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Loyalty Effects and Price Response at Online and Offline Channels:

A Study across Consumer Packaged Goods Categories.♦

Abstract

Loyalty effects and price sensitivity in online and offline grocery shopping are analyzed and specifically compared in this study. Regarding loyalty, the hypotheses suggest that the observed effects of brand and size loyalty at the online channel will be higher than those offline, and that this difference will be higher for categories of products whose attributes are inadequately transmitted online. Regarding price, the hypothesis suggests that consumers will be less price sensitive at the online channel than at the offline channel. Empirical results for six different consumer packaged goods categories support our hypotheses (but one that is partially supported). Our main contribution is that we use online and offline purchase trips and no-purchase trips from the same sample of consumer as data for the estimations. Previous studies had used different consumers' datasets while comparing online and offline choices.

Key Words

Brand loyalty, size loyalty, price sensitivity, sensory products, Internet, logit model

1. Introduction

The rapid diffusion of computer and information technologies throughout businesses and homes has changed the world of marketing completely (Winer et al 1997). A few years ago, almost every purchase was made in a physical retail store and it was difficult to imagine that a new shopping channel, the Internet, would appear as a valuable alternative to consumers. However, it did. Consumers do not only purchase several offerings from conventional retail stores but also from virtual stores. Furthermore, several studies predict a steady increase on online purchasing for the next years. Forrester Research (2005a, 2005b) reports that e-commerce will grow from $172 billion in 2005 to $329 billion in 2010 for the United States, and from €103 billion in 2006 to €263 billion in 2011 for Europe. Besides, it also forecasts that European e-commerce in travel, clothes, groceries and consumer electronics will exceed the €10 billion per year mark by 2011.

Marketing research has traditionally focused on consumer shopping at the traditional channel. However, virtual and physical channels do not present the same characteristics and there exist differences between them, such as the amount and the quality of the information that is available at each environment or the risk consumers perceive about transactions' security and quality of the products purchased, that could make consumers modify their behavior while purchasing products from the Internet (Burke et al. 1992, Hoffman and Novak 1996, Alba et al. 1997, Otto and Chung 2000). For instance, Häubl and Trifts (2000) found that the interactive decision tools that are present at online shopping have the potential to drastically transform the way in which consumers search for product information and make purchase decisions. Thus, in the current context, firms may find it useful to understand consumer behavior at the new media (Internet) and, therefore, know how different channels affect consumer decision processes. This will allow firms to design better business strategies at each channel in which they operate and, as a consequence, increase their profitability.

Although there have been some empirical attempts to clarify consumers' behavior across offline and online shopping channels, in particular in the grocery industry (Degeratu et al. 2000; Danaher et al. 2003; Andrews and Currim 2004), they have not been able to isolate the effects of shopping media on consumer behavior from those produced by the intrinsic characteristics of consumers. Even though Degeratu et al. (2000), Danaher et al. (2003) and Andrews and Currim (2004) try to select consumers with similar characteristics for their online and offline samples to mitigate this problem, they unavoidably end up using different samples of consumers to analyze the effects of marketing variables on consumer choice. Thus, although these works show interesting results, they do not inform about the real impact of online channels on consumer response to marketing strategies, since it might be hidden by the effect of consumer demographics.

In this paper, we use the purchases made by a *unique sample of consumers* at *both* the *offline* and *online* stores from the *same grocery retailer* to study shopping behavior at the two channels, what allow us to overcome the problem. To the best of our knowledge, there is still no published paper that uses the same group of consumers to analyze the effect of the Internet media on consumer shopping compared to offline. In concrete, we compare online and offline shopping focusing on two different aspects that could drive consumers' decisions and are much related to the level of competition within the store: (brand and size) loyalty and price sensitivity. Loyalty has been the focus of much research due to its importance to

manufacturers and retailers. From the perspective of marketing, loyalty is due to consumers having feelings of satisfaction after a purchase that stimulate them to repurchase a product, what, at the same time, simplify decision process and relieve purchase risks (see for example, Kotler et al. 2000). If we found that loyalty effects are significantly stronger for a shopping channel, it would imply a higher level of difficulty for the introduction of new products in the market through that channel, what could be of special interest for multichannel retailers. Besides, we analyze the effect of price on consumer choice in each channel. Only a proper understanding of consumers' price sensitivity across online and offline channels will allow retailers to develop appropriate pricing strategies for each channel and earn more profits

In addition, we also study if the differences between the role of loyalty and price at online and offline channels are magnified for categories of product whose main attributes/characteristics are more difficult to be conveyed online (sensory categories) than for others (non-sensory categories). In the empirical application, we use six categories of consumer packaged goods (CPG) to check whether the results obtained hold for different kinds of categories. Three of these categories of products are defined as sensory (kitchen paper, toilet paper and sandwich bread) and three as non-sensory (canned tuna, rice and full-fat milk) given their most important attributes. Thus, we are able to compare the results between sensory and non-sensory categories.

The paper has the following structure: In Section 2 we briefly describe our conceptual framework. First, we show the main characteristics that differentiate online and offline channels. Second, we analyze the role of information at online and offline channels. Third, we revise the main studies on online grocery shopping. In Section 3 we present the hypotheses. Then, in Sections 4 and 5 we describe the characteristics of the data employed and the methodology. In Section 6 we analyze the results obtained for our six categories of product and finally, Section 7 concludes the paper.

2. Literature Review

2.1 Characteristics of Online and Offline Shopping Channels

Marketing channels can be viewed as sets of interdependent organizations involved in the process of making a product or service available for consumption or use (Sterne and El-Ansary 1996). In concrete, a marketing channel performs three key functions: to operate as a

communication channel, as a transaction channel and as a distribution channel. In this sense, both conventional and online stores allow information exchange between sellers and buyers, sales activities and physical exchange of products/services (Kiang et al. 2000). However, each channel has unique characteristics that make it satisfy these functions in a different way.

The existing literature in marketing in online channels has documented the characteristics - *and thus also advantages and disadvantages* - of online stores compared to traditional stores. We will follow the works from Hoffman and Novak (1996), Alba et al. (1997), Peterson et al. (1997), Otto and Chung (2000), and Kiang et al. (2000) to characterize each channel. The advantages of each shopping environment, classified into the three functions a marketing channel can perform, include the following:

Online channel: As a communication channel: i) For accessing and searching [written] information - *the Internet allow customers to access and search through a great amount of information such as price or other product characteristics [e.g,. weight 250g.].-* ii) It makes it easy to gather information about customers via surveys. As a transaction channel: i) Retailers can reach a much bigger customer base - *no geographic limitation -.* ii) Convenience - *it does not require shoppers to leave their location to conduct transactions. -* iii) It allows customizing promotion and sales to individual customers. v) 24-hour availability, 7 days a week. As a distribution channel: i) For retailers, it eliminates huge inventories, storage costs, utilities, and space rental. Ii) It serves as a physical and immediate distribution medium for certain goods - *e.g. software, music or books in electronic format -.*

Offline channel: As a communication channel: i) It allows real inspection of products - *consumers can smell, touch and see the real characteristics of the merchandise.* ii) There is a face-to-face interaction between sellers and costumers. As a transaction channel: i) Consumers perceive higher security in transactions at physical stores compared to other shopping channels, both regarding payments and the quality of the products purchased. ii) A physical store usually accepts more type of payment options than an online store - *e.g. it also accepts cash -.* As a distribution channel: i) Immediacy - *when a shopper purchases an item from a physical store, the product can usually be immediately taken home with the shopper -.* ii) There are usually no shipping costs.

2.2 The role of information at online and offline environments

After a shopping experience, an important quantity of information regarding the shopping environment and the product purchased is retained at consumers' memories. Nevertheless, at a new purchase occasion, consumers do not consider the information retained on their memories but also, the information currently available. In fact, the available information at purchase occasion is greatly valued. In general, if the relevant information for choice is available at the shopping channel, consumers grant an important weigh to the information that the environment provides. However, if this information is not available, individuals infer it from other attributes - *whose information is available* - or use information from previous purchase occasions (Degeratu et al, 2000). For instance, brand names allow consumers to infer product quality when it is difficult to measure (Alba et al, 1997). This mechanism makes consumers choose better when all the relevant information is not present.

There is no doubt that information availability at shopping environments plays a key role on consumer choice. There is a conceptual framework that analyzes this issue: the Information Integration Theory. Following the concise description from Degeratu et al (2000), it can be said that "the Information Integration Theory offers a specific mechanism to describe how individuals integrate separate pieces of available information into an overall index of preference. In the context of product evaluations, this theory suggests that consumers assign importance weights and scale values (utilities) to product attributes for which information is available at the time of decision making, and then combine these weights and values according to some rule (e.g., adding, averaging) to come up with an overall evaluation". Once all the alternatives are evaluated, consumers select that which better meets their necessities.

To choose an alternative from all the available ones, individuals usually focus on pieces of information that are available, such us the brand name, price, whether the product is on promotion or not; and also, depending on the category of product, on its aroma, texture, color, etc. However, not all shopping environments equally communicate different types of information.

Information availability is usually different at online and offline channels regarding search costs and search strategies (Degeratu et al, 2000). In fact, retail formats compete in the types of information they convey effectively to customers (Alba et al, 1997). One of the main advantages of offline channels respect to online channels is the possibility of to physically inspect the products (Alba et al. 1997, Otto and Chung 2000). Some papers note the

importance of this issue for consumers. Degeratu et al. (2000) point out that there are categories of product whose main attributes can be defined as "sensory" - *since they are difficult to be transmitted online* -, and others whose main attributes can be defined as "non-sensory" - *since they are easily conveyed online* -. Additionally, McCabe and Nowlis (2003) found that "material"(sensory) products were highly preferred to be bought offline, while there was no significant preference for online or offline channels for the purchase of "geometric"(non-sensory) products.

Sensory attributes: Sensory attributes are those directly perceived by our senses, particularly by the touch, the smell, the hearing and also the taste. Moreover, other visual aspects such as volume, that is not so easily communicated online, could be also considered as a sensory attribute. A category of product extremely characterized by sensory attributes is perfume. The aroma plays the principal role when acquiring this product. The aroma cannot be communicated online but it can be perceived at traditional stores. According to this, sensory attributes are transmitted worse online than offline. This implies that for sensory categories, less relevant information for choice is available at the Internet than at traditional shopping environments.

Non-sensory attributes: Non-sensory attributes as those that can be easily transformed into written information, i.e. into "words". There are many categories of products where non-sensory attributes are the most important ones, e.g., books. When purchasing a book at a traditional store, consumers use to read its plot from the back cover. Books' summaries are available both online and offline but the Internet provides both additional information to consumers - *other readers' reviews* – and online search engines that facilitate consumers to compare books. Therefore, we consider that for non-sensory categories the online channel appears as an attractive environment for consumers.

2.3 Online Consumer Behavior

Burke et al. (1992), Alba et al. (1997), Lynch and Ariely (2000), Degeratu et al. (2000), Häubl and Trifts (2000), Reibstein (2002), Danaher et al. (2003) and Andrews and Currim (2004) have recently focused on the study of consumer choice behavior at the Internet. These investigations deal with information seeking and consumer choice processes in depth, emphasizing the effects of interactive decision aids, search costs, role of brand names, price and loyalty.

From these studies, only those from Degeratu et al. (2000), Danaher et al. (2003) and Andrews and Currim (2004) compare online and offline consumer shopping in the grocery context using real purchase observations. However, none of them analyzed whether the same sample of consumers behaved differently when purchasing online and offline. We have searched in the literature and have not found any previous study that had used a unique group of consumers to study choice behavior at these two channels but the exception of Burke et al (1992). This work analyzes consumer choice behavior at supermarkets and computer simulated environments using exactly the same sample of consumers. Nevertheless, its results can be only considered as a proxy since not real virtual purchase observations are used in the analysis. Thus, we will concentrate on the works from Degeratu et al. (2000), Danaher et al. (2003) and Andrews and Currim (2004) as the most accurate ones to explain online consumer behavior. Albeit they do not reach to explain if the same consumers would present another behavior on the Internet than in physical stores, their findings suggest it might be different.

Andrews and Currim (2004), analyze how online consumers purchase compared to offline consumers. They observe significant differences between the parameters describing online and offline choice processes and conclude that online and offline consumers behave differently. Compared to traditional shoppers, virtual consumers are less sensitive to price changes, prefer bigger sizes, present a stronger size loyalty and do more screening on the basis of brand names but less screening on the basis of sizes. They also notice that online consumers choose within a smaller number of brands than offline consumers. Besides, they also notice that the majority of online consumers (69-100%) present a different behavior to that observed for offline consumers. They also observe that the majority of offline consumers (61-89%) show a different behavior than online consumers.

Degeratu et al. (2000) focus on the influence of brand name, price and presence of sensory attributes or non-sensory attributes in the category on consumer decision making. Their results suggest that the impact of brand names at the Internet and physical stores depends on the amount of information available at each shopping environment. In those categories of products where sensory attributes are more relevant, the impact of this kind of attributes is smaller online than offline and the effect of brand names is higher online. In the case of products with non-sensory attributes, the impact of non-sensory attributes is stronger online and the effect of brand names smaller online. They also notice higher price sensitivity at the Internet, but they believe this is a consequence of promotions being a strong signal of

discounts at this channel. However, if considering the joint impact of price and promotions, the effect found is smaller online than offline.

On the other hand, Danaher et al (2003) specifically study the role of brand loyalty online and offline. They compare observed brand loyalty levels for these two environments with brand loyalty levels obtained from a new Dirichlet base model. Their work show different results regarding the physical or virtual channel. At the conventional environment, brands' market share is not related to the differences between the loyalty level observed and the level of loyalty estimated by the model. However, at the Internet, an excess of brand loyalty can be observed for high-market share brands while the opposite for low-market share brands. Thus, their conclusion is that there is a strong evidence of online brand loyalty being superior to offline brand loyalty.

3. Hypotheses

As previously depicted, transacting through a virtual medium for consumers is different from physical shopping environments since they present different characteristics. In general, it seems that consumers perceive online shopping as more risky than offline shopping (Van den Poel and Leunis 1999; Montoya-Weiss et al. 2003), what makes them use brand names as credibility and quality signals, and repeat previous purchases – *i.e. increasing their loyalty* – (Burke et al. 1992, Alba et al. 1997, Brynjolfsson and Smith 2000a & 2000b). Besides, this effect is enhanced in the grocery industry, since online grocery stores seem to offer, in general, less amount of information than offline stores about the product attributes, and to provide online automation tools that make it easy to replicate previous purchases (Häubl & Trifts 2000). This all suggest our first hypothesis:

H1: The effect of loyalty on consumer choice will be higher online than offline.

> *H1a: The effect of brand loyalty on consumer choice will be higher online than offline*
> *H1b: The effect of size loyalty on consumer choice will be higher online than offline*

Nevertheless, while analyzing the effect of loyalty at these two channels, the role that the availability of information plays on consumer choice must be highlighted. According to our analysis from the Information Integration Theory at Subsection 2.2, sensory attributes are transmitted worse online than offline. This implies that for those categories of products

characterized by sensory attributes, less relevant information for choice is available at the Internet than at traditional stores. Then, in this framework, we propose our second hypothesis:

H2: The impact of loyalty online with respect to offline will be higher for those categories of products whose attributes are transmitted online with difficulty.

     H2a: The impact of brand loyalty online with respect to offline will be higher for those categories of products whose attributes are transmitted online with difficulty.

     H2b: The impact of size loyalty online with respect to offline will be higher for those categories of products whose attributes are transmitted online with difficulty

Finally, we propose a third hypothesis regarding price. Smith and Brynjolfsson (2001) made one of the first approaches about consumer choice behavior at the Internet. In particular, their research relies on choices in an Internet shopbot and their findings suggest that shopbot consumers were very sensitive to how total price was allocated between the item price, shipping price, and tax. However, these findings may be viewed in the context of shopbot consumers, who are likely to be among the most price sensitive consumers on the Internet. Lynch and Ariely (2000) analyzed by a lab experiment how the reduction of search costs online affected competition on price, quality and distribution. They found that lowering search costs for quality information reduced price sensitivity. On the other hand, they found that lowering search costs for price information increased price sensitivity. Thus, the net effect would depend on these two issues. In reality, research about price sensitivity with real purchase data has found somewhat mixed results about the effect of price online compared to offline. Andrews and Currim (2004) observed that online consumers were less price sensitive than offline consumers, while Degeratu et al (2000) found that price sensitivity was higher online. However, the latter consider that this higher price sensitivity online was due to a stronger signaling effect of online price discounts. This last two results on the grocery context, joint to the fact that some surveys, as the one from Morganosky and Cude (2000) show that the majority of online shoppers considered that convenience and time saving were the main advantages to buy groceries on the Internet give us support to formulate the following hypothesis:

H3: Price sensitivity online will be lower than offline.

4. Data

4.1 General data

Our data come from one of the five leading grocery chains in Spain. It has an important presence in the Spanish geography (583 stores) and was a pioneer at Internet sales, having opened its virtual store in 2001.

From this grocery chain, we obtained the purchases made by a group of 2742 consumers over the 12 month period from December 2002 to November 2003. To be included in the panel, the households had to have made at least one purchase at the retailer's online store. For these households, we observe all their trips both to the online and offline stores of this grocery chain. For each trip, we observe the entire basket, and for every item in the basket, its price, brand, size and also, depending on the item, other characteristics such as its flavor or color. The offline data were collected as scanner data while the online data were registered by the Web site.

It is possible to shop online in most of the towns where a physical store of the retailer exists, and the variety and depth of product lines are quite similar in both environments. However, there are some differences in pricing across the two channels. While the retailer practices zone pricing for the offline stores, it does not do it for the online store. For the offline channel, the grocery chain establishes two price zones. Both offline price zones are pretty similar in its price-cut policies but prices are slightly higher in one of the zones. For the online channel, the retailer decided to replicate the prices of the high price offline zone.

4.2 Categories in the study

We have selected six CPG categories that are frequently purchased both online and offline. We have tried that these categories represent a varied range of products to make findings easier to generalize, while taking into account that we needed some categories with sensory characteristics and others with non-sensory characteristics. In addition, we also searched for categories in which we could find different brands and sizes. In particular, it was difficult to find branded sensory categories, since clear sensory categories, such as fresh produce did not present brands but types, e.g. potatoes: special potato for frying, baking, etc. Finally, the categories of sandwich bread, paper kitchen and toilet paper were selected as "sensory" categories, and canned tuna, full-fat milk and rice as "non-sensory" ones.

On the one hand, we have the three sensory categories. We have considered sandwich bread as a sensory product because freshness, which is an important attribute in the category, is difficult to transmit online. Two aspects that could help consumers to infer freshness are the expiration date and softness but both can only be checked physically. In the case of kitchen paper and toilet paper, two relevant attributes, such as texture and volume are also difficult to be conveyed online; thus, we also include them as sensory categories. Additionally, a characteristic that is shared by these three categories is that their package allows consumers to check the product, since it is usually transparent and soft.

On the other hand, there are the three non-sensory categories. Canned tuna and milk have an opaque package that does not permit to check the merchandise. Furthermore, the important characteristics of these products, such as if the oil used in the canned tuna is olive oil (best quality oil) or other vegetable oil, and the level of fat of the milk are easily communicated online. Thus we assign them to the group of non-sensory products. For the category of rice, it is true that some brads present a transparent package, but we believe the package works in this case simply as a signal for consumers for not to get the wrong type of rice at the conventional store. At the online store the types of rice are clearly stated at different sections of the Web page.

For each of these categories, we only included in the model the purchases made by those consumers who bought in the category both on the Internet and from physical stores that *exclusively* pertained to the high-price offline zone (i.e., those stores whose prices are exactly the same as online prices). This means that these consumers always saw equal prices online and offline while shopping in the category. For instance, 484 consumers purchased sandwich bread at least once on the Internet and once in physical stores during the collection period (Table 1). Additionally, for each category we include both purchase data and no-purchase data - *those trips in which consumers visited the physical or virtual store but did not shop any product from that category* - as observations for the estimations. Ignoring observations in which category incidence does not occur could be problematic if there were unobservable factors that affect the no-purchase and the brand-choice decisions (Chib et al. 2004). However, we decided to include only some of these no-purchase occasions, those that we define as "unplanned no-purchases" in the category. We explain this further in the next section.

5. Methodology

Imagine that in a concrete trip t to the store, a consumer/household h chooses either the alternative k (brand-size combination[1]) that provides her with the highest utility in the category or not to buy in the category. The trip can be either to a physical store (F) or to the virtual store, the Internet (I). The utility from the purchase of alternative k is given by:

$$U_k^t = \alpha_b + \alpha_s + BL_b^t(\beta_I^{BL}I_I^t + \beta_F^{BL}I_F^t) + SL_s^t(\beta_I^{SL}I_I^t + \beta_F^{SL}I_F^t) + P_k^t \cdot (\beta_I^P I_I^t + \beta_F^t I_F^t) + \varepsilon_k^t \qquad (1)$$

where:

α_m = the effect of brand b (b = 1, ..., B), given that alternative k has brand name b;

α_s = the effect of size s (s = 1, ..., S), given that alternative k has size s;

BL_b^t = a measure of loyalty to brand b (given that alternative k has brand name b) that equals one if brand b is purchased on the previous trip in which a purchase is done;

β_I^{BL} and β_F^{BL} = online and offline brand loyalty effects;

SL_s^t = a measure of loyalty to size s (given that alternative k has size s) that equals one if size s is purchased on the previous trip in which a purchase is done;

β_I^{SL} and β_F^{SL} = online and offline size loyalty effects;

P_k^t = price paid for alternative k at purchase occasion t;

β_I^P and β_F^P = online and offline price response parameters;

I_I^t and I_F^t = indicators for online or offline purchases; and

ε_k^t = error term

On the other hand, the no-purchase utility is given by:

$$U_0^t = \varepsilon_0^t \qquad (2)$$

Assuming that ε_k^t follows Gumbel distribution, the probability that household h chooses alternative k can be represented by a multinomial logit model:

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[1] Alternative k is usually a combination of brand and size, although for some alternatives such as canned tuna or sandwich bread, there appear additional characteristics to identify the different alternatives in the choice set.

$$p_k = \frac{\exp(\alpha_b + \alpha_s + BL_b^t(\beta_I^{BL}I_I^t + \beta_F^{BL}I_F^t) + SL_s^t(\beta_I^{SL}I_I^t + \beta_F^{SL}I_F^t) + P_k^t \cdot (\beta_I^P I_I^t + \beta_F^P I_F^t))}{1 + \sum\limits_{k'=1}^{J} \exp(\alpha_{b'} + \alpha_{s'} + BL_{b'}^t(\beta_I^{BL}I_I^t + \beta_F^{BL}I_F^t) + SL_{s'}^t(\beta_I^{SL}I_I^t + \beta_F^{SL}I_F^t) + P_{k'}^t(\beta_I^P I_I^t + \beta_F^P I_F^t))} \quad (3)$$

Household h will choose alternative k at trip t if $U_k^t > U_{k'}^t$ for all k'≠k and $U_k^t > U_0^t$. However, we do not consider all no-purchase trips for this comparison. As we have previously noted, a no-purchase trip is a trip in which the household visits the store but does not purchase in the category considered. However, within them, we distinguish between "planned no-purchases" and "unplanned no-purchases". We define a "planned no-purchase" as a trip in which a consumer visits the store but, since she has no need to purchase in a concrete category, she does not even go to check the alternatives in that category and obviously does not buy. On the other hand, we define an "unplanned no-purchase" as a trip t in which a household h visits an online or offline store with the intention of purchasing in the category but, once at the store, decides not to buy. The reasons can be diverse: her favorite brand is not at the shelf, prices are too high, etc. In our estimations, we only include "unplanned no-purchases". We think that this approach is closest to consumer real behavior than assuming that she observes all alternatives available (and their prices) at a certain category every time she visits a store.

Let's assume that t={t_k,t_0}, where t_k is the subset formed by the trips in which the household purchases in the category and t_0 the subset formed by the trips in which she does not purchase in the category. To determine which trips from t_0 are being considered in the comparison, we use the following criterion: First of all, we eliminate all those no-purchase trips previous to the first purchase of each household, since we cannot calculate any measure of loyalty for these trips[2]. Then, 1) for each household, we calculate her average purchase interval (API) - *average interval of days between purchases in the category* - 2) for each household, observing all her trips to the store and, beginning from her first trip (that is a purchase trip) and from now named "reference trip", we add the API and look for her following purchase, 2a) if the following purchase occurs prior to when it should have happened according to her API, we mark it as our new reference trip and incorporate it as an observation for the model (i.e. purchase trips are always considered), 2b) if this second purchase occurs after when it should have happened according to the API, we incorporate the first no-purchase trip after the API (if it exists) as a new observation for the model. We mark it as our new reference trip. Then we

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[2] The first purchase trip of each household will neither be included as an observation for estimation of the model since we cannot assign any loyalty value to it. We eliminate the first purchase of each household once we have built our loyalty measures.

just repeat this mechanism until we have analyzed all trips. All those no-purchase trips that have not been marked as reference trips are eliminated since it is considered that the household visited the store but had planned not to purchase in the category. The parameters of the model are estimated by maximum likelihood.

6. Results

Table 1 shows the results of the different estimations and some descriptive statistics for the six categories of product. Once all no-purchases are eliminated, purchase incidence in all categories is around 85%, what seems to be more reasonable than considering that purchase incidence is around 20%, number that we would obtain if we considered all no-purchase trips. Statistics also show that online purchases per year are smaller than offline purchases, what is not surprising, since consumers still purchase more at conventional stores than at the Internet.

All brand loyalty parameters, size loyalty parameters and price parameters are correctly signed and statistically significant for every category. For the kitchen paper category, we observe that, in line with our expectations, the impact of brand loyalty online (1.414) is stronger than offline (0.951), the impact of size loyalty online (1.315) is also stronger than offline (0.790) and that the price coefficient is smaller online (-3.668) than offline (-4.642). These results can be extended for the rest of categories in the analysis. However, to test our hypothesis, it is necessary to check whether these differences between online and offline parameters are statistically significant. Results for the asymptotic t-test for differences between parameters (Ben-Akiva and Lerman 1985) at table 2 give support to hypotheses H1 and H3. All online brand and size loyalty parameters are statistically higher than offline brand and size loyalty parameters, which were the results expected by our H1a and H1b hypotheses, respectively. For the case of the price parameter, it is statistically higher online than offline for 5 out of 6 categories. For the sandwich bread the difference is not statistically significant. However, we believe the estimation results obtained give enough support to our third hypothesis.

Finally, it rests to test whether the differences between online and ofline loyalty parameters are remarkably higher for the sensory categories than for the non-sensory categories. In choice models, the coefficients across models cannot be directly compared because coefficients of a model are scaled by the variance of the errors (Swait and Louviere 1993). However, the ratios of the same two variables across different models are comparable. Thus,

to check the validity of H2, we order the different categories by their ratio for online/offline brand and size loyalty effects. They are ordered from the biggest ratio to the smallest one (table 3). For the brand loyalty ranking, all sensory categories appear at the top of the table while non-sensory categories appear at the bottom, what gives support to H2a. For the ranking of size loyalty, we observe that this tendency exists, but results are not so clear: canned tuna is between the three categories with highest ratio. This means we cannot accept H2b and thus, that H2 is only partially supported.

7. Conclusion

In this paper we used a *unique dataset* to analyze online and offline consumer behavior in the grocery industry. This approach is new in the literature, since previous studies about consumer behavior across online and channels had used different sets of consumers for the comparison, thus being unable to observe the real impact of the Internet on consumer choice.

Concretely, we focused on the role of brand and size loyalty and price at each channel. Our attention was centered on these two aspects since both the effects of loyalty and price on consumer behavior play a key role on the design of firms' business strategies. To exhaustively study the effects of loyalty, our attention concentrated on the availability of information for choice at virtual and physical stores. The results show that consumers behave differently at online and offline shopping environments and that the impact of loyalty is not equal when the same group of consumers purchase online or offline. The effects of brand and size loyalty are stronger online and this difference, regarding brand loyalty, is even higher for those categories of products whose attributes are worse communicated online. This may involve difficulties for retailers while selling new products online, being this even harder for products where sensory attributes predominate. These results should motivate chains operating both online and offline to introduce new products (principally those with sensory attributes) at their physical stores or at their physical and virtual stores at the same time, but not exclusively at their virtual stores. Additionally, this would also imply that to make consumers switch between brands, more promotion activity would be needed online than at conventional stores.

Finally, we have found that price sensitivity online is lower than offline. Given this result, firms might increase online prices over offline prices without reducing sales. However, further research in price response is needed to check consumers' reaction towards a

hypothetical rise of online prices over offline prices. In any case, this result will surely be of interest for retailers for the design of their pricing and promotion polices online.

Table 1: Estimation results and descriptive statistics

	Sandwich Bread		Kitchen Paper		Canned Tuna		Toilet Paper		Full-fat Milk		Rice	
		Coefficient (p-value)		Coefficient (p-value)		Coefficient (p-value)		Coefficient (p-value)		Coefficient (p-value)		Coefficient (p-value)
Brand/size effects												
	Bimbo	-2.285(.000)	Scottex	2.759(.000)	Albo	-1.858(.000)	Scottex	-1.157(.041)	Asturiana	0.824(.255)	Caprabo	0.296(.346)
	Caprabo	-1.950(.000)	Colhogar	3.914(.000)	Cabo	-3.231(.000)	Colhogar	-1.879(.000)	Ato	0.909(.218)	Deltebro	0.015(.965)
	295 grammes	0.211(.207)	Caprabo	4.034(.000)	Calvo	-2.602(.000)	Caprabo	-1.203(.004)	Caprabo	0.176(.774)	Garrido	0.060(.880)
	450 grammes	-0.494(.000)	2 rolls	0.994(.000)	Caprabo	-2.102(.000)	4 rolls	0.089(.666)	Celta	-0,142(.589)	La Cigala	-1.143(.011)
	550 grammes	-0.044(.325)	3 rolls	-1.192(.000)	Cuca	-1.137(.001)	12 rolls	0.430(.000)	Pascual	0.318(.673)	Nomen	0.861(.020)
	Without Crust (1/0)	2.201(.000)	4 rolls	0.470(.004)	Rianxeira	-2.702(.000)	18 rolls	-0.666(.023)	President	-0.297(.686)	Perla Ebro	-1.753(.000)
					110 g	0.460(.000)			Nieve	-1.065(.052)		
					195 g	0.368(.002)			2 liters	-0.240(.915)		
					240 g	0.407(.001)						
					Olive (1/0)	0.499(.000)						
Brand loyalty												
Offline		1.691(.000)		0.951(.000)		2.113(.000)		1.429(.000)		2.727(.000)		2.036(.000)
Online		2.353(.000)		1.414(.000)		2.619(.000)		2.525(.000)		3.235(.000)		2.526(.000)
Size loyalty												
Offline		1.315(.000)		0.790(.000)		1.230(.000)		0.932(.000)		1.822(.000)		
Online		1.567(.000)		1.315(.000)		1.547(.000)		1.166(.000)		2.129(.000)		
Price												
Offline		-0.325(.000)		-4.642(.000)		-0.299(.000)		-0.468(.018)		-6.575(.000)		-2.211(.000)
Online		-0.308(.000)		-3.668(.000)		-0.192(.000)		-0.391(.052)		-4.710(.000)		-0.876(.015)
# Observations	7769		5694		4641		8418		6298		3558	
Log likelihood	-11348,680		-7116,561		-7562,418		-12305,510		-6898,448		-4100,713	
# Purchase trips	6567		4907		3726		7258		5388		3038	
# No-purchase. trips	17624		28365		19444		32023		15348		18167	
# Total trips	24191		33272		23170		39281		20736		21205	
# No-purchase trips included	1202		787		915		1160		910		520	
% Purchase incidence*	84,53		86,18		80,28		86,22		85,55		85,39	
# Consumers	484		630		431		765		417		387	
# Online purchases/year	4,55		3,48		3,95		3,80		4,89		3,21	
# Offline purchases/year	9,02		4,31		4,69		5,69		8,03		4,64	
# Total purchases/year	13,57		7,79		8,65		9,49		12,92		7,85	

* Purchase incidence is calculated over trips/observations included in the final analysis

Table 2: Asymptotic t-tests for differences between online and offline coefficients

Category	Brand loyalty		Size loyalty		Price	
	Ratio on/off	Asymptotic t-test	Ratio on/off	Asymptotic t-test	Ratio on/off	Asymptotic t-test
Sandwich bread	1.392	7.023	1.192	3.882	0.948	0.685
Kitchen paper	1.487	6.235	1.664	5.971	0.790	11.751
Canned tuna	1.240	6.378	1.257	3.543	0.642	9.108
Toilet paper	1.767	16.156	1.251	4.052	0.834	2.215
Full-fat milk	1.186	5.935	1.169	2.275	0.716	7.188
Rice	1.241	5.064	-	-	0.396	10.430

Table 3: Ordered ratios of online/offline loyalty coefficients

Brand loyalty		Size loyalty	
Toilet paper	1.767	Kitchen paper	1.664
Kitchen paper	1.487	Canned tuna	1.257
Sandwich bread	1.392	Toilet paper	1.251
Rice	1.241	Sandwich bread	1.192
Canned tuna	1.240	Full-fat milk	1.169
Full-fat milk	1.186	Rice	-

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