'. *Journal of Business* **61**(October), 427–450.

Narasimhan, C. and R. Wilcox (1998), 'Private labels and the channel relationship: A cross-category analysis'. *Journal of Business* **71**(4), 573–600.

Peles, Y. (1972), 'On the uses of private brands'. *Journal of Industrial Economics* **20**(2), 173–178.

Raju, J. S., R. Sethuraman, and S. K. Dhar (1995a), 'The introduction and performance of store brands'. *Management Science* **41**(6), 957–978.

Raju, J. S., R. Sethuraman, and S. K. Dhar (1995b), 'National brand-store brand price differential and store brand market share'. *Pricing Strategy and Practice* **3**(2), 17–24.

Raju, J. S., V. Srinivasan, and R. Lal (1990), 'The effects of brand loyalty on competitive price promotional strategies'. *Management Science* **36**(3), 276–304.

Rao, R. C. (1991), 'Pricing and promotions in asymmetric duopolies'. *Marketing Science* **10**(2), 131–144.

Sayman, S., S. J. Hoch, and J. S. Raju (2002), 'Positioning store brands'. *Marketing Science* **21**(Fall), 378–397.

Sayman, S. and J. Raju (2004), 'How category characteristics affect the number of store brands offered by the retailer: A model and empirical analysis'. *Journal of Retailing* **80**(4), 279–287.

Sayman, S. and J. Raju (2007), 'Store brands: From back to the future'. In: N. K. Malhotra (ed.): *Review of Marketing Research* , vol. 3. M.E. Sharpe Inc.

Schmalensee, R. (1978), 'Entry deterrence in the ready-to-eat breakfast cereal industry'. *Bell Journal of Economics* **9**(2), 305–327.

Scott-Morton, F. and F. Zettelmeyer (2004), 'The strategic positioning of store brands in retailer — manufacturer negotiations'. *Review of Industrial Organization* **24**(2), 161–194.

Sethuraman, R. (1991), 'Analysis of national brand — store brand competition'. Working Paper based on Ph.D. Thesis, Northwestern University.

Sethuraman, R. (2002), 'Positioning Store brands against national brands: Get close or keep a distance?'. Working Paper SMU-Cox School of Business.

Sethuraman, R. (2009), 'Assessing the external validity of analytical results from national brand and store brand competition models'. *Marketing Science* **28**(4), 759–781.

Soberman, D. and P. M. Parker (2004), 'Private labels: Psychological versioning of typical consumer products'. *International Journal of Industrial Organization* **22**(September), 849–861.

Soberman, D. A. and P. M. Parker (2006), 'The economics of quality-equivalent store brands'. *International Journal of Research in Marketing* **23**(2), 125–139.

Steiner, R. L. (2004), 'The nature and benefits of national brand/private label competition'. *Review of Industrial Organization* **24**(2), 105–127.

Tyagi, R. (2006), 'Store brand strength'. *Review of Marketing Science* **4**(Article 2).

Wolinsky, A. (1987), 'Brand names and price discrimination'. *Journal of Industrial Economics* **35**(3), 255–268.

Wu, C.-C. and C.-J. Wang (2005), 'A positive theory of private label: A strategic role of private label in a duopoly national-brand market'. *Marketing Letters* **16**(2), 143–161.