

Advertising competition and industry channel structure

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Abstract The introduction of independent retailers has long been recognized as a buffer that alleviates the price competition between channels. In this paper, we argue that this effect may be counter-balanced if the manufacturers compete along dimensions that differ from prices (such as advertising). We find that delegating to retailers may intensify other non-price competition between the manufacturers and therefore make the manufacturers worse off. Our analysis shows that the “retailer buffer” may be a two-edged sword and thus suggests that channel structure may critically depend on the specific dimensions along which the manufacturers compete with each other.

Keywords Distribution channel · Competition · Advertising · Game theory

1 Introduction

A central issue in the marketing literature is the selection of channel structure. At least dating back to Spengler (1950), there has been a vast discussion on the

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comparison between the “direct channel,” in which a manufacturer sells the products directly to end consumers, and the “indirect channel,” in which the manufacturer delegates the sales responsibility to the retailer. Spengler (1950) demonstrates that delegation may lead to “a cascade of monopolies”: Since both the manufacturer and the retailer intend to mark up the prices to claim their profits, the retail price is driven upwards away from the socially efficient level and ultimately hurts the entire channel. Consequently, vertical integration may be more favorable than delegation. This is the celebrated “*double marginalization*” problem.

A remarkable observation made by McGuire and Staelin (1983) is that such preference over channel structure may be reversed if the manufacturer–retailer dyad is confronted with *competition* from other channels. They demonstrate that, when two channels engage in price competition in the consumer market, delegating to (independent) retailers may relax the price competition. This “*retailer buffer*” may be beneficial for the manufacturers if the products are highly substitutable, i.e., if the competition is intense; as a result, it increases manufacturers’ profits even when the channel is not coordinated. McGuire and Staelin (1983) also identify a number of examples with this predicted industry structure, namely, fast food chains, automobiles, gasolines, soft drinks, industrial gases, fork lift trucks, heavy farm equipment, and numerous wholesalers that distribute through retail outlets. Since then, its robustness has been elaborated by a number of researchers, including Bonanno and Vickers (1988), Coughlan (1985), Gupta and Loulou (1998), Rey and Stiglitz (1995), and Trivedi (1998), among others.

Despite its widely accepted position, we note that the aforementioned papers focus exclusively on the price competition, whereas in practice most manufacturers are engaged in other forms of competition, e.g., advertising, product/service quality, and R&D expenditure (DeGraba 1987; Vilcassim et al. 1999). Among them, the most notable form of competition is *advertising* due to its large impact in various industries. Numerous advertisements by Miller and Coors are running on a daily basis in all sports programs (such as Super Bowl, NBA playoffs, and Wimbledon Championships) in major TV channels, e.g., ABC, ESPN, and TNT. In 2003, \$3.32 billion was spent by Procter and Gamble to advertise its detergents and cosmetics in the nationwide media such as magazines and television channels, and Pfizer devoted \$2.84 billion to the advertisement of its drugs (see Bagwell 2007). R.J. Reynolds spent between \$25 and \$50 million on advertising and marketing their newly introduced Camel No. 9 cigarettes in numerous women’s magazines such as Glamour, Cosmopolitan, and Vogue. The purpose of advertising these products is apparently to compete against other manufacturers in the same categories.¹ These

¹For example, Procter and Gamble competes against Johnson & Johnson, Pfizer’s drug market is also exposed to Bayer and Merck & Co., and R.J. Reynolds’s main competitors are the tobacco companies Virginia Slims Capri and Misty.

impacts are not only prevalent but also growing: According to the report by World Advertising Research Center, the advertising expenditure is expected to increase by 33% to 52% over the next decade, despite the current economic recession and downturns of other business aspects.²

Built upon these observations, this paper attempts to address the following research question: *In the presence of non-price competition, does delegating to retailers remain beneficial for the manufacturers?* To this end, we consider a model with two manufacturers, two dedicated retailers, and three groups of consumers with heterogeneous preferences. Among the consumers, there are a group of switchers that are highly price-sensitive, and two less price-sensitive loyal segments that prefer to purchase from one manufacturer rather than the other. The manufacturers produce horizontally differentiated products, and are confronted with an economic tradeoff: (1) each manufacturer can integrate the (downstream) retailer to bypass the double marginalization problem, which we label as the “direct channel” scenario; (2) the manufacturers could rather delegate to the retailers to escape from the intense price competition; this is labeled as the “indirect channel” scenario. To examine how the channel structure affects the competition of different forms, we assume that each manufacturer can choose to spend a lump sum advertising expense to increase consumers’ gross valuation (reservation price) for its own product.³

We find that, in the indirect channel, it may be beneficial for a manufacturer to advertise if the rival chooses not to do so; moreover, the manufacturer suffers from a significant loss if it does not advertise but the rival does. The intuition is as follows. When the manufacturers delegate to the independent retailers, the resulting retail prices tend to be set high (due to the aforementioned double marginalization problem); this, in turn, dissuades some loyal consumers from purchasing any product. In this case, it is profitable for the manufacturer to advertise, for it shifts upwards the consumers’ preferences and allows the manufacturer to capture more loyal consumers. However, we also observe that, in certain conditions, advertising may make both manufacturers worse off. Collectively, the availability of advertising may drag the manufacturers into the trap of “*prisoners’ dilemma*”: advertising appears to be an individually

²See <http://www.creativematch.co.uk/viewnews/?90183> and AA’s Quarterly Survey of Advertising Expenditure at <http://www.adassoc.org.uk/>.

³Note that we do not model the channel structure decisions to be an explicit function of advertising and pricing decisions for two reasons. First, the selection of channel structure is relatively a long-term decision for the manufacturers for their selling business, whereas the advertising and pricing strategies can be tailored for a specific product. Thus, it seems more appropriate to assume that, while the manufacturers decide the advertising and pricing strategies, the channel structure has been pre-determined. Second, as we investigate the manufacturers’ competition, it is not clear how the two competing manufacturers can jointly select a channel structure. This conceptual problem is particularly challenging when the manufacturers are competitors and no coordination scheme is available.

dominant strategy, but both manufacturers may be better off if they could commit not to advertise. On the contrary, if the manufacturers sell directly to the consumers, they may stop the temptation of making wasteful advertising.

Our results demonstrate that competition along dimensions other than prices may alter the manufacturers' preference over channel structures. In the concluding section, we discuss some empirical evidence that validates our predictions. Specifically, these include the fast food chains and the automobile industry, two important examples mentioned in McGuire and Staelin (1983), for which the advertising expenditures are empirically shown to be higher in the indirect channel than in the direct channel. Naturally, our specific choice of advertising is only one form of non-price competition. Our results are, however, not necessarily limited to this specific form of competition. Potentially, all our results could hold qualitatively when the manufacturers' strategies affect directly the consumers' valuation regarding the product/ service, thereby leading to the belief that the manufacturers may prefer the direct channels occasionally if the nature of competition is complicated/multi-dimensional.

Our paper contributes to the vast literature on channel management. The majority of the extant literature suggests that dedicated intermediaries (retailers) can mitigate price competition among manufacturers following McGuire and Staelin (1983). Coughlan (1985) generalizes the demand function to validate the robustness of the result in McGuire and Staelin (1983). Gupta and Loulou (1998) find that the conclusion of McGuire and Staelin (1983) is not prone to the presence of vertical externality of a manufacturer's effort reduction in process innovation. Rey and Stiglitz (1995) show that exclusive territories can serve as a device to reduce competition among manufacturers. They further show that intermediaries may be employed when the channel competition is intense. There are other papers that evaluate the connection between price competition, channel structure, and the strategic interactions between upstream manufacturers and the downstream retailers, see, e.g., Bonanno and Vickers (1988), Chen et al. (2009), Fay (2009), Trivedi (1998), Wang et al. (2009), and Wu and Wang (2005). In line with this research, we incorporate advertising competition and, thus, offer further insights into the strategic effects of adopting different channel structures.

Since we investigate the strategic role of channel structure with the presence of advertising competition, our paper is connected to the literature on advertising strategies. Unlike our paper, most of the established work is confined within the direct channel framework, including Dixit and Norman (1978), Meurer and Stahl (1994), Parker and Kim (1999), Singh et al. (1998), Soberman (2004), Stegeman (1991), and von der Fehr and Stevik (1998). The advertising strategies in the common retailer channel settings have been investigated in Shaffer and Zettelmeyer (2002, 2004, 2009), and Sethuraman and Tellis (2002). Shaffer and Zettelmeyer (2002, 2004, 2009) investigate the benefit of using targeted advertising to create product differentiation. In contrast, we allow the channel competition and focus on how different channel structures affect the nature of the competition. The possibility of excessive competition from

persuasive advertising is also investigated by some researchers. For example, Alemson (1970), Kelton and Kelton (1982), and Tremblay and Tremblay (2005) report that, if a manufacturer increases its expenditure on advertising, its rival manufacturer(s) may increase their expenditure on advertising, as well as a counteraction; this could lead to wasteful advertising expenses due to the reciprocal cancellation. In stark contrast with the aforementioned papers, we show that this reciprocal cancellation need not arise if the channel structure is taken into consideration.

We organize the remainder of this paper as follows: In Section 2, we discuss our basic model characteristics, including the consumer preferences, the channel structure, and the manufacturers and retailers' objective and decisions. Section 3 examines how the advertising competition affects the equilibrium channel structure. In Section 4, we offer some concluding remarks and empirical evidence that supports our analytical predictions. All the proofs are in the [Appendix](#).

2 The model

In our model, there are two manufacturers, two dedicated retailers, and three groups of consumers with heterogeneous preferences and single-unit demand. To model the consumers' heterogeneous preferences, we adopt the Hotelling models with a line segment structure over $[0,1]$ (Hotelling 1929) for each group. The two manufacturers, labeled as M_1 and M_2 , are symmetric and located at the endpoints of this line segment: 0 for M_1 and 1 for M_2 . We denote product 1(2) as the product produced by manufacturer $M_1(M_2)$. The production cost of each manufacturer is assumed to be constant and normalized to zero without loss of generality.

The Hotelling model allows us to classify the consumers into three groups: switchers, the loyal segment of M_1 , and the loyal segment of M_2 , which we describe in detail below. The preference of a switcher is modeled as an ideal point, denoted by x that lies within the Hotelling line $[0, 1]$, and switchers uniformly reside in the interval $[0, 1]$ with normalized unit density 1. Each switcher obtains a common valuation V from either product 1 or 2 and incurs a transportation cost with a common transportation parameter t . This transportation cost captures the negative utility arising from the discrepancy between her ideal point x and the product position, and the transportation parameter measures her price sensitivity.

In addition to the switchers, there are two groups of loyal consumers that belong to the turfs of the two manufacturers, respectively. Compared to the switchers, these loyal consumers are less price-sensitive with a higher transportation parameter γt , where $\gamma > 1$. The loyal consumers for M_1 are uniformly located along the same preference space in the interval $[0, 1]$ with density β , and those for M_2 reside uniformly similarly on $[0, 1]$ with density β

as well. We assume that a loyal consumer obtains a valuation V upon obtaining one unit of her favorable brand, and valuation 0 upon the other brand. We use x_1 and x_2 to denote the preference of a consumer loyal to manufacturers 1 and 2 in the corresponding Hotelling line $[0, 1]$. These three separate Hotelling lines allow us to explicitly formulate the consumer behaviors within different groups.

From the above description, the turf of a manufacturer is composed of a group of consumers that are exclusively loyal to their favorite manufacturer, and are also heterogeneous with regard to the tolerance specified by their ideal points. Similar to the discrete model with a group of homogeneous loyal consumers (e.g., Agrawal 1996), these loyal consumers are in strong favor of their favorite manufacturer. Nevertheless, the heterogeneity among loyal consumers in a manufacturer's turf leads to an *effective demand curve* a manufacturer faces in its own turf in response to the pricing decision. This is arguably a more practical situation than the typical discrete setting, since it allows us to capture the heterogeneity among loyal consumers and endogenize their purchasing behavior with a micro-foundation. As we elaborate later, this demand curve turns out to be crucial for driving most of our results.

Given the model architecture, if a switcher is located at $x \in [0, 1]$, her utility upon purchasing one unit of product from either manufacturer can be represented as follows:

$$U_x = \begin{cases} V - p_1 - tx, & \text{if purchasing product 1} \\ V - p_2 - t(1 - x), & \text{if purchasing product 2} \\ 0, & \text{otherwise} \end{cases},$$

where p_1 and p_2 denote the prices for products 1 and 2, respectively. For a loyal consumer located at $x_1 \in [0, 1]$ (in M_1 's turf), her utility can be expressed as:

$$U_{x_1} = \begin{cases} V - p_1 - \gamma tx_1, & \text{if purchasing product 1} \\ 0, & \text{otherwise} \end{cases}.$$

Likewise, a loyal consumer for M_2 with ideal point $x_2 \in [0, 1]$ obtains a utility:

$$U_{x_2} = \begin{cases} V - p_2 - \gamma t(1 - x_2), & \text{if purchasing product 2} \\ 0, & \text{otherwise} \end{cases}.$$

Each consumer rationally makes her purchase decision to maximize her utility.

In the presence of dedicated retailers, the manufacturers are confronted with an economic tradeoff: (1) Each manufacturer can integrate the (downstream) retailer to bypass the double marginalization problem; it is conceivable that, upon integration, the manufacturers are able to drive the retail price down

towards the “monopoly” level; consequently, it may allow the manufacturer to extract a higher revenue from its loyal consumers. (2) The manufacturers could rather delegate to the retailers; in this scenario, the “buffer” created by the retailers’ mark-up may prevent these two channels from the intense price competition in the consumer market (McGuire and Staelin 1983). Following McGuire and Staelin (1983), we adopt the wholesale price contract in the manufacturer–retailer transactions. We label scenario 1 as the “*direct channel*” and scenario 2 as the “*indirect channel*.” A primary goal of our paper is to compare these two channel structures and investigate how the presence of loyal consumers affects the manufacturers’ decisions.

To examine the impact of advertising competition, we assume that each manufacturer now is able to decide whether to spend a fixed expense C to advertise. If an advertising strategy is adopted by a manufacturer, consumers’ gross valuation for purchasing its product is increased by a constant $\Delta > 0$ that is independent of the consumers’ ideal points.⁴ To simplify our analysis, we shall focus on the situation in which the preference shift is reasonably small/bounded above (the exact requirements will be given in the analysis).

The sequence of events is as follows. In the direct channel scenario, both manufacturers simultaneously decide whether to advertise in the first period, and then simultaneously set prices for consumers in the second period. In the indirect channel scenario, both manufacturers simultaneously decide whether to advertise in the first period, and then the manufacturers’ advertising strategies are made public; next, the manufacturers set the wholesale prices for their dedicated retailers in the second period; subsequently, retailers simultaneously determine the retail prices to sell to the consumers. Since the game involves multiple rounds of strategic interaction, we adopt subgame perfect Nash equilibrium as our solution concept. In the next section, we evaluate how the advertising competition affects the manufacturers’ strategies and the channel structure.

3 The impact of advertising competition

In the sequel, we first characterize the equilibrium behavior of the manufacturers in the direct channel, and then derive the equilibrium behavior in the manufacturer–retail dyads in the indirect channel scenario. In the end, we compare these two scenarios to see the interaction between the channel

⁴In principle, we could allow the advertising expense and the valuation increase to depend on each other, i.e., $C = C(\Delta)$. This flexible advertising cost may allow us to determine the optimal advertising expenditure in the competitive environment. However, since our primary goal is to demonstrate that the retailer buffer may amplify the advertising competition, such an extension does not alter our conclusions.

structure and the advertising strategies. Furthermore, to facilitate our analysis and to rule out trivial cases, we impose the following assumption:

Assumption 1

$$t(\gamma + 2\beta + 1) < V < \frac{\gamma t (24\beta^2 + 64\beta^3 + 24\gamma\beta + 72\gamma\beta^2 + 4\gamma^2 + 18\gamma^2\beta + \gamma^3)}{(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)},$$

and Δ is small.⁵

Assumption 1 implies that, in the direct channel, the consumers in the turfs will be induced to purchase the products, whereas in the indirect channel, some consumers in the turfs intend not to purchase in equilibrium. Furthermore, in order to focus on the effect of advertising competition, we restrict the size of the turfs within a reasonable range, i.e., $\beta < 1$.

3.1 Direct channel

In the direct channel, both manufacturers sell their products directly to final consumers. We analyze the equilibrium behavior in two stages. By backward induction, we first derive the equilibrium pricing strategies for any given advertising strategy profile; after this, we return to the first stage—the advertising competition game.

The detailed derivations of equilibrium pricing strategies are provided in the [Appendix](#). Based on these pricing strategies, we are able to obtain the equilibrium payoffs for the manufacturers under each scenario of advertising strategies. These serve as the inputs to the first-stage advertising game, which is summarized in the following *normal-form* game, where the subscript denotes the manufacturer's index and the superscript D indicates the “direct channel.”

⁵Specifically, $0 < \Delta < \min \{\Delta_1, \Delta_2\}$, where

$$\Delta_1 = \left[1 - \frac{2V\beta - \gamma t + V\gamma}{\gamma t(\gamma + 4\beta)} + \frac{(\gamma + 2\beta)(3\gamma + 4\beta)(2V\beta + \gamma t)}{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)} \right] \\ \times \frac{t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)}{4(\gamma + 2\beta)(\gamma^2 + 6\gamma\beta + 6\beta^2)(\gamma^2 + 8\gamma\beta + 8\beta^2)},$$

$$\Delta_2 = \frac{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2) + (\gamma + 2\beta)(3\gamma + 4\beta)(2V\beta + \gamma t) - (\gamma V + 2V\beta - \gamma t)(\gamma^2 + 14\gamma\beta + 16\beta^2)}{(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)}.$$

Please see the [Appendix](#) for details.

Table 1 The advertising game in the direct channel context

M_2	N (do not advertise)	A (advertise)
M_1		
N	$\pi_1^D(N, N), \pi_2^D(N, N)$	$\pi_1^D(N, A), \pi_2^D(N, A)$
A	$\pi_1^D(A, N), \pi_2^D(A, N)$	$\pi_1^D(A, A), \pi_2^D(A, A)$

where⁶

$$\begin{aligned} \pi_1^D(N, N) &= \pi_2^D(N, N) = \frac{t}{2} (1 + 2\beta)^2, \\ \pi_1^D(A, N) &= \pi_2^D(N, A) = \frac{1}{2t} \left[t(1 + 2\beta) + \frac{\Delta}{3} \right]^2 - C, \\ \pi_1^D(N, A) &= \pi_2^D(A, N) = \frac{1}{2t} \left[t(1 + 2\beta) - \frac{\Delta}{3} \right]^2, \\ \pi_1^D(A, A) &= \pi_2^D(A, A) = \frac{t}{2} (1 + 2\beta)^2 - C. \end{aligned}$$

Based on Table 1, we obtain the following result:

Proposition 1 *In the direct channel, no advertising is the dominant strategy for a manufacturer if $C \geq F_1^D$, where $F_1^D = \frac{(1+2\beta)\Delta}{3} + \frac{\Delta^2}{18t}$; in this case, each manufacturer earns a profit $\frac{t}{2}(1 + 2\beta)^2$.*

Proposition 1 is intended to convey the following messages. When the manufacturers are privileged with loyal consumers, as indicated by the inequality $C \geq F_1^D$, advertising is not favorable if either (1) the size of loyal consumers is too small, (2) the preference shift is not significant, or (3) the “transportation cost” of consumers for purchasing a product away from their ideal points is moderate. These results can be explained as follows. The advertising serves two purposes for the manufacturer: (1) to enhance the loyalty within its turf; (2) to gain a more advantageous position in competing for the switchers vis-à-vis the rival manufacturer. As there are not many loyal consumers, the first effect is less crucial. The consequence of preference shift is also straightforward: the more effective the advertising is in altering consumers’ preferences, the higher incentive a manufacturer has to advertise. Perhaps less intuitively, the manufacturers are unwilling to advertise when the consumers are highly hesitant to purchase products positioned away from their ideal points (for a large t). All else being equal, when consumers incur a higher cost in purchasing a product that does not fit their preferences well, advertising is not favorable for two reasons. First, the manufacturer can seize its loyal consumers easily without making advertising. Second, even if it advertises, it attracts relatively fewer new switchers. Having obtained the

⁶Note that, under Assumption 1, all consumers in the turfs are served in equilibrium under the direct channel.

Table 2 The advertising game in the indirect channel context

M_2	N (do not advertise)	A (advertise)
M_1		
N	$\pi_1^I(N, N), \pi_2^I(N, N)$	$\pi_1^I(N, A), \pi_2^I(N, A)$
A	$\pi_1^I(A, N), \pi_2^I(A, N)$	$\pi_1^I(A, A), \pi_2^I(A, A)$

manufacturers' equilibrium behavior in the direct channel, we next turn to the indirect channel.

3.2 Indirect channel

In the indirect channel, the game is analyzed in three stages. We first derive the equilibrium retail prices set by the retailers for any given wholesale price profile and advertising strategies of the manufacturers; after that, we derive the manufacturers' optimal decisions on wholesale prices; finally, we return to the first-stage advertising game between the manufacturers. While details are relegated to the [Appendix](#), we present the conceptual normal-form advertising game in [Table 2](#) below, where the subscript denotes the manufacturer's index and the superscript I indicates the "indirect channel"; the closed-form expressions of the profits are characterized in the [Appendix](#).

The results of this advertising game is summarized below.

Proposition 2 *In the indirect channel, there exist thresholds F_2^I and F_3^I with $F_3^I < F_2^I$ such that (1) advertising is the dominant strategy for a manufacturer if $C < F_2^I$; 2) If $F_3^I < C < F_2^I$, advertising is the manufacturers' dominant strategy but both manufacturers would be better off had they not advertised.⁷*

Proposition 2 depicts that when advertising is not too costly, it is beneficial for a manufacturer to advertise if the rival chooses not to do so; moreover, the manufacturer suffers from a significant loss if it does not advertise but the rival does. The intuition is as follows. When the manufacturers delegate to the independent retailers, the resulting retail prices tend to be set high (due to the double marginalization problem); this in turn dissuades some loyal consumers from purchasing any product. In such a scenario, it is profitable for the manufacturer to advertise, for it shifts upwards the consumers' preferences and allows the manufacturer to capture more loyal consumers or "cover" its entire turf. The exact expressions of these thresholds to sustain a dominant strategy are given in the [Appendix](#).

However, we also observe that, in certain conditions, advertising may make both manufacturers worse off. Collectively, the availability of advertising may drag the manufacturers into the trap of "prisoners' dilemma": advertising

⁷Note that we focus on the situation in which the profit in the direct channel is smaller than that in the indirect channel when $V > V_6$; moreover, Propositions 1 and 2 can be sustained simultaneously if $V > V_7$, where the values V_6 and V_7 are derived in the [Appendix](#).

appears to be an individually dominant strategy, but both manufacturers may be better off if they could commit not to advertise. The rationale for this prisoners’ dilemma follows from the manufacturer’s incentive to attract more loyal consumers and switchers. Nevertheless, when both manufacturers advertise, the increased valuations are cancelled out for the switchers; consequently, each manufacturer only benefits from selling to more loyal consumers. This may be outweighed by the advertising expenditure, and therefore, a net loss results.

3.3 Channel comparison

Let us now compare the direct and indirect channels and state our main result.

Proposition 3 *It is possible that the manufacturers do not advertise in the direct channel but both advertise in the indirect channel; moreover, the manufacturers obtain lower profits under the indirect channel than under the direct channel.*

Proposition 3 implies that delegation to retailers may drag the manufacturers into a *prisoners’ dilemma*, thereby making both manufacturers worse off. Specifically, we find that $F_1^D \leq F_3^I$ can hold within an appropriate range of V , in which case the manufacturers do not advertise in the direct channel but advertise in the indirect channel.⁸ The rationale follows closely the double marginalization problem, as we have elaborated after Proposition 2. Past literature has established that delegation allows the manufacturers to escape from the intense price competition. Our results echo this conventional wisdom; in addition, we identify a previously ignored effect: *delegation could also lead to an intense advertising competition that would otherwise be avoided in the direct channel.* We thus conclude that competition along dimensions other than prices (such as advertising) may induce the manufacturers to select the direct channel over the indirect channel.

We have also worked out a numerical example to validate our analytical results on the channel comparison. In our example, we adopt the following parameter combinations: $\gamma = 2$, $V = 5.9t$, $\Delta = 0.1t$, $\beta = 0.8$, and $C = 0.12t$. With these parameters, if advertising is not available and the manufacturers therefore engage only in price competition, we find that, in the direct channel, each manufacturer obtains $\frac{169}{50}t$ in equilibrium, whereas, in the indirect channel, its equilibrium profit becomes higher ($\frac{44608707}{13110250}t$). However, when advertising is an available option, the equilibrium profit of each manufacturer is higher in the direct channel ($\frac{169}{50}t$) than in the indirect channel ($\frac{115159197}{34086650}t$). Thus, the preference of channel structure may get reversed when advertising is introduced.

⁸This can be sustained if

$$C > \frac{(\gamma + 2\beta)(3\gamma + 4\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)[\gamma t + 2\beta(V + \Delta)]^2}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2} - \frac{t}{2}(1 + 2\beta)^2,$$

and $V_8 < V < V_9$, where V_8 and V_9 are given in the [Appendix](#).

4 Discussions and conclusions

In this paper, we show that delegating to retailers may induce the manufacturers to advertise and make both manufacturers worse off. This suggests that channel structure may critically depend on the specific dimensions along which the manufacturers compete with each other. Following McGuire and Staelin (1983), numerous researchers have reexamined the buffer effect of introducing independent retailers in various settings. Our analysis shows that the “retailer buffer” may be a two-edged sword and, thus, suggests that channel structure may critically depend on the specific dimensions along which the manufacturers compete with each other. Since we aim at pointing out the previously ignored effects of the retailer buffers, all our analysis is confined within the two scenarios for given channel structures. The equilibrium/ optimal channel structure (from the manufacturers’ perspective) is left unaddressed and is beyond the scope of this paper. Nevertheless, it is conceivable that if one were to characterize the equilibrium channel structure, the effects identified in our paper should play a significant role. In the following, we report some empirical evidence that validates our results and lays out possible extensions.

We are aware of two recent empirical studies that rigorously investigate the interdependence between channel structures and advertising expenditures. Srinivasan (2006) uses panel data of U.S. restaurant chains for the period 1992–2002. Srinivasan (2006) uses the proportion of the restaurant chain’s franchised units to the total number of its system units to measure the degree of integration. Specifically, this proxy is a continuous variable in $[0,1]$, where 0 indicates a completely vertically integrated channel and 1 corresponds to a completely decentralized (franchised) channel. He finds a statistically and economically significant relation between the channel structure and advertising expenditure. When a firm’s operation is closer to a vertically integrated channel, it spends less in advertising, whereas a firm that primarily franchises to independent retailers tends to allocate more resource in the advertisement.

The second related empirical paper is Arruñada and Vázquez (2007), where they estimate the relative performance between firms with different organizational choices in a sample of 250 Spanish car distributors. In these car distributors, 179 of them are independent from the manufacturers and 71 distributors are company-owned (i.e., they correspond to the direct channel in our context). The panel data come from the financial statements for the 1994 financial year. Arruñada and Vázquez (2007) use the advertising effort/expenditure as a proxy for the importance of manufacturer’s effort (more precisely, it is “the percentage of sales spent on advertising by each manufacturer”). Interestingly, Arruñada and Vázquez (2007) first conjectured that vertical integration should lead to a higher advertising effort, a contradiction to our prediction, and then found that this hypothesis is firmly rejected by their empirical analysis.

Our analysis can be extended in a number of ways. In this paper, we restrict our attention to the wholesale price contract in the manufacturer-retailer relationship. In practice, there are various forms of contracts that are widely used to coordinate the channels, including quantity discount, returns, rebates,

and quantity flexibility contracts. It would be interesting to study whether and how the choice of channel structure are affected by other contract forms. Another direction may be to extend our results to a more general/complicated supply chain network. For example, a real supply chain may involve multiple manufacturers with a nexus of common and dedicated retailers, a manufacturer may sell through multiple channels, and the retailers may own private labels that compete with the manufacturers’ products. Further study is needed to understand how the presence of loyal consumers affect the integration-delegation tradeoff.

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Appendix

Proof of Proposition 1 We first derive the payoffs for both manufacturers in Table 1. Following this, we then characterize the conditions under which a manufacturer will not advertise regardless of whether its rival advertises.

1) Deriving the manufacturers’ payoffs in Table 1.

For ease of exposition, let us use $V_1(V_2)$ to denote the common valuation a switcher obtains from product 1(2); for example, if manufacturer 1 advertises and manufacturer 2 does not, we have $V_1 = V + \Delta$, and $V_2 = V$. Recall that while determining the prices, each manufacturer intends to extract revenue from the switchers and its corresponding turf. Moreover, under Assumption 1 ($V_3 < V < V_4$, where V_3, V_4 is defined below), for any given pair (p_1, p_2) , the marginal consumer in the competitive market would be $x = \frac{t + (V_1 - V_2) + p_2 - p_1}{2t}$ (from $V_1 - tx - p_1 = V_2 - t(1 - x) - p_2$). Likewise, when $V_i - \gamma t - p_i > 0$, the marginal consumer in the turf of $M_1(M_2)$ is $x_1 = 1$ ($x_2 = 0$), which means that all loyal consumers are served in equilibrium.

We derived the equilibrium when all loyal consumers are served. The effective demand of each product comes from the competitive market and the corresponding turf. Thus, the equilibrium prices (p_1^*, p_2^*) should solve the following equations simultaneously:

$$\pi_i^D = \max_{p_i} \left\{ p_i \left(\frac{t + V_i - V_j + p_j - p_i}{2t} + \beta \right) - C_{Ai} \mid \text{s.t. } V_i - \gamma t - p_i > 0 \right\},$$

where $j \neq i$ represents the rival manufacturer and $C_{Ai} = C$ if manufacturer i advertises, and $C_{Ai} = 0$ otherwise. Our strategy is to first ignore the constraint $V_i - \gamma ta - p_i > 0$ and characterize the equilibrium prices via the first-order conditions, and later we discuss the condition when this constraint is satisfied.

The first-order conditions give rise to the equilibrium prices $p_1^* = t(1 + 2\beta) + \frac{V_1 - V_2}{3}$ and $p_2^* = t(1 + 2\beta) + \frac{V_2 - V_1}{3}$; the corresponding demands of M_1 and M_2 are $D_1 = \frac{1}{2} + \frac{V_1 - V_2}{6t} + \beta$ and $D_2 = \frac{1}{2} + \frac{V_2 - V_1}{6t} + \beta$. Therefore, the resulting profits of M_1 and M_2 are

$$\pi_i^D = \frac{1}{2t} \left[t(1 + 2\beta) + \frac{V_i - V_j}{3} \right]^2 - C_{Ai}, \quad j \neq i.$$

If no manufacturer advertises ($V_1 = V_2 = V$), we have $\pi_1^D(N, N) = \pi_2^D(N, N) = \frac{t}{2} (1 + 2\beta)^2$; if only manufacturer i advertises, we have $\pi_1^D(A, N) = \pi_2^D(N, A) = \frac{1}{2t} \left[t(1 + 2\beta) + \frac{\Delta}{3} \right]^2 - C$, and $\pi_2^D(A, N) = \pi_1^D(N, A) = \frac{1}{2t} \left[t(1 + 2\beta) - \frac{\Delta}{3} \right]^2$; finally, when both manufacturers advertise, $V_1 = V_2 = V + \Delta$, and $\pi_1^D(A, A) = \pi_2^D(A, A) = \frac{t}{2} (1 + 2\beta)^2 - C$.

Let us now check the constraint $V_i - \gamma ta - p_i > 0$. It is easy to verify that under the condition $V > t(1 + \gamma + 2\beta) \equiv V_3$, $V_i - \gamma t - p_i > 0, i = 1, 2$ is satisfied by the above price pair (p_1^*, p_2^*) .

2) Deriving the conditions under which the manufacturer does not advertise.

Define $F_1^D \equiv \pi_1^D(A, NA) - \pi_1^D(NA, NA) + C$ and $F_2^D \equiv \pi_2^D(A, A) - \pi_2^D(A, NA) + C$. From the expressions of $\pi_1^D(A, NA)$, $\pi_1^D(NA, NA)$, and $\pi_2^D(A, A)$, we obtain

$$F_1^D = \frac{(1 + 2\beta)\Delta}{3} + \frac{\Delta^2}{18t}, \text{ and } F_2^D = \frac{(1 + 2\beta)\Delta}{3} - \frac{\Delta^2}{18t},$$

which after some algebra leads to $F_1^D > F_2^D$. Therefore, if $C \geq F_1^D$, it is not beneficial for a manufacturer to advertise, regardless of whether its rival advertises or not. □

Proof of Proposition 2 We first derive the payoffs for both manufacturers in Table 2. Following this, we then characterize the conditions under which a manufacturer will advertise, regardless of whether its rival advertises, and advertising makes both manufacturers worse off.

1) Deriving the manufacturers’ payoffs in Table 2.

Let us assume that each switcher obtains a common valuation $V_1(V_2)$ from product 1(2). The equilibrium behavior is characterized by backward induction: We first take the wholesale price pair (w_1, w_2) as given and derive

the retailers’ optimal strategies (of the retail prices); we then proceed to characterize the equilibrium wholesale prices for the manufacturers’ competition.

Given the wholesale price pair (w_1, w_2) , each retailer chooses the retail price to maximize its profit. Let (p_1, p_2) denote the retail prices chosen by retailers 1 and 2, respectively. When M_1 advertises, for $V > V_3$, the marginal consumer in the competitive market would be located at $x = \frac{t + V_1 - V_2 + p_2 - p_1}{2t}$ (which follows from $V_1 - tx - p_1 = V_2 - t(1 - x) - p_2$). Likewise, if we assume that V and Δ are small enough ($V < V_4$ and $\Delta < \min\{\Delta_1, \Delta_2\}$, see the discussions below), the marginal consumers for M_1 ’s and M_2 ’s turfs are located at $x_1 = \frac{V_1 - p_1}{\gamma t}$ and $x_2 = 1 - \frac{V_2 - p_2}{\gamma t}$, respectively; in other words, the loyal consumers for both manufacturers are not fully served in equilibrium. Therefore, the equilibrium price pair (p_1^*, p_2^*) can be derived as follows:

$$\max_{p_i} \left\{ (p_i - w_i) \left(\frac{t + V_i - V_j + p_j - p_i}{2t} + \beta \frac{V_i - p_i}{\gamma t} \right) \right\}, \quad j \neq i, i, j = 1, 2.$$

The first-order conditions yield the following prices:

$$p_1^* = \frac{\gamma t + 2\beta V_1}{\gamma + 4\beta} + \frac{\Delta' \gamma (\gamma + 2\beta) + 2(\gamma + 2\beta)^2 w_1 + \gamma (\gamma + 2\beta) w_2}{(3\gamma + 4\beta)(\gamma + 4\beta)},$$

$$p_2^* = \frac{\gamma t + 2\beta V_2}{\gamma + 4\beta} - \frac{\Delta' \gamma (\gamma + 2\beta) + 2(\gamma + 2\beta)^2 w_2 + \gamma (\gamma + 2\beta) w_1}{(3\gamma + 4\beta)(\gamma + 4\beta)},$$

where $\Delta' \equiv V_1 - V_2$. Given these equilibrium prices, we obtain that the marginal consumers in the competitive market and the two turfs as follows:

$$x^* = \frac{1}{2} + \frac{(V_1 - V_2)(\gamma + 2\beta) + (\gamma + 2\beta)(w_2 - w_1)}{2t(3\gamma + 4\beta)},$$

$$x_1^* = \frac{V_1(\gamma + 2\beta)(3\gamma + 4\beta) - \gamma t(3\gamma + 4\beta) - \Delta' \gamma (\gamma + 2\beta) - 2(\gamma + 2\beta)^2 w_1 - \gamma (\gamma + 2\beta) w_2}{\gamma t(3\gamma + 4\beta)(\gamma + 4\beta)},$$

$$1 - x_2^* = \frac{V_2(\gamma + 2\beta)(3\gamma + 4\beta) - \gamma t(3\gamma + 4\beta) + \Delta' \gamma (\gamma + 2\beta) - 2(\gamma + 2\beta)^2 w_2 - \gamma (\gamma + 2\beta) w_1}{\gamma t(3\gamma + 4\beta)(\gamma + 4\beta)}.$$

Now we return to the manufacturers’ problem. In the wholesale price competition, M_1 and M_2 choose w_1 and w_2 to maximize their own profits:

$$\pi_1^I = \max_{w_1} \{ w_1(x^* + \beta x_1^*) - C_{A1} \},$$

$$\pi_2^I = \max_{w_2} \{ w_2[1 - x^* + \beta(1 - x_2^*)] - C_{A2} \},$$

where $C_{Ai} = C$ if manufacturer i advertises, and $C_{Ai} = 0$ otherwise. Applying the first-order conditions, we obtain

$$w_1^* = \frac{(3\gamma + 4\beta)(\gamma t + 2\beta V_1)}{\gamma^2 + 14\gamma\beta + 16\beta^2} + \frac{\Delta' \gamma (\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)},$$

$$w_2^* = \frac{(3\gamma + 4\beta)(\gamma t + 2\beta V_2)}{\gamma^2 + 14\gamma\beta + 16\beta^2} - \frac{\Delta' \gamma (\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)},$$

and the corresponding marginal consumers are characterized as follows:

$$x^* = \frac{1}{2} + \frac{\Delta' (\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{2t(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)},$$

$$x_1^* = \frac{V_1(\gamma + 2\beta) - \gamma t}{\gamma t(\gamma + 4\beta)} - \frac{(\gamma + 2\beta)(3\gamma + 4\beta)(2V_1\beta + \gamma t)}{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)}$$

$$- \frac{4\gamma \Delta' (\gamma + 2\beta)(3\gamma + 4\beta)(\gamma^2 + 6\gamma\beta + 6\beta^2)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{\gamma t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)},$$

$$1 - x_2^* = \frac{V_2(\gamma + 2\beta) - \gamma t}{\gamma t(\gamma + 4\beta)} - \frac{(\gamma + 2\beta)(3\gamma + 4\beta)(2V_2\beta + \gamma t)}{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)}$$

$$+ \frac{4\gamma \Delta' (\gamma + 2\beta)(3\gamma + 4\beta)(\gamma^2 + 6\gamma\beta + 6\beta^2)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{\gamma t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)}.$$

Therefore, if $x_1^* < 1$ and $0 < 1 - x_2^* < 1$ for all possible V_1, V_2 , we get the effective demands of the manufacturers:

$$D_1^* = \frac{(\gamma + 2\beta)(\gamma t + 2\beta V_1)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)}$$

$$+ \frac{\Delta' (\gamma + 2\beta)^2 (\gamma^2 + 8\gamma\beta + 8\beta^2)(3\gamma^2 + 16\gamma\beta + 8\beta^2)}{2t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)},$$

$$D_2^* = \frac{(\gamma + 2\beta)(\gamma t + 2\beta V_2)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)}$$

$$- \frac{\Delta' (\gamma + 2\beta)^2 (\gamma^2 + 8\gamma\beta + 8\beta^2)(3\gamma^2 + 16\gamma\beta + 8\beta^2)}{2t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)}.$$

In the following we make extensive use of the effective demands D_1^* and D_2^* to derive the retailers' equilibrium profits. We again divide our analysis into three cases, depending on the manufacturers' advertising strategies: (1) no manufacturer advertises; (2) only one manufacturer advertises; and (3) both manufacturers advertise.

We first check the constraints $x_1^* < 1$ and $0 < 1 - x_2^* < 1$. It is required that

$$\frac{[(\gamma + 2\beta)V_i - \gamma t](\gamma^2 + 14\gamma\beta + 16\beta^2) - (\gamma + 2\beta)(3\gamma + 4\beta)(2\beta V_i) + \gamma t}{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)} < 1, i = 1, 2,$$

for all possible values of V_1 and V_2 . Rearranging the above equations, we obtain the following conditions:

$$V < \frac{\gamma t(64\beta^3 + 24\beta^2 + 72\gamma\beta^2 + 24\gamma\beta + 18\gamma^2\beta + 4\gamma^2 + \gamma^3)}{(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)} \equiv V_4,$$

$$\Delta < \left[1 - \frac{2\beta V - \gamma t + \gamma V}{\gamma t(\gamma + 4\beta)} + \frac{(\gamma + 2\beta)(\gamma t + 2\beta V)(3\gamma + 4\beta)}{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)} \right]$$

$$\times \frac{t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)}{4(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)(\gamma^2 + 6\gamma\beta + 6\beta^2)} \equiv \Delta_1,$$

$$\Delta < \frac{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)}{(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)} + \frac{(\gamma t + 2\beta V)(3\gamma + 4\beta)}{(\gamma^2 + 8\gamma\beta + 8\beta^2)}$$

$$- \frac{(2\beta V - \gamma t + \gamma V)(\gamma^2 + 14\gamma\beta + 16\beta^2)}{(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)} \equiv \Delta_2.$$

In case 1, $V_1 = V_2 = V$, and therefore we have

$$\pi_1^I(NA, NA) = \pi_2^I(NA, NA)$$

$$= \frac{(\gamma + 2\beta)(3\gamma + 4\beta)(\gamma t + 2\beta V)^2(\gamma^2 + 8\gamma\beta + 8\beta^2)}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2}.$$

In case 2, since only one manufacturer advertises, it is either $V_1 = V + \Delta$, $V_2 = V$ or $V_1 = V$, $V_2 = V + \Delta$. Without loss of generality, let us focus on the case in which manufacturer 1 advertises. In such a scenario, we have

$$\pi_1^I(A, N) = \pi_2^I(N, A)$$

$$= -C + \left[\frac{(3\gamma + 4\beta)(\gamma t + 2\beta(V + \Delta))}{\gamma^2 + 14\gamma\beta + 16\beta^2} \right.$$

$$\left. + \frac{\Delta\gamma(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)} \right]$$

$$\times \left[\frac{(\gamma + 2\beta)(\gamma t + 2\beta(V + \Delta))(\gamma^2 + 8\gamma\beta + 8\beta^2)}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)} \right.$$

$$\left. + \frac{\Delta(\gamma + 2\beta)^2(\gamma^2 + 8\gamma\beta + 8\beta^2)(3\gamma^2 + 16\gamma\beta + 8\beta^2)}{2t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)} \right]$$

and

$$\begin{aligned} \pi_2^I(A, N) &= \pi_1^I(N, A) \\ &= \left[\frac{(3\gamma + 4\beta)(\gamma t + 2\beta V)}{\gamma^2 + 14\gamma\beta + 16\beta^2} - \frac{\Delta\gamma(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)} \right] \\ &\quad \times \left[\frac{(\gamma + 2\beta)(\gamma t + 2\beta V)(\gamma^2 + 8\gamma\beta + 8\beta^2)}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)} \right. \\ &\quad \left. - \frac{\Delta(\gamma + 2\beta)^2(\gamma^2 + 8\gamma\beta + 8\beta^2)(3\gamma^2 + 16\gamma\beta + 8\beta^2)}{2t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)(3\gamma^2 + 18\gamma\beta + 16\beta^2)} \right]. \end{aligned}$$

We next investigate case 3 in which both manufacturers advertise; that is, $V_1 = V_2 = V + \Delta$. In this case, we obtain

$$\begin{aligned} \pi_1^I(A, A) &= \pi_2^I(A, A) \\ &= \frac{(\gamma + 2\beta)(3\gamma + 4\beta)(\gamma t + 2\beta(V + \Delta))^2(\gamma^2 + 8\gamma\beta + 8\beta^2)}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2} - C. \end{aligned}$$

2) Deriving the conditions for the manufacturers’ incentive to advertise.

To derive the conditions under which each manufacturer advertises regardless of whether its rival advertises and both manufacturers are worse off upon advertising, we define the following thresholds: $F_1^I \equiv \pi_1^I(A, NA) + C - \pi_1^I(NA, NA)$, $F_2^I \equiv \pi_2^I(A, A) + C - \pi_2^I(A, NA)$, and $F_3^I \equiv \pi_1^I(A, A) + C - \pi_1^I(NA, NA)$. Straight forward algebra shows that

$$\begin{aligned} F_1^I(V) &= \frac{2(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)(2V\beta + \gamma t) \times G_1(\beta, \gamma)\Delta}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2(3\gamma^2 + 18\gamma\beta + 16\beta^2)} \\ &\quad + \frac{(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)(\gamma^4 + 28\gamma^3\beta + 156\gamma^2\beta^2 + 256\gamma\beta^3 + 128\beta^4) \times G_2(\beta, \gamma)\Delta^2}{2\gamma t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2(3\gamma^2 + 18\gamma\beta + 16\beta^2)^2}, \\ F_2^I(V) &= \frac{4\beta(\gamma + 2\beta)(3\gamma + 4\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)(2V\beta + \gamma t)\Delta}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2} \\ &\quad + \frac{4\gamma(\gamma + 2\beta)^2(\gamma^2 + 8\gamma\beta + 8\beta^2)(\gamma + 2\beta)(\gamma^2 + 6\gamma\beta + 4\beta^2)(2V\beta + \gamma t)\Delta}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2(3\gamma^2 + 18\gamma\beta + 16\beta^2)} \\ &\quad - \frac{\gamma^2(\gamma + 2\beta)^3(\gamma^2 + 8\gamma\beta + 8\beta^2)^2(3\gamma^2 + 16\gamma\beta + 8\beta^2)\Delta^2}{2\gamma t(\gamma + 4\beta)(3\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2(3\gamma^2 + 18\gamma\beta + 16\beta^2)^2} \\ &\quad + \frac{4\beta^2(3\gamma + 4\beta)(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)\Delta^2}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2}, \\ F_3^I(V) &= \frac{2(\gamma + 2\beta)(3\gamma + 4\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)(2V\beta + \gamma t + \beta\Delta)\beta\Delta}{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2}, \end{aligned}$$

where

$$\begin{aligned}
 G_1(\beta, \gamma) &= 256\beta^5 + 64\beta^4 + 576\gamma\beta^4 + 160\gamma\beta^3 + 456\gamma^2\beta^3 \\
 &\quad + 122\gamma^2\beta^2 + 146\gamma^3\beta^2 + 29\gamma^3\beta + 15\gamma^4\beta + 2\gamma^4, \\
 G_2(\beta, \gamma) &= \gamma(\gamma + 4\beta)(3\gamma^2 + 18\gamma\beta + 16\beta^2) \\
 &\quad + 2\beta(3\gamma + 4\beta)(5\gamma^2 + 32\gamma\beta + 32\beta^2).
 \end{aligned}$$

Furthermore, it can be verified that $F_1^I(V) > F_2^I(V)$, and $F_2^I(V) > F_3^I(V)$ if

$$V > \frac{\gamma(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)(3\gamma^2 + 16\gamma\beta + 8\beta^2)}{\beta(3\gamma + 4\beta)(3\gamma^2 + 18\gamma\beta + 16\beta^2)(\gamma^2 + 6\gamma\beta + 4\beta^2)} - \frac{\gamma t}{2\beta} \equiv V_5.$$

Recalling the definitions of F_1^I , F_2^I , and F_3^I , we conclude that when $F_3^I < C < F_2^I$, each manufacturer advertises regardless of its rival’s advertising strategy and advertising makes the manufacturers worse off. \square

Proof of Proposition 3 Let us first show that in the absence of the advertising competition, it is possible that the manufacturers will be better off under the indirect channels (compared to the direct channels). To this end, it suffices to identical conditions under which $\pi_i^I(NA, NA) > \pi_i^D(NA, NA)$, where $i = 1, 2$. This condition is satisfied when $V > V_6$, where

$$\begin{aligned}
 V_6 &= \frac{t(1 + 2\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)}{2\beta} \\
 &\quad \times \left[\frac{\gamma(\gamma + 4\beta)}{(\gamma + 2\beta)(3\gamma + 4\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)} \right]^{\frac{1}{2}} - \frac{\gamma t}{2\beta}.
 \end{aligned}$$

Let us now introduce the advertising competition. Recall that the thresholds are defined as $F_1^I(V) \equiv \pi_1^I(A, NA) + C - \pi_1^I(NA, NA)$, $F_2^I(V) \equiv \pi_2^I(A, A) + C - \pi_2^I(A, NA)$, and $F_3^I(V) \equiv \pi_1^I(A, A) + C - \pi_1^I(NA, NA)$. From Proposition 1 and 2, if we define V_7 as the solution of $F_1^D(V) = F_2^D(V)$,⁹ then it can be derived that $F_1^D(V) < F_2^D(V)$ when $V > V_7$.

Hence, if $F_1^D(V) < C < F_2^D(V)$, the manufacturers do not advertise if both are selling through the direct channels but attempt to do so when selling through the indirect channels. Furthermore, from Proposition 2, if $F_3^I(V) < C < F_2^I(V)$, both manufacturers intend to advertise under the indirect channels and would be better off if they could commit not to do so.

⁹This can be explicitly expressed as:

$$\begin{aligned}
 V_7 &= \left\{ - \left[4\beta^2(3\gamma + 4\beta) - \frac{\gamma^2(\gamma + 2\beta)^2(\gamma^2 + 8\gamma\beta + 8\beta^2)(3\gamma^2 + 16\gamma\beta + 8\beta^2)}{(3\gamma + 4\beta)(3\gamma^2 + 18\gamma\beta + 16\beta^2)^2} \right] \frac{(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)\Delta}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2} \right\} \\
 &\quad \times \frac{\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2(3\gamma^2 + 18\gamma\beta + 16\beta^2)}{4\beta(\gamma + 2\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)(\gamma^4 + 17\beta\gamma^3 + 82\beta^2\gamma^2 + 128\beta^3\gamma + 64\beta^4)} - \frac{\gamma t}{2\beta}.
 \end{aligned}$$

For ease of exposition, let us define the profit difference:

$$F(V) \equiv \pi_1^I(A, A) + C - \pi_1^D(NA, NA) \\ = \frac{(\gamma + 2\beta)(3\gamma + 4\beta)(\gamma^2 + 8\gamma\beta + 8\beta^2)(2\beta V + 2\beta\Delta + \gamma t)^2}{2\gamma t(\gamma + 4\beta)(\gamma^2 + 14\gamma\beta + 16\beta^2)^2} - \frac{t}{2}(1 + 2\beta)^2.$$

When $C > F(V)$, both manufacturers with indirect channels are worse off than with direct channels.

Furthermore, define V_8 and V_9 as the two solutions of $F_2^I(V) = F(V)$.¹⁰ It can then be derived that $F_2^I(V) > F(V)$ when $V_8 < V < V_9$.

Recall that we assume $V_3 < V < V_4$, which means that under the indirect channel, the manufacturer does not serve its entire turf; whereas the entire turf is served under the direct channel (this follows from the proofs of Propositions 1 and 2). Combining all above conditions, we conclude that if $\max\{V_3, V_5, V_6, V_7, V_8\} < V < \min\{V_4, V_9\}$, and Δ is small, there exists a range of C such that $\max\{F_1^D, F_3^I, F\} < C < F_2^I$. In this case, the manufacturers are dragged into a prisoners’ dilemma under the indirect channel but would not adopt the wasteful advertising if they use direct channels. □

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¹⁰These values can be explicitly expressed as follows:

$$V_8 = \frac{\gamma \Delta (\gamma + 2\beta) (\gamma^2 + 6\gamma\beta + 4\beta^2)}{\beta (3\gamma + 4\beta) (3\gamma^2 + 18\gamma\beta + 16\beta^2)} - \frac{\gamma t}{2\beta} \\ - \frac{1}{2\beta} \sqrt{\frac{\gamma t^2 (\gamma + 4\beta) (\gamma^2 + 14\gamma\beta + 16\beta^2)^2 (1 + 2\beta)^2}{(\gamma + 2\beta) (3\gamma + 4\beta) (\gamma^2 + 8\gamma\beta + 8\beta^2)} + \frac{\gamma^4 (\gamma + 4\beta)^2 (\gamma + 2\beta)^2 \Delta^2}{(3\gamma + 4\beta)^2 (3\gamma^2 + 18\gamma\beta + 16\beta^2)^2}}, \\ V_9 = \frac{\gamma \Delta (\gamma + 2\beta) (\gamma^2 + 6\gamma\beta + 4\beta^2)}{\beta (3\gamma + 4\beta) (3\gamma^2 + 18\gamma\beta + 16\beta^2)} - \frac{\gamma t}{2\beta} \\ + \frac{1}{2\beta} \sqrt{\frac{\gamma t^2 (\gamma + 4\beta) (\gamma^2 + 14\gamma\beta + 16\beta^2)^2 (1 + 2\beta)^2}{(\gamma + 2\beta) (3\gamma + 4\beta) (\gamma^2 + 8\gamma\beta + 8\beta^2)} + \frac{\gamma^4 (\gamma + 4\beta)^2 (\gamma + 2\beta)^2 \Delta^2}{(3\gamma + 4\beta)^2 (3\gamma^2 + 18\gamma\beta + 16\beta^2)^2}}.$$

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