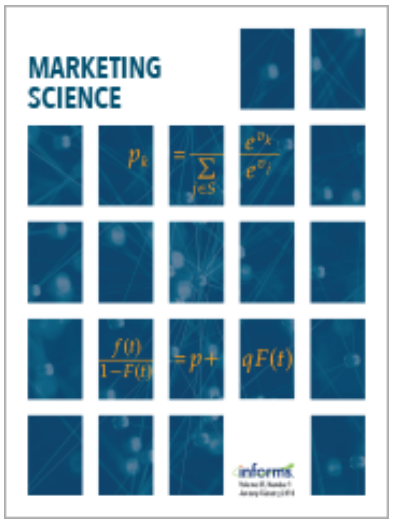

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The Bright Side of Supplier Encroachment

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The common wisdom is that a retailer suffers when its wholesale supplier encroaches on the retailer's operations by selling directly to final consumers. We demonstrate that the retailer can benefit from encroachment even when encroachment admits no synergies and does not facilitate product differentiation or price discrimination. The retailer benefits because encroachment induces the encroaching supplier to reduce the wholesale price in order not to diminish unduly the retailer's demand for the manufacturer's wholesale product. The lower wholesale price and increased downstream competition mitigate double marginalization problems and promote efficiency gains that can secure Pareto improvements.

Key words: channels of distribution; encroachment; market entry; retailing and wholesaling
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1. Introduction

Manufacturers have competed with retailers for the loyalty of retail customers for many years. Such competition—often referred to as "encroachment"—has taken different forms, including company-owned franchises, catalog sales, direct telemarketing, and manufacturer outlets (Tannenbaum 1995). The recent proliferation of online supply channels has raised concerns about encroachment to a fever pitch (Tedeschi 2005). Although retail competition typically is viewed as a healthy economic force, competition from a retailer's own supplier has not met with universal approval. Dissent often is expressed as outrage that mercenary manufacturers, bent on becoming vertical behemoths, are viciously exploiting their faithful retailers.[1]

The primary purpose of this paper is to demonstrate that contrary to the conventional wisdom, an incumbent retailer may benefit from encroachment by its wholesale supplier. The gain for the retailer arises from the lower wholesale price that can naturally accompany encroachment. Although a higher wholesale price can afford the encroaching supplier a competitive edge in the retail market, the higher price also reduces retailer demand for the supplier's product. Importantly, the increased competition from encroachment can render a retailer's demand more sensitive to wholesale price increases. As a result, an encroaching supplier finds it profitable to lower its wholesale price in order to increase the retailer's purchases of the wholesale product.[2] When the retailer is particularly adept at serving customers, the encroaching manufacturer finds it optimal to reduce the wholesale price to such an extent that the retailer (like the manufacturer and consumers) gains from supplier encroachment.

We identify these Pareto gains from encroachment in a simple model that precludes the most apparent reasons for such gains. In particular, we rule out product complementarity by focusing on a Cournot model with a homogeneous retail product. Our model with a single market-clearing price also precludes price discrimination that, in principle, could be facilitated by the dual marketing channels that arise under supplier encroachment (Hendershott and Zhang 2006).[3]

[1] A common complaint is that manufacturers renege on implicit or explicit promises of exclusive sales territories for retailers. Conflict over the nature and the propriety of manufacturer encroachment has led to substantial judicial and legislative activity (Kalnins 2004).

[2] This finding reveals that in contrast to the well-documented benefits of raising a rival's operating costs (e.g., Salop and Scheffman 1983), an encroaching supplier may prefer to lower the costs of a retail rival (in order to stimulate the rival's demand for the supplier's wholesale product).

[3] Liu and Zhang (2006) show that the implementation of retail price discrimination can harm a retailer by increasing the profit-maximizing wholesale price charged by the manufacturer. The authors also show that a retailer may implement price discrimination in order to deter encroachment by the manufacturer.

By abstracting from these issues, we emphasize that Pareto gains can arise from supplier encroachment even when it introduces intense competition with no apparent synergistic gains.

To abstract from other well-known effects of encroachment, we assume the retail demand function is not affected by encroachment. Therefore, the possibility that encroachment might undermine a retailer's incentive to promote a product or provide customer assistance (Fein and Anderson 1997) or affect the coordination of complementary demand-enhancing activities (Bell et al. 2003, Tsay and Agrawal 2004) does not arise in our model. We also abstract from the possibility that encroachment might promote brand awareness (Blair and Lafontaine 2005, Chapter 8) or dilute brand image (Frazier and Lassar 1996).[4]

Our analysis is related to those of Sibley and Weisman (1998) and Chiang et al. (2003) in that all three studies identify conditions under which wholesale suppliers undertake actions that assist retail competitors. In a setting with an exogenous (regulated) wholesale price, Sibley and Weisman (1998) find that a regulated vertically integrated provider may refrain from sabotaging the operation of its retail rival in order to enhance wholesale demand. Chiang et al. (2003) demonstrate that Pareto gains can arise when a manufacturer threatens to establish a direct distribution channel. This threat compels the retailer to lower its retail price in order to convince the manufacturer not to enter its market. In anticipation of the low retail price, the manufacturer offers concessions. Our work differs in part by identifying circumstances in which a retailer benefits when its supplier actually implements a direct distribution channel and encroaches on the retailer's territory. We find that encroachment benefits all parties because it induces lower wholesale prices to support the wholesale demand of the weakened incumbent retailer.

Our analysis proceeds as follows. Section 2 describes the key elements of our basic model. Section 3 presents our central findings. Section 4 extends the analysis to incorporate differentiated products, price competition, and nonlinear costs. Section 5 provides concluding observations.

2. The Basic Model

Consider a standard model of a vertical supply chain in which a manufacturer (supplier) sells a wholesale product to a retailer that, in turn, sells the product to final consumers. In addition, the manufacturer may sell the product directly to consumers, perhaps by establishing its own online store. This initial focus on a setting where the manufacturer and retailer are the only potential retail sellers is adopted primarily for expositional and analytic simplicity. However, the setting may reflect circumstances in which the retailer is particularly efficient (e.g., Wal-Mart) or serves an exclusive territory (perhaps because of an exclusive franchise, for example). The effects of additional retail competition are examined in §3.4.

Consumer demand for the product is represented by a linear, downward sloping, (inverse) demand function $P = a - bQ$, where a and b are strictly positive constants and where P and Q are the price and the quantity of the product, respectively. The manufacturer produces the good at a constant unit (marginal) cost which is normalized to zero. In addition, we normalize the retailer's unit selling cost to zero and let $c \in [0, a)$ denote the manufacturer's unit cost of selling directly to consumers. Thus, just as the manufacturer has an advantage in production, the (incumbent) retailer has an advantage in the sales process. The retailer's advantage might stem from superior knowledge of customer preferences, more direct contact with customers, or economies of scope with other retailing activities, etc.[5]

The manufacturer is assumed to set a unit price (w) for its wholesale product. Linear pricing arrangements of this sort are commonly employed in models of channel conflict (e.g., McGuire and Staelin 1983, Moorthy 1988, Padmanabhan and Png 1997, Sudhir 2001) and also are prevalent in practice (e.g., Lariviere and Porteus 2001, Cachon 2003, Ray et al. 2006). Linear pricing also admits a nontrivial role for encroachment in the setting analyzed here. The ability to implement nonlinear wholesale pricing would endow the manufacturer with the (unrealistic) ability to extract the entire monopoly profit from the more efficient retailer.[6] Consequently, encroachment could not provide strict gains for the manufacturer.

The timing in the model is as follows. First, the manufacturer establishes its wholesale price (w). Second, the retailer chooses its profit-maximizing retail output q_R. Third, the manufacturer determines the number of units (q_M) of the homogeneous product it will sell directly to consumers (via online sales or through a company-owned retail store, for example). Backward induction is employed to identify the

[4] Vinhas and Anderson (2005) summarize the extant literature highlighting the key determinants of the success or failure of concurrent channels.

[5] Of course, if the manufacturer were the more efficient retail provider, it would not require the services of an independent retailer.

[6] The manufacturer could do so with a two-part tariff that sets the unit price of the input at cost to maximize channel efficiency and sets the fixed component of the tariff to expropriate the entire channel profit.

equilibrium of this game.[7] The key properties of the equilibrium are presented in §3.

3. Findings

3.1. The No-Encroachment Setting

As a benchmark, first consider the *no-encroachment setting* in which the manufacturer can only reach consumers through its retailer. In this setting, the retailer chooses its output q_R to maximize its monopoly profit from retail sales, taking the unit wholesale price w as given. The retailer's problem is:

$$\underset{q_R}{\text{Maximize}}[a - bq_R]q_R - wq_R. \tag{1}$$

Performing the optimization in Equation (1) provides $q_R^N(w)$, the retailer's output in the no-encroachment setting given unit wholesale price w:

$$q_R^N(w) = \frac{a-w}{2b}. \tag{2}$$

Anticipating the retailer's response to the wholesale price it sets, the manufacturer chooses w to maximize its profit, solving:

$$\underset{w}{\text{Maximize}}\, wq_R^N(w) \;\Leftrightarrow\; \underset{w}{\text{Maximize}}\, \frac{w[a-w]}{2b}. \tag{3}$$

Performing the maximization in Equation (3) yields w^N, the wholesale price of the product in the no-encroachment setting. Substituting w^N into Equation (2) yields the equilibrium retail output q_R^N:

$$w^N = \frac{a}{2} \quad \text{and} \quad q_R^N = \frac{a}{4b}. \tag{4}$$

Substituting the price and quantity from Equation (4) into Equations (1) and (3) yields the retailer's profit Π_R^N and the manufacturer's profit Π_M^N in the no-encroachment setting:

$$\Pi_R^N = \frac{a^2}{16b} \quad \text{and} \quad \Pi_M^N = \frac{a^2}{8b}. \tag{5}$$

Consumer surplus in the no-encroachment setting CS^N is:

$$CS^N = \int_0^{q_R^N} b[q_R^N - q]\,dq = \frac{b}{2}[q_R^N]^2 = \frac{a^2}{32b}. \tag{6}$$

3.2. The Encroachment Setting

Now consider the *encroachment setting* in which the manufacturer can sell the product directly to consumers after setting the wholesale price and supplying the wholesale product to the (incumbent) retailer.

[7] The equilibrium is the well-known Stackelberg equilibrium adjusted to reflect the late mover's (the encroaching manufacturer's) supply of a vital input to the early mover (the retailer). Equilibria are identified by relevant first-order conditions throughout the ensuing analysis. For the parameters of interest, the identified solutions reflect unique subgame perfect equilibria.

The equilibrium outcomes in this setting are again determined by backward induction. Given wholesale price w and retailer supply q_R, the manufacturer chooses q_M to:

$$\underset{q_M}{\text{Maximize}}[a - bq_R - bq_M]q_M - cq_M + wq_R. \tag{7}$$

The first term in Equation (7) is the manufacturer's revenue from selling directly to consumers, the second term is the manufacturer's direct selling costs, and the last term is the profit the manufacturer derives from its sales to the retailer. Performing the optimization in Equation (7) provides $q_M^E(q_R)$, the manufacturer's optimal direct sales to consumers in the encroachment setting given the retailer's output q_R:

$$q_M^E(q_R) = \frac{a-c-bq_R}{2b}. \tag{8}$$

Given wholesale price w and anticipating the manufacturer's response in Equation (8), the retailer chooses its retail output q_R to:

$$\underset{q_R}{\text{Maximize}}[a - bq_R - bq_M^E(q_R)]q_R - wq_R. \tag{9}$$

Substituting $q_M^E(q_R)$ from Equation (8) into Equation (9) and performing the maximization in Equation (9) yields $q_R^E(w)$, the retailer's profit-maximizing output as a function of the manufacturer's wholesale price:

$$q_R^E(w) = \frac{a+c-2w}{2b}. \tag{10}$$

Substituting $q_M^E(q_R)$ from Equation (8) into Equation (7) and then substituting $q_R^E(w)$ from Equation (10) into Equation (7) permits a representation of the manufacturer's profit solely as a function of w. Maximizing this expression with respect to w yields w^E, the manufacturer's preferred wholesale price in the encroachment setting. Substituting this expression for w^E into Equations (10) and (8) provides the profit-maximizing retail outputs of the retailer (q_R^E) and the manufacturer (q_M^E):

$$w^E = \frac{a}{2} - \frac{c}{6}, \quad q_R^E = \frac{2c}{3b}, \quad \text{and} \quad q_M^E = \frac{3a-5c}{6b}. \tag{11}$$

The expressions in Equation (11) are readily employed to compute retailer profit (Π_R^E, from Equation (9)), manufacturer profit (Π_M^E, from Equation (7)), and consumer surplus in the encroachment setting:

$$\Pi_R^E = \frac{2c^2}{9b}, \quad \Pi_M^E = \frac{3a^2-6ac+7c^2}{12b}, \quad \text{and} \quad CS^E = \frac{b}{2}[q_R^N + q_M^N]^2 = \frac{[3a-c]^2}{72b}. \tag{12}$$

3.3. No Encroachment vs. Encroachment

Because encroachment increases retail competition, one would expect encroachment to increase consumer surplus. The ability to sell directly to consumers also

would seem to be a boon for the manufacturer. Proposition 1, which follows directly from Equations (5), (6), (11), and (12), confirms this conventional wisdom. Proposition 1 also notes that the manufacturer will encroach ($q_M^E > 0$) if and only if its retail cost disadvantage is not too pronounced.

Proposition 1. *The manufacturer encroaches if and only if* $c < 3a/5$. *The manufacturer and consumers both benefit from encroachment in this case*: $\Pi_M^E - \Pi_M^N = (3[a-2c]^2 + 2c^2)/[24b] > 0$ *and* $CS^E - CS^N = [9a-2c] \times [3a-2c]/[288b] > 0$.

The conventional wisdom also suggests the increased competition that accompanies encroachment will harm the retailer. The harm would seem to be particularly pronounced in the simple setting considered here, where encroachment dissipates the retailer's monopoly power. This logic, though, misses a key point: encroachment by the manufacturer can alter its preferred wholesale price.

One might expect an encroaching manufacturer to increase its wholesale price in order to bolster its competitive position in the retail market. In fact, the opposite is true in the present setting. (Notice from Equations (11) and (4) that w^E is less than w^N.) The manufacturer sets a lower wholesale price in the encroachment setting than in the no-encroachment setting in order to offset the advantage its retail arm secures when it effectively receives the input at cost. If this competitive advantage were not counterbalanced by a lower wholesale price, the advantage would reduce the output of the incumbent retailer unduly and thereby reduce its demand for the essential input. Thus, although the lower input price reduces the retail profit of the encroaching manufacturer, it increases its wholesale profit by a greater amount by supporting the retailer's substantial demand for the input. The retailer's substantial output stems both from its cost advantage in the sales process and from its desire to expand its own retail output in order to limit the output the encroaching manufacturer will subsequently produce.

The reduction in the wholesale price implies that the retailer may benefit from manufacturer encroachment. Expressions (5) and (12) reveal this is indeed the case when the manufacturer encroaches ($c < 3a/5$), provided the retailer's sales cost advantage is sufficiently pronounced relative to the intercept of the market demand curve ($c > 3a/[4\sqrt{2}]$).

Proposition 2. *Encroachment that increases retailer profit arises if and only if* $c \in (3a/[4\sqrt{2}], 3a/5)$.

Propositions 1 and 2 reveal that the systematic reduction in the wholesale price that arises under encroachment can secure Pareto gains. Thus, an efficient franchise or retail store might welcome competition from a (less efficient) manufacturer-owned store, just as a retailer with a local monopoly position might be pleased to see its major supplier begin to compete directly for retail customers through online sales. Pareto gains arise in our model when the retailer has a substantive advantage in the sales process but the advantage is not so pronounced that the manufacturer refrains from encroachment. Under these circumstances, the manufacturer reduces the price of the wholesale product in order to increase the retailer's demand for the input and thereby expand the use of the efficient sales channel. When the retailer's cost advantage is sufficiently pronounced, the substantial wholesale price reduction outweighs the direct reduction in demand due to the manufacturer's retail sales, and the retailer benefits from encroachment.

The region of Pareto gains from encroachment arises in a setting where the manufacturer chooses its preferred wholesale price. A corresponding region also arises if the wholesale price is a result of bargaining between the parties. In particular, suppose the wholesale price is determined by generalized Nash bargaining, where the weights $\beta \in (0, 1]$ and $1-\beta$ reflect the bargaining strengths of the manufacturer and the retailer, respectively. Encroachment that produces Pareto gains will arise in this setting if and only if $c \in (3a/[4\sqrt{2}], 3a/[7-2\beta])$. The interval is nonempty whenever the manufacturer's bargaining strength is sufficiently pronounced (i.e., $\beta > [7-4\sqrt{2}]/2 \approx 0.67$). Intuitively, substantial manufacturer bargaining strength produces relatively high wholesale prices in the absence of encroachment, which permits the wholesale price reductions that generate Pareto gains under encroachment.[8]

Of course, encroachment can enhance industry profit even when it reduces the retailer's profit. When the manufacturer is a relatively efficient retail provider (so c is small), its ability to avoid the double marginalization problem when it sells directly to consumers creates potential efficiency gains.[9] Expressions (5) and (12) reveal that the increase in industry profit in the encroachment setting is:

$$\Pi_R^E + \Pi_M^E - [\Pi_R^N + \Pi_M^N] = \frac{9a^2 - 72ac + 116c^2}{144b}. \quad (13)$$

Identifying the two roots of the expression in Equation (13) yields Proposition 3.

[8] The setting where the manufacturer chooses its preferred wholesale price corresponds to the case of $\beta = 1$. Notice that when $\beta = 1$, the region of Pareto gains coincides with the region specified in Proposition 2.

[9] A double marginalization problem arises when a retailer pays more for an input than the supplier's marginal cost of production, which results in a retail price that exceeds the price that maximizes the joint profits of the retailer and the supplier.

Proposition 3. *Encroachment that increases industry profit arises if and only if* $c \in [0, 3a/[2[6+\sqrt{7}]])$ *or* $c \in (3a/2[6-\sqrt{7}], 3a/5)$.

Proposition 3 reveals that encroachment will increase industry profit either when the retailer's downstream cost advantage is sufficiently pronounced or when it is sufficiently limited. Expressions (5) and (13) reveal that industry profit can increase by as much as 28% when the retailer's downstream cost advantage is pronounced ($c > 0.45a$), in which case the primary effect of encroachment is to reduce the wholesale price and thereby limit losses from double marginalization. Industry profit can increase by as much as 33% when the retailer's cost advantage is limited ($c < 0.17a$), in which case encroachment enables the manufacturer to profit from serving retail customers directly and thereby limit losses from double marginalization by using a direct channel.

The analysis to this point has considered the *sequential encroachment setting* in which the manufacturer chooses its retail output after the retailer chooses its output. Such timing may be the most natural, as encroachment typically entails a manufacturer entering the market of an established retailer. However, other timing patterns are conceivable. For example, consider the *simultaneous encroachment setting* in which the manufacturer and incumbent retailer choose their retail output levels simultaneously after the manufacturer implements its preferred wholesale price. It is readily verified that in this setting, the wholesale price and output levels under encroachment are:

$$w^E = \frac{a}{2} - \frac{c}{10}, \qquad q_R^E = \frac{2c}{5b}, \quad \text{and} \quad q_M^E = \frac{5a-7c}{10b}. \tag{14}$$

Consequently, profit levels and consumer surplus in this setting are:

$$\Pi_R^E = \frac{4c^2}{25b}, \quad \Pi_M^E = \frac{5a^2-10ac+9c^2}{20b}, \quad \text{and} \quad CS^E = \frac{[5a-3c]^2}{200b}. \tag{15}$$

Comparing the expressions in Equations (15) and (12) when encroachment arises provides the following conclusion:

Proposition 4. *The retailer, the manufacturer, and consumers all are better off under sequential encroachment than under simultaneous encroachment.*

When it serves as the Stackelberg leader, the retailer's demand for the wholesale product becomes more sensitive to the wholesale price. (The retailer's demand decreases as w increases at the rate $1/b$ in the sequential setting and at the lower rate $2/[3b]$ in the simultaneous setting.) Consequently, the manufacturer lowers wholesale price more substantially in the sequential encroachment setting. (Notice that the wholesale price is lower in Equation (11) than in Equation (14).) The lower wholesale price provides direct gains for the retailer and also ensures increased output and a higher level of consumer surplus. Thus, coincident preferences may lead naturally to the sequential interaction analyzed throughout this paper.

3.4. The Effect of Additional Retail Competition

The preceding analysis demonstrates that a monopolistic retailer can benefit from encroachment by its supplier. We now examine whether a retailer that faces incumbent competition also can gain from encroachment. In practice, retailers often face the threat of supplier encroachment even as they compete with other retail operators. For example, a McDonald's franchise may face the prospect of a neighboring company-owned franchise as it competes with nearby Burger King and Wendy's outlets.

Formally, suppose the retailer (denoted R) now faces competition from $n \geq 0$ incumbent rivals (where rival i is denoted R_i'). For simplicity, each rival is presumed to be a vertically integrated producer of a substitute good who operates with unit cost c.[10] The inverse demand function is $P = a - b[q_R + \sum_i q_{R_i'} + q_M]$, where q_R, $q_{R_i'}$, and q_M denote the retail output of retailer R, established rival R_i', and the manufacturer, respectively.

Using the methodology employed in §3.1, it is readily shown that when encroachment is not possible in this setting, the wholesale price and retail outputs are:

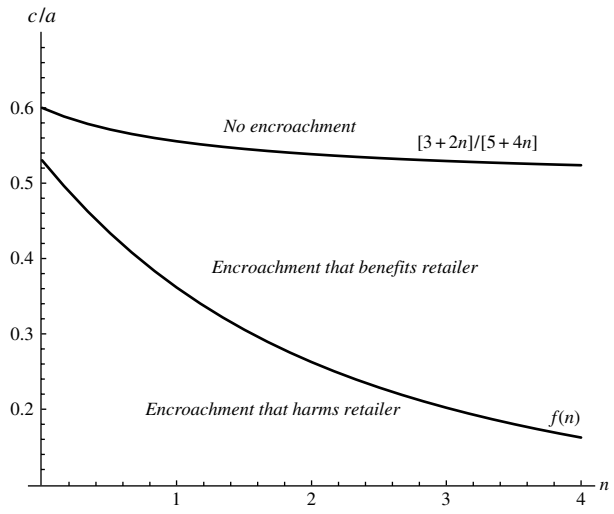
$$w^N(n) = \frac{a+nc}{2[1+n]}, \quad q_R^N(n) = \frac{a+nc}{2b[2+n]}, \quad \text{and} \quad q_{R_i'}^N(n) = \frac{a[3+2n]-c[4+3n]}{2b[2+3n+n^2]}. \tag{16}$$

Similarly, following the analysis in §3.2, equilibrium outcomes when encroachment is possible are readily shown to be:

$$w^E(n) = \frac{a[3+n]+c[-1+5n+2n^2]}{2[3+6n+2n^2]}, \quad q_R^E(n) = \frac{na+c[2+3n+2n^2]}{b[3+6n+2n^2]}, \quad q_{R_i'}^E(n) = \frac{a[3+2n]-c[5+4n]}{b[3+6n+2n^2]}, \quad \text{and} \quad q_M^E(n) = \frac{a[3+2n]-c[5+4n]}{2b[3+6n+2n^2]}. \tag{17}$$

[10] This assumption places all rivals of retailer R on equal footing. Results similar to those reported in this section can arise when all retailers purchase the key input from the manufacturer. In this case, though, encroachment can be less attractive for the manufacturer because it reduces its sales to multiple retailers without securing substantial retail profit (due to the more intense retail competition).

Figure 1 The Incidence and Effects of Encroachment



Expressions (16) and (17) can be employed to show that when encroachment arises, the manufacturer and consumers gain for all n. In contrast, the established rivals (R_i') suffer from encroachment. Their loss arises both because they face increased competition from the manufacturer and because their cost disadvantage relative to retailer R becomes more pronounced as the wholesale price declines under encroachment. Retailer R's profit in this setting under no encroachment and under encroachment are, respectively:

$$\Pi_R^N(n) = \frac{[a+nc]^2}{4b[2+n]^2} \quad \text{and}$$
$$\Pi_R^E(n) = \frac{[na+c(2+3n+2n^2)]^2}{2b[3+6n+2n^2]^2}. \tag{18}$$

Proposition 5 and its corollary follow from Equations (16), (17), and (18).

Proposition 5. *For all $n \geq 0$:*

(i) *Encroachment arises if and only if $c < [3+2n]a/[5+4n]$, in which case both the manufacturer and consumers benefit from encroachment; and*

(ii) *Encroachment that increases retailer profit arises if and only if*

$$c \in \left(f(n)a, \frac{[3+2n]a}{[5+4n]} \right), \quad \textit{where}$$
$$f(n) = \frac{9+36n+40n^2+16n^3+2n^4}{7n+4n^2-4n^3-2n^4+\sqrt{2}[2+n]^2[3+9n+8n^2+2n^3]}.$$

Corollary. *The range of c values for which the retailer benefits from encroachment increases as n increases, i.e., $[3+2n]a/[5+4n] - f(n)a$ is increasing in n.*

Figure 1 illustrates the key conclusions in Proposition 5 and its corollary. As n increases, retailer R is weakened by the larger number of retail rivals it faces. Consequently, retailer R's demand becomes more sensitive to the established wholesale price as n increases. (Retailer R's demand decreases as w increases at the rate $2[1+n]/[2+n]$, which is an increasing function of n.) In response to this increased sensitivity, the manufacturer lowers the input price. (For the c realizations identified in conclusion (ii) of Proposition 5, $w^E(n)$ is decreasing in n.) This benefit of encroachment accrues exclusively to retailer R. In contrast, the burden of the revenue reduction caused by encroachment is shared by all incumbent retailers. Consequently, the range of c/a realizations in which retailer R gains from encroachment increases as the number of incumbent retailers (n) increases. Importantly, the range in which encroachment secures retailer gains in the absence of incumbent retail competition (i.e., when $n = 0$, as specified in Proposition 2 and as illustrated by the region between the vertical intercepts of the two curves in Figure 1) is smaller than the corresponding range in the presence of incumbent retail competition.

4. Extensions

We now consider extensions of the basic model analyzed in §3 to further assess the robustness of our key findings. The analysis in this section demonstrates that retailer gains continue to arise from encroachment when consumers view the manufacturer's and retailer's products as imperfect substitutes, when the parties engage in price competition, and in the presence of nonlinear selling costs.

4.1. Imperfect Substitutes

Consider again the setting where there is only one incumbent retailer ($n = 0$), but suppose consumers no longer view the retail products of the incumbent retailer and the manufacturer as perfect substitutes. For example, some consumers may value highly the personal touch provided by a brick and mortar retailer while others may particularly value the convenience of in-home shopping provided by a manufacturer's online store.

To allow for differentiated retail products, let the (inverse) demand curve for the retail product of firm i be $P_i = a - q_i - kq_j$, where P_i is the price of firm i's product, and q_i and q_j are the retail outputs of firms i and j, respectively (for $i, j = R, M$). The parameter $k \in (0,1)$ represents the degree of product substitution. The demands for the two retail products become independent as k approaches 0. The retail products become perfect substitutes (as in §3) as k approaches 1.

Employing the methodology developed in §3, it is readily shown that when encroachment is possible in

this setting and when the supplier and the encroaching manufacturer set quantities sequentially, the equilibrium wholesale price and outputs are:

$$w^E(k) = \frac{a}{2} - \frac{k^2[a(1-k)+ck]}{2[8-5k^2]},$$
$$q_R^E(k) = \frac{2[a(1-k)+ck]}{8-5k^2}, \quad (19)$$
$$q_M^E(k) = \frac{[a-c][8-3k^2]-2ak}{2[8-5k^2]}.$$

Using expressions (4) and (19), it can be shown that when the manufacturer encroaches, consumers and the manufacturer both benefit for all values of k. Using Equation (19), the retailer's profit under encroachment in the present setting is readily shown to be:

$$\Pi_R^E(k) = [a - q_R^E(k) - kq_M^E(k)]q_R^E(k) - wq_R^E(k)$$
$$= \frac{[4-2k^2][a(1-k)+ck]^2}{[8-5k^2]^2}. \quad (20)$$

Comparing $\Pi_R^E(k)$ in Equation (20) with Π_R^N in Equation (5) for $b=1$ provides the following conclusion:

Proposition 6. *With imperfect substitutes*:

(i) *Encroachment arises if and only if* $c < ([8-2k-3k^2]a)/[8-3k^2]$, *in which case both the manufacturer and consumers benefit from encroachment*; *and*

(ii) *Encroachment that increases retailer profit arises if and only if*

$$c \in \left(g_1(k)a, \frac{[8-2k-3k^2]a}{[8-3k^2]}\right), \quad \textit{where}$$
$$g_1(k) = \frac{128-112k-64k^2+57k^3}{4[(8-5k^2)\sqrt{4-2k^2}+8(2-2k-k^2+k^3)]}.$$

When consumer demand for the products of the manufacturer and the retailer are independent, the manufacturer always encroaches (the upper bound of the interval identified in conclusion (i) of Proposition 6 is a) and encroachment does not affect the retailer's profit ($\Pi_R^E(0) = \Pi_R^N$). As product homogeneity (k) increases, the manufacturer becomes less inclined to encroach (i.e., the identified upper bound declines as k increases) because encroachment reduces wholesale profit more substantially.

As the firms' products become more homogeneous (k increases), the retailer's demand for the input becomes more sensitive to the wholesale price. (The retailer's demand declines as w increases at the rate $1/[2-k^2]$, which is an increasing function of k.) In response to this increased sensitivity, the manufacturer reduces the input price. (Formally, $w^E(k)$ declines with k for the realizations of c identified in conclusion (ii) of Proposition 6.) Although the retailer benefits from the lower wholesale price as k increases, the retailer is harmed by the more intense retail competition that arises when retail products are more homogeneous. Consequently, the retailer's net benefit from encroachment can either increase or decrease with k, depending upon parameter values.

4.2. Price Competition

Now suppose the retailer and encroaching manufacturer set prices rather than quantities. The equilibrium wholesale price and retail quantities under encroachment in this setting with imperfect substitutes and price competition are readily shown to be:[11]

$$\tilde{w}^E(k) = \frac{a}{2} - \frac{k^2[a(1-k)+ck]}{2[8-5k^2+k^4]},$$
$$\tilde{q}_R^E(k) = \frac{[2-k^2][a(1-k)+ck]}{[1-k^2][8-5k^2+k^4]}, \quad \text{and} \quad (21)$$
$$\tilde{q}_M^E(k) = \frac{[a-c][8-7k^2+k^4]-ak[6-5k^2+k^4]}{2[1-k^2][8-5k^2+k^4]}.$$

Using Equation (21), the retailer's profit under encroachment and price competition can be shown to be:

$$\tilde{\Pi}_R^E(k) = [a - \tilde{q}_R^E(k) - k\tilde{q}_M^E(k)]\tilde{q}_R^E(k) - w\tilde{q}_R^E(k)$$
$$= \frac{[4-2k^2][a(1-k)+ck]^2}{[1-k^2][8-5k^2+k^4]^2}. \quad (22)$$

Using Equations (4), (5), (21), and (22) provides the following conclusion:

Proposition 7. *Under retail price competition*:

(i) *Encroachment arises if and only if* $c < [8-6k-7k^2+5k^3+k^4-k^5]a/[8-7k^2+k^4]$, *in which case both the manufacturer and consumers benefit from encroachment*; *and*

(ii) *Encroachment that increases retailer profit arises if and only if*

$$c \in \left(g_2(k)a, \frac{[8-6k-7k^2+5k^3+k^4-k^5]a}{[8-7k^2+k^4]}\right), \quad \textit{where}$$
$$g_2(k) = \frac{128-176k-64k^2+153k^3-51k^5+11k^7-k^9}{4[(8-5k^2+k^4)\sqrt{4-6k^2+2k^4}+8(2-2k-k^2+k^3)]}.$$

Price competition reduces the manufacturer's incentive to encroach because the more intense retail competition magnifies the retailer's selling advantage. (Notice that the upper bound identified in conclusion (i) of Proposition 7 is smaller than the corresponding upper bound identified in conclusion (i) of Proposition 6.) Expressions (19) and (21) reveal that

[11] The wholesale price and retail output in Equation (4) reflect the monopoly retail setting with no encroachment. Consequently, these variables are the same whether the retailer sets a price or an output level.

although encroachment reduces the wholesale price under retail price competition, the wholesale price reduction is less pronounced with price competition than with quantity competition. The higher wholesale price arises under retail price competition because prices are strategic complements (Bulow et al. 1985). Therefore, the manufacturer secures greater retail profit by raising the wholesale price and thereby inducing the retailer to set a high retail price.

Although the retailer's gain from encroachment is reduced by the higher wholesale price under retail price competition, the retailer's sales cost advantage is more potent in this setting. When the products are particularly good substitutes ($k > 0.82$), the added potency of the retailer's advantage eliminates the incidence of profitable encroachment that benefits the retailer (i.e., the region identified in conclusion (ii) of Proposition 7 is empty). However, when encroachment does occur (as it will for the c realizations identified in conclusion (i)), the retailer secures more profit under price competition than under quantity competition (i.e., $\widetilde{\Pi}_R^E(k) > \Pi_R^E(k)$).

4.3. Nonlinear Costs

The linear functional forms employed to this point facilitate the analysis in part by admitting relatively simple closed form solutions for all relevant variables. Before concluding, we briefly illustrate the effects of allowing nonlinearities. To do so most simply, suppose the manufacturer's cost of selling q_M units of output is $cq_M + c_2[q_M]^2$, while demand for the homogenous product is linear, $P = a - q_R - q_M$.

When encroachment is possible in this setting with nonlinear costs, the wholesale price and output levels are:

$$w^E(c_2) = \frac{a}{2} - \frac{c + ac_2}{6 + 22c_2 + 16c_2^2}, \quad q_R^E(c_2) = \frac{2[c + ac_2]}{3 + 8c_2}, \quad q_M^E(c_2) = \frac{3a[1 + 2c_2] - c[5 + 8c_2]}{6 + 22c_2 + 16c_2^2}. \tag{23}$$

Using Equation (23), the retailer's profit in this setting when encroachment is possible is:

$$\Pi_R^E(c_2) = \frac{2[1 + 2c_2][c + ac_2]^2}{[1 + c_2][3 + 8c_2]^2}. \tag{24}$$

Using expressions (5), (6), (23), and (24) provides the following conclusion:

Proposition 8. *In the setting with nonlinear costs*:

(i) *Encroachment arises if and only if* $c < 3[1 + 2c_2]a/[5 + 8c_2]$, *in which case both the manufacturer and consumers benefit from encroachment*; *and*

(ii) *Encroachment that increases retailer profit arises if and only if*

$$c \in \left(h(c_2)a, \frac{3[1 + 2c_2]a}{[5 + 8c_2]} \right), \quad \textit{where}$$

$$h(c_2) = \frac{9 + 57c_2 + 80c_2^2}{4[8c_2(1 + 2c_2) + (3 + 8c_2)\sqrt{2 + 6c_2 + 4c_2^2}]}.$$

Greater convexity in selling costs (higher c_2) endows the manufacturer with a credible commitment to produce a limited amount of retail output if it encroaches, thereby reducing the extent to which encroachment reduces retailer demand for the input. Consequently, the retailer's demand for the input becomes less sensitive to the input price as c_2 increases. (Retailer demand declines with w at the rate $[1 + c_2]/[1 + 2c_2]$, which is a decreasing function of c_2.) This reduced sensitivity induces the manufacturer to set a higher input price under encroachment as c_2 increases. (Formally, $w^E(c_2)$ increases with c_2 for the c realizations identified in conclusion (ii) of Proposition 8.) Because the higher wholesale price is accompanied by less potent encroachment, the retailer's net gains from encroachment can either increase or decrease with c_2, depending upon parameter values.

5. Conclusion

In summary, we have shown that encroachment by a manufacturer does not necessarily harm an incumbent retailer. To the contrary, encroachment can secure gains for an incumbent retailer, the manufacturer, and consumers alike. Although encroachment reduces the demand for the retailer's product, it also induces the manufacturer to reduce the wholesale price it charges in order to support the incumbent retailer's demand for the essential input. When the incumbent retailer is a particularly efficient provider of retail services, the wholesale price reduction is so pronounced that encroachment increases the retailer's profit (and the manufacturer's profit and consumer surplus).

Because it reduces the demand for the retailer's product, encroachment can harm an incumbent retailer even when it produces a lower wholesale price. Our model suggests that retailers are most likely to be harmed by encroachment when the manufacturer is an effective retail competitor (so c is small) and when the stakes from encroachment (in terms of potential market revenue, as reflected in the demand intercept a) are high.

Although our model has many simplifying features, it may help to explain why some retail outlets and franchises condone territorial encroachment. For instance, Kalnins (2004) reports that franchisees benefit from the additional competition introduced by new franchise outlets provided the new outlets are owned

by the franchisor. Our findings suggest one possible explanation for the different impact of new franchisor-owned and independent franchise outlets. An independent franchise outlet simply provides additional competition for the established franchisee. In contrast, in settings where the franchisor sells key inputs to its franchisees, a new franchisor-owned outlet also can induce the franchisor to reduce the prices it charges for key inputs and thereby can increase the profit of the established franchise outlet.[12]

To provide a richer set of empirical predictions or to set the stage for empirical calibration (e.g., Ailawadi et al. 2005), our model should be expanded to allow for more general demand and cost structures, competition among manufacturers, uncertainty, incomplete contracting, repeated play, and (cooperative) sales efforts and agreements that might be undermined by encroachment. These extensions and others await future research.

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[12] Our findings also may help to identify the determinants of exclusivity in franchise arrangements. Empirical evidence suggests exclusivity provisions in franchising agreements reflect industry and demand characteristics more than a desire to safeguard franchisee power (Bercovitz 1999).