COMPETITION AND COOPERATION IN MARKETING CHANNEL CHOICE: THEORY AND APPLICATION

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This paper discusses the problem of choosing a vertical marketing channel in a product-differentiated duopolistic market. Firms choose product price and the form of the marketing channel to maximize profits. It is shown that integration of the marketing function results in greater price competition and lower prices than does the use of independent marketing middlemen. The profitability of reducing price competition by using such middlemen is investigated. Two hypotheses—that integration is negatively associated with the products’ substitutability and that symmetric channel structures are stable—are tested in a preliminary way and supported with survey data from the international semiconductor industry.

(Distribution Channels; Vertical Integration; Game Theory; Semiconductor Industry)

1. Introduction

In selecting a channel through which to market its products, a manufacturer weighs the profit alternatives of integrating or not integrating forward into the marketing step. This paper develops and examines the empirical implications of a model of marketing channel choice in which the use of independent marketing middlemen (that is, choosing not to integrate) can be more profitable than forward integration (for both the manufacturer and the channel as a whole) when products are differentiated and hence imperfect substitutes in demand. This conclusion arises because the use of exclusive private marketing middlemen with pricing autonomy is equivalent to a restriction of the firm’s ability to react to its competitor’s price changes vis-à-vis the case of integration. These restricted reactions imply a diminished ability of manufacturers to compete in price; and decreasing price competition is more valuable (i.e., enhances manufacturer profits more), the more competitive the products are. Separation of the manufacturing and marketing steps can thus help manufacturers achieve marketing channel profits close or equal to the cooperative or collusive profit level.

The model and analysis presented here are inspired by work done by McGuire and Staelin (1983a, b), but extend and generalize their results. Their specific linear demand function is generalized here to apply to a wide set of linear demand cases as well as to cases of demand concavity or convexity with respect to own price. Also, McGuire and Staelin’s work (like that of other authors in this area) provides only descriptive evidence of the empirical validity or applicability of their models. In this paper, some of the implications of this model and those of McGuire and Staelin are tested using original interview data from the international semiconductor industry.
The body of the paper starts with a review of the pertinent literature. Next, a model of marketing channel choice is developed which indicates the implications of channel choice for the degree of price competition between firms. Following is a discussion of the profitability of restricting price competition by using independent marketing middlemen. The model's implications are then tested on data from the semiconductor industry. The conclusion summarizes the paper's results and indicates directions for future research.

2. Review of the Literature

The analytical marketing literature on channel choice has a relatively long history, with most of the articles dealing in one way or another with the nature of the manufacturer-distributor relationship (competitive or cooperative). For instance, some early work (e.g., Artle and Berglund 1959; Baligh and Richartz 1967) concentrates on the vertical interactions within a channel rather than on competitive reactions between manufacturers, as the model in this paper does. The description of contracts which enhance cooperation between channel members is a concern of other authors (Jeuland and Shugan 1983; McGuire and Staelin 1982; Zusman and Etgar 1981).

Other marketing papers deal explicitly with the situation where several distributors compete to sell the same product (e.g., Etgar 1978; Etgar and Zusman 1982). Where the market is competitive at both the manufacturing and distribution levels, Etgar shows how a manufacturer can use forward integration to differentiate his product by providing a higher level of service at the distributive level than would an independent distributor. Etgar and Zusman model distributors as the owners of specialized information, so that the marketing channel becomes a communications network. In both cases, the lack of market power on the part of manufacturers and distributors, and the lack of differentiation in their products, distinguishes these approaches from the one in this paper. However, these papers do not model differentiated products, while the focus here is on the impact of degree of differentiation or substitutability on channel choice.

Jeuland and Shugan (1983) focus on the channel coordination problem in the context of a single-producer, single-retailer channel. They note that coordination or cooperation is not a natural behavior pattern for channel members unless it is forced on all channel members, due to the incentive to renege on any voluntary cooperative agreement. In their framework, integration is but one means of coordinating manufacturing and marketing actions to maximize channel profit; others include simple contracts, implicit understandings, profit sharing, and quantity discounts. Because they analyze the problem of a single manufacturer and a single retailer, they show that coordination (i.e., joint profit-maximizing resulting from the alignment of manufacturing and marketing interests) is always more profitable than noncoordination (i.e., individual profit-maximizing resulting from the nonalignment of manufacturing and marketing interests); the results derived here and in McGuire and Staelin (1982, 1983b) showing that integration need not be the profit-maximizing channel choice rest on the assumptions of a market which consists of competing retailer outlets and Stackelberg leadership by the manufacturers vis-à-vis the retailers.

The model developed here generalizes the well-defined linear demand structure postulated by McGuire and Staelin (1983a, b), with demand a function of own price and the price of the other good. In addition, this paper provides some preliminary empirical evidence on marketing channel choice which is compatible with the predictions generated from the seemingly restrictive assumptions of the McGuire/Staelin demand framework. These findings are that the substitutability of products is negatively related to the likelihood of observing an integrated channel structure, and that mixed channel
structures (one manufacturer integrated, one using an independent marketing middleman) tend to evolve into integrated ones.

In the next section, a model of marketing channel choice in a product-differentiated duopoly is developed to show the competition-reducing role of independent distributors.

3. A General Model of Duopolistic Vertical Integration

In this section, the profit-maximizing problems of the manufacturers, and middlemen where applicable, are developed and examined. We do this in order to analyze the role played by marketing middlemen in a world where marketing economies of scale, economies of scope, and middleman "value added" are not present to justify the use of middlemen. Even when these generally-cited reasons for using middlemen are not present, this model shows that they can serve to inhibit price competition between manufacturers. This may well be valuable when price competition is very strong, as the next section will show.

It will be assumed throughout that manufacturers and marketers maximize profits, with prices as strategic variables. Manufacturing and marketing costs are assumed to be zero. The results derived with this cost structure are identical to those with constant marginal costs when demand is linear (for a demonstration of this point, see McGuire and Staelin, 1983a, b, hereafter referred to as McGuire and Staelin a, b). The analysis thus abstracts from economies of scale and economies of scope in marketing. Demand keeps the same functional form throughout; we examine the profitability of marketing channel choice by allowing the manufacturers’ choices of marketing channels to vary.

We make the following assumptions:
A1: Each manufacturer makes one product.
A2: Demand functions are symmetric, i.e., own-price demand derivatives are equal for the two products, as well as cross-price demand derivatives.
A3: Own-price demand derivatives are negative.
A4: Cross-price demand derivatives are positive and constant for any state of the world (e.g., a market at some time and place).
A5: Own-price demand derivatives are greater (in absolute value) than cross-price demand derivatives.
A6: Price marginal revenue (the derivative of total revenue with respect to price) is a decreasing function of own price.
A7: Own price marginal revenue is an increasing function of the competitor’s strategic variable.
A8: All players maximize their profits, given their beliefs about other players’ actions in the system.
A9: Marketing and manufacturing costs are zero.

Assumption A4 means that the sensitivity of demand for one product with respect to the other product’s price is not a function of the level of demand or of either party’s channel decisions. It does permit this derivative to be different in different industries or different times. Assumption A6 simply insures that the second-order conditions of all the marketing middleman and manufacturer maximizations provide for profit maxima rather than profit minima.

Assumptions A2–A5 imply a demand function of the following form:

\[ q^i = f(p^i; \gamma) + d\gamma p^i, \quad i = 1, 2, \quad j = 3 - i, \]

(1)

where for \( f'(p^i; \gamma) = \partial f / \partial p^i, f''(p^i; \gamma) < 0, |f'| > d\gamma, d\gamma > 0, \) and no \textit{a priori} assumptions are made about the signs of the second derivative of \( f \) with respect to price. Hence, demand can be convex, linear, or concave in own price, although it is linear with respect to the other product’s price. The variable \( \gamma \) acts as a substitutability
parameter, and is assumed to be nonnegative. The variable $d$ expresses the differential effect of substitutability on cross-price and own-price demand effects. Henceforward the notation $f^i$ is used to denote $f(p^i; \gamma)$ for product $i$.

Because of Assumption A9, that marketing and manufacturing costs are zero, price marginal revenue (the derivative of total revenue with respect to price) is also the derivative of profit with respect to own price in this model. Clearly, given the structure of the demand function in (1), Assumption A7 is satisfied: the derivative of price marginal revenue with respect to $p^j$ is just $d\gamma$, a positive constant given the substitutability in demand of products $i$ and $j$.

Four distinct marketing channel structures are considered in the duopoly model. In all four, each manufacturer makes one good (which is a gross substitute with that of his competitor). The differences between these structures revolve around (a) whether the two manufacturers cooperate (collude) or compete with each other, and (b) how many (if either) of the manufacturers use independent marketing middlemen, as opposed to integrating the marketing function into the firm.

Now in fact, a firm modeled here as an “integrated” firm can represent any firm in the real world which has achieved “coordination” with its marketing middlemen, where coordination is meant in the Jeuland/Shugan (1983) sense. For them, coordination means mathematically that the manufacturing and marketing divisions act to maximize their joint profits; it means intuitively that the two groups work within the firm as a team, with no divergent interests or incentives. This coordination may be achieved by actually integrating the marketing function into the firm, so that the firm includes both a manufacturing and a marketing division (although even in some firms where the marketing/selling function is performed in-house, it is clear that “coordination” has not been achieved). Coordination may also be achieved with appropriate agreements and long-term relationships with a trusted nonintegrated distributor or representative (although again, not all manufacturer-distributor relationships are so harmonious). Jeuland and Shugan (1983) thoroughly discuss mechanisms by which such coordination can be achieved, so we do not repeat them here. However, it should be remembered that the discussion of “integrated” channels really applies to any channel form where both the manufacturer and the marketer share the same objectives and incentives.

First, then, in the collusive case, both manufacturers integrate the marketing function and set prices to maximize their joint profits. This case serves as a benchmark for judging the relative profitability of other channel structures, since it represents the greatest level of channel profit for one manufacturer without lessening the profit of the other manufacturer. The maximization problem in this case is:

$$\max_{p^1, p^2} \Pi_c = p^1q^1 + p^2q^2 = \sum_{i=1}^{2} p^i[f(p^i; \gamma) + d\gamma p^i].$$  \hspace{1cm} (2)

Since the collusive problem is symmetric,¹ there exists a symmetric equilibrium characterized by equal price for the two goods.² The symmetric solution in the collusive case can be illustrated by the graph in Figure 1, with demand assumed to be linear. In

¹ A problem is symmetric if the profit function for one actor can be turned into the profit function for his direct competitor simply by exchanging every decision variable of the first actor for the analogous one of the second actor, and vice versa. In the collusive case, that means exchanging every $p^1$ for a $p^2$ and vice versa. Asymmetries could occur in such markets through differing values of the own-price demand derivative (e.g., one firm’s demand could be more price-inelastic than another’s) or through some difference in plant capacity and hence firm size. By abstracting from these asymmetries, we abstract from reasons other than purely competitive ones which could drive distribution channel choices and pricing decisions. The asymmetry assumption is restrictive in the sense that it precludes several motivations for channel choice; but the reason for this restrictiveness is to concentrate on competitive motivations instead.

² A proof of this point is available from the author.
$p^1 - p^2$ space, the reaction functions $p^1(p^2)$ and $p^2(p^1)$ (which are obtained by solving the first-order conditions for each price as a function of the other price) intersect on the 45-degree line, where $p^1$ and $p^2$ are equal. The intersection point C is the collusive equilibrium implied by the problem's first-order conditions. Equilibrium quantities and profits for both manufacturers are then obtained by substituting these equilibrium prices into the demand and profit equations.

In the *Nash integrated case*, both manufacturers again integrate the marketing function. However, unlike the collusive case, here the manufacturers act as Nash competitors, each taking his competitor's price as given when he maximizes profits. The maximization problems are:

$$\max_{p^j} \Pi^j_m = p^j(q^i = p^i[f(p^j; \gamma) + d^j p^i], \quad i = 1, 2, \quad j = 3 - i. \quad (3)$$

Since the manufacturers' problems are symmetric (as defined in the collusive case), by the same argument as in the collusive case there will exist a symmetric equilibrium characterized by equal price for the two goods. A graphical depiction of the symmetric solution in the integrated case looks qualitatively the same as that in the collusive case in Figure 1, except that the reaction functions in the integrated case have half the slope of those in Figure 1 (that is, are steeper; this can be verified by solving for them in this case and calculating $\partial p^j/\partial p^i$). Equilibrium quantities and profits for both producers in the integrated case are computed by evaluating the demand and profit equations at the equilibrium prices.

In the *private case*, neither manufacturer integrates the marketing step into his firm; both use exclusive private marketing agents (which will be called "middlemen" or "marketing middlemen" in this paper). Each manufacturer sells his product to his marketing middleman for unit wholesale price $w^i$; the middleman then sells the product to final customers for unit final price $p^j$. The middleman sets final price, $p^j$, while the manufacturer sets wholesale price $w^i$. The middlemen compete in a Nash framework with each other; the manufacturers also compete against each other in a Nash framework. Each manufacturer is assumed to act as a Stackelberg leader relative to both middlemen, however; that is, each maximizes profit taking both middlemen's decision rules into account while assuming that the other manufacturer's price is given.
Each middleman maximizes the following profit function, where \( r \) stands for “retailer” and indicates the middleman’s problem:

\[
\max_{p} \Pi_i^j = (p^i - w^j)[f(p^i; \gamma) + d\gamma p^j], \quad i = 1, 2, \quad j = 3 - i. \quad (4)
\]

Using the same argument as in the collusive case, a symmetric middleman equilibrium is characterized by final prices which are symmetric functions of the wholesale prices, denoted by \( h(w^i, w^j) \). Each manufacturer inserts the \( h \) functions in his demand function, and hence uses a “derived” demand function in his maximization decision rather than the structural demand functions of equation (1). Manufacturer \( i \)’s maximization problem is then:

\[
\max_{w^i} \Pi_i^m = w^i q^{**} = w^i f[h(w^i, w^j); \gamma] + d\gamma w^i h^j(w^i, w^j), \quad i = 1, 2, \quad j = 3 - i. \quad (5)
\]

By an argument similar to that in the collusive case, a symmetric equilibrium exists which exhibits the characteristic \( w^1^* \) equals \( w^2^* \). Substitution of these values into the appropriate equations generates equilibrium price, quantity, and profit values, which are equal for the two manufacturers and the two middlemen.

Finally, in the mixed case, manufacturer \( i \) is assumed not to integrate, while manufacturer \( j \) does integrate. Manufacturer \( i \)’s marketing middleman sets final price \( p^i \), manufacturer \( i \) sets wholesale price \( w^i \), and manufacturer \( j \) sets price \( p^j \). Various competitive assumptions can be made which would affect the outcome of the maximization problems. The analysis here assumes that manufacturers \( i \) and \( j \) both use middleman \( i \)’s decision rule in maximizing their profits in a Nash framework vis-à-vis each other. This reflects an industry structure where manufacturers are familiar with the decision rules of middlemen, whether they use them or not. Clearly, alternative assumptions could generate a different set of equilibrium prices, quantities, and profits than this one (see, for instance, McGuire and Staelin, 1983a, b, and 1982).

Marketer \( i \)’s profit is first maximized with respect to final price \( p^i \), taking wholesale price \( w^i \) and final price of its vertically integrated competitor \( p^j \) as given:

\[
\max_{p^i} \Pi_i^j = (p^i - w^j)[f(p^i; \gamma) + d\gamma p^j]. \quad (6)
\]

Since both manufacturers use the \( i \)th manufacturer’s middleman’s decision rule in the maximization of their profits, they replace \( p^i \) in their demand functions with \( k \), where \( k \) is derived from the first-order condition and expresses \( p^i \) as a function of \( p^j \) and \( w^i \). The two manufacturers therefore use “derived” demand functions, \( q^{**} \) and \( q^{**} \), in their profit functions. Their maximization problems are:

\[
\max_{w^i} \Pi_i^m = w^i q^{***} = w^i f[k(p^i, w^j); \gamma] + d\gamma p^j, \quad (7)
\]

\[
\max_{p^j} \Pi_i^m = p^j q^{***} = p^j f(p^i; \gamma) + d\gamma k(p^i, w^j). \quad (8)
\]

By an argument analogous to that in the collusive case, the existence of an equilibrium is assured. One difference between this case and the collusive, Nash integrated, and private cases is that the equilibrium values for the manufacturers’ control variables, \( w^i \) and \( p^j \), are not generally equal, even though the manufacturers react to each other in a Nash framework. Nor is the equilibrium final price \( p^j \) equal to price \( p^j \) in general. These inequalities result from the asymmetric nature of the

\[\partial k/\partial p^i = -d\gamma/[2f'' + (p^i - w^i)f'''], \quad \partial k/\partial w^i = f''/[2f'' + (p^i - w^i)f''']\]
mixed case. These equilibrium values of \( w^i \) and \( p^i \) can be used to determine the equilibrium value of \( p^i \), quantities sold and profits made by the middleman and manufacturers.

It is worth re-emphasizing that the existence of marketing middlemen can be justified even with the absence of marketing economies of scale or scope and of any "value added" by the middleman. The own- and cross-price derivatives of the demand equations faced by manufacturers in the Nash integrated, private, and mixed cases are of interest in defining their role in this model. Differences in the magnitudes of these derivatives indicate differences in manufacturer's competitive abilities under different channel structures, since they define how strongly a manufacturer can influence his own or his competitor's quantity demanded by changing his price. Proposition 1 states the relationship among these derivatives: 4

**Proposition 1(a).** A given change in own price by a manufacturer influences quantity demanded less in the private case than in the integrated case, for demand functions which satisfy the following convexity condition:

\[
(i) \quad f'' + (p^i - w^i)f'' < 0.
\]

**Proposition 1(b).** A given change in own price by a manufacturer influences quantity demanded less in the mixed case than in the integrated case, for demand functions which satisfy convexity condition (i). This holds for both manufacturers.

**Proposition 1(c).** A given change in own price by a manufacturer influences quantity demanded more in the mixed case than in the private case, under a slightly stricter convexity condition on demand:

\[
(ii) \quad |f'' + (p^i - w^i)f''| \geq d^\gamma.
\]

This proposition is of some importance in uncovering the role of exclusive private marketing middlemen in a competitive duopoly. It says that manufacturer price change effects on quantity demanded are strongest when manufacturers integrate the marketing function, that these effects are muted in strength in the mixed case, when one manufacturer employs a marketing middleman, and that they are muted even more when neither manufacturer integrates. The separation of manufacturing and marketing activities hence restricts manufacturers' ability either to initiate or to respond to price competition, and does so more when neither manufacturer integrates than when just one does so. This holds even though the products' inherent substitutability is not altered in consumers' eyes under different channel structures.

The result of the maximization exercises in this section is therefore to identify the role of exclusive private marketing middlemen in a product-differentiated duopoly. These indirect channels insulate manufacturers from the final market and thereby inhibit price competition between them. The result implies that one of the incentives to use a private marketing channel might be precisely to protect the firm from direct competition at the market level. The result is reinforced and extended in the next section.

4. Channel Choice and Product Substitutability

In the above section, the role of marketing middlemen is identified as agents to help manufacturers decrease price competition. In this section, we ask when this is a profitable strategy to follow. We do this by examining the profitability of various marketing channel structures (as opposed to the price-competitiveness of the channel

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4 A proof of this proposition is available from the author.
structures, discussed in the above section). We derive some analytical results comparing equilibrium final prices in the different channels, and then discuss the implications of these prices for the profitability of various channel structures. The discussion identifies the two goals of the empirical analysis in the next section: to investigate the relationship between substitutability and channel structure, and to investigate the stability of "pure" (i.e., not mixed) channel structures.

In order to examine the relative profitability of various marketing channels, we first examine the relationship between equilibrium final product prices in the collusive, Nash integrated, and private cases.\(^5\) The collusive case equilibrium price provides a benchmark as the price generating the greatest amount of profits for the duopolists. However, if joint profit maximization is impossible, whether because of legality or because of the incentive to cheat on the collusive agreement, the channel structure generating a final product price closest to that in the collusive case is the structure maximizing total channel profits. While this does not inform us of the manufacturer's profitability of using either an integrated or a private channel, it gives us a preliminary idea about whether using marketing middlemen can ever be more profitable than integrating. For instance, if it can be shown that the equilibrium price in the Nash integrated case is always closer to the collusive price than is the equilibrium private case price, then we can infer that integration is always the profit-maximizing strategy for firms in this competitive duopoly.

Proposition 2 defines the relationship between the three equilibrium prices.\(^6\)

**Proposition 2(a).** Equilibrium final product prices in the collusive (joint profit-maximizing) case are always higher than those in the Nash integrated case, except for the situation where \(\gamma\) equals zero, when they are equal.

**Proposition 2(b).** Equilibrium final product prices in the private case are always higher than those in the Nash integrated case.

Proposition 2 implies that only when \(\gamma\) equals zero, that is, when the two products are unrelated in demand, can we be sure that there is no profit incentive to use marketing middlemen in the marketing channel. This is because for \(\gamma\) equal to zero, the duopolists are in effect monopolists, since they do not compete against each other; hence, Nash integrated case profits equal collusive case profits. For positive values of \(\gamma\), however, both the collusive and the private case final product prices exceed that in the Nash integrated case, so that it is at least possible that using middlemen is more profitable than integrating.

Figure 2 helps us intuitively see the problem.\(^7\) By the assumption of symmetry of the demand functions and of the channel choice problems, any equilibrium in the collusive, Nash integrated, or private cases has the characteristic \(p^1* = p^2*.\) Hence, we can graph a function which is identical to the single firm's profit function, but with \(p^1\) equal to \(p^2\) equal to \(p:\)

\[
\Pi = p[f(p; \gamma) + d\gamma p].
\] (9)

\(^5\) We do not include equilibrium prices in the mixed case in this discussion, because their relationship to the other equilibrium prices is ambiguous due to the asymmetric nature of the case. The interested reader is referred to Coughlan (1982) for a more detailed discussion of the mixed channel structure as an equilibrium.

\(^6\) A proof of this proposition is available from the author. In addition, Coughlan (1983a) proves a more general form of Proposition 2(b), which says that equilibrium final product prices increase monotonically with the number of layers of middlemen in a pure channel structure, for any given finite nonnegative \(\gamma.\) This analysis is more restrictive, since it looks only at the choice between having zero or one middleman in the marketing channel.

\(^7\) I am indebted to an anonymous reviewer for suggesting this direction of analysis for examining the relative profitability of the collusive, Nash integrated, and private cases.
This is a function only of $p$ and $\gamma$. By Assumption A6, that price marginal revenue is a decreasing function of own price, equation (9) can be graphed as in Figure 2 as a concave function of own price, for any given value of $\gamma$.

The maximum point of the profit function (9) (and that of the parabola in Figure 2) is given mathematically by:

$$\frac{\partial \Pi}{\partial p} = 0 = f(p; \gamma) + 2d\gamma p + pf'' = K. \quad (10)$$

Call the price-derivative of profit $K$, and note that it is the formula for the slope of the profit function in Figure 2. Then note that (10) is the same condition as that describing the maximum collusive profit, for the equilibrium where $p^1$ equals $p^2$:

$$\frac{\partial \Pi_C}{\partial p} = 0 = f(p^1; \gamma) + 2d\gamma p^2 + p^1f'' = 0. \quad (11)$$

Therefore, the maximum point of the profit function in Figure 2 describes the set of equilibrium prices which maximizes each duopolist's profit in the collusive case. We label the price ordinate of this point as $p^C$, the collusive optimum.

Proposition 2(a) guarantees that the set of equilibrium prices in the Nash integrated case, denoted as $p^N$ in Figure 2, is less than $p^C$. In particular, for $p^1$ equal to $p^2$, the Nash integrated prices are described by the following expression (the first-order condition in the Nash integrated case):

$$\frac{\partial \Pi_N}{\partial p} = 0 = f + d\gamma p + pf'' = K - d\gamma p. \quad (12)$$

This means that at $p^N$, the slope of the profit function in Figure 2 (equal to $K$) is $d\gamma p$, a positive number for positive $\gamma$. Note that for $\gamma$ equal to zero, $K$ equals zero and the Nash integrated and collusive equilibria coincide; this makes sense, since $\gamma$ equal to zero means that the two duopolists are in effect non-competing monopolists.

For demand linear in price, the profit function (9) is a parabolic function.\footnote{The general equation for a concave parabola with maximum point $(a, b)$ in $(x, y)$ space and with $y$ (i.e., profit) equal to zero when $x$ (i.e., price) equals zero is: $y = x((2b/a) - (b/a^2)x).$ Hence, any profit function with demand linear in price will generate a parabolic profit function.} Then a firm's profits equal the Nash integrated level when the slope of (9) is either $d\gamma p$ or
\[ -d\gamma p. \] Hence, if the slope of the profit function at the private case equilibrium set of prices is between \( d\gamma p \) and \(-d\gamma p\), equilibrium channel profits (the sum of the manufacturer's and the middleman's profits) are greater in the private case than in the Nash integrated case. Otherwise, the Nash integrated channel structure is more profitable than the private channel structure. It is true that a private case profit function slope between \( d\gamma p \) and \(-d\gamma p\) will not tell us whether private case manufacturer profits exceed Nash integrated case profits, since such an analysis does not address how the channel profits will be split between the two independent agents. However, the comparison is still of interest in generating necessary conditions for the profitability of the private case. The comparison is also of interest if one permits a Jeuland/Shugan (1983) type of coordination between the manufacturer and the middleman.

Equal equilibrium prices in the private case are described by the middleman’s first-order condition in that case, with \( p^1 \) equal to \( p^2 \) equal to \( p^i \):

\[ \frac{\partial \Pi_p}{\partial p} = 0 = -f + d\gamma p + pf' - w^f = K - d\gamma p - w^f. \] (13)

This implies that at \( p^x \), the equilibrium set of prices in the private case, the slope of the profit function in Figure 2 (equal to \( K \)) is \((d\gamma p + w^f)\). Note that since \( f' \) is negative (the derivative of demand with respect to own price), the slope of the profit function (9) is smaller in the private case than in the Nash integrated case. This means that \( p^x \) exceeds \( p^0 \), reconfirming Proposition 2(b). However, \( p^0 \) can lie in one of four places:

(a) between \( p^h \) and \( p^c \), as at point \( p^h_1 \) in Figure 2; here, private case channel profits exceed Nash integrated case profits, but \( p^h \) is less than the collusive price.

(b) between \( p^c \) and \( p^l \), as at point \( p^l_2 \) in Figure 2; here, private case channel profits exceed integrated case profits, but \( p^l \) is greater than the collusive price.

(c) at \( p^l \) in Figure 2, where private case channel profits just equal Nash integrated profits, and \( p^l \) is greater than \( p^c \).

(d) higher than \( p^l \), as at point \( p^l_3 \) in Figure 2; here, private case channel profits are less than Nash integrated profits, and \( p^l \) is greater than \( p^c \).

Thus, private case channel profits exceed Nash integrated profits if \( p^f \) is less than \( p^l \) in Figure 2. But \( p^l \) is just the point where the slope of the profit function, \( K \), equals \(-d\gamma p\). If the slope of the profit function at \( p^f \) is greater than \(-d\gamma p\), then private case channel profits exceed Nash integrated case profits. Mathematically, this condition is:

\[ d\gamma p + w^f > -d\gamma p \quad \text{or} \quad 2d\gamma p + w^f > 0. \] (14)

Call the expression \((2d\gamma p + w^f)L\). Then as \( L \) is greater than, equal to, or less than zero, private case channel profits are greater than, equal to, or less than Nash integrated profits.

It is easy to see that if \( \gamma \) equals zero (the products are unrelated in demand) or \( d \) equals zero (cross-price effects are nonexistent), \( L \) is less than zero (unless \( f' \) is a multiplicative function of \( \gamma \), in which case \( L \) equals zero for \( \gamma \) equal to zero). So if the products are not substitutable, or cross-price effects are unimportant, using middlemen will not enhance channel profits. This is sensible, since in these cases there is no competition-reducing role for middlemen to play.

On the other hand, \( L \) increases linearly in the parameter \( d \). The constraint that own-price demand derivatives be greater in absolute value than cross-price demand

\[ \text{To see this, take any point } x = (a - \varepsilon) \text{ on the horizontal axis of the general parabola in the above footnote (remember } a \text{ is the horizontal coordinate of the maximum point of the parabola). At this point, the slope of the parabola is } 2b/a^2. \text{ At the point } x = (a + \varepsilon), \text{ the slope of the parabola is } -2b/a^2. \text{ Further, the value } y \text{ equals } [b - (b^2/a^2)] \text{ for } x \text{ equal to either } (a - \varepsilon) \text{ or } (a + \varepsilon). \text{ Translating to the price-profit axes, this means that the two prices where profits equal equilibrium Nash integrated profits are where the slope of the profit function is } d\gamma p \text{ and } -d\gamma p. \]
derivatives implies the following condition on $d$: $d < -f'/g$. Letting $d$ equal this limit value would make $L$ equal to $-f' \cdot (2p - w)$, which is unambiguously positive. Hence, there are some permissible values of $d$ (that is, some situations where cross-price demand derivatives are “large enough” compared to own-price demand derivatives) for which integration is never a profit-maximizing channel strategy. Intuitively, these are markets where competitive price effects are relatively strong, and hence where competition-reducing middlemen are profitable to use.

We can also examine the effect of different levels of the substitutability parameter, $\gamma$, on the relative profitability of the Nash integrated and private cases. $L$ changes with $\gamma$ according to the following rule: $\partial L/\partial \gamma = 2dp + w \cdot \partial f'/\partial \gamma$. $L$ is negative (and Nash integration is optimal) for $\gamma$ equal to zero; if $\partial L/\partial \gamma$ is positive, then above some level of product substitutability, the use of middlemen maximizes channel profits.

Of the terms in $\partial L/\partial \gamma$, $p$ is always greater than $w$; and $\partial f'/\partial \gamma$ is logically negative (it makes sense for own-price demand derivatives to become more strongly negative, the more substitutable are the products). The parameter $d$ measures how the cross-price demand derivative ($\partial f'/\partial p$) varies with $\gamma$ (i.e., $d$ equals the derivative of $\partial f'/\partial p$ with respect to $\gamma$), while $\partial f'/\partial \gamma$ measures how the own-price demand derivative varies with $\gamma$. Now, a sufficient (but more than necessary) condition for $\partial L/\partial \gamma$ to be positive is that $2d$ be greater than $|\partial f'/\partial \gamma|$—that is, that cross-price effects be at least half as responsive to changes in $\gamma$ as are own-price effects. This condition holds for the McGuire/Staelin (1983b) linear demand function. Again, this is a sensible intuitive result, since in our stylized world, middlemen serve only to decrease price competition between manufacturers. Thus, unless competitive price effects are strong enough, there is not much of a role for middlemen to play.

The McGuire/Staelin (1983b) linear demand function is one where $\partial L/\partial \gamma$ is positive, and hence where private case channel profits exceed Nash integrated profits above some level of $\gamma$. However, because they use a specific demand example, they can analyze the profitability of the mixed case as well (which is not possible in our analysis, because of the unequal equilibrium prices in that case). The pure channel structure cases they analyze have rules similar to those used here, but in the mixed case the nonintegrated manufacturer is assumed to be a Stackelberg leader with respect to both his middleman and the other manufacturer. They find first that the mixed case is never a Nash equilibrium channel structure. Further, the Nash integrated case is a Nash equilibrium for all positive values of $\gamma$, although it is not the unique Nash equilibrium for $\gamma$ greater than 13.49 (McGuire and Staelin's analysis is in terms of $\theta$, which equals $\gamma/(1 + \gamma)$ and varies between 0 and 1). For $\gamma$ greater than 13.49, either Nash integration or the private case are equilibria, and given that a channel structure is of one sort or the other, there is no incentive to switch to the other structure. However, in this range of $\gamma$, the private case gives manufacturers higher profits than does the Nash integrated case. Finally, for $\gamma$ between 2.42 and 13.49, a classic prisoner's dilemma situation prevails: the private case is more profitable for both manufacturers than is Nash integration, but each manufacturer has an incentive to integrate given that the other retains his marketing middleman. Once one manufacturer integrates (instituting the mixed case), the other manufacturer also has a profit incentive to integrate, so that the Nash integrated case is the only stable equilibrium structure.

Analyzing the mixed case as the model in this paper does, McGuire and Staelin arrive at the same conclusions regarding the mixed equilibrium as in their 1983b paper. They also come to similar conclusions using other noncooperative game structures. In two of the games they study, the mixed structure is a Nash equilibrium for values of $\gamma$ greater than those for which the Nash integrated structure is an equilibrium, but not over wide ranges of $\gamma$. Hence, the two conclusions we can draw from this paper's analysis and their example are that, under reasonable parametric
restrictions, the incentive to use marketing middlemen increases with the substitutability of the products (consistent with our description of middlemen as agents to decrease price competition between firms), and that pure channel structures are more stable than mixed structures. Although they argue that "to confront our models to empirical data would be premature," (1983, p. 190), we proceed in the next section to use data from the international semiconductor industry to examine these two hypotheses.

5. Empirical Evidence from the International Semiconductor Industry

In this section, we would like to test our model's implications. We discuss this issue in a preliminary way in the context of one industry for which appropriate data exist—the international semiconductor industry. This examination is meant not only to test the model's predictions concerning the relationship between substitutability and channel choice and concerning the stability of pure channel structures, but also to illustrate the data requirements for testing of the model. The estimation here is called preliminary precisely because the data used are not perfect for the task at hand; nevertheless, they are more appropriate than most public data sources available.

In answering the first question, whether substitutability is negatively related to the propensity to integrate the marketing function, we seek to test the claim that middlemen inhibit price competition between manufacturers, and the associated analytical and numerical results in the above section. The second question is designed to test the model's implications for equilibrium channel structures. If the pure channel structure (e.g., an all-distributor channel) breaks down, the structure of the channel can be traced over time to see if a mixed structure is stable or if an all-integrated structure eventually results. While this sort of empirical analysis cannot "prove" that any one demand function is the right one to use or that firms cooperate in their marketing channel decisions, it can at least provide an example of one industry's channel choice decisions and can be compared with the implications of the model.

The data used here are the product of a National Science Foundation study on international technology transfer in the semiconductor industry. Fourteen component, equipment, and materials technologies are represented, and are listed in Table 1.

| TABLE 1 |
| Product Technologies in the Dataset |

- **Component Technologies**
  - High Power Rectifier
  - Operational Amplifier
  - 4K RAM (random-access memory)
  - TTL (transistor-transistor logic)
  - C-MOS (complementary metal-oxide semiconductor)

- **Equipment Technologies**
  - Mask Aligner
  - Diffusion Furnace
  - Ion Implanter
  - Wire Bonder
  - Plastic Encapsulation Molds

- **Materials Technologies**
  - Single Crystal Silicon
  - Epoxy B for Plastic Encapsulation

*These technologies are represented only in the first regression reported.

"Components" are semiconductor chips, like memories or logic circuits. They are inputs in the production of myriad types of final products, including home appliances, calculators, automobiles, and computers. The term "materials" refers to the basic substances used to make semiconductor components. Semiconductor "equipment" includes various pieces of capital equipment used to manufacture semiconductor components. The technologies were chosen to cover a wide range of production steps in the equipment group and a wide range of semiconductor devices in the component group. Entry dates into foreign markets range from 1954 to 1979, but are predominantly in the late 1960's and early 1970's.

An observation comprises a particular technology, produced by a particular firm, and sold in a particular foreign market. Foreign markets are defined as Western Europe, Japan, Southeast Asia, and Rest of the World. Observations consist of situations where the firm either sells a technology direct in a foreign market (i.e., integrates), or sells it through a middleman such as an independent distributor or representative in the foreign market (i.e., does not integrate) when it introduces the technology to the foreign market. The integration decision is represented as a zero-one dummy variable. In addition, the channel structures in a product technology often comprise more than two manufacturers, but never more than five. Hence, while the duopoly assumption is not always met, the product markets all are characterized by small-numbers competition.10

In all the regressions (reported in Table 2), the observations used are ones where the firm had no prior experience selling this or any other product in the foreign market in question. This restriction is made to insure that the firm has no overwhelming cost advantage favoring integration or nonintegration (although it clearly does not control for all cost differences).11 The restriction is necessary, since Coughlan (1983) finds that prior use of a particular type of marketing channel is a very strong predictor of continued use of that channel for a new product. All the observations are also ones where there is a strictly positive number of competitors in the foreign market when the firm in question begins marketing its product in that market. The first regression reported in Table 2 uses only these two restrictions to define relevant observations, and is based on 62 observations and 26 firms.

The second and third regressions include observations meeting the above two restrictions as well as another stipulating that a nonmixed channel structure be in place in the foreign market at the time of entry (i.e., one or more competitors sell in the market, and all distribute through the same channel type). This restriction ensures that the entering firm faces a pure channel structure and permits us to examine the pure-structure assumption.12 These regressions include 50 observations and 22 firms.

The fourth regression includes one other restriction, that the entering firm pick the same channel when it first enters as existed among its competitors prior to its entry. This sample permits a stricter examination of the substitutability-integration relationship in the model above, since it holds the overall channel structure constant. This regression includes 31 observations and 18 firms. The fifth regression stipulates further that the

10 Were we able to measure \( \gamma \) precisely, the violation of the model's duopoly assumption would imply more competition than predicted by the model (this might, for example, be reflected in a higher \( \gamma \)). This would mean that the model would underestimate the profitability of the private channel structure in an intermediate range of \( \gamma \). But since the substitutability measure is so crude in this empirical analysis, the violation does not seem great.

11 Note that this does not control for cost advantages due to prior experience in a different foreign market, but we expect these advantages to be significantly less in value.

12 Although the model developed in this paper assumes a duopoly, several of these markets contain more than two competitors; however, the total number of competitors is small enough for a pure channel structure to approximate a single competitor with that type of channel.
<table>
<thead>
<tr>
<th>Regression and No. of Observations</th>
<th>Mean of INT</th>
<th>Mean of LOWSUB</th>
<th>Mean of INTMKT</th>
<th>INTERCEPT</th>
<th>LOWSUB</th>
<th>INTMKT</th>
<th>MODEL $\chi^2$ (D.F.) (P)</th>
<th>% Correctly Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (62 obs.)</td>
<td>0.403</td>
<td>0.516</td>
<td>N/A</td>
<td>-0.847</td>
<td>0.847*</td>
<td></td>
<td>2.60</td>
<td>59.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(-2.127)</td>
<td>(1.591)</td>
<td>(0.300–0.500)</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>2. (50 obs.)</td>
<td>0.380</td>
<td>N/A</td>
<td>0.600</td>
<td>-1.386</td>
<td></td>
<td>1.386**</td>
<td>4.80</td>
<td>62.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(-2.480)</td>
<td></td>
<td>(2.076) (0.200–0.500)</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>3. (50 obs.)</td>
<td>0.380</td>
<td>0.560</td>
<td>0.600</td>
<td>-1.454</td>
<td>0.164</td>
<td>1.344**</td>
<td>4.87</td>
<td>66.0</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>(-2.339)</td>
<td>(0.256)</td>
<td>(1.96) (0.344–0.382) (0.204–0.495)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>4. (31 obs.)</td>
<td>0.484</td>
<td>0.581</td>
<td>N/A</td>
<td>-0.811</td>
<td></td>
<td>1.263**</td>
<td>2.84</td>
<td>64.5</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(-1.349)</td>
<td></td>
<td>(1.637) (0.308–0.611)</td>
<td>(1)</td>
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</tr>
<tr>
<td>5. (25 obs.)</td>
<td>0.600</td>
<td>0.480</td>
<td>N/A</td>
<td>-0.811</td>
<td></td>
<td>3.209***</td>
<td>10.72</td>
<td>80.0</td>
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<td></td>
<td></td>
<td></td>
<td>(-1.349)</td>
<td></td>
<td>(2.663) (0.308–0.917)</td>
<td>(1)</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at 0.10 level or better in a one-tail test.
** Significant at 0.05 level or better in a one-tail test.
*** Significant at 0.01 level or better in a one-tail test.
See text for description of dataset.
entering firm's channel decision be stable, in order to preserve the pure channel structure after the firm's entry. This excludes six more observations where a firm which initially entered with a nonintegrated marketing facility switched one or two years later to an integrated facility. The fifth regression includes 25 observations and 18 firms.

The variables used in the regressions are all dummy variables. Their definitions are:

INT: equal to one when the firm sells the technology through an integrated sales office as of date of first sale of the technology in the foreign market in question; equal to zero when the firm first sells the technology through a marketing middleman (dependent variable in all regressions).

LOWSUB: equal to one for technologies in the component and materials segments; equal to zero for those in the equipment segment.

INTMKT: equal to one when all competitors in the foreign market used integrated marketing facilities as of year of entry for this firm; equal to zero when all competitors in the foreign market used marketing middlemen as of year of entry for this firm in this geographic market.

The variables used here to predict marketing channel choice are LOWSUB and INTMKT. LOWSUB is a proxy for the substitutability parameter \( \gamma \) in the model in this paper. Separation of the sample into low- and high-substitutability segments in this fashion may seem quite crude, but it has a technical basis. In interviews with executives from the companies in this dataset, we discovered that pieces of equipment are much more easily substituted for each other than are semiconductor components or materials. This is because the semiconductor production line is made up of several different machines, which are either not connected to each other at all or are connected only by what are called "wafer handlers." When one of the machines (say, a mask aligner) breaks down and must be replaced, or when a new line is being built up and a mask aligner must be purchased for it, it is relatively easy to substitute a new brand of machine for the one previously used. It is of course not costless to switch brands, but it is less costly to do so with equipment than with components or materials. For these products, the brand choice is much less reversible, since particular chips or brands of silicon or epoxy are designed into a whole system. Manufacturers have differentiated their products so that one brand of circuit or material is not perfectly interchangeable with another. While this proxy is clearly a crude one, it has the advantage of being objectively defined, rather than subjectively determined from interviewees' answers.

The variable INTMKT is used to control for the influence of pure channel structures on the channel decision of an entering firm. To the extent that entrants market their product through the same channel form as do incumbents, we cannot reject the hypothesis that marketing channels can be a means of cooperation among sellers. To the extent that pure channels are not stable, we can examine whether a different pure channel form establishes itself over time. There are in fact some interesting examples of this phenomenon, which are discussed below. The existence of such phenomena supports (but does not prove) the McGuire/Staelin approach which emphasizes the gaming aspect of marketing channel choice.

5.1. Interpretation of the Regressions

Because of the binary nature of the dependent variable INT, logit regression is performed on the data rather than ordinary least squares.\(^{13}\) Below each coefficient in Table 2 is listed its \( t \)-statistic, in parentheses. Below this is a range of probabilities in parentheses. The first is the estimated probability of integration, assuming that the

\(^{13}\) When the dependent variable is binary, ordinary least squares produces biased and inefficient estimates. See Kmenta (1971, pp. 425 ff.) and McFadden (1976) for discussions of the uses of logit.
independent variable in question equals zero and any other independent variable takes its mean value. The second assumes that the independent variable in question equals one and any other independent variable takes its mean value.

For instance, in regression 3, the mean of LOWSUB is 0.560. To calculate the effect which INTMKT has, first calculate the predicted probability of integration assuming INTMKT equals zero and LOWSUB equals 0.560:

\[
\ln\left\{ \frac{P(\text{INT})}{[1 - P(\text{INT})]} \right\} = -1.454 + 0.164 \cdot (0.560) + 1.344 \cdot (0) \rightarrow \\
P(\text{INT}) = 0.204,
\]

where \( P(\text{INT}) \) is the probability of marketing integration. Then calculate the same predicted probability, but assume INTMKT equals 1:

\[
\ln\left\{ \frac{P(\text{INT})}{[1 - P(\text{INT})]} \right\} = -1.454 + 0.164 \cdot (0.560) + 1.344 \cdot (1) \rightarrow \\
P(\text{INT}) = 0.495.
\]

These calculations yield a measure of the effect of the independent variable on the probability of integration; in this case, INTMKT has a strong effect on the predicted probability.

At the end of each line in Table 2, the model chi-square (\( \chi^2 \)) statistic is reported. It is defined as:

\[
\chi^2 = -2[(\text{Log likelihood at maximum}) - (\text{Log likelihood at } \beta = 0)].
\]

This variable has approximately the \( \chi^2 \) distribution with \( k \) degrees of freedom, where \( k \) is the number of parameters. The number in parentheses reported below the number of degrees of freedom is \( P \), the significance level of the model chi-square; it tells at what level the regression relationship is significantly different from random.

5.2. Empirical Results

The first question to be asked is whether we observe a negative relationship between the propensity to integrate and the substitutability of the product with those of competitors. The positive and predominantly significant coefficients on LOWSUB in Table 2 support the hypothesis in this data. Specifically, in regression 1 (which excludes observations with previous marketing experience and monopoly entrants), LOWSUB has a positive and significant coefficient, although only at the 10 percent level (i.e., firms selling the more differentiated products tended to integrate). In regression 3 (also excluding observations where a mixed marketing channel structure characterized the market at entry), LOWSUB remains positive but becomes insignificant in the presence of INTMKT (a cross-tabulation of LOWSUB and INTMKT implies some multicollinearity between them, the chi-square statistic being significant at the 6 percent level).

Regressions 4 and 5, which control for preservation of the pure channel structure upon initial entry and over the longer run, respectively, indicate the strongest relationship between LOWSUB and INT. Here, the question being answered is not so much whether LOWSUB is a good predictor of INT—indeed, these are all cases where INTMKT is a perfect predictor of INT. Rather, the question is whether the form of the pure marketing structure follows the rule predicted by the model in this paper. Indeed, those products characterized by a lower \( \gamma \) (those where LOWSUB equals one) are the ones more likely to be marketed through an integrated channel. This evidence supports the predictions of the model using the McGuire/Staelin demand function.

In examining whether the pure channel structure is preserved by new entrants, two pieces of information from Table 2 can be used. One, of course, is the significance of the coefficients of INTMKT in the reported regressions; the other is the number and type of firms which do not preserve the pure channel structure. INTMKT performs
very well in regressions 2 and 3, with the expected positive and significant coefficients: that is, the presence of a private channel structure at the time of entry makes it more likely that the entrant also uses an independent distributor or representative (i.e., a marketing middleman). Likewise, an integrated symmetric channel structure (INTMKT equal to one) is associated with integration for the entrant.

Perhaps just as interesting are the number and nature of the observations lost due to imposing the restriction that the entrant preserve the existing pure structure by choosing the same channel type as its competitors have. The criterion results in the exclusion of 19 observations, or 38 percent of the observations in regressions 2 and 3. Of these 19, 15 are cases where the entrant uses a private marketing channel when all of its competitors use integrated channels; only four are observations where the entrant integrates while its competitors use marketing middlemen. The 15 which do not integrate (although their competitors do) are primarily firms which are small, young, and probably face higher marketing costs of integrating than their competitors. This suggests that cost factors, which are left out here, have a nontrivial effect on marketing channel choice.

Observations where an entrant integrates when his incumbent competitors currently use middlemen pose another interesting possibility. The McGuire/Staelin gaming framework suggest that such actions, which turn a pure private channel structure into a mixed one, in general, result in competitors following suit until the channel becomes a pure integrated channel. While this may not have been as profitable for each firm as a pure private structure, given the fact that the structure has been broken, the only stable equilibrium structure is a pure integrated channel.

Two of the four observations of interest concern equipment firms whose competitors had only had about one year to react to the changed channel structure by 1980, when data collection ended. One of the four instituted a mixed channel structure, in which it has remained the sole integrated firm since 1974, a fairly stable structure. The last of the four was a component firm which did precipitate a change by both of the incumbents to an integrated channel, as well as inducing one of two later entrants to enter with an integrated marketing facility. The chronology of events was as follows (firms are denoted by capital letters only, to protect their confidentiality. Firm C is the one spoken of here):

1965: firm A entered, not integrated.
1967: firm B entered, not integrated.
1968: firm C entered, integrated.
1969: firm B integrated;
     firm D entered, not integrated.
1970: firm A integrated;
     firm E entered, integrated.

In this case, firm D was the smallest, newest firm, and probably faced differentially high costs of marketing integration.

A very similar pattern occurs for this product in two other market areas, and for another product in three market areas (these observations are among the ones excluded because the firm had prior distribution experience in the market in question). The major firms involved are the same in all cases, although the firm which first breaks the pure channel is not always the same one. It seems clear that these firms compete

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14 Specifically, only 3 of the 15 observations are technologies produced by large component firms; one of those firms is a high-power rectifier manufacturer which moved its product to Europe in 1954, before the European electronics market was well-developed. The other 12 observations are equipment technologies made in firms which were young (primarily less than five years old) at the time they moved the technologies overseas.
in their choice of channel as well as in variables such as price, and that the competitive story told in the McGuire/Staelin framework exists in some cases.

What can be concluded from this exercise? Although the proxy for substitutability is crude, it does indicate some support for the hypotheses that the probability of observing marketing integration is inversely related to the substitutability of the products, both in pure and mixed channels. Further, there is some support for the McGuire/Staelin notion of gaming in the choice of marketing channels, although in a larger number of markets, pure structures are quite stable. Finally, the financial cost of forming an integrated channel is significant, and should not be ignored when modeling channel system choice.

These results should not be taken as proof of the validity of one demand function or model form over another, but rather as some stylized facts which are consistent with a particular form of the model for one set of market segments. For a manager to use the model as a tool for picking a marketing channel, he would need first to estimate the parameters of the demand function, including \( \gamma \), the substitutability parameter. Information on own price, competitor's price (or the average price of competitors) and own quantity demanded is necessary to do this estimation.

Along with these estimates, the manager must decide whether the underlying assumptions of the model fit his industry. The industry should be characterized by small-numbers competition. The costs of using an integrated channel should not differ greatly from those of using a marketing middleman. Since the model ignores multi-product marketing economies of scale and dynamic learning economies in marketing, these factors should not be of overwhelming importance in the industry. Markets fitting this description include those for automobiles, home computers, and some types of industrial equipment. If these general restrictions are met, the model's predictions can be applied. The linear McGuire/Staelin demand example can be used to make more specific statements about channel choice than can the general functional form used throughout the paper (but this fact should alert the reader to the possibility that an application with nonlinear demand may not produce results consistent with the McGuire/Staelin predictions).

With better data, one could estimate the demand functions for each of the goods studied in an empirical investigation, and thus have a more powerful measure of the relationship between substitutability and channel choice. The Federal Trade Commission's Line of Business data may have a level of detail sufficient to support testing of the hypotheses in this paper. One researcher (Martin 1982) has used these data to study the profitability of wholesale trade. Currently, however, these data are available only to employees or researchers at the FTC who sign a confidentiality agreement not to reveal the names of the firms for whom data are used. In this section, the demand function was not estimated because of data limitations; hence caution is advised in interpreting the empirical results. One does not know whether the results imply that a particular functional form for demand is right, or whether the results are driven by the manner in which substitutability is measured. Nevertheless, in a sample where outside effects are as accurately controlled as possible, the model produces a verified prediction about the substitutability-channel relationship and about the stability of pure channel structures.

6. Conclusion

This paper examines the profit implications of different marketing strategies by manufacturers of substitutable products in a duopoly setting. Conditions determining the equilibrium channel structure (integrated or private) are developed, with the conclusion that marketing integration is not always the profit-maximizing channel
strategy for the manufacturers. Marketing middlemen can be profit-maximizing, even in the absence of cost advantages due to using middlemen.

Several results lead to the conclusion that the use of marketing middlemen can be means of increasing marketing channel profits. One is that price change effects on quantity demanded become weaker, the more channel members there are; this indicates that marketing middlemen inhibit manufacturers’ price-competing abilities. Another supporting result is that both the collusive equilibrium price and the equilibrium price in the presence of marketing middlemen exceed equilibrium price in the Nash integrated case, for products which are substitutable in demand. Finally, for demand structures where one product’s demand is strongly affected by changes in the other product’s price, high levels of substitutability imply that using middlemen is profit-maximizing. This is because the role of middlemen (to inhibit price competition between manufacturers) is more valuable, the more competitive the products.

A preliminary empirical analysis using interview data on the international semiconductor industry indicates support both for the pure channel structure assumption and for an inverse relationship between substitutability and the probability of marketing integration. Certain examples of competition in marketing channel structures also support the noncooperative view of channel choice, where the channel structure progresses from an all-private one to a mixed one, and finally to a wholly integrated structure. While the analysis seeks to control for other factors which probably have a strong effect on channel choice, the control is clearly not perfect, nor is the measurement of substitutability of products very refined. Nevertheless, the preliminary results support the notion of a predictable relationship between substitutability and optimal channel choice.

The primary limitations of this analysis are that it ignores the transactions costs of dealing with marketing middlemen and that it ignores the specific benefits and services arising out of the use of marketing middlemen. Economics of scale or scope therefore are not considered, nor do we consider the possibility of using more than one level of middlemen. It also does not permit a truly dynamic analysis of channel choice, and hence does not give insights into the optimal progression of a channel over time as demand grows or costs fall. These limitations will be considered in future research efforts. However, the results of this analysis are still valuable because of their identification of the role of marketing middlemen as a means of decreasing competition between manufacturers and because of the empirical support lent to the analytical hypotheses.15

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