

Managing a Distribution Channel Under Asymmetric Information with Performance Requirements

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In this paper we study how performance requirements may improve the working of a distribution channel when the retailer is better informed about demand conditions than the manufacturer. *Performance requirements* means that the manufacturer and retailer agree to (1) have the manufacturer set requirements on retail price or service or both, and (2) jointly invest in the information systems required to monitor the retailer's compliance with the requirements. We show that performance requirements on price and service will improve channel performance. But if requirements cannot be set on both performance dimensions, the choice among the remaining options is not straightforward. Price requirements may be worse than no requirements, and service requirements no better. The central problem with setting requirements on only one dimension is that the retailer then behaves suboptimally on the other. Between the two partial options, service requirements are better than price requirements in aligning the interests of the manufacturer and the retailer, whereas price requirements are better at inducing the retailer to reveal his demand.

(Pay-for-Performance; Distribution Channels)

1. Introduction

Distribution channels are the marketing intermediaries that take a product from the manufacturer to the end-users. They provide a variety of services. For example, in a typical distribution channel for a packaged good, the manufacturer sells to retailers, who in turn sell to consumers. The retailer breaks bulk, holds inventories, provides shelf space, promotional displays, advertising, one-stop shopping, and generally a pleasant shopping environment. All of these activities enhance the demand for the manufacturer's product.

A central feature of distribution channels is that the retailer is closer to the consumer than the manufacturer. Therefore, he is often better informed about demand conditions than the manufacturer. This is especially true today because automated electronic scanner check-out systems provide *daily* information

about demand conditions to retailers (Messinger and Narasimhan 1995).

The issue we look at in this paper is how a manufacturer and a retailer should *structure* the marketing arrangements between them so that, even with each party acting in its own interest, the channel as a whole performs optimally. The marketing arrangements we have in mind are three types of retail performance requirements: (1) price, (2) service, and (3) price and service. With price requirements, the retailer is required to charge a certain price, but is free to set his service level as he pleases. With service requirements, the retailer is required to provide a certain level of service, but there is no restriction on his price. With price and service requirements, the retailer has no discretion at all. Each type of requirement may be associated with a different information system to monitor compliance with re-

quirements. Given the costs of these information systems, is any form of requirement better than no requirements at all? If the answer is yes, what form should it take: price requirements, service requirements, or both?

Our study is motivated by the rapid growth of channel partnerships and information technology (Clemons and Row 1992, Buzzell and Ortmeier 1995). Examples of such initiatives include electronic data interchange (EDI), efficient customer response (ECR), continuous product replenishment (CPR), and category management (Wang and Seidmann 1995). *The Progressive Grocer* (December 1994) reports that vendors to Wal-Mart "can now tap into daily product movement information via Wal-Mart's data-based, scanner-accumulated Retail Link system." Clemons and Row (1992) note that McKesson's Economost system—McKesson is a large drug wholesaler selling to retailers—"offers the drug store lower prices, electronic ordering, preprinted price and shelf tags, and management reports." Curry (1993, p. 133) documents the variety of "single-source retail data" available on-line to manufacturers from independent market research firms like IRI and Nielsen.

The first question to ask in assessing the benefits and costs of performance requirements is, whose benefits and whose costs? We use the Pareto criterion. Both manufacturer and retailer must be at least as well off in any new arrangement as in their status quo position, and at least one of them should be strictly better off. This makes sense, because performance requirements require investments in information systems, and those investments will not be made unless both parties cooperate (Bakos and Brynjolfsson 1993).¹ We take "complete delegation," i.e., no requirements, as the status quo position. The two parties will revert to this if they cannot agree on a performance requirements system.

¹ Subsequent noncooperative behavior is possible, and indeed expected. For example, after the partnership has been established and the necessary information systems set up, the day-to-day transactions will involve noncooperative behavior. The manufacturer will be choosing wholesale prices and franchise fees to maximize his own profit, and the retailer will be choosing prices and service levels—to the extent allowed by the performance requirements—to maximize his own profit.

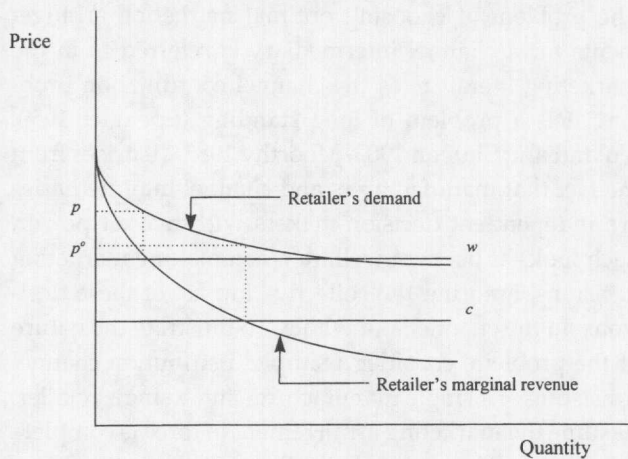
The Channel Coordination Problem

The problem of choosing optimal marketing arrangements for a channel intermediary is referred to in the marketing literature as the channel coordination problem; it is a problem of long standing (Spengler 1950, Jeuland and Shugan 1983, Moorthy 1987). It arises from the fact that manufacturers and channel intermediaries are independent decision-makers with market power. Each looks at his own welfare when making marketing decisions, ignoring the collective impact of these decisions on the channel as a whole. To illustrate the nature of the problem, consider a simple distribution channel consisting of a single manufacturer and a single retailer. Assume the marketing arrangement in force is complete delegation. The optimal retail price that maximizes channel profits—the sum of manufacturer's profits and retailer's profits—is given by p^o , the price that a vertically integrated retailer would set, but absent vertical integration, the manufacturer sells the product to the retailer at a wholesale price w , after taking a markup of $w - c$ (c is the manufacturer's marginal cost). The retailer, in turn, takes a markup of $p - w$, selling the product to consumers at p (we are assuming here that the retailer's marginal cost of providing retail services is negligible). See Figure 1. Because the manufacturer sets $w > c$ (in order to make money), the retailer sets p too high; i.e., higher than p^o . A similar problem arises in getting the retailer to provide optimal service to consumers. Once again, the service level that maximizes channel profits is defined by the vertically integrated channel, say s^o , but given $w > c$ in a nonvertically integrated channel, the retailer provides too little service.

Simple solutions to the channel coordination problem that work within the framework of complete delegation are well-known. Jeuland and Shugan (1983) suggest that the manufacturer offer a quantity discount scheme that will generate a marginal cost curve for the retailer intersecting the retailer's marginal revenue curve at c . Simpler still, Moorthy (1987) recommends that the manufacturer employ a two-part tariff, where the product is sold to the retailer at the manufacturer's marginal cost c and a franchise fee is charged to divide the channel's profits between the manufacturer and the retailer.

Neither of these solutions works, however, if the retailer is better informed about demand conditions than the manufacturer—the common situation as argued

Figure 1 Illustrating the Channel Coordination Problem



above.² In the case of the Jeuland-Shugan scheme, the manufacturer has to know the demand curve in order to compute p^o and s^o . In the case of the Moorthy scheme, the manufacturer has to know the demand curve in order to determine the magnitude of the franchise fee. If the fee is too low, the manufacturer may leave money on the table; if the fee is too high, the retailer may refuse to carry the product. In other words, if the manufacturer's contract does not induce the retailer to reveal his true demand situation—what is referred to in the literature as the “demand revelation” problem (Myerson 1979)—then the retailer may extract informational rents from his private information.³

Similar problems arise when the manufacturer is selling through multiple, noncompeting heterogeneous retailers—heterogeneous in the demand conditions they face—even if the manufacturer knows each retailer's demand function. In principle, the manufacturer could now offer retailer-specific Jeuland-Shugan or

Moorthy schemes, but the Robinson-Patman Act will prevent such direct price discrimination. The alternative is to offer a menu of contracts and allow each retailer to self-select the actual contract under which he operates. But then the heterogeneous retailers, known demand case reduces to the single retailer, unknown demand case. In what follows, we will concentrate on the single retailer, unknown demand interpretation while keeping in mind that it also applies to a channel system with non-competing heterogeneous retailers whose demand is known to the manufacturer.

Preview of Our Results

This paper offers performance requirements as a solution to the problem just described. Our logic is as follows. With no performance requirements, we have seen that a single franchise fee along with a wholesale price equal to the manufacturer marginal cost, while providing the right performance incentives to the retailer, does not promote demand revelation. Either the contract is not accepted or the manufacturer fails to maximize his profit. On the other hand, if the manufacturer offers a menu of franchise-fee contracts, while it is possible to get demand revelation, at least one of the contracts must have a wholesale price greater than the manufacturer's marginal cost and channel performance will suffer—service provided will be too low, price too high (Katz 1989). Performance requirements—with direct monitoring to ensure retailer compliance—seem to have the potential to control the retailer's behavior directly while letting the wholesale prices and franchise fees focus solely on the demand revelation problem. Do they really work?

We show that the answer is both yes and no. Performance requirements on both retail price *and* service do indeed deliver the highest channel profits (gross of the costs of the information systems involved). Retail price and service are restored to the levels one would get if there were no asymmetric information. So if the cost of the information systems involved is not large, a complete performance requirements arrangement, with price and service requirements, is indicated. On the other hand, the manufacturer and the retailer need to be much more skeptical about partial requirements. Neither price requirements nor service requirements, by themselves, are clearly better than no requirements—

² They also do not work if the manufacturer doesn't know the retailer's costs (see Crocker 1983, Rey and Tirole 1986). In this paper, however, we will focus on demand uncertainty.

³ The asymmetric information situation modeled here is different from the one studied by Rey and Tirole (1986). They assume that the retailer gets private information about demand only after the contracts have been signed with the manufacturer. In contrast, we assume that the retailer has superior information about demand at the contracting stage. While both informational situations are possible, we believe our model represents the real world better because manufacturer-retailer contracts are usually short-term.

even without the costs of an information system factored in. Depending on the probability of high demand conditions, service requirements may be no better than no requirements (and considering information system costs, strictly worse), and price requirements often worse. On the other hand, demand conditions may be such that both service requirements and price requirements are better than no requirements. The difference between service requirements and price requirements, we find, is that the former is stronger in aligning the interests of the manufacturer and retailer—thus enabling better downstream performance—whereas price requirements are stronger than service requirements in handling the demand revelation problem. As demand becomes increasingly responsive to service, downstream performance becomes increasingly important, and the area of superiority of service requirements over price requirements increases.

Our results are in sharp contrast to Gal-Or's (1991) results. She argues that price requirements are optimal even when the retailer has private information at the contracting stage. However, her model does not consider provision of retail service. We show that when demand is affected by both price and service, and the marketing agreement covers only price requirements, then the retailer will choose suboptimal service. This result is reminiscent of Holmstrom and Milgrom's (1991) observations in the principal-agent model. They argue that when agent performance has multiple dimensions and only some of them are observable, then the principal may be better off not basing his compensation scheme entirely on the observable dimensions. Blair and Lewis (1994) examine a setting very similar to ours, except they look at price and quantity requirements, not price and service requirements.

The rest of this paper is organized as follows. In §2 we describe our model. In §3 we analyze the benchmark case: no performance requirements. Section 4 begins our analysis of various performance requirements with price requirements, and then proceeds in turn to service requirements and price and service requirements. Section 5 compares the various schemes and presents our main proposition. In §6 we discuss the implementation issues related to performance requirements. Section 7 concludes the paper. (Proofs are in an appendix, available separately from the authors.)

2. Model

Consider a manufacturer, M , selling his product through a retailer, R . The demand, D , for M 's product at retail depends on the price charged by the retailer, p , the service provided by the retailer, s , and local demand conditions, α . We assume that:

$$D(p, s) = \alpha - \beta p + \gamma \sqrt{s} \quad (\alpha, \beta, \gamma > 0),$$

which reduces to:

$$D(p, s) = \alpha - p + \gamma \sqrt{s} \quad (\gamma < 2),$$

when we normalize β to 1 without loss of generality (the unit of measurement of quantity being arbitrary). α here refers to any local demand factors that are known only to the retailer. For example, it could represent the size of the local market, local tastes, or the strength of the retailer's private-label brand.

The retailer has two decision variables when he operates under no requirements: price and service. Service refers to the dollars expended by the retailer on demand-enhancing activities, which can be things like presales advice, after-sales service, holding inventory (which reduces the probability of stock-outs), in-store advertising (shelf-space, promotional displays), and media advertising (e.g., feature advertising). It will appear as a fixed cost in the retailer's profit function because these activities are largely fixed in nature.⁴ For example, in-store displays have a fixed cost, independent of volume. Media advertising such as feature ads costs the same regardless of quantity sold. The opportunity cost of the shelf-space given to a product is fixed because it is determined by the profits obtainable from the "next best product." After-sales services are fixed costs because they largely depend on investments in facilities and manpower. The fact that service is a fixed cost means that there is a fundamental difference between price and service. While both affect demand, only price affects the retailer's margin. This feature will play a significant role in determining how price and service requirements work.

⁴ Note that retailer fixed costs arise endogenously in our model, through service, unlike in Ingene and Parry (1995).

Our demand function is meant to capture three key empirical regularities: (1) demand is decreasing in price, (2) demand is increasing in service, and (3) there are diminishing returns to service. The specific functional form we have used has these properties and is tractable; for other examples of similar specifications see Naert and Leeflang (1978), Winer (1980), Gasmi et al. (1992), and Wang and Seidmann (1995).⁵

The manufacturer does not know α at the time of contracting with the retailer, whereas the retailer does. We assume that α can take one of two values, $\{\alpha_L, \alpha_H\}$, with $\alpha_H > \alpha_L > 0$, and the manufacturer knows this. Further, he assesses the probability of α_H to be $\phi > 0$. We will call the situation where the retailer's demand conditions are α_L , a type-L retailer, and the other situation, a type-H retailer.

We assume that the interaction between the manufacturer and the retailer happens in two stages. First, they jointly negotiate a *marketing agreement*. Second, the manufacturer announces a menu of wholesale price-franchise fee contracts $\{(w, F)\}$ and asks the retailer to choose one.⁶ Everyday transactions will be governed by the contract chosen, under the overall framework of the marketing agreement already signed. As discussed in the introduction, the marketing agreement can be of one of four types: (1) no performance requirements, (2) price performance requirements, (3) service performance requirements, and (4) price and service perfor-

mance requirements. The separation of the marketing agreement decision from the wholesale price-franchise fee decision, and the temporal precedence of the former, is meant to suggest that marketing agreements are more of a strategic long-term decision than wholesale prices. This makes sense because a marketing agreement involving any form of performance requirement will entail substantial investments in information systems.

Our method of analysis will be to first assume that a marketing agreement is already in place, and then examine the manufacturer's and retailer's second-stage decisions. In this second stage, the manufacturer will be taken as the Stackelberg leader: he will announce a menu of franchise fee-wholesale price contracts and the performance requirements called for by the marketing agreement (if any). The retailer will take these as given and, depending on the marketing agreement, choose whatever retail variable he has discretion over.⁷ In making these decisions, the manufacturer and retailer will be maximizing their own expected profits. Once the second-stage equilibrium has been computed, we back up to the first stage and ask what the optimal marketing agreement should be. In choosing the optimal marketing agreement we will be using expected channel profits as the criterion, because if one marketing agreement yields higher expected channel profits than another, it is possible to negotiate the former so that *both* parties

⁵ Another common formulation in the literature is the demand function $\alpha - p + s$ paired to a cost function $s^2/2$ (Lal 1990, Gal-Or 1991, Dutta et al. 1994). Here s is not in dollars, but in units of service. An earlier version of this paper used this formulation and the results were similar to what we report now.

⁶ Inclusion of franchise fees in manufacturer-retailer contracts has a long history in the literature (Jeuland and Shugan 1983, Rey and Tirole 1986, Moorthy 1987). In the present context, it has two effects. First, it presents the no-performance-requirements agreement in the best possible light, giving us a conservative posture in choosing any of the performance-requirements agreements. Without franchise fees, the no-performance requirements case will perform considerably worse than it does with franchise fees; see below under "no performance requirements." On the other hand, the performance of the other schemes is less affected by going from franchise fees to no franchise fees because of the additional controls available. See the discussion under the price-and-service-requirements case. The other effect of franchise fees is to provide a mechanism for dividing the profits from everyday transactions between the manufacturer and the retailer.

⁷ The manufacturer as a Stackelberg leader in the second stage makes sense for a variety of reasons, chief among them being that the retailer as Stackelberg leader is: (1) difficult to operationalize, and (2) unrealistic. If the retailer were to move first and announce a retail price, then the manufacturer's best response will be to charge a wholesale price as close as possible to the retail price, leaving just enough retail profit to keep the retailer interested. In other words, instead of increasing the retailer's power, Stackelberg leadership reduces it. A similar problem will arise even in a simultaneous-moves formulation. A "theoretical fix" to this problem is to have the retailer announce a margin. The retailer is essentially telling the manufacturer: "Whatever price you charge, I will add \$X to it." But this seems very unrealistic, for one thing because if different retailers announce different margins, the manufacturer's wholesale price responses will be different—even under identical demand conditions for the retailers—and this will violate the Robinson-Patman Act. In the asymmetric information situation, the retailer announcing margins may *signal* his demand conditions—something the retailer does not want to do because his bargaining power comes from keeping the manufacturer guessing.

are better off. This is the Pareto optimality criterion mentioned in the introduction.

3. Managing a Channel Without Performance Requirements

Without performance requirements, the manufacturer has no direct control over the retailer's choice of service, s , or price, p . All that the manufacturer can do is encourage desirable retailer behavior by choosing his wholesale price and franchise fee appropriately. The retailer will take the wholesale price and franchise fee as given and choose his price and service levels to maximize his profits.

Consider first what happens when there is complete information, i.e. both the retailer and the manufacturer know the realization of α at the time of contracting. Suppose the manufacturer offers the contract $\{w_H, F_H\}$ when α_H is realized and the contract $\{w_L, F_L\}$ when α_L is realized. In choosing these contracts, the manufacturer must:

- (i) provide the retailer at least his reservation level of profits (which we normalize to zero) in both demand conditions; and,
- (ii) realize that his profits depend on the service and price chosen by the retailer, which in turn depend on the wholesale price offered (because no performance requirements are in force).

Given $\{w_i, F_i\}$, $i = L, H$, the type i retailer chooses (s, p) to maximize the retail profit function, π^R :

$$\pi^R = (p - w_i)(\alpha_i - p + \gamma\sqrt{s}) - s - F_i.$$

The first-order conditions of this problem yield:

$$p_i = \frac{\alpha_i + \gamma\sqrt{s_i} + w_i}{2}, \quad (1)$$

$$s_i = \left[\frac{\gamma(p_i - w_i)}{2} \right]^2. \quad (2)$$

Note that:

1. The second-order necessary conditions for a maximum are satisfied because $2 > \gamma$.
2. The retailer's price is increasing, and his service level decreasing, in wholesale price.

3. The retailer's price is increasing in service level, and his service level is increasing in retail price. In other words, retail price and service are complements: the higher the one, the higher the other. This fact will play an important role when we discuss partial performance requirements.

4. For given wholesale price and service levels, the higher α is, the higher the retail price chosen by the retailer. On the other hand, for given wholesale and retail prices, the retailer's choice of service level is independent of α . This fact will also play an important role below.

5. For a given wholesale price, the higher γ is, the greater the price and service levels chosen by the retailer.

Solving for price and service as a function of wholesale price, we get:

$$p_i = \frac{2\alpha_i + w_i(2 - \gamma^2)}{4 - \gamma^2}, \quad (3)$$

$$s_i = \left[\frac{\gamma(\alpha_i - w_i)}{4 - \gamma^2} \right]^2. \quad (4)$$

Anticipating these choices, the manufacturer's problem is to choose $\{(w_i, F_i)\}_{i=H,L}$ so that his profits, π^M , are maximized and the retailer gets at least his reservation level of profits:

$$\pi_i^M = (w_i - c)D_i(p_i, s_i) + F_i \quad (i = H, L).$$

The solution is to maximize channel profits—the total pie—because the manufacturer can always extract all of it for himself by setting the franchise fees so that the retailer gets nothing more than his reservation profits. See Figure 1 and Moorthy (1987). Channel profits, π^C , are the manufacturer's profits plus the retailer's profits, i.e.:

$$\pi_i^C = (p_i - c)D_i(p_i, s_i) - s_i \quad (i = H, L),$$

where, if we substitute from (3) and (4), we get

$$\pi_i^C = \frac{(\alpha_i - w_i)(\alpha_i + w_i - 2c)}{4 - \gamma^2}, \quad (5)$$

which is decreasing in w_i . So the optimal solution involves $w_L = w_H = c$, where c is the manufacturer's marginal cost. The franchise fees that extract the retailer's profits will be such that $F_H > F_L$.

Of course this solution cannot be implemented under asymmetric information. If only the retailer knows the realization of α at the time of contracting, and the manufacturer offers the menu $\{(c, F_L), (c, F_H)\}$ ($F_L < F_H$), from which the retailer is to pick one contract, then, regardless of α , the retailer will pick (c, F_L) . If the manufacturer offers only (c, F_L) , then, too, the same thing will happen. In either case, the manufacturer leaves money on the table if α_H is the true state of demand. On the other hand, if he offers only (c, F_H) , then there is the possibility, if α_L is realized, that the retailer will reject the contract. This is the "demand revelation" issue alluded to earlier.

These observations illustrate the central tension in the model. Optimal channel performance in the sense of maximum channel profits requires $w_L = w_H = c$, but demand revelation requires otherwise. What is the best compromise under these circumstances? It is easy to show that the best the manufacturer can do is offer the following menu of franchise fee-wholesale price contracts and ask the retailer to pick one:

$$w_H = c,$$

$$F_H = \begin{cases} \frac{2\phi(\alpha_H - \alpha_L)^2 + (1 - \phi)(\alpha_L - c)^2}{(1 - \phi)(4 - \gamma^2)} & \text{if } \phi < \phi_n^*, \\ \frac{(\alpha_H - c)^2}{(4 - \gamma^2)} & \text{if } \phi_n^* \leq \phi, \end{cases}$$

$$w_L = \begin{cases} c + \frac{\phi(\alpha_H - \alpha_L)}{1 - \phi} & \text{if } \phi < \phi_n^*, \\ c & \text{if } \phi_n^* \leq \phi, \end{cases}$$

$$F_L = \begin{cases} \frac{((1 - \phi)(\alpha_L - c) - \phi(\alpha_H - \alpha_L))^2}{(1 - \phi)^2(4 - \gamma^2)} & \text{if } \phi < \phi_n^*, \\ \frac{(\alpha_H - c)^2}{4 - \gamma^2} & \text{if } \phi_n^* \leq \phi. \end{cases} \quad (6)$$

The menu has been designed to maximize the manufacturer's expected profits subject to the constraints that: (1) the type- H retailer pick the contract (w_H, F_H) and the type- L retailer pick the contract (w_L, F_L) , and (2) both types of retailer make nonnegative profits. The retailer's

choice of price and service are given by Equations (3)–(4).

$$p_H = \frac{2\alpha_H + c(2 - \gamma^2)}{4 - \gamma^2}, \quad s_H = \frac{\gamma^2(\alpha_H - c)^2}{(4 - \gamma^2)^2},$$

$$p_L = \begin{cases} \frac{2\alpha_L + (2 - \gamma^2)\left(c + \frac{\phi(\alpha_H - \alpha_L)}{1 - \phi}\right)}{4 - \gamma^2} & \text{if } \phi < \phi_n^*, \\ \alpha_L & \text{if } \phi_n^* \leq \phi, \end{cases}$$

$$s_L = \begin{cases} \frac{\gamma^2\left(\alpha_L - c - \frac{\phi(\alpha_H - \alpha_L)}{1 - \phi}\right)^2}{(4 - \gamma^2)^2} & \text{if } \phi < \phi_n^*, \\ 0 & \text{if } \phi_n^* \leq \phi. \end{cases} \quad (7)$$

The conditions involving ϕ_n^* determine whether or not the manufacturer serves both types of retailer. If $\phi \geq \phi_n^*$, the manufacturer chooses not to serve the type- L retailer— F_L is such that the type- L retailer will make less than his reservation profits by participating⁸—because doing so limits the amount of profit he can extract from the type- H retailer via F_H . If F_H is too large, then the type- H retailer may prefer to masquerade as a type- L retailer. (This is why the F_H under $\phi < \phi_n^*$ does not extract all of the type- H retailer's profits; he ends up making higher-than-reservation-level profits.) So, when the prior probability of the retailer being type- H is high, the manufacturer would rather forego the profits from the type- L retailer and extract the maximum possible from the type- H retailer.

Note that the manufacturer charges a wholesale price equal to marginal cost to the type- H retailer whereas he charges a wholesale price greater than marginal cost to the type- L retailer (when he is served, that is). We argued earlier that demand revelation requires at least one wholesale price greater than marginal cost. Why does the manufacturer choose the type- L retailer's wholesale price to do this?

⁸ In this situation, the menu of contracts is not really a menu because only one of the contracts is ever chosen. This result is analogous to Ingene and Parry's (1995) result that with heterogeneous fixed costs among retailers, it is sometimes optimal not to offer a menu of contracts.

The manufacturer realizes that a wholesale price greater than marginal cost will induce suboptimal price and service choices by the retailer (cf. (5)). The amount of suboptimality will be greater from the type- H retailer than from the type- L retailer because demand is higher for a type- H retailer. Stated differently, the gain in profit from having the type- H retailer behave optimally is more than the gain in having the type- L retailer behave optimally.⁹

We turn to the question of whether direct controls on retailer performance via performance requirements can improve channel performance while providing adequate incentives for the retailer to reveal demand.

4. Managing the Channel with Performance Requirements

We consider price requirements, service requirements, and price and service requirements, in that order.

4.1. Price Requirements

The manufacturer will now require a certain price from the retailer, and we assume that information systems are in place so that the retailer will indeed perform as asked. In effect, the price decision is being taken out of the retailer's hands. But he can still choose his service level freely. The manufacturer's task is to design a menu of contracts, $\{(w_i, F_i, p_i)\}_{i=L,H}$, that maximizes his expected profits, subject to the constraints: (1) the type- H retailer picks the contract (w_H, F_H, p_H) and the type- L retailer picks the contract (w_L, F_L, p_L) , and (2) both types of retailer make non-negative profits.

The solution is to offer the following menu:

$$w_H = c, \quad w_L = \begin{cases} c + \frac{2\phi(\alpha_H - \alpha_L)}{\gamma^2(1 - \phi)} & \text{if } \phi < \phi_p^* \\ \frac{c + \alpha_L}{2} & \text{if } \phi_p^* \leq \phi, \end{cases}$$

⁹ Note that if franchise fees were prohibited, the situation would be even worse. Both wholesale prices would need to be greater than c , and that will adversely affect the performance of the type- H retailer.

$$F_H = \begin{cases} \frac{\left(1 + \frac{8\phi}{\gamma^2(1 - \phi)}\right)(\alpha_H - \alpha_L)^2 + (\alpha_L - c)^2}{4 - \gamma^2}, & \text{if } \phi < \phi_p^* \\ \frac{(\alpha_H - c)^2}{4 - \gamma^2} & \text{if } \phi_p^* \leq \phi, \end{cases}$$

$$F_L = \begin{cases} \frac{(\alpha_L - c)\left(\alpha_L - c - \frac{4\phi(\alpha_H - \alpha_L)}{\gamma^2(1 - \phi)}\right)}{4 - \gamma^2} & \text{if } \phi < \phi_p^* \\ 0 & \text{if } \phi_p^* \leq \phi, \end{cases}$$

$$p_H = \frac{2\alpha_H + c(2 - \gamma^2)}{4 - \gamma^2},$$

$$p_L = \begin{cases} \frac{2\alpha_L + c(2 - \gamma^2) - \frac{2\phi(\alpha_H - \alpha_L)}{1 - \phi}}{4 - \gamma^2} & \text{if } \phi < \phi_p^* \\ \frac{c + \alpha_L}{2} & \text{if } \phi_p^* \leq \phi, \end{cases} \quad (8)$$

from which the retailer will pick the H -contract if he is type- H and the L -contract if he is type- L . He will then choose the following service levels:

$$s_H = \frac{\gamma^2(\alpha_H - c)^2}{(4 - \gamma^2)^2},$$

$$s_L = \begin{cases} \frac{\left(\gamma(\alpha_L - c) - \frac{4\phi(\alpha_H - \alpha_L)}{\gamma(1 - \phi)}\right)^2}{(4 - \gamma^2)^2} & \text{if } \phi < \phi_p^* \\ 0 & \text{if } \phi_p^* \leq \phi. \end{cases} \quad (9)$$

For the type- H retailer, there is no difference between this contract and the contract offered without performance requirements—even the price requirement is the same as what the retailer would have chosen on his own—with the sole exception of the franchise fee. The franchise fee is higher now because switching to the

type-*L* retailer's contract is less attractive for the type-*H* retailer than before; the manufacturer is able to raise the franchise fee and still prevent switching. The type-*L* contract comes with a retail price requirement, and this price is lower than what the type-*L* retailer would have chosen without requirements. As shown by (1), the type-*H* retailer's natural preference is for a higher retail price than a type-*L* retailer, *ceteris paribus*. On the wholesale price side, w_L is higher than before if and only if $\gamma^2 < 2$. The net result is that the margin ($p_L - w_L$) is lower than before for all values of γ . So if the type-*H* retailer were to masquerade as a type-*L* retailer, he will end up choosing a lower service level (cf. (2)). The combination of lower service level and lower retail price makes masquerading as a type-*L* retailer unattractive.

Channel performance under type-*L* conditions is mixed. On the positive side, the manufacturer is moving the retailer's price in the direction of the complete information optimum. On the negative side, because of the complementarity between price and service (see (2)), the retailer moves the service level away from the complete information optimum. Whether channel profits increase or decrease with price requirements is therefore an open question, which we will take up in §5.

4.2. Service Requirements

With service requirements, the manufacturer's task is to design a menu of contracts, $\{(w_i, F_i, s_i)\}_{i=H,L}$, that maximizes his expected profits, subject to the constraints: (1) the type-*H* retailer pick the contract (w_H, F_H, s_H) and the type-*L* retailer pick the contract (w_L, F_L, s_L) , and (2) both types of retailer make nonnegative profits. Note that service levels are being set by the manufacturer as part of the contracting process, and only price is being delegated to the retailer. The appendix shows that the solution to this problem is to offer the menu:

$$w_H = c, \quad w_L = \begin{cases} c + \frac{\phi(\alpha_H - \alpha_L)}{1 - \phi} & \text{if } \phi < \phi_s^*, \\ \alpha_L & \text{if } \phi_s^* \leq \phi, \end{cases}$$

$$F_H = \begin{cases} \frac{\left(\frac{\gamma^2}{4} + \frac{2\phi}{1 - \phi}\right)(\alpha_H - \alpha_L)^2 + (\alpha_L - c)^2}{4 - \gamma^2}, & \text{if } \phi < \phi_s^*, \\ \frac{(\alpha_H - c)^2}{4 - \gamma^2} & \text{if } \phi_s^* \leq \phi, \end{cases}$$

$$F_L = \begin{cases} \frac{\left(\alpha_L - c - \frac{\phi(\alpha_H - \alpha_L)}{1 - \phi}\right)^2}{4 - \gamma^2} & \text{if } \phi < \phi_s^*, \\ 0 & \text{if } \phi_s^* \leq \phi, \end{cases}$$

$$s_H = \frac{\gamma^2(\alpha_H - c)^2}{(4 - \gamma^2)^2},$$

$$s_L = \begin{cases} \frac{\gamma^2\left(\alpha_L - c - \frac{\phi(\alpha_H - \alpha_L)}{1 - \phi}\right)^2}{(4 - \gamma^2)^2} & \text{if } \phi < \phi_s^*, \\ 0 & \text{if } \phi_s^* \leq \phi, \end{cases} \quad (10)$$

from which the retailer will pick the *H*-contract if he is type-*H* and the *L*-contract if he is type-*L*. He will then choose the following price levels:

$$p_H = \frac{c(2 - \gamma^2) + 2\alpha_H}{4 - \gamma^2},$$

$$p_L = \begin{cases} \frac{(2 - \gamma^2)\left(c + \frac{\phi(\alpha_H - \alpha_L)}{1 - \phi}\right) + 2\alpha_L}{4 - \gamma^2} & \text{if } \phi < \phi_s^*, \\ \alpha_L & \text{if } \phi_s^* \leq \phi. \end{cases} \quad (11)$$

Once again, for the type-*H* retailer, there is no difference between this contract and the contract offered without performance requirements, except that the franchise fee is higher. But the type-*L* retailer's contract, and the actions he takes, are all identical to the no-requirements case. How, then, is the manufacturer able to charge a higher franchise fee to the type-*H* retailer? Switching to the type-*L* contract is not as attractive as it was in the no-requirements case because the type-*L* contract comes with a service requirement. At the wholesale price being charged the type-*L* retailer, the type-*H* retailer would have chosen a higher price level and a higher service level (cf. (1), (2)), but now he is prevented from doing so. The reduced attractiveness of the type-*L* contract because of the service requirement allows an increase in the type-*H* retailer's franchise fee.

4.3. Price and Service Requirements

With price and service requirements, the manufacturer's task is to design a menu of contracts, $\{(w_i, F_i, p_i, s_i)\}_{i=H,L}$, that maximizes his expected profits, subject to the constraints (1) the type- H retailer picks the contract (w_H, F_H, p_H, s_H) and the type- L retailer picks the contract (w_L, F_L, p_L, s_L) , and (2) both types of retailer make non-negative profits.

The solution is obvious. The manufacturer will specify the complete-information levels of price and service, set $w_H = p_H$, $w_L = p_L$, and pay each type of retailer a fixed payment F_i ($i = L, H$) just enough to compensate them for the service rendered. Note that this set of contracts automatically takes care of the demand revelation problem: the type- H retailer will not gain from masquerading as the type- L retailer because his net profit will be zero in that contract as well. The optimal menu of contracts, then, is

$$\begin{aligned} w_H &= p_H, & w_L &= p_L, \\ F_H &= -s_H, & F_L &= -s_L, \\ p_H &= \frac{2\alpha_H + c(2 - \gamma^2)}{4 - \gamma^2}, & p_L &= \frac{2\alpha_L + c(2 - \gamma^2)}{4 - \gamma^2}, \\ s_H &= \frac{\gamma^2(\alpha_H - c)^2}{(4 - \gamma^2)^2}, & s_L &= \frac{\gamma^2(\alpha_L - c)^2}{(4 - \gamma^2)^2}, \end{aligned} \quad (12)$$

from which the retailer is asked to select one contract. Given the design of the menu, the retailer will choose (w_L, F_L, p_L, s_L) under type- L conditions, and (w_H, F_H, p_H, s_H) otherwise.

The performance requirements are exactly the same as under complete information, i.e., (3)–(4) with c substituted for w_i . This means that channel profits are identical to the channel profits under complete information. The wholesale prices and franchise fees are, however, different from what they were under complete information. In particular, both wholesale prices are much greater than c . The manufacturer is not worried about the retailer reacting adversely to a wholesale price greater than c because the performance requirements assure retail performance. So the wholesale prices essentially squeeze out the entire retail margin. The franchise fees are negative: the manufacturer pays each type

of retailer just enough to compensate for the service they provide.¹⁰

5. Choosing the Right Marketing Agreement

Now that we know what the manufacturer and retailer will do under each type of marketing agreement, we can return to the first stage of their relationship and ask what kind of marketing agreement they will sign. Let us look at the manufacturer's and retailer's expected profits under each of the four possible marketing agreements (Figure 2).¹¹

Using the subscripts N, P, S , and PS to indicate the four types of agreements, and the superscripts M and R to denote the manufacturer and retailer, respectively, we get the following preference orderings:

$$\begin{aligned} \pi_{PS}^M &> \pi_P^M \geq \pi_S^M \geq \pi_N^M, \\ \pi_{PS}^R &\leq \pi_P^R \leq \pi_S^R \leq \pi_N^R. \end{aligned}$$

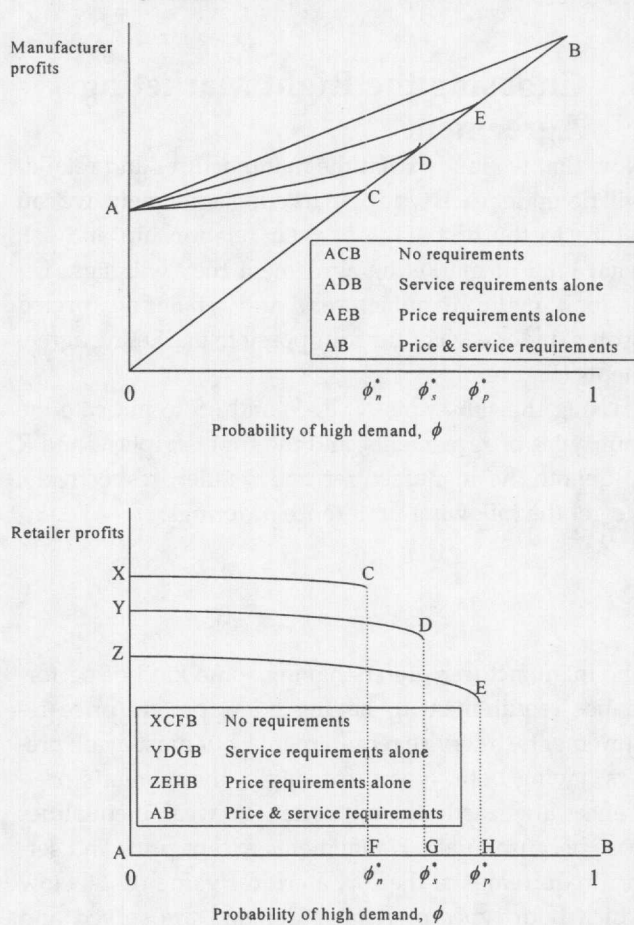
The manufacturer prefers having some kind of performance requirement to having none, prefers price requirements to service requirements, but most of all, prefers having both. Not surprisingly, the retailer's preferences are exactly the opposite. The weak inequalities arise because in all arrangements except price and service requirements, there is a critical value of ϕ below which both types of retailer demand are served and above which only the high demand retailer is served. The critical values are arranged in a particular order:¹²

¹⁰ In this context, it is easy to see why the absence of franchise fees will affect the performance requirements cases less adversely than the no-requirements case. Suppose franchise fees are not allowed in the price and service performance requirements case. In order to implement any nonzero service levels, the type- L and type- H wholesale prices will need to be lower to provide the retailer with enough margin to be interested in incurring the fixed costs of the service requirements. But, for the type- H retailer, the margin needs to be even higher to prevent him from masquerading as a type- L retailer. Nevertheless, because of the performance requirements, this adjustment is less than what it would be without requirements.

¹¹ Note that the retailer's profit when L is realized is always zero, so his expected profit is essentially his profit under H . Also, $\pi^R = 0$ and $\pi^M = [\phi(\alpha_H - c)^2]/(4 - \gamma^2)$ whenever $\phi > \phi_j^*$ ($j \in \{n, p, s\}$).

¹² Both ϕ_s^* and ϕ_p^* are increasing in γ —whereas ϕ_n^* is independent of γ —but, as γ approaches 2, ϕ_s^* and ϕ_p^* converge to the same value.

Figure 2 Manufacturer and Retailer Profits Under Various Marketing Agreements



$$0 < \phi_n^* < \phi_s^* < \phi_p^* < 1.$$

It is no surprise that, with price and service requirements, the manufacturer serves both types of retailer for all values of ϕ . As we noted earlier, with direct control over the retailer's actions, the manufacturer does not have to pay a price for lack of information about retail demand. The four instruments at his disposal—service requirements, price requirements, wholesale price, franchise fee—are sufficient to induce demand revelation. But once we reduce the number of performance dimensions over which he can set requirements, tradeoffs arise between “promoting retailer performance” and “demand revelation.” The no-requirements case has the smallest critical value, ϕ_n , because the demand revelation problem is most severe in this case. But why is ϕ_s^*

$< \phi_p^*$? Why is the demand revelation problem less severe with price requirements than with service requirements? Once again, Equations (1)–(2) hold the answers. For a given wholesale price and service level, the price choice of the type-H retailer is higher than the price choice of the type-L retailer. On the other hand, for given wholesale and retail prices, the service choice of the type-H retailer does not differ from that of the type-L retailer. (The difference comes from the fact that retail service choice affects demand and fixed costs, but not margins, whereas retail price choice affects demand and margins.) As a result, a price requirement put on the type-L retailer is relatively more unacceptable to the type-H retailer than is a service requirement. In other words, it is harder to prevent the type-H retailer from masquerading as a type-L retailer with service requirements than with price requirements. Of course, this is precisely the reason the manufacturer prefers price requirements to service requirements in the region $\phi < \phi_p^*$.

So there is no unanimity in preferences in the region where both types of retailer are being served under price requirements, the region $\phi < \phi_p^*$. On the other hand, in the region $\phi \geq \phi_p^*$, there is unanimity: the manufacturer prefers price and service requirements, and the retailer is indifferent among all agreements.

Can there be any agreement in the region $\phi < \phi_p^*$? Yes, because the two parties can use transfer payments to mitigate the disagreement. The Pareto-optimal agreement with transfer payments is the one that maximizes channel profits: if improvement in channel profits is possible when going from agreement A to agreement B, then it should be possible to devise a transfer payment that makes both parties better off with A than with B. For example, suppose $\pi_A^R < \pi_B^R$ and $\pi_A^M > \pi_B^M$, but $\pi_A^R + \pi_A^M > \pi_B^R + \pi_B^M$. Without transfer payments, the manufacturer prefers A to B, and the retailer prefers B to A. But with transfer payments, the manufacturer can offer the retailer $\pi_B^R - \pi_A^R + \epsilon$ (ϵ arbitrarily small) at the marketing agreement stage, making the retailer prefer agreement A to agreement B, and still maintain his own preference for A over B.

In other words, channel profits is the key. It is easy to calculate that:

$$\pi_{PS}^C = \left(\frac{1}{4 - \gamma^2} \right) \{ \phi(\alpha_H - c)^2 + (1 - \phi)(\alpha_L - c)^2 \},$$

$$\pi_S^C = \begin{cases} \pi_{PS}^C - \left(\frac{1}{4 - \gamma^2}\right) \left\{ (\alpha_H - \alpha_L)^2 \left(\frac{\phi^2}{1 - \phi} \right) \right\} & \text{if } \phi < \phi_s^*, \\ \left(\frac{1}{4 - \gamma^2}\right) \{ \phi(\alpha_H - c)^2 \} & \text{if } \phi \geq \phi_s^*, \end{cases}$$

$$\pi_N^C = \begin{cases} \pi_{PS}^C - \left(\frac{1}{4 - \gamma^2}\right) \left\{ (\alpha_H - \alpha_L)^2 \left(\frac{\phi^2}{1 - \phi} \right) \right\} & \text{if } \phi < \phi_n^*, \\ \left(\frac{1}{4 - \gamma^2}\right) \{ \phi(\alpha_H - c)^2 \} & \text{if } \phi \geq \phi_n^*, \end{cases}$$

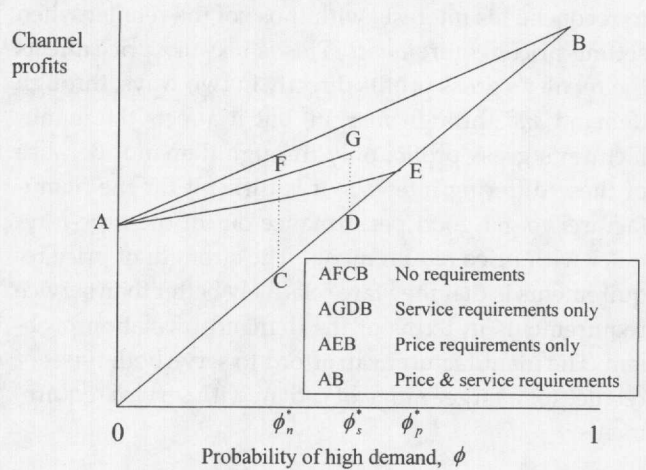
$$\pi_P^C = \begin{cases} \pi_{PS}^C - \left(\frac{1}{4 - \gamma^2}\right) \left(\frac{4}{\gamma^2} \right) \left\{ (\alpha_H - \alpha_L)^2 \left(\frac{\phi^2}{1 - \phi} \right) \right\} & \text{if } \phi < \phi_p^*, \\ \left(\frac{1}{4 - \gamma^2}\right) \{ \phi(\alpha_H - c)^2 \} & \text{if } \phi \geq \phi_p^*. \end{cases}$$

A comparison of channel profits reveals the following (see Figure 3):

1. Price and service requirements yield the highest channel profit.
2. For $\phi \leq \phi_n^*$, no requirements and service requirements both yield the second highest channel profits.
3. For $\phi_n^* < \phi \leq \phi_s^*$, service requirements yield the second highest channel profits.
4. For $\phi_s^* < \phi \leq \phi_p^*$, price requirements yield the second highest channel profits.
5. For $\phi_p^* < \phi$, no requirements, service requirements and price requirements all yield the second highest channel profits.

Not surprisingly, given that the retailer's actions under price and service requirements are the same as under complete information, channel profits are the greatest in this case. However, the next best system depends on ϕ , the probability of high demand. Service requirements beat price requirements as long as both types of retailer are being served under service requirements,

Figure 3 Channel Profits Under Various Marketing Agreements



i.e., as long as $\phi \leq \phi_s^*$. Price requirements beat service requirements when both types of retailer are being served under price requirements and only the high-demand retailer is being served under service requirements, i.e., when $\phi_s^* < \phi \leq \phi_p^*$. Beyond ϕ_p^* only the high-demand retailer is being served under all three partial requirements conditions and the channel profits are identical. Note, too, that service requirements yield the same channel profit as no requirements as long as both types of retailer are being served under the latter.

As γ increases, i.e., as demand becomes relatively more responsive to service than to price, both ϕ_p^* and ϕ_s^* increase, the latter faster than the former. In effect, the area of superiority of service requirements over price requirements increases.

These results point to the strengths and weaknesses of service requirements vis-a-vis price requirements. The strength of service requirements is that they are easier for the manufacturer to set without causing a great deal of conflict between what he would like and what the retailer would like. This is because the two parties' interests are more aligned to begin with on service. Service affects the retailer's gross profits and the manufacturer's gross profits directly only through demand, and both manufacturer and retailer share an interest in increasing demand. The fact that service also affects the fixed costs of the retailer does not change this because fixed costs do not affect the retailer's price choices and can be compensated for fully through franchise fees. On

the other hand, it is more difficult for the manufacturer to reconcile his interests with those of the retailer when setting price requirements. This is because price affects the retailer's gross profits directly in two ways, through demand and through margin, but it affects the manufacturer's gross profits only through demand. Because of these differing interests, it is difficult for the manufacturer to get good performance out of the type-L retailer with price requirements. The strength of price requirements is that they fare relatively better than service requirements in terms of the demand-revelation problem. The manufacturer can afford to serve both types of retailer for a larger range of ϕ than with service requirements.

PROPOSITION 1. *Abstracting from the costs of implementing the marketing agreements:*

1. The best marketing agreement is price and service requirements.
2. The second best marketing agreement is no requirements or only service requirements for $\phi \leq \phi_n^*$, only service requirements for $\phi_n^* < \phi \leq \phi_s^*$, and only price requirements for $\phi_s^* < \phi \leq \phi_p^*$.
3. As the relative importance of service in the demand function increases, the area in which service requirements is second best, $\phi_n^* < \phi \leq \phi_s^*$, increases, whereas the area in which price requirements is second best decreases.

Of course, marketing agreements are not costless to implement, and we turn to the implementation issues in the next section.

6. Implementation

The implementation of performance requirements schemes depends on the existence of information systems that can report on retailer performance, and information systems, no matter how crude, cost money. How do we account for these costs in choosing among various performance requirements? One way to do it is to think of the channel profits accruing under the various marketing agreements as the cash flows from investments in various information systems. Then we can do traditional NPV analysis to choose among the various investments.

Let $I_s > 0$ be the capitalized cost of implementing service requirements, $I_p > 0$ the capitalized cost of im-

plementing price requirements, and $I_{ps} > 0$ be the capitalized cost of implementing both requirements simultaneously. We expect $I_s > I_p$ because service monitoring is more difficult than price monitoring, and $I_{ps} < I_s + I_p$ because of synergies between service and price monitoring. (For example, at a small added cost, a service information system may be able to report on retail price as well.) Let i denote the per-period interest rate. We assume that marketing agreements will be agreements in perpetuity, and the manufacturer and the retailer will be discounting their period cash flows by means of a discount factor $1/(1+i) \in (0, 1)$.¹³ Given implementation costs, how do the various marketing agreements stack up? The next proposition provides the answer.

PROPOSITION 2.

1. In the region $\phi \leq \phi_n^*$ and $\phi \geq \phi_p^*$, the first best marketing agreement is price and service requirements if $(\pi_{ps}^c/i) - I_{ps} > (\pi_n^c/i)$ and no requirements otherwise.
2. In the region $\phi_n^* < \phi \leq \phi_p^*$, the first best marketing agreement is price and service requirements if $(\pi_{ps}^c/i) - I_{ps} > \max\{(\pi_n^c/i), (\pi_s^c/i) - I_s, (\pi_p^c/i) - I_p\}$. Otherwise, it is no requirements or price requirements or service requirements depending on which of them yields the highest value in $\max\{(\pi_n^c/i), (\pi_s^c/i) - I_s, (\pi_p^c/i) - I_p\}$.

It is clear that the cost of implementing various performance requirements may play a crucial role in determining what the manufacturer and retailer will ultimately agree to. What can we say about these costs?

Retail service in our model represents any activity that the retailer engages in which has the effect of increasing demand for the manufacturer's product. Broadly speaking, these activities can be classified into non-advertising-oriented activities like maintaining adequate inventory levels, after-sales service, etc., and advertising-oriented activities like media and in-store advertising. Regarding inventories, one of the main achievements of CPR systems is manufacturer-maintained inventories at retail, a necessary condition

¹³ Of course, these are simplifications. The manufacturer and the retailer may have different costs of capital, which will change the calculations somewhat. Similarly, neither manufacturer nor retailer will have an infinite partnership horizon. Nevertheless, our main argument will go through under these more realistic assumptions.

for which is the continuous monitoring of retailer sales and inventories. Two recent case studies from Harvard Business School give some idea of the costs of implementing CPR for a manufacturer (Campbell Soup Company) and a grocery retailer (H. E. Butt Grocery Company) (see Clark 1994 and Clark and Croson 1994). After-sales service can be monitored via customer surveys. Retailer performance with respect to media advertising, specifically print advertising, is relatively easy to monitor, and, in fact, has been monitored for a long time. For example, it is a common practice for manufacturers to give promotional allowances to retailers conditional on their products being featured in the retailer's newspaper ad (see, e.g., Kotler and Armstrong 1990, p. 423-424). The retailer provides evidence of compliance by presenting a copy of the newspaper ad. Television advertising performance is much harder to monitor. There are two issues here: (1) the design of the commercial—whether the ad says what it is supposed to say, and (2) whether the commercial is aired in the requisite quantity. One of the ways manufacturers obtain control over the first aspect is to actually produce the commercials themselves and offer it to the retailers. For example, many retailer ads for automobiles are actually produced by the manufacturers. As for the second part, vendors of single-source data such as IRI and Nielsen monitor advertising exposure at the individual consumer level (Curry 1993). In-store advertising in the form of displays and shelf-space is, however, difficult to monitor without the cooperation of the retailer.

Until recently, price monitoring was difficult, except in a promotional environment where prices needed to be advertised in a newspaper ad. Then evidence of compliance could be presented by supplying a copy of the ad. The advent of electronic scanners at check-out counters and advances in information technology, e.g., electronic data interchange (EDI), have reduced the costs of monitoring pricing performance. As a result, several consumer goods companies have changed their trade promotion format from simply giving retailers an off-invoice discount and hoping for "pass through" to "scan-back promotions" where the discount is given only on the basis of scanner data showing that the retailer passed on the discount (e.g., see Liesse in *Advertising Age*, August 9, 1993). This change has eliminated in one stroke a major source of conflict between manufacturers and retailers. In the old system, manufacturers

complained about forward buying by the retailer, diversion, and pocketing of trade incentives without complying with performance requirements. With scan-back promotions, the retailer does not gain from these practices.

How will the manufacturer and retailer enforce the performance requirements if noncompliance is reported by the information system? Our theory assumes that enforcement is achieved by the implicit threat of termination. How legal are these threats?

Price and Service Requirements and the Law

Manufacturer requirements, of any kind, run the risk of running afoul of "vertical restraints of trade" laws, so the question may be raised whether the price and service requirements we have considered can ever be implemented legally. The first thing to note is that service requirements do not have a problem under the law: the manufacturer is allowed to specify the level of service to be provided by distributors as a condition of sale to them (Nagle and Holden 1995). Price requirements are more problematic. Resale price maintenance (RPM) is currently considered illegal per se, but the law has had a checkered history in the United States. In the early 1900s RPM was legal per se, but in 1937, under the Miller-Tydings Amendment to the Sherman Act, Congress moved the law toward limited legality, giving the states some discretion. In 1976, Congress changed its mind once again, repealed the Miller-Tydings Amendment, and made RPM illegal per se. The economic basis for illegality is that RPM enables a manufacturer to reduce competition at the retail level by fixing resale prices. Posner (1992), however, has argued that RPM should be legal per se because: (1) a manufacturer has the right, as part of its marketing strategy, to control how the product is sold at retail; (2) RPM can be pro-competitive in terms of service competition; and (3) RPM prevents free-riding by a discount retailer on the service provided by a "high service" retailer.

The anti-price-competitive rationale is the driving force behind the RPM law. It explains why (1) the law has been enforced with respect to *minimum* resale prices and not maximum resale prices,¹⁴ and (2) evidence of

¹⁴ Nagle and Holden (1995) note that in *Atlantic Richfield Co. v. USA Petroleum Co.*, 495 U.S. 328, 110 S. Ct. 1884 (1990), the Supreme Court "accepted the view that a plaintiff cannot have antitrust injury from

"concerted" action to fix resale prices is being used currently to judge whether there has been a violation or not. The first point is important because the sorts of price requirements considered in this paper are in the nature of maximum resale prices, not minimum resale prices. By setting price requirements, either by themselves, or in conjunction with service requirements, the manufacturer is trying to *lower* the retail price, not raise it (compare prices in Equations (8) and (12) with those in (7)). Regarding the second point, Nagle and Holden (1995, p. 369) observe that even "an agreement between a manufacturer and a distributor to terminate another distributor because of the latter's pricing practices, without any understanding as to the prices that will be charged by the remaining distributor or distributors, might constitute concerted action, but could not be characterized as concerted action to fix resale prices within the meaning of the *per se* rule." They conclude that the *per se* status of resale price maintenance is "only nominally intact and decreases the likelihood that a terminated dealer can mount a successful attack against a manufacturer. The Supreme Court is now skeptical that vertical agreements can be used to foster collusion among manufacturers or among retailers."

7. Conclusion

We have studied channel management in a setting where the retailer knows more about the demand for the manufacturer's product than the manufacturer himself. Such a setting poses twin managerial challenges: (1) how to reconcile the different incentives of the manufacturer and the retailer, while making the most of their common interests, and (2) how to subdue the retailer's tendency to exploit his superior information in his own interest at the expense of the vertical relationship. The focus of our inquiry was on performance-requirements contracts where the manufacturer directly controls the behavior of the retailer on price and service levels, either alone or in combination, by means of jointly accepted information systems that monitor the retailer's performance. Our analysis recognizes that, while any performance-

requirements scheme will be infeasible unless the two parties are ready to cooperate in making the long-term investments in information systems, it nevertheless must allow for the day-to-day transactions to be governed by the parties' self-interest.

We show that performance requirements can go a long way toward ameliorating the coordination problems that arise in a channel. While there is evidence that manufacturers and retailers understand this and are increasingly using pay-for-performance schemes (Nielsen 1996), it is not clear that they understand the nuances of designing such schemes. We provide some guidelines. First, comprehensiveness is an important virtue in designing performance-requirements schemes. Partial-requirements schemes, either price requirements alone or service requirements alone, may be no better, and in some cases worse, than no requirements because the retailer may perform very suboptimally on the uncontrolled dimension. Second, complete requirements schemes may be more costly to implement than partial requirements schemes because of the higher cost of the information systems involved. Exactly how much costlier will depend on how much synergy can be built into the information systems designed to monitor price and service performance. Integration of scanner-based check-out systems with EDI systems promises to reduce the cost of comprehensive monitoring. Third, in making the choice between the two partial-requirements schemes, it is important to consider the relative strengths of price versus service requirements. Service requirements are stronger in aligning the interests of the manufacturer and retailer—thus enabling better retailer performance—whereas price requirements are stronger in handling the asymmetric information problem.

Our purpose in this paper has been to highlight the main issues, but in the process we have omitted some important details. We noted in Proposition 2 that the cost of various information systems may play an important role in determining which performance-requirements scheme is ultimately optimal, but we did not investigate what these costs actually are. A more serious study is warranted. In particular, given the clear superiority of price and service requirements over either alone, it would be useful to find out what

maximum resale price maintenance by a competitor and its supplier in the absence of predatory pricing."

the synergies are in designing information systems that can monitor both dimensions. Another issue is security. What are the security measures that need to be in place to prevent either party from accessing more information than was intended in the marketing agreement?

We have tested the robustness of our conclusions on two versions of our model, but clearly there is scope for more work in generalizing our results. Particularly fruitful would be an analysis of demand settings where there is an interactive effect between retail price and retail service. In addition, we need to consider the possibility of service coming from the manufacturer. What are the manufacturer's incentives to provide optimal service? (Romano 1994 studies this problem, but in a model with no asymmetric information.) Another type of generalization would explore the implications of a different form of asymmetric information. What if the retailer comes to the relationship with superior information and picks up new information on an ongoing basis during the relationship? How does the partnership create incentives for the retailer to use his information in the channel's interest? How does the type of information asymmetry affect the division of channel profits between the two parties? Finally, while the issue of compliance with performance requirements was largely outside our model, there is scope for bringing it into the model. Pay-for-performance would be a natural way to do this. For example, a regular wholesale price may be offered as a baseline, with a discount from regular prices for good performance.

In summary, the advent of new information technology offers much to enhance channel performance. However, improved performance is contingent on understanding several issues, some of which have been discussed in this paper. We hope our analysis will spark more research on information system design, pay-for-performance schemes and supply-chain management.¹⁵

¹⁵ An earlier version of this paper was presented at the Marketing Science Conference in Sydney, Australia. The authors thank the attendees, Martin Lariviere, David Sappington, four anonymous referees, and the editors for their comments and suggestions.

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