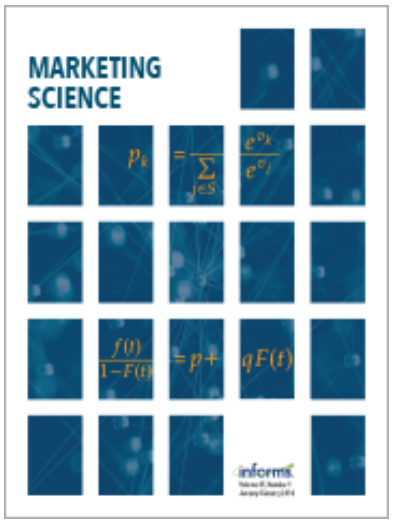

Marketing Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

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To cite this article:
Trichy Krishan, Kitty Koelemeijer, Ram Rao, (2002) Consistent Assortment Provision and Service Provision in a Retail Environment. Marketing Science 21(1):54-73. https://doi.org/10.1287/mksc.21.1.54.158

Consistent Assortment Provision and Service Provision in a Retail Environment

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Abstract

In a recent article, Broniarczyk et al. (1998) report an interesting finding that the availability of consumers' most preferred alternative in an assortment positively influences their perceptions of assortment size. This finding points to the impact of a hitherto unexplored retail strategic dimension, what we call, commitment to assortment consistency. So far, researchers have been examining retail strategies that pertain to assortment width and depth. The consistency factor featuring in the assortments offered by some retailers has largely gone unnoticed or ignored in the extant literature. We seek to address this dimension in our research.

By consistency in assortment we mean the tacit promise made by a retailer to carry a given set of brands, sizes, flavors, colors, etc. from one period to next, so that a consumer who looks for his preferred brand (or size, flavor, etc.) will be able to find that brand for sure at that retail store. Of course, not all retailers commit themselves to carrying a consistent assortment. For example, if someone walks into a warehouse club such as Sam's Choice, he may be able to buy *a* branded product at a lower price but not *the* brand or *the* size (or color, flavor, etc.) he looks for. One reason for this inconsistency is that these stores make a bulk of their purchases during trade deals that are offered by the branded manufacturers and hence have less say on what they can carry in a given period. In the apparel market, an example of a store that does not carry a consistent assortment is Ross Dress for Less. If we draw a continuum from a point of no commitment (to assortment contents) to a point of full commitment, it is rather obvious that one can locate retailers such as Sam's Choice at its low end and retailers such as Macy's at its top end.

While it is obvious that the mere existence of the consumer segment that looks for consistent assortments will drive some retailers to adopt such commitments to consistent assortments (C2C for short), what is less obvious is that this strategy is affected (negatively) by supply side factors such as the availability of trade deals. This is because while opportunistic buying helps a retailer to reduce his acquisition costs, it introduces inconsistency in the assortment. It is also important to note that although consumers may seek particular brands, their final choice of a retailer is affected also by price and location of the retailers. Thus, it is not clear how a retailer would react in a competitive environment even if a sizable segment of the market seeks consistent assortment. Apart from adopting C2C strategy, offering a service oriented shopping environment (such as having more knowledgeable store personnel and a well-lit parking lot) is another way by which a retailer can increase the store traffic. Our research question is: In a market served by two retailers, what supply and demand conditions would enable one or both retailers to adopt C2C and/or offer service?

Out of the various retail market structures possible, one particular structure is of importance to us. This is the market where only one retailer adopts C2C and offers service as well. Our focus on this market structure is motivated by two factors: prevalence of this retail structure in many markets, and availability of enough data from one such market, the Dutch flower market, which we use to validate our theoretical predictions. By using a three-stage game theoretic formulation, we show that in equilibrium only one retailer would adopt C2C and offer service as well if the other retailer does not have a high acquisition cost advantage in the supplier market, and if the cost of offering service is neither too high nor too low. Another interesting result we get is that even when a large section of the market seeks a consistent assortment, it will not be profitable for both the retailers to adopt C2C. This is because a retailer not adopting C2C can still attract customers by passing on his supply side savings to them through low prices and engaging in less price-based competition with the C2C retailer, while adopting C2C in retaliation would bring down the profits of both the retailers. We actually measure the model parameters in the Dutch flower retail market and show that with these values the model predicts the equilibrium outcome (i.e., one retailer alone offering both C2C and service) that characterizes the structure of this market. We carry out sensitivity analysis to demonstrate the robustness of the model prediction.

(*Assortment Consistency; Competition; Service; Retail Strategy; Dutch Flower Market*)

0732-2399/02/2101/0054/$05.00
1526-548X electronic ISSN

Introduction

Retailer strategies have become sophisticated in the last two decades, as pointed out by Drucker in his article, ''The Retail Revolution'' (*The Wall Street Journal,* July 15, 1993). During this time, there have come to exist many retail innovations, such as warehouse clubs, category killers, EDLP (everyday low price) grocery stores and, of course, mass merchandisers such as Wal-Mart. To explain the rationale behind the success and coexistence of these different retail formats, researchers have examined consumer heterogeneity in the need for one or more of the following retail attributes: quality, service, commitment to low price (i.e., EDLP), and assortment width and depth. For example, Lal and Rao (1997) show how some supermarkets make a commitment to EDLP as a positioning strategy to compete with a Hi-Lo store. More generally, retailers have been innovative by focusing on attributes that segment the market in a new way, and then positioning themselves in one or more of those newly formed segments. In turn, these segmentation and positioning strategies have dramatically changed consumer shopping behavior.

Turning our attention to research on retail assortment, we find that extant research, starting with Baumol and Ide (1956), focuses mainly on assortment size represented by its width and depth. For example, Messinger and Narasimhan (1997) modeled consumer store choice as a function of assortment size, represented by the number of categories carried, average price, and other retail services that act as substitute for the consumer's shopping time. A number of studies argue that heterogeneous consumer demand with respect to price sensitivity is a basis for explaining differences in retailer price and assortment decisions (see, for example, Shugan 1988, 1989). While these findings explain the rationale behind many of the retailers assortment strategies, they fail to address another important assortment characteristic that we will now explain.

Consider Sam's Choice, a warehouse club store. If a consumer walks into Sam's Choice with the intention of buying cereal, he[1] can reasonably expect to get (1) a large volume box, (2) a comparatively lower price, and (3) poor service (in terms of store ambience, personnel help, etc.). However, what is not usually recognized is that the consumer may not get the exact brand or variety (size, flavor, etc.) he is interested in, although he might be aware of that possibility. It does not mean that the brands Sam's Choice carries are of low quality; it may have some name brands and varieties other than the one this consumer is interested in during this particular shopping trip. Similarly consider Ross Dress for Less, the apparel store. One may be able to get some brand name dress but not the particular brand name or color or size he likes. In other words, with retailers such as Sam's Choice and Ross Dress for Less, the assortment size, namely, depth and width, may remain the same from one month to next, but the contents of that assortment are likely to keep changing significantly. One reason for this inconsistency in their assortments may be their opportunistic buying behavior in the supplier market. In contrast, retailers such as Macy's and Kroger tend to carry an assortment (within each category) that is consistent from one period to another. This consistency is achieved because these retailers expend special effort in their purchasing process. In doing so, they may be foregoing some of the price deals available in the supplier market and thus end up paying a higher procurement price overall.

Thus we find that retailers differ in yet another dimension, which we label commitment to consistent assortment (C2C, for short). So far researchers have not explored this dimension. This attribute is obviously important for a segment of consumers. For example, recent research by Broniarczyk et al. (1998) has found that the presence of consumers' favorite alternative in an assortment substantially reduced the impact of item reductions and in some cases even made those item reductions go unnoticed. This implies that a significant number of consumers look for, and perhaps look only for, their favorite brands. Thus a retailer who caters to this segment by adopting C2C strategy can expect to win this segment over from a competing retailer who does not.

While we have evidence from the consumer side on the need for C2C, do we have evidence that re-

[1] The word ''he'' will be used throughout the text to refer to a consumer or a retailer, and it does not carry any gender-specific meaning.

tailers recognize this as part of their strategic role? Retailers, in fact, do recognize this as a part of their strategy. For example, it is common to see the advertisements of Ross Dress for Less, KG Mens Stores, and Burlington Coat Factories making the claim, ''We carry name brands for less,'' ''We carry name brands[2] y% cheaper than department stores,'' and ''My mama told me: You better shop around.'' Clearly, they do not want to commit to their assortment contents but rather stress that what they carry will be at a lower price relative to competition. In turn, this might reflect the fact that they have a lower cost of procurement, possibly due to a price deal. In contrast, advertisements by Foley's and Macy's explicitly name the brands they carry, and they do not make any low price claims.[3] A similar observation can be made in other retail markets as well. For example, it is not uncommon to see warehouse clubs such as Sam's Choice and Auchan come up with advertisements in their weekly fliers for name brands in assorted categories (such as Samsonite suitcases, Panasonic answering machines, Minolta cameras, wines, and certain name brand grocery items such as Folger's coffee) at very low prices. It is clear to consumers and retailers as well that a couple of weeks after this promotion is over, the advertised products may not be available at all (i.e., even at regular prices). Events like these are almost nonexistent with retailers such as Macy's and Kroger.

Thus we find that in many markets some retailers focus on C2C and others do not. Retailers who do not adopt C2C naturally have a lower acquisition cost. Faced with a choice, would the retailer adopt C2C with a higher acquisition cost or prefer an inconsistent assortment with a lower acquisition cost? Among other things, this would depend on what the competing retailer does. The question also has implications for the vertical channel structure in the market. For example, the retailer desiring to adopt C2C may find a wholesaler better positioned to provide him the required brands/varieties at required time in required quantity, whereas the retailer who wants to engage in opportunistic buying would value the wholesaler's services less and hence might go directly to the supplier market. Thus, what competing retailers do with respect to C2C has implications for the channel as a whole.

Now, let us look at another attribute that retailers consider very important. This is the service attribute. Service includes, in the context of the grocery industry for example, maintaining a better store ambience such as brighter lighting, merchandising, etc., having a better parking lot, employing knowledgeable and helpful service personnel, assembling assortment, having a bank outlet inside the store, offering tips, providing information on various brands they carry, building easily accessible shelves, providing ready-made light meals inside the store, etc. It is generally acknowledged that providing service increases customer traffic and loyalty. However, if both the competing retailers adopt it, the effect may dissipate.

Given the two dimensions of retail strategy, C2C and service, what should a retailer do? Should he adopt both, or adopt one of them, or adopt neither? The question we address in this paper is: In a market served by two retailers who have the opportunity to differentiate themselves on these two dimensions, what would their actions be in equilibrium? We provide an answer to this question by delineating and interpreting the conditions under which different equilibrium outcomes are supported. In particular, we are interested in the conditions under which two formats, one adopting both C2C and service and the other without either, exist in equilibrium. We further obtain sharper insights into the role of C2C through an examination of the Dutch domestic retail flower market in which both formats exist. We do this by examining how our model conditions apply to the Dutch flower market and what the outcome in that market is. We find that our model predictions are consistent with observations.

The questions we raise and answer are important for several reasons. First, it formally examines one more piece in the retail market strategy puzzle. Sec-

[2] These advertisements never mention any specific brand name.

[3] We should note that retailers such as Macy's carry high fashion items that will usually hit the shelves of retailers such as Ross Dress for Less after a few months time, i.e., once they go out of fashion. The scope of our research does not include such products but could be applied to items such as jeans, shoes, dress shirts, etc., which stay in the market for a long time.

ond, it offers insights to retailers. Many retail chains face difficulties because of failure to understand the retail attributes that define the competitive landscape of the market they serve. Hence, understanding the implications of adopting C2C and service strategies and developing strategies against a competing retailer who adopts C2C or/and service strategy is important for a retailer. Third, there is a growing number of studies addressing similar issues. For example, Lal and Rao (1997) explore whether a relationship exists between commitment to EDLP and offering service in a market differentiated along the EDLP vs. Hi/Lo pricing strategies. Another example is that of Betancourt and Gautschi (1993), who analyze the effect of retail competition on service levels and retail margins as a function of assortment size, assuming consumer heterogeneity with respect to both price and service. Our research adds to this growing literature.

The rest of the paper is organized as follows. We first present the framework of the proposed multistage model and discuss the assumptions we have made to provide structure to the model. The retailers are assumed to make decisions in stages. In the first stage, a decision is made regarding C2C adoption, and in the second stage a decision is made regarding service offering. However, we first focus on stage 2 and derive the different conditions that lead to different equilibrium outcomes with respect to retailers offering service. We then focus on stage 1, in which the retailers have to make decisions with respect to adopting C2C, explicitly taking into account what might happen in stage 2. We then derive the conditions that support the equilibrium of one retailer alone adopting C2C and offering service. Following that, we discuss the Dutch retail flower market and empirically demonstrate how the model predictions are in line with the retail structure found in that market. Finally, we conclude the paper by explaining our results and giving directions for further research in this area.

The Model

We first develop a retail model named C2C that captures the attribute of interest to us. We formulate the competing retailers' decisions as a multistage game and then solve it. The game has three stages. In the first stage retailers decide on whether or not to adopt C2C. In the second stage decision on service offering is made. In the third stage prices are chosen. Each of the first two stages has four outcomes, so that there are 16 possible nodes at stage 3 in which prices are chosen.

We begin by solving for the Nash equilibrium prices corresponding to each of the 16 outcomes at the end of stage 2. We then work backwards to identify the conditions under which the equilibrium is one in which one retailer adopts C2C and offers service and the other retailer does not. Thus our analysis produces a subgame perfect equilibrium, while our focus is on outcomes that are asymmetric that lead to the coexistence of two formats.

We first state and describe the assumptions that provide the framework for the model. Following that we develop the model and derive the results. We make six assumptions, the first five of which describe the retail market of interest, the sixth describes the consumer segments in the market.

Assumption 1. *The market is served by two retailers, R1 and R2, who carry a single identical product category.*

The assumption of a single product category reflects our interest in retail competition as it affects assortment decisions within a product category. As already remarked, in a store such as Sam's Choice a consumer might not find, for example, the same set of brands of cereals over time. A similar situation exists with respect to apparel at Ross Dress for Less. Clearly, in practice these stores carry many product categories. Our assumption abstracts away from the decision of which categories a store might carry. Rather, we focus on whether the retailer is committed to a consistent assortment or not. The strategy of assortment consistency, being part of the positioning strategy, can be expected to apply to all categories carried by the store. To keep our analysis tractable and focused we make the simplifying assumption that each retailer carries just one category.

Assumption 2. *The acquisition cost of goods is lower for the retailer who is not committed to a consistent assortment.*

This reflects the fact that a retailer could take advantage of lower prices that may become available on various brands from time to time and buy only those brands for most of his assortment if he is not committed to carrying any specific set of brands. One way this can occur in practice is through buying largely brands that are accompanied by trade deals. Indeed, it is believed that warehouse clubs such as Sam's Choice follow this type of buying strategy. Another example is in the apparel industry, where retailers such as Ross Dress for Less buy only those designer brands that are available at low prices at any given time.

ASSUMPTION 3. *Two retailers R1 and R2 lie on either end of a line of unit length and the consumers are distributed uniformly along the unit interval. The unit traveling cost for consumers is t.*

This assumption reflects the fact that stores differ in their overall appeal (or convenience) to each shopper. The traveling cost can be thought of as representing the impact of other store specific variables (such as store loyalty, store size, geographic proximity, etc.) not considered in our analysis. By letting the cost be t we can analyze to what extent the traveling cost impacts the outcome. A lower value for t would suggest that the focal factors, namely, service, C2C strategy, and retail prices, are more important than the traveling cost for the consumers.

ASSUMPTION 4. *A retailer can provide service at one of two levels. Without loss of generality we assume that a retailer can either provide service or not. Moreover, the cost of providing service is a fixed cost, denoted by F. This assumption of fixed cost of service reflects the fact that service cost does not vary with sales. For example, training salespersons or providing a better store ambience would entail only a periodical (i.e., fixed) cost.*

Note that in contrast, adopting C2C incurs only a variable cost as we have modeled it. Thus, we are able to look at two types of strategies: one entailing a fixed cost and the other entailing a variable cost.

ASSUMPTION 5. *When a retailer does not offer service, some consumers incur an additional cost in terms of, for example, making a bouquet when buying flowers or spending time evaluating the warranty features of a product in a department store. This additional variable cost is represented by h.*

This assumption reflects the fact that the act of purchasing an item involves many ancillary processes such as understanding the terms of sale and warranty details, forming a bouquet with different flowers, assembling parts (what Wal-Mart expects consumers to do when buying furniture or bikes), gift wrapping the item, taking the grocery cart up to the car and loading the groceries into the car, etc. If a retailer does not provide such a service the consumer has to necessarily internalize those activities and this will increase his cost of acquisition. This assumption is in line with previous research, for example, that of Messinger and Narasimhan (1997), Betancourt and Gautschi (1990), and Ratchford and Stoops (1988). Note that not all consumers would necessarily incur this additional cost. This is further elaborated in Assumption 6 below.

ASSUMPTION 6. *The market consists of two major types of consumers. One type cares about the retailer's commitment to a consistent assortment, and the other type does not. Denote the C2C seeker type as C and the other as NC. For a consumer of type NC, choosing a retailer is based on two aspects: price and location. For type C, the choice is based on three aspects: price, location, and consistent assortment. It is best to think of a type C consumer as wanting to be assured of finding certain brands in the store he plans to visit. In other words, for this consumer type the cost of visiting a store and not finding the desired set of brands is significant, while it is not so for a consumer of type NC.*

Within each of two major types, there are two subtypes: one that cares for service and the other that does not. Those who care for service will incur an additional cost h *if they buy at the retailer offering no service, while for the other subtype there is no such additional cost. Let* d *denote the fraction of the market that has customers of type NC and let* α *denote the fraction (within each type) that seeks service. Then, we have the market characterized as follows:*

Segment Type	Size
Who seeks consistent assortment but not service (C-NS)	$(1 - d)(1 - \alpha)$
Who seeks service but not consistent assortment (NC-S)	$d\alpha$
Who seeks both service and consistent assortment (C-S)	$(1 - d)\alpha$
Who seeks neither service nor consistent assortment (NC-NS)	$d(1 - \alpha)$

It is important to note that although there are four types of consumers in the market, the eventual retail choice by a consumer of any type is determined by all the factors, namely, whether he is of type C-S, C-NS, NC-S, or NC-NS, his location with respect to each retailer, price at each retailer's premise, which retailer is committed to assortment consistency (important for C-S and C-NS types alone), and which retailer offers service (important for C-S and NC-S types alone). Thus, the actual choice of a retailer is driven by two forces:

1. The inherent heterogeneity in the market as to whether a consumer seeks consistent assortment with respect to purchasing this product and whether he seeks service. This heterogeneity is driven by demographic and psychographic variables and hence is assumed to be exogenously determined for our analysis.

2. The three strategies the retailers adopt, namely, pricing, commitment to consistent assortment, and service provision.

Having stated the six assumptions that describe the market we are studying, we are now in a position to formulate and solve the retailers' problems. Recall that each retailer must make three decisions: in the first stage whether to adopt C2C or not, in the second stage whether to adopt service or not, and finally in the third stage what price to charge.

Stage 2: Who Would Offer Service?

We assume that the two retailers have made their decisions with respect to adopting C2C. We face a situation where either R1 alone has adopted C2C, or R2 alone has adopted C2C, or both R1 and R2 have adopted C2C, or neither has adopted C2C. Since we do not know what situation we are in, we will analyze each of these four cases regarding what the retailers would do with respect to offering service.

Case A: R1 Alone Has Adopted C2C

Here we have a case where R1 alone has adopted C2C. Now, we ask who would offer service. There are clearly four possible outcomes: R1 alone offers service, R2 alone offers service, both offer service, or neither offers service. To determine which of the four outcomes would prevail, we first derive the profit functions of the retailers associated with each of the four possible situations. We use the following notations for the profit functions under different scenarios:

	R1 Offers Service	*R1* Does Not
R2: Offers service	*AG1****, *AG2****	*AG1*****, *AG2*****
R2: Does not	*AG1***, *AG2***	*AG1**, *AG2**

Scenario 1 (R1 Offers and R2 Does Not Offer Service)

Let $p1$ and $p2$ be the prices at R1 and R2, respectively. Consider a consumer of type C-S or C-NS. He can go to R1 and buy his preferred brand at R1 at price $p1$, or he can go to R2 first but may not be able to buy his preferred brand because R2 is not committed to carrying a consistent assortment. If it is available at R2 he will buy it at price $p2$. However, since R2 does not offer service, the C-S type will have to incur an additional cost h if he buys at R2. If he does not find his preferred brand in R2, he will come back to R1, where the brand will be available with probability 1. Here, he will buy it at $p1$. Let Pr denote the probability of finding a brand in R2. This measures the degree of inconsistency in the assortment carried by R2. A lower Pr indicates a higher assortment inconsistency in R2. For R1, Pr is simply 1 and for R2 it is strictly less than 1.

Consider a consumer of type C-NS located at a distance x from R1. Visiting R1 first would entail a cost of $p1 + 2xt$, while visiting R2 first would entail a cost of $p2 + 2(1 - x)t$ with probability Pr and $p1 + 2t$ with probability $1 - \Pr$. Assuming that the expected

cost drives the consumer's decision on choosing a retailer, it can be seen that

$$p1 + 2xt < \Pr(p2 + 2(1 - x)t) + (1 - \Pr)(p1 + 2t) \Rightarrow \mathrm{R1} > \mathrm{R2}. \quad (1)$$

Let $X0$ denote the location such that consumers at $x < X0$ choose to visit R1 first, those at $x > X0$ choose to visit R2 first, and those at $X0$ are indifferent to choosing one retailer over the other for their first visit. For those visiting R1 first, the desired brand will be available. However, for those visiting R2 first, their desired brand may not available, and this happens with a probability $1 - \Pr$. Then, with a probability of $1 - \Pr$, these consumers will go to R1 and buy their preferred brand. Thus, the market share of R1 in the C-NS type of consumer market can be shown to be:

$$\mu 1 \mid \text{C-NS} = \frac{2t - \Pr(p1 - p2)}{2t(1 + \Pr)} + (1 - \Pr)\left[1 - \frac{2t - \Pr(p1 - p2)}{2t(1 + \Pr)}\right]. \quad (2)$$

Consider a consumer of type C-S. For him, purchasing at R2 would entail, as explained earlier, an additional cost h. Going along similar lines as before, it can be shown that the market share of R1 in the C-S type of consumer segment is:

$$\mu 1 \mid \text{C-S} = \frac{2t - \Pr(p1 - p2 - h)}{2t(1 + \Pr)} + (1 - \Pr)\left[1 - \frac{2t - \Pr(p1 - p2 - h)}{2t(1 + \Pr)}\right].$$

Consider a consumer of type NC-NS. For him, Pr is 1 at both R2 and R1 because he is not concerned about buying a particular brand. Moreover, he does not care about service. The market share of R1 in this market can be shown to be:

$$\mu 1 \mid \text{NC-NS} = \frac{2t - (p1 - p2)}{4t}. \quad (3)$$

Similarly, it can be shown that the market share of R1 in the NC-S type of consumer segment is:

$$\mu 1 \mid \text{NC-S} = \frac{2t - (p1 - p2 - h)}{4t}.$$

Thus, consumer heterogeneity, together with retailers' strategies with respect to C2C and service, determines the eventual market share of each retailer. Noting that $(1 - d)\alpha$ is the size of the C-S type of consumers, $(1 - d)(1 - \alpha)$ is the size of the C-NS type of consumers, $d\alpha$ is the size of the NC-S type of consumers, and $d(1 - \alpha)$ is the size of the NC-S type of consumers, market shares of R1 and R2 can be shown, after algebraic manipulation and simplification, to be:

$$\begin{aligned}\mu 1 &= [(1 - d)\alpha\mu 1 \mid \text{C-S}] + [(1 - d)(1 - \alpha)\mu 1 \mid \text{C-NS}] \\ &\quad + [d\alpha\mu 1 \mid \text{NC-S}] + [d(1 - \alpha)\mu 1 \mid \text{NC-NS}] \\ &= 1 - L[2t + p1 - p2 - h\alpha], \end{aligned} \quad (4)$$

where

$$L = \frac{d}{4t} + \frac{(1 - d)\Pr^2}{2t(1 + \Pr)}. \quad (5)$$

It is easy to see that the market share of R2 is:

$$\mu 2 = 1 - \mu 1 = L[2t + p1 - p2 - h\alpha], \quad (6)$$

where L is given by Equation (5). The aggregate demand function is linear in price difference, and this is in line with past research (McGuire and Staelin 1983, Krishnan and Rao 1995). This makes the mathematical results tractable. Furthermore, with a linear function the market share equations are continuous in $(p1 - p2)$ implying that $(p1 - p2)$ can take any value, positive or negative.

From Equation (4) we can derive R1's profit function as follows:

$$AG1(p1) = (p1 - c1)\mu 1,$$

where $c1$ is the acquisition cost of goods for R1. To arrive at the optimal $p1$, we differentiate R1's profit function with respect to $p1$ (treating $p2$ as a constant) and set that derivative to 0. After simplifying the resulting expression, we get that for a given $p2$,

$$p1^{**} = \frac{1}{2}\left[\frac{1}{L} + c1 - 2t + p2 + h\alpha\right]. \quad (7)$$

Similarly, we can derive the R2's profit maximizing $p2$ for a given $p1$ as

$$p2^{**} = \frac{1}{L} + c1 + c2 - p1. \tag{8}$$

Solving Equations (7) and (8) simultaneously, we arrive at the optimal prices as follow:

$$p1^{**} = \frac{1}{3}\left[\frac{2}{L} + h\alpha - 2t + 2c1 + c2\right], \tag{9}$$

$$p2^{**} = \frac{1}{3}\left[\frac{1}{L} - h\alpha + 2t + c1 + 2c2\right], \tag{10}$$

where L is given by Equation (5) and $c1$ and $c2$ are acquisition costs of R1 and R2, respectively. By subtracting Equation (10) from Equation (9) we get:

$$p1^{**} - p2^{**} = \frac{1}{3}\left[\frac{1}{L} + 2h\alpha - 4t + c_d\right],$$

where L is given by Equation (5) and $c_d = c1 - c2$. Noting that L varies positively with d and Pr, both of which are bounded between 0 and 1, we see that the $\max(L) = 0.25/t$, or $\min(1/L) = 4t$. This implies that $(1/L - 4t)$ is always positive. Since by construction c_d is also positive, the right-hand side of the above equation is clearly positive, which implies that the optimal price at R1 is higher than that at R2. The price differential depends on two opposing forces. First is the cost advantage R2 has over R1, i.e., $c1 - c2$. The greater the cost advantage R2 has over R1, the lower the price at R2. Second is the advantage accruing to R1 over R2 because of his commitment to carrying a consistent assortment. The larger the part of the market that seeks consistent assortment (i.e., $1 - d$) and/or the greater the inconsistency in R2's assortment, the higher the price at R1. Similarly, the greater the impact of service as captured by h and α, the larger the price difference. Thus we find, as expected, that the more differentiated retailers are in their strategic roles, the higher is the price difference between them.

Prices $\{p1^{**}, p2^{**}\}$ as given by expressions (9) and (10) are the Nash equilibrium prices in the sense that neither retailer would like to deviate from his chosen price, given the competitor's price. Note that these equilibrium prices are under the condition that only R1 adopts both C2C and service. In other words, $\{p1^{**}, p2^{**}\}$ are subgame perfect Nash equilibrium prices.

Using the optimal prices and the corresponding market shares we can evaluate the equilibrium profits as:

$$AG1^{**} = \frac{L}{9}\left[\frac{2}{L} + h\alpha - 2t - c_d\right]^2 - F, \tag{11}$$

$$AG2^{**} = \frac{L}{9}\left[\frac{1}{L} - h\alpha + 2t + c_d\right]^2, \tag{12}$$

where F is the fixed cost of offering service, L is given by Equation (5), and $c_d = c1 - c2$. Expressions (11) and (12) are the optimal operating profits of R1 and R2, respectively, when R1 adopts both C2C and service and R2 adopts neither.

Scenario 2 (Both R1 and R2 Offer Service)
Since both offer service, R1 loses the advantage he had in scenario 1 in attracting the service seeking segment. If we follow the same procedure as before, it can be shown that the equilibrium profits to the retailers are:

$$AG1^{***} = \frac{L}{9}\left[\frac{2}{L} - 2t - c_d\right]^2 - F, \tag{13}$$

$$AG2^{***} = \frac{L}{9}\left[\frac{1}{L} + 2t + c_d\right]^2 - F, \tag{14}$$

where F is the fixed cost of offering service, L is given by Equation (5) and $c_d = c1 - c2$. Expressions (13) and (14) are the optimal operating profits of R1 and R2, respectively, when R1 adopts both C2C and service and R2 adopts only service.

Scenario 3 (Neither R1 nor R2 Offers Service)
This scenario is similar to scenario 2, except that both retailers are comparatively better off since neither offers service. It can be shown that their profits in this scenario are:

$$AG1^{*} = \frac{L}{9}\left[\frac{2}{L} - 2t - c_d\right]^2, \tag{15}$$

$$AG2^{*} = \frac{L}{9}\left[\frac{1}{L} + 2t + c_d\right]^2, \tag{16}$$

where L is given by 5 and $c_d = c1 - c2$. Expressions (15) and (16) are the optimal operating profits of R1 and R2, respectively, when R1 adopts C2C but not service and R2 does not adopt either.

Case A

Service Chosen By	Profits of R1 (C2C Retailer), R2
Neither	$AG1^* = \frac{L}{9}\left[\frac{2}{L} - 2t - c_d\right]^2, \quad AG2^* = \frac{L}{9}\left[\frac{1}{L} + 2t + c_d\right]^2$
Only R1	$AG1^{**} = \frac{L}{9}\left[\frac{2}{L} + h\alpha - 2t - c_d\right]^2 - F,$ $AG2^{**} = \frac{L}{9}\left[\frac{1}{L} - h\alpha + 2t + c_d\right]^2$
Both	$AG1^{***} = \frac{L}{9}\left[\frac{2}{L} - 2t - c_d\right]^2 - F,$ $AG2^{***} = \frac{L}{9}\left[\frac{1}{L} + 2t + c_d\right]^2 - F$
Only R2	$AG1^{****} = \frac{L}{9}\left[\frac{2}{L} - h\alpha - 2t - c_d\right]^2,$ $AG2^{****} = \frac{L}{9}\left[\frac{1}{L} + h\alpha + 2t + c_d\right]^2 - F$

Scenario 4 (R1 Does Not and R2 Offers Service)
Going along the same lines in scenario 1, it can be shown that equilibrium retailer profits are:

$$AG1^{****} = \frac{L}{9}\left[\frac{2}{L} - h\alpha - 2t - c_d\right]^2, \qquad (17)$$

$$AG2^{****} = \frac{L}{9}\left[\frac{1}{L} + h\alpha + 2t + c_d\right]^2 - F, \qquad (18)$$

where F is the fixed cost of offering service, L is given by Equation (5), and $c_d = c1 - c2$. Expressions (17) and (18) are the optimal operating profits of R1 and R2, respectively, when R1 adopts C2C only while R2 offers service only.

Case A: Given R1 Alone Adopts C2C, Who Would Offer Service?
Having derived the profits of both retailers in the four situations, namely, neither R1 nor R2 offering service, R1 alone offering service, both R1 and R2 offering service, and R2 alone offering service, we will now examine the equilibrium outcomes under different conditions. For convenience we state the profits we have derived under different scenarios in Table A,

Case B

Service By	Profit Functions of R1 (C2C Retailer), R2 (C2C Retailer)	
Neither	$BG1^* = t,$	$BG2^* = t$
Only R1	$BG1^{**} = \frac{1}{36t}[6t + h\alpha]^2 - F,$	$BG2^{**} = \frac{1}{36t}[6t + h\alpha]^2$
Both	$BG1^{***} = t - F,$	$BG2^{***} = t - F$
Only R2	$BG1^{****} = \frac{1}{36t}[6t - h\alpha]^2,$	$BG2^{****} = \frac{1}{36t}[6t + h\alpha]^2 - F$

where L is given by Equation (5) and $c_d = c1 - c2$. Note that the profits in each cell pertain to the Nash equilibrium prices that the two retailers would adopt in the given scenario. Which of the four would prevail in equilibrium depends on the values the various parameters assume in a given market situation. We are specifically interested in the equilibrium where R1 alone offers service. For this to prevail as a Nash equilibrium, the market must exhibit certain characteristics and inherit corresponding parameter values. Specifically, if $\{d, \Pr, \alpha, t, h, F, C_d\}$ are such that $AG1^{**} > AG1^*$ and $AG2^{**} > AG2^{***}$, then $R1$, the C2C retailer, alone will offer service. As we will show later, these are only necessary conditions but not sufficient to provide support for one retailer to offer both C2C and service in equilibrium. This is because in this analysis we have assumed that only R1 adopts C2C. We must examine other cases corresponding to only R2 adopting C2C, both adopting C2C, and neither adopting C2C. These are taken up next.

Case B: Both R1 and R2 Have Adopted C2C
Case B is similar to Case A, except that in Case B both retailers have adopted C2C, which implies that Pr, the probability of finding one's preferred brand in R2, is 1. Furthermore, both retailers will have the same acquisition cost, implying that $c1 = c2$. Putting $\Pr = 1$ and $c_d = 0$ for the expressions in Case A, it can be shown that putting $\Pr = 1$ and $c_d = 0$ for the expressions in Case A, the profit functions of the retailers can be derived for the various scenarios. These are provided in Case B.

The retailers' profits $BG1^* = BG2^* = t$ reflect the location-based loyalty enjoyed by each retailer who

otherwise does not have any competitive edge over the other. Stated differently, due to intense competition, the only consumer surplus the retailers extract from consumers is their traveling costs, a well-known result from Lal and Matutes (1994).

Which of the four scenarios would prevail in equilibrium depends on the values the various parameters assume in a given market situation. However, since both retailers offer C2C, the only parameters that matter are t (unit traveling cost), α (fraction of market that seeks service), h (additional cost incurred by service seeking consumers if they decide to buy at a retailer who does not offer service), and F (fixed cost of offering service). Denote the Nash equilibrium (in prices) profits of R1 as $BG1(NE)$ and those of R2 as $BG2(NE)$. The pair $\{BG1(NE), BG2(NE)\}$ will be either $\{BG1^*, BG2^*\}$ or $\{BG1^{**}, BG2^{**}\}$ or $\{BG1^{***}, BG2^{***}\}$ or $\{BG1^{****}, BG2^{****}\}$, depending on the values the parameters t, α, h, and F have in a given market place.

Case C: Neither R1 nor R2 Has Adopted C2C

Case C is interesting. Consider a consumer who looks for a particular brand. He can go to R1 first but may not be able to buy his preferred brand; then he can go to R2 but still may not be able to buy his preferred brand because neither R1 nor R2 is committed to carrying a consistent assortment. Then, he will simply drop out of the market in this period.[4] In this case, one who offers service will have an edge over the other. Except for this assumption, the rest of the derivations are similar to those of case A. Without going into details, we provide in Table C the relevant profits, where N and M are given below:

$$N = \frac{d}{2} + (1 - d)\Pr\left(1 - \frac{\Pr}{2}\right),$$

$$M = \frac{d}{4t} + (1 - d)\frac{\Pr^3}{4t}.$$

Denote the Nash equilibrium (in prices) profits of R1 as $CG1(NE)$ and those of R2 as $CG2(NE)$. The pair $\{CG1(NE), CG2(NE)\}$ will be either $\{CG1^*, CG2^*\}$ or $\{CG1^{**}, CG2^{**}\}$ or $\{CG1^{***}, CG2^{***}\}$ or $\{CG1^{****}, CG2^{****}\}$, depending on the values the parameters have in a given market.

Case C

Service By	Profits of R1, R2—Neither is C2C Retailer	
Neither	$CG1^{***} = \frac{N^2}{M'}$,	$CG1^{***} = \frac{N^2}{M}$
Only R1	$CG1^{**} = \frac{M}{9}\left[\frac{3N}{M} + h\alpha^2\right] - F$,	$CG2^{**} = \frac{M}{9}\left[\frac{3N}{M} - h\alpha^2\right]$
Both	$CG1^{***} = \frac{N^2}{M} - F$,	$CG1^{***} = \frac{N^2}{M} - F$
Only R2	$CG1^{****} = \frac{M}{9}\left[\frac{3N}{M} - h\alpha^2\right]$,	$CG2^{****} = \frac{M}{9}\left[\frac{3N}{M} + h\alpha^2\right] - F$

Case D: R2 Alone Has Adopted C2C

This case is similar to Case A, except that the roles of R1 and R2 are reversed. Hence, we can directly write the equilibrium profits of the retailers under different scenarios as in Table D, where $c_{dd} = c22 - c11$. Note that while all other parameters carry the same meaning as in other cases, $c11$ and $c22$ are different. Note that $c11$ and $c22$ are the costs of acquisition of retailers R1 and R2, respectively, where R1, who has not adopted C2C, has a lower acquisition cost than R2, who has adopted C2C. However, $c11$ is the same as $c2$ of Case A, and $c22$ is the same as $c1$ of Case A.

Denote the Nash equilibrium (in prices) profits of R1 as $DG1(NE)$ and those of R2 as $DG2(NE)$. The pair $\{DG1(NE), DG2(NE)\}$ will be either $\{DG1^*, DG2^*\}$ or $\{DG1^{**}, DG2^{**}\}$, $\{DG1^{***}, DG2^{***}\}$, or $\{DG1^{****}, DG2^{****}\}$, depending on the values the parameters have in a given market.

Stage 1: Who Would Adopt C2C?

As mentioned earlier, there are four possible outcomes: Case A (R1 alone adopts C2C), Case B (both adopt C2C), Case C (neither adopts C2C), and Case D (R2 alone adopts C2C). Each outcome would lead to a different equilibrium outcome with respect to

[4] Another way to model this is to assume that the consumer will buy a brand at the second retailer, even though he may not find his preferred brand. However, we assume that the consumer will drop out, as suggested by one of the reviewers. We thank him/her for the same.

Case D

Service By	Profits of R1, R2 (C2C Retailer)
Neither	$DG1^* = \frac{L}{9}\left[\frac{1}{L} + 2t + c_{dd}\right]^2, \quad DG2^* = \frac{L}{9}\left[\frac{2}{L} - 2t - c_{dd}\right]^2$
Only R1	$DG1^{**} = \frac{L}{9}\left[\frac{1}{L} + h\alpha + 2t + c_{dd}\right]^2 - F,$
	$DG2^{**} = \frac{L}{9}\left[\frac{2}{L} - h\alpha - 2t - c_{dd}\right]^2$
Both	$DG1^{***} = \frac{L}{9}\left[\frac{1}{L} + 2t + c_{dd}\right]^2 - F,$
	$DG2^{***} = \frac{L}{9}\left[\frac{2}{L} - 2t - c_{dd}\right]^2 - F$
Only R2	$DG1^{****} = \frac{L}{9}\left[\frac{1}{L} - h\alpha + 2t + c_{dd}\right]^2,$
	$DG2^{****} = \frac{L}{9}\left[\frac{2}{L} + h\alpha - 2t - c_{dd}\right]^2 - F$

offering service, which can be deduced from the associated profit functions provided in Table A (for Case A), Table B (for Case B), Table C (for case C), and Table D (for Case D). Which stage 2 (i.e., offering of service) outcome would align with which stage 1 (i.e., adopting C2C) outcome depends largely on the values the various parameters assume in a given marketplace. Since we can potentially list a large number of such combinations, we restrict ourselves to one particular combination: R1 adopts C2C and offers service while R2 neither adopts C2C nor offers service. We are interested in this particular equilibrium outcome for two reasons: First, many markets are characterized by such a market structure. Examples include the U.S. grocery industry (Kroger has adopted C2C and offers a good service as well, while Sam's Choice neither has adopted C2C nor offers a good service), the European grocery industry (Albert Heijn in the Netherlands has adopted C2C and offers a good service as well, while Aldi neither has adopted C2C nor offers service), the U.S. apparel industry (Foley's has adopted C2C and offers a good service as well, while Ross Dress for Less and KG Men's Stores neither have adopted C2C nor offer a good service). Second, we were able to collect extensive data from the Dutch retail flower market that exhibits this particular outcome. This enables us to check our model predictions with the data we collected.

Thus we seek to find an answer to the following question: What are the conditions that would support the equilibrium where R1 adopts C2C and offers service as well while R2 neither adopts C2C nor offers service?

When Would R1 Alone Adopt C2C and Offer Service? We answer this in three steps. In the first step we ask: If R1 alone has adopted C2C, what conditions would support the equilibrium where R1 alone offers service as well? In the second step we ask: Given that R1 can predict what would happen subsequently in the market with respect to offering service, will he be better off adopting C2C than not adopting it? In the third step we ask: Given that R2 can predict what would happen subsequently in the market with respect to offering service, will he be better off not adopting C2C than adopting it?

Step 1. Given that R1 alone has adopted C2C, the conditions that would support the equilibrium of him alone offering service as well can be derived from the associated profit functions in Table A. Noting that

1. profits to R1 if he offers service when R2 does not offer it = $AG1^{**}$;
2. profits to R1 if he does not offer service when R2 does not offer it = $AG1^{*}$;
3. profits to R2 if he (i.e., R2) does not offer service when R1 offers it = $AG2^{**}$; and
4. profits to R2 if he (i.e., R2) offers service when R1 offers it = $AG2^{***}$.

We can infer that if R1 has adopted C2C and R2 has not, and if $\{d, \Pr, \alpha, t, h, F, c_d\}$ are such that $AG1^{**} > AG1^{*}$ and $AG2^{**} > AG2^{***}$, then R1 alone will offer service. Thus we have:

Condition 1. $\{d, \Pr, \alpha, t, h, F, c_d\}$ have to assume values such that $AG1^{**} > AG1^{*}$ and $AG2^{**} > AG2^{***}$.

Now we go to the second step.

Step 2. Here we ask whether the Nash equilibrium profits for R1 ($AG1^{**}$) are greater than the profits he would have made if he had decided to not adopt C2C

while R2 had decided to not adopt C2C. This of course depends on what would R1 and R2 do subsequently (i.e., following R1's decision to not adopt C2C) with respect to offering service. Noting that R2 is not adopting C2C, we are considering Case C, where both retailers have not adopted C2C. Hence, we use the profit functions derived in Table C, where we have defined the various profits pertaining to who would adopt service, namely {*CG*1*, *CG*2*}, neither R1 nor R2 offers service; {*CG*1**, *CG*2**}, R1 alone offers service; {*CG*1***, *CG*2***}, both R1 and R2 offer service; and {*CG*1****, *CG*2****}, R2 alone offers service. One of these would be the equilibrium outcome, and it depends on the values that the various parameters assume in a given market place. Denoting, as mentioned earlier, by {*CG*1(*NE*), *CG*2(*NE*)} the Nash equilibrium profits of Case C, we can see that if R2 decides to not adopt C2C and if {*d,* Pr, α, *t, h, F,* c_d} is such that *AG*1** > *CG*1(*NE*), then R1 will find it more profitable to adopt C2C than not. Thus we have:

Condition 2. {*d,* Pr, α, *t, h, F,* c_d} has to assume values such that *AG*1** > *CG*1(*NE*).

Next we go to the third step.

Step 3. Here we ask whether the Nash equilibrium profits for R2 (*AG*2**) are greater than the profits he would have made if he had decided to adopt C2C while R1 had decided to adopt C2C. This depends on what would R1 and R2 do subsequently (i.e., following R2's decision to adopt C2C) with respect to offering service. Noting that R1 is adopting C2C, we are basically considering Case B, where both retailers have adopted C2C. Hence, we use the profits derived in Table B, where we have defined the various profits pertaining to who would adopt service, namely, {*BG*1*, *BG*2*}, neither R1 nor R2 offers service; {*BG*1**, *BG*2**}, R1 alone offers service; {*BG*1***, *BG*2***}, both R1 and R2 offer service; and {*BG*1****, *BG*2****}, R2 alone offers service. One of these would be the equilibrium outcome, and it depends on the values that the various parameters assume in a given marketplace. Denoting, as mentioned earlier, by {*BG*1(*NE*), *BG*2(*NE*)} the Nash equilibrium profits of Case B, we can see that if R1 decides to adopt C2C and if {*d,* Pr, α, *t, h, F,* c_d} is such that *AG*2** > *BG*2(*NE*), then R2 will find it more profitable to not adopt C2C than adopt. Thus we have:

Condition 3. {*d,* Pr, α, *t, h, F,* c_d} has to assume values such that *AG*2** > *BG*2(*NE*).

If R1 adopts C2C and R2 does not adopt it and if Condition 1 is satisfied, then Condition 2 ensures that R1 will not find it profitable to unilaterally change his strategy with respect to C2C while Condition 3 ensures that R2 will not find it profitable to unilaterally change his strategy with respect to C2C. Thus, all three conditions are necessary and collectively sufficient to result in the equilibrium where R1 alone would adopt C2C and offer service. It is important to note that whether all three conditions are satisfied or not in a given market depends exclusively on the values the various parameters in the model take in that market. It might be insightful if we could use all three conditions and derive algebraic expressions that would define the parameter space housing the stated equilibrium. However, such an objective is impossible to achieve here. Instead, we resort to numerical analysis and ask the following: Suppose we consider a market exhibiting this equilibrium (i.e., one retailer type alone has adopted C2C and is offering service as well) and measure the parameters used in the model. Will those parameter values satisfy the three conditions suggesting the plausibility of the stated equilibrium? This is the objective of our following empirical section.

Empirical Demonstration

One way to validate a theoretical model is to see how far the model is able to provide compelling rationale for the interesting observations made in the market. This approach is used by, for example, Lal (1990). At the other extreme, model predictions may be tested against the empirical data through statistical analyses. An example of this approach for a game theoretic model is Krishnan and Rao (1995). There is yet another way. One can actually evaluate in the focal market the key parameters of the proposed model. Then, based on these parameter values, the theoretical predictions of the model can be evaluated and compared

with the empirical observations of the same market. An example of this approach is Shankar (1997). This is the approach we also take in this paper.

What is a good way to evaluate the parameter of a particular model? Our approach is to directly measure them for a given market.[5]

We examine the Dutch domestic cut-flower retail market to validate our model predictions. There are several reasons why we chose this particular market. First, we had access to a good data set and knowledge of this market that enabled us to measure the model parameters with a high degree of confidence. Second, the Dutch domestic cut-flower market matches well with our theoretical market in that it consists of two types of retail formats similar to those in the focal market structure in our model. Third, in this retail market we do not encounter complications arising from retailers carrying multiple categories; both retail types carry only one broad category, namely, fresh-cut flowers. Fourth, we believe that the Dutch retail flower market shares with other retail markets in Europe and the U.S.A. the important institutional features we modeled in this paper, particularly, the product acquisition process, consumer segments (consistent assortment seeking, service seeking), and retail attributes including assortment and its consistency, price, and service.

This section is organized as follows. First, we describe the Dutch retail flower market, explaining in detail the market characteristics that enable the existence of different types of retailers, namely, one who can commit to consistent assortment, one who need not, one who can offer service, etc. Second, we describe the type of equilibrium that exists in the Dutch retail flower market. Finally, we measure in this market all the parameters used in the model and assess whether these values, when fitted to our theoretical model, yield an outcome that is in line with the market structure observed in the market. We show the robustness of our model findings through sensitivity analysis.

Dutch Retail Flower Market

This section briefly describes the Dutch retail cut-flower market and explains how the market conditions could support more than one type of retail structure.

Consumers in this market spend yearly the equivalent of over 600 million dollars on fresh-cut flowers.[6] Fresh-cut flowers are a frequently purchased product that is bought by more than 70% of the Dutch households, 25% of which buy cut flowers at least once every 2 weeks. Consumers buy cut flowers for different purposes, e.g., as a gift, for a special occasion, or for their own home's ambience, and will accordingly seek particular flower variants or low prices. Thus whether a consumer is deal prone or not is based on both purchase occasion and type of consumer. Of course, we do not make a distinction between the two in this paper. In other words, the deal-prone segment will have different members on different occasions, but the overall size (modeled as d) remains the same.

Service provision is mainly considered in this paper as facilitating all consumers' acquisition process, and this is in line with, for example, the work of Betancourt and Gautschi (1990). Thus, being deal prone or not has no relevance to the cost saving offered by the service.

Cut flowers are distributed by over 4000 independent retailers, who specialize in flowers and other related items.[7] The retailers can acquire cut flowers either through a wholesaler, who in turn purchases the product at a flower auction, or directly at a flower auction. Auctions are held every day, and the prices depend on supply and demand and fluctuate accordingly. Retailers who purchase through a wholesaler can only to a limited extent take advantage of the price variations, but for the most part they can select what they want to carry in their assortments. They pay a higher price than what one can get at auction because of the added wholesaler margin. On the other hand, retailers who buy at the flower auction can wait for a lower price at the auction and acquire their flowers at low prices. However, they cannot be choosy

[5] Shankar (1997) uses time series data on sales and advertising in a pharmaceutical industry to estimate the parameters in his model.

[6] It is interesting to note that the global consumption of flowers is estimated to be worth 45 billion US dollars and that the Netherlands, Columbia, Israel, Italy, and Kenya export the major requirements of the world flower market.

[7] Although several grocery chains also sell cut flowers their market share is small, about 10–15%.

for a major part of their assortment. They are sure to buy some of the important flowers (i.e., the traffic builders) but in general are likely to choose whatever flowers are available at low prices at the auction.

Thus we see that the Dutch flower market provides potentially two types of product acquisition processes for a retailer. Similar, if not identical, supply side characteristics can be found in many other markets in the United States as well. For example, many grocery manufacturers offer random trade deals where they offer large volumes of certain brands at low prices on certain specific occasions. Retailers can take advantage of such trade deals to such an extent that they can simply make most of their acquisitions during those trade deals.

For convenience, let R-WS denote the type of retailers who buy at wholesalers and R-AU denote the type who buy at auction. According to the Dutch Florist Association, 50–60% of retailers are of R-AU type with an average annual turnover of 200,000 to 350,000 Dfl (1 U.S. $ is 2.5 Dfl, approximately, as of the turn of the century). The question is whether these retailers have made use of the specific nature of their product acquisition process in devising their marketing strategies.

Apart from having the potential to adopt different marketing strategies thanks to the availability of two types of acquisition processes, retailers in the flower market have another option to entice consumers to patronize their shops. Many consumers buy flowers for special occasions and hence may have to take extra care to make them presentable, such as forming a special bouquet. This involves time and effort. Retailers can offer those services to the needy consumers. Such services can be offered by any retailer, irrespective of where he buys his flowers (wholesaler or auction point).

Having described the Dutch flower market, we next show what types of marketing strategies the retailers have adopted to compete effectively in this market.

Retail Structure of the Dutch Flower Market

We are interested in finding out which retailers have adopted C2C and which offer service in the Dutch flower market. We make use of results from a retailer survey and an in-store customer survey for this.

C2C Adoption. For the retailer survey, we identified from a random sample of retail flower specialists 61 R-AU type retailers and 99 R-WS type retailers.[8] Since retailers generally differ in what they carry as their assortment contents and given that there are many subvarieties within each major flower type and that each retailer is sure to carry certain traffic-building flower types and subtypes all the time, one way to check for who-has-adopted-C2C-strategy is to find out which retailers exhibit and are willing to have a higher consistency than others in their assortments over time. In line with this, each retailer was asked to mention the cut flowers he *consistently* carried in his assortment. They did this by choosing a maximum of 12 flowers from the top 15 flower types sold in The Netherlands. Rose, Chrysanthemum, Tulip, and Lily are the top four selling flower types. Based on the retailers' responses we found that certain types of retailers seemed to exhibit more commitment to maintaining a consistency in their assortment contents than others. Specifically, we found that the R-WS type retailers carried the top four flowers more often and/or in more different varieties and more consistently than the R-AU type retailers. For example, with respect to Rose 64.6% of the R-WS type retailers said they carried them consistently while only 50% of the R-AU type retailers said they did. The corresponding figures for Chrysanthemum are 83.8% and 72.1%, for Tulip 88.9% and 68.9%, and for Lily 69.7% and 52.5%. The differences in consistency between these two types of retailers are significant both statistically and from a consumer point of view. It is very important to note here that within each flower variety, such as Rose, often tens of subvarieties exist. The R-AU type retailers take hardly any interest in these subvarieties in their purchase process while the R-WS type retailers tend to be consistent with respect to purchasing even among those subvarieties, such as Baccara Rose. Thus, the differences in consistency between these two retailer types run deeper than what is represented by the numbers mentioned above.

[8] The two retailer types in the sample do not differ significantly in size-related measures, such as annual turnover and store selling space, nor differ significantly with respect to consumer perceptions of assortment size.

For the in-store customer survey, we interviewed a sample of 494 customers shopping at the R-WS type retail stores and 376 customers at the R-AU type retail stores. Customers were asked to rate their retailer on a 7-point Likert-type scale on product quality, freshness, and appearance. The customers, irrespective of where they shop, rated the R-WS type retailers significantly higher ($p < 0.001$) than the other type of retailers. Our further discussion showed that the perceived product quality of flowers in a retail store partly reflected the consistency of the retailer in offering such quality brands/types of flowers. Although this survey does not directly address the question of commitment to consistency, taken with the result from the retailer survey, it is reasonable to infer that in the Dutch flower market those who buy at wholesalers (R-WS) carry a more consistent assortment than those who buy at auction (R-AU).

Service Provision. We also found that R-WS type retailers provide more product-related services than the R-AU type retailers. We measured this from the same two surveys mentioned earlier, i.e., the retailer survey and the in-store customer survey. We found that the R-WS type retailers sell a larger share of mixed flower bouquets and special work (72.40%) than the other type (55.82%) ($t_{158} = 4.605$, $p < 0.001$). From the in-store customer survey, we found that the R-WS type retailers scored significantly ($p < 0.001$) and consistently higher with respect to service, including store ambience, personal attention by salesperson, salesperson's responsiveness, politeness, knowledge, and skills, and even on pleasure associated with visiting the store.

Thus we find that in the Dutch retail flower market, the R-WS type retailers have adopted C2C strategy and also offer a higher level of service than the R-AU type retailers. In other words, this market exhibits an equilibrium in which one retailer has adopted C2C and offers service while the other retailer has not adopted either.

We next measure the parameters of our theoretical model for this market.

Determining Model Parameters

We measure the model parameters using three sources: experts in the Dutch Florist Association, a household panel survey, and the annual record of various flower associations. Recall that the parameter $1 - d$ is the size of the consumer segment seeking particular brands (i.e., d is the market size of the deal-prone type); the parameters $c1$ and $c2$ reflect the R-WS type retailer's and the R-AU type retailer's acquisition costs, respectively; the parameter Pr reflects the probability that a consumer will find his desired brand at R-AU; the parameter α is the size of service seeking segment of consumers; the parameter h is the additional cost the service seeking consumers have to incur if they buy from retailers offering no service; the parameter t captures the traveling cost; and the parameter F reflects the fixed cost of service provision.

Consumer Segments Sizes, d and α. We measured this from two sources: experts in the florist associations and household panel survey. The experts were of the opinion that the price-sensitive segment made up 60–70% of the market. Next, we used the results from the household panel survey, where the panel members (of size 1,453) were asked to rate in order of importance some of the aspects of their flower-purchasing process. The attributes related to consistent assortment (specific flower, color and stem length, and quality) were marked to be important by almost 40–50% of the panel members. This coincided with the experts' opinion. Thus, d was set at 0.6.

With respect to service, we found that in this particular market almost every consumer needs help from retailers. This is because the cut flowers are a perishable, nonbranded product with its quality varying across purchase occasions and outlets, and hence a consumer can always use some extra help from retailers in his assessment of what to buy. Hence, we fixed α, which represents the need for service, to be 1. In other words, almost all consumers value the extra help offered by a retailer. How much value they attach to that help is given by h. Note however, that we do not expect the same value of α for other product categories. For example, for branded commodities such as coffee, α could be substantially lower.

Cost Advantage of R-AU Over R-WS, c_d. We used the annual records and databases of various flower associations, such as the Dutch Association of Flower

Auctions and the Dutch Floricultural Wholesale Board, to measure the acquisition costs. Based on an annual investigation by the Dutch Floricultural Wholesale Board we learned that the average domestic wholesaler gross margins for cut flowers were 15.5–16.5%. In addition, because of their experience in auction buying, the R-AU type retailers usually achieve a further 6.5% saving. In total, the R-AU type retailers enjoy a 21–23% cost advantage over those retailers who buy from wholesalers. Note that this corresponds to $(c1 - c2)/c1$ in the model. As per the Dutch Flower Auction Association, the yearly average auction price of a cut flower is around 0.50 Dfl, the monthly average price varying from 0.28 Dfl in August to 0.55 Dfl in Dcember. Thus, it can be calculated that $c1$ is around 0.60 Dfl while $c2$ is around 0.47 Dfl. Hence we have c_d equal to 0.13.

Fixed Cost of Service, *F.* Based on the experts' input, we estimated that after adjusting for size-related expenses, for a store with a turnover of 375,000 units of flowers, it would cost 147,000 Dfl (40,000 Dfl for rent, 100,000 Dfl for employees, and 7,000 Dfl for interior decoration) annually to provide service. Note that since each retailer type is certain to provide some sort of a base level service, what we are interested in is the ''additional'' service to be offered by a retailer to make the difference in service. The additional service includes features such as employing better trained and more personnel, better store ambience, offering several types of bouquets, etc. To calculate the cost of this additional service, we obtained information on the cost of the minimum amount of service needed in this business, which came to 73,500–83,500 Dfl. Moreover, we found that 36,750–41,750 Dfl, or half of the minimum service costs, would account for the unique needs of being a particular retailer type. Thus, in total 105,250 (or 147,000 − 41,750) Dfl to 110,250 (or 147,000 − 36,750) Dfl needs to be spent annually if a retailer wants to offer the additional service that is needed to provide the extra utility to the consumer. In other words, in a market of size 750,000 units (''average turnover of a retailer'' times ''the number of retailers serving a market''), it costs 105,250–110,250 Dfl to provide the infrastructure that is needed to offer distinctive service to the consumer. To be in line with the other parameters, we normalize the cost of service with respect to the market size. Thus F was estimated to be 0.140–0.147 for a market of size 1.

Traveling Cost, *t.* As mentioned in Assumption 3, the traveling cost can be thought of as representing the impact of other store specific variables (such as store loyalty, store size, etc.) not considered in our analysis. Letting the cost be t helps us analyze how far these ''other'' factors are important relative to the focal factors in the model. For example, a value close to 0 for t would mean that only the focal factors, namely, C2C, price, and service are important. To start with, we assume t to be 1 and later do sensitivity analysis in the empirical section.

Probability of Finding a Preferred Brand at R2, *Pr.* We measured this from the retailer survey. We looked into the self-reported assortment consistency with respect to which flowers are carried in the retailers' assortments, and our study revealed that on average for 11 or 12 assortment items R-AU type's consistency was 0.50 to 0.60, compared to that of R-WS. We use 0.55 as an estimate for *Pr.*

Service Utility Parameter, *h.* Note that h is the cost additionally incurred by a customer at the retail store that does not offer service. In other words, h is just one way to capture the impact of service. Another way is to ask: How would the market share of a retailer change if he doubles the service level unilaterally? The Florist Association experts opined that in a market with two retailers who offer some base level service, doubling one store's service efforts would bring in a 10% increase, at the maximum, in the market share for that store. A normal increase would be in the order of 6.5–7.5%. To use this information, we applied our model to a market with two stores that are similar in all respects, except for service provision. In this market Pr = 1 for both stores. Then, it can be shown that if R-WS type alone offers service he will have an equilibrium market share of $\mu 1^* = (6 + h)/12$. When R-WS doubles his service provision, assuming a linear relationship between service provision and reduced consumer cost it brings forth $\mu 1^*$ (double the service level) $= (6 + 2h)/12$. The percentage increase in R-WS type's market share in this mar-

ket with doubled service effort equals $h/(6 + h)$. Equating this with the experts opinion, we found that h ranged from 0.41 to 0.48.[9]

Having mapped the market characteristics to the model parameters, we next applied them in the proposed model to see how robustly the proposed model could predict the observed equilibrium of R-WS type alone adopting C2C and offering service.

Does the Model Predict the Correct Equilibrium? We have seven parameters in all. Of these, three pertain to C2C (Pr, d, $c1 - c2$), three pertain to service (F, h, α) and one is common to both (t). In the Dutch flower market recall that the parameters are found to be at the following values:

C2C parameters:

$$\Pr = 0.55; \qquad d = 0.60; \qquad c_d = c1 - c2 = 0.13;$$

Service parameters:

$$F = 0.145 \text{ (i.e. 0.140 to 0.147);}$$

$$h = 0.44 \quad \text{(i.e. 0.41 to 0.48);} \qquad \alpha = 1;$$

Parameter common to both:

$$t = 1.$$

Using these parameter values we did the following. First, we applied these specific parameter values to our model and numerically checked whether the equilibrium of one retailer alone offering both C2C and service is supported by these sets of values. Basically, we tested whether the three conditions previously derived were satisfied or not. We found that this equilibrium did indeed find support in these parameter values, implying that the model is able to predict an outcome that is in line with the actual market condition in the Dutch flower market.

Next, we checked how robust the empirical support for this equilibrium is. We took one parameter at a time and assigned to it different values around its actually measured value while fixing other parameters at their respective actual values. We then numerically evaluated for each parameter how ''widely'' it supports the equilibrium of R-WS type alone adopting C2C and offering service. We found that, ceteris paribus, this equilibrium is supported as long as:

1. The probability of finding one's preferred brand in R-AU is less than 0.70, i.e., as long as $\Pr \leq 0.70$.
2. The C2C seeking segment is larger than 0.1, i.e., as long as $1 - d \geq 0.10$, or $d \leq 0.90$.
3. The cost advantage to R-AU is smaller than 0.60, i.e., as long as $c_d = c1 - c2 < 0.60$.
4. The fixed cost of service, F, and the service utility parameter, h, are such that[10]

$$\{h = 0.41,\ 0.132 \leq F \leq 0.148\} \quad \text{to}$$

$$\{h = 0.45,\ 0.145 \leq F \leq 0.162\}.$$

5. The size of the service seeking segment is larger than 0.91, i.e., as long as $\alpha > 0.91$.
6. The traveling cost is greater than 0.18, i.e., as long as $t \geq 0.18$.

Clearly, the equilibrium predicted by the model for the Dutch market is very robust with respect to almost every parameter in the model. However, note that we analyzed the impact of each parameter in isolation. How about considering all of the C2C-related parameters together and all of the service related parameters together? We found our model results to be robust in such multidimensional settings also.[11]

Now, let us discuss some of the results we can draw from these sensitivity analyses. First, consider the C2C parameters, namely, Pr, d, and c_d. We see that large values for any of these three parameters is less likely to support the observed equilibrium. The rationale is as follows. A higher Pr implies that even without adopting C2C a retailer is able to offer a fairly high level of consistent assortment and hence adopting one will not increase market share high enough

[9] Although the Flower Association experts wholeheartedly agreed with our conceptualization of the service impact through h, they could not explicitly come up with a number for it. However, since they were ready to quantify the impact of service in terms of market share change, we decided to use that information and make the connection between the two types of impact, namely, the h and the market share change. We believe that the current way of measuring h is, although imprecise, not misleading.

[10] Since these two parameters were always jointly quoted by the experts in the flower market we decided to treat them as a pair for the empirical demonstration purposes.

[11] Graphical illustrations of these results can be obtained from the authors.

to offset the increased cost of adopting C2C. This implies that neither retailer would adopt C2C. A very high d indicates a very low fraction of consumers seeking particular brands and hence it would not be profitable for either retailer to try attracting this segment. A higher c_d implies higher additional cost involved in adopting C2C, which in turn says that the reduced profit margin is not enough to offset the increase in market share and the positive effects of a reduced competition. It is interesting to see why a sufficiently low $c1 - c2$ (for a given d and Pr) makes it attractive for one retailer to adopt C2C and the other not to adopt it. When one adopts C2C, the other retailer may suffer in his profits but adopting C2C in retaliation could make it worse for the following reasons. If both adopt C2C, the competition intensifies resulting in lower price levels,[12] zero price differential,[13] and lower profits. Thus profit margin gets affected on both ends, i.e., lower price and higher cost (i.e., cost of adopting C2C). Further, not all the C2C-seeking consumers are attracted to the retailer with C2C because some of them may still shop at the other store due to location convenience and lower price. Hence, adopting C2C in retaliation would bring in loss that would more than offset the market share the retailer might get back by attracting some of the C2C-seeking consumers. It is interesting to note here that our numerical analysis showed that, without the service component in the equation, both retailers adopting C2C was never an equilibrium. This is because of the fact that with only one retailer adopting C2C, the price based competition reduces, yielding more profits than when both adopt C2C.[14]

Now let us consider the service parameters, namely, F, h, and α. As mentioned earlier we treated F and h as a pair. It can be noticed that for a given h we don't find support for the observed equilibrium outside a certain range of F. The intuition behind this result is as follows. If F, the cost of offering service, is very low, both the retailers would like to offer service and hence one retailer alone offering service is not a possible equilibrium. The same is true when the cost of offering service is very high because in this case neither would find it profitable to offer service. What if F were moderately high? It depends on the C2C parameters. Recall that for a given Pr and d, a lower $c1 - c2$ indicates a lower cost advantage for R-AU type and thus a higher market share and revenue for R-WS type. In this situation, if the cost of offering service is sufficiently high, R-AU type will not be able to offer service and hence R-WS type will be able to offer one. Furthermore, when R-WS type offers service, because of increased market share, he will be more reluctant to wage a price-based competition that, in turn, enhances R-AU type's profits. Hence, R-AU type is better off not offering service in this situation. However, if $c1 - c2$ is high, we found that the model resulted in another equilibrium and not the one observed in the Dutch market. This is because in that case the R-AU type's high cost advantage hands him enough market share and profits to offer service on his own. With respect to α, we found that a very sizable segment of the market has to be seeking service for any retailer to offer service. However, even if the size of the service seeking segment is high, when one retailer offers service, the other retailer is better off not offering one because of the benefits he accrues thanks to the reduced competition and due to the fact that he can still attract many of the customers through a lower price and location.[15]

Finally, note that the model prediction is very robust with respect to the traveling cost. Only for very low values of t, does the model fail to predict the observed equilibrium. The intuition behind this result is as follows. Recall that a very low traveling cost implies that the consumers pay a lot more attention to the included variables in the model, namely, C2C and service from retailers. In such a situation it will be more prudent for either retailer to adopt C2C and offer service that, in turn suggests that one retailer

[12] Our numerical analyses show that when the situations are right for a retailer to adopt C2C and if he only adopts C2C, the equilibrium price for the other goes up.

[13] Here we assume away, for explanation sake, the role of service.

[14] We thank a reviewer for prompting us to analyze this aspect.

[15] However note that for a different set of values for F and h, we found that the range of α that sustained the equilibrium lay well inside the [0, 1] interval. This is because, as a reviewer pointed out, F is a fixed cost while its benefit, h, varies with sales.

alone adopting C2C and offering service is less likely to be a Nash equilibrium outcome.

Caveats. There are four caveats. The first caveat is that the equilibrium observed in the Dutch retail flower market, i.e., R-WS type alone adopting C2C and offering service, may be entirely due to a different set of reasons. Then, one way to lend support to the proposed theory is to observe and see whether the proposed theory holds well in many markets. The second caveat is that we did not consider intraretail-type competition in our model. It is easy to conjecture that competition among R-WS type retailers would result in further higher service and competition among R-AU type retailers and would result in further lower price. However, we leave this open for future research. The third caveat is regarding the three stage game we adopted and solved in this paper to explain the rationale behind the Dutch retail flower market structure. We assumed here that the competing retailers decided to adopt (or not) C2C strategy first with the forward thinking on what would they do with respect to offering service and the prices to be chosen. While we tested this framework with the Dutch flower retail market rather successfully, it might have actually been that the Dutch market evolved over time, first with respect to adopting C2C strategy and then years later with respect to adopting service strategy, implying no apparent forward thinking as we assumed in this paper. Will such a model predict the Dutch retail market outcome? We solved this model by using a similar framework and found that this model also predicts the equilibrium outcome found in the Dutch market rather successfully. The fourth caveat is regarding the methods that we used to extract from the market data the various parameters of the model. While we faced no problems in general with this process, with a few parameters, especially the service utility parameter, we felt that we could have adopted a different method.

Conclusions

In this paper we have addressed the issue of consistent assortments, one that has not received much attention in the past. Betancourt and Gautschi (1990) and other researchers, such as Messinger and Narasimhan (1997), focus on how retailers decide on what to offer as assortment, price, and service. While assortment depth and width have garnered the attention of these researchers, commitment to a consistent assortment has not. Committing to consistency can be expected to increase the cost of acquisition since the retailer cannot make use of low price opportunities in the supplier market. At the same time, consistent assortment will enhance value because consumers now know for sure what they could expect to see in the retailer's premises. However, not all retailers make such a commitment. Examples of consistent assortment retailers include department stores such as Foley's and grocery stores such as Kroger, while examples of retailers without consistent assortment include stores such as Ross Dress for Less and warehouse clubs such as Sam's Choice. We focused on C2C along with another common retail attribute, service. Having the option to adopt these two strategies, what would two competing retailers do with respect to adopting them? We analyzed this retail competition by formulating a three-stage sequential game theoretic model and deriving the subgame perfect Nash equilibrium. We characterized the conditions that support the equilibrium of one retailer offering both C2C and service and the other not offering either. We then used our analytical results to lend insights into the working of the Dutch retail flower market. This market supports two formats of retailing, C2C retailers and non-C2C retailers. Furthermore, in this market the decision to acquire flowers through wholesalers at higher cost or at an auction at lower costs is correlated with whether a retailer has adopted or not adopted C2C. What is more interesting is that the C2C retailers offer higher levels of service. By careful measurements of this market's cost and demand structure we inferred our model's parameters for this market and evaluated the model. We found that the observed retail structure is in agreement with the model prediction for the given parameter values. This can be seen as a validation of our model predictions. We also carried out what-if analysis by altering the various parameters around their inferred values and found that the model was able to correctly predict the

observed outcome in most of the cases, suggesting the robustness of the proposed model.

We found that as long as there is sufficient demand for C2C and if the cost of providing it is not very high, one of the retailers would adopt it. We also found that the retailer who has a relatively stronger advantage with respect to the C2C decision will offer service in equilibrium. For example, if R-WS type retailer's C2C advantage is relatively stronger with respect to the R-AU type retailer's acquisition cost advantage, then R-WS alone would offer service. The result implies that the cost advantage enjoyed by R-AU type retailer is not sufficiently high while at the same time the consumers exhibit a strong demand for consistent assortment.

Our paper adds one more piece to solving the puzzle of what types of conditions lead a retailer to adopt C2C and offer service. Another contribution is that this is the first paper that, to our knowledge, analyzes the impact of the assortment consistency on retail strategy and the ensuing retail structure. We hope that our research, along with the Broniarczyk et al. (1998) findings, points to new directions for research in this important area.

One important area for future research is to explore how the various differentiating strategies, namely, Hi/Lo vs. EDLP, commitment to consistent assortment and not committing to it, etc. could be modeled in a single framework and analyzed with respect to the service attribute. Also, service is clearly a multidimensional attribute and how to treat the different dimensions is a real challenge. For example, one can ask whether it is possible that one retailer adopts one particular subset of the service dimensions while his competitor adopts a different subset. Second, we offered empirical validation only for one type of market equilibrium. There are more possible equilibriums. Can we find empirical examples for the others as well? A casual observation on the operating models of the category killers such as Circuit City shows that there exist some markets where retailers offering low price (compared to the corresponding prices at the department stores) offer C2C and service as well. More research needs to be done in this area. Also, we did not explicitly model the wholesaler role in this research. An interesting research direction would be to analyze whether the adoption of C2C by a retailer necessitates the existence of a wholesaler in the market.

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This paper was received April 13, 1999, and was with the authors 18 months for 3 revisions; processed by Rajiv Lal.