Store-Within-a-Store

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Abstract

Under the store-within-a-store arrangement, retailers essentially rent out their retail space to manufacturers and give them complete autonomy over retail decisions like pricing and in-store service. This is an intriguing phenomenon observed in an increasing number of large department stores all over the world. In this paper, we use an analytical model to investigate the economic incentives that a retailer faces while deciding upon this arrangement. The retailer's trade-off is between channel efficiency and inter-brand competition, moderated by returns to in-store service and increased store traffic. The retailer cannot credibly commit to the retail prices and the service levels that the manufacturers will effect in an integrated channel, so it decides, instead, to allow them to set up stores-within-a-store. This suggests that stores-within-a-store is a phenomenon that emerges when a power retailer, ironically, gives manufacturers autonomy in its retail space. An extension of our model to the case of competing retailers shows that the store-with-a-store arrangement can also mediate inter-store competition.

Keywords: store-within-a-store, distribution channels, game theory.

1 Introduction

On a visit to any major department store like Macy's, Bloomingdale's or Neiman Marcus, one can observe a number of vendor shops (typically for cosmetics, apparel, apparel accessories, electronics and toys) that stand out from the rest of the department store. These vendor shops, also called boutiques or stores-within-a-store, have autonomy over a small part of the store, sell a particular brand exclusively, and are done up to reflect the image of that brand. For instance, the cosmetics sections at almost all the major department stores such as Macy's, Neiman Marcus, Nordstrom, Bloomingdale's, Lord & Taylor and Saks Fifth Avenue are populated with stores-within-a-store representing several major brands such as Chanel, Estée Lauder, Lancôme, MAC, Dior and others (Anderson 2006).

The store-within-a-store arrangement is also observed in the apparel category. Almost all of the above mentioned department store chains have stores-within-a-store for formal and casual men's and women's apparel, apparel accessories, jewelry and footwear — Bloomingdale's has stores-within-a-store for several brands such as Ralph Lauren, Calvin Klein, DKNY and Kenneth Cole; Marshall Field's (now operating as Macy's) houses Louis Vuitton, Thomas Pink, BCBG and Jil Sander (Anderson 2005); Neiman Marcus has Armani and Gucci; Nordstrom has Chanel, Chloe and YSL (Glassman 2006), and so on. Stores-within-a-store are also prevalent, albeit to a lesser extent, in categories such as furniture and home décor. Looking beyond retailers in the USA, this arrangement is widely prevalent in Asia and Europe, and is typically found in many more categories than in the USA (O'Connell and Dodes 2009).

The store-within-a-store arrangement is unique and intriguing for the reason that only in some specific categories manufacturers take almost complete autonomy over a part of the store owned by retailers (Cotton 1998, Kirk 2003, O'Connell and Dodes 2009, Prior 2003). A store-within-a-store operated by a manufacturer typically has the following characteristics — the inventory is owned by, and the retail prices are decided by, the manufacturer rather than the department store and the representatives providing in-store service are employed and trained by the manufacturers owning the brands, as opposed to being employed or trained by the department store, and they offer specific and expert service for the products offered by their brand alone. In short, activities such as pricing, stocking and merchandising are handed over completely to the parent brands.[1] In return, the retailer simply charges a rent (typically a "lease payment") for the in-store real estate and does not set its own margin over and above the manufacturers' prices. Furthermore, in categories such as cosmetics and high-end apparel, as made clear by the examples above, we observe co-located stores-within-a-store for different brands in the same department store, i.e., the brands are competing directly on price and in-store service in these categories. However, in other categories such as middle- and low-end apparel the arrangement is slightly different, with some brands having stores-within-a-store, and other brands sold in the usual manner with the retailer owning the inventory and deciding retail price. Finally, for most categories like kitchenware and housewares, we observe only the standard arrangement wherein the retailer purchases the products from competing suppliers at a wholesale price and then sets the retail prices for all products (henceforth called the retailer-resell arrangement). In this case, the retailer also appoints its own in-store service representatives for the category and decides the level of in-store service to be provided for each brand.

The above observations naturally lead to several questions on the store-within-a-store phenomenon. Why does the retailer prefer to give complete autonomy over its in-store real estate as well as merchandising and pricing decisions to the manufacturer for some categories but not for others? For which categories is this optimal, i.e., what are the category characteristics that are the drivers behind this decision? Furthermore, for which categories

[1] Vendor Managed Inventory (VMI) and Category Captainship are two related but very different phenomena. VMI is a logistics-focused arrangement where the vendor manages the inventory in the space of the retailer. In contrast, in store-within-a-store, the manufacturer is involved in a much more holistic way inside the store — setting prices, managing inventory, providing in-store service, design the store-within-a-store to reflect the image of the brand, etc. Category Captainship refers to the case when one manufacturer plans the management of the full category for the retailer. Note that the retailer typically reserves the power to reject this plan. This is, once again, very different from stores-within-a-store, where one manufacturer manages only his own brand, and the retailer typically gives him autonomy in the retail store (after charging a fixed rent).

does the retailer prefer to have competing brands set up stores-within-a-store and for which categories does it prefer to have only one brand as store-within-a-store and other brands under the standard retailer-resell arrangement? How is the provision of in-store customer service related to these decisions? Introduction of products in a retail store through stores-within-a-store can help to bring new customers to the store who also want to purchase other products in the store. In exactly what manner does this store-traffic effect come into play? Finally, how does competition between retailers affect their choice of using stores-within-a-store?

Apparently, the store-within-a-store phenomenon is not a random occurrence and some discernable regularities regarding the phenomenon do exist. The best way to determine such regularities is to analyze industry data. Unfortunately, such data are not available. The next-best means to gain insights is by tapping into the knowledge of retailers and manufacturers dealing with stores-within-a-store. We talked to practitioners in retail chains and cosmetics companies that have stores-within-a-store and other retailing experts with many years of experience in the retail sector. Based on these interviews, we gather preleminary motivation for our formal analysis. Then, to rigorously investigate the store-within-a-store phenomenon, we develop a game theory model of retail management and channel design.

Before we proceed further, we note that our paper does not model the store-within-a-store phenomenon in all of its different manifestations. First, the contract form that we focus on (the retailer charging a periodic rent and giving autonomy to the manufacturers) is apparently fairly common, but variations to this contract form certainly exist. As one example, we find from our conversations with practitioners that the retailer sometimes shares a percentage of the revenues that the manufacturer earns from the sales of the product while charging a smaller periodic rent to share risk with the manufacturer (an aspect we do not model). Second, stores-within-a-store are sometimes operated inside department stores by other retailers. Sephora's cosmetics stores in JC Penney and FAO Schwarz's toy stores in Saks Fifth Avenue are examples of the latter. In this arrangement, another retailer (i.e., Sephora and FAO Schwarz) operates a store-within-a-store in the department store (i.e., JC Penney and Saks Fifth Avenue), where it sells several different brands in that category. In this paper, we study the arrangement where manufacturers operate stores-within-a-store. Some of our insights might carry over to the latter arrangement as well, but we do not model it explicitly as additional factors such as cross-selling of brands, category-specific service with complementarities across brands and retailing and service provision effeciencies by retailers specializing in the category come into play. We leave the detailed study of other forms of the store-within-a-store arrangement to future work.

Past research has devoted a lot of attention to channel structures and channel pricing strategies. In particular, our work is related to Choi (1991), McGuire and Staelin (1983) and Bernheim and Whinston (1985). Choi (1991) considers a two-manufacturer, one-retailer channel structure and compares the outcomes of different scenarios in which the manufacturers and the retailer make their strategic pricing decisions in different orders. It, however, treats the channel structure as given — the two manufacturers always sell through the retailer — while only the order of decisions is varied. In our setting, we analyze different channel structures (with the set-up in Choi (1991) being just one of them) and determine the channel structure that the retailer prefers under different conditions. Both McGuire and Staelin (1983) and Bernheim and Whinston (1985) study the channel structure that emerges when the manufacturers are the architects of the channel. The former studies the case when two manufacturers selling differentiated products unilaterally make the decisions (for their own channels) to vertically integrate, or vertical separate through independent retailers. The latter considers a situation where two competing manufacturers delegate their marketing-mix decisions to a common agency and offer a "sell out" contract that incentivizes the common agency (that decides the mix for the two firms jointly) to achieve the monopoly outcome by making it the residual claimant of all profits. In contrast with these papers, we study the channel structure that emerges when the retailer is the architect of the channel.

Our work is also related to the literature on bilateral monopoly channels, where the main question is that of channel coordination (Moorthy 1988, Jeuland and Shugan 1983, Desai, Koenigsberg and Purohit 2004); on duopoly channels with two manufacturers operating through exclusive retailers, where the main question is that of strategic vertical separation or integration (McGuire and Staelin 1983, Coughlan 1985, Bonanno and Vickers 1988, Coughlan and Wernerfelt 1989); and on the channel coordination problem in a one-manufacturer, two-retailer setting (Ingene and Parry 1995, Iyer 1998). In our work, we also model the impact of non-price factors, such as service provision, on prices and channel arrangements. This is related to work by Winter (1993), Iyer (1998) and Coughlan and Soberman (2005) all of which consider the impact of price and non-price competition on vertical contracting and channel structure.

The last two decades, however, have seen a change in the retailing landscape — the year 2002 census of the US Census Bureau (http://www.census.gov/econ/census02/) found that retail chains with a hundred or more stores accounted for only 0.06% of the total number of firms in the retail sector, yet they accounted for 43% of sales. As a few chain stores account for a disproportionately high percentage of retail sales, the retailer's power has become significantly larger in the manufacturer-retailer relationship (Kadiyali, Chintagunta and Vilcassim 2000). This phenomenon of increasing retailer power has motivated a number of recent research papers (Bloom and Perry 2001, Iyer and Villas-Boas 2003, Raju and Zhang 2005, Dukes et al. 2006, Geylani et al. 2006). In this paper, we take the research on power retailers one step further to investigate what channel structures emerge when the retailer is the architect of the channel. Specifically, we address a number of questions in the setting where the retailer owns the retail space and can therefore decide whether to allow the manufacturer to set up a store-within-a-store or not: How is the channel configuration different when the retailer is in the "driver's seat," and why? Do we see new channel structures emerge? How do non-price variables, e.g., in-store service and store-traffic effect, impact the channel arrangement?

The rest of the paper is organized as follows. In Section 2, we summarize the main points of our interviews with industry practitioners. In Section 3, we develop and analyze our model and determine the conditions under which the retailer will choose the store-within-a-store arrangement. In Section 4, we extend the basic model to consider the adverse effect of service from competing products on own demand, the store-traffic effect, and competition at the retail level. We conclude in Section 5.

2 Interviews with Practitioners

To benefit from the insights of practitioners, we contacted and interviewed executives of large retail corporations with extensive experience. We interviewed three retailing experts in the USA and three in China with experience with stores-within-a-store and in the cosmetics and apparel categories (in which stores-within-a-store are found most commonly).[2] From our conversations, the following salient facts about stores-within-a-store emerged.

First, in the USA, retailers choose stores-within-a-store in the cosmetics and apparel categories in which consumers perceive a difference between the various brands in the categories. In other categories where consumers do not perceive the different brands to be different, stores-within-a-store are almost never used. In China and other Asian countries such as Hong Kong, Japan, Singapore and South Korea, stores-within-a-store are used across the board for more product categories.

Second, retailers usually have an upper hand in the negotiations on stores-within-a-store with the manufacturers. This is because the retailers have a large clientele and manufacturers want to tap into this customer base, a large part of which they would otherwise not be able to access. We found out from our conversations from the experts on retailing in China that,

[2] In the USA, we interviewed: Terry Lundgren, Chief Executive Officer of Macy's, Inc., a leading department store chain with stores-within-a-store in a large number of its outlets, Erin Armendinger, Managing Director of the Jay H. Baker Retailing Initiative at the Wharton School who previously worked in the Merchandising division at Tiffany & Co., and William Cody, Chief Talent Officer of Urban Outfitters, Inc., a large specialty retail chain that primarily sells apparel and apparel accessories. In China, we interviewed the Vice President, Dong Jiasheng, and the Deputy Chief of Retailing, Guo Zongliang, of Beijing Wangfujing Department Store (Group) Co., Ltd., a leading Chinese department store chain (both of them are closely involved in negotiations with brands that set up stores-within-a-store) and Emma Walmsley, Vice President of L'Oreal China.

in China, most brands have stores-within-a-store in department store chains to gain access to the customers visiting these department stores, even though these brands clearly have (and use) other channels of distribution for their products.

Third, store-within-a-store contracts are typically of the form in which manufacturers manage all retailing decisions, and the retailers charge them a periodic rent. The rent basically guarantees a minimum payment to the retailer. In addition to this, the retailer sometimes shares the risk with the manufacturer by charging a smaller periodic rent and sharing a percentage of the revenues that the manufacturer earns from sales in the department store.

Armed with the insights from these conversations and the popular-press articles, we now proceed to develop our model.

3 Model Development

Our model consists of a single retailer ("she") selling differentiated products (different brands in the same category) from two competing manufacturers (both "he"). The manufacturers offer differentiated products that must be sold through the retailer who owns the "last ten feet to the customer." In this setting, the retailer faces the following problem: when should she lease her retail space to the competing manufacturers and delegate all the merchandising and pricing decisions for their respective products to them; when should she let only one manufacturer set up a store-within-a-store but buy at a wholesale price from the other manufacturer and then decide the retail price for this brand; and when should she opt for the retailer-resell arrangement for both brands and jointly set the prices and in-store service levels.

The demand curves for the two products are assumed to be given by

$$q_1 = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_1 + \frac{\beta}{1-\beta^2}p_2 + \theta s_1, \quad q_2 = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_2 + \frac{\beta}{1-\beta^2}p_1 + \theta s_2 \quad (1)$$

where q_i is the quantity of product i, p_i is the retail price for product i, s_i is the in-store service level for product i, $\beta \in [0,1]$ is the substitutability index, and $\theta \geq 0$ is a "returns to service" parameter.[3]

To understand this demand schedule, first consider substitutability between products. $\beta = 0$ implies fully differentiated products and $\beta = 1$ implies perfectly substitutable products. As substitutability β increases, (1) the price sensitivity for a product, $\frac{1}{1-\beta^2}$, increases (which is consistent with the intuition that customers are more price sensitive for more substitutable products), and (2) the size of the total potential market, $\frac{2}{1+\beta}$, decreases (which is consistent with the intuition that more differentiated products reach a wider customer base).

Now, consider in-store service for products. Providing a service level of s for a product increases the base demand for that product by θs. The parameter $\theta \geq 0$ can be interpreted as a "returns to service" parameter, i.e., the increase in the base demand for every unit of in-store service that is provided. Further, we assume that providing a service level of s costs $\frac{s^2}{2}$. Additively separable demand enhancing effect of marketing effort and convex effort costs have been assumed previously in the marketing literature, namely Lal (1990) and Bhardwaj (2001). For an alternative but equivalent formulation, please see Section WA1 in the web appendix.

The manufacturers can approach the customers only through the retailer's store. The retailer can choose among three channel arrangements:

1. The retailer buys products from both manufacturers at wholesale prices and then sells them at marked-up retail prices. We abbreviate this arrangement by RR. Figure 1(a) shows a schematic representation.

[3] This demand specification corresponds to a quadratic utility function $\mathcal{U}(q_1, q_2) = \big(1 + \theta s_1 + \theta\beta s_2\big)q_1 + \big(1 + \theta s_2 + \theta\beta s_1\big)q_2 - \frac{1}{2}(q_1^2 + q_2^2 + 2\beta q_1 q_2)$. Note that this utility function implies that, if $\theta > 0$, in-store service increases consumer utility. Further, service for one product also enhances the utility from the other product, but diminished by the substitutability index β. This is intuitive, since the products are of the same category. The above demand curves can also be obtained by starting from the inverse demand curves $p_i = 1 + \theta(s_i + \beta s_j) - q_i - \beta q_j, i \in 1, 2, j = 3 - i$, as in Singh and Vives (1984). Generalizing this demand schedule, while keeping it symmetric, as $q_i = \frac{A}{1+\beta} - \frac{\gamma}{1-\beta^2}p_i + \frac{\beta}{1-\beta^2}p_{3-i} + \theta s_i, i \in \{1, 2\}$, where $A > 0$ and $0 \leq \beta \leq \gamma$, does not change any insights from the model.

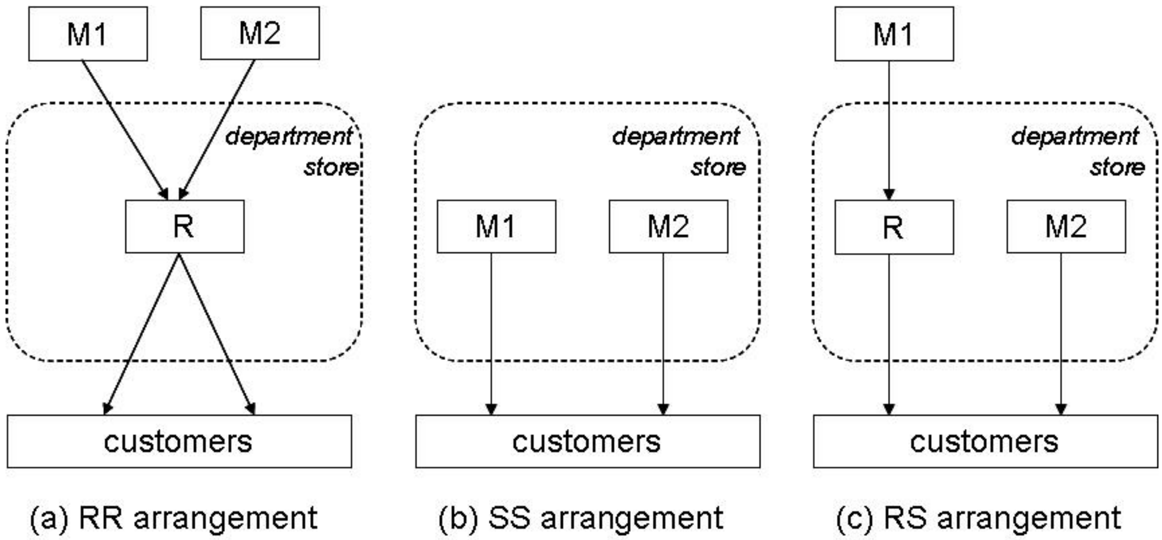


Figure 1: Schematic representations of the RR, SS and RS channel structures. M1 and M2 denote the two manufacturers and R denotes the retailer.

2. Both manufacturers set up stores-within-a-store. We abbreviate this arrangement by SS. Figure 1(b) shows a schematic representation.

3. One manufacturer sets up a store-within-a-store, and the retailer buys the other's product at a wholesale price and sells it at a marked-up retail price. We abbreviate this arrangement by RS. Figure 1(c) shows a schematic representation.

We now proceed to analyze these choices in detail for the retailer under different values of β and θ. We first analyze this basic model to obtain some core insights and then enrich it further in the later sections of the paper.

3.1 Retailer-resell arrangement for both manufacturers

In the RR arrangement (denoted by the subscript r), the two manufacturers sell their products to the retailer at wholesale prices, which she then sells to the customers at marked-up retail prices. The game proceeds in the following manner. In the first stage, the retailer offers the manufacturers take-it-or-leave-it contracts to enter into the retailer-resell arrangement. If the manufacturers accept these contracts, they have to pay the retailer slotting fees F_{1r}

and F_{2r}. We allow the retailer to charge a slotting fee to reflect the reality that many retailers charge slotting fees (Shaffer 1991, Kuksov and Pazgal 2007). In addition, by allowing the retailer to charge the slotting fees, we also make the retailer-resell arrangement more profitable so as to set a higher bar to justify the alternative arrangements. In the second stage, both manufacturers simultaneously determine the wholesale prices w_{ir}, given F_{ir}. In the third stage, the retailer determines the retail prices p_{1r} and p_{2r} and the service levels s_{1r} and s_{2r}. This set up is consistent with the insights obtained from our conversations with industry experts. The expressions for the quantities sold and profits in terms of prices and service levels are:

$$q_{1r} = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_{1r} + \frac{\beta}{1-\beta^2}p_{2r} + \theta s_{1r}, \quad q_{2r} = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_{2r} + \frac{\beta}{1-\beta^2}p_{1r} + \theta s_{2r}$$

$$\pi_{M1r} = w_{1r}q_{1r} - F_{1r}, \quad \pi_{M2r} = w_{2r}q_{2r} - F_{2r}$$

$$\pi_{Rr} = (p_{1r} - w_{1r})q_{1r} + (p_{2r} - w_{2r})q_{2r} - \frac{s_{1r}^2}{2} - \frac{s_{2r}^2}{2} + F_{1r} + F_{2r}$$

We assume that both manufacturers know the contract offered to the other manufacturer, and all agents can observe the actions of all other agents. A simplifying assumption that we make in our analysis is that the outside option of the manufacturers is zero. This implies that the retailer can charge rent to the manufacturers (the rent for retail space) to make their profits exactly zero and they will accept these contracts. In other words, the retailer is simply extracting all profits from the manufacturers using the fixed rents. Note that the main assumption here is that the outside option is an exogenously specified constant. Assuming this to be zero or any other constant does not in any way change the qualitative insights from the model as it leaves intact the strategic implications of the different arrangements.

We solve for the subgame-perfect equilibrium for the above game using backward induction. Table 1 shows the expressions for the equilibrium prices, service levels and slotting fees. One main feature of this arrangement is that there is a double markup on the product prices before the customers buys it — the manufacturer sells it to the retailer at a wholesale

Quantity	*Expression*
p_{1r}, p_{2r}	$\frac{6-5\theta^2+\theta^4+\beta^3\theta^4-\beta(2-\theta^2)^2-\beta^2\theta^2(1+\theta^2)}{2((2-\theta^2)(2-\theta^2-\beta)-\beta^2\theta^2(1-\beta\theta^2))}$
w_{1r}, w_{2r}	$\frac{(1-\beta)(2-(1-\beta)\theta^2)}{2(2-\beta-\theta^2+\beta\theta^2(1-\beta))}$
s_{1r}, s_{2r}	$\frac{\theta(2-(1+\beta^2)\theta^2)}{2((2-\theta^2)(2-\theta^2-\beta)-\beta^2\theta^2(1-\beta\theta^2))}$
F_{1r}, F_{2r}	$\frac{(1-\beta)(2-(1-\beta)\theta^2)(2-(1+\beta^2)\theta^2)}{4(1+\beta)(2-\beta-\theta^2+\beta\theta^2(1-\beta))^2(2-(1+\beta)\theta^2)}$

Table 1: The table above shows the expressions for the various quantities in the retailer-resell (RR) arrangement.

price, and the retailer then marks it up further and sells it to the customers. The other main feature, advantageous for the retailer, is that the manufacturers are setting the wholesale prices competitively, but she is subsequently setting the retail prices for both products jointly. As product substitutability β increases and competition between products intensifies, the wholesale prices go down, but the retail prices do not drop as fast, since they are being set jointly. Hence, the RR arrangement leads to high retail prices due to double marginalization (which surely hurts quantity sold) but it also has a competition cushioning effect at the retail level, which prevents retail prices from plummeting when products are close substitutes.

To understand how the optimal level of service is set, note that, in equilibrium, this will be set by the retailer for both products based on the net returns to service of each. A one unit increase in service level for product i increases demand by θ units and profit from sales for the retailer by $\theta(p_{ir} - w_{ir})$ units. Hence, the larger is the retailer's margin, the higher will the level of service provision. For a fixed θ, as β increases, both w_{ir} and p_{ir} decrease, but the former goes down faster for the reasons explained above, so that the retailer's margin from each product increases. Therefore, we obtain the counter-intuitive insight that, as β increases, the in-store service provided increases. In other words, in the RR arrangement, higher in-store service is provided for categories in which inter-brand substitutability is high rather than low.

For a fixed β, as θ increases, the in-store service provided increases. This is because of two effects. The first effect is the *direct effect* — for a fixed margin, the return to service is higher, so more service will be provided. The second effect is the *indirect effect* — provision of in-store service boosts the demand at the retailer, and a higher θ implies a higher boost in demand for every unit of service provided. With demand being boosted in this way, the retailer can charge a higher retail price, which implies higher margins. (The wholesale prices charged by the manufacturers also increase, but, being set competitively by two players, they increase at a slower rate.) Hence, as θ increases, more in-store service is provided by the retailer for both brands.

3.2 Store-within-a-store arrangement for both manufacturers

In the SS arrangement (denoted by the subscript s), both manufacturers open a stores-within-a-store (and make pricing and service decisions) representing their respective brands in the department store. The game proceeds in the following manner. In the first stage, the retailer offers the manufacturers take-it-or-leave-it contracts to open stores-within-a-store. If the manufacturers accept their respective contracts, they have to pay the retailer fixed rents F_{1s} and F_{2s}. In the second stage, both manufacturers simultaneously determine the retail prices p_{is} and in-store service levels s_{is} given F_{is} (which is a sunk cost at this point). This set up is consistent with the insights obtained from our conversations with industry experts.[4] The expressions for the quantities sold and profits in terms of prices and service levels are:

$$q_{1s} = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_{1s} + \frac{\beta}{1-\beta^2}p_{2s} + \theta s_{1s}, \quad q_{2s} = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_{2s} + \frac{\beta}{1-\beta^2}p_{1s} + \theta s_{2s}$$

$$\pi_{M1s} = p_{1s}q_{1s} - \frac{s_{1s}^2}{2} - F_{1s}, \quad \pi_{M2s} = p_{2s}q_{2s} - \frac{s_{2s}^2}{2} - F_{2s}$$

[4]Our demand system is deterministic and so we do not model the risk-sharing aspect through sharing of revenues between the manufacturers and the retailer. In stores-within-a-store with deterministic demand, the retailer does not have an incentive for sharing revenue. This is because the manufacturer is providing in-store service, and reducing the revenue per unit sold for the manufacturer (by making him share this revenue with the retailer) will lead to lesser in-store service. This, in turn, will reduce overall profits from the channel and the retailer will only be able to extract a smaller periodic rent from the manufacturer.

$$\pi_{Rs} = F_{1s} + F_{2s}.$$

We again solve for the subgame-perfect equilibrium for the above game using backward induction. Table 2 shows the expressions for the equilibrium prices, service levels and rents charged. First, consider the effect of substitutability. A main advantage of the SS arrangement is that it removes double marginalization from the channel since the manufacturers are directly setting the retail prices and so rids the channel of the double marginalization problem. This, however, also means that the two manufacturers will have to duel it out in price to compete for customers inside the retailer's store. Thus, when the substitutability parameter β is large, the intensity of competition will be high, the retail prices will plummet and the profits in the channel will reduce.

The in-store service level is being decided by the manufacturers for their respective products, and they will set this based on their net returns to service. A one unit increase in service level by manufacturer i increases demand by θ units and profit by θp_{is} units. For a fixed β, as θ increases, the optimal level of service increases. This is once again due to the two effects — the direct effect (keeping price fixed, a higher θ induces more service provision), and the indirect effect (a higher θ implies a higher boost in demand through service provision, which allows charging a higher price, which in turn induces more service provision). However, for a fixed θ, as the value of β increases and prices decrease due to increased competition, since increase in profit from every unit of service provided is tied to the level of price, the level of service provided decreases. At the extreme, when products are perfect substitutes ($\beta = 1$), both manufacturers charge a retail price of zero (equal to marginal cost), and hence no service will be provided. In other words, in the SS arrangement, higher in-store service is provided for categories in which the inter-brand substitutability is low (in contrast to the RR arrangement, where higher in-store service is provided for categories in which the inter-brand substitutability is high).

The above discussion provides us the insight that the SS arrangement can be a two-edged sword — the channel is free of double marginalization, and if products are sufficiently

Quantity	*Expression*
p_{1s}, p_{2s}	$\frac{1-\beta}{2-\beta-\theta^2(1-\beta^2)}$
s_{1s}, s_{2s}	$\frac{\theta(1-\beta)}{2-\beta-\theta^2(1-\beta^2)}$
F_{1s}, F_{2s}	$\frac{(1-\beta)(2-(1-\beta^2)\theta^2)}{2(1+\beta)(2-\beta-\theta^2(1-\beta^2))^2}$

Table 2: The table above shows the expressions for the various quantities in the store-within-a-store (SS) arrangement.

differentiated then prices, service levels and channel profits are all high, but as the products become more substitutable, both prices and service levels go down and therefore channel profits also go down.

3.3 Store-within-a-store arrangement for one manufacturer, and retailer-resell arrangement for the other

The retailer is free to have different arrangements for the two brands. Specifically, she can have a store-within-a-store only for one brand, and a retailer-resell arrangement for the other brand. This RS arrangement is observed in the categories of toys and apparel, where frequently only one brand opens a store-within-a-store, but the other brands are sold in the standard manner by the retailer herself. We denote it by o (to denote that *one* manufacturer sets up a store-within-a-store). The game proceeds in the following manner. In the first stage, the retailer offers take-it-or-leave-it contracts to the manufacturers. We assume without any loss of generality that the retailer offers a retailer-resell arrangement to the first manufacturer and a store-within-a-store arrangement to the second manufacturer. If the manufacturers accept the offers, the first manufacturer has to pay a slotting fee F_{1o} and the second manufacturer has to pay a rent F_{2o}. In the second stage, the first manufacturer decides the wholesale price w_{1o}. In the third stage, the retailer decides the retail price p_{1o} and the service level s_{1o} and the second manufacturer simultaneously decides the retail price p_{2o} and the service level s_{2o}. The expressions for the quantities sold and profits in terms of prices and service levels are:

Quantity	*Expression*
p_{1o}	$\frac{\left((1-\beta)\left(6-5\,\theta^2+\theta^4+\beta^4\,\theta^4+\beta^2\left(-2+5\,\theta^2-2\,\theta^4\right)\right)\right)}{2\left(\beta\,(-2+\theta^2)+(-2+\theta^2)^2-\beta^3\,(-1+\theta^2)+\beta^4\,\theta^2\,(-1+\theta^2)+\beta^2\,(-2+5\,\theta^2-2\,\theta^4)\right)}$
p_{2o}	$\frac{\left((1-\beta)\left(4+\beta-2\,\theta^2-\beta\,\theta^2+\beta^3\,\theta^2+2\,\beta^2\left(-1+\theta^2\right)\right)\right)}{2\,(2-\beta-\theta^2+\beta^2\,\theta^2)\,(2-\theta^2+\beta^2\,(-1+\theta^2))}$
w_{1o}	$\frac{(1-\beta)\left(2+\beta-\theta^2+\beta^2\,\theta^2\right)}{4-2\,\theta^2+2\,\beta^2\,(-1+\theta^2)}$
s_{1o}	$\frac{\theta(1-\beta)}{4-2\,\beta-2\,\theta^2+2\,\beta^2\,\theta^2}$
s_{2o}	$\frac{\left((1-\beta)\,\theta\left(4+\beta-2\,\theta^2-\beta\,\theta^2+\beta^3\,\theta^2+2\,\beta^2\left(-1+\theta^2\right)\right)\right)}{2\,(2-\beta-\theta^2+\beta^2\,\theta^2)\,(2-\theta^2+\beta^2\,(-1+\theta^2))}$
F_{1o}	$\frac{\left((1-\beta)\left(2+\beta-\theta^2+\beta^2\,\theta^2\right)\right)}{4\,(1+\beta)\,(2-\beta-\theta^2+\beta^2\,\theta^2)\,(2-\theta^2+\beta^2\,(-1+\theta^2))}$
F_{2o}	$\frac{\left((1-\beta)\left(2+\left(-1+\beta^2\right)\theta^2\right)\left(4+\beta-2\,\theta^2-\beta\,\theta^2+\beta^3\,\theta^2+2\,\beta^2\left(-1+\theta^2\right)\right)^2\right)}{8\,(1+\beta)\left(\beta\,(-2+\theta^2)+(-2+\theta^2)^2-\beta^3\,(-1+\theta^2)+\beta^4\,\theta^2\,(-1+\theta^2)+\beta^2\,(-2+5\,\theta^2-2\,\theta^4)\right)^2}$

Table 3: The table above shows the expressions for the various quantities when one manufacturer has a store-within-a-store (RS).

$$q_{1o} = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_{1o} + \frac{\beta}{1-\beta^2}p_{2o} + \theta s_{1o}, \quad q_{2o} = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_{2o} + \frac{\beta}{1-\beta^2}p_{1o} + \theta s_{2o}$$

$$\pi_{M1o} = w_{1o}q_{1o} - F_{1o}, \quad \pi_{M2o} = p_{2o}q_{2o} - \frac{s_{2o}^2}{2} - F_{2o}$$

$$\pi_{Ro} = (p_{1o} - w_{1o})q_{1o} - \frac{s_{1o}^2}{2} + F_{1o} + F_{2o}.$$

Once again, we solve for the subgame-perfect equilibrium for the above game using backward induction. Table 3 shows the expressions for the equilibrium retail and wholesale prices, service levels and rent. The RS arrangement has double marginalization in one channel but brings efficiency in the other channel (the store-within-a-store channel). The retail prices are set competitively, so they cannot be sustained at the high levels of the RR arrangement. At the same time, they do not fall as fast with increasing product substitutability as in the SS arrangement, because the price of one product (set by the retailer) is high due to double markups, and, prices being strategic complements, the price of the other product (set directly by the manufacturer) rises. To summarize, the RS arrangement is a compromise between the RR and the SS arrangement.

The service levels are again set by the two players based on their net returns to service. For the product sold by the retailer the returns to service are given by $\theta(p_{1o} - w_{1o})$, and for the product sold through the store-within-a-store, by θp_{2o}. For a fixed β, the optimal level of in-store service provided in equilibrium increases with θ for both products, and once again, both the direct effect and indirect effect of returns to service explained earlier are at play. For a fixed θ, the provision of service falls for both products as β increases, because of increased competition in retail prices and the resulting reduced margins. However, this decrease in service levels is slower than the decrease in the SS arrangement, due to the reasons explained above. An interesting insight that we obtain from the model is that, for the RS arrangement, the level of service provided for the store-within-a-store product is higher than that for the retailer-resell product for all values of β and θ. This is because the margin for the store-within-a-store product is higher than the margin for the retailer-resell product.

3.4 Optimal choice for the retailer

For different values of the parameters β and θ, the retailer will have a preference for one of the three arrangements based on her profits from each arrangement. The following proposition summarizes our analysis.

Proposition 1 *If the returns to service is small (θ is small), then the retailer prefers the SS arrangement for categories with low inter-brand substitutability (small values of β), the RS arrangement for categories with medium inter-brand substitutability (medium values of β) and the RR arrangement for categories with high inter-brand substitutability (large values of β). If the returns to service is large (θ is large), then the retailer prefers the SS arrangement for categories with low inter-brand substitutability (low values of β) and the RR arrangement for categories with medium and high inter-brand substitutability (medium and large values of β), and the RS arrangement is never preferred.*

Proof: Refer Appendix A1.

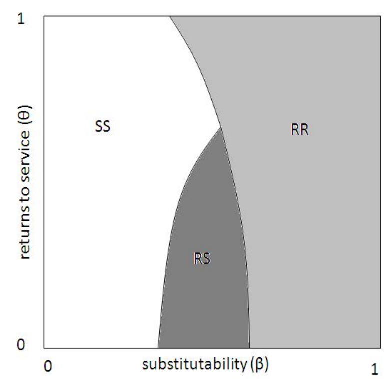


Figure 2: Optimal arrangement for the retailer as substitutability (β) and returns to service (θ) vary across categories.

Figure 2 shows the optimal choice of the retailer.[5] Intuitively, given that the retailer is in the position of extracting the channel profit, it wants to select the channel structure that can maximize the channel profit. Channel inefficiency and price competition can both dissipate the channel profit, and the retailer needs to strike a balance between removing channel inefficiency by encouraging price competition, and moderating price competition by introducing double marginalization. Hence, both θ and β are mediating factors in the retailer's decision.

At a sufficiently low θ, when β is low, the products are highly differentiated and price competition is not excessive. The retailer thus prefers the SS arrangement to take advantage of channel efficiency by removing double marginalization. When β is high, the retail price competition is intense. In this situation, the retailer chooses RR, using channel markups to raise the retail prices in order to increase its own profitability, even if at the expense of introducing inefficiency. When β is at a medium value, the retailer finds it optimal to go for the RS arrangement, a compromise solution. While this arrangement does not remove price competition at the retail level, it raises prices in one channel (the resell channel) due to double marginalization in this channel. Retail prices being strategic complements, the price in the other channel (the store-within-a-store channel) also rises. Thus, this arrangement saves

[5]By definition, $\beta \in [0, 1]$. In Figure 2, we only consider $\theta \in [0, 1]$. This is because, for $\beta \in [0, 1]$, equilibria exist for all arrangements only if $\theta \in [0, 1]$.

one channel from inefficiencies from double marginalization and utilizes the other channel to stem the decrease in retail prices.

Furthermore, as we increase β for a fixed θ, the effects of service provision also drive the retailer toward choosing the SS, RS and RR arrangements, in that order. When β is small, service provision and the corresponding increase in profits is the highest in the SS arrangement. This is because the manufacturers in the SS arrangement choose the service levels based on the retail prices they charge, while if the retailer is making this decision (for both channels in the RR arrangement and one channel in the RS arrangement), she will choose service levels based on her margins, which are smaller in this region. However, as β increases, only in the RR arrangement the service provided increases. This higher service provision, in turn, boosts the retailer's profits, so that her preference for the RR arrangement increases with increasing β. As before, the RS arrangement is a compromise between SS and RR — service provision is high in the store-within-a-store channel but low in the retailer-resell channel, and decreases with increasing β in both — and is preferred for medium values of β.

Once we understand the effect of inter-brand substitutability (β) on the retailer's choice of SS and RR, it is fairly easy to understand the impact of the demand enhancing effect of service (θ), on the channel arrangement. Note that for very low and very high values of β, the SS and RR arrangements are respectively optimal for all values of θ. This is because when substitutability (and therefore intensity of competition) is low the efficiency from SS is very large, while when substitutability (and therefore intensity of competition) is high the competition cushioning effect in RR is very large. It is only when substitutability is at a medium level that the interplay between the different forces — channel efficiency, cushioning competition and returns to service — becomes intricate. This is the region (the darkened region in the middle) on which we shall focus.

Increasing θ increases the level of service provided in all three channel arrangements, but at different rates. As discussed earlier, the provision of in-store services boosts the demands at the retailer. As a result, the retailer has an incentive to induce a high level of service provision through its choice of the channel arrangement, all else being equal, and internalize the benefits of high service effectiveness. For this reason, the retailer has more tolerance for double marginalization and chooses RR instead of RS and SS at a higher θ, as illustrated by the right hand side boundary of this region (between "RS" and "RR", and "SS" and "RR" in Figure 2). Furthermore, because of the demand boosting effect, service provisions increase retail prices, all else being equal. For this reason, the retailer has more incentive, at a higher θ, to favor channel efficiency by choosing SS, instead of choosing RS to moderate price competition, as long as SS does not lead to excessive price competition. This is why as θ increases, the RS region progressively tapers off, as is illustrated by the left hand side boundary of this region (between "SS" and "RS" in Figure 2).

From the analysis of this simple model, we see that the store-within-a-store arrangement, at the most basic level, gives the retailer the flexibility to maximize channel efficiency and hence the rent it can charge for access to consumers. Thus, the store-within-a-store arrangement is a power retailer's way to achieve channel efficiency. Such an arrangement is most profitable for the retailer when it allows the manufacturers of products that are *not* close substitutes to open stores-within-a-store.

4 Extensions of the Basic Model

The basic model in the previous section highlights product substitutability and returns to service as key drivers behind the retailer's decision of setting up stores-within-a-store. However, it does not capture other prominent effects associated with this phenomenon. In this section, we extend the basic model to assess the impact of three such effects.

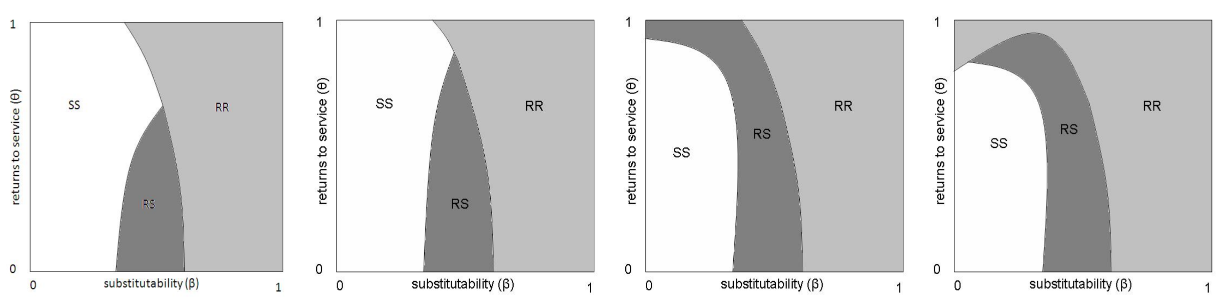
4.1 Adverse effect of competitor's in-store service

When two competitors provide in-store service to induce customers to buy their respective brands, it is possible that, for both brands, service provision by one brand partly mitigates the gains from service provision by the other brand. To incorporate this effect, we introduce the parameter $\psi \in [0,1]$ and modify the demand system in the following manner, while keeping everything else the same (and ignoring the store-traffic effect for simplicity).

$$q_1 = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_1 + \frac{\beta}{1-\beta^2}p_2 + \theta\left(s_1 - \psi s_2\right), \quad q_2 = \frac{1}{1+\beta} - \frac{1}{1-\beta^2}p_2 + \frac{\beta}{1-\beta^2}p_1 + \theta\left(s_2 - \psi s_1\right)$$

As the value of ψ increases, the adverse effect of the competitor's in-store service on own demand increases.[6] Note that if $\psi = 0$, the demand schedules are the same as in the basic model in Section 3.

Upon solving for the subgame-perfect equilibrium, we get the expressions shown in Table A1 in the appendix. The effect of ψ on the region where the retailer prefers SS is shown in Figure 3.



(a) $\psi = 0$ (b) $\psi = 0.15$ (c) $\psi = 0.3$ (d) $\psi = 0.45$

Figure 3: The effect of the (ψ) on the retailer's choice of channel arrangement.

[6]This demand specification corresponds to the quadratic utility function $\mathcal{U}(q_1, q_2) = \big(1 + \theta(1-\psi\beta)s_1 + \theta(\beta-\psi)s_2\big)q_1 + \big(1+\theta(1-\psi\beta)s_2 + \theta(\beta-\psi)s_1\big)q_2 - \frac{1}{2}(q_1^2 + q_2^2 + 2\beta q_1 q_2)$. Note that this utility function implies that: (1) In-store service affects consumer utility only if $\theta > 0$, (2) Service for own product can only increase consumer utility (because $\psi, \beta \in [0,1]$ which implies $1 - \psi\beta \geq 0$), and (3) If the adverse effect of competitor's service is large enough, i.e., if $\psi > \beta$, then competitor's in-store service has an overall negative effect on the utility from own product. We impose 1 as an upper bound on ψ to rule out cases when providing in-store service decreases overall category demand in equilibrium. To see this, note that the net effect of in-store service on consumer utility will be negative if $(1-\psi\beta)s_i + (\beta - \psi)s_j < 0 \implies \psi > \frac{s_i + \beta s_j}{s_j + \beta s_i}$. Since firms are symmetric, the equilibrium will be symmetric, i.e., $s_i = s_j$ in equilibrium. Hence, the net effect of in-store service on consumer utility will be negative if $\psi > 1$, which we exclude.

From the figure, one can immediately see that when θ is large, the effect of ψ on the choice of channel arrangement is quite dramatic. As ψ increases, the retailer prefers the RR arrangement in a larger region, even for small β. Further, the retailer also prefers the RS arrangement over the SS arrangement for a larger region.

To see the reason behind this, note that in the SS arrangement, both the manufacturers are setting service levels competitively. Since there is a negative effect from the competitor's service, a part of the service provision effort of both manufacturers is simply wasted from the retailer's perspective. However, neither manufacturer can afford to reduce his service level, because the competing manufacturer will not do so, and his profitability will reduce (because of a lower service level he provides for his own product, and the negative effect of a higher service level being provided by the competing manufacturer). Hence, in equilibrium, both manufacturers provide high levels of costly in-store service but don't benefit from a part of it because it does not induce higher demand. This reduces the channel profits from the SS arrangement.

The above is not the case, however, in the RR arrangement, because the retailer sets the service levels jointly for both the products. The retailer thus incorporates the negative effect of service into her decisions (i.e., this negative "externality" is "internalized") and reduces the service provision for both products simultaneously. This reduced investment in service provision increases overall channel profits from the RR arrangement, and hence the retailer's preference for it. As ψ increases, this advantage offered by the RR arrangement increases and the retailer prefers it for a larger region of the parameter space. In the RS arrangement, the service levels are being set competitively by the retailer and one manufacturer and neither player can afford to reduce her/his service level unilaterally. However, as we saw in Section 3, the service level of the retailer is not as high as the service levels in the SS arrangement, which implies: (1) a smaller investment in service cost by the retailer for the retailer-resell product and therefore lesser wastage, and (2) a smaller negative effect on the service being provided by the manufacturer for the store-within-a-store product. As a consequence, the retailer prefers the RS arrangement over the SS arrangement for a larger region.

The gist of the above discussion is presented in the following proposition.

Proposition 2 *As the adverse effect on demand from in-store service by competing products increases, the retailer's is less likely to implement the store-within-a-store arrangement.*

The proof of Proposition 2 is obtained by comparing the profit functions of the various arrangements. This proposition suggests that we are likely to observe some variations in the incidence of stores-within-a-store across different product categories where the adverse effects from competitors' in-store service differ. For example, casual observations suggest that stores-within-a-store are found lesser in men's accessories than in women's cosmetics, and our conversations with retailing experts suggest that the negative effect of competitors' service on each others' demand is more pronounced in the former category than in the latter category (where purchasing is typically less restrained).

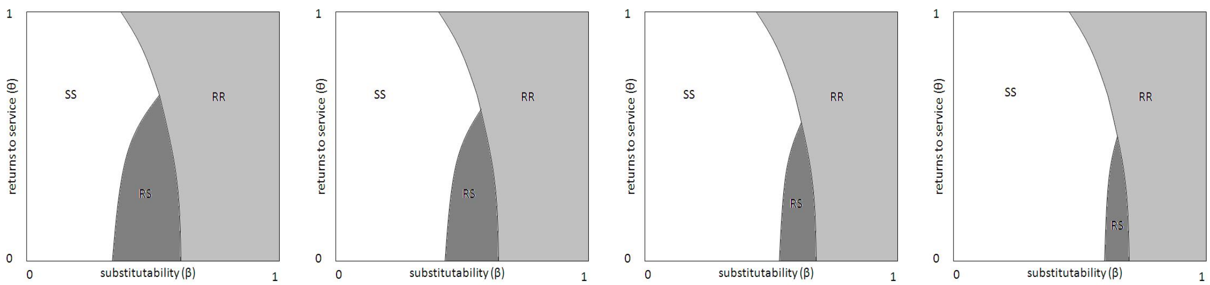
4.2 Store-traffic effect

The introduction of new products through stores-within-a-store can bring new customers to the store who want to purchase the focal product and also purchase other products in the store. This would provide added incentive to the retailer to choose stores-within-a-store. To understand the impact of such a store-traffic effect, we model it by using a larger intercept of the demand function when the store-within-a-store arrangement is used.[7] Specifically, if manufacturer i's brand is sold through a store-within-a-store, we assume that the demand for the product is given by[8]

$$q_i = \frac{1+T}{1+\beta} - \frac{1}{1-\beta^2}p_i + \frac{\beta}{1-\beta^2}p_{3-i} + \theta s_i.$$

[7] We thank an anonymous reviewer for suggesting this analysis.

[8] This corresponds to the utility function $\mathcal{U}(q_1, q_2) = \big(1+\mathbb{1}_1 T+\theta s_1+\theta\beta s_2\big)q_1 + \big(1+\mathbb{1}_2 T+\theta s_2+\theta\beta s_1\big)q_2 - \frac{1}{2}(q_1^2 + q_2^2 + 2\beta q_1 q_2)$, where $\mathbb{1}_i = 1$ if manufacturer i's brand is sold via a store-within-a-store, else it is 0. Note that using a demand function of the form $q_i = \frac{1}{1+\beta} + T - \frac{1}{1-\beta^2}p_i + \frac{\beta}{1-\beta^2}p_{3-i} + \theta s_i$ for a brand sold through a store-within-a-store gives, qualitatively, the same results.



(a) $T = 0$ (b) $T = 0.05$ (c) $T = 0.1$ (d) $T = 0.15$

Figure 4: The effect of the store-traffic effect (T) on the retailer's choice of channel arrangement.

Note that for a retailer-resell arrangement we always use $T = 0$. For a store-within-a-store arrangement we use the above demand function. In this case, if $T = 0$ we obtain the original demand system in (1) and as the value of T increases the magnitude of the store-traffic effect increases.

The structure of the game for each arrangement is exactly the same as before and we solve for the subgame-perfect equilibrium of each game using backward induction. The analytical expressions for the different quantities in this case are provided in the appendix in Table A2.

Figure 4 shows that as the store-traffic effect increases (i.e., T increases) the SS arrangement is preferred increasingly over the RS and RR arrangements, and the RS arrangement is preferred increasingly over the RR arrangement. Intuitively, since the store-within-a-store arrangement increases the traffic in the store, the retailer makes more profit and the stronger the store-traffic effect is, the higher is the profit. Note also that a larger demand intercept also implies that higher prices can be charged. In the SS arrangement, the store-traffic effect is present for both products so that, as its magnitude increases, SS is preferred over the other two arrangements for a greater region of the parameter space. Further, as the store-traffic effect increases, the RS arrangement is also preferred over the RR arrangement for a larger region of the parameter space, but since the benefit accrues only from one product in RS, this trend is positive but weak.

The gist of the above discussion is presented in the following proposition.

Proposition 3 *In product categories associated with a significant store-traffic effect, the retailer is more likely to choose the store-within-a-store arrangement.*

4.3 Competition at the retail level

Until now, we have considered the case when there is one retailer and two manufacturers sell their products through this common retailer. Our stores-within-a-store problem is motivated by examples of vendor boutiques in large department stores like Macy's. These stores are often found in large malls, where more than one department store offering similar products may be located. Naturally, this introduces competition between the retail stores also, and adds an extra degree of competition between products, which might influence the decision of whether to open stores-within-a-store or not. In this section, we extend our analysis to this scenario to assess the implications of retailer competition on the store-within-a-store arrangement.[7]

Consider the scenario where there are two competing manufacturers selling their respective brands possibly through two competing retailers, i.e., both retailers can stock both brands. Let p_{ij}, q_{ij} and $s_{ij}, i, j \in \{1, 2\}$ denote the price, quantity and service level, respectively, of the j^{th} brand at the i^{th} store. We assume the following demand curves:[9]

$$q_{ij} = A_0 + A_1\ p_{ij} + A_2\ p_{i,3-j} + A_3\ p_{3-i,j} + A_4\ p_{3-i,3-j} + \theta s_{ij}$$

$$\text{where } A_0 = \frac{1}{1 + \beta + \chi - \beta\,\chi}$$

[9]This demand specification corresponds to a quadratic utility function

$$\begin{aligned}\mathcal{U}(q_{11}, q_{12}, q_{21}, q_{22}) =&(1 + \theta S_{11})q_{11} + (1 + \theta S_{12})q_{12} + (1 + \theta S_{21})q_{21} + (1 + \theta S_{22})q_{22} \\ &- \frac{1}{2}\Big(q_{11}^2 + q_{12}^2 + q_{21}^2 + q_{22}^2 + 2\beta(1-\chi)q_{11}q_{12} + 2\beta(1-\chi)q_{21}q_{22} \\ &\quad + 2(1-\beta)\chi q_{11}q_{21} + 2(1-\beta)\chi q_{12}q_{22} + 2\beta\chi q_{11}q_{22} + 2\beta\chi q_{12}q_{21}\Big),\end{aligned}$$

where $S_{ij} = s_{ij} + \beta(1-\chi)s_{i,3-j} + (1-\beta)\chi s_{3-i,j} + \beta\chi s_{3-i,3-j}$. Note that this utility function implies that, if $\theta > 0$, in-store service increases consumer utility. Further, we can see from S_{ij} that service for one product in one store also enhances the utility from the other product in that store and the utility from purchasing products from the other store, but diminished by the corresponding multiplicative factors which are functions of inter-brand and inter-store substitutability.

		R_2			
		SS	SR	RS	RR
R_1	SS	I	II	III	IV
	SR	V	VI	VII	$VIII$
	RS	IX	X	XI	XII
	RR	$XIII$	XIV	XV	XVI

(a) Strategic-form game for the retailers in Stage 1.

		M_2			
		NN	NY	YN	YY
M_1	NN	–	–	–	–
	NY	–	i	ii	iii
	YN	–	iv	v	vi
	YY	–	vii	$viii$	ix

(b) Strategic-form game for the manufacturers in Stage 2.

Table 4: Strategic-form games in Stages 1 and 2.

$$A_1 = \frac{1-\chi^2+2\beta\chi^2+2\beta^3\,(-1+\chi)\,\chi^2-\beta^2\,(1-2\chi+\chi^2+2\chi^3)}{(-1+\beta^2)\,(-1+\chi^2)\,(-1+\chi^2-4\beta\chi^2+\beta^2\,(1-4\chi+3\chi^2))}$$

$$A_2 = \frac{\beta\,(-1+\chi+\chi^2+\chi^3-2\beta\chi^3+\beta^2\,(1-3\chi+\chi^2+\chi^3))}{(-1+\beta^2)\,(-1+\chi^2)\,(-1+\chi^2-4\beta\chi^2+\beta^2\,(1-4\chi+3\chi^2))}$$

$$A_3 = \frac{\chi\left(-1+\beta+\beta^3\,(-1+\chi)^2+\chi^2-3\beta\chi^2+\beta^2\,(1+\chi^2)\right)}{(-1+\beta^2)\,(-1+\chi^2)\,(-1+\chi^2-4\beta\chi^2+\beta^2\,(1-4\chi+3\chi^2))}$$

$$A_4 = \frac{\beta\chi\left(-1+\beta^2\,(-1+\chi)^2+2\chi+\chi^2-2\beta\,(-1+\chi+\chi^2)\right)}{(1-\beta^2)\,(-1+\chi^2)\,(-1+\chi^2-4\beta\chi^2+\beta^2\,(1-4\chi+3\chi^2))}$$

In the above demand schedule, $\beta \in [0,1]$ measures the substitutability between brands as before, $\chi \in [0,1]$ measures the substitutability between competing stores, which captures the intensity of inter-store competition, and θ is the "returns to service" parameter. A large value of χ corresponds to a high intensity of inter-store competition. Note that when $\chi = 0$ the stores are not in competition, and we get the original demand system in (1) and the original utility function for each store. Similarly, when $\beta = 0$, only the inter-store competition effect is present. Note that Lee and Staelin (1997), Trivedi (1998), Lal and Villas-Boas (1998), Kim and Staelin (1999) and Dukes et al. (2006) have a two-manufacturer-two-retailer set up, but they use different demand specifications, different contract forms and focus on different research questions.

The game with competing retailers is significantly more complicated as compared to the game with one retailer. In Stage 1, both retailers simultaneously make take-it-or-leave-it offers to both manufacturers. This gives rise to sixteen possible combinations which are shown as Cases I to XVI in Table 4(a). The rows show the offers by retailer 1 (R_1) and the columns show the offers by retailer 2 (R_2). For each retailer, S in position i denotes an offer for a store-within-a-store to manufacturer i and R denotes an offer for a retailer-resell arrangement. Case VII, for instance, is the case "SR,RS", which means that retailer 1 offers a store-within-a-store to manufacturer 1 and a retailer-resell arrangement to manufacturer 2, and retailer 2 offers a retailer-resell arrangement to manufacturer 1 and a store-within-a-store to manufacturer 2. Each offer is accompanied by the rent that the retailer will charge the manufacturer if he accepts the retailer's offer. We denote the rent that retailer i demands from manufacturer j by F_{ij}.

In Stage 2, the two manufacturers simultaneously decide whether to accept each retailer's offer or not. This again gives rise to sixteen possibilities, as shown in Table 4(b). For each manufacturer, N in position i denotes rejecting retailer i's offer and Y denotes accepting the offer. Case iii, for instance, is the case "NY,YY", which means that manufacturer 1 rejects retailer 1's offer but accepts retailer 2's offer, and manufacturer 2 accepts both offers. We assume that the outside option for a manufacturer (if he does not sell through either retailer) is zero, which implies that a manufacturer following the strategy NN will surely earn zero profits from the market in question and hence this is weakly dominated. We are therefore left with nine cases, as marked in the table. Hence, taking Stages 1 and 2 together, we have $16 \times 9 = 144$ channel arrangements to consider.

Before we proceed to Stages 3 and 4 of the game, note that the final channel arrangement is the result of the offers made by the retailers and the subsequent decisions made by the manufacturers. For instance, if the retailers make the offers "SR,RS" and the manufacturers make the decisions "NY,YY", then the channel configuration is "øR,RS" — R_1 does not sell M_1's brand but sells M_2's brand in the retailer-resell arrangement, and R_2 sells M_1's brand

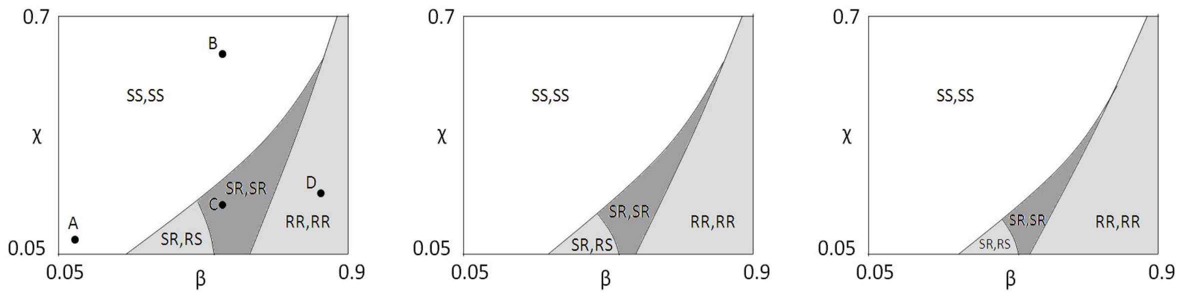


Figure 5: Equilibrium channel arrangements as product substitutability (β), store substitutability (χ) vary for different levels of returns to service (θ). The points marked A, B, C and D in (a) correspond to the games in Tables WA5(a), WA5(b), WA5(c) and WA5(d), respectively.

in the retailer-resell arrangement and M_2's brand in the store-within-a-store arrangement. Note that in this arrangement only three products are being sold, while our demand system presented earlier is for four products. (In other cases, e.g., "SR,RS" in Stage 1 followed by "NY,YN" in Stage 2, only two products are being sold.) Hence, while analyzing these cases, we re-derive the demand functions for three (or two, if that is the case) products from first principles by appropriately adjusting the utility function.

In Stage 3, the manufacturers decide the wholesale prices if any retailer-resell arrangement emerges after the second stage. In Stage 4, the retail prices and service levels are set.

We solve the four-stage game described above by backward induction. The subgames in Stage 4 followed by Stage 3 can be solved analytically. As mentioned earlier, we analytically solve 144 subgames, one for each channel arrangement. We then solve Stage 2 and Stage 1, in that order, numerically.[10] For considerations of length, we relegate the details of this analysis to Section WA2 in the web appendix. Here, we discuss the results and the main insights that emerge from the analysis.

The results of the analysis are presented in Figure 5 for β between 0.05 and 0.9, χ between 0.05 and 0.7 and three values of θ: 0 (low value), 0.15 (medium value) and 0.3 (high value). These are the allowable values of β, χ and θ, i.e., where all quantities are positive and second-

[10]Note that we only consider pure-strategy equilibria in Stages 2 and 1, i.e., we only consider pure-strategy equilibrium channel arrangements and do not consider mixed-strategy equilibrium channel arrangements.

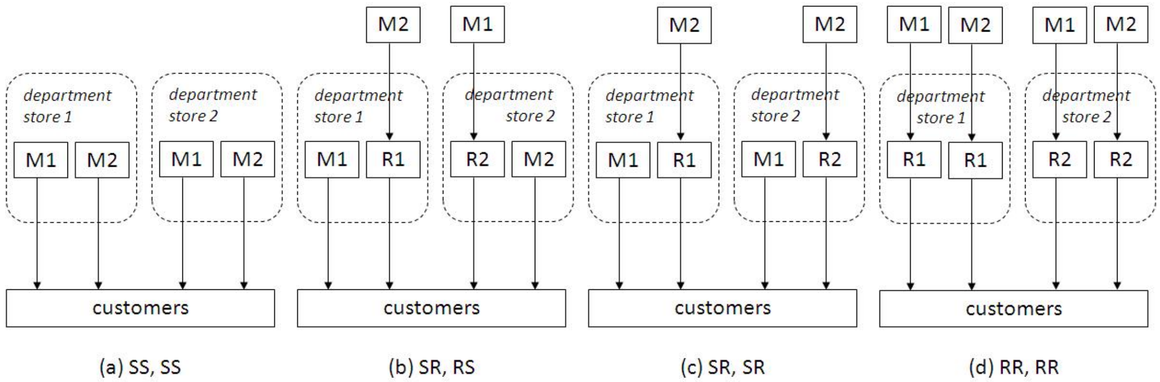


Figure 6: Schematic representations of the "SS,SS", "SR,RS", "SR,SR" and "RR,RR" channel arrangements. Note that in "SR,RS" and "SR,SR", the identities of the manufacturers can be interchanged. This implies that, from the point of view of the retailers, in Stage 1, Case VI and Case XI are equivalent and Case VII and Case X are equivalent.

order conditions hold. In the region marked "SS,SS", both retailers have stores-within-a-store for both brands, and in the region marked "RR, RR", both retailers have the retailer-resell arrangement for both brands. In the regions marked "SR,SR" and "SR,RS", both retailers have mixed arrangements. However, under "SR, SR" one manufacturer has stores-within-a-store at both retailers and the other manufacturer has retailer-resell arrangements at both retailers, while under "SR,RS" each manufacturer has a store-within-a-store and a retailer-resell arrangement at each retailer. These arrangements are shown in Figure 6. The other possible channel arrangements do not occur as pure-strategy equilibrium arrangements.

In this model with competing retailers, two new forces emerge (compared to the one-retailer model) that can influence the channel arrangement. First, the manufacturers are no longer dependent solely on one retailer to sell their products. This acts to their advantage because in Stage 1 the retailers cannot charge them monopsony-level rents (to make their profit equal to zero, the outside profit), since in Stage 2 both manufacturers can choose to reject one offer and sell only through the other retailer. The retailers will make their offers in Stage 1 taking this into account.

The second factor that can also influence the equilibrium channel arrangement is that the two retailers are also in competition with each other at the retail level, i.e., besides inter-brand competition, there is also inter-store competition while setting retail prices and service levels in Stage 4. The choice of the channel arrangement has an impact on which one of inter-brand or inter-store competition is reduced or intensified. If the "RR,RR" arrangement is chosen, the inter-brand competition is reduced (because one retailer decides the prices and service levels of both brands in her store) and the inter-store competition is intensified (because the two retailers are setting their prices and service levels to compete for customers). If the "SS,SS" arrangement is chosen, the inter-store competition is reduced (because one manufacturer sets the prices and service levels of his brand offered in both stores to maximize his joint profit from his products sold in both stores) but the inter-brand competition is intensified (because the manufacturers set their prices and service levels to compete for customers in a given store).

Consider Figure 5(a). When inter-brand competition is low to start with (β is small), the "SS,SS" arrangement is preferred for all values of inter-store competition (χ). This is because when competition between brands is low, the stores-within-a-store arrangement offers efficiency gains (just as in the one-retailer case) and also helps to reduce inter-store competition. The game described in Table WA5(a) in the web appendix (corresponding to point A in Figure 5(a)) is an example of such a case.

When inter-brand competition is high (β is large), then if inter-store competition is low (χ is small), the "RR,RR" arrangement is preferred, since it moderates inter-brand competition (just as in the one-retailer case). The game described in Table WA5(d) in the web appendix (corresponding to point D in Figure 5(a)) is an example of such a case. However, if inter-brand competition is high (β is large) and inter-store competition is *also* high (χ is large), then the "SS,SS" arrangement is preferred. This seemingly counter-intuitive result occurs because of a classic "prisoners' dilemma" situation — if both retailers have retailer-resell arrangements and inter-store competition is high they will both make higher profits, but each retailer has the incentive to unilaterally deviate to the store-within-a-store arrangement. This deviation leads to lower prices at this retailer, which increases sales and profits at this retailer, and the non-deviating retailer suffers. Consequently, in equilibrium, both retailers choose the stores-within-a-store arrangement even though they make smaller profits. The game described in Table WA5(b) in the web appendix (corresponding to point B in Figure 5(a)) is an example of such a case.

As in the one-retailer case, the mixed arrangements ("SR,SR" and "SR,RS") occur as a compromise between the above arrangements for medium values of the parameter β (when χ is not too large) — store-within-a-store arrangements are used to bring efficiency into the channel and retailer-resell arrangements are used to charge higher retail prices due to double marginalization. The game described in Table WA5(c) in the web appendix (corresponding to point C in Figure 5(a)) is an example of the case "SR,SR".

The interesting question in the case of mixed arrangements is: When is "SR,SR" the equilibrium arrangement and when is "SR,RS" the equilibrium arrangement? To compare the two arrangements, note that in "SR,RS", the two manufacturers decide wholesale prices charged to the two retailers in competition with each other (in Stage 3 of the game), while in "SR,SR", one manufacturer decides the wholesale prices charged to the two retailers. Hence, inter-brand competition is moderated in Stage 3 of the game in "SR,SR" but not in "SR,RS". This, in turn, implies that channel profits are higher in "SR,SR", and this effect is, of course, weak for small β and stronger for larger β (for any given value of χ). On the other hand, in "SR,SR", one manufacturer (M_1 in Figure 6(c)) has the more efficient stores-within-a-store at both retailers while the other manufacturer (M_2 in Figure 6(c)) has the less efficient retailer-resell arrangements at both retailers. Hence, though in "SR,SR" the inter-brand competition is moderated in Stage 3, the two manufacturers are benefitting disproportionately from it (M_2 makes a smaller profit than M_1).

It is due to the interplay between the above forces that the retailers, who extract a part of the manufacturers' profits through the rents they charge, choose "SR,SR" when β is large because moderating inter-brand competition in Stage 3 has a significant benefit and choose "SR,RS" when β is small because moderating inter-brand competition in Stage 3 is less beneficial, while the manufacturer who has retailer-resell arrangements at both retailers can, in fact, make more profit under "SR,RS" (part of which the retailers can then extract from him) even if channel profit is overall lower.

Finally, for a fixed level of inter-store substitutability (χ), as the returns to service (denoted by θ) increase, the mixed arrangements will be seen less often. This result is qualitatively the same as the result in Section 3.4 and is driven by the same force — the demand at the retailers is boosted as the returns to service increase. Increased base demand leads to increased tolerance to double marginalization which increases preference for the pure retailer-resell arrangements, and increased base demand also allows charging of higher prices which moderates price competition and increases the preference for the more efficient stores-within-a-store arrangements.

To summarize, the efficiency effect of stores-within-a-store is a robust phenomenon which sustains even in the case of competitive retailers. In fact, stores-within-a-store can help to reduce inter-store competition to the benefit of competing retailers when inter-brand substitutability is small. However, when inter-brand substitutability and inter-store substitutability are both large, the stores-within-a-store arrangement can lead to a prisoners' dilemma situation where both competing retailers are in this arrangement but are also worse off because of it. Hence, in a market envrionment where inter-brand substitutability is larger, the stores-within-a-store arrangement may be a sign that retailers are caught in a prisoners' dilemma situation where they would be better off without such a practice. However, in a market environment where inter-brand substutability is smaller, the stores-within-a-store arrangement can benefit competing retailers by moderating inter-store competition. We present the last insight above in the following proposition.

Proposition 4 *Channel arrangements can mediate both inter-brand and inter-store competition. Specifically, the store-within-a-store arrangement can mediate inter-store competition.*

5 Conclusions and Discussion

Stores-within-a-store is a curious phenomenon observed worldwide in the retailing industry. Many stores have autonomous stores in them, but many others do not. When stores have stores in them, they reserve the arrangement for a few selected product categories. Our objective in this paper is to investigate the economic incentives facing a retailer while making those decisions. The simple model we have developed helps us to generate a number of insights into the phenomenon.

First, the presence of a manufacturer's store within a retailer's store could suggest the weakness of the retailer or the dominance of the manufacturer, as the manufacturer has autonomy in the space owned by the retailer. However, our analysis shows that the SS arrangement can, in fact, be a sign of the retailer's strength. In our model, for the most part, the channel structure is a familiar one, with two manufacturers selling through a common retailer. Indeed, the economic forces that are at work in the channel are also familiar ones: double marginalization and inter-brand competition. However, by placing the retailer in the driver's seat, stores-within-a-store emerge as an equilibrium phenomenon. Furthermore, under some conditions the retailer will prefer that competing brands set up stores-within-a-store, and under other conditions she will prefer that just one brand sets up a store-within-a-store.

Second, in our model, the retailer could have avoided the SS arrangement altogether if it could credibly commit to the retail prices and the service levels that the manufacturers would have effected under the SS arrangement. However, any such commitments would not be credible to the manufacturers. From this perspective, the SS arrangement is a commitment device on the part of the retailer. Such a device then gives the retailer the needed structural flexibility to manage channel effciency and inter-brand competition to its own benefit. This and the previous insight together imply, rather ironically, that one would expect to see the SS arrangement only in the stores of power retailers, as is commonly the case.

Third, our analysis also shows that when the retailer takes the lead to shape the channel structure, we have different channel structures emerging. This is reflected in the fact that the retailer does not always allow all manufacturers to integrate forward and it may choose to allow only one of them to do so.

Fourth, our analysis shows that a number of factors could motivate a retailer to favor the stores-within-a-store arrangement in a product category, and these factors include the substitutability between competing products, the effectiveness of in-store services or the costs of such services, the store-traffic effect and the intensity of competition at the retail level. As a testable implication, our model suggests that in the categories where products are not very substitutable, the costs of in-store service for those products are high, and the traffic effect of the product category is pronounced, the stores-within-a-store arrangement is more likely to be observed.

The above testable implications are consistent with casual observations from the retailing industry. A rigorous empirical test of these can be conducted by analyzing data from department stores and other one-stop shops with store-loyal customers — in these markets retailers "own" this specific set of consumers and this would ensure consistency with the assumption of an exogenous outside option for the manufacturers (i.e., in these settings manufacturers find it difficult to approach the group of store-loyal consumers through channels other than through these retailers). We can test our implications by regressing (a simple logit model would be sufficient) store-within-a-store likelihood in different markets that have different levels of our independent variables while controlling for consumer demographics. The values of the independent variables (e.g., inter-brand substitutability, returns to service/cost of service, store-traffic effect, etc.) can be determined using consumer surveys. Furthermore, our model suggests that prices in the store-within-a-store arrangement will be lower than in the retailer-resell arrangement. This implication can be tested by analyzing data on prices at department stores that sell the same product assortment (once again, controlling for consumer demographics), but some sell through the store-within-a-store arrangement, while others sell through the retailer-resell arrangement. Note that department store chains have rolled out stores-within-a-store only in a fraction of their stores. This phenomenon can be leveraged to obtain data to test the above implications.

Finally, our analysis shows that the stores-within-a-store arrangement can be optimal in the case of competing retailers as well and it can, in fact, moderate inter-store competition when inter-brand substitutability is small.

Our framework has a number of limitations that future research can address. First, our conversations with retailing experts suggest that retailers also use stores-within-a-store to decrease the consumer-perceived substitutability of competing brands in a category to cushion competition. In our model, we treat substitutability as an exogenous parameter, but the above effect would imply that the retailer will opt for this arrangement for a larger number of product categories. Second, we have analyzed the case of symmetric brands, in which an exclusive store-within-a-store arrangement (one brand opens a store-within-a-store and the other brand is not sold by the retailer) does not occur as an equilibrium arrangement. When brands are asymmetric (for instance, one brand is a niche brand with a smaller price sensitivity than the other), an exclusive store-within-a-store arrangement, with the niche brand sold through a store-within-a-store, might be profitable for the retailer under some conditions. We leave this investigation to future work. Third, we assume in the basic model that in setting the rent that the manufacturer pays to the retailer in return for opening the store-within-a-store, the manufacturer has no bargaining power. Incorporating this manufacturer bargaining power into the model (e.g., as in Iyer and Villas-Boas (2003)) will lead to different results for the parameter ranges under which different channel arrangements are preferred, but should leave the strategic implications qualitatively untouched. Fourth, our conversations with practitioners and other experts in retailing indicate that the predictions from our model conform with the intuition of people knowledgeable about retail. As suitable data becomes available, a more rigorous empirical test should enhance our understanding of this intriguing phenomenon.

Last, but not the least, this is the first attempt to study stores-within-a-store and ours is but one plausible way to model this channel arrangement. In practice, there can be other manifestations of this phenomenon that our model does not capture. For instance, General Nutrition Companies (GNC) considers itself running stores-within-a-store at Rite Aid Pharmacy stores for which it is paid fees by Rite Aid for these store openings (GNC 2008), although Rite Aid purchases these products at wholesale prices from GNC and GNC does not perform any retail functions inside the Rite Aid stores. Another related practice is stores-within-a-store managed by other retailers who serve a full category for the department store. For example, Sephora runs the cosmetics department in JC Penney and sells several cosmetics brands. The incentives driving this arrangement could be very different from the incentives driving manufacturer-run stores-within-a-store; for instance, this could depend on the efficacy of cross-selling brands, category-level service with complementarities across brands, retailing and service provision efficiencies by retailers specializing in the category, etc. Exploring these and other scenarios is a fascinating direction in which our research could be extended.

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Appendix

A1 Proof of Proposition 1

To consider the retailer's choice of arrangement, consider the profits that the retailer makes from each of the arrangements in equilibrium.

As discussed in Section 3.1, the retailer's profit in the RR arrangement is given by

$$\pi_{Rr} = (p_{1r} - w_{1r})q_{1r} + (p_{2r} - w_{2r})q_{2r} - \frac{s_{1r}^2}{2} - \frac{s_{2r}^2}{2} + F_{1r} + F_{2r},$$

where the equilibrium values of $p_{ir}, q_{ir}, w_{ir}, s_{ir}$ and $F_{ir}, i \in \{1, 2\}$ are given in Table 1.

As discussed in Section 3.2, the retailer's profit in the SS arrangement is given by

$$\pi_{Rs} = F_{1s} + F_{2s},$$

where the equilibrium values of $F_{is}, i \in \{1, 2\}$ are given in Table 2.

As discussed in Section 3.3, the retailer's profit in the RS arrangement is given by

$$\pi_{Ro} = (p_{1o} - w_{1o})q_{1o} - \frac{s_{1o}^2}{2} + F_{1o} + F_{2o},$$

where the equilibrium values of $p_{1o}, q_{1o}, w_{1o}, s_{1o}$ and $F_{io}, i \in \{1, 2\}$ are given in Table 3.

To determine the retailer's equilibrium choice of arrangement at each point in the β–θ plane, we simply compare her equilibrium profits from the different arrangements at each point in the plane; her choice is the one that yields the highest profit at that point. Figure 2 shows this choice at each point in the β–θ plane.

A2 Expressions for extended models in Section 4

Store-within-a-store arrangement for both manufacturers (SS)	
$p_{1s} = p_{2s}$	$\frac{-3+2\,\beta}{-4+2\,\beta-\theta^2\,(-1+\psi)+\beta^2\,\theta^2\,(-1+\psi)}$
$s_{1s} = s_{2s}$	$\frac{(-1+\beta)\,\theta}{-4+2\,\beta-\theta^2\,(-1+\psi)+\beta^2\,\theta^2\,(-1+\psi)}$
$F_{1s} = F_{2s}$	$\frac{-\left((-1+\beta)\left(4+\left(-1+\beta^2\right)\theta^2\right)\right)}{2\,(1+\beta)\,(4-2\,\beta+\theta^2\,(-1+\psi)-\beta^2\,\theta^2\,(-1+\psi))^2}$
Retailer-resell arrangement for both manufacturers (RR)	
$p_{1r} = p_{2r}$	$\frac{6+\theta^4\left(-1+\psi^2\right)^2+\beta^3\,\theta^4\left(-1+\psi^2\right)^2-5\,\theta^2\left(1+\psi^2\right)-\beta^2\,\theta^2\left(1+8\,\psi+\psi^2+\theta^2\left(-1+\psi^2\right)^2\right)-\beta\left(4+\theta^4\left(-1+\psi^2\right)^2-4\,\theta^2\left(1+3\,\psi+\psi^2\right)\right)}{2\left(4+\theta^2\,(-4+2\,\psi-4\,\psi^2)+\theta^4\,(-1+\psi)^2\,(1+\psi+\psi^2)+\beta^3\,\theta^4\,(-1+\psi)^2\,(1+\psi+\psi^2)-\beta^2\,\theta^2\,(1+(4+3\,\theta^2)\,\psi+(1-6\,\theta^2)\,\psi^2+3\,\theta^2\,\psi^3)+\beta\left(-2-3\,\theta^4\,(-1+\psi)^2\,\psi+\theta^2\,(1+10\,\psi+\psi^2)\right)\right)}$
$w_{1r} = w_{2r}$	$\frac{-2+\theta^2\,(1+\psi)^2+\beta^2\,\theta^2\,(1+\psi)^2-2\,\beta\left(-1+\theta^2\,(1+\psi)^2\right)}{2\,(-2+\theta^2\,(1+\psi+\psi^2)+\beta^2\,\theta^2\,(1+\psi+\psi^2)-\beta\,(-1+\theta^2\,(1+4\,\psi+\psi^2)))}$
$s_{1r} = s_{2r}$	$\frac{\theta\,(-1+\psi)\left(-2+\theta^2\left(1-4\,\beta\,\psi+\psi^2+\beta^2\left(1+\psi^2\right)\right)\right)}{2\left(4+\theta^2\,(-4+2\,\psi-4\,\psi^2)+\theta^4\,(-1+\psi)^2\,(1+\psi+\psi^2)+\beta^3\,\theta^4\,(-1+\psi)^2\,(1+\psi+\psi^2)-\beta^2\,\theta^2\,(1+(4+3\,\theta^2)\,\psi+(1-6\,\theta^2)\,\psi^2+3\,\theta^2\,\psi^3)+\beta\left(-2-3\,\theta^4\,(-1+\psi)^2\,\psi+\theta^2\,(1+10\,\psi+\psi^2)\right)\right)}$
$F_{1r} = F_{2r}$	$\frac{-\left(\left(-2+\theta^2\,(1+\psi)^2+\beta^2\,\theta^2\,(1+\psi)^2-2\,\beta\left(-1+\theta^2\,(1+\psi)^2\right)\right)\left(-2+\theta^2\left(1-4\,\beta\,\psi+\psi^2+\beta^2\left(1+\psi^2\right)\right)\right)\right)}{4\left(-2+2\,\beta\left(-1+\theta^2\,(-1+\psi)^2\right)+\theta^2\,(-1+\psi)^2+\beta^2\,\theta^2\,(-1+\psi)^2\right)(-2+\theta^2\,(1+\psi+\psi^2)+\beta^2\,\theta^2\,(1+\psi+\psi^2)-\beta\,(-1+\theta^2\,(1+4\,\psi+\psi^2)))^2}$
Retailer-resell for one manufacturer, store-within-a-store for other manufacturer (RS)	
p_{1o}	$\frac{(\beta-1)\left(\beta^4\left(\psi^2-1\right)\theta^4+\left(\psi^2-1\right)\theta^4+3\beta^3\psi\theta^2-3\beta\psi\theta^2+5\theta^2+\beta^2\left(-2\left(\psi^2-1\right)\theta^4-5\theta^2+2\right)-6\right)}{2(\beta^2(\psi-1)\theta^2-(\psi-1)\theta^2+\beta-2)(\theta^2\psi\beta^3-(\theta^2-1)\beta^2-\theta^2\psi\beta+\theta^2-2)}$
p_{2o}	$\frac{(\beta-1)\left(\theta^2(2\psi-1)\beta^3+\left((\psi-2)\theta^2+2\right)\beta^2+\left(\theta^2(1-2\psi)-1\right)\beta-\theta^2(\psi-2)-4\right)}{2(\beta^2(\psi-1)\theta^2-(\psi-1)\theta^2+\beta-2)(\theta^2\psi\beta^3-(\theta^2-1)\beta^2-\theta^2\psi\beta+\theta^2-2)}$
s_{1o}	$\frac{(\beta-1)\theta}{2(\beta^2(\psi-1)\theta^2-(\psi-1)\theta^2+\beta-2)}$
s_{2o}	$\frac{(\beta-1)\theta\left(\theta^2(2\psi-1)\beta^3+\left((\psi-2)\theta^2+2\right)\beta^2+\left(\theta^2(1-2\psi)-1\right)\beta-\theta^2(\psi-2)-4\right)}{2(\beta^2(\psi-1)\theta^2-(\psi-1)\theta^2+\beta-2)(\theta^2\psi\beta^3-(\theta^2-1)\beta^2-\theta^2\psi\beta+\theta^2-2)}$
w_{1o}	$\frac{(\beta-1)\left(\beta^2(\psi+1)\theta^2-(\psi+1)\theta^2+\beta+2\right)}{2(\theta^2\psi\beta^3-(\theta^2-1)\beta^2-\theta^2\psi\beta+\theta^2-2)}$
F_{1o}	$\frac{(1-\beta)\left(\beta^2(\psi+1)\theta^2-(\psi+1)\theta^2+\beta+2\right)}{4(\beta+1)(\beta^2(\psi-1)\theta^2-(\psi-1)\theta^2+\beta-2)(\theta^2\psi\beta^3-(\theta^2-1)\beta^2-\theta^2\psi\beta+\theta^2-2)}$
F_{2o}	$\frac{(1-\beta)\left(\left(\beta^2-1\right)\theta^2+2\right)\left(\theta^2(2\psi-1)\beta^3+\left((\psi-2)\theta^2+2\right)\beta^2+\left(\theta^2(1-2\psi)-1\right)\beta-\theta^2(\psi-2)-4\right)^2}{8(\beta+1)(\theta^4(\psi-1)\psi\beta^5+\theta^2(-(\psi-1)\theta^2+2\psi-1)\beta^4-(2(\psi-1)\psi\theta^4+(2\psi+1)\theta^2-1)\beta^3+(\theta^2-2)(2(\psi-1)\theta^2+1)\beta^2+((\psi-1)\psi\theta^4+(2\psi+1)\theta^2-2)\beta-(\theta^2-2)((\psi-1)\theta^2+2))^2}$

Table A1: The table above shows the expressions for the various quantities in the SS, RR and RS arrangements when there is an adverse effect on demand (ψ) from the in-store service of the competitor brand. Figure 3 shows the impact of increasing ψ on the retailer's choice among these arrangements.

Store-within-a-store arrangement for both manufacturers (SS)	
$p_{1s} = p_{2s}$	$\frac{(T+1)(1-\beta)}{\beta^2\theta^2-\beta-\theta^2+2}$
$s_{1s} = s_{2s}$	$\frac{(T+1)(1-\beta)\theta}{\beta^2\theta^2-\beta-\theta^2+2}$
$F_{1s} = F_{2s}$	$\frac{(T+1)^2(1-\beta)\left(\left(\beta^2-1\right)\theta^2+2\right)}{2(\beta+1)(-\beta^2\theta^2+\beta+\theta^2-2)^2}$
Retailer-resell arrangement for both manufacturers (RR)	
$p_{1r} = p_{2r}$	$\frac{\beta^3\theta^4-\beta^2\left(\theta^4+\theta^2\right)-\beta\left(\theta^2-2\right)^2+\theta^4-5\theta^2+6}{2\left(\beta^3\theta^4-\beta^2\theta^2+\beta(\theta^2-2)+(\theta^2-2)^2\right)}$
$s_{1r} = s_{2r}$	$\frac{\theta\left(\left(2-\beta^2+1\right)\theta^2\right)}{2\left(\beta^3\theta^4-\beta^2\theta^2+\beta(\theta^2-2)+(\theta^2-2)^2\right)}$
$w_{1r} = w_{2r}$	$\frac{(\beta-1)\left((\beta-1)\theta^2+2\right)}{2(\beta^2\theta^2-\beta\theta^2+\beta+\theta^2-2)}$
$F_{1r} = F_{2r}$	$\frac{(1-\beta)\left((\beta-1)\theta^2+2\right)\left(\left(\beta^2+1\right)\theta^2-2\right)}{4(\beta+1)(\beta^2\theta^2-\beta\theta^2+\beta+\theta^2-2)^2((\beta+1)\theta^2-2)}$
Retailer-resell for one manufacturer, store-within-a-store for other manufacturer (RS)	
p_{1o}	$\frac{(1-\beta)\left(\beta^4\theta^4+\beta^2\left(-2\theta^4+5\theta^2-2\right)+\theta^4-5\theta^2+6\right)\left(T\beta+\beta^2\theta^2+\beta-\theta^2+2\right)}{2\left(\beta^6\theta^4(\theta^2-1)+\beta^4(-3\theta^6+8\theta^4-5\theta^2+1)+\beta^2(3\theta^6-13\theta^4+17\theta^2-6)-(\theta^2-2)^3\right)}$
p_{2o}	$\frac{(1-\beta)\left(T\left(\beta^4\theta^2\left(2\theta^2-1\right)+\beta^2\left(-4\theta^4+9\theta^2-3\right)+2\left(\theta^2-2\right)^2\right)+\beta^5\theta^4+\beta^4\theta^2\left(2\theta^2-1\right)+\beta^3\left(-2\theta^4+5\theta^2-2\right)+\beta^2\left(-4\theta^4+9\theta^2-3\right)+\beta\left(\theta^4-5\theta^2+6\right)+2\left(\theta^2-2\right)^2\right)}{2\left(\beta^6\theta^4(\theta^2-1)+\beta^4(-3\theta^6+8\theta^4-5\theta^2+1)+\beta^2(3\theta^6-13\theta^4+17\theta^2-6)-(\theta^2-2)^3\right)}$
s_{1o}	$\frac{(1-\beta)\theta\left(T\beta+\beta^2\theta^2+\beta-\theta^2+2\right)}{2\left(\beta^4\theta^4+\beta^2(-2\theta^4+4\theta^2-1)+(\theta^2-2)^2\right)}$
s_{2o}	$\frac{(1-\beta)\theta\left(T\left(\beta^4\theta^2\left(2\theta^2-1\right)+\beta^2\left(-4\theta^4+9\theta^2-3\right)+2\left(\theta^2-2\right)^2\right)+\beta^5\theta^4+\beta^4\theta^2\left(2\theta^2-1\right)+\beta^3\left(-2\theta^4+5\theta^2-2\right)+\beta^2\left(-4\theta^4+9\theta^2-3\right)+\beta\left(\theta^4-5\theta^2+6\right)+2\left(\theta^2-2\right)^2\right)}{2\left(\beta^6\theta^4(\theta^2-1)+\beta^4(-3\theta^6+8\theta^4-5\theta^2+1)+\beta^2(3\theta^6-13\theta^4+17\theta^2-6)-(\theta^2-2)^3\right)}$
F_{1o}	$\frac{(1-\beta)\left(T\beta+\beta^2\theta^2+\beta-\theta^2+2\right)^2}{4(\beta+1)(\beta^2(\theta^2-1)-\theta^2+2)\left(\beta^4\theta^4+\beta^2(-2\theta^4+4\theta^2-1)+(\theta^2-2)^2\right)}$
F_{2o}	$\frac{(1-\beta)\left(T\beta+\beta^2\theta^2+\beta-\theta^2+2\right)^2}{4(\beta+1)(\beta^2(\theta^2-1)-\theta^2+2)\left(\beta^4\theta^4+\beta^2(-2\theta^4+4\theta^2-1)+(\theta^2-2)^2\right)}$
w_{1o}	$\frac{(1-\beta)\left(T\beta+\beta^2\theta^2+\beta-\theta^2+2\right)}{2\beta^2(\theta^2-1)-2\theta^2+4}$

Table A2: The table above shows the expressions for the various quantities in the three arrangements (SS, RR and RS) upon incorporating the store-traffic effect (T). Figure 4 shows the impact of increasing T on the retailer's choice among these arrangements.

Web Appendix to Accompany "Store-Within-a-Store"

WA1 Different costs of service for different categories

In our basic model, we have different returns to service (measured by θ) for different categories. However, in practice, not only are the returns to service for all categories different, but the cost of providing that service also differs. This can be easily incorporated into the model by introducing a service cost parameter κ for the category. Thus, in this alternative formulation, providing a service level of s increases the base demand for the product by θs and costs $\frac{(\kappa s)^2}{2}$. Introducing this modification does not change the insights obtained from the original model.

The results are presented in Table WA1. Figure WA1 shows the equilibrium arrangement for different values of β and κ when θ is fixed at 1. From Figure WA1 and Figure 2 it is clear that results obtained for large values of κ (when θ is fixed) mirror those for small values of θ (when κ is fixed) and vice versa, which is what we would expect intuitively.

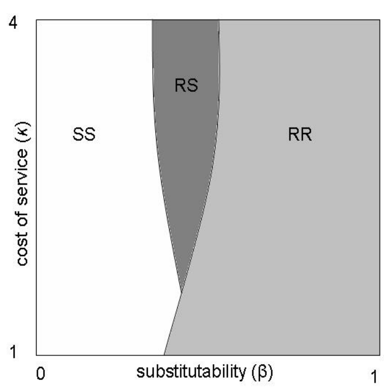

Figure WA1: The effect of the cost of providing service parameter κ on the channel arrangement when the returns to service parameter θ is fixed at 1. As the cost of providing service increases, the SS arrangement is preferred over the RR arrangement for larger values of the substitutability parameter β.

Store-within-a-store arrangement for both manufacturers (SS)	
$p_{1s} = p_{2s}$	$-\left(\frac{(-1+\beta)\,\kappa^2}{(-1+\beta^2)\,\theta^2-(-2+\beta)\,\kappa^2}\right)$
$s_{1s} = s_{2s}$	$\frac{\theta-\beta\,\theta}{(-1+\beta^2)\,\theta^2-(-2+\beta)\,\kappa^2}$
$F_{1s} = F_{2s}$	$\frac{-\left((-1+\beta)\,\kappa^2\left(\left(-1+\beta^2\right)\theta^2+2\,\kappa^2\right)\right)}{2\,(1+\beta)\,((-1+\beta^2)\,\theta^2-(-2+\beta)\,\kappa^2)^2}$
Retailer-resell arrangement for both manufacturers (RR)	
$p_{1r} = p_{2r}$	$\frac{(-1+\beta)^2\,(1+\beta)\,\theta^4-\left(5-4\,\beta+\beta^2\right)\theta^2\,\kappa^2+2\,(3-2\,\beta)\,\kappa^4}{2\,((1+\beta^3)\,\theta^4+(-4+\beta-\beta^2)\,\theta^2\,\kappa^2-2\,(-2+\beta)\,\kappa^4)}$
$w_{1r} = w_{2r}$	$\frac{(-1+\beta)\left((-1+\beta)\,\theta^2+2\,\kappa^2\right)}{2\,((1-\beta+\beta^2)\,\theta^2+(-2+\beta)\,\kappa^2)}$
$s_{1r} = s_{2r}$	$\frac{-\left(\theta\left(\left(1+\beta^2\right)\theta^2-2\,\kappa^2\right)\right)}{2\,((1+\beta^3)\,\theta^4+(-4+\beta-\beta^2)\,\theta^2\,\kappa^2-2\,(-2+\beta)\,\kappa^4)}$
$F_{1r} = F_{2r}$	$\frac{-\left((-1+\beta)\,\kappa^2\left(\left(1+\beta^2\right)\theta^2-2\,\kappa^2\right)\left((-1+\beta)\,\theta^2+2\,\kappa^2\right)\right)}{4\,(1+\beta)\,((1+\beta)\,\theta^2-2\,\kappa^2)\,((1-\beta+\beta^2)\,\theta^2+(-2+\beta)\,\kappa^2)^2}$
Retailer-resell for one manufacturer, store-within-a-store for other manufacturer (RS)	
p_{1o}	$\frac{(1-\beta)\left(\left(\beta^2-1\right)^2\theta^4+5\left(\beta^2-1\right)\kappa^2\theta^2-2\left(\beta^2-3\right)\kappa^4\right)}{2((\beta^2-1)\theta^2-(\beta-2)\kappa^2)((\beta^2-1)\theta^2-(\beta^2-2)\kappa^2)}$
p_{2o}	$\frac{(1-\beta)\kappa^2\left(\left(\beta^3+2\beta^2-\beta-2\right)\theta^2+\left(-2\beta^2+\beta+4\right)\kappa^2\right)}{2\left((\beta^2-1)^2\theta^4-(\beta^4+\beta^3-5\beta^2-\beta+4)\kappa^2\theta^2+(\beta^3-2\beta^2-2\beta+4)\kappa^4\right)}$
s_{1o}	$\frac{\theta(1-\beta)}{2(\beta^2-1)\theta^2-2(\beta-2)\kappa^2}$
s_{2o}	$\frac{(1-\beta)\theta\left(\left(\beta^3+2\beta^2-\beta-2\right)\theta^2+\left(-2\beta^2+\beta+4\right)\kappa^2\right)}{2\left((\beta^2-1)^2\theta^4-(\beta^4+\beta^3-5\beta^2-\beta+4)\kappa^2\theta^2+(\beta^3-2\beta^2-2\beta+4)\kappa^4\right)}$
w_{1o}	$\frac{(1-\beta)\left(\left(\beta^2-1\right)\theta^2+(\beta+2)\kappa^2\right)}{2(\beta^2-1)\theta^2-2(\beta^2-2)\kappa^2}$
F_{1o}	$\frac{(1-\beta)\kappa^2\left(\left(\beta^2-1\right)\theta^2+(\beta+2)\kappa^2\right)}{4(\beta+1)\left((\beta^2-1)^2\theta^4-(\beta^4+\beta^3-5\beta^2-\beta+4)\kappa^2\theta^2+(\beta^3-2\beta^2-2\beta+4)\kappa^4\right)}$
F_{2o}	$\frac{(1-\beta)\left(\left(\beta^3+2\beta^2-\beta-2\right)\theta^2+\left(-2\beta^2+\beta+4\right)\kappa^2\right)^2\left(2\kappa^4+\left(\beta^2-1\right)\theta^2\right)}{8(\beta+1)\left((\beta^2-1)^2\theta^4-(\beta^4+\beta^3-5\beta^2-\beta+4)\kappa^2\theta^2+(\beta^3-2\beta^2-2\beta+4)\kappa^4\right)^2}$

Table WA1: The table above shows the expressions for the various quantities in the SS, RR and RS arrangements in terms of substitutability β, returns to service θ and cost of service κ.

WA2 Competition at the retail level

In this section, we describe in detail the solution to the game in which there are two competing retailers and two competing manufacturers.

Demand schedule

Consider the scenario where both retailers stock both brands. Let p_{ij}, q_{ij} and $s_{ij}, i, j \in \{1, 2\}$ denote the price, quantity and service level, respectively, of the j^{th} brand at the i^{th} retail store. We assume the following demand schedule:[11]

$$
\begin{aligned}
q_{ij} &= A_0 + A_1\; p_{ij} + A_2\; p_{i,3-j} + A_3\; p_{3-i,j} + A_4\; p_{3-i,3-j} + \theta s_{ij} \\
\text{where } A_0 &= \frac{1}{1+\beta+\chi-\beta\,\chi} \\
A_1 &= \frac{1-\chi^2+2\,\beta\,\chi^2+2\,\beta^3\,(-1+\chi)\,\chi^2-\beta^2\,(1-2\,\chi+\chi^2+2\,\chi^3)}{(-1+\beta^2)\,(-1+\chi^2)\,(-1+\chi^2-4\,\beta\,\chi^2+\beta^2\,(1-4\,\chi+3\,\chi^2))} \\
A_2 &= \frac{\beta\,(-1+\chi+\chi^2+\chi^3-2\,\beta\,\chi^3+\beta^2\,(1-3\,\chi+\chi^2+\chi^3))}{(-1+\beta^2)\,(-1+\chi^2)\,(-1+\chi^2-4\,\beta\,\chi^2+\beta^2\,(1-4\,\chi+3\,\chi^2))} \\
A_3 &= \frac{\chi\,\left(-1+\beta+\beta^3\,(-1+\chi)^2+\chi^2-3\,\beta\,\chi^2+\beta^2\,(1+\chi^2)\right)}{(-1+\beta^2)\,(-1+\chi^2)\,(-1+\chi^2-4\,\beta\,\chi^2+\beta^2\,(1-4\,\chi+3\,\chi^2))} \\
A_4 &= \frac{\beta\,\chi\,\left(-1+\beta^2\,(-1+\chi)^2+2\,\chi+\chi^2-2\,\beta\,(-1+\chi+\chi^2)\right)}{(1-\beta^2)\,(-1+\chi^2)\,(-1+\chi^2-4\,\beta\,\chi^2+\beta^2\,(1-4\,\chi+3\,\chi^2))}
\end{aligned}
$$

In the above demand schedule, $\beta \in [0,1]$ measures the substitutability between brands, $\chi \in [0,1]$ measures the substitutability between competing stores, which captures the intensity of inter-store competition, and θ is the "returns to service" parameter. A large value of χ corresponds to a high intensity of inter-store competition. Note that when $\chi = 0$ the stores are not in competition, and we get the original demand system in (1) and the original utility function for each store. Similarly, when $\beta = 0$, only the inter-store competition effect is present.

[11]This demand schedule corresponds to a quadratic utility function

$$
\begin{aligned}
\mathcal{U}(q_{11}, q_{12}, q_{21}, q_{22}) =& (1+\theta S_{11})q_{11} + (1+\theta S_{12})q_{12} + (1+\theta S_{21})q_{21} + (1+\theta S_{22})q_{22} \\
& - \frac{1}{2}\Big(q_{11}^2 + q_{12}^2 + q_{21}^2 + q_{22}^2 + 2\beta(1-\chi)q_{11}q_{12} + 2\beta(1-\chi)q_{21}q_{22} \\
& + 2(1-\beta)\chi q_{11}q_{21} + 2(1-\beta)\chi q_{12}q_{22} + 2\beta\chi q_{11}q_{22} + 2\beta\chi q_{12}q_{21}\Big),
\end{aligned}
$$

where $S_{ij} = s_{ij} + \beta(1-\chi)s_{i,3-j} + (1-\beta)\chi s_{3-i,j} + \beta\chi s_{3-i,3-j}$. Note that this utility function implies that, if $\theta > 0$, in-store service increases consumer utility. Further, we can see from S_{ij} that service for one product in one store also enhances the utility from the other product in that store and the utility from purchasing products from the other store, but diminished by the corresponding multiplicative factors which are functions of inter-brand and inter-store substitutability.

		R_2			
		SS	SR	RS	RR
R_1	SS	I	II	III	IV
	SR	V	VI	VII	$VIII$
	RS	IX	X	XI	XII
	RR	$XIII$	XIV	XV	XVI

(a) Strategic-form game for the retailers in Stage 1.

		M_2			
		NN	NY	YN	YY
M_1	NN	–	–	–	–
	NY	–	i	ii	iii
	YN	–	iv	v	vi
	YY	–	vii	$viii$	ix

(b) Strategic-form game for the manufacturers in Stage 2.

Table WA2: Strategic-form games in Stages 1 and 2.

Stages of the game

The game with competing retailers proceeds in four stages. In Stage 1, both retailers simultaneously make take-it-or-leave-it offers to both manufacturers. This gives rise to sixteen possible combinations which are shown as Cases I to XVI in Table WA2(a). The rows show the offers by retailer 1 (R_1) and the columns show the offers by retailer 2 (R_2). For each retailer, S in position i denotes an offer for a store-within-a-store to manufacturer i and R denotes an offer for a retailer-resell arrangement. Each offer is accompanied by the rent that the retailer will charge the manufacturer if he accepts the retailer's offer. We denote the rent that retailer i demands from manufacturer j by F_{ij}.

In Stage 2, the two manufacturers simultaneously decide whether to accept each retailer's offer or not. This again gives rise to sixteen possibilities, as shown in Table WA2(b). For each manufacturer, N in position i denotes rejecting retailer i's offer and Y denotes accepting the offer. We assume that the outside option for a manufacturer (if he does not sell through either retailer) is zero, which implies that a manufacturer following the strategy NN will surely earn zero profits and hence this is weakly dominated. We are therefore left with nine cases, as marked in the table. Hence, taking Stages 1 and 2 together, we have $16 \times 9 = 144$ channel arrangements to consider.

In Stage 3, the manufacturers decide the wholesale prices if any retailer-resell arrangement emerges after the second stage. In Stage 4, the retail prices and service levels are set.

Solution of the game

We solve the four-stage game described above by backward induction. The details follow.

Stage 4 and Stage 3

At this point, the retailers have made their Stage 1 offers and the manufacturers have made their Stage 2 decisions. Hence, the channel structure has been determined. As mentioned earlier, there are 144 possible channel arrangements and there is one subgame for each channel arrangement. We determine analytical solutions to each of these 144 subgames.

We denote each subgame by the index (Y-Z) where $Y \in \{I, \cdots, XVI\}$ indexes the Stage 1 offers of the retailers and $Z \in \{i, \cdots, ix\}$ indexes the Stage 2 decisions of the manufacturers. E.g., if the retailers choose "SR,RS" in Stage 1 (which is choice VII) and the manufacturers choose "NY,YY" in Stage 2, which is case iii, then this subgame is indexed as (VII-iii).

The channel arrangement in these stages is the result of the offers made by the retailers in Stage 1 and the subsequent decisions made by the manufacturers in Stage 2. For instance, in the subgame (VII-iii), where the retailers make the offers "SR,RS" and the manufacturers make the decisions "NY,YY", the channel configuration is "øR,RS" — R_1 does not sell M_1's brand but sells M_2's brand in the retailer-resell arrangement, and R_2 sells M_1's brand in the retailer-resell arrangement and M_2's brand in the store-within-a-store arrangement. Note that in this arrangement only three products are being sold, while our demand system presented earlier is for four products. (In other cases, e.g., "SR,RS" in Stage 1 followed by "NY,YN" in Stage 2, only two products are being sold.) While analyzing the cases with less than four products being sold, we re-derive the demand functions for three (or two, if that is the case) products from first principles by appropriately adjusting the utility function.[12]

[12]For instance, for the channel arrangement "øR,RS", retailer 1 is not selling manufacturer 1's brand in

To illustrate our approach, we show here the formulation for two subgames: Case (I-ix) (when the retailers offer "SS,SS" and both manufacturers accept) and Case (XVI-ix) (when the retailers offer "RR,RR" and both manufacturers accept). The formulations for the other 142 cases are similar.

Case (I-ix)**:** The profit functions in this case are:

$$
\begin{aligned}
\pi_{M1,(I\text{-}ix)} &= \Pi_{M1,(I\text{-}ix)} - F_{12,(I\text{-}ix)} - F_{22,(I\text{-}ix)} \\
&= p_{11,(I\text{-}ix)}q_{11,(I\text{-}ix)} + p_{21,(I\text{-}ix)}q_{21,(I\text{-}ix)} - \frac{s^2_{11,(I\text{-}ix)}}{2} - \frac{s^2_{21,(I\text{-}ix)}}{2} - F_{11,(I\text{-}ix)} - F_{21,(I\text{-}ix)} \\
\pi_{M2,(I\text{-}ix)} &= \Pi_{M2,(I\text{-}ix)} - F_{12,(I\text{-}ix)} - F_{22,(I\text{-}ix)} \\
&= p_{12,(I\text{-}ix)}q_{12,(I\text{-}ix)} + p_{22,(I\text{-}ix)}q_{22,(I\text{-}ix)} - \frac{s^2_{12,(I\text{-}ix)}}{2} - \frac{s^2_{22,(I\text{-}ix)}}{2} - F_{12,(I\text{-}ix)} - F_{22,(I\text{-}ix)} \\
\pi_{R1,(I\text{-}ix)} &= \Pi_{R1,(I\text{-}ix)} + F_{11,(I\text{-}ix)} + F_{12,(I\text{-}ix)} = 0 + F_{11,(I\text{-}ix)} + F_{12,(I\text{-}ix)} \\
\pi_{R2,(I\text{-}ix)} &= \Pi_{R2,(I\text{-}ix)} + F_{21,(I\text{-}ix)} + F_{22,(I\text{-}ix)} = 0 + F_{21,(I\text{-}ix)} + F_{22,(I\text{-}ix)}
\end{aligned}
$$

In this case, in Stage 4 manufacturer 1 jointly determines the prices $p_{11,(I\text{-}ix)}$ and $p_{21,(I\text{-}ix)}$ and the service levels $s_{11,(I\text{-}ix)}$ and $s_{21,(I\text{-}ix)}$ (incurring the costs $\frac{s^2_{11,(I\text{-}ix)}}{2}$ and $\frac{s^2_{21,(I\text{-}ix)}}{2}$) in competition with manufacturer 2, who determines the prices $p_{12,(I\text{-}ix)}$ and $p_{22,(I\text{-}ix)}$ and the service levels $s_{12,(I\text{-}ix)}$ and $s_{22,(I\text{-}ix)}$ (incurring the costs $\frac{s^2_{12,(I\text{-}ix)}}{2}$ and $\frac{s^2_{22,(I\text{-}ix)}}{2}$). Note that there are no wholesale prices in this case.

Case (XVI-ix)**:** The profit functions in Case (XVI-ix) are:

$$
\begin{aligned}
\pi_{M1,(XVI\text{-}ix)} &= \Pi_{M1,(XVI\text{-}ix)} - F_{11,(XVI\text{-}ix)} - F_{21,(XVI\text{-}ix)} \\
&= w_{11,(XVI\text{-}ix)}q_{11,(XVI\text{-}ix)} + w_{21,(XVI\text{-}ix)}q_{21,(XVI\text{-}ix)} - F_{11,(XVI\text{-}ix)} - F_{21,(XVI\text{-}ix)} \\
\pi_{M2,(XVI\text{-}ix)} &= \Pi_{M2,(XVI\text{-}ix)} - F_{12,(XVI\text{-}ix)} - F_{22,(XVI\text{-}ix)}
\end{aligned}
$$

---

her retail store. In this case, the quadratic utility function used to derive the demand schedule is:

$$
\begin{aligned}
\mathcal{U}(q_{12}, q_{21}, q_{22}) =& (1+\theta S_{12})q_{12} + (1+\theta S_{21})q_{21} + (1+\theta S_{22})q_{22} \\
&- \frac{1}{2}\Big(q_{12}^2 + q_{21}^2 + q_{22}^2 + 2\beta(1-\chi)q_{21}q_{22} + 2(1-\beta)\chi q_{12}q_{22} + 2\beta\chi q_{12}q_{21}\Big),
\end{aligned}
$$

where $S_{ij} = s_{ij} + \beta(1-\chi)s_{i,3-j} + (1-\beta)\chi s_{3-i,j} + \beta\chi s_{3-i,3-j}, i, j \in \{i, 2\}$ and $s_{11} \equiv 0$.

$$
\begin{aligned}
&= w_{12,(XVI\text{-}ix)}q_{12,(XVI\text{-}ix)} + w_{22,(XVI\text{-}ix)}q_{22,(XVI\text{-}ix)} - F_{12,(XVI\text{-}ix)} - F_{22,(XVI\text{-}ix)} \\
\pi_{R1,(XVI\text{-}ix)} &= \Pi_{R1,(XVI\text{-}ix)} + F_{11,(XVI\text{-}ix)} + F_{12,(XVI\text{-}ix)} \\
&= (p_{11,(XVI\text{-}ix)} - w_{11,(XVI\text{-}ix)})q_{11,(XVI\text{-}ix)} + (p_{12,(XVI\text{-}ix)} - w_{12,(XVI\text{-}ix)})q_{12,(XVI\text{-}ix)} \\
&\quad - \frac{s^2_{11,(XVI\text{-}ix)}}{2} - \frac{s^2_{12,(XVI\text{-}ix)}}{2} + F_{11,(XVI\text{-}ix)} + F_{12,(XVI\text{-}ix)} \\
\pi_{R2,(XVI\text{-}ix)} &= \Pi_{R2,(XVI\text{-}ix)} + F_{21,(XVI\text{-}ix)} + F_{22,(XVI\text{-}ix)} \\
&= (p_{21,(XVI\text{-}ix)} - w_{21,(XVI\text{-}ix)})q_{21,(XVI\text{-}ix)} + (p_{22,(XVI\text{-}ix)} - w_{22,(XVI\text{-}ix)})q_{22,(XVI\text{-}ix)} \\
&\quad - \frac{s^2_{21,(XVI\text{-}ix)}}{2} - \frac{s^2_{22,(XVI\text{-}ix)}}{2} + F_{21,(XVI\text{-}ix)} + F_{22,(XVI\text{-}ix)}
\end{aligned}
$$

where $w_{ij,(XVI\text{-}ix)}$ denotes the wholesale price that manufacturer j pays to retailer i. In Stage 3, manufacturer 1 determines the wholesale prices $w_{11,(XVI\text{-}ix)}$ and $w_{21,(XVI\text{-}ix)}$ in competition with manufacturer 2 who determines the wholesale prices $w_{12,(XVI\text{-}ix)}$ and $w_{22,(XVI\text{-}ix)}$. In Stage 4, retailer 1 jointly determines prices $p_{11,(XVI\text{-}ix)}$ and $p_{12,(XVI\text{-}ix)}$ and service levels $s_{11,(XVI\text{-}ix)}$ and $s_{12,(XVI\text{-}ix)}$ incurring the costs $\frac{s^2_{11,(XVI\text{-}ix)}}{2}$ and $\frac{s^2_{12,(XVI\text{-}ix)}}{2}$, in competition with retailer 2, who determines prices $p_{21,(XVI\text{-}ix)}$ and $p_{22,(XVI\text{-}ix)}$ and service levels $s_{21,(XVI\text{-}ix)}$ and $s_{22,(XVI\text{-}ix)}$ incurring the costs $\frac{s^2_{21,(XVI\text{-}ix)}}{2}$ and $\frac{s^2_{22,(XVI\text{-}ix)}}{2}$.

Note that the solved expressions for the prices and service levels are independent of the fixed rents (which is, in fact, the case in all 144 subgames).[13] In the subgame (Y-Z), we denote the optimum profit that manufacturer i makes (before accounting for the fixed rent) by $\Pi_{M_i,(Y\text{-}Z)}$ (the total rents that the manufacturer pays to the retailers cannot exceed this value) and the optimum profit that retailer i makes (before accounting for the fixed rent) by $\Pi_{R_i,(Y\text{-}Z)}$. These quantities are in terms of β, χ and θ and are extremely complicated. We solve for them using the software Mathematica and do not present the algebraic expressions here as they do not directly help the understanding of the reader.

[13]From the second-order conditions we check that these values give the maximum.

		M_2			
		NN	NY	YN	YY
	NN	–	–	–	–
	NY	–	$\Pi_{M_1,(Y\text{-}i)} - F_{21}$ $\Pi_{M_2,(Y\text{-}i)} - F_{22}$	$\Pi_{M_1,(Y\text{-}ii)} - F_{21}$ $\Pi_{M_2,(Y\text{-}ii)} - F_{12}$	$\Pi_{M_1,(Y\text{-}iii)} - F_{21}$ $\Pi_{M_2,(Y\text{-}iii)} - F_{12} - F_{22}$
M_1	YN	–	$\Pi_{M_1,(Y\text{-}iv)} - F_{11}$ $\Pi_{M_2,(Y\text{-}iv)} - F_{22}$	$\Pi_{M_1,(Y\text{-}v)} - F_{11}$ $\Pi_{M_2,(Y\text{-}v)} - F_{12}$	$\Pi_{M_1,(Y\text{-}vi)} - F_{11}$ $\Pi_{M_2,(Y\text{-}vi)} - F_{12} - F_{22}$
	YY	–	$\Pi_{M_1,(Y\text{-}vii)} - F_{11} - F_{21}$ $\Pi_{M_2,(Y\text{-}vii)} - F_{22}$	$\Pi_{M_1,(Y\text{-}viii)} - F_{11} - F_{21}$ $\Pi_{M_2,(Y\text{-}viii)} - F_{12}$	$\Pi_{M_1,(Y\text{-}ix)} - F_{11} - F_{21}$ $\Pi_{M_2,(Y\text{-}ix)} - F_{12} - F_{22}$

Table WA3: Payoffs in the strategic-form game in Stage 2 when the Stage 1 offer from the retailers is indexed by $Y \in \{I, \cdots, XVI\}$. The first row and the first column are dominated strategies.

Stage 2

At this point, the retailers have made their offers to the manufacturers for a particular channel arrangement and have specified the fixed rents F_{ij} they will charge to the manufacturers if they accept. The manufacturers simultaneously decide whether they will accept or reject each retailer's offer. Given the solutions to the subgames in Stages 4 and 3 and the fixed rents, the strategic-form game between the manufacturers, along with their payoffs, is represented in Table WA3. (This corresponds to the matrix in Table WA2(b).) As explained above, the expressions for $\Pi_{M_i,\cdot}$ in Table WA3 are independent of the fixed rents. Note that manufacturer i's profit in a particular strategy k is given by the profit $\Pi_{M_i,(Y-k)}$ minus the fixed fees that he has to pay to the retailer(s) whose offer he has accepts in strategy k.

We solve this stage numerically, i.e., we construct the strategic-form game above by calculating the profit expresisons for numerical values of β, χ, θ and the fixed rents and solve for the equilibria in this game. We use the software Gambit (McKelvey et al. 2007) for calculating the equilibria numerically.

Stage 1

In this stage, the two retailers simultaneously decide the offers they will make to the manufacturers, where each offer includes the channel arrangement and the fixed rents. We divide this stage into two sub-stages. In Stage 1A, the retailers simultaneously choose the channel

		R_2				
		$< F^1_{21}, F^1_{22} >$	$\cdots$	$< F^m_{21}, F^m_{22} >$	$\cdots$	$< F^{N_2}_{21}, F^{N_2}_{22} >$
R_1	$< F^1_{11}, F^1_{12} >$					
	$\vdots$					
	$< F^l_{11}, F^l_{12} >$			$\Pi_{R_1,(Y\text{-}*)} + \mathbb{1}_{11,(Y\text{-}*)} F^l_{11} + \mathbb{1}_{12,(Y\text{-}*)} F^l_{12}$ $\Pi_{R_2,(Y\text{-}*)} + \mathbb{1}_{21,(Y\text{-}*)} F^m_{21} + \mathbb{1}_{22,(Y\text{-}*)} F^m_{22}$		
	$\vdots$					
	$< F^{N_1}_{11}, F^{N_1}_{12} >$					

(b) Payoffs in the strategic-form game in Stage 1B when the Stage 1A offer from the retailers is indexed by $Y \in \{I, \cdots, XVI\}$.

		R_2			
		SS	SR	RS	RR
R_1	SS	$\pi^{I,F}_{R_1}, \pi^{I,F}_{R_2}$	$\pi^{II,F}_{R_1}, \pi^{II,F}_{R_2}$	$\pi^{III,F}_{R_1}, \pi^{III,F}_{R_2}$	$\pi^{IV,F}_{R_1}, \pi^{IV,F}_{R_2}$
	SR	$\pi^{V,F}_{R_1}, \pi^{V,F}_{R_2}$	$\pi^{VI,F}_{R_1}, \pi^{VI,F}_{R_2}$	$\pi^{VII,F}_{R_1}, \pi^{VII,F}_{R_2}$	$\pi^{VIII,F}_{R_1}, \pi^{VIII,F}_{R_2}$
	RS	$\pi^{IX,F}_{R_1}, \pi^{IX,F}_{R_2}$	$\pi^{X,F}_{R_1}, \pi^{X,F}_{R_2}$	$\pi^{XI,F}_{R_1}, \pi^{XI,F}_{R_2}$	$\pi^{XII,F}_{R_1}, \pi^{XII,F}_{R_2}$
	RR	$\pi^{XIII,F}_{R_1}, \pi^{XIII,F}_{R_2}$	$\pi^{XIV,F}_{R_1}, \pi^{XIV,F}_{R_2}$	$\pi^{XV,F}_{R_1}, \pi^{XV,F}_{R_2}$	$\pi^{XVI,F}_{R_1}, \pi^{XVI,F}_{R_2}$

(a) Payoffs in the strategic-form game in Stage 1A.

Table WA4: Strategic-form games in Stage 1.

arrangement (e.g., they choose "SR,RS") and in Stage 1B they simultaneously decide the fixed rents given this channel arrangement, keeping in mind how the game will unfold from Stage 2 onwards.

In Stage 1B, the retailers play the strategic-form game in Table WA4(b). In the table, $(Y\text{-}*)$ denotes the subgame that the manufacturers choose in Stage 2 when the retailers offer the channel arrangement Y in Stage 1 along with the fixed rents F_{11}, F_{12}, F_{21} and F_{22}. $\Pi_{R_i,(Y\text{-}*)}$ denotes the profit that the retailer i makes in this subgame (before accounting for the fixed rents). $\mathbb{1}_{ij,(Y\text{-}*)}$ is an indicator function equal to 1 if manufacturer j accepts the offer by retailer i in the subgame $(Y\text{-}*)$ (and this is when the retailer gets the fixed rent from the manufacturer). The pair $< F^l_{i1}, F^l_{i,2} >$ denotes the fixed fees charged by retailer i in strategy l to manufacturers 1 and 2 if they accept. Given fixed values of β, χ and θ, and the arrangement $Y \in \{I, \cdots, XVI\}$, we consider N_1 pairs $< F_{11}, F_{12} >$ for retailer

1 and N_2 pairs $< F_{21}, F_{22} >$ for retailer 2. This gives rise to the $N_1 \times N_2$ strategic-form matrix shown in Table WA4(b) and we numerically find the equilibria of this game using the software Gambit. This gives us the profits that the two retailers will make from the channel arrangement Y.

In Stage 1A, the retailers simultaneously choose the channel arrangement given the solutions to all the subgames after this stage. The strategic-form game between the manufacturers, along with their payoffs, is represented in Table WA4(a). (This corresponds to the matrix in Table 4(a).) We use $\pi_{R_i}^{Y,F}$ to denote the profit that retailer i makes when the channel arrangement is Case $Y, Y \in \{I, \cdots, XVI\}$ and the optimal fixed-rent vector is given by $F = (F_{11}, F_{12}, F_{21}, F_{22})$ found in Stage 1B. For fixed values of β, χ and θ, we solve this game numerically with the software Gambit using the results from the Stages 1B onward.

Description of Numerical Analysis

Solving the game by backward induction in the manner described above, we obtain the equilibrium channel arrangements for different combinations of the values of β, χ and θ. The solution algorithm we use is shown in Figure WA2.

In PHASE I of the algorithm, we use three values of the returns-to-service parameter θ — low ($\theta = 0$), medium ($\theta = 0.15$) and high ($\theta = 0.3$). The inter-brand substitutability (β) and inter-store substitutability (χ) parameters can take values in the interval $(0, 1)$. For each of the three values of θ, for both β and χ we use the values in $\{0.05, 0.1, \cdots, 0.95\}$.

In PHASE II of the algorithm, for every combination of values of β, χ and θ, we use an 8-point grid for the fixed rents and vary the values of every F_{ij} from 0 to the maximum profit that manufacturer j (to whom this fixed rent is charged) makes in the subgame under consideration. Hence, in every subgame, the strategic-form game in Stage 2 (in Step II-1.1.1.1) is solved $8^4 = 4096$ times and the strategic-form game in Stage 1B (in Step II-1.1.2) is of dimension 64×64. Note that when θ has the value 0.15 or 0.3, the second-order conditions do not always hold and the optimal values of the service level turn out to be negative for certain values of β and χ. We present the results only for those values of β and χ that lead to allowable results for all values of θ. Hence, we present the results for $\beta \in \{0.05, \cdots, 0.9\}, \chi \in \{0.05, \cdots, 0.7\}$ and $\theta \in \{0, 0.15, 0.3\}$.

In Section 4.3 in the paper, we present the equilibrium channel arrangements and discuss the insights that emerge. In Table WA5, we show four representative strategic-form games in Stage 1.

		R_2			
		SS	SR	RS	RR
R_1	SS	**0.394**	0.395	0.395	0.396
		0.394	0.349	0.349	0.312
	SR	0.349	0.353	0.351	0.354
		0.395	0.353	0.351	0.314
	RS	0.349	0.351	0.353	0.354
		0.395	0.351	0.353	0.314
	RR	0.312	0.314	0.314	0.317
		0.396	0.354	0.354	0.317

(a) Payoff matrix for $\beta = 0.1$ and $\chi = 0.1$. Case I is the equilibrium arrangement. Each manufacturer makes a profit of 0.052 in equilibrium.

		R_2			
		SS	SR	RS	RR
R_1	SS	**0.163**	0.208	0.208	0.258
		0.163	0.160	0.160	0.136
	SR	0.160	0.184	0.180	0.239
		0.208	0.184	0.180	0.172
	RS	0.160	0.180	0.184	0.239
		0.208	0.180	0.184	0.172
	RR	0.136	0.172	0.172	0.215
		0.258	0.239	0.239	0.215

(b) Payoff matrix for $\beta = 0.5$ and $\chi = 0.6$. Case I is the equilibrium arrangement due to a "prisoners' dilemma" situation. Each manufacturer makes a profit of 0.109 in equilibrium.

		R_2			
		SS	SR	RS	RR
R_1	SS	0.207	0.233	0.233	0.286
		0.207	0.212	0.212	0.211
	SR	0.212	**0.248**	0.238	0.253
		0.233	**0.248**	0.238	0.241
	RS	0.212	0.238	**0.248**	0.253
		0.233	0.238	**0.248**	0.241
	RR	0.211	0.241	0.241	0.274
		0.286	0.253	0.253	0.274

(c) Payoff matrix for $\beta = 0.5$ and $\chi = 0.15$. Cases VI and XI are the equilibrium arrangements (they are equivalent form the retailers' point of view, with only the identities of the manufacturers reversed). The manufacturer with two stores-within-a-store makes a profit of 0.069 and the other manufacturer makes a profit of 0.011.

		R_2			
		SS	SR	RS	RR
R_1	SS	0.233	0.183	0.183	0.230
		0.233	0.251	0.251	0.304
	SR	0.251	0.181	0.177	0.210
		0.183	0.181	0.177	0.207
	RS	0.251	0.177	0.181	0.210
		0.183	0.177	0.181	0.207
	RR	0.304	0.207	0.207	**0.258**
		0.230	0.210	0.210	**0.258**

(d) Payoff matrix for $\beta = 0.8$ and $\chi = 0.2$. Case XVI is the equilibrium arrangement. Each manufacturer makes a profit of 0.012.

Table WA5: Channel configurations and equilibrium arrangements in the case of retail competition when $\theta = 0$. The games in (a), (b), (c) and (d) correspond to the points A, B, C and D in Figure 5(a).

PHASE I:

I-1 Analytically solve all 144 subgames in Stage 4 and Stage 3.

I-2 For each instance in a grid of values of β, χ and θ:

- **I-2.1** Using the expressions in Step I-1 above, evaluate and store the profits the retailers and manufacturers make in each subgame (to be used in PHASE II).

PHASE II:

II-1 For each instance in the grid of values of β, χ and θ used in PHASE I:

- **II-1.1** For each of the 16 cases in the strategic-form game in Stage $1A$:
  - **II-1.1.1** For each instance in a grid of values of $F_{11}, F_{12}, F_{21}, F_{22}$:
    - **II-1.1.1.1** Use the results from PHASE I to construct the strategic-form game of Stage 2 and find the equilibrium of this game. Store the choice of the manufacturers and the profits that the manufacturers and the retailers make (to be used in Stage $1B$).
  - **II-1.1.2** Use the retailers' profits from the Step II-1.1.1 to construct the strategic-form game in Stage $1B$ and solve for the equilibrium. Store the profits that the retailers make (to be used in Stage $1A$).
- **II-1.2** Using the profits in Step II-1.1.2, construct the strategic-form game in Stage $1A$ and solve for the equilibrium arrangement that the retailers will offer to the manufacturers.

Figure WA2: Solution algorithm for numerically calculating equilibrium channel arrangements.