Retail Pricing: Does Channel Length Matter?

Anne T. Coughlan; Rajiv Lal


Stable URL:
http://links.jstor.org/sici?sici=0143-6570%28199205%2F06%2913%3A3%3C201%3ARPDC%3E2.0.CO%3B2-7

*Managerial and Decision Economics* is currently published by John Wiley & Sons.

----------------------------------------------------------------------------------

Your use of the JSTOR archive indicates your acceptance of JSTOR’s Terms and Conditions of Use, available at http://www.jstor.org/about/terms.html. JSTOR’s Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at http://www.jstor.org/journals/jwiley.html.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

----------------------------------------------------------------------------------

JSTOR is an independent not-for-profit organization dedicated to creating and preserving a digital archive of scholarly journals. For more information regarding JSTOR, please contact support@jstor.org.
Retail Pricing: Does Channel Length Matter?

Anne T. Coughlan
*Kellogg Graduate School of Management, Northwestern University, IL, USA*

and

Rajiv Lal
*Graduate School of Business, Stanford University, Stanford, CA, USA*

The number of intermediary levels between a manufacturer and the final market in a distribution channel varies from industry to industry. In some cases, none are used (i.e., the distribution function is vertically integrated), while several middleman levels are used in other cases (e.g., the use of a wholesaler, a jobber, and a retailer in the distribution of meat). In this paper we examine the effect of competition on the profit-maximizing length of the distribution channel. We find that the optimal number of middleman levels increases with the substitutability of products in the market, but that there are institutional limits on the maximum number of levels in a channel. The analysis also suggests that differences in the objectives of channel members (e.g., the maximization of total channel profit versus the maximization of each member’s individual profit) affect optimal channel length: a goal of total channel profit maximization produces a channel at least as long as one of individual (non-co-operative) member profit maximization. The work thus complements existing research focusing on intra-channel (e.g., cost-based) explanations of channel length, using a framework similar to those investigating competitive incentives for vertical integration in distribution.

INTRODUCTION

The problem of structuring a distribution channel involves deciding on the ownership level in the channel, the number of competing intermediaries to use at a given level in it, and its length. The first issue, at its simplest, concerns the decision to vertically integrate the selling function or not. The second relates to the degree and type of competition to foster at any given intermediary level—for instance, whether or not to grant exclusive territorial rights to distributors. The third issue, that of channel length, concerns the number of intermediary levels to use between the manufacturer and the final market. It is this issue that we address in this paper.

Empirically, we observe varying channel lengths within and across firms. For example, multiple intermediary levels are commonly used in Japan (Shimaguchi, 1979a, b). In an article in *The Wall Street Journal*, high retail prices were attributed to the length of Japanese distribution systems:

Consider a can of Del Monte peach halves and its Japanese odyssey. The peaches land in Yokohama at 26 cents a can. Immediately, customs and handling add 9 cents to the price. Then the importer sticks on a bit more than a penny. He sells it to a wholesaler, who adds another 3 cents. The wholesaler sells it to another wholesaler, who adds a further 2 cents. He sells it to a grocery store, which adds an additional 11 cents. The retail price: 52 cents a can—a far cry from the 30 cents or so the 15-ounce can might command in a suburban US supermarket. So it’s no surprise that in a typical Japanese city, some 90% of the imported canned peaches are sold wrapped as expensive gifts (Hartley, 1972).

McMillan (1984) also provides evidence of the long distribution channels in Japan as compared to those in the United States. On a per capita basis, he shows that Japan has more retailers and wholesalers than any other major country. One of the major implications of this is ‘that consumer prices
in Japan are higher because of the profit margins associated with the many layers in the distribution channel (McMillan, 1984, p. 245). He also says that competition among products within a product class is intense among trading firms in Japan, and that the more concentrated an industry, the stronger the influence of the manufacturer or a high-level distributor in the channel. He further argues that one means of managing channel relationships in these longer channels is price co-ordination within and across channels, a pervasive practice in Japan.

The existence of varied channel lengths is also well documented by Kotler (1988, p. 532). Examples of zero-level channels include Franklin Mint selling collectible objects through mail order and Singer selling its sewing machines through company stores. Towards the other extreme, one may find as many as three intermediaries (a wholesaler, a jobber, and a retailer) in the meat-packaging industry. Kotler points out that higher-level marketing channels are also found, but rather infrequently, due to problems in gaining information and exercising control in longer channels.

In this paper we attempt to provide an explanation for the existence of differing numbers of intermediary levels within and across industries, despite the fact that longer channels tend to increase retail prices and reduce demand for the products concerned. We also seek to explain why a longer channel in Japan is accompanied by price co-ordination within and across channels and by strong competition among trading firms in a given product class. The existing research on channel length is not extensive; it tends to focus on information-provision reasons and cost or efficiency reasons for choosing the appropriate number of intermediary levels. We, in contrast, explore competitive impacts on the choice of channel length. Our major insight is that more competitive product markets can profitably foster longer distribution channels, but that there are natural reasons for limits to the optimal channel length.

The rest of the paper is organized as follows. The next section reviews related literature on channel structure and the contribution of this work to that literature. In the third section we develop a modeling framework to address this issue. The fourth section provides a discussion of results of the model and an intuitive explanation for why we observe different numbers of intermediaries in a distribution network. In the fifth section we consider some institutional factors affecting the optimal number of middleman levels and how they influence our results. We give conclusions in the sixth section.

LITERATURE REVIEW

The distribution channels literature has focused on several different factors influencing channel structure ('structure' meaning both channel breadth (how many competing intermediaries at a given level) and channel length (how many intermediary levels in the channel)). These factors include uncertainty and information provision; cost minimization and economies of scale; and assortment and routinization of transactions. The existing work studies various combinations of these factors and their effects on channel breadth or channel length; our work complements this stream of research by examining the effects of competition among manufacturers on channel length.

Balderston (1958) models channels of distribution as conduits for information between the buyer and seller. Due to uncertainty in the demand for and supply of products, Balderston argues that the introduction of intermediaries in a channel of distribution reduces the cost of information flow between buyers and sellers. Baligh and Richartz (1967) extend Balderston's framework to investigate the length of a distribution channel. More recently, Etgar and Zusman (1982) develop further the analysis of Baligh and Richartz by allowing for an active intermediary who tries to sell information at a price to maximize its profits, taking into account the costs of communication. They find that the price of an information bit declines as information moves from one channel level to the next. Furthermore, they establish that the number of intermediaries at any given level (i.e. the breadth of a channel) and the number of levels in a channel (i.e. the length) depend on the number of buyers and sellers, the cost of information transmission, and the cost of establishing a contact between any two members in the distribution chain.

In summary, this stream of research focuses on the cost side of information transmission and seeks to explain the length and breadth of channels of distribution.

A second, cost-based reason that we see several levels in channels of distribution is based on Stigler's (1951) argument that the division of labor is limited by the extent of the market. He argues
that if we think of a firm in terms of functions or processes that constitute the scope of its activity, then one would expect to find many different patterns of average costs across these different functions which, in turn, depend on the technologies involved in these functions. While the market may not initially be large enough to support independent specialized firms to perform the functions, as the market grows and the demand for these functions increases, these processes will be taken over by specialized firms who will exploit the economies of scale.

Stigler cites as an example a comparison of a 1919 study by Willard Thorp with a 1937 review by Walter Crowder. In 1919, among companies with two or more manufacturing processes, 602 out of 4635 (13.0%) had two or more plants using raw materials that were produced internally, while in 1937 this dropped to 10% (565 out of 5625 companies). Considering all companies, a similar pattern was found, with the percentage decreasing from 34.4% to 27.5%. Stigler aruges from this example that the trend in industries over time is toward vertical disintegration, not vertical integration.

Thus, if we were to think of the marketing of goods as a set of different functions, then one could argue that the number of levels in a channel will depend on the size of the market and technologies involved in the various processes in the marketing function. Early in the life cycle, when the market is small, one would see a vertically integrated firm; but as the market grows, certain marketing functions will be taken over by specialized firms, thus adding to the number of levels in the channel.

Building on this argument, the managerial literature offers a similar insight into the reasons we observe different channel lengths across different industries. Kotler (1988) views the distribution channel as a means of carrying out various marketing functions more efficiently—i.e. at lower cost—than the manufacturer himself could. Stern and El-Ansary (1988) provide four specific reasons for the existence of intermediaries: (1) increased efficiency, (2) provision of a valued assortment at a given place and time, (3) aiding in the routinization of transactions, and (4) facilitation of the searching process (Stern and El-Ansary, 1988, p. 5). Both sets of authors, then, rely on the notion of middlemen providing valuable marketing activities at the lowest possible cost. Their focus is thus on within-channel productivity and cost minimization.

Finally, another set of marketing articles (McGuire and Staelin, 1983; Coughlan, 1985; Lal, 1990; Coughlan and Wernerfelt, 1989) examines the effect of competition on channel choice. The first three consider duopolistic manufacturers who make substitutable products, and assume that transfer prices take the form of one-part tariffs. These models investigate whether the optimal channel choice, i.e. the profit-maximizing channel, is vertically integrated (no middlemen) or decentralized (one intermediary level). Since these analyses focus on the subject of vertical integration versus decentralization (with one intermediary level), they do not address the issue of channel length: i.e. how many intermediary levels are appropriate for a distribution channel. They find that products that are not very substitutable (close to monopolies) should be sold direct, while more competitive products can be sold profitably with the use of one level of independent middlemen. Coughlan offers preliminary empirical support for this result, while Lal concentrates on the effect of uncertainty on the channel choice problem. The Coughlan/Wernerfelt paper assumes that two-part tariffs and an auctioning system can be used by a powerful channel member (whether a manufacturer or a retailer) to extract channel profits from the less powerful channel member. Under these assumptions, they show that infinitely long channels are optimal if channel contracts are observable between rivals, but that the optimal retail prices are equal to the zero-middleman level when contract observability cannot be assured.

The existing literature thus examines the effect of several factors on channel structure: uncertainty and information, cost, assortment and routinization, and competition. The first three parts of the literature are cost and within-channel oriented, and provide plausible explanations for the varying channel lengths we see within and across industries. We follow in the path of the competition-based literature and predict channel length as a function of the degree of competitiveness of products, assuming that contracts are observable.

**THE MODEL**

The basic framework used in this analysis assumes that manufacturers hold most of the power in transacting with middlemen. Two manufacturers, each producing one differentiated product, have the
following strategies to choose from: (1) both manufacturers sell through company-owned retail outlets (i.e., integrate the distribution function); (2) both distribute through exclusive, independent outlets and have to decide on the number of independent middlemen.

We analyze only `symmetric' channel structures here—those where each manufacturer has the same number of independent middlemen. A unit transfer price is charged by each channel member to the next channel member; the final channel member, that is, the Nth middleman, is, by definition, the retailer, so that his unit transfer price equals the retail price charged for the product.

Each middleman is assumed to carry just one manufacturer’s product, and each manufacturer makes a single product. Two products, each distributed through an N-middleman channel, are characterized by the following retail demand function:

\[ q_N = 1 - p_N + \theta(p_N - p_{N-1}) \quad i = 1, 2, j = 3 - i \]  

Demand is a negative function of own price and a positive function of the disparity between the rival’s own price. Thus, \( \theta \) reflects demand substitutability in the market, and ranges from 0 (when the products are unrelated in demand) to +\( \infty \) (when the products are perfect substitutes).

We use game-theoretic notions as in McGuire and Staelin (1983) and Coughlan (1985) to model the sequence of decisions made by the middlemen and manufacturers. In a channel where each manufacturer has \( N \) middlemen, the two \( N \)-level middlemen are, by definition, the retailers, since they are closest to the retail market. They choose retail prices, \( p_N \) (the ‘transfer prices’ to the retail market), to maximize their profits, taking the transfer prices charged to them by the \((N - 1)\)-th middlemen as given:

\[ \max_{p_N} \Pi_N = (p_N - p_{N-1}) \cdot q_N \]  

We assume that all channel members are fully informed about the structure of the game and the objectives of all other members in the channel, and that each channel level Stackelberg leads the level immediately downstream from it. This assumption simply reflects who gets to precommit first in the chain of members in the distribution channel. In particular, we assume that a manufacturer quotes a price list to the intermediary directly below him in the channel. This first intermediary takes the manufacturer's transfer price as given, and goes to the next intermediary level, quoting a price list in turn to the second intermediary. This second intermediary takes his transfer price from the first intermediary as given, and so on in the channel. We also assume that the institutional situations analyzed herein are not affected by the observability issues discussed in Coughlan and Wernerfelt (1989), that is, that channel structure and transfer pricing contracts in one manufacturer’s channel are observable to the rival channel. This is often a reasonable assumption, e.g. when prices are observable (in the price list) and the incentives to renegotiate channel contracts are weak. Such a situation might exist when a manufacturer uses several intermediaries in the distribution channel, but each intermediary deals with an exclusive territory. Thus, if the manufacturer renegotiates any one contract he has to incur possibly very high renegotiating costs because of legal requirements to offer all middlemen the same deal. Further, given the legal need to renegotiate with all middlemen, it becomes less likely in a multi-territory channel that a manufacturer could conceal ‘under the table’ renegotiations as Coughlan and Wernerfelt postulate.

The Nash solution to this problem characterizes the equilibrium market prices charged by the two \( N \)-level (retailer) middlemen, \( p_N^k \) and \( p_N^k \), as functions of the transfer prices facing them \( (p_{N-1}^k \) and \( p_{N-1}^k \)) and \( \theta \), the substitutability parameter. These, in turn, imply a derived demand function \( q_{N-1} \) as a function of \( p_{N-1}^k \), \( p_{N-1}^k \), and \( \theta \). Next, each \((N - 1)\)-th level middleman chooses his profit-maximizing downstream transfer price \( (p_{N-1}^k) \), with knowledge of the retailers’ response functions and taking as given the upstream transfer prices facing him \( (p_{N-1}^k) \):

\[ \max_{p_{N-1}^k} \Pi_{N-1} = (p_{N-1}^k - p_{N-2}^k) \cdot q_{N-1} \]  

The Nash solution to the \((N - 1)\)-level middlemen’s game will characterize their chosen transfer prices \( (p_{N-1}^k) \) as a function of the transfer prices faced from the upstream middlemen \( (p_{N-2}^k) \) and the substitutability parameter \( \theta \). This process continues through the distribution channel until the manufacturers each choose transfer prices \( (p_N^k) \) to the first-level middlemen in a Nash fashion to maximize their profits, in knowledge of the first-level middlemen’s response functions. Hence, the players within a level act as Nash competitors, and each player at the \( k \)th level is a Stackelberg leader \( \text{c.q.} \) each player at the \( (k + 1) \)th level. The solution to the
manufacturers’ Nash game is a characterization of their transfer prices, \( p^\theta_i \), as functions of \( \theta \) alone. Then, recursively, one can calculate equilibrium values of each level's transfer prices (e.g., \( p^i_k \) for the \( k \)th level), the final market prices (\( p_N^j \)), quantities sold (\( q^j_N \)), and profits to all players and to the channel as a whole.

Assuming that demand at the retail level is given by Eqn (1), and using the game structure described above, equilibrium is determined by simultaneously solving the following set of linear best-response functions, for any set of channels with up to four middleman levels:

\[
p^i_0 = \frac{A \cdot B \cdot C \cdot D + (E \cdot F \cdot G \cdot H)p^i_0}{2K} \quad i = 1, 2, j = 3 - i \tag{4}
\]

\[
p^i_1 = \frac{A \cdot B \cdot C + (E \cdot F \cdot G)p^i_1}{2H} + \frac{p^i_0}{2} \quad i = 1, 2, j = 3 - i \tag{5}
\]

\[
p^i_2 = \frac{A \cdot B + (E \cdot F)p^i_2}{2G} + \frac{p^i_1}{2} \quad i = 1, 2, j = 3 - i \tag{6}
\]

\[
p^i_3 = \frac{A + E p^i_3}{2F} + \frac{p^i_2}{2} \quad i = 1, 2, j = 3 - i \tag{7}
\]

\[
p^i_4 = \frac{1 + \theta p^i_4}{2(1 + \theta)} + \frac{p^i_3}{2} \quad i = 1, 2, j = 3 - i \tag{8}
\]

where

\[
A = 2 + 3\theta
\]

\[
B = 4 + 9\theta + 3\theta^2
\]

\[
C = 16 + 66\theta^2 + 84\theta^3 + 33\theta^4
\]

\[
D = 256 + 2064\theta + 6696\theta^2 + 11420\theta^3
\]

\[
+ 100300\theta^4 + 4809\theta^5 + 1137\theta^6
\]

\[
+ 111\theta^7 + 3\theta^8
\]

\[
E = \theta(1 + \theta)
\]

\[
F = 2 + 4\theta + \theta^2
\]

\[
G = 8 + 32\theta + 39\theta^2 + 14\theta^3 + \theta^4
\]

\[
H = 128 + 1024\theta + 3292\theta^2 + 5416\theta^3 + 48100\theta^4
\]

\[
+ 2248\theta^5 + 511\theta^6 + 46\theta^7 + \theta^8
\]

\[
K = 32768 + 524288\theta + 3782400\theta^2
\]

\[
+ 16253400\theta^3 + 46298720\theta^4
\]

\[
+ 920874240\theta^5 + 1312711960\theta^6
\]

\[
+ 1355817200\theta^7 + 1014853200\theta^8
\]

\[
+ 545868800\theta^9 + 207394870^{10}
\]

\[
+ 54126660^{11} + 9291350^{12}
\]

\[
+ 980200^{13} + 56850^{14}
\]

\[
+ 1460^{15} + \theta^{16}
\]

For comparison, the profit-maximizing price in the case where the two manufacturers collude and use no intermediaries is 1/2, and collusive profits are 1/4. For any symmetric channel structure with less than four middleman levels, say with \( k = 2 \) middleman levels, one simply sets the first \((4-k)\) or 2 transfer prices equal to zero—\( p_0 \) and \( p_1 \)—and then the manufacturer's transfer prices are the solution to the two best-response function equations for \( p^i_2 \) with \( p^i_1 \) set equal to zero:

\[
p^i_2 = \frac{A \cdot B + (E \cdot F)p^i_2}{2G} \quad i = 1, 2, j = 3 - i \tag{9}
\]

Comparing E qs (9) and (6), note that this transfer price is lower than \( p_2 \) is in the case of four middleman levels, by the amount \( p^i_1/2 \). The first middleman level's transfer price is now \( p_3 \) (as in Eqn (7)) and the second middleman level's transfer price (now the retail price) is now \( p_4 \) (as in Eqn (8)), but each of these now takes a lower value than in the four-middleman-level case because they are functions of the now-lower upstream transfer price, \( p_2 \). Finally, equilibrium quantities sold and profits for the manufacturer and middlemen (as well as total channel profits) can be determined for any value of \( \theta \) using the above formulas.

**RESULTS FROM THE MODEL**

In this section we analyze the issue of optimal length of the distribution channel and its impact on retail prices. The model developed above is used to show the optimality of various channel lengths at different values of the substitutability parameter \( \theta \). We define optimality in two ways: maximizing manufacturer profits and maximizing total channel profits. The former type of channel might be one where manufacturers deal corporately separate wholesalers and retailers, with whom they have no relationship other than a purely business one. Alternatively, the goal might be to maximize total channel profits if the channel consists of separate divisions within a company, each of which is a profit center (then the company as a whole is concerned with the overall profitability of the total channel, rather than with the manufacturing division's profitability alone). A similar situation might exist in some Japanese industries, where membership in a keiretsu (an association of more or less related companies, with complex interlocking directorates among them) implies a concentration for the whole organization's well-being, and not just with
one individual member company’s profits. In the following discussion we first describe results pertaining to manufacturer profit maximization, and then compare these with results assuming channel profit maximization.

Table 1 shows ranges of $\theta$ for which various numbers of middleman levels (up to four) are profit maximizing, from the viewpoint of either the manufacturer profit or the total channel profit. The profit-maximizing number of middleman levels in a symmetric channel is nondecreasing in $\theta$.

Figure 1 shows the relationship among manufacturer profits in the collusive, direct, and $N$-middleman-level cases for $N$ up to 4 in value. As we would expect, collusion between the manufacturers generates the highest possible profit for them (a constant $1/4$ for all $\theta$). For $\theta$ equal to zero, however, manufacturer profits in the direct case coincide with collusive profits—integrating into the retailing function is the most profitable channel alternative because the two manufacturers are essentially monopolists. Figure 1 also shows a smooth progression from fewer intermediary levels being profit maximizing to more, as $\theta$ increases in value. Finally, even though it is optimal to increase channel length with greater substitutability, manufac-

<table>
<thead>
<tr>
<th>Table 1. The Effect of $\theta$ on Manufacturer and Total Channel Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit-maximizing channel length</td>
</tr>
<tr>
<td>Direct</td>
</tr>
<tr>
<td>One middleman</td>
</tr>
<tr>
<td>Two middlemen</td>
</tr>
<tr>
<td>Three middlemen</td>
</tr>
<tr>
<td>Four middlemen</td>
</tr>
</tbody>
</table>

Figure 1. Optimal manufacturer and retailer profits: objective—maximize manufacturer profits. □ = manufacturer profits; + = retailer profits. Note: Horizontal axis is not to scale. Point A corresponds to $\theta = 2.42242$, point B to $\theta = 6.96305$, point C to $\theta = 20.56629$, and point D to $\theta = 61.36911$. Between zero and A, zero middlemen maximize manufacturer profits; between A and B, one middleman; between B and C, two middlemen; between C and D, three middlemen; and beyond D, four middlemen.
urer profits fall as $\theta$ increases (a standard price-
competition result). Had the option to increase
channel length not been available, manufacturer
profits would have decreased even more severely
with $\theta$. Thus, increasing channel length helps main-
tain manufacturer profitability in ever more com-
petitive product markets.

Figure 2 depicts channel profits for various chan-
nel lengths and varying $\theta$. As in Fig. 1, the optimal
number of middleman levels from a channel-profit-
multiplying viewpoint is non-decreasing in $\theta$. A col-
usive strategy between the two manufacturers still
generates consistently greater profits than any other,
except for those distinct values of $\theta$ where one of the other strategies generates just equal
profits to those in the collusive case. Channel
profits equal collusive profits given a zero-middle-
man channel for $\theta = 0$; a one-middleman channel
for $\theta = 2.3234$; a two-middleman channel for
$\theta = 9.1385$; a three-middleman channel for $\theta =
29.5562$; and a four-middleman channel for
$\theta = 90.802$.

Table 1 and Figs 1 and 2 show that if the man-
ufacturer aims to maximize only his own profits, he
will tend to have no more middleman levels than if
he seeks to maximize total channel profits, and in
some cases fewer middleman levels. For example,
for $\theta$ equal to 5.0, the manufacturers maximizing
their own profits will choose to use just one middle-
man level, while a goal of maximizing total channel
profits would cause them to use two middleman
levels.

How do retailers fare in these channels? Table
2 shows retailer profits at all levels of $\theta$ which are
crossover points from one optimal channel length
to another (given either total channel profit or
manufacturer profit maximization). Retail profits
are concave in $\theta$ for any given channel length.
Holding $\theta$ constant, however, profits decrease with
channel length; thus, the manufacturer’s decision to
add another layer to the channel makes the retailer
worse off. Finally, because retail price approaches
zero as $\theta$ approaches $+\infty$ (proven in Lemma 2,
below), so do retail profits.

![Figure 2](image_url)

**Figure 2.** Optimal channel and retailer profits: objective—maximize channel profits. $\square =$ channel
profits; $+$ = retailer profits. Note: Horizontal axis is not to scale. Point A corresponds to $\theta = 0.76156$,
point B to $\theta = 4.66814$, point C to $\theta = 16.29044$, and point D to $\theta = 51.13457$. Between zero and A,
zero middlemen maximize channel profits; between A and B, one middleman; between B and C, two
middlemen; between C and D, three middlemen; and beyond D, four middlemen.
Table 2. Retailer Profit as a Function of Channel Length and \( \theta \)

<table>
<thead>
<tr>
<th>( \theta )</th>
<th>0 Mid.</th>
<th>1 Mid.</th>
<th>2 Mid.</th>
<th>3 Mid.</th>
<th>4 Mid.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.25</td>
<td>0.0625</td>
<td>0.0156</td>
<td>0.0039</td>
<td>0.0010</td>
<td>Direct channel achieves collusive profit level</td>
</tr>
<tr>
<td>0.7616</td>
<td>0.2310</td>
<td>0.0744</td>
<td>0.0211</td>
<td>0.0056</td>
<td>0.0015</td>
<td>Crossover point from 0-1 mid. (channel profit max.)</td>
</tr>
<tr>
<td>2.4224</td>
<td>0.1750</td>
<td>0.0750</td>
<td>0.0249</td>
<td>0.0072</td>
<td>0.0019</td>
<td>Crossover point from 0-1 mid. (mfr. profit max.)</td>
</tr>
<tr>
<td>4.6881</td>
<td>0.1275</td>
<td>0.0672</td>
<td>0.0258</td>
<td>0.0081</td>
<td>0.0022</td>
<td>Crossover point from 1-2 mid. (channel profit max.)</td>
</tr>
<tr>
<td>6.9631</td>
<td>0.0991</td>
<td>0.0594</td>
<td>0.0254</td>
<td>0.0085</td>
<td>0.0024</td>
<td>Crossover point from 1-2 mid. (mfr. profit max.)</td>
</tr>
<tr>
<td>16.2904</td>
<td>0.0517</td>
<td>0.0389</td>
<td>0.0217</td>
<td>0.0087</td>
<td>0.0028</td>
<td>Crossover point from 2-3 mid. (channel profit max.)</td>
</tr>
<tr>
<td>20.5663</td>
<td>0.0426</td>
<td>0.0334</td>
<td>0.0200</td>
<td>0.0086</td>
<td>0.00285</td>
<td>Crossover point from 2-3 mid. (mfr. profit max.)</td>
</tr>
<tr>
<td>51.1346</td>
<td>0.0185</td>
<td>0.0166</td>
<td>0.0126</td>
<td>0.0071</td>
<td>0.00291</td>
<td>Crossover point from 3-4 mid. (channel profit max.)</td>
</tr>
<tr>
<td>61.3691</td>
<td>0.0155</td>
<td>0.0142</td>
<td>0.0112</td>
<td>0.0067</td>
<td>0.00287</td>
<td>Crossover point from 3-4 mid. (mfr. profit max.)</td>
</tr>
</tbody>
</table>

Note: shaded boxes show optimal channel length given objective in “Notes” column.

The analysis thus far has considered channels with up to four middleman levels. Can a greater number of levels be profit maximizing from the perspective of either the manufacturer or the total channel? We discuss some pertinent analytical results here. First, the equilibrium collusive price is constant at \( 1/2 \) for all \( \theta \). The following is true for demand functions of the form in Coughlan (1985), of which Eqn (1) is an example:

**Lemma 1.** Equilibrium retail product prices increase monotonically with the number of intermediary levels in a symmetric channel, for any given nonnegative \( \theta \) (proof in Appendix).

This Lemma implies that the retail price path for any \( k \)-intermediary-level channel lies everywhere above the retail price path for a \( (k - 1) \)-intermediary-level channel. Further, given any specific channel length, we also have:

**Lemma 2.** Equilibrium retail product prices decrease monotonically with \( \theta \), for any given symmetric number of intermediary levels, and approach zero as \( \theta \) approaches \( +\infty \) (proof in Appendix).

The intuition behind Lemma 2 is that, as products become perfect substitutes (\( \theta \to +\infty \)), competition forces pricing behavior to approach the classic Bertrand model’s predictions of price equal to marginal cost and zero profits. Finally, these two Lemmas imply the following proposition directly:

**Proposition 1.** The channel-profit-maximizing number of intermediary levels in a symmetric distribution channel is non-decreasing in \( \theta \), and approaches infinity as \( \theta \) approaches one, for the demand function in Eqn (1) (proof in Appendix).

That is, there is some range of \( \theta \) for which any arbitrary number of middleman levels is channel-profit maximizing; that number is greater, the more substitutable the products are.

Hence, when the organizational goal is to maximize total channel profits, and transfer prices are single-part tariffs, a finite number of intermediary levels is optimal for any finite level of product
substitutability, \( \theta \). Since a channel where manufacturers seek to maximize their own profits has, at most, the same number of intermediary levels as a channel-profit-maximizing channel, the optimal number of intermediary levels in this situation is also finite for finite \( \theta \). The optimal number of intermediary levels is nondecreasing in \( \theta \), and furthermore, the channel-profit-maximizing channel length also tends to infinity as \( \theta \) approaches \( +\infty \).

Thus, although it is a standard result in competitive retail pricing models that retail prices decrease with an increase in product substitutability in the absence of intermediaries, increasing substitutability also raises the optimal number of intermediaries in the distribution channel. The increase in the number of intermediaries curbs the fall in retail prices, thereby increasing channel profits. Therefore, although substitutability has a direct negative impact on retail prices, it has an indirect positive one on retail prices through the increase in the optimal number of intermediaries in the channel. The indirect effect (channel lengthening) is overshadowed by the direct effect (increasing competition), leading overall to a decrease in retail prices as \( \theta \) increases.

In the next section we discuss institutional and contractual issues that also affect channel length, and we argue that these reinforce our finding that a limited number of intermediary levels is usually optimal.

**INSTITUTIONAL AND CONTRACTUAL ISSUES**

The model examined above implies that the profit-maximizing number of middleman layers between a manufacturer and the final market is a function of the substitutability of products in the market; the more substitutable they are, the more middleman layers are optimal. In particular, for very competitive product markets, a very large number of middleman levels can be optimal. Also, in this highly competitive range very small changes in product substitutability can imply the addition of a level of marketing middlemen between the manufacturer and the retailer—a relatively large and lumpy change in channel structure, given a small change in substitutability.

We do not, however, see exactly these phenomena in many product markets. We believe that various institutional factors cause the observed number of middleman levels to be not only finite but also rather small, and subject to inertia, in most industries. We can explain some channel practices (e.g. the longer channels in Japanese distribution systems than in US systems) by the difference in institutional objectives found in them. In this section we discuss some of the institutional factors that can affect distribution channel length. We emphasize that these factors tend to reinforce the general import of our findings, rather than to undermine them. Because they are not explicitly modeled, it is valuable to indicate their existence and probable effects.

First, middlemen almost certainly require some minimum levels of profitability to be willing to carry a manufacturer’s product. A middleman’s opportunity cost of distributing a product is a positive function of the attractiveness of his alternative distribution opportunities and of his costs of carrying the product (e.g. for servicing it or educating customers in its use). This opportunity cost effectively puts a ceiling on the manufacturer’s earnings per unit in a channel using these middlemen, and thus lessens the benefits of using a many-middleman channel system. For example, for \( \theta \) equal to 8.0, two middleman levels (e.g. a distributor and a retailer) are optimal to use both from the manufacturer profit and total channel profit viewpoints. Manufacturer profits in this case are 0.1577, while total channel profits are 0.2494. This leaves 0.0917 in profits for the distributor and the retailer in the channel, or 0.04585 on average for each (i.e. the distributor and retailer each get 18.4% of the total profit pie on average from this product). If, however, the middlemen demand a higher cut of the profits (e.g. if the retailer demands a lump-sum payment, like a slotting allowance), using fewer middleman levels can quickly become profit maximizing. For instance, if the middlemen demand in total not 0.0917 but 0.11, in profits, each manufacturer is better off using only one middleman level with profits equal to 0.1491 as against 0.1394 if they were to use two middleman levels apiece. Many other illustrative examples are possible, but the point remains that when middlemen face higher costs or more attractive opportunities than we have allowed for in the model, fewer middleman levels can become attractive to use.

Further, there may be uncertainty associated with selling the products concerned for given prices—that is, the demand function may be stochastic, rather than deterministic, as we have
assumed. Lal (1990) models a similar channel choice problem where the focus is on uncertainty in the sales response function, and shows that risk-averse middlemen demand a risk premium for undertaking uncertain sales activities. In other words, greater uncertainty in the selling environment has an effect similar to that of higher costs facing the middleman, causing him to demand a higher payoff for carrying the product, all other things equal. This implies that our predicted number of middleman levels for a given \( \theta \) is the maximum we would expect to see, given uncertainty in the sales response function. It is likely that fewer middleman levels would be used in very uncertain selling situations, since the risk premia required to make the intermediaries willing to carry the product would swamp any increased profitability due to using them.

Another factor is that the 'power structure' in the industry may not be as we have modeled it here. Middlemen may have more power over manufacturers than our Stackelberg model implies. If this is so, the middlemen will tend to garner greater shares of the total channel profits, and for manufacturers interested in maximizing only their own profitability, fewer middleman levels will be more attractive.

Another characteristic of the model's findings is that maximizing total channel profits implies that at least as many middleman levels are optimal as when maximizing manufacturer profits alone. This suggests a possible reason for the greater length of Japanese (versus American) distribution channels. If Japanese industries have more joint profit goals, due to organizations such as the keiretsu or trading companies, they may find it more profitable to increase the length of their distribution chains \textit{vis-à-vis} their American counterparts. Conversely, if US objectives are more firm profit oriented than total channel profit oriented, we would expect to see shorter distribution channel lengths in the USA on average. Even in Japan, however, McMillan (1984) argues that greater industrial concentration (i.e. more market power for the manufacturer) is correlated with the manufacturer taking a greater role in channel governance. This is consistent with our finding that lower \( \theta \) values (less competitive product markets, more like monopolies) are more likely to foster integration. Further, the longer channels in Japan are accompanied by strong competition (higher \( \theta \) in the terms of our model) within a given product class, also indicating channel practices consistent with our model results.

Thus, various institutional factors point to an explanation for the limited length of distribution channels, even in competitive product markets. Among these factors are the opportunity costs middlemen face to carry a manufacturer's product, the marketing costs of doing so, and the uncertainty associated with selling the product. Further, different goals (maximizing the welfare of the total channel versus of the manufacturer alone) indicate different optimal channel lengths in different industries or cultures. Finally, the power structure in the channel—who 'leads' whom—can have a great impact on the profitability of using channel intermediaries. While our findings are generally consistent with distribution practices in the United States versus those in Japan, the presence of these factors reinforces our general finding that for most industries, a finite and rather small number of layers of marketing intermediaries is profit maximizing, whether from the channel-profit or the manufacturer-profit standpoint.

CONCLUSION

In this paper we have presented a simple model of optimal distribution channel length and its effect on retail prices in a competitive-products industry. The results are consistent with those found in the McGuire and Staelin (1983), Coughlan (1985), and Lal (1990) frameworks in that they corroborate that more marketing middlemen are optimal when more substitutable products are sold. Our results differ from those in Coughlan and Wernerfelt (1989) because of two differences in assumptions: we assume that channel contracts are observable and that transfer prices are one-part prices, while Coughlan and Wernerfelt assume that contracts need not be observable and that two-part tariffs are used in transfer pricing arrangements. Our results here show that many more middleman levels than just one can be profit maximizing, whether the goal is to maximize total channel profits or just manufacturer profits. The finding that more channel levels are optimal, the more competitive are the products in the market, is consistent with institutional knowledge (McMillan, 1984) concerning the length of Japanese distribution channels.

Practical and institutional considerations, which are not explicitly modeled, nevertheless imply consistent results. We find in our model that, in general, a finite and relatively small number of
middleman layers is optimal in a distribution channel, although theoretically, for infinitely substitutable products, an infinite number of middleman layers is optimal. When, however, one considers the opportunity costs facing a middleman of carrying a particular manufacturer’s product, the absolute marketing costs of carrying products through many middleman levels, and possible uncertainty associated with sales of the product, it can become optimal to use fewer layers between the manufacturer and the final market. Since we observe relatively few middleman layers in most real-life distribution channels, we infer that such considerations are of some importance in deciding on optimal channel length.

Further, the nature of the objective sought—whether it is to maximize total channel profits or just manufacturer profits—affects the optimal length of the channel. When manufacturers seek to maximize only their own profits, they will choose to use, at most, as many middleman levels as when the objective is to maximize total channel profits, and possibly less. This finding is consistent with the difference in channel lengths in some Japanese distribution situations as compared to those of the USA, if indeed Japanese industrial organization encourages the overall health of the channel rather than the narrow interests of one set of members of the channel.

The problem of optimal channel length is complicated by many factors. Our model highlights competitive impacts on channel structure. Future research, incorporating more institutional factors explicitly into current models as well as empirically verifying channel structure and practice, will continue to enrich our understanding of channel strategy.

APPENDIX: PROOF OF POINTS IN THE TEXT

Lemma 1. Equilibrium retail product prices increase monotonically with the number of intermediaries in a symmetric channel, for any given nonnegative $\theta$.

Proof. Assume the general demand function:

$$q_N = f_N(p_N; \theta) + \theta p_N \frac{\partial f_N}{\partial p_N} < 0$$

of which Eqn (1) is an example. The first-order conditions for profit maximization in the integrated (zero middlemen) case and for the middleman in the one-middleman case are, respectively, as follows for the symmetric equilibrium where $p_N$ equals $p_N^*$:

$$0 = f_N^* + \theta p_N^* + p_N^* \frac{\partial f_N^*}{\partial p_N^*}$$

$$\equiv H^*(p_N^*) \text{ (integrated)}$$

(A1)

$$0 = f_N^* + \theta p_N^* + p_N^* \frac{\partial f_N^*}{\partial p_N^*} - p_{N-1}^* \frac{\partial f_N^*}{\partial p_N^*}$$

$$\Rightarrow p_{N-1}^* \frac{\partial f_N^*}{\partial p_N^*} = H^*(p_N^*) < 0 \text{ (one-middleman)}$$

(A2)

$H^*(p_N^*)$ is a decreasing function of $p_N^*$, by the second-order conditions for a stable profit maximum. Since $H^*(p_N^*)$ equals zero in the integrated case and is negative in the one-middleman case, the one-middleman case equilibrium retail price exceeds the integrated case equilibrium retail price.

To generalize the argument to any arbitrary number of middlemen in a symmetric channel, $N$, for each manufacturer, the first-order condition for the one-middleman case, which is written above, is identical to the first-order condition facing the channel member closest to the final customer in the $N$ middleman case. $H^*(p_N^*)$ is decreasing in $p_{N-1}^*$ for such a channel structure; if it can be shown that $p_{N-1}^*$ increases with the number of middleman levels, then final product price, $p_N^*$, also increases with the number of middleman levels.

Call the channel member closest to the final customer member $N$; the member next furthest away from the final customer member $(N - 1)$; and so on. The manufacturer is member 0 (zero). Then compare two duopoly channel structures: one where each product is distributed through $N$ vertical middleman levels and one where each product is distributed through $(N + 1)$ vertical middleman levels. Compare the first-order conditions of the channel member $N$ levels away from the final market in each structure. In the first structure that channel member is the manufacturer, who maximizes a profit function given by quantity sold times the transfer price, $p_0^*$, which he receives for selling his product to the $(N - 1)$th middleman:

$$\max_{p_0} \Pi_0 = p_0^* q_0^* \quad i = 1, 2$$

$(N$-middleman levels) (A3)
In the second structure, the channel member $N$ levels away from the final market is the marketing middleman closest to the manufacturer, who maximizes a profit function given by quantity sold times the difference between the transfer price, $p_i^*$, which he receives for selling to the next downstream channel member and the transfer price, $p_0^*$, which he must pay to the manufacturer:

$$\max_{p_i^*} \Pi_i^* = (p_i^* - p_0^*)q_i^* \quad i = 1, 2 \quad ((N + 1)\text{-middleman levels})$$ (A4)

The process of comparing optimal values of the decision variable $(p_0^* \text{ or } p_i^*)$ in these two structures is qualitatively the same as that of comparing optimal values of $p_N^*$ in the integrated case and the one-middleman case. In both situations we are comparing the objective functions of actors $k$ steps away from the final market (here, $k$ is equal to $N$, whereas in the other case, $k$ is equal to 0). By the same argument as above, therefore, it can be concluded that the transfer price $N$ levels away from the market is higher when there are $(N + 1)$ middlemen than when there are $N$ middlemen. Since the subsequent problems to be solved in the downstream stages are otherwise identical in the $(N)$- and $(N + 1)$-middleman channel structures, the higher transfer price in the $(N + 1)$-middleman case will translate into higher transfer prices, $p_{N-1}^*$, for the two products in the second-closest level to the market. Hence, equilibrium final product prices, $p_N^*$, increase monotonically with the number of members in a symmetric channel structure. QED

**Lemma 2.** Equilibrium retail product prices decrease monotonically with $\theta$, for any given symmetric number of intermediary levels, and approach zero as $\theta$ approaches $+\infty$.

**Proof.** The first-order condition for profit maximization at the retail level of an $N$-level channel is (for the symmetric equilibrium where $p_N^*$ equals $p_N^*$):

$$0 = f_N^* + \theta p_N^* + (p_N^* - p_{N-1}^*) \frac{\partial f_N^*}{\partial p_N^*}$$ (A5)

TOTally differentiating with respect to $p_N^*$ and $\theta$ and solving for $\partial p_N^*/\partial \theta$ at equilibrium, we get:

$$\frac{\partial p_N^*}{\partial \theta} = \left(\frac{\partial f_N^*}{\partial \theta}\right) + p_N^* + \left(\frac{\partial^2 f_N^*}{\partial p_N^* \partial \theta}\right)(p_N^* - p_{N-1}^*)$$

$$- (SOC)$$ (A6)

where SOC is the second-order condition for a unique profit maximum (and hence SOC is the negative). Thus, the denominator of Eqn (A6) is positive. Further, for our demand function in Eqn (1), we have:

$$\frac{\partial f_N^*}{\partial \theta} = -p_N^*$$ and $$\frac{\partial^2 f_N^*}{\partial p_N^* \partial \theta} = -1$$ (A7)

Thus

$$\frac{\partial p_N^*}{\partial \theta} = -\frac{(p_N^* - p_{N-1}^*)}{SOC} = \frac{(p_N^* - p_{N-1}^*)}{SOC} < 0$$ (A8)

This shows that equilibrium retail prices decrease monotonically with $\theta$, for any given symmetric number of intermediary levels.

Now, the first-order conditions at the retail (Nth) level of an $N$-middleman channel are:

$$p_N^* = \frac{1}{2(1 + \theta)} + \frac{\theta}{2(1 + \theta)} p_N^* + \frac{1}{2} p_{N-1}^*$$

$$i = 1, 2, j = 3 - i$$ (A9)

Solving these two conditions simultaneously, we can derive the equilibrium retail pricing policy, given any pair of upstream transfer prices, $p_{N-1}^*$ and $p_{N-1}^*$:

$$p_N^* = \frac{1}{2 + \theta} + \frac{1 + \theta}{2 + \theta} \left[2(1 + \theta)p_{N-1}^* + \theta p_{N-1}^*\right]$$

$$i = 1, 2, j = 3 - i$$ (A10)

At the symmetric equilibrium, where $p_{N-1}^* = p_{N-1}^*$, Eqn (A10) reduces to:

$$p_N^* = \frac{1}{2 + \theta} + \frac{1 + \theta}{2 + \theta} p_{N-1}^*$$ (A11)

Then as $\theta \rightarrow +\infty$, clearly $p_N^* \rightarrow p_{N-1}^*$, that is, retail margins (and hence retail profits) approach zero.

Using the formulae for $p_N^*$ in Eqn (A10), we can express the derived demand facing the $(N-1)$th-level middleman as:

$$q_N^* = \frac{1}{2 + \theta} \left[1 - p_{N-1}^* + \frac{\theta(1 + \theta)}{(2 + \theta)} \times(p_N^* - p_{N-1}^*)\right]$$

$$i = 1, 2, j = 3 - i$$ (A12)

This looks very similar to the structural demand function facing the retailer; in the $(N-1)$th-level middleman's profit-maximization problem the $[1 + \theta](2 + \theta)$ term in Eqn (A12) will drop out, and the coefficient on $(p_{N-1}^* - p_{N-1}^*)$ is now
\[ \frac{\theta(1 + \theta)(2 + 3\theta)}{(2 + 3\theta)} \], instead of simply \( \theta \), as in the structural demand function. Both \( \theta \) and \( \frac{\theta(1 + \theta)(2 + 3\theta)}{(2 + 3\theta)} \), however, approach \( +\infty \) as \( \theta \) approaches \( +\infty \). This will be useful below.

Let \( K \) be identically equal to \( \frac{\theta(1 + \theta)(2 + 3\theta)}{(2 + 3\theta)} \).

Then the first-order conditions at the \((N-1)\)th-level optimization are:

\[
p_{N-1}^i = \frac{1}{2(1 + K)} + \frac{K}{2(1 + K)} p_{N-1}^{j-1} + \frac{1}{2} p_{N-2}^i
\]

\[ i = 1, 2, j = 3 - i \]  \( \text{(A13)} \)

These conditions are of exactly the same form as those in Eqn (A9), with \( \theta \) replaced by \( K \). Thus, analogously to Eqn (A11), we see that at the symmetric equilibrium,

\[
p_{N-1}^i = \frac{1}{2 + K} + \frac{1 + K}{2 + K} p_{N-2}^i
\]

\[ i = 1, 2 \]  \( \text{(A14)} \)

implying that the \((N-1)\)th-middleman's profit margins also approach zero, and \( p_{N-1}^{j-1} \rightarrow p_{N-2}^i \), as \( \theta \rightarrow +\infty \).

Then analogously to Eqn (A12), but replacing \( \theta \) with \( K \), we can derive the derived demand function facing the \((N-2)\)nd middleman as:

\[
q_{N-2}^i = \frac{1 + K}{2 + K} \left[ 1 - p_{N-2}^j + \frac{K(1 + K)}{(2 + 3K)} \right]
\]

\[ \times (p_{N-2}^j - p_{N-2}^i) \]

\[ i = 1, 2, j = 3 - i \]  \( \text{(A15)} \)

Since \( K \) has the same properties as \( \theta \) as \( \theta \rightarrow +\infty \), we know that \( \frac{K(1 + K)}{(2 + 3K)} \rightarrow +\infty \) as \( \theta \rightarrow +\infty \). Then we let \( L \) be identically equal to \( \frac{K(1 + K)}{(2 + 3K)} \), and proceed repetitively with the same arguments we used to develop the \((N-1)\)th-level results.

Applying this logic all the way to the zeroth level of the channel (that is, the manufacturer's level), we will arrive at an equilibrium transfer price analogous to those in Eqns (A11) and (A14), but with no 'upstream' transfer price, since the manufacturer is at the top of the channel:

\[
p_{0}^i = \frac{1}{2 + \Omega}
\]

\[ i = 1, 2 \]  \( \text{(A16)} \)

where \( \Omega \) is some polynomial in \( \theta \) and where \( \Omega \rightarrow +\infty \) as \( \theta \rightarrow +\infty \). Thus, the manufacturer's transfer price (and hence profits) approaches zero as products become perfectly competitive, and so do all other transfer prices in the channel, including the retail price. We have thus shown that (1) retail prices decrease monotonically as substitutability increases, and (2) retail prices approach zero as \( \theta \) approaches \( +\infty \). QED

**Proposition 1.** The channel-profit-maximizing number of intermediary levels in a symmetric distribution channel is non-decreasing in \( \theta \), and approaches infinity as \( \theta \) approaches one, for the demand function in Eqn (1).

**Proof.** Lemma 1 implies that the retail price path (that is, price as a function of \( \theta \) for any \( k \)-middleman channel lies everywhere below that for a \((k+1)\)-middleman channel. This means that the retail price path for any \( k \)-middleman channel must have a finite maximum, to permit the \((k+1)\)-middleman channel's price path to lie above it everywhere. Lemma 2 implies that not only are the retail price paths non-intersecting but also each one (for a given channel length) declines to an asymptote of zero as \( \theta \) approaches \( +\infty \).

Now for the demand function in Eqn (1) the collusive retail price is equal to \( 1/2 \) for all values of \( \theta \). For \( \theta \) equal to zero, the collusive and zero-middleman case prices coincide, indicating that integration maximizes channel profits there. Since the collusive price does not vary with \( \theta \), and since every \( k \)-intermediary channel price path lies above a \((k-1)\)-intermediary price path (but finitely so), the collusive price path must intersect every \( k \)-intermediary price path once. Further, the collusive case price path intersects any \( k \)-intermediary channel price path at a \( \theta \) higher than it intersects a \((k-1)\)-intermediary price path. Since the coincidence of the collusive and \( k \)-intermediary price paths indicates that the \( k \)-intermediary channel maximizes total channel profits for that \( \theta \), there is some range of \( \theta \) over which any \( k \)-intermediary channel is optimal from a channel-profit point of view, and that range of \( \theta \) is higher for greater values of \( k \). In the limit, as \( \theta \) approaches \( +\infty \), therefore, an infinite number of middleman levels becomes optimal. QED

**Acknowledgements**

The authors thank Roger Betancourt, David Gaukochi, and the attendees at the Workshop on the Analysis of Retail Activities, EIASM, Brussels, Belgium, for helpful comments. Any remaining errors are, of course, the responsibility of the authors.
NOTES

1. ‘Mixed’ channel structures, where the manufacturers have unequal numbers of middleman levels, are more difficult to deal with analytically, and so are not modeled here. McGuire and Staelin’s (1983) finding that mixed channel structures are generally unstable, and Coughlan’s (1985) empirical evidence corroborating this, support this decision.

2. A more commonly used demand function is \( q_s = 1 - \rho_n + \theta \rho_n \) (see, for example, McGuire and Staelin, 1983). This functional form implies that total demand is increasing in \( \theta \), the demand substitutability parameter. Our demand function assumes that total demand is independent of \( \theta \).

3. For information on keiretsu, see Hadley (1970), especially Chapters 11, 12, and 13. Related organizations are the Japanese trading companies, or sogosho, which specialize in marketing and distribution (see McMillan, 1984, Chapter 10, for a relevant discussion).

REFERENCES


