Manufacturer's Returns Policies and Retail Competition

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Abstract

Manufacturers' returns policies are a common feature in the distribution of many products. The obvious rationale for returns policies is insurance. Practitioners, not surprisingly, have a different perspective and view returns as a cost of doing business. In this paper, we study the strategic effect of returns policies on retail competition and highlight its profitability implications for a manufacturer. The setting for our research is the distribution of products with uncertain demand, limited shelf lives, and retail competition. Our objective is to provide a better understanding of when manufacturers should adopt returns policies. The insights are obtained with a model based on the economics of strategy and decision making under uncertainty.

We show that when retailing is competitive and there is no uncertainty in demand, a returns policy subtly induces retailers to compete more intensely. The provision of a returns policy reduces retail prices without affecting wholesale prices, thereby reducing retailer margins and improving manufacturer profitability. The intuition is that with a returns policy, Cournot-like levels of retail stocks cannot be sustained. Each retailer will order stocks so that it will not be constrained by stocks, and so, intensifying retail competition.

When, however, demand is uncertain and there is a single retailer, a returns policy encourages the retailer to over-stock, and so decreases (upstream) manufacturer profits. While the provision of a returns policy leads to lower retail margins, the optimality of returns policy depends on the overall uncertainty and marginal cost. A returns policy reduces the dispersion in retail prices between the high and low states of demand and the range of retail prices in the returns case is contained within the range of retail prices for the no-returns case.

In the general setting, when there are competing retailers and demand is uncertain, there is a trade-off for the manufacturer between the benefits (more intense retail competition) and the costs (excessive stocking) of a returns policy. We find that a manufacturer should accept returns when the marginal production cost is sufficiently low and demand uncertainty is not too great.

To validate the results of our theory, we conduct an empirical test with data from a major U.S. retailer. The tests confirm our prediction that a returns policy intensifies retail competition and reduces retailer margins. Our theory and empirical test should interest practitioners and researchers in distribution, especially those concerned with managing retail competition.

(*Returns Policies; Retail Competition; Pricing; Perishables; Demand Uncertainty*)

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1. Introduction

Manufacturers accept returns from retailers in many sectors of retail distribution. An obvious explanation for manufacturers' returns policies is risk-sharing. This explanation makes sense if the manufacturer is better able to absorb risk than the retailer. Consider, however, the following examples: in books, Ten Speed Press (revenues of $2 million) accepts returns from Barnes and Noble (revenues of $1087 million); in recorded music, Windham Hill (revenues of $25 million) accepts returns from Wherehouse Entertainment (revenues of $457 million); in software, Chipsoft (revenues of $70 million) accepts returns from Egghead Software (revenues of $665 million); in clothing apparel, Aris Isotoner—a subsidiary of Sara Lee Personal Products (revenues of $6449 million) accepts returns from Macy's (revenues of $6,163 million).[1]

In each of the preceding examples, the manufacturer is much smaller than the corresponding retailer, which suggests that risk sharing does not account for the returns policies. In this paper, we develop an alternative theory that is consistent with these examples. The setting for this research is the retailing of products with limited shelf lives. In this context, we consider the impact of two factors—retail competition and demand uncertainty—on a manufacturer's decision whether to accept returns.

- Retailing of all of the products that we mention above is competitive.[2] We show that a returns policy can benefit a manufacturer by inducing retailers to compete more intensely. Kreps and Scheinkman (1983) showed that, where competing sellers first order stocks then compete on prices, the resulting equilibrium is similar to that when sellers compete directly on quantities.[3] In a similar setting, we show that, by offering a returns policy, a manufacturer effectively nullifies the constraint of previously-ordered stocks. Hence, a returns policy shifts the basis of competition from quantities (Cournot) to price (Bertrand) and so intensifies the degree of competition (Singh and Vives 1984). From the manufacturer's viewpoint, more intense retail competition means lower retail prices, greater sales, and larger profits for itself.

- One of the few certainties about the demand for products such as new books, CDs, software, fashion wear, and winter clothing is that it is uncertain. A returns policy eliminates the cost to retailers of excess inventory and so encourages retailers to stock aggressively when faced with uncertainty in demand. For this reason, a returns policy tends to reduce the manufacturer's profit.

In general, when there are competing retailers and demand is uncertain, there is a trade-off between the benefits (more intense retail competition) and the costs (excessive stocking) of a returns policy. We find that a manufacturer should adopt a returns policy when marginal production cost is sufficiently low. An empirically testable prediction of our theory is that a manufacturer's returns policy intensifies retail competition. Using data from a major U.S. retailer for ten product categories encompassing a hundred products, we tested this hypothesis. The results indicated strong support for the hypothesis that a returns policy intensifies retail competition, thereby lowering retail profitability. We could not directly test our theory of when a manufacturer should accept returns as we did not have the requisite data on marginal costs and demand variability.

Our theory applies to settings where the manufacturer sets a wholesale price and chooses between a returns policy or no returns policy. We abstract from other contracting policies such as two-part tariffs, profit sharing, and bargaining that a manufacturer may use to coordinate the distribution channel. Generally, a manufacturer can achieve complete channel coordination through a two-part tariff (McGuire and Staelin 1986, Moorthy 1987). We have checked that this applies to our context (Padmanabhan and Png 1995b). Our model, however, is silent on the reasons why a manufacturer chooses not to employ a two-part tariff. Accordingly, we focus here on the returns policy decision. We look at returns policies from the perspective of a single manufacturer marketing through one or more retailers. We

[1] All reported revenues are for 1994.

[2] For instance, Windham Hill distributes recorded music through Wherehouse Entertainment, Tower Records, amongst others; Chipsoft distributes software through Egghead Software, Computer Attic, and others; Liz Claiborne distributes fashion apparel through Macy's, May, and others.

[3] Davidson and Deneckere (1986), however, observe that the result of Kreps and Scheinkman (1983) is sensitive to the mechanism by which a seller rations products when demand exceeds its stock.

do not consider the effect of competition among manufacturers in the distribution channel.

The paper is organized as follows. Section 2 reviews related research, and §3 presents the basic setting. In §4, we analyze a benchmark scenario in which retailing is a monopoly and demand is certain. Then, we separately consider the effects of retail competition (§5) and demand uncertainty (§6). In §7, we discuss the general scenario where retailing is competitive and demand is uncertain. Section 8 presents an empirical test of a key hypothesis. Section 9 concludes with a brief summary and a discussion of directions for future research.

2. Related Research

There has been substantial research into the reasons why manufacturers might accept returns from retailers. Much of the previous scholarship, however, focuses on how returns insure retailers against demand uncertainties and ignores the strategic role of returns policies (Lin 1993, Marvel and Peck 1992).[4]

The research that has considered strategic issues has focused on stocking levels and ignored the effect of returns policies on retail price competition. Pellegrini (1986) shows that, by providing a returns policy, a manufacturer can encourage retailers to carry larger stocks and thereby improve sales of its brand relative to competing products. Pasternack (1985) examines how a manufacturer can use return policies to induce multiple retailers to carry the optimal level of stocks. Kandel (1996) takes account of asymmetric information and the incentives for service and product quality.

By contrast, our central concerns are with the effect of a returns policy on pricing as well as stocking in a competitive retail sector. We show that these effects have significant implications for manufacturer profitability.

3. Basic Setting

We use a stylized model to study the effect of returns policies on retail competition. There is a single upstream provider of some product which may be either a service or a good. The product has a limited shelf life because of either product obsolescence or physical decay. The upstream entity could be a manufacturer, distributor, or service provider. For brevity, we will refer to the upstream entity as a "manufacturer." The manufacturer must use the services of one or more downstream entities, whom we call "retailers," to reach the final consumers.

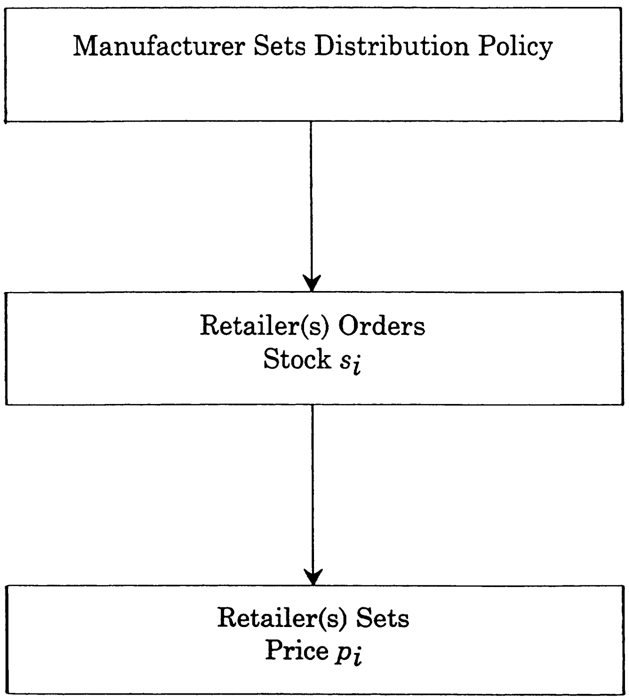
Retail demand depends on two elements—primary demand for the product, and store-level factors that influence consumers' sensitivity to retail price. Specifically, let p represent price, and retail demand be

$$q = \alpha - \beta p, \tag{1}$$

where $\alpha > 0$ represents the primary demand and $\beta > 0$ represents the store-level factors.

We first present the information structure and sequence of moves (see Figure 1). In the first stage, the manufacturer sets the distribution policy: this includes a uniform wholesale price, w, and possibly a returns policy. By uniform, we mean that the retailer pays the same price for every unit. The manufacturer behaves like a Stackelberg leader. For simplicity, we restrict the

Figure 1 **Benchmark Case and Retail Competition: Sequence of Moves**



[4] See Padmanabhan and Png (1995a) for a detailed review.

Table 1 Benchmark Scenario

Variable	Independent Retailer No Returns	Independent Retailer Full Returns
Wholesale Price w	$\frac{\alpha + \beta c}{2\beta}$	$\frac{\alpha + \beta c}{2\beta}$
Stocking Level s	$\frac{\alpha - \beta c}{4}$	$\frac{\alpha - \beta c}{4}$
Retail Price p	$\frac{3\alpha + \beta c}{4\beta}$	$\frac{3\alpha + \beta c}{4\beta}$
Manufacturer Profits Π^B	$\frac{(\alpha - \beta c)^2}{8\beta}$	$\frac{(\alpha - \beta c)^2}{8\beta}$

manufacturer to two options—full returns or no returns. Under a (full) returns policy, the manufacturer will give retailers a full refund of the wholesale price for any quantity of unsold items. The alternative is no refund, in which case the retailer must bear the cost of excess inventory.[5]

We suppose that, at all times, the manufacturer and the retailer have equal information, so there are no asymmetries of information in the channel. Specifically, knowing the retail demand, the manufacturer can look ahead and anticipate the retailer's stocking and pricing decisions.

We suppose that retailers must have stocks in hand before selling to consumers. Specifically, in the second stage, given the manufacturer's distribution policy, the retailer decides how much stock, s, to order. In the third stage, with stock in hand, the retailer sets price, p, to the final consumer. The product has a limited shelf life. For convenience, we assume that, at the end of the third stage, unsold inventory is worthless.[6] These assumptions fit the distribution of books, recorded music, and seasonal goods. Retailers must carry stocks. At the end of the relevant selling period, excess inventory is virtually worthless. Indeed, publishers sometimes instruct bookstores to destroy excess books rather than ship them back.

For simplicity, we assume that manufacturing involves zero fixed cost and a constant marginal cost, c, while the only cost of retailing is the payment of the wholesale price, w. To abstract from the insurance role of returns policies, we assume that all parties are risk neutral.

[5] In reality, returns policies take a variety of formats. Procter & Gamble, for instance, offers a full returns policy for Ban-de-soleil. At the end of summer, it refunds retailers the full value of unsold inventory. By contrast, in book distribution, publishers such as Prentice Hall give retailers a credit that can be applied to subsequent purchases. McKesson, a major distributor of health and beauty aid products, offers retailers a menu of return policies. Retailers can choose between more generous returns policies or lower wholesale prices.

[6] Note that, if a retailer need not carry stocks, then a returns policy would be irrelevant. Similarly, if the product has an unlimited shelf life, a retailer could carry unsold inventory over to the next selling season, so there would be little need for a returns policy.

4. Benchmark

It is useful to understand the effect of a returns policy in a simple setting before proceeding to a more general analysis. We develop a benchmark scenario in which there is *no retail competition* and *no demand uncertainty*. In this scenario, the channel consists of a single manufacturer and an independent channel (a single retailer), and the primary demand, α, is certain.

In this benchmark scenario and all the more general scenarios, we go through the following steps. We analyze two cases: first, where the manufacturer does not provide a returns policy; and second, where the manufacturer provides a full returns policy. Then, we compare the two cases in terms of manufacturer's profit and price, as well as retail stock and price.

4.1. No Returns

First, we consider the outcome when the manufacturer sets a wholesale price w but does not accept returns. The manufacturer moves first, followed by the retailer. Since decisions are sequential, we must analyze the game by a recursive procedure.

In the second stage, the retailer orders a stock s. Then, by the third stage, the cost of this stock is sunk, hence, the retailer aims to maximize revenue $p(\alpha - \beta p)$.

REMARK 1. The retailer will price to sell the stock, s, that it ordered in the second stage.

Suppose otherwise, that it sets price so that sales $q < s$. Then, looking forward from the first stage, profits would be $pq - ws$, meaning that, if it stocked less than s, it could reduce costs without affecting revenues.

Accordingly, it will set price so as to sell the entire stock, $q = \alpha - \beta p = s$, hence $p = (\alpha - s)/\beta$. In the second stage, given the manufacturer's distribution policy, the retailer must decide how much stock to order. It aims to maximize profit, $pq - ws$, by choice of stocking level s. Since $q = s$ this yields the optimal stocking level as

$$s = \frac{\alpha - \beta w}{2}. \quad (2)$$

In the first stage, the manufacturer must set the wholesale price, w. Since it has access to the retailer's information, it can perfectly anticipate how the retailer will decide on stock and price as a function of w. The manufacturer aims to maximize profit, $\Pi_{NR}^{B} = (w - c)s$. Maximizing with respect to w,

$$w = \frac{\alpha + \beta c}{2\beta}. \quad (3)$$

The expressions for the prices (wholesale and retail), stocking level and manufacturer profits are provided in Table 1.

4.2. Full Returns

Next, we consider the case where the manufacturer sets a wholesale price w, and gives the retailer a full refund for unsold stock. Since the manufacturer accepts returns, if the retailer orders stock s but sells only $q < s$ units, it can return the unsold $(s - q)$ units and need pay only wq to the manufacturer. Thus, in the third stage, the retailer prices to maximize profits $(p - w)q = (p - w)(\alpha - \beta p)$. By removing the stocking constraint, the returns policy changes the retailer's optimization problem. Maximizing with respect to price, the retailer will set

$$p = \frac{\alpha + \beta w}{2\beta}. \quad (4)$$

This implies sales are

$$q = \frac{\alpha - \beta w}{2} = s, \quad (5)$$

which is the stock, s, that the retailer will order from the manufacturer.

In the first stage, anticipating the retailer's stocking and pricing strategy, the manufacturer's profit is $\Pi_{R}^{B} = (w - c)s$. Maximizing with respect to the wholesale price,

$$w = \frac{\alpha + \beta c}{2\beta}. \quad (6)$$

The expressions for the prices (wholesale and retail), stocking level and manufacturer profits are provided in Table 1.

4.3. Summary

When there is no returns policy, the retailer sets price subject to a quantity constraint. By contrast, when the manufacturer accepts returns, the retailer does not face a quantity constraint. From Table 1, we see that the manufacturer's profit is the same. Essentially, the manufacturer needs to coordinate only one retail level variable—the retail price. Hence, having the additional instrument of a returns policy does not provide any extra mileage. Our aim in presenting the benchmark is to show a basic set of conditions where a returns policy makes no difference. We now turn to consider two sets of circumstances where a returns policy may provide extra profit—retail competition and demand uncertainty. In both these cases, the manufacturer needs to coordinate more than one retail variable. Hence the wholesale price alone is not enough and the returns policy provides an additional degree of freedom.

5. Competition in Retailing

How should a manufacturer factor retail market structure into a decision on a returns policy? To address this issue, we broaden the benchmark setting by letting the independent retail channel be a duopoly. Each retailer's demand depends on three basic elements—the primary demand, α, store-level factors, β, and competitive factors, γ. Specifically, retailer 1 faces demand

$$q_1 = \alpha - \beta p_1 + \gamma p_2, \quad (7)$$

while retailer 2 faces demand

$$q_2 = \alpha - \beta p_2 + \gamma p_1. \quad (8)$$

It seems reasonable to suppose that sales are relatively more sensitive to price at that store than price at the competing store. Accordingly, we let $\beta > \gamma$.

We do not change any other aspect of the benchmark scenario. The sequence of moves follows Figure 1.

Table 2 Competition in Retailing

Variable	Independent Retailer No Returns	Independent Retailer Full Returns
Wholesale Price w	$\frac{\alpha + (\beta - \gamma)c}{2(\beta - \gamma)}$	$\frac{\alpha + (\beta - \gamma)c}{2(\beta - \gamma)}$
Stocking Level s	$\frac{\beta + \gamma}{2(2\beta + \gamma)}[\alpha - (\beta - \gamma)c]$	$\frac{\beta}{2(2\beta - \gamma)}[\alpha - (\beta - \gamma)c]$
Retail Price p	$\frac{(3\beta + \gamma)\alpha - (\beta^2 - \gamma^2)c}{2(2\beta + \gamma)(\beta - \gamma)}$	$\frac{(3\beta - 2\gamma)\alpha + \beta(\beta - \gamma)c}{2(2\beta - \gamma)(\beta - \gamma)}$
Manufacturer Profits Π^C	$\frac{\beta + \gamma}{2(2\beta + \gamma)(\beta - \gamma)}[\alpha - (\beta - \gamma)c]^2$	$\frac{\beta}{2(2\beta - \gamma)(\beta - \gamma)}[\alpha - (\beta - \gamma)c]^2$

Further, the information structure is the same as in the benchmark scenario. We follow the same steps as in the benchmark analysis.

5.1. No Returns

First, we analyze the outcome when the manufacturer sets a wholesale price w, but does not accept returns. Suppose that retailer 1 has stock s_1. Assume that in the third stage, retailer 1 will price to sell the entire stock, and likewise for retailer 2.[7] This implies that $p_1 = (\alpha + \gamma p_2 - s_1)/\beta$, and similarly for p_2. Looking forward from the second stage, retailer 1 aims to maximize profits, $(p_1 - w)s_1$ with respect to s_1. Likewise for retailer 2. Solving the first order conditions simultaneously, we have

$$s_1 = s_2 = \frac{\beta + \gamma}{2\beta + \gamma}[\alpha - (\beta - \gamma)w]. \quad (9)$$

In the first stage, the manufacturer sets wholesale price to maximize profit, $\Pi^C_{NR} = 2(w - c)s_1$. The wholesale and retail prices, stocking level, and manufacturer profits are reported in Table 2.

5.2. Full Returns

Next, we analyze the case where the manufacturer sets a wholesale price w, and gives a full refund for unsold stock. Since the manufacturer accepts returns, if retailer 1 orders stock s_1 but sells only $q_1 < s_1$ units, it can return the unsold $(s_1 - q_1)$ units and need pay only wq_1 to the manufacturer. Thus, in the third stage, the retailer has no stocking constraint and prices to maximize profit $(p_1 - w)(\alpha - \beta p_1 + \gamma p_2)$, rather than revenue. Likewise for retailer 2. Solving the first order conditions for the retailers yields the retail prices and the retail sales,

$$q_1 = q_2 = \frac{\beta}{2\beta - \gamma}[\alpha - (\beta - \gamma)w]. \quad (10)$$

This is the stock that each retailer will order from the manufacturer in the second stage.

Looking forward from the first stage, the manufacturer will set the wholesale price to maximize profit, $\Pi^C_R = 2(w - c)q_1$. The wholesale and retail prices, stocking level, and manufacturer profit are reported in Table 2.

5.3. Summary

From Table 2, we can see that the manufacturer's profit with a returns policy is higher than with no returns. Further, we can prove:

PROPOSITION 1. *When retailing is competitive, demand is certain, and the manufacturer distributes through an independent channel using a uniform wholesale price,*

(a) *The manufacturer's profit is strictly greater with a returns policy than when it does not accept returns;*

(b) *The difference in profit between a returns policy and no returns is decreasing in the marginal production cost, c, and increasing in the primary demand, α.*

[7] Theoretically, a retailer might set price so as to generate excess demand. The outcome would then depend on the scheme by which available stock is rationed and the impact on the demand facing the other retailer (Davidson and Deneckere 1986). We cannot, however, address this issue in our framework where demands are specified as aggregates, rather than at the level of individual consumers.

Kreps and Scheinkman (1983) showed that, where competing sellers first order stocks then compete on prices, the resulting equilibrium is similar to that when sellers compete directly on quantities (Cournot competition). Absent a returns policy, the retailers compete in a manner so as to sell all the retail stock. To the extent that the retailers are constrained by the stocks, these constraints limit the intensity of price competition. Hence, our case of independent distribution with *no returns policy* is a concrete application of the Kreps and Scheinkman (1983) theory.

We show, however, that, if the manufacturer accepts returns, then the retailers will not be constrained by their stocks. Equivalently, a returns policy effectively nullifies the constraint of previously-ordered stocks. Hence, the Kreps and Scheinkman (1983) theory *does not apply*: since retailers are not constrained by stocks, they compete only on price. Singh and Vives (1984) show that price (Bertrand) competition is more intense than quantity (Cournot) competition. This means that retail prices are lower and retailers' sales are higher. From Table 2, the manufacturer's wholesale price is the same with and without returns. Hence, when retail sales are higher, the manufacturer's profits will be higher as well.

The provision of a returns policy reduces the retail price without affecting the wholesale price, hence reduces the retail margins. Furthermore, it reduces the retailer's profit, as may be seen by comparing the retailer profit in the case of no returns

$$\pi_{NR} = \frac{\beta(\beta + \gamma)[\alpha - (\beta - \gamma)w]^2}{(\beta - \gamma)(2\beta + \gamma)^2} \tag{11}$$

and retailer profit with a returns policy

$$\pi_R = \frac{\beta[\alpha - (\beta - \gamma)w]^2}{(2\beta - \gamma)^2}. \tag{12}$$

To reiterate, when the manufacturer accepts returns, the Cournot-like levels of retail stocks *cannot be sustained*. Each retailer will order a stock so that it will not be constrained, and so, intensifying the competition between the retailers.[8] This insight about the role of returns policy in influencing the intensity of downstream retail competition is new to the literature. It is also a rare (perhaps, the only) instance where the basis of downstream competition (quantity or price) depends endogenously on a marketing variable. Essentially, when retailing is competitive, the manufacturer needs to coordinate two retail-level variables—the two retail prices. Hence, the single instrument of the wholesale price is not adequate and a returns policy, by providing a second instrument, raises the manufacturer's profit. By contrast, in the benchmark, the manufacturer was coordinating only one retail level variable, hence the returns policy added no value.

[8] The returns policy helps to overcome the double marginalization problem (Spengler 1950).

6. Demand Uncertainty

In the previous section, we considered how a manufacturer's decision on a returns policy depends on retail competition. Let us now consider how the manufacturer's decision depends on uncertainty about demand. Clearly, the demand for new books and CDs, fashion wear, and seasonal items is difficult to predict. Hence, it is important to consider how uncertainty about demand affects the desirability of a returns policy. We will see that demand uncertainty is another situation where the retailer needs to coordinate two retail level variables.

To address this issue, we use the benchmark scenario with one change—the primary demand is now uncertain. We keep the other aspects of the benchmark. In particular, there is a single retailer, and, further, at all times, the manufacturer and the retailer have equal information about retail demand for the product.

To incorporate uncertainty, let retail demand now be

$$q = \alpha_s - \beta p, \tag{13}$$

where $s = \ell$ and $s = h$ denote low and high primary demand, respectively. Let λ denote the probability of demand being low. We assume that λ and β are known. This is the minimal change that introduces uncertainty. Demand uncertainty is captured by two aspects of our model, the range of possible demand outcomes, $\alpha_h - \alpha_\ell$, and the probability of either event λ and $(1 - \lambda)$. In the former case, uncertainty is increasing in α_h (holding α_ℓ constant). In the latter case, uncertainty is maximized when $\lambda = 0.5$.

The characterization (13) applies to retail businesses where it is relatively easier to predict the effect of store level factors (such as location, price and display) than the effect of primary demand factors on retail demand. Also, define average primary demand, $\bar{\alpha} = \lambda\alpha_\ell + (1 - \lambda)\alpha_h$.

Let us review the information structure and sequence of moves (Figure 2). Initially, all parties are uncertain about the primary demand. In the first stage, the manufacturer sets the distribution policy as a Stackelberg leader. The distribution policy includes a wholesale price, w, and possibly a returns policy. In the second stage, the retailer orders stock s, while, in the third stage, the retailer sets price.

It is reasonable to suppose that some of the uncertainty about demand is resolved between the second and third stages. We capture this effect by assuming that the true state of demand is revealed to *all parties* between the second and third stages (i.e., after the retailer orders stock and before it sets price).[9]

6.1. No Returns

We now consider the case where the manufacturer sets a wholesale price w, but does not accept returns. In the second stage, let the retailer order a stock s. Then the uncertainty about demand will be resolved, and, in the third stage, the retailer sets price (see Figure 2).

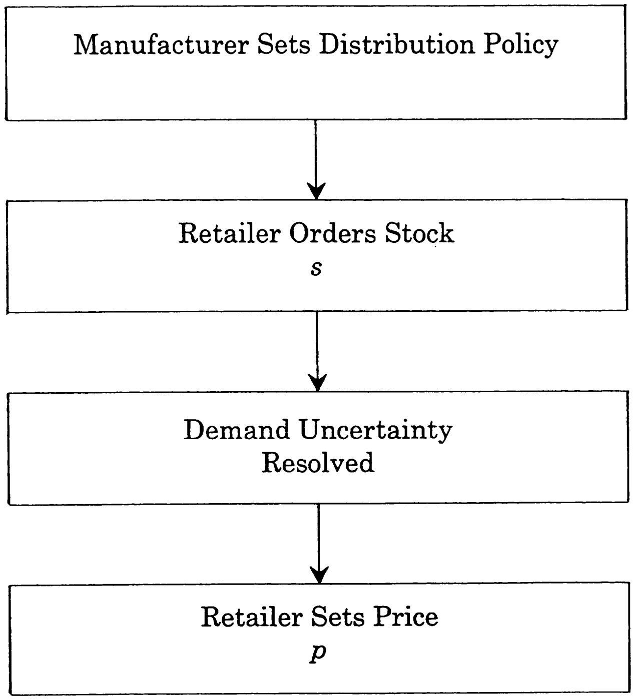
By a generalized version of Remark 1, we can show that, if demand is high, the retailer will price to sell all the stock. Hence, $p_h = (\alpha_h - s)/\beta$. Next suppose that the retailer learns that the demand is low (i.e., $\alpha = \alpha_l$). Then, there are two possibilities—either set the price to clear all the stock or to leave some unsold. We prove the following result in the appendix.

REMARK 2. When demand is uncertain but resolved before retail price is set, and $\alpha_h - \alpha_l \geq (\beta c/(1 - \lambda))$, the retailer will choose a stock, s, so that its sales are not constrained when demand is low.

Remark 2 implies that if there is sufficient difference between high and low demand, the retailer will find it

[9] We have two other reasons for focusing on this information structure. First, it is the least possible deviation from the benchmark. With this structure, all parties have equal and full information about demand at the time of setting the retail price. Second, the alternative information structure—where the state of demand is revealed at the end of the third stage, after the retailer has set the retail price is analytically not tractable.

Figure 2 Demand Uncertainty: Sequence of Moves



optimal to order a stocking level, s, such that he will stock out if demand is high and hold excess inventory if demand is low. By Remark 2, if demand is low, the retailer will price to leave some stocks unsold. Hence, $p_\ell = \alpha_\ell/2\beta$. Looking forward from the second stage, the retailer's profit is

$$\lambda \frac{\alpha_\ell^2}{4\beta} + (1 - \lambda) \frac{\alpha_h - s}{\beta} s - ws.$$

The profit maximizing stocking level, s, is

$$s = \frac{(1 - \lambda)\alpha_h - \beta w}{2(1 - \lambda)}.$$

In the first stage, anticipating the retailer's stocking and pricing strategy, the manufacturer's profit is $\Pi_{NR}^U = (w - c)s$ which is maximized by choice of a wholesale price. The wholesale and retail prices, stocking level, and manufacturer profit are reported in Table 3.

6.2. Full Returns

Next, we consider the case where the manufacturer distributes through an independent retailer, sets a whole-

Table 3 Demand Uncertainty

Variable	Independent Retailer No Returns	Independent Retailer Full Returns
Wholesale Price w	$\frac{(1-\lambda)\alpha_h + \beta c}{2\beta}$	$\frac{\bar{\alpha} + \beta c}{2\beta}$
Stocking Level s	$\frac{(1-\lambda)\alpha_h - \beta c}{4(1-\lambda)}$	$\frac{2\alpha_h - \bar{\alpha} - \beta c}{4}$
Retail Price		
p_l	$\frac{\alpha_l}{2\beta}$	$\frac{2\alpha_l + \bar{\alpha} + \beta c}{4\beta}$
p_h	$\frac{3(1-\lambda)\alpha_h + \beta c}{4\beta(1-\lambda)}$	$\frac{2\alpha_h + \bar{\alpha} + \beta c}{4\beta}$
Manufacturer Profits Π^U	$\frac{[(1-\lambda)\alpha_h - \beta c]^2}{8\beta(1-\lambda)}$	$\frac{(\bar{\alpha} + \beta c)^2 - 4\beta c\alpha_h}{8\beta}$

sale price w, and gives a full refund for unsold stock. Since the manufacturer accepts returns, in the third stage, the retailer aims to maximize profit, $(p_s - w)(\alpha - \beta p_s)$, where $s \in \{\ell, h\}$. By maximizing with respect to prices, we obtain p_ℓ and p_h. Provided that the retailer has enough stocks to meet its demand in the high state, $s \geq q_h$, it does not benefit from having additional stock. Accordingly, we suppose that it orders $s = q_h = (\alpha_h - \beta w)/2$.

In the first stage, anticipating the retailer's stocking and pricing strategy, the manufacturer's profit is

$$\Pi_R^U = \lambda \frac{(\alpha_\ell - \beta w)w}{2} + (1-\lambda)\frac{(\alpha_h - \beta w)w}{2} - \frac{\alpha_h - \beta w}{2} c = \frac{1}{2}(\bar{\alpha} - \beta w)w.$$

The manufacturer maximizes profit by choosing the wholesale price. The wholesale and retail prices, stocking level, and manufacturer profits are reported in Table 3.

6.3. Summary

From Table 3, the manufacturer's profit with no returns is higher than with a returns policy if the high primary demand is sufficiently large. We can prove:

PROPOSITION 2. *When retailing is a monopoly, demand is uncertain, and the manufacturer distributes through an independent channel using a uniform wholesale price,*

(a) *The manufacturer's profit is strictly greater with no returns than with a returns policy if*

$$\frac{\alpha_h}{\alpha_l} > \frac{\lambda}{(1-\lambda)^{1/2} - (1-\lambda)}. \tag{14}$$

(b) *The manufacturer's profit is strictly greater with a returns policy than with no returns policy if $c = 0$ and*

$$\frac{\alpha_h}{\alpha_l} < \frac{\lambda}{(1-\lambda)^{1/2} - (1-\lambda)}. \tag{15}$$

(c) *The difference in profit between a returns policy and no returns is decreasing in the marginal production cost, c, and decreasing in uncertainty (i.e., increasing in α_h holding fixed α_l and λ).*

Conditions (a), (b), and (c) in combination provide the reader with a feel for the trade-off between knowledge of the outcome (i.e., λ) and the ratio of the high and low demand outcome (i.e., α_h/α_ℓ). By L'Hopital's rule, as $\lambda \to 0$,

$$\frac{\lambda}{(1-\lambda)^{1/2} - (1-\lambda)} \to 2.$$

Hence, a necessary condition for the manufacturer not to accept returns is that $\alpha_h > 2\alpha_\ell$. Further, the function

$$\frac{\lambda}{(1-\lambda)^{1/2} - (1-\lambda)}$$

is increasing in λ. So, as the probability of low demand increases, the no returns policy becomes less attractive. By contrast, as marginal costs increase, a no-returns policy become better relative to returns policy, holding everything else fixed. Finally, conditions (a) and (b) imply that both policies can be good for a manufacturer and that the optimality depends on both overall uncertainty and marginal costs.

A returns policy affects the manufacturer's profit in two ways. The returns policy shifts the cost of excess inventory from the retailer to the manufacturer, hence encourages the retailer to increase stock. The larger stock intensifies retail distribution, which benefits the manufacturer.[10] On the other hand, a returns policy causes the retailer to order stock according to the high demand, which is excessive relative to an integrated channel. At some point, when uncertainty is sufficiently large, the manufacturer is worse off with a returns policy than not allowing returns.

It is also interesting to consider the effect of a returns policy on retail pricing. The returns policy reduces the dispersion of retail prices between high and low states. From Table 3 it is easy to show that the price dispersion when the manufacturer does not accept returns is,

$$p_h - p_\ell = \frac{\alpha_h - \alpha_\ell}{2\beta} + \frac{w}{2(1-\lambda)},$$

while it is

$$p_h - p_\ell = \frac{\alpha_h - \alpha_\ell}{2\beta},$$

when the manufacturer accepts returns. Also, the range of retail prices in the returns case is contained within the range of retail prices for the no-returns case.

Also note that the provision of a returns policy reduces the retailer's expected margin. The retailer's expected margin is $\lambda p_l + (1 - \lambda)p_h - w$. Algebraic simplification after substitution from Table 3 yields the retailer's expected margin in the case of no returns to be

$$\frac{\bar{\alpha} + \lambda\alpha_\ell - \beta c}{4\beta}. \tag{16}$$

By contrast, with a returns policy, the retailer's expected margin can be shown to be

$$\frac{\bar{\alpha} - \beta c}{4\beta}. \tag{17}$$

Hence, the retailer's expected margin is always smaller with a returns policy. Still, in the event that demand is low, the *realized* retail margin may be higher with a returns policy.

7. Retail Competition and Uncertain Demand

We have examined two different extensions of the benchmark: in one, retailing was competitive while demand was certain, while in the other, retailing was a monopoly but demand was uncertain. A general scenario would involve retail competition as well as uncertain demand. Rather than formally studying the general scenario, let us draw together the implications of the two extensions already analyzed.[11]

By Proposition 1, when retailing is competitive but demand is certain, a returns policy intensifies retail competition, so benefiting the manufacturer. In contrast, when retailing is a monopoly while demand is uncertain, a returns policy helps the manufacturer by intensifying retail distribution, but hurts by encouraging excessive stocking. Proposition 2(a) outlines conditions when the manufacturer is best offering and not offering a returns policy. More specifically, it states that the advantage of a returns policy decreases as marginal costs and demand uncertainty increase.

Accordingly, there is one clear implication for the general scenario of retail competition as well as uncertain demand. The manufacturer should adopt a returns policy if the marginal production cost, c, and demand uncertainty are sufficiently low. The lower the marginal cost and demand uncertainty, the greater will be the benefit from more intensive retail competition and the smaller will be the manufacturer's loss from excessive retail stocking. Thus we note that marginal costs of producing books, CDs, and computer software are small in comparison to their price, and returns policies are common in distribution of books, recorded music, and software.

The effect of the high primary demand, α_h, on the manufacturer's decision whether to accept returns, however, is ambiguous. From Proposition 1(b), the higher is the (average) demand, the greater is the manufacturer's benefit from intensifying retail competition. However, increasing α_h widens the possible range of demand, and thus the uncertainty. This in turn can lead to loss from excessive retail stocking.

8. Empirical Validation

A key implication of our theory is that a manufacturer's returns policy leads, on average, to reduced retail margins. We show this occurs when retailing is competitive

[10] The returns policy helps to overcome the double marginalization problem (Spengler 1950).

[11] Interested readers can obtain the formal analysis from the authors.

(and demand is certain), and when demand is uncertain (and the retailer is a monopolist). In order to test this prediction, we obtained data from a major U.S. department store chain. Note that our hypothesis that a returns policy reduces retail margins is also consistent with the insurance rationale for a returns policy. When a manufacturer accepts returns, it can set a higher wholesale price—because risk-averse retailers are willing to pay a premium for the insurance against the risk of unsold inventory. Other explanations of returns policies, however, are silent on the relation between manufacturers' returns policies and retail profitability. Specifically, the theories of Lin (1993), Marvel and Peck (1992), Pellegrini (1986), and Pasternack (1985) do not say how returns policies will affect retail margins in a systematic fashion.

8.1. Data

After detailed discussions, management of the retail chain identified ten product categories that met our criteria of limited shelf life, competition at the retail level, and demand uncertainty. The categories were gloves, mufflers, caps, seasonal footwear (men's and women's), ladies footwear, hair accessories, fashion accessories, bath accessories, automatic blankets, and dinnerware.

Management stressed that, in each of these categories, sales followed a distinct seasonal pattern. Additionally, there was considerable turnover in the stock keeping units from one season to the next. This indicates that the products do have a limited shelf life. Note that since these categories are not literally "perishable," the dataset is biased against our theory. The sales leaders in the different categories were nationally advertised brands that were also sold through competing retail chains. Therefore, the market structure is consistent with the model assumptions on retail competition. Typically, the store's buyers placed orders with vendors six months ahead of the selling season. The store, however, fixed retail prices less than four weeks ahead of the selling season. During the lengthy time between ordering stocks and pricing, the store would learn more about customer demand with information about fashion trends, weather, and other relevant factors. This sequence is consistent with our assumption that information about demand is revealed after retailers order stocks but before they set prices.

Table 4 Summary Data on Returns Policies

Category	Number of Brands in Category	Number of Brands with Returns Policy
1	3	2
2	12	2
3	2	1
4	10	2
5	6	2
6	6	1
7	23	1
8	2	1
9	30	1
10	7	3

In addition, no supplier used two-part pricing. Rather, every one of them set a uniform wholesale price, with some also offering a returns policy. Accordingly, this data-set is very suitable for testing our hypothesis regarding the relation between manufacturers' returns policies and retail profitability.

There are records of two variables for 100 products in 10 different product categories for 1993 sales. First, $RMARGIN_i$, defined as retail profit as a percentage of retail sales revenue, measures the retail margin of product i. Second, the binary variable, $RETURNS_i$, indicates whether the supplier of the product accepted returns ($RETURNS = 1$) or not ($RETURNS = 0$). Table 4 reports the means. By agreement with management, we do not directly identify the categories and do not report the retail margins. Note that, within a category, different brands may differ in their marginal production cost and demand uncertainty. Accordingly, it is consistent with our results that some suppliers choose to accept returns while others do not.[12]

8.2. Model and Results

To test the hypothesis that returns policies reduce retailer margins, we estimated the following model by ordinary least squares.

[12] A cursory inspection of Table 4 indicates that there is no relation between the number of brands in a category and the likelihood of a returns policy. Hence, Pellegrini's explanation does not apply.

$$RMARGIN_i = \alpha_0 + \alpha_1 RETURNS_i + \alpha_2 D_2 + \alpha_3 D_3 \cdots + \alpha_{10} D_{10} + \alpha_{11} SALES_i. \quad (18)$$

Our theory predicts that $\alpha_1 < 0$. However, retail margins might vary across categories for reasons other than the presence of returns policies. Accordingly, we included nine dummy variables to control for these possible level effects. In addition, the sales revenue might directly affect retail margin through volume discounts or differences in supplier-retailer power. Thus, we included sales revenue for the product, $SALES_i$, measured in dollars, as another independent variable.

Table 5 reports the results. Consistent with our hypothesis that a returns policy reduces retailer margins, the coefficient α_1 was negative and significant. The estimated coefficient $\alpha_1 = -6.33$ suggests that the presence of a returns policy cuts the retail margin by just over six percentage points. This is a substantial reduction when compared with the average retail margin in the ten product categories.[13] Sales revenue of the product had no significant relation to retail profitability.

Table 5 Impact of Returns Policies on Retailer Profitability

Variable	Parameter Estimate	T-Statistic	Prob > $\|T\|$
Returns	−6.33	2.898	0.005
D_2	−11.13	2.534	0.013
D_3	−2.61	0.436	0.664
D_4	−13.79	3.109	0.002
D_5	−3.03	0.644	0.521
D_6	−6.68	1.261	0.211
D_7	4.77	1.125	0.264
D_8	−3.05	0.503	0.617
D_9	−8.96	2.133	0.036
D_{10}	3.06	0.668	0.506
Sales	0.00038	0.576	0.566

$R^2 = 0.55$.
Adjusted $R^2 = 0.50$.
F-value = 10.085 (0.001).

There are two other ways of explaining the significant negative relation between retail margins and a returns policy. Both of these flow from the insurance theory. One is that the suppliers set higher wholesale prices when accepting returns. Risk-averse retailers accept higher prices because they benefit from insurance. Another explanation is that, as retailers are risk-averse, a returns policy induces more retailers to carry the product and thereby intensifies retail competition which results in lower retail margins.

Both of these alternative explanations rely on retailers being relatively more risk-averse than the supplier. This, however, is quite unlikely for the store that we consider. In 1994, the store's sales revenue exceeded a billion dollars. By contrast, the largest supplier in the database accounted for only \$6 million in total retail sales at the chain. Further, the annual domestic sales of the supplier was considerably lower than a billion dollars. This suggests that it is very unlikely that these suppliers were accepting returns to insure this store. Consequently, we feel confident in rejecting the alternative explanations.

9. Conclusion and Discussion

Manufacturers of a wide range of products accept returns from their retailers. We show that, by effectively nullifying the constraint of previously-ordered stock, a returns policy intensifies retail competition. Intensified retail competition benefits the manufacturer. Our result may seem somewhat ironic: at first glance, it would seem that a returns policy benefits retailers at the expense of the manufacturer. Only by considering the subtle strategic effects is it possible to see how returns policies actually work to the manufacturer's advantage. We show that manufacturers should accept returns if production costs are sufficiently low and demand uncertainty is not too great.

In order to focus on retail competition and demand uncertainty, we assumed that all parties were risk-neutral.[14] If the retailers are risk-averse, a manufacturer

[13] We note that the estimate of α may be biased as the returns policy may be simultaneously determined with retail prices. Unfortunately, we do not have access to suitable instrumental variables to perform the estimation with instrumental variables.

[14] In addition, we ignored the costs of administering and implementing returns policies. These costs also should be considered when a manufacturer decides whether or not to accept returns.

should accept returns over a wider range of costs. Retailer risk-aversion also has obvious implications for the manufacturer's wholesale price. The wholesale price with returns should incorporate an insurance premium, hence would be higher than in our setting. By contrast, the wholesale price without returns would be lower than in our setting as the manufacturer must take account of the retailers' aversion to risk.

We have not considered heterogeneity among retailers. Ideally, in this situation, the manufacturer should devise some mechanism by which to segment retailers according to their attitudes towards risk and other characteristics. In this regard, it is interesting to note that McKesson, a major distributor of health and beauty aid products, offers retailers a menu of return policies. Retailers can choose generous returns at the expense of higher wholesale prices. McKesson's menu approach, incorporating partial returns, is a way of segmenting heterogeneous retailers.

There are many interesting opportunities for future research in this area. We have not considered competition at the manufacturer level in a distribution level. It would be useful to understand the strategic effects of returns policies in such a setting. Consideration of issues such as retailer and manufacturer marketing efforts would add further richness to the model. We illustrate the impact of returns policies in a world wherein the trade-off is between a returns policy or no returns policy. It would be worthwhile to explore the trade-offs between returns policies and more general contracting policies on channel coordination. The present analysis concentrates on the role of returns policies on manufacturer-distributor interaction. Combining this with a model of end consumers would add completeness to our understanding of returns policies.[15]

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Appendix

PROOF OF REMARK 2. By Remark 1, when demand is high, the retailer's sales will be constrained by stock, hence, $p_h = (\alpha_h - s)/\beta$.

• Suppose that, when demand is low, the retailer's sales will also be constrained by stock. Then $p_\ell = (\alpha_\ell - s)/\beta$. Looking forward from the first stage, the retailer's profit is

$$\pi' = \lambda \frac{\alpha_\ell - s}{\beta} s + (1 - \lambda) \frac{\alpha_h - s}{\beta} s - cs.$$

Maximizing with respect to s,

$$s = \frac{\bar{\alpha} - \beta c}{2},$$

hence,

$$\pi' = \frac{(\bar{\alpha} - \beta c)^2}{4\beta}. \tag{19}$$

• Alternatively, suppose that, when demand is low, the retailer's sales are not constrained by stock. Then, it sets p_ℓ to maximize revenue, $p_\ell(\alpha_\ell - \beta p_\ell)$. Maximizing with respect to price, $p_\ell = \alpha_\ell/2\beta$, and $q_l = \alpha_\ell/2$. Looking forward from the first stage, the retailer's profits

$$\pi'' = \lambda \frac{\alpha_\ell^2}{4\beta} + (1 - \lambda) \frac{(\alpha_h - s)s}{\beta} - cs. \tag{20}$$

Maximizing with respect to the stock,

$$s = \frac{(1 - \lambda)\alpha_h - \beta c}{2(1 - \lambda)}. \tag{21}$$

This stock will be sufficient for the sales $q = \alpha_\ell/2$ if

$$\frac{(1 - \lambda)\alpha_h - \beta c}{2(1 - \lambda)} \geq \frac{\alpha_\ell}{2} \tag{22}$$

or

$$\alpha_h - \alpha_l \geq \frac{\beta c}{1 - \lambda}. \tag{23}$$

Substituting for the stocks in the retailer's profit

$$\pi'' = \lambda \frac{\alpha_\ell^2}{4\beta} + \frac{((1 - \lambda)\alpha_h - \beta c)^2}{4\beta(1 - \lambda)}. \tag{24}$$

• Comparing (19) with (24), we find that $\pi' < \pi''$, which proves Remark 2.

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