

The demand for and the supply of distribution services: A basis for the analysis of customer satisfaction in retailing

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Abstract This paper brings together two bodies of literature. One of them is a literature on the special role of the consumer in retailing. The other one is the literature on customer satisfaction. This joining of literatures is accomplished by identifying distribution services as outputs of retail firms and fixed inputs into the production functions of consumers and relaxing the standard assumption that the demand for these services is always equal to the supply of these services. The result is a new conceptual framework for the analysis of customer satisfaction in retailing. This framework extends the basic ideas on customer satisfaction developed for manufacturing in a homogeneous single product setting to the heterogeneous multi-

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product setting relevant for many retailers. The paper illustrates one approach to the implementation of this framework with data for a set of supermarkets in Pamplona, Spain, that measure distribution services by asking consumers questions explicitly identifying these services. The five main categories of distribution services identified by the conceptual framework and measured in the data are economically important and statistically robust determinants of customer satisfaction with supermarkets. These results are obtained controlling for other variables typical of the customer satisfaction literature and measuring customer satisfaction in a manner consistent with that literature. The results are robust to corrections for sample selection and alternative estimation methods. Perhaps our most interesting novel result is that the effect of the determinants of customer satisfaction on future purchase intentions in the supermarket case is different when measured directly in a one stage process than when measured indirectly in a two stage process through the attributes/satisfaction/purchase intentions chain.

Keywords Retailing · Customer satisfaction · Distribution services · Supermarkets

JEL Classification M3 · L8 · M31 · L81

1 Introduction

In this paper, we bring together two separate bodies of literature. First, we consider the main strand of literature on customer satisfaction. This strand is best illustrated by Anderson and Sullivan's (1993) frequently cited paper. The latter focuses on the manufacturer's point of view and the manufacturing firm as the unit of analysis, stresses the quality of products relative to expectations about that quality as the main determinant of customer satisfaction, and emphasizes repurchase intentions as the relevant economic performance variable determined by satisfaction.

Subsequent work has taken a number of directions. One sub-strand has considered the impact of customer satisfaction on other performance variables. For instance, Anderson et al. (1994) emphasize the rate of return on investment and Anderson et al. (2004) emphasize Tobin's q as the relevant performance variable. Given the nature of our data, we can obtain direct results on the relation between attributes and customer satisfaction and between customer satisfaction and repeat patronage intentions but we can only obtain results with respect to other economic performance variables by making extraneous assumptions about behavior.

A related sub-strand of literature has proceeded by extending these ideas to the service sector. In some cases this is done treating "...service quality and customer satisfaction almost interchangeably...", Rust and Zahorik (1993, p.193), and in other cases differentiating between these two concepts. For example Gomez et al. (2004) focus on a firm in food retailing, and reduce 18 attributes identified by survey questions into three components (customer service, quality and value) through the use of factor analysis. It is these components that are assumed to determine satisfaction. Malthouse et al. (2004) extend the analysis of customer satisfaction to multiple units or establishments of a service sector firm and apply it to the health and newspaper industries. Our approach identifies conceptual measures of service for

retail establishments and illustrates their explicit measurement using a survey designed for this purpose. In so doing it shows that the measures of service are distinct from customer satisfaction in the context of retail establishments as well as distinct from the typical measures of quality and customer service obtained through the statistical approach.

Yet another related sub-strand of this literature emphasizes asymmetries and non-linearities in the links between attributes satisfaction and economic performance variables, for example Anderson and Mittal (2000). With cross-section data we will not be able to say anything about asymmetries, but we are able to address an important non-linearity that affects whether one employs the direct or the indirect approach to evaluate effects on performance. If the links were linear the direct impact of attributes on economic performance variables would be the same as the indirect one and either approach is valid. An example of the use of the direct approach in the case of retention is Rust and Zahorik (1993). The indirect approach is obtained by first estimating the impact of an attribute on customer satisfaction and subsequently estimating the impact of customer satisfaction on the economic performance variable. An example of the use of the indirect approach is Kamakura et al. (2002). We show that in the context of our data the indirect and the direct approach generate different answers.

Applying the ideas in the customer satisfaction literature above to retail establishments raises two difficulties at the conceptual level. First, since retailing is a multi-product activity, what is the relevant product quality in retailing? In the manufacturing sector, the answer focuses on the quality of the firm's explicit product or a few varieties within a product category. In the case of retail establishments such as supermarkets there are tens of thousands of explicit products that are turned over; hence, there is no clear extension of the concept of quality used in manufacturing.

In the service sector, as discussed above, one answer has been to use customer satisfaction and service quality interchangeably and the other one has been to use answers to survey questions to come up with constructs based on statistical methods that can be labeled quality and/or customer service that can differ from customer satisfaction. The statistical approach allows for variations from sample to sample in terms of each construct's basic elements and even in the constructs themselves. Our approach, which is an extension of a second body of literature discussed below, solves this problem at the conceptual level by identifying five broad categories of distribution services as the relevant measures of quality in the context of retail establishments. In this paper we also illustrate their measurement and their impact on an empirical measure of customer satisfaction used in the literature.

A second related difficulty in applying the ideas of customer satisfaction developed for the manufacturing sector to the service sector in general and to retail establishments in particular is, what are the relevant quality expectations in the case of retailing? The literature focusing on the manufacturing sector emphasizes the gap between expectations and realization as the basis for customer satisfaction and in more recent versions considers alternative approaches to the formulation of expectations and relies on a direct role for expectations, in addition to satisfaction, for determining repeat purchases of products, Kopalle and Lehmann (2006). The application of these concepts to retail establishments has not addressed expectations about product quality explicitly. We suggest how this can be done in our approach at the

conceptual level through the demand for distribution services. But we do not implement this approach empirically. Instead, we show how a simple assumption on this approach allows us to proceed empirically in the same manner as other empirical analyses of retail establishments which have made the assumption implicitly.

A second and separate body of literature on the role of the consumer in retailing is relevant for our purposes. This literature has argued that retailing differs from other industries in that the consumer plays a different role. For instance, Oi (1992) identifies this difference by arguing that self-service implies that the consumer is an input in the transformation process in retailing. Shaw et al. (1989) identified this difference by arguing that demand and marketing forces determine establishment (store) size, instead of economies of scale as in other industries. Ofer (1973) argues that the store has two outputs: turnover and services. He goes on to identify the main difference characterizing retailing as the result of the consumer choosing the ratio of the two outputs. Finally, Berne et al. (1999) argue that the difference from other industries is that the store's output is the result of an encounter between the consumer and the retailer.

The new conceptual framework for the analysis of customer satisfaction put forth here, which is derived from an extension of the analysis in Betancourt (2004), incorporates these arguments. Furthermore, it will be shown how the various roles of the consumer in retailing identified in this literature can be captured with a proper of specification of the demand for and the supply of distribution services. This is done in the next section where these distribution services are also described in detail. In Section 3 we discuss data and estimation issues. These include the specification of our main estimating equation for customer satisfaction, estimation issues due to characteristics of our data and our unique measurement of distribution services.

In Section 4 we present the main results of employing our approach to estimate the determinants of customer satisfaction in supermarkets with cross-section data, consisting primarily of supermarkets' customers in Pamplona Spain. In Section 5 we specify and present the results of estimating the effects of distribution services on repeat patronage intentions directly and indirectly (through their effect on customer satisfaction). Section 6 draws the implications of our results. A brief conclusion highlights the main contributions and limitations that suggest areas for further research. A data appendix, available upon request, provides additional details on the nature of our data.

2 Conceptual framework

Betancourt (2004) reconciles different views on the role of the consumer in retailing by relying on three ideas: first, the household production model as the basis for retail demand, including specifying distribution services as fixed inputs into the household production function of consumers; second, the specification of distribution services as outputs of retail firms; and third, the assumptions that the quantity demanded of retail items or turnover equals the quantity supplied of retail items, Q , and that the quantity demanded of distribution services equals the quantity supplied of distribution services, D . The first task of this section is to generalize these results by relaxing the third idea. This generalization provides the conceptual framework for

linking customer satisfaction with the store to the demand and supply of turnover and distribution services. This link, which is also explicitly drawn in this section, is one of the main contributions of this paper.

Distribution services have been identified as outputs in the retail literature by various authors, starting with Bucklin (1973) and continuing with Betancourt and Gautschi (1988) and Oi (1992) among others. Usually they can be assigned to one of the following five broad categories: accessibility of location, information, assortment (breadth or depth), assurance of product delivery (in the desired form or at the desired time), and ambiance. Attempts at measurement of these services at the level of the store are starting to appear, e.g., Barber and Tietje (2004), and will be explicitly discussed in the next section.

Here, we note the essence of the process whereby the level of distribution services provided by a store is determined. Namely, as a result of how equilibrium in a retail market comes about. The retailer sets a level of services, that is the level of services supplied; the consumer responds to that level of services, relative to her demand for these services, by choosing what quantities to buy and how frequently to patronize the store. In the end stores that don't supply an adequate bundle of services relative to the demand for these services by a segment of a market get no patronage from this segment, and go out of business if it is the only segment in their market. Since this is a market equilibrium outcome, it is sometimes difficult to visualize.¹

In order to proceed, it is necessary to capture the role of distribution services as outputs of retailers. This is done by Betancourt (2004, Chapter 4, Eq. 4.19) through the specification of the cost function of the retailer as $C=C(v, Q, D)$, where v are the prices of the inputs of the retailers other than goods sold, Q is a vector of the levels of output of retail items demanded by consumers and sold by the retailers, D is a vector of the levels of distribution services supplied by retailers (implicitly assumed to equal the level demanded by consumers) and C are the costs of retailing net of the costs of goods sold.

Similarly, it is necessary to capture the role of distribution services as fixed inputs into the household production functions of consumers. This is done by Betancourt (2004, Chapter 4, Eq. 4.18), following Betancourt and Gautschi (1990), through the specification of the demand function for retail items as $Q=f(p, D, W)$ where Q is a vector of the quantity of retail items demanded by consumers (and supplied by retailers), p are the prices of these retail items, D is a vector of the levels of distribution services supplied to consumers at a retailer (and assumed to equal the level demanded by these consumers), and W is the level of wealth.

Betancourt (2004, Chapter 4) shows that Oi's argument about the consumer as an input into the production function collapses to acknowledging that distribution services are outputs of the retailer and that they influence the demand functions of consumers. In a market equilibrium, where turnover demand equals turnover supply, Q , Oi's argument on the special role of the consumer reduces to acknowledging the endogeneity of Q and D in any econometric procedure. Betancourt goes on to argue that similar assertions by Ofer (1973), Shaw et al. (1989) and Berne et al. (1999) can

¹ For a discussion of how distribution services affect retail equilibrium configurations see, for example, Betancourt (2004, Chapter 2, Sections 4 and 5).

also be captured by acknowledging the endogeneity of Q and D in any econometric procedure. While this is possible, it obscures a much richer set of possibilities that become apparent once the assumption of equality between demand and supply is relaxed with respect to both turnover (Q) and distribution services (D).

The discussion below is most easily interpreted by assuming that there is only one retail item and one distribution service. Nonetheless, the discussion is easily adapted to any level of aggregation used in either the marketing or the economics literature and relying on cost or demand functions consistent with standard economic theory. To illustrate, we will undertake the discussion treating both turnover and distribution services as vectors. A general and precise formulation of the cost function is given by

$$C = C(v, Q^s, D^s), \quad (1)$$

and a general and precise formulation of the demand function is given by

$$Q^d = f(p, D^s, W). \quad (2)$$

In both cases the superscript indicates the relevant decision maker: s for the supplier of both goods or retail items and distribution services, which is usually the retailer, and d for the demander of both goods or retail items and distribution services, which is usually the consumer.

We are now in a position to generalize Betancourt's (2004) arguments and to encounter the much richer set of possibilities that the generalization offers. In this more general setting Oi's argument is captured through the demand function in Eq. 2. The higher the level of distribution services supplied by the store (D^s), the less the consumer has to work in her purchase activities and, consequently, the higher will be the demand for retail items by the consumer, Q^d , when she patronizes the store. The specification of the cost function in Eq. 1 with two types of outputs, Q^s and D^s , is consistent with Ofer's argument that the store output has at least two dimensions: the level of turnover of retail items (Q^s) and the level of distribution services (D^s). Since the quantities of retail items demanded by the consumer, Q^d , are specified as a function of retail prices and the actual distribution services provided by the store, D^s , by choosing Q^d , the consumer chooses the ratio between Q^d and D^s as well, which was the other one of Ofer's two assertions.

Shaw, Nisbet and Dawson's argument is accommodated in this framework as follows: In the short-run store size and the supply of retail items and distribution services [Q^s ; D^s] provided by the store is relatively fixed and determined by the retailer. Because in the short-run capital is normally assumed fixed. Hence, the size of the store is fixed by the size of the building, for example, as well as by the equipment it may be using. This will be the case whatever the level of demand. In the long-run, however, demand and marketing forces [Q^d ; D^d] are likely to be more important as emphasized by Shaw et al. That is high (H) levels of these demand variables due to demographic, economic or technological changes, for example, will induce the building of larger stores and the provision of higher levels of turnover and distribution services by the retailer in a long run equilibrium [$Q^s=Q^d(H)$; $D^s=D^d(H)$]. This supply response to substantial changes in demand conditions, however, requires additional resources and time to build.

Finally, Berne, Mugica and Yague's argument can be reconciled with this framework as follows: the outcome of the encounter between the retailer and the customer is a relation between the quantities demanded of these two types of output [Q^d ; D^d] and the quantities supplied of these two types of output [Q^s ; D^s]. One would expect this relation frequently to satisfy these inequalities, $Q^d \leq Q^s$ and $D^d \geq D^s$. The first inequality rules out consumers facing stock-outs for any item. In the case of stock-outs for any items, $Q^d > Q^s$, a number of interesting economic issues arise on the relation between the retailer's inventory decisions that lead to stock-outs and the brand shares of manufacturers. For an analysis of some of these issues see Aguirregabiria (2004). The second inequality rules out retailers providing distribution services at levels that are not wanted by consumers for any one service. Since this second situation is a money losing proposition when these services are costly to produce, it is likely to be a temporary phenomenon. We will not comment further on either of these two issues in this paper to focus on the situation where our conceptualization generates novel insights.

There are four possibilities in our case, i.e., when $Q^d \leq Q^s$ and $D^d \geq D^s$. A relatively simple one assumes that as a result of the encounter both equalities hold. In this case all the analyst has to worry about is the econometric problem of endogeneity of $Q = Q^d = Q^s$ and $D = D^d = D^s$. This is the case explicitly analyzed by Betancourt (2004). Another relatively simple case assumes no stock-outs for any items ($Q^d \leq Q^s$) and, just as in the previous case, that quantities demanded of distribution services equal quantities supplied, i.e., [$D^d = D^s$]. In these two cases customer satisfaction is at its maximum and, if this is the case for every customer, its measurement is irrelevant. To our knowledge, this economic interpretation of the limit condition has not been identified in the prior literature on customer satisfaction in retailing. Furthermore our empirical methodology captures this limit condition on distribution services, namely that the outcome of the encounter is a fully satisfied customer.

The third and most interesting case, in our context, is one where there are no stock-outs for any item ($Q^d \leq Q^s$) and consumers' demand for distribution services is always greater than the levels supplied by the retailer, $D^d > D^s$. It is in this case that the measurement of customer satisfaction becomes intrinsically meaningful, since a consumer may be very close or very far from its desired or demanded level of distribution services for one or more of these services. This conceptual foundation for the measurement of customer satisfaction in retailing is one of our principal contributions to the literature.

Incidentally, the no stock-outs condition [$Q^d \leq Q^s$] is necessary for the degree of consumer satisfaction to be economically interesting in the single transaction case. Because it allows the retailer a mechanism to satisfy increased demand by customers for at least some items as a result of increasing satisfaction, which is what generates profits from increasing customer satisfaction in the single transaction case. This is most easily seen by considering the fourth case. This one is not economically interesting, at least in the single transaction case. For, it requires a dissatisfied customer, $D^d > D^s$, and a retailer that can't benefit from improving satisfaction because she is operating at full capacity for all items ($Q^d = Q^s$). Increasing satisfaction can't increase sales for any item. Hence, it can't increase profits even if the costs of increasing satisfaction are zero!

Since identification of the third case is one of the main contributions of this paper to the literature, it is useful to add precision to the discussion as follows: consumer i satisfaction with a store, k , is going to be given by a relation of the following form

$$S_i(k) = f \left\{ [D^d(i) - D^s(k)]_j, p(k), X(i, k) \right\}, \quad (3)$$

where $S_i(k)$ is a measure of customer satisfaction, i.e., of consumer i satisfaction with store k . This satisfaction is going to be a decreasing function, $f'_j < 0$, of the distance between each of the j distribution services actually provided by store k , $D^s(k)$, and the level of each of the j distribution services demanded by consumer i , $D^d(i)$. Thus, the distance between the demand and supply of distribution services for each j th service, $[D^d(i) - D^s(i)]_j$, suggests itself as a natural measure of the components of the lack of customer satisfaction with a store.

The specification in Eq. 3 captures the emphasis on product quality in the customer satisfaction literature in manufacturing. It does so, however, by identifying the distribution services provided by the retailer at the k th establishment, $D^s(k)$, as the relevant measure of product quality in retailing. This adapts the view of customer satisfaction in manufacturing, which is based on a single explicit product, to the multiple explicit product context of the retailer without requiring a measure of quality for the thousand of individual items stocked by most retailers. It relies on the view that one of the two basic ‘outputs’ of retailing is the vector of distribution services supplied by the retailers. These distribution services are usually common to all or to various subsets of the explicit products of the retailer. For instance, having extended hours or information on items on sale are higher levels of distribution services that, in principle, can increase the demand for all or a subset of retail items which can be sold at the retail establishment.

It is worth noting that the literature on customer satisfaction in retailing does not address this issue explicitly, for example none of the references cited in the introduction identify product quality in retailing explicitly at the conceptual level. Implicitly, Gomez et al. (2004) addressed the issue by labeling a subset of the attributes in one of their three statistically determined factors, quality. But, these attributes leave out a substantial number of products available in the store and include a few but by no means all of the services provided by a retail establishment.

A second aspect of the customer satisfaction literature in manufacturing is their emphasis on expectations about product quality. The specification in Eq. 3 provides an explicit mechanism to capture it in retailing. Namely, expectations about product quality in retailing are determined by the level of the vector of distribution services demanded by consumers, $D^d(i)$. One way of proceeding, for example, is to infer the demand for these services from the inverse demand function for distribution services, derived in Betancourt (2004, Chapter 3, p. 44). That is,

$$r_j = g(p, D^d, W, Z), \quad (4)$$

where r_j indicates the shadow price of the j th distribution service, p is a vector of retail prices, D^d is a vector of distribution services demanded by a consumer, W is wealth and Z is a vector of conditioning variables. The functional form of g is determined by what one assumes about the consumer’s expenditure function, since g

is the negative of the first derivative of this function with respect to the j th distribution service.

The specification of the rest of the items in Eq. 3 follows the literature. Namely, one would also expect the function in Eq. 3 to be a decreasing function of the average prices charged by store k . In addition, consumer characteristics or other store characteristics may affect the consumer's satisfaction with a store and are captured by the vector $X(i, k)$. Both of these ideas are captured, for example, in Gomez et al. (2004) and in many of the references they cite.

In sum, Eq. 3 adapts the original concepts of the literature on customer satisfaction in manufacturing to incorporate important features relevant for retailing. It also captures the main aspects of the literature on customer satisfaction in retailing that have been implemented empirically. Finally, it is based on a generalization of the literature on the role of the consumer in retailing which relies on widely accepted fundamental economic concepts.

3 Empirical implementation: Data and estimation

Equation 3 can be viewed as a stand alone relation or as the customer satisfaction module in a more general setting where the aim is to implement the service profit chain framework or the return to quality framework or any variant of these frameworks. How one proceeds with respect to these issues depends, among other things, on the nature of the data available. Our main data set are surveys of customers from 11 supermarket establishments in the city of Pamplona, Spain.² This means that, in principle, one can estimate the stand alone relation but not many of the variants that require a module linked directly to economic performance variables, which usually refer to firms. While we have some supplementary information on these retail establishments, about the retail firms that own them we know only their identity (four firms own two establishments each and three firms own one establishment). Thus we can estimate only one variant as a module directly linked to economic performance: namely the impact of customer satisfaction on future patronage intentions. We will discuss this topic in Section 5. In this section we focus on the data and estimation of Eq. 3 as a stand alone relation.

Consumers were selected to fill the survey upon exiting the supermarket during one particular week in 1998. These surveys generated a total of 874 observations with a maximum number of 85 interviews at any one supermarket, and a minimum number of 79. A unique feature of these data is the measurement of distribution

² A supermarket in Pamplona is defined as a self-service establishment, usually between 250 and 2,500 squared meters of surface area, with an assortment predominantly oriented toward food products. The sample of 11 supermarkets was selected from the 18 establishments classified as supermarkets in Pamplona by the 1997 Census. The universe consisted of 5 chains with 14 establishments and 4 single establishment firms. A small and a large establishment, in terms of square feet, was chosen from each of four chains and three of four establishments, also varying in size, were chosen from the four single establishment firms. Customers were interviewed as they exited the supermarket with purchases. Interviews were conducted by a team of five interviewers at each supermarket who conducted all the interviews spread throughout the day for a period of 6 days between March 23rd and April 4th of 1998. The response rates were between 40 and 50% at each supermarket. These rates are typical for supermarket surveys in Pamplona.

services as attributes associated with a supermarket establishment directly. Consumers were asked to rate on a scale of 0–10 a number of attributes that corresponded to the five distributions services emphasized by Betancourt and Gautschi (1988): accessibility of location, $D_i(k)_1$, information, $D_i(k)_2$, assortment, $D_i(k)_3$, assurance of product delivery, $D_i(k)_4$, and ambiance, $D_i(k)_5$.

Since it is difficult to separate into mutually exclusive and additive categories all the dimensions of each of these attributes, we tried to capture the essential aspects of each attribute in a single question whenever possible. This seemed feasible for four of the attributes and it was implemented. Thus, accessibility of location is measured from the answer to the question—To what extent the store’s location facilitates your accessibility to the retail establishment? Information is measured from the answer to the question—To what extent the employees and the signs in this establishment facilitate your information needs with respect to items, their location in the store, prices, sales, etc.? Assortment is measured from the answer to the question—To what extent the assortment and the variety in the store products facilitate your making all your purchases at this establishment?³ Finally, ambiance is measured from the answer to the question—To what extent your treatment by employees, and the cleanliness and orderliness of the store allow your purchases to be an agreeable experience?

With respect to assurance of product delivery, however, the situation differs in two ways. First, it has at least two dimensions, desired form and desired time. Second, desired time has at least two aspects (one is mainly speed and the other is mainly timing) that we thought could be identified separately in the data through two different questions. Our approach was to use the simple average of the answers to the following two questions that capture speed and timing, respectively. To what extent the number of registers open and the acceptance of different means of payment facilitate the speed and convenience of paying for your purchases? To what extent the hours and the days the store is open facilitate making your purchases when you need to do so?

$D_i(k)_j$, $j=1,\dots,5$, represents the consumer’s perception of the level of the j th distribution service provided by the retailer at the k th establishment. It is a measure of the realized performance of the supermarket in supplying these services as perceived by the consumer. Thus, we replace the objective levels in Eq. 3, $D^s(k)_j$, with the levels of supply of distribution services perceived by the consumer, $D_i(k)_j$, for purposes of estimation.

In general one does not observe the level of distribution services demanded by consumers, $D^d(i)$. Nonetheless, in principle the demand for these distribution services could be estimated by estimating the inverse demand system in Eq. 4. This would require undertaking surveys of the willingness to pay for distribution services. While these surveys have not been undertaken before for this purpose, they would be similar to the willingness to pay surveys that already exist for other purposes, for example Wang et al. (2005). Here we pursue a simpler alternative. Namely, we assume consumers are never satisfied and that they always demand the maximum

³ Assortment has two dimensions: breadth and depth. The latter is normally associated with different varieties within a product line and the former with different product lines. Thus, breadth can in principle include product lines as different as food and banking services.

level they can expect with respect to any distribution service. This expectation leads to the demand for each of the j distribution services to be at its maximum, $D^d(i)=M$. When the maximum (M) is assumed the same for all consumers and distribution services, and equal to the maximum value that can be perceived to be provided by the retailer, we have $D^d(i)=M=10$.

An appealing aspect of this approach to retailing, besides its feasibility of empirical implementation, is that every study of customer satisfaction in retailing that measures attributes on the basis of surveys makes this assumption implicitly, if their concept is to be related to the original idea of quality relative to expectations about quality. This is true of earlier constructs, for example Servqual, or of their modern replacements (customer service, quality and value) as used in, for example, Gomez et al. (2004). One interpretation of this assumption is consistent with the literature focused on manufacturing. Namely, the consumption of (demand for) distribution services should be measured against a standard of pleasure or displeasure, Oliver (1999, p.34). We (and the retailing literature) are simply using the maximum as the standard. Parenthetically, making the assumption explicit facilitates relaxing it in the future.

Another advantage is that it provides a clear connection between our empirical work and the existing empirical work on retailing. The main difference is that our work reflects direct answers about questions on these five distribution services. The literature asks a much larger set of questions about services in general, as many as 20 for example, and then tries to collapse them with statistical methods into a smaller set of constructs. The latter sometimes coincide with ours, for a most ingenious and well done example of this approach see Barber and Tietje (2004).

For estimation purposes, Eq. 3 then becomes

$$S_i(k) = f \left\{ [10 - D_i(k)]_j, p_i(k), X(i, k) \right\} + \varepsilon_{ik}. \tag{5}$$

The dependent variable, $S_i(k)$, represents consumer's I satisfaction with store k and it can be represented by any of the typical measures of customer satisfaction used in the literature. In our case it was measured as the answer to the following question, also on a scale of 0–10—What is your degree of satisfaction with the services provided and the purchases made in this establishment?

Notice that, an increase in $[10 - D_i(k)]_j$ implies a lowering of the level of the j th distribution service as perceived by the consumer and, thus, it should result in a lower level of customer satisfaction because the distance between the quality or service offered and the one expected has increased. Just as noted above this interpretation is at best implicit in the references in the literature. Also note that there was a similarly rated question on store prices, $p_i(k)=X_i(k)_6$. Namely—To what extent the prices in the store are high relative to other similar establishments?

In implementing Eq. 5 empirically we selected a number of variables for inclusion as explanatory variables for various reasons. For instance, general demographic characteristics of consumers were included as controls, but we had no expectations as to how gender (X_{i7}), age (X_{i8}), position in the life cycle (X_{i9}) or extent of work outside the home (X_{i10}) would affect customer satisfaction.⁴ Two objective

⁴ For a more detailed description of all variables see the data Appendix.

characteristics of customers buying habits were also included as controls. These were the length of stay at the store (X_{i11}) and the size of the market basket (X_{i12}). Attitudes toward purchasing food products relevant for any establishment were also included. These were: do you enjoy engaging in this activity by yourself (X_{i14}); how important is the time you spent on this activity (X_{i15}); and do you search for alternative establishments while engaged in this activity (X_{i16}). Two variables that capture objective characteristics of the environment were included: namely, surface area [$X_{22}(k)$] to capture the effect of store size and dummies for the firm to which the store belongs, $F(k)$, to capture firm effects.

One econometric problem that arises in estimating equation (5) is that our dependent variable can be interpreted as censored, especially at the top since there are no observations at the bottom.⁵ The standard procedure to address censoring is Tobit analysis. According to Maddala (1983), however, if there is a true maximum the censoring interpretation does not apply. The discussion leading to our estimating equation suggests that 10 is a true maximum. In any event, we estimated Eq. 5 with Tobit analysis as well as with regression analysis and the results were exactly the same in terms of statistical significance and economic significance. Hence, we will present only the regression results to conserve space.

A couple of other econometric problems arise due to the nature of our data. That is, the customers were interviewed immediately after patronizing a particular supermarket establishment. This feature raises two issues. First, the standard assumption that the disturbances are uncorrelated with each other is unlikely to hold if there are events that affect all the customers of one establishment and their satisfaction with that establishment. This problem is addressed by clustering by the establishment so that the standard errors are robust to the possibility of correlation among the error terms for consumers of that establishment.⁶ While the results are quite similar with and without the correction, note that the correction only affects the standard errors, they are not exactly the same. Hence, we will present the t-ratios associated with both sets of results.

Second, the effect of any variable, for example the distribution services, that appears both in a supermarket selection equation and in the customer satisfaction equation on customer satisfaction could be biased if Eq. 5 is estimated ignoring the selection problem. We have a variable that is very close to a selection variable. This variable is the frequency of purchases at this particular establishment within a month [$X_{i13}(k)$], which is defined as a dummy variable that takes on the value of 1 if the customer patronizes the establishment four or more times within a month and zero

⁵ It turns out there are no observations for this variable that take on the value of 0 (and only one that takes on the value of 1), but there are 161 that take on the value of 10.

⁶ When the observations are clustered, the assumption that the observations are independent of each other within the cluster is unlikely to be true. In the estimation of a mean, for example, this issue is incorporated into the analysis by modifying the standard formula for the sample variance of the mean, S^2/n , as follows [S^2/n] [$1 + \rho(n_c - 1)$]. Here ρ is the intra-cluster correlation and n_c is the sample size of each cluster. In this simple case ρ and n_c have been assumed to be the same for each cluster. In more complex settings these assumptions are relaxed, but the basic idea for constructing variance estimates of regression coefficients to calculate robust t-ratios is the same. We implemented the correction with a widely used econometrics program, STATA, where it has become a standard feature in recent years.

otherwise. Hence, we added this variable as an explanatory variable in Eq. 5 to correct for the possibility of selection bias.

An objection that can be raised to this procedure is that frequency of purchases introduces an endogeneity problem into the regression. We have three pieces of evidence that this is unlikely to be a problem in our case. First, whether or not this variable is included has no effect on our main results. The same variables are statistically significant in both cases using a t -ratio of 2 as a criterion and the coefficients of the statistically significant variables are the same up to the second decimal.

Second, we performed the following experiment. We defined the variable somewhat differently: namely, as taking on the value of 1 if the consumer patronizes the establishment 3 or more times within a month and zero otherwise. Use of this new variable in the analysis leads to exactly the same results as use of the old one, which is unlikely if the variable was truly endogenous. For instance, the same variables are statistically significant using the same criterion of a t -ratio of 2 and the coefficients of all the statistically significant variables are the same up to the third decimal!

Finally, we ran regressions explaining frequency of purchases. Both the perceptions of the five distribution services and customer satisfaction were used as explanatory variables. Customer satisfaction was statistically insignificant at either the 1 or the 5% level using both probit and OLS as estimation methods. Adding other explanatory variables lowers the t -ratio of customer satisfaction even more.

4 Results on customer satisfaction

Table 1 presents summary statistics on all the variables used in the paper, including some appearing in the next section but not in this one. It also gives a descriptive name as well as the corresponding symbol for each variable used in the analysis in this section and the next one. The results of estimating Eq. 5 by OLS with and without the cluster correction, are presented in Table 2. Just as mentioned earlier, estimation with Tobit analysis generates the same results statistically and substantively as OLS. Similarly, whether or not the frequency of purchases, $X_{113}(k)$, is included has no effects on the results. What does make a minor difference in the results is the cluster correction.

Our most important result is support for the soundness of the underlying approach described in the paper. The outcome of the shopper's experience is determined basically by the distribution services provided by the store as perceived by the customer. Every one of the variables involving the distribution services identified in our analysis has the expected sign, and a t -ratio greater than 2. In terms of statistical and economic significance as determinants of customer satisfaction, however, one can say that the assortment, assurance and ambiance provided by the establishment, as perceived by the customer, are far more important than the accessibility of location and the information provided by the establishment. Among the last three, ambiance in the form of courteous treatment, cleanliness and orderliness is three times as important from an economic perspective. Moreover its t -ratio is so much greater than the other t -ratios that it is the one most likely to survive a wide barrage

Table 1 Descriptive statistics

Variable name	Symbol	Mean	Standard deviation	Maximum	Minimum
Customer satisfaction	S	7.82	1.67	10	1
Accessibility of location	D ₁	7.86	2.46	10	0
Information	D ₂	7.34	2.25	10	0
Assortment	D ₃	7.31	2.32	10	0
Assurance	D ₄	7.51	1.80	10	2
Ambiance	D ₅	7.86	2.00	10	0
Price	X ₆	5.67	2.17	10	0
Gender 0 (male)	X ₇₀	0.19	0.39	1	0
Gender (female)	X ₇₁	0.81	0.39	1	0
Age 0 (less than 25)	X ₈₀	0.17	0.38	1	0
Age 1(25–40)	X ₈₁	0.36	0.48	1	0
Age 2 (41–60)	X ₈₂	0.34	0.47	1	0
Age 3(>than 60)	X ₈₃	0.13	0.34	1	0
Life cycle 0 (single)	X ₉₀	0.25	0.43	1	0
Life cycle 1(no child)	X ₉₁	0.15	0.36	1	0
Life cycle 2 (child<6 years)	X ₉₂	0.12	0.32	1	0
Life cycle 3(6<ch age<14)	X ₉₃	0.12	0.32	1	0
Life cycle 4 (child> 14 years)	X ₉₄	0.36	0.48	1	0
Hours worked	X ₁₀	3.59	3.80	15	0
Mean length of stay (min)	X ₁₁	17.61	10.84	90	1
Size of purchases	X ₁₂	0.27	0.45	1	0
Frequency of purchases	X ₁₃	0.66	0.47	1	0
Pleasure in purchasing	X ₁₄	7.96	2.24	10	0
Importance of time	X ₁₅	6.21	3.30	10	0
Searches for other stores	X ₁₆	5.20	3.15	10	0
Seeks help in store	X ₁₇	5.26	3.76	10	0
Seeks home delivery	X ₁₈	0.55	1.85	10	0
Enjoys shopping w/ others	X ₁₉	2.98	3.28	10	0
Future patronage intentions	X ₂₀	7.47	2.36	10	0
Recommends store to others	X ₂₁	6.81	2.35	10	0
Store surface (100 m ²)	X ₂₂	9.69	3.43	14	1.5

of econometric adjustments. Interestingly, these results hold with and without the cluster correction. That is, whether one uses column 3 or column 4 to evaluate the statistical significance of the results.

Among the other results, higher prices, as expected, lower customer satisfaction, but the result is not statistically significant at the 5 or 1% level if one uses the cluster correction. Similarly, larger establishments lower customer satisfaction and this result holds at an even higher level of significance as a result of the cluster correction. Once the level of services is controlled for store size has a negative impact on satisfaction. One example of a mechanism generating this result would be an increase in the amount of time spent by the consumer in gathering information about prices or assortment when size increases given the levels of distribution services. Another example would be an increase in the amount of time spent at checkout counters when size increases given the levels of distribution services.

Finally, customer characteristics seem to have little or no impact on customer satisfaction. This is true of general demographic characteristics, general attitudes

Table 2 Customer satisfaction and its determinants: Regression specification of Eq. 5

Variable	Regression coefficient	<i>t</i> -Ratio	Robust <i>t</i> -Ratio
Constant	10.27	31.15 ^a	34.75 ^a
[10-D ₁]	-0.04	-2.30 ^a	-2.44 ^a
[10-D ₂]	-0.05	-2.03 ^a	-2.22 ^a
[10-D ₃]	-0.13	-5.72 ^a	-4.89 ^a
[10-D ₄]	-0.12	-3.95 ^a	-3.80 ^a
[10-D ₅]	-0.39	-13.27 ^a	-10.56 ^a
X ₆	-0.05	-2.25 ^a	-1.44
X ₂₂	-0.05	-2.31 ^a	-6.51 ^a
X ₇₁	0.01	0.07	0.06
X ₈₁	0.15	1.03	0.96
X ₈₂	0.11	0.68	0.69
X ₈₃	0.06	0.35	0.32
X ₉₁	-0.11	-0.76	-0.71
X ₉₂	-0.2	-1.08	-0.94
X ₉₃	-0.08	-0.50	-0.53
X ₉₄	0.08	0.60	0.44
X ₁₀	-0.02	-1.30	-1.15
X ₁₁	0.01	1.13	1.07
X ₁₂	-0.12	-1.21	-1.57
X ₁₄	-0.01	-0.60	-0.61
X ₁₅	-0.02	-1.10	-0.98
X ₁₆	-0.01	-0.59	-0.56
X ₁₃	0.11	1.16	1.57
F1	-0.33	-1.83	-6.06 ^a
F2	0.13	0.70	0.94
F3	0.03	0.14	0.13
F4	-0.02	-0.08	-0.14
F5	-0.30	-1.53	-6.04 ^a
F6	0.13	0.69	4.64 ^a
R ²	0.50	-	-

^a *t*-Ratio greater than 2

toward purchase activities and attitudes toward specific features of the establishment. In the same vein, objective characteristics of the purchase activity, for example the average size of the basket purchased by the customer, do not matter in explaining customer satisfaction. Firm dummies were included in the regressions. While none of the firm dummies were statistically significant at the 1% level without the cluster correction, three of them were with the cluster correction. Literally this means customers of supermarkets owned by two (one) of these seven firms experienced lower (higher) levels of satisfaction than the residual firm, which is measured by the constant, after controlling for distribution services and other variables. One possible substantive interpretation is that brand, as captured by the firm's name, matters for these supermarkets. Our conceptual framework and our data are focused on customer satisfaction with a single transaction. Hence, this is merely a possibility. Furthermore, there are other equally valid ones. For instance, any firm characteristic that is invariant to consumer's perceptions of an establishment but that varies across firms could generate the same empirical result.

5 Results on future patronage intentions

In this section we consider the impact of customer satisfaction on future patronage intentions. One of the survey questions asks the customers to indicate on a scale of 0–10—To what extent do you plan to patronize this establishment in the future for your food purchases? Thus, we are in a position to answer the question of what is the effect of increasing the level of a distribution service perceived by the consumer [$D_i(k)$] on future patronage intentions (FP_i) in two different ways. The first one is a direct one where distribution services become explanatory factors in a regression explaining future patronage intentions, for example as in the equation below,

$$FP_i(k) = f[D_i(k), p_i(k), X(i, k)]. \quad (6)$$

When the effect of the attribute or distribution service in Eq. 5 is linear and the link between customer satisfaction (S) and future patronage intentions is also linear, then the coefficient of the service or attribute in a linear specification of Eq. 6 gives the same answer as the following two step procedure. In the first step one estimates the impact of the service on customer satisfaction as in Eq. 5. That is $-b_j = \partial S / \partial D_j$ is the negative of the estimate of the j th distribution service, for example the ones in the second column of Table 2. In the second step one estimates the impact of customer satisfaction on future patronage intentions. That is $a = \partial FP / \partial S$ is the impact of a one unit increase in customer satisfaction on future patronage intentions, which is estimated from the following specification,

$$FP_i(k) = f[S_i(k), p_i(k), X(i, k)]. \quad (7)$$

The results of OLS estimation⁷ of both specifications with and without the cluster correction are presented in Table 3. That the two specifications will not give the same results is easy to see in our case. Not all distribution services in column 2 of Table 3 are statistically significant using a t -ratio of 2 as a criterion. Indeed only accessibility and ambiance are statistically significant if one uses robust standard errors. Yet all distribution services were statistically significant by this criterion in Table 2 and so is customer satisfaction (S) in Table 3. Hence, the two step procedure is valid for all five distribution services. Given that the results differ, the two step procedure is presumed to be the appropriate one. Because it is more general, for example it does not require linearity. Non-linearity is not the only potential reason for the difference. In addition, in any multivariate regression the correlations between the explanatory variables can lead to differences in results, unless there is orthogonality among them, and the explanatory variables in the two specifications are intrinsically different.

Incidentally, this result obtains despite our measure (S) focusing on satisfaction with a single transaction. While conceptually satisfaction with a single transaction and cumulative satisfaction are distinct, one can argue that in practical applications the two concepts are hard to differentiate and in some settings generate similar results. Indeed, evidence in favor of this similarity is provided for the case of future patronage intentions by Berne et al. (2005). This is not surprising since cumulative satisfaction is logically the result of the aggregation of satisfaction with single

⁷ We also tried Tobit analysis in this context and the main results were the same as with OLS.

Table 3 Future patronage intentions

Variable	Regression specification of Eq. 6			Regression specification of Eq. 7		
	Coefficient	<i>t</i> -Ratio	Robust <i>t</i> -ratio	Coefficient	<i>t</i> -Ratio	Robust <i>t</i> -ratio
Constant	1.43	2.29*	1.2	1.66	2.70*	1.51
S	–	–	–	0.46	10.10*	5.63*
D ₁	0.17	5.47*	5.33*	–	–	–
D ₂	0.03	0.84	0.68	–	–	–
D ₃	0.11	2.88*	1.91	–	–	–
D ₄	0.08	1.64	1.45	–	–	–
D ₅	0.19	3.94*	4.24*	–	–	–
X ₆	–0.03	–0.86	–0.82	–0.01	–0.34	–0.28
X ₂₂	–0.04	–1.4	–3.31*	–0.04	–1.6	–3.08*
X ₇₁	–0.32	–1.69	–1.89	–0.29	–1.55	–1.61
X ₈₁	0.25	1.04	0.79	0.26	1.08	0.95
X ₈₂	0.31	1.2	1.44	0.28	1.08	1.26
X ₈₃	0.26	0.86	0.98	0.38	1.29	1.31
X ₉₁	–0.22	–0.93	–1.31	–0.24	–1.02	–1.23
X ₉₂	–0.22	–0.73	–1.1	–0.18	–0.58	–0.72
X ₉₃	–0.06	–0.2	–0.19	–0.05	–0.18	–0.17
X ₉₄	–0.03	–0.13	–0.16	–0.08	–0.35	–0.36
X ₁₀	–0.01	–0.44	–0.37	0	1.1	0.01
X ₁₁	0.01	1.36	1.75	0	0.84	1.17
X ₁₂	0	–0.02	–0.02	0.16	0.99	0.81
X ₁₄	0.02	0.55	0.34	0.05	1.64	0.97
X ₁₅	–0.06	–2.72*	–1.91	–0.06	–2.64*	–1.93
X ₁₆	0.03	1.48	0.98	0.05	2.05*	1.34
X ₁₃	1.48	9.53*	6.74*	1.62	10.70*	7.25*
F1	1.19	4.02*	13.11*	1.49	5.15*	14.98*
F2	1.11	3.67*	3.82*	1.12	3.79*	3.55*
F3	1.17	3.60*	6.27*	1.46	4.63*	15.27*
F4	1.89	5.75*	11.62*	1.62	5.18*	10.01*
F5	0.8	2.46*	11.80*	0.97	2.96*	11.85*
F6	1.4	4.32*	34.27*	1.38	4.26*	22.99*
R ²	0.31	–	–	0.30	–	–

* *t*-Ratio greater than 2

transactions. Satisfaction with the most recent transaction, which is what our survey measures, would be expected to have greater weight than the others on cumulative satisfaction in the case of supermarket purchases by regular customers. It can be seen from the descriptive statistics that 66% of the sample of customers interviewed patronize the supermarket where they were interviewed at least four times a month.

Three other strong results emerge from Table 3 using a *t*-ratio of 2 with the cluster correction as a guide. The higher the frequency of purchases, *X*₁₃, the higher the score on the future patronage intentions variable with both the direct and the indirect specification methods. Similarly, the larger the size of the establishment, the lower the score on future patronage intentions. Finally, all six firm dummy variables are significantly different from zero, indicating that intentions of future patronage are higher for all of these firms relative to the residual category firm. All of the above results as well as those in the previous section continue to hold if we add the variables that represent attitudes toward purchasing at the establishment, namely *X*₁₇, *X*₁₈, *X*₁₉. Similarly, the results in this section are also robust to the exclusion of

variables, including frequency of purchases. For instance, if we use only the five distribution services as explanatory variables accessibility and ambiance have the coefficients with the two highest magnitudes and the two highest t -ratios (8.00 and 4.00, respectively), just as they do in columns 2–4 of Table 3.

6 Implications

Here we note briefly the economic and managerial implications of our results. In order to evaluate the effect of a service on economic performance through the service/satisfaction/intentions chain, the manager of a store needs to know the answer to two questions First, what is the impact on customer satisfaction of increasing the level of a distribution service per unit cost? Namely,

$$\partial S / \partial D_j / c_j = -b_j / c_j. \quad (8)$$

The piece of information in the numerator is the result of the statistical analysis in Section 4. The piece of information in the denominator in general should be available to the store manager from knowledge and data on the operations of the store.

Mention should be made in this context of a practical issue identified by a referee's comment. In our case ambiance, $D_i(k)_s$, is the distribution service with the greatest impact on satisfaction. But the question in the survey asked about ambiance is the subject of some ambiguity. For instance, are we increasing ambiance by increasing the training of employees to treat customers courteously or by increasing the training of employees to keep the store clean and orderly? Our analysis assumes the impact on satisfaction is the same, but in a real life application one may want to split the question in the survey into two separate questions and make sure that this is indeed the case.

Second, what is the impact of increasing customer satisfaction by one unit on future patronage intentions in terms of economic performance variables? Namely,

$$[\partial R / \partial FP][\partial FP / \partial S] = [\partial R / \partial FP][a]. \quad (9)$$

One piece of information comes from the statistical analysis in Section 5 (a). Just as before the first piece of information should be available to the store manager from knowledge and data on the operations of the store. It is the expected amount of revenues generated by a unit increase in future patronage intentions. Since a unit increase in FP is a movement of one unit in a scale of 0–10, we can interpret it as an increase of 0.10 in the probability of a visit. Thus, 0.10 times the average expenditures on a visit gives an estimate of $[\partial R / \partial FP]$.

To illustrate with an example: suppose expected revenues from increasing future purchase intentions per customer by a unit $[\partial R / \partial FP]$ are 0.10 times average yearly expenditures of \$500 per customer at the supermarket ($=\$50$); then, a one unit increase in customer satisfaction generates, according to Table 3, a 0.46 increase in future purchase intentions $[\partial FP / \partial S = a]$; thus, the \$50 increase becomes \$23.15. Furthermore, a one unit increase in ambiance generates a 0.39 ($-b_5$) increase in customer satisfaction, according to Table 2. Hence, a one unit increase in ambiance generates an \$9.03 ($.39 \times 23.15$) increase in revenues per customer. For a

supermarket that has 100 customers, this implies that it should undertake the costs of increasing ambience by one unit as long as the costs of doing so (c_5) are less than \$903 per unit per year. These costs would entail the costs of training employees to be courteous and of providing cleanliness and orderliness in the store.

7 Concluding Remarks

Our main contributions in this paper are the following. First, we integrate the literature on the role of the consumer in retailing with the literature on customer satisfaction. We do so by drawing the implications of viewing distribution services as outputs of retail firms and as fixed inputs into the household production functions of consumers and by relaxing the assumption that the demand for and the supply of distribution services are always equal. The resulting conceptualization provides an economic foundation for the analysis of customer satisfaction in retailing at the transaction level. Second, we have implemented this framework empirically using a unique data set. While the results are consistent with earlier literature, for example the lack of importance of demographic variables, they entail a new more direct way of measuring distribution services. Substantively, these results imply that distribution services are the main mechanism through which retailers can influence customer satisfaction with a transaction at the supermarket level. Third, the effects of distributions services on future purchase intentions are very different empirically when estimated directly than when estimated as part of an attribute/satisfaction/future intentions chain.

All research has limitations and often these limitations are useful as guides to areas of further research. Ours is no exception. First, operational implementation of our approach requires supermarket managers to estimate the costs of increasing effort in the provision of distribution services as well as estimating the expected benefits of an increase in future patronage intentions. We used illustrative numbers here, but there are clear practical benefits to future research that generates reliable estimates of these costs and benefits. Second, our analysis focuses on transaction specific customer satisfaction but extending the analysis to cumulative customer satisfaction is an attractive area for future academic research. Finally, our data set measures distribution services in a new fashion but it has no information to compare this measurement to an interesting alternative in the literature, namely the one employed by Barber and Tietje (2004). Constructing a new data set that allowed a comparison of the two approaches with respect to their effect on customer satisfaction and on future purchase intentions could be a fruitful area for future research.

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