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Assesing the success of private labels online: differences across categories in the grocery industry

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Abstract This paper analyses online competition between private labels and national brands. Purchase data from a grocery retailer operating both on and offline are used to compute two measures of competition (intrinsic loyalty and conquesting power) for both the private label, and what this paper terms the "reference brand" (a compound of the different national brands within a category), in 36 product categories. The results show that the competitive position of the private label, relative to that of the reference brand, varies across categories and across channels. Using the framework devised by Steenkamp and Dekimpe (Long Range Plan 30(6):917–930, 1997. https://doi.org/10.1016/S0024-6301(97)00077-0) we combine the two computed measures of competition, and classify the private label as a miser, a giant, a fighter or an artisan in each channel and category. The results show: (1) that private labels significantly improve their competitive position online; and (2) that this improvement is not equal across all categories.

Keywords Private label · Store brand · National brands · Brand competition · Online channel · Multichannel retailing

1 Introduction

Private labels (PL), products branded by the retailer, also known as store brands or retailer brands, are becoming a dominant feature in Western world markets. More than two-thirds of total U.S. households (70%) agree that store brands are a good

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alternative to name brand products [2]. According to a 2014 report [3], PL products accounted for roughly 16% of Fast-Moving Consumer Goods dollar share worldwide; and over 25% in many Western Europe countries.

Not surprisingly, the growth of PLs has triggered an intense battle to see whether PLs or national brands are proclaimed the winners in consumer markets. Some research has been conducted on the increasing importance of PLs [1] and the factors influencing their market share [4, 5] while other studies, such as [6] explore the possibility of a decline in customer loyalty to national brands. Other streams focus on the competitive strategies (positioning on price, quality or feature differentiation) of PLs and national brands [7, 8]; or the cross-category effects of PLs [9]. None of this research, however, has considered the new arena of competition between PLs and national brands: online shopping channels. In 2016, online sales accounted for $399.53 billion in the U.S. and $261.7 billion in Western Europe [10]; and all the predictions suggest further growth in the future. This raises a new question: what form will the rivalry between PLs and national brands take online?

Previously, researchers have little attempt under this issue [11–13]. Kopalle et al. [13] propose the online channel as an interesting context in which to examine competition between PLs and national brands, but go no further. Amrouche and Yan [11] offer a theoretical approach to the question, but do not study it empirically. Arce-Urriza and Cebollada [12] analyse the issue, but focus on general differences across channels rather than on the cross-channel and cross-category differences examined in this paper. Canadian Center of Science and Education [14] analyze the consumer's choice between online and offline channels for different types of products (search, experience and credence), but recognize, as a limitation, that other factors, such as the assortment of PL products may affect the decision.

The design and implementation of successful marketing strategies require a deep understanding of the competitive patterns of PLs and national brands across channels. This paper has investigated the difference in online and offline competition between PLs and national brands in grocery channels. We compute two measures to characterize the competitive position of the PL and what we call the reference brand, or RB (a conglomerate representing all national brands in the market). To evaluate the strength of brand competition between PL and RB, we examine their intrinsic loyalty (a measure of customer loyalty towards a brand) and conquesting power (the level of attraction of a brand to buyers of other brands) across the two channels [1, 15]. With these metrics, we classify the competitive position of the PL against the RB as a giant, a fighter, an artisan or a miser in each channel using the framework developed by Steenkamp and Dekimpe [1]. The results show that, when marketed online as opposed to offline, the PL scores higher than national brands in these two measures. Furthermore, the fact that this general improvement is not homogeneous across product categories suggests the need for management to adjust online global marketing strategies to category-specific characteristics.

The rest of the paper has been organized as follows. Section 2 reviews the literature on the growth of PLs and their success across categories; evaluates the emergence of the online channel, particularly in the grocery industry; and highlights the contribution of this research. Section 3 explains the model used; Sect. 4 presents

the data; Sect. 5 describes the results; and Sect. 6 provides the conclusions. Finally, Sect. 7 discusses the limitations of the paper and proposes lines for future research.

2 Literature review

2.1 The growth of PLs

When they emerged in the market in the 60's and 70's, PLs offered cheap, generic products, far removed in quality from leading national brands. Since then, however, PLs have greatly improved, and now closely rival national brands in quality and variety. This improvement has turned them into a more acceptable, wiser option for a large group of consumers [16]. PLs are perceived as trademarks; they constitute brands in their own right [16]. They are, in fact, popping up everywhere and enjoying record sales. According to PLMA (Private Label Marketing Association) PL sales in the US in 2014 and 2015 combined grew 5% across all channels, reaching a dollar share of 17.7%, the highest ever [17].

Not only are PLs drawing level with national brands in terms of consumer expectations, but their appeal for consumers is becoming even stronger due to the current economic recession. A 2014 report [18] reveals that 60% of consumers across 55 countries from the Asia Pacific region, Europe, North America, Latin America and Middle East/Africa said they were shifting to PLs as a result of the economic downturn. In Europe also, they are attracting huge numbers of consumers, and in 2014 already accounted for at least 30% of the consumer-packaged goods (CPG) market across all of Europe. Switzerland, the UK and Spain have the highest dollar share, above 40%. PL is developed in Eastern Europe, with shares from 24% in Poland to 5% in Ukraine [18]. Dubé et al. [19] also confirm that during the past economic recession PL share increased significantly.

PLs are not just a recession phenomenon, however. Some of the growth of PLs in a recession remains as a consequence of consumer learning [16]. It is not surprising, therefore, that national brands are appealing to consumer loyalty through advertising and promotions designed to maintain their market shares. Manufacturers are well aware that the 'scars' in their market shares made by economic downturns are slow to heal, even after the economy picks up [20]. A recent study [21] proves this unequivocally: using data covering 21 years for 106 grocery categories in the U.S., it finds that PLs behave counter-cyclically; i.e., they show gains in market share during economic downturns, but part of the gains they make during contractions persist into subsequent expansion periods.

2.1.1 Differences across categories

Traditionally, PLs have been available in supermarkets, drug stores and discount stores, but they are now also prominent in specialist chains (such as those selling hardware, household goods, baby care, home improvement, pet care, toys, sporting goods and others). According to PLMA [22], PLs enjoyed robust growth in U.S. drug chains, with sales increasing by + 5.5% to reach a total of $8 billion in 2012,

with a unit share of 16.6%. In the drug sector, sales of PLs have grown at an annual rate of + 6.9% since 2009, while annual gains for national brands have averaged only + 1.6%. However, the most spectacular figures are to be found in the grocery sector. PL sales in U.S. supermarkets totaled $59 billion in 2012, with a unit share of 23.1%. Since 2009, sales in the supermarket channel have increased at an annual rate of + 2.6%, versus + 0.9% for national brands [22].

Hoch and Banerji [4] find dramatic variation in PL market share across grocery categories, with PL refrigerated and frozen foods showing higher market shares, and non-food items and health and beauty aids showing lower shares. Private labels do better in categories where product quality is high and variability is low; and retailers tend to position their PLs in larger, more profitable categories. A 2014 report [18] shows PL in the grocery sector to be strong in commodity categories such as milk, fresh eggs, rice, edible oil, vinegar and sugar or in those with little differentiation (e.g., first aid, foil and plastic wrappings), and weak in categories where national brands (e.g., candy, gum, and beer) and high-innovation brands (e.g., detergents, deodorants, cosmetics) engage in heavy marketing. The results obtained by [18] and [4] indicate therefore that certain categories are less suited to PLs than others: a point on which a third of consumers (35%), even in highly PL-developed markets, such as Europe, agree [3].

2.2 The emergence of the online channel

In parallel with the above, both the retailing and the shopping experience have evolved greatly with the transition from traditional to electronic commerce [23, 24]. The main exponents of electronic retailing is the Internet, which has emerged as a new channel for product marketing and distribution. Despite the latest economic crisis, the growth of the Internet as a sales channel has persisted in recent years and is expected to continue in the future. For example, according to [10], U.S. online retail sales grew from $349.25 bn in 2015 to $399.53 bn in 2016, and are growing at a rate of 14% yearly. Center for Retail Research [10] shows that Western European online retail sales also grew from €201.33 bn in 2015 to €232.60 bn in 2016, growing at a yearly rate of 15%.

Consumers are increasingly using the Internet not only to purchase goods, but also to seek product information [25]. In other words, the Internet is becoming a major marketing channel, whether the final purchase is made online or offline. In fact, several studies have investigated the multichannel performance and strategies of firms operating both on and offline [26]. Nevertheless, as will be explained later, the question remains of how well PLs perform in the online channel.

2.3 The online grocery industry

Theoretically, as frequently-purchased, tangible products with varying differentiation potential, groceries are one of the most difficult products to sell online. Many are perishable, and therefore have a limited shelf life; a problem that does not affect other products. In addition, some purchase habits acquired offline (e.g. sampling and examining the product before purchase) are not possible online, and many

consumers may find home delivery expensive in relation to the volume purchased [27–29]. Online grocery marketing isn't totally beset by snags, however. Shopping for groceries online is an attractive option for consumers who dislike conventional shopping [27] and seek the general ease and convenience (i.e. no searching for a parking space, no crowds, no queues at the till, and no heavy shopping bags to carry) attached to online grocery shopping. As a blogger writes, "Internet shopping carts weigh only 0.03 grams" and "The grocery delivery person does it all; [load your groceries in the car, unload them at home, and carry them into the kitchen]" [30]. Recent research [31] shows that when consumers start buying groceries online, they tend to select the store of their preferred chain. Over time, however, consumers compare across online stores, and online assortment becomes an important criterion for store choice.

Online retailing, particularly in the grocery industry, seems to be a promising area for research into competition between PLs and national brands [13]. On the one hand, despite its pros and cons, the online grocery market is experiencing rapid growth. From a doubtful beginning at the end of the 90s, online grocery shopping has become an option for many consumers. A recent report [32] shows that 40% of Chinese consumers, have ever purchased fresh groceries online, being the figures for South Korea and the UK 39 and 25% respectively.

It is hard to find any major grocery retailer that hasn't opened an online store. Even major players like Amazon now sell groceries; including perishables (see Amazon Fresh). On the other hand, when shopping for groceries, consumers behave differently online versus offline, and spending in categories such as food and beverages, and, particularly, health and beauty products, is higher online than offline [33].

Further to the above, while the confrontation between PL and national grocery brands in the offline channel has been widely analysed [1, 4, 8], to our knowledge, little empirical research has focused on this phenomenon in the online channel. As already noted, [13] signal the interest of the topic, but go no further. The authors of [11] argue that research has focused on offline versus online channel competition, but has not investigated brand competition in the new channel. They propose a game-theoretic model to examine the possibility of combating the increasing popularity of PLs through the direct sale of national brands online. Works dealing, at least indirectly, with brand competition online include [34] and [35], which forecast a change in the importance of brand names and price in the online environment, but do not tackle the PL-national brand dichotomy. Arce-Urriza and Cebollada [12] have investigated the issue, but do not go far into the subject of PL/national brand competition at category-level.

2.4 Contribution of this research

The primary interest in this study is to evaluate online PL/national brand competition empirically and thereby enhance the literature on the topic. Our approach is to compare offline and online brand competition using 36 grocery product categories. As already shown, PLs are firmly established in the grocery market, therefore appropriate data for the purpose are easily available. We conduct

our analysis by focusing on competition between PL and RB (a construct summarizing all national brands within a category) in each category. Competition between these two types of brand online and offline is measured with two metrics, intrinsic loyalty (customer loyalty to a brand) and conquesting power (the level of attraction of a given brand to buyers of other brands) [1, 15]. Note that, although online loyalty has been examined extensively in the literature from the perspective of "loyalty to a website", (e.g., [36]; see [37] for a detailed review), this paper considers the issue from the perspective of "brand loyalty online versus brand loyalty offline". Ho [38] do, in fact, analyse online brand characteristics, focusing, unlike us, on inter-brand comparisons (not loyalty) and on auction markets.

Some other investigations [12, 33, 35] have evaluated online versus offline consumer behaviour for different grocery categories. Unlike us, however, they do not study consumer choice between PLs and national brands. Chu et al. [35] focus their attention not on brand loyalty, but on consumer price sensitivity. Accounting for observed and unobserved household heterogeneity within a random coefficients logit model for purchase incidence and brand choice, they observe that consumers exhibit lower price sensitivities in the online than in the offline medium. Chu et al. [33] study consumer behaviour in 93 grocery categories, and show that consumers are more brand and size loyal but less price sensitive in the online than in the offline environment, and that this result is category dependent (differences between channels widen in the food and sensory product categories). As well as by making a distinction between loyalty for PLs and national brands, we also differ from [33] in how we measure brand loyalty. While they define brand loyalty as an exponentially-weighted average of past purchases as in [39], pre-specifying the smoothing constant as .8, as in [40], we follow [1, 15] by measuring a brand's competitive position using two different dimensions: intrinsic loyalty and conquesting power.

Arce-Urriza and Cebollada [12] evaluate competition between PLs and national brands using three indicators: market share, loyalty and conquesting power. They find that, whereas loyalty to both PLs and national brands increases in the online environment, market share and conquesting power increase only for PLs. Our investigation differs from [12] in several ways. Firstly, we take a relative approach to the problem (i.e., we evaluate the competitive strengths of the PL with respect to national brands, as will be explained in more detail further on), whereas [12] follow an absolute approach (i.e., they evaluate the competitive strengths of PLs and national brands separately). Secondly, we show results at category level. Lastly, we evaluate the competitive position of each brand type (PLs and national brands) for every product category in both the online and offline environments.

Colombo and Morrison [15] present a simple model (the hard-core loyal/potential switcher model) for analysing and interpreting the inherent loyalty in consecutive product purchases. Their model proposes that brand repurchases are the result of (a) hard-core loyal consumers repurchasing brand i due to their attachment to the brand or its superior performance, and (b) the fraction of potential switchers (non-brand i buyers) who will next buy brand i. Our methodology is inspired by their model, but differs from theirs in many respects. Firstly, [15] do not consider the PL-national brand dichotomy. Secondly, theirs is not an extensive cross-category study. In fact, they test their methodology on only two categories: automobiles and an

unspecified CPG category, whereas we use 36 grocery categories. Thirdly, they do not consider shopping channel effects, while we focus on online/offline differences.

Steenkamp and Dekimpe [1] also measure brand power in terms of intrinsic loyalty-building capacity and conquesting power. Based on the brand's position along these two dimensions, they classify it as a giant, a miser, a fighter or an artisan. They then use this classification to evaluate the absolute and relative strength of Albert Heijn, the leading Dutch PL, in 19 grocery categories. The results show that the power of the PL varies dramatically across product categories. We adopt the methodology proposed by [1] but with several variations. Firstly, we perform the analysis for both the online and offline channels, whereas they focus solely on the offline channel. In this sense, we could say that our investigation is an evolution from [1], given that we add a new channel to the competitive environment. Secondly, we extend the investigation from 19 to 36 grocery categories. Thirdly, while they compare the relative position of the PL with respect to the average of the top three national brands (weighted by their respective market share), we use an average metric to represent all the national brands in each category (we call this the reference brand) thereby not limiting the analysis to the top three national brands. Lastly, to classify the PL as a giant, a miser, a fighter or an artisan, we use a ratio instead of a difference (further details of this appear in the methodology section).

3 Model

We have investigated competition between PL and national brand grocery products online and offline. Specifically, we examine whether the competitive position of PLs against national brands varies across channels and product categories. As already noted, our choice of methodology to reach this objective is inspired by the framework of [1], who analyse the competitive position of the PL against national brands in the offline channel by examining two dimensions: intrinsic loyalty and conquesting power [15]. The combination of these two dimensions yields four competitive positions: Giants, Misers, Fighters and Artisans.

3.1 Intrinsic loyalty and conquesting power[1]

We use the model devised by [15] to make intrinsic loyalty and conquesting power constructs. The input to the model is a switching matrix whose elements (i, j) represent the fraction of customers who purchased brand i on one purchase occasion but switched to brand j on the following occasion. The diagonal elements of the matrix can be used to compute the repeat-purchase probabilities, but they do not distinguish between (1) customers who repurchase the brand out of intrinsic loyalty towards it; and (2) customers who are brand indifferent and repurchase it by chance.

[1] This section follows the description of Colombo and Morrison's model from [1]. The interested reader is referred to the original [15] for a more detailed discussion of the model and its estimation.

The model allows us to differentiate between intrinsically brand-loyal customers, and potential switchers.

In [15] 's model, the probability of repurchasing brand i is $p_{ii} = \alpha_i + \pi_i(1 - \alpha_i)$; that is, p_{ii} is the proportion of intrinsic loyalists (α_i) plus the proportion (π_i) of potential switchers $(1 - \alpha_i)$ who end up repurchasing brand i. Similarly, the probability of purchasing brand j after purchasing brand i is $p_{ij} = \pi_j(1 - \alpha_i)$; that is, the proportion (π_j) of potential switchers $(1 - \alpha_i)$ who choose brand j. In terms of our two measures of interest, in the case of brand i', it is clear that α_i measures its intrinsic loyalty (the ability of a brand to keep its current consumers), while π_i is a measure of its conquesting power (the share of non-loyal consumers it is able to attract over a given period). Please see further specifications of our model in the "Appendix 1".

3.2 The reference brand

Although intrinsic loyalty and conquesting power are calculated across all brands and categories in the study (183 brands in 36 categories, as will be explained later), we try to keep the analysis manageable by concentrating on their values for two specific brand types: the PL and the reference brand (RB).

In our study, there is only one PL in each category but there may be one or more national brands. In the spaghetti category, for example, there are 4 national brands (see Table 4 in "Appendix 3)". The RB enables us to summarize the intrinsic loyalty and conquesting power effects of these 4 national brands into single measures of intrinsic loyalty and conquesting power, respectively. That is, the RB is used to evaluate the competitive strengths of all national brands in a category as a whole. This gives 36 categories*2 brands (PL and RB)*2 channels (online and offline)*2 loyalty metrics (intrinsic loyalty and conquesting power) = 288 metrics to compute, which would otherwise result in 183 brands*2 channels*2 loyalty metrics = 732 parameters.

We compute the intrinsic loyalty and conquesting power of the RB in the offline environment as: $IL(RB)_i^{OFF} = \sum_{i=1}^{I} \frac{IL_i^{OFF} \cdot MS_i^{OFF}}{\sum_{i=1}^{I} MS_i^{OFF}}$ and $CP(RB)_i^{OFF} = \sum_{i=1}^{I} \frac{CP_i^{OFF} \cdot MS_i^{OFF}}{\sum_{i=1}^{I} MS_i^{OFF}}$, where IL_i, CP_i and MS_i are, respectively, the intrinsic loyalty, conquesting power and market share of brand $i = 1,\ldots, I$ in the offline environment, where I is the number of national brands in the category.

Thus, the intrinsic loyalty (conquesting power) of RB is the average of the intrinsic loyalty (conquesting power) of all the national brands in the market, weighted by its market share. Note that $\sum_{i=1}^{I} MS_i < 1$ (because the PL market share is not included in this equation).

Analogously, the intrinsic loyalty and conquesting power of the RB in the online setting are $IL(RB)_i^{ON} = \sum_{i=1}^{I} \frac{IL_i^{ON} \cdot MS_i^{ON}}{\sum_{i=1}^{I} MS_i^{ON}}$ and $CP(RB)_i^{ON} = \sum_{i=1}^{I} \frac{CP_i^{ON} \cdot MS_i^{ON}}{\sum_{i=1}^{I} MS_i^{ON}}$.

3.3 The relative approach

Imagine a category with three competing brands: the PL, national brand A and national brand B. If we were to adopt an "absolute" approach, we would see 1) how PL competes against national brand A, and 2) how PL competes against national brand B, but we would not see how PL competes against national brands in general (A and B together). To overcome this limitation, therefore, we adopt a "relative" approach, and compare the IL and CP of the PL against the IL and CP of the RBs, in each setting. The importance of the relative approach is illustrated in detail with an example in "Appendix 2".

While [1] use both the absolute and relative approaches, we use only the latter, but introduce a variation by comparing the IL and CP of the PL and the RB by means of a ratio instead of computing differences. The main advantage of ratios over differences is that they are easier to compare across categories.

The offline IL and CP ratios of PLs and RBs are:

$$RIL^{OFF} = IL(PL)^{OFF} \Big/ IL(RB)^{OFF} \text{ and } RCP^{OFF} = CP(PL)^{OFF} \Big/ CP(RB)^{OFF}$$

and the analogous ratios online are:

$$RIL^{ON} = IL(PL)^{ON} \Big/ IL(RB)^{ON} \text{ and } RCP^{ON} = CP(PL)^{ON} \Big/ CP(RB)^{ON}$$

These relative brand competition measures (RIL and RCP) are used hereafter to examine PL competitive position across product categories and channels.

3.4 The miser-to-giant classification

According to [1], intrinsic loyalty and conquesting power can be combined in a single, 2 × 2 brand-power matrix, yielding four quadrants (Fig. 1): low or high intrinsic loyalty combined with low or high conquesting power.

Fig. 1 Miser-to-giant classification

We fix the separating lines between what we consider low and high intrinsic loyalty, and low and high conquesting power, respectively, at value 1. We select this value because RIL higher (lower) than 1 indicates that the PL commands stronger (weaker) intrinsic loyalty in the market than RB does. Similarly, RCP higher (lower) than 1indicates that PL has stronger (weaker) conquesting power in the market than RB does.

In a given category, if RIL and RCP are both lower than 1 (lower-left-hand quadrant), the PL is classified as a *Miser*, since there is no doubt that this quadrant is the least attractive. If, in contrast, RIL and RCP are both higher than 1 (upper-right-hand quadrant), the PL is labeled a *Giant*, because this quadrant is clearly the most attractive.

The upper-left hand quadrant and the lower-right hand quadrant represent intermediate levels of attractiveness. In categories that fall into the upper-left-hand quadrant, the PL performs as a *Fighter,* in other words, it is more successful than the average national brand in the fight to attract the customer on each purchase occasion (i.e., it has more conquesting power). Finally, in categories that fall into the lower-right-hand quadrant, the PL performs as an *Artisan*. In these categories, PL has a larger base of loyal consumers than the average national brand, but is less successful in attracting new customers.

We apply the miser-to-giant classification in the offline and online settings, respectively and then compare, by categories, the performance of the PL in each setting.

4 Data

We investigate one of the leading grocery chains operating in Spain.[2] In terms of sales value, it ranks among the top ten retail chains in the country [41] and among the top 250 worldwide [42]. It offers mainly supermarket formats, with medium-sized and large stores, and emphasises service, customer relationship management, and loyalty programs. The retailer has a PL carrying the same name as the store, which is positioned as a high-quality brand, and is more attractively priced than national brands (i.e., it is what is known as a copycat or me-too PL) [43]. This chain also offers two more PL brandsin a small number of categories with a marginal share (one generic claiming to be the cheapest in the category, and another premium brand). Overall, 1600 out of approximately 16,000 references sold are PL (10%), which represents a market share of 39.54% across categories in unit terms.

The retailer in question went online in 2001, thus becoming a pioneer in the market. The online store was its largest store in terms of sales when the data were collected. It has adopted the policy of offering, basically, the same assortment at the same prices in both settings. Marketing activity (promotions) is also at roughly the same level across both environments. Purchases from this grocery chain by a group of 2742 consumers resident in Barcelona were analysed over the 12-month period from December 2002 to November 2003. To be included in the panel, the

[2] Confidentiality prevents us from naming the retailer.

households had to have made at least one online purchase from this retailer. Observations included all trips by these households both to the online and offline stores of this grocery chain, every item in the basket, together with the price, brand, size, and, for some references, characteristics such as flavour or colour. The offline data were collected as scanner data, and the online data through the website.

4.1 Categories included in the study

To examine the performance of PLs against national brands across online and offline channels, we use 36 product categories. Like any other grocery chain, our retailer sells a huge range of products, and these 36 categories are an attempt to adequately represent this variety, by covering food, beverage, personal care and household cleaning/care products. Two further criteria were applied in the category selection process: (a) the category should include a PL, and (b) the PL should be available both offline and online. The categories included in the study and their basic descriptive statistics are shown in Table 4 ("Appendix 3").

In each product category, all brands with more than 100 observations, and a market share of more than 1% are retained. The number of brands satisfying these requirements varies across categories (e.g., 2 brands in the aluminium foil category versus 10 in the biscuit category). However, the total market share of the brands considered within each category exceeded 75% in all instances. For 29 categories, moreover, the summed market shares of the brands retained amounted to 85%. It is also worth noting that the PL fulfils all the established requirements in every category, and is therefore retained in all cases. The analysis covered a total of 183 brands from 36 different product categories.

Table 4 ("Appendix 3") shows several characteristics of the categories under study: number of brands in the category, the PL's market position (the ranking of the PL among the top brands in the category in terms of market share), category inter-purchase time (in days), and some market share and price data. The volume market share data include market concentration in the category (measured as a Herfindahl concentration index), the PL market share, and the RB market share (as the weighted market share of all national brands within the category). The price data include price of PL, price of RB (as the weighted price of all national brands within the category) and percentage price difference between PL and RB.

The spaghetti category, for example, features 5 brands (4 national brands and the PL), with the PL commanding the highest market share. Mean inter-purchase time in this category is 44.61 days, and the market concentration (Herfindahl Index) is 0.27 online and 0.30 offline. The PL accounts for a market share of 28.52% offline, and 39.02% online, whereas RB accounts for a market share of 26.59% offline and 23.87% online. Finally, consumers pay 1.11 Euros per Kg for PL spaghetti and 1.74 Euros per Kg (on average) for a national brand. In other words, the PL is 36.06% cheaper than the national brand in the spaghetti category. The last row in the table depicts the average category in the study.

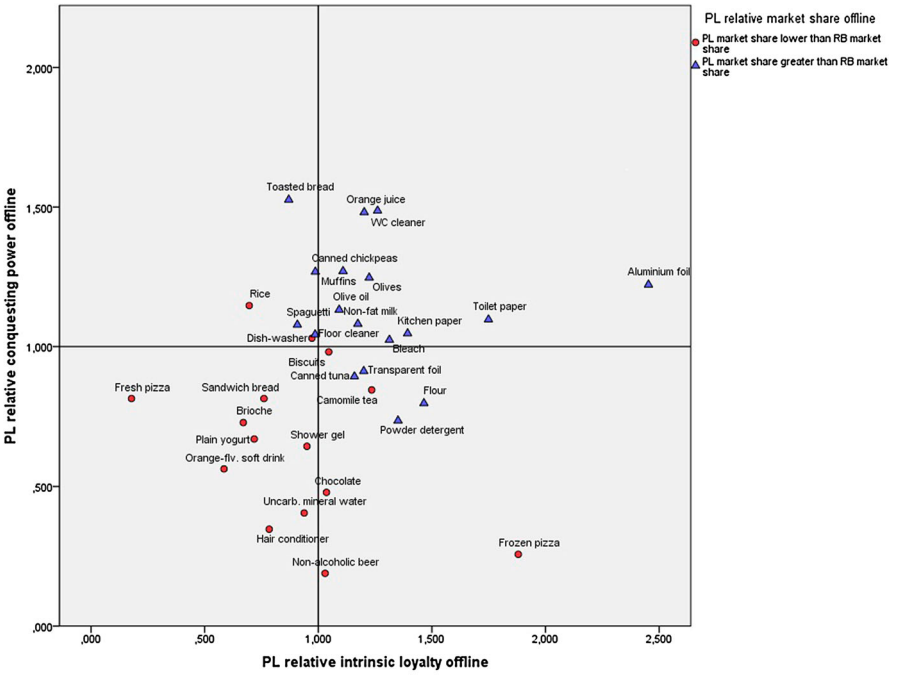
5 Results

5.1 Miser-to-giant classification offline and online

Figure 2 shows the PL's relative position in terms of intrinsic loyalty and conquesting power in the offline channel for all 36 product categories. The interested reader can check the specific values used as input for this map in Table 5, "Appendix 3".

Figure 2 indicates those categories where the PL competes offline as a giant, a miser, a fighter or an artisan. We find that PL can adopt any of these roles offline, depending on the category. Thus, it can be seen to be: (1) a giant in categories such as WC cleaner and non-fat milk; (2) a miser in categories such as hair conditioner and still mineral water; (3) a fighter in categories such as toasted bread and rice; and (4) an artisan in categories such as flour and frozen pizza.

For the sake of completeness, Fig. 2 not only informs about the relative intrinsic loyalty and conquesting power of the PL across categories, but also about its relative market share. For the product categories in triangles, the PL's market share is higher than that of the RB, whereas, for the product categories in circles, it is lower. These scores enable us to observe that the stronger the PL's relative intrinsic loyalty and



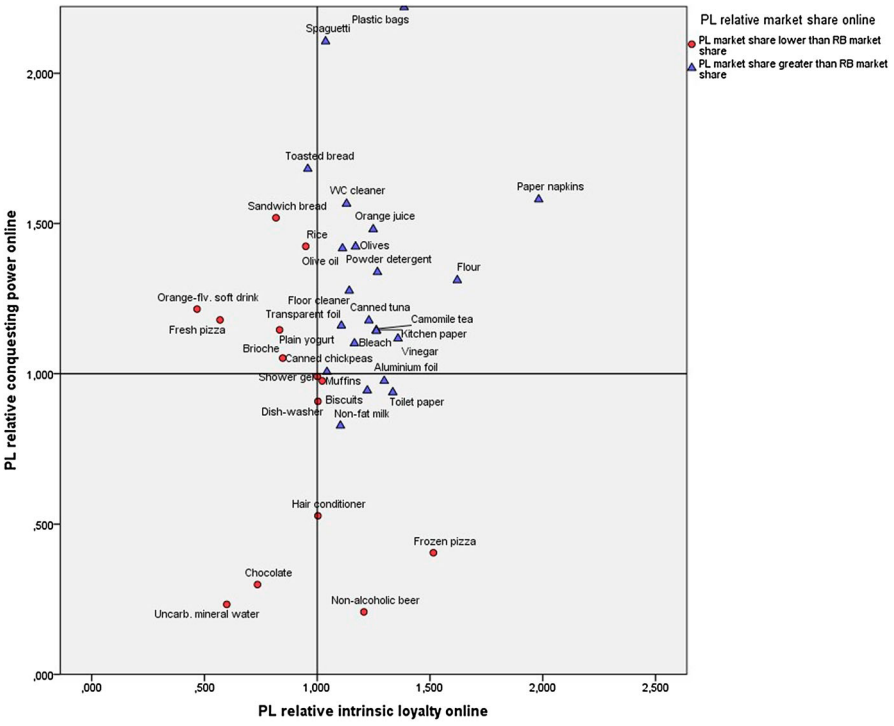
Note 1: PL relative conquesting power (intrinsic loyalty) < 1, PL conquesting power (intrinsic loyalty) lower than RB conquesting power (intrinsic loyalty); PL relative conquesting power (intrinsic loyalty) > 1, PL conquesting power (intrinsic loyalty) greater than RB conquesting power (intrinsic loyalty).
Note 2: To improve the visibility of the figure, Plastic Bags (3.63, 1.08), Vinegar (3.94, 1.30) and Paper Napkins (5.30, 1.36) (at the upper-right-hand quadrant: giants) are not shown.

Fig. 2 Relative position of the PL offline

conquesting power, the greater also is its relative market share. In all categories where it is a miser, the market position ratio of the PL is lower than 1; whereas in all categories where it is a giant it is greater than 1.

Figure 3 displays the PL's relative competitive position across categories online. The interested reader can check the specific values used as input for this map in Table 5, "Appendix 3". Figure 3 shows that the number of categories in which the PL classes as a miser decreases considerably in the online setting, where it performs as such in only two categories: still mineral water and chocolate. Offline also, the PL is a miser in the still mineral water category; thus, it is a miser in both settings for this category. The PL is not a miser in the chocolate category offline, however, and has therefore migrated, between settings, from artisan to miser in this category. This is an exception, however. The general pattern shows that PL competitive strengths improve online. In the transition from offline to online, several misers turn into fighters (e.g., orange soft drink), artisans (e.g., hair conditioner) or giants (e.g., brioche). Thus, the PL surpasses its rivals in more categories online than offline.

Looking closely at Fig. 3, it is easy to see that the PL has higher conquesting power with respect to RB online than offline. The results are less clear when it comes to intrinsic loyalty, however. This finding is easier to appreciate in terms of numbers (see Table 5 in "Appendix 3)". Average PL relative conquesting power grows from 0.94



Note: PL relative conquesting power (intrinsic loyalty) < 1, PL conquesting power (intrinsic loyalty) lower than RB conquesting power (intrinsic loyalty); PL relative conquesting power (intrinsic loyalty) > 1, PL conquesting power (intrinsic loyalty) greater than RB conquesting power (intrinsic loyalty).

Fig. 3 Relative position of the PL online

offline to 1.14 online (both statistically significant), thereby corroborating the improvement found in PL conquesting power online. However, average PL relative intrinsic loyalty declines from 1.37 offline to 1.11 online, although this finding is not statistically significant. Does this mean that the PL commands less intrinsic loyalty online than the RB does? Definitely not. Notice that PL intrinsic loyalty online is still greater than one, which means that IL(PL, On) $>$ IL(RB, On). What these figures show is that, compared to RB, the PL has more intrinsic loyalty, both offline and online, although the difference does not increase online.

Figure 4 summarizes all the repositioning of categories in the miser-to-giant classification following the transition from offline to online. Specifically, there are 16 no changes and 20 changes in the classification, 14 of which are improvements, 4 are deteriorations and 2 are neutral.

5.2 Characteristics of misers-to-giants offline and online

Tables 1 and 2 show the characteristics of the categories in which the PL competes as a giant, a miser, a fighter, and an artisan, offline and online, respectively. Each table includes, below the basic descriptives, the results for the independent sample t-tests to check the significance of the differences across the four groups. These tables show the categories, (a) by type of product: food, drink, home-care, or personal care; and (b) whether it is a sensory category (yes/no). A category is considered sensory when its packaging is transparent (and therefore allows consumers to check the product before the purchase). These tables also show that (c) the weight of the category in the shopping basket (in units averaged across customers), (d) the average price gap between PL and RB within the category (%), (e) category inter-purchase time (days, averaged across products and customers), (f) market concentration in the category (Herfindahl index), and (g) the number of brands in the category.

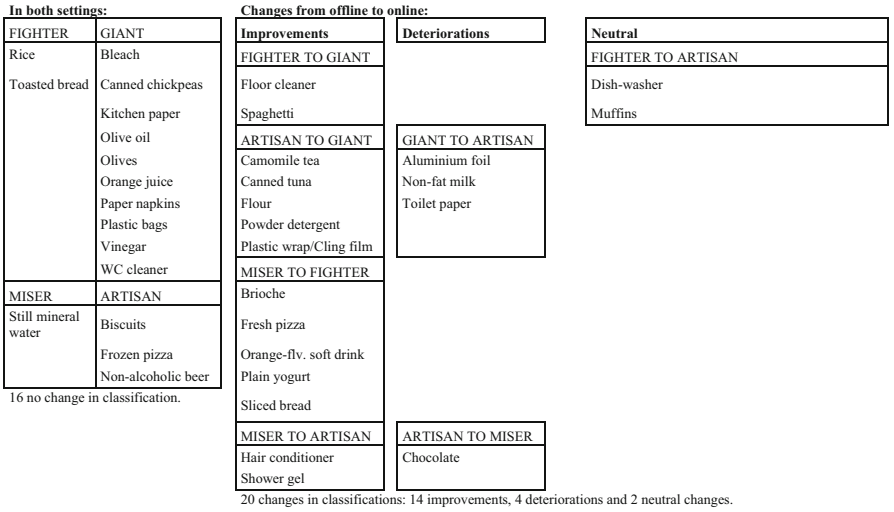


Fig. 4 Miser-to-giant classification: offline/online differences

Table 1 Characteristics of giants, misers, fighters and artisans in the offline setting

Fighter				Giant			
N	6				13		
Characteristics	Mean	SD	Std. error mean	Characteristics	Mean	SD	Std. error mean
Food	66.67%	0.52	0.21	Food	30.77%	0.48	0.13
Drinks	0.00%	0.00	0.00	Drinks	15.38%	0.38	0.10
Home care	33.33%	0.52	0.21	Home care	53.85%	0.52	0.14
Pers. care	0.00%	0.00	0.00	Pers. care	0.00%	0.00	0.00
Sensory	66.67%	0.52	0.21	Sensory	53.85%	0.52	0.14
Basket weight	0.39%	0.18	0.07	Basket weight	0.46%	0.29	0.08
PL and RB price difference	25.02%	0.09	0.04	PL and RB price difference	21.03%	0.13	0.04
Interp. time (days)	42.84	8.89	3.63	Interp. time (days)	43.42	13.91	3.86
Mk. concen. off.	0.29	0.04	0.02	Mk. concen. off.	0.45	0.16	0.04
# Brands	5.00	1.26	0.52	# Brands	4.08	1.66	0.46
Miser				Artisan			
N	8				9		
Characteristics	Mean	SD	Std. error mean	Characteristics	Mean	SD	Std. error mean
Food	50.00%	0.53	0.19	Food	66.67%	0.50	0.17
Drinks	25.00%	0.46	0.16	Drinks	11.11%	0.33	0.11
Home care	0.00%	0.00	0.00	Home care	22.22%	0.44	0.15
Pers. care	25.00%	0.46	0.16	Pers. care	0.00%	0.00	0.00
Sensory	50.00%	0.53	0.19	Sensory	11.10	0.33	0.11
Basket weight	0.65%	0.60	0.21	Basket weight	0.34%	0.24	0.08
PL and RB price difference	39.58%	0.11	0.04	PL and RB price difference	30.96%	0.10	0.03

Table 1 continued

Miser				Artisan			
N	8				9		
Characteristics	Mean	SD	Std. error mean	Characteristics	Mean	SD	Std. error mean
Interp. time (days)	32.10	13.05	4.61	Interp. time (days)	46.75	18.18	6.06
Mk. concen. off.	0.45	0.27	0.10	Mk. concen. off.	0.32	0.13	0.04
# Brands	6.62	6.16	2.18	# Brands	5.22	2.86	0.95

Characteristic	Independent samples test (Sig.)					
	Fighter versus giant	Miser versus artisan	Fighter versus miser	Giant versus artisan	Miser versus giant	Fighter versus artisan
Food	0.16	0.52	0.57	0.11	0.40	1.00
Drinks	0.16	0.48	0.17	0.79	0.61	0.43
Home care	0.43	0.17	0.17	0.14	0.00	0.66
Pers. care	[a]	0.17	0.17	[a]	0.17	[a]
Sensory	0.62	0.10	0.57	0.03	0.87	0.02
Basket weight	0.60	0.20	0.27	0.32	0.41	0.67
PL and RB price difference	0.52	0.11	0.02	0.07	0.00	0.25
Interp. time (days)	0.93	0.08	0.11	0.63	0.08	0.59
Mk. concen. off.	0.01	0.22	0.12	0.05	0.94	0.52
# Brands	0.24	0.57	0.49	0.30	0.29	0.84

Mk. concen. off Market concentration offline

[a]t cannot be computed because the standard deviations of both groups are 0

Table 2 Characteristics of giants, misers, fighters and artisans in the online setting

Fighter				Giant			
N	7				17		
Characteristics	Mean	SD	Std. error mean	Characteristics	Mean	SD	Std. error mean
Food	85.71%	0.38	0.14	Food	47.06%	0.51	0.12
Drinks	14.29%	0.38	0.14	Drinks	5.88%	0.24	0.06
Home care	0.00%	0.00	0.00	Home care	47.06%	0.51	0.12
Pers. care	0.00%	0.00	0.00	Pers. care	0.00%	0.00	0.00
Sensory	57.14%	0.53	0.20	Sensory	41.18%	0.51	0.12
Basket weight	0.48%	0.43	0.16	Basket weight	0.40%	0.25	0.06
PL and RB price difference	31.01%	0.15	0.06	PL and RB price difference	24.50%	0.13	0.03
Interp. time (days)	31.96	9.38	3.55	Interp. time (days)	47.53	14.62	3.55
Mk. concen. on.	0.53	0.20	0.07	Mk. concen. on	0.41	0.17	0.04
# Brands	3.29	1.38	0.52	# Brands	4.47	1.91	0.46
Miser				Artisan			
N	2				10		
Characteristics	Mean	SD	Std. error mean	Characteristics	Mean	SD	Std. error mean
Food	50.00%	0.71	0.50	Food	30.00%	0.48	0.15
Drinks	50.00%	0.71	0.50	Drinks	20.00%	0.42	0.13
Home care	0.00%	0.00	0.00	Home care	30.00%	0.48	0.15
Pers. care	0.00%	0.00	0.00	Pers.care	20.00%	0.42	0.13
Sensory	50.00%	0.71	0.50	Sensory	40.00%	0.52	0.16
Basket weight	1.03%	1.05	0.74	Basket weight	0.43%	0.28	0.09
PL and RB price difference	44.90%	0.12	0.08	PL and RB price difference	29.53%	0.11	0.03

Table 2 continued

Miser				Artisan			
N	2				10		
Characteristics	Mean	SD	Std. error mean	Characteristics	Mean	SD	Std. error mean
Interp. time (days)	25.98	11.12	7.86	Interp. time (days)	41.53	13.98	4.42
Mk. concen. on.	0.26	0.11	0.08	Mk..concen. On.	0.32	0.16	0.05
# Brands	8.00	2.83	2.00	# Brands	6.80	5.29	1.67

Characteristic	Independent samples test (Sig.)					
	Fighter versus giant	Miser versus artisan	Fighter versus miser	Giant versus artisan	Miser versus giant	Fighter versus artisan
Food	0.06	0.62	0.34	0.40	0.94	0.02
Drinks	0.52	0.42	0.34	0.35	0.54	0.78
Home care	0.00	0.08	[a]	0.40	0.00	0.08
Pers. care	[a]	0.53	[a]	0.17	[a]	0.17
Sensory	0.50	0.81	0.88	0.95	0.82	0.52
Basket weight	0.58	0.56	0.25	0.75	0.55	0.80
PL and RB price difference	0.29	0.09	0.28	0.30	0.05	0.81
Interp. time (days)	0.02	0.17	0.46	0.31	0.06	0.14
Mk concen. on	0.14	0.61	0.11	0.18	0.24	0.02
# Brands	0.15	0.77	0.01	0.21	0.03	0.07

Mk. concen. on Market concentration online

[a]t cannot be computed because the standard deviations of both groups are 0

Table 1 shows the characteristics of the categories in which the PL competes offline as a giant, a miser, a fighter, or an artisan.

The average category profile in which the PL competes as an offline miser is a food category with a large number of brands (6.62), and a market concentration of 0.45. This profile accounts for 0.65% of unit sales per basket, and within it the PL is 39.58% cheaper on average than national brands—the widest price gap in the table—and purchased once a month (specifically, every 32.10 days). The profile for the category in which the PL competes as an offline giant, meanwhile, is a sensory home-care category with fewer brands (4.08) and a market concentration of 0.45. This profile accounts for 0.46% of unit sales per basket, and within it, the PL is 21.03% cheaper on average than national brands—the narrowest price gap in the table—and purchased about once every six weeks (specifically, every 43.42 days).The between-group differences are significant in that there are fewer hygiene categories, the inter-purchase time is shorter, and the price difference between the PL and RB is greater in categories where the PL competes as a miser than where it competes as a giant.

Between these two profiles lie those categories in which the PL competes online as a fighter or an artisan (see Table 1 for further information). To improve the presentation of the results, we focus on misers and giants; since it is between these that the most notable differences emerge.

Table 2 shows the characteristics of the categories in which the PL competes online as a giant, a miser, a fighter, or an artisan.

The category profile in which PL competes as an online miser is a food or drink category with a large number of brands (8) and a market concentration of 0.26. This profile accounts for 1.03% of unit sales per basket; within it, the PL is 44.90% cheaper on average than national brands—the widest price gap in the table—and is purchased roughly once a month (every 25.98 days, to be exact). Where the PL competes as an online giant, meanwhile, is a non-sensory food or home-care category with fewer brands (4.47) and a market concentration of 0.41. This profile accounts for 0.40% of unit sales per basket; within it, the PL is 24.50% cheaper on average than national brands—the narrowest price gap in the table—and is purchased roughly once every six weeks (every 47.53 days, to be precise). The between-group differences are significant in that there are fewer home and personal care categories, more brands, a shorter inter-purchase time, and a greater price difference between the PL and the RB in categories where the PL competes as a miser than where it competes as a giant. Again, the categories in which PL competes online as a fighter or an artisan lie between these two profiles.

5.3 Factors that improve the online competitive position of the PL

To evaluate the factors that cause product category competitiveness to improve (or not) from the offline to the online channel, we separate the 36 categories into groups. In assessing the factors that influence the PL's relative intrinsic loyalty, we distinguish between categories where RIL has improved ($RIL^{ON}/RIL^{OFF} > 1$) and those where it has deteriorated ($RIL^{ON}/RIL^{OFF} > 1$). Similarly, to evaluate the factors that influence the PL's relative conquesting power, we distinguish between

categories where RCP has improved ($RCP^{ON}/RCP^{OFF} > 1$) and those where it has worsened ($RCP^{ON}/RCP^{OFF} > 1$).

As potential factors driving a change in the competitive position of the PL with respect to that of national brands, we use the category characteristics mentioned in the previous sections. Table 3 shows the results of the Pearson's Chi square test for the contingency tables (for two factors: type of product and sensory/non-sensory) and the F-tests for the comparison of two means (for the remaining factors: PL and RB price difference, inter-purchase time, market concentration and number of brands). Results are separated into RIL issues (top of the table) and RCP issues (bottom of the table).

First, we find that the PL's RIL improves with the transition from offline to online in the case of a food category (68.40%), whereas it deteriorates in that of a home care category (52.90%) (Sig. 2-tailed: 0.02). This means that, in the online environment, intrinsic loyalty towards the PL improves with respect to national brands in food categories, and declines in home care categories. In the grocery industry, online tools such as "past purchase lists", which allow consumers to repeat previous purchases, might explain an increase in brand loyalty, but this would apply to all kinds of brands, not just PLs. However, the online tools provided by our grocery retailer, such as "change all items in basket to PLs and compare total cost", might explain an increase in PL loyalty. Once the consumer has switched to PL items, subsequent purchases would be repeats from past purchase lists. The remaining factors have no statistically-significant impact on RIL.

The PL's RCP, on the other hand, improves when moving from offline to online in the case of a non-sensory category (76.90%), whereas it deteriorates in that of a sensory category (60%) (Sig. 2-tailed: 0.03). This means that, in the online environment, the conquesting power of the PL improves with respect to that of national brands in non-sensory categories and declines in sensory categories. Previous research, such as [10], claims that the online channel offers consumers more useful information in non-sensory categories, while the offline channel provides more in sensory categories. Possible explanations for this finding may relate to online tools such as "past purchase lists" and "change all items in basket to PLs" together with the fact that the online environment appears better adapted to non-sensory categories. The remaining factors have no statistically- significant impact on RCP.

6 Conclussions and remarks

PLs are becoming a dominant feature in grocery markets. Having evolved greatly since the 60's and 70's, they now closely rival national brands in quality and range of choice, and the current economic recession is making consumers lean even more heavily towards them. While the confrontation between PLs and national brands has been widely analysed in the offline setting, it has, to our knowledge, attracted little empirical research so far in the online setting. This paper is an attempt to expand the literature on the topic by investigating competition between PLs and national brands across the online and offline channels of a grocery retailer. The approach involves a category-level relative analysis to measure the competitive position of the PL against the RB, a global indicator of national brands. The competitive position is evaluated by examining and comparing intrinsic loyalty and conquesting power between the PL and the RB.

Table 3 Factors influencing RIL and RCP changes from the offline to the online setting

	$RIL^{ON}/RIL^{OFF} < 1$ (%)	$RIL^{ON}/RIL^{OFF} > 1$ (%)	Test
Food	29.40	68.40	Pearson's Chi square test: 10.13 (Sig-2 tailed: 0.02)
Drinks	17.60	10.50	
Pers. care	0.00	10.50	
Home care	52.90	10.50	
Total	100.00	100.00	
Non-sensory	64.70	68.40	Pearson's Chi square test: 0.06 (Sig-2 tailed: 0.81)
Sensory	35.30	31.60	
Total	100.00	100.00	

	Mean	SD	Mean	SD	
PL and RB price difference	4.35	2.26	5.74	4.12	F-test: 1.51 (Sig. 0.23)
Interp. time	43.41	14.72	40.05	14.91	F-test: 0.46 (Sig. 0.50)
Mk. concen.	0.30	0.13	0.27	0.13	F-test: 0.47 (Sig. 0.50)
# Brands	0.45	0.20	0.35	0.16	F-test: 2.81 (Sig. 0.10)

	$RCP^{ON}/RCP^{OFF} < 1$ (%)	$RCP^{ON}/RCP^{OFF} > 1$ (%)	Test
Food	50.00	50.00	Pearson's Chi square test: 1.14 (Sig-2 tailed: 0.77)
Drinks	20.00	11.50	
Pers. care	0.00	7.70	
Home care	30.00	30.80	
Total	100.00	100.00	
Non-sensory	40.00	76.90	Pearson's Chi square test: 4.43 (Sig-2 tailed: 0.03)

Table 3 continued

	$RCP^{ON}/RCP^{OFF} < 1$ (%)		$RCP^{ON}/RCP^{OFF} > 1$ (%)		Test
Sensory	60.00		23.10		
Total	100.00		100.00		
	Mean	SD	Mean	SD	
PL and RB price difference	5.50	2.88	4.92	3.62	F-test: 0.20 (Sig. 0.65)
Interp. time	41.22	17.35	41.80	13.94	F-test: 0.01 (Sig. 0.92)
Mk. concen.	0.30	0.11	0.28	0.14	F-test: 0.16 (Sig. 0.69)
# Brands	0.34	0.15	0.42	0.19	F-test: 1.36 (Sig. 0.25)

RIL Relative intrinsic loyalty, *RCP* relative conquesting power, *PL* private label, *RB* reference brand

While the results of our research suggest some implications for management, we must be cautious about generalising them, since they are derived from the analysis of a single retailer. With respect to the PL's relative intrinsic loyalty and conquesting power, we show that the PL may perform as a giant (the most attractive role), a miser (the least attractive role), a fighter or an artisan (intermediate roles) depending on the category and the channel. It also emerges, however, that the number of categories where it is a miser decreases dramatically in the online environment. That is, the transition to the online setting is found to be associated with a general improvement in the PL's competitive position. Although we must caution against generalising these results, this overall improvement is good news for retailers. Given the increasing importance of online retailing, together with the overall boost it has given to the PL, it is safe to predict an increase, not only in retailer bargaining power, but also in sales and profits. For manufacturers, meanwhile, this analysis suggests that they will need to reinforce their online efforts in the coming years, and differentiate their products by intensifying quality, innovation and/or advertising.

Another interesting conclusion is that the general improvement of the PL online is not equal across categories: in some, the PL occupies the same position in both channels, but, in others, its position changes online. In the WC cleaner category, for instance, the PL competes as a giant in both channels, whereas, in the orange soft drink category, it changes from an offline miser into an online fighter. For the retailer, this means that each category needs to be managed separately. For categories in the first group, i.e. where the PL occupies the same position online and offline, retailers could design and adopt a single strategy across both channels. For categories in the second group, however, they should consider a separate strategy for each. Needless to say, the best strategy with a giant will not necessarily work with a miser, a fighter or an artisan. Retailers might concentrate on improving the online performance of the PL in categories such as chocolate, where its position is weaker. This means that the implications for the manufacturer also depend on the target category. Chocolate manufacturers, for example, have little need for concern in this respect, because PL chocolate competes less well online than offline.

Finally, we have identified some factors relating to the improvement in the competitive position of the PL in terms of intrinsic loyalty and conquesting power at category-level. The relative intrinsic loyalty of the PL improves considerably more online in food categories than it does in drinks and personal and home care products. To improve their online competitive position, therefore, retailers need to make a more intense marketing effort in non-food categories than in food categories. However, the improvement in the PL's relative conquesting power when marketed online is considerably greater in the non-sensory than in the sensory categories. This means that retailers aiming to snatch market share from national brands will have an easier task in non-sensory categories, and will need to make more intense marketing efforts in sensory categories.

7 Limitations and future research

This study, like any other, has several limitations. Firstly, we analyse the purchases of a group of consumers in the stores of a single grocery retailer, but we have no information regarding their possible purchases in the same categories in other grocery chains. We do

not consider this a serious limitation, however, because we focus on loyalty-card holders, typically the most loyal customers, of which the retailer in question is known to have a strong base. Secondly, while the analysis evaluates consumer behaviour in 36 grocery categories, this could be expanded further. It does, in any event, include most of the top categories in terms of unit and dollar sales. Thirdly, the outcomes of this study pertain only to private labels previously purchased by the customer offline, but studies without this restriction are encouraged. Fourthly, we in no way suggest that the dimensions used here are the only ones that can be used to compare the competitive position of the PL against that of national brands. Differences in price, quality or marketing efforts could also be used. Any of these limitations may in itself suggest more potential lines of research. Finally, this analysis could be extended to other markets such as durables.

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Appendix 1: Details of our approach

The model in [15] is based on the construction of a switching matrix, which requires the consideration of only two observations per consumer. Given that we observe the purchase behaviour of our customers over a whole year, we apply the model in [15] to successive switching matrices to obtain the values of α_i and π_i at purchase occasion level, rather than customer level. This means that we examine the repetitive or switching behaviour of every customer in our database between brands from one purchase occasion to the next.

Imagine a market with three brands, brand A, brand B and brand C. Consider that customer *h* purchases brand A on her first purchase occasion, brand A on the second, and brand C on the third. Further consider that customer *k* purchases brand B on his first purchase occasion, brand A on the second, brand C on the third, and brand C on the fourth. Our approach does not limit attention to two consecutive purchases of each customer (let us say the first two purchase occasions), but to every purchase occasion of every customer. For customer *h*, we consider the following switching matrices:

Purchase occasion 1	Purchase occasion 2			Purchase occasion 2	Purchase occasion 3		
	Brand A	Brand B	Brand C		Brand A	Brand B	Brand C
Brand A	1	0	0	Brand A	0	0	1
Brand B	0	0	0	Brand B	0	0	0
Brand C	0	0	0	Brand C	0	0	0

For customer *k*, we consider the following switching matrices:

Purchase occasion 1	Purchase occasion 2			Purchase occasion 2	Purchase occasion 3			Purchase occasion 3	Purchase occasion 4		
	Brand A	Brand B	Brand C		Brand A	Brand B	Brand C		Brand A	Brand B	Brand C
Brand A	0	0	0	Brand A	0	0	1	Brand A	0	0	0
Brand B	1	0	0	Brand B	0	0	0	Brand B	0	0	0
Brand C	0	0	0	Brand C	0	0	0	Brand C	0	0	1

Hence, we apply the methodology in [15] to the following switching matrix:

Purchase occasion t − 1	Purchase occasion t		
	Brand A	Brand B	Brand C
Brand A	1	0	2
Brand B	1	0	0
Brand C	0	0	1

If we wished to consider only the first two purchase occasions of each customer, we would need to apply the model in [15] to the following switching matrix:

Purchase occasion t − 1	Purchase occasion t		
	Brand A	Brand B	Brand C
Brand A	1	0	0
Brand B	1	0	0
Brand C	0	0	0

With our approach, we (1) take into consideration every purchase of every customer in a product category and therefore introduce the weight of each customer's purchases in the total purchases per category, i.e., we give more weight to heavy than to light buyers within the category. Thus, we (2) are able to consider a larger number of observations in each category, and extend our investigation to a wide range of categories. Otherwise, the switching matrices for some categories would have presented too many zeros to enable estimation of the parameters.

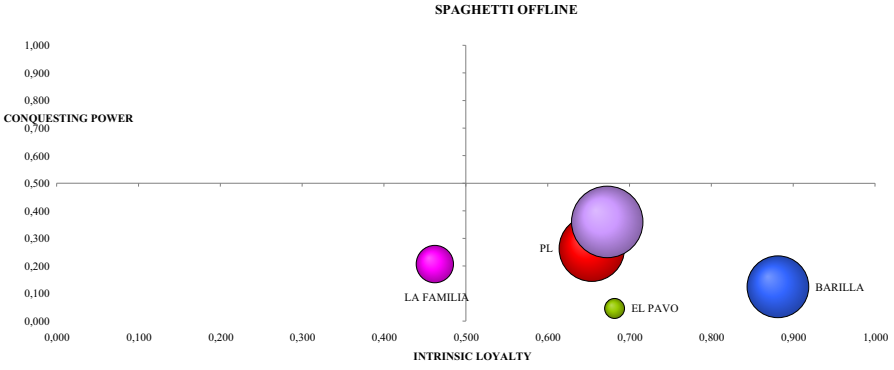
A further aim of this investigation is to identify differences in brand power between the online and offline settings. Given that the construction of a switching matrix requires the evaluation of pairs of consecutive purchases, we need to define the terms "offline observation" and "online observation". In our database, we find four different combinations for a pair of purchases: (1) both purchases are made offline, (2) both purchases are made online, (3) the first purchase is made offline and the second online, and (4) the reverse, the first purchase is made online and the second offline. By limiting our attention to the first two cases, where the differentiation between an offline observation and an online observation is clear, we would have disregarded many of the purchases registered on our database, since many customers switch between channels from one occasion to the next. Hence, we establish the following criterion to distinguish between offline and online observations: a consecutive pair of purchases is considered an offline observation when the second purchase is made offline, whereas it is considered an online observation when the second purchase is made online. In other words, it is the channel used for the second purchase that determines whether an observation is classed as offline or online. Thus, in determining current shopping behaviour, more importance is attached to how the customer is shopping currently than to how she has shopped previously.

We build a switching matrix per category and channel, such that for the estimation of the intrinsic loyalty and conquesting power parameters we use 72 switching matrices (36 product categories × 2 channels).

Appendix 2: The importance of the relative approach

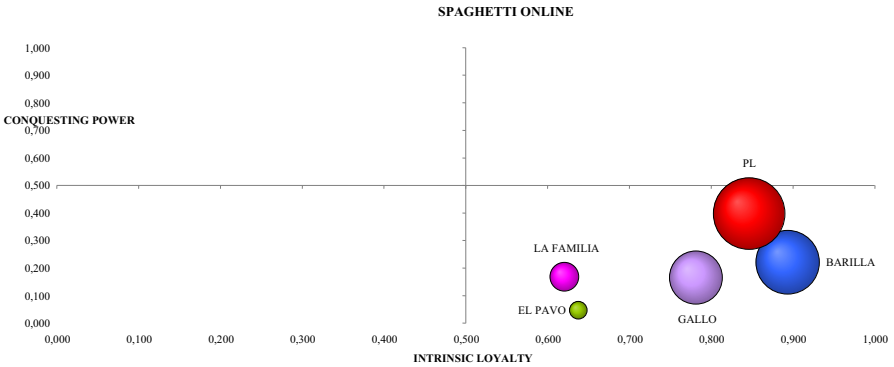
The importance of the relative approach can be demonstrated in a specific category, say, the spaghetti category. Figure 5 shows the "absolute" market position of the different brands competing in the spaghetti category offline and Fig. 6 those competing online. Each brand is located on these "absolute" maps by its intrinsic loyalty and conquesting power estimates; while its size (circle diameter) indicates its market share.

Direct observation of either of these maps clearly reveals the importance of the relative analysis. In the spaghetti category, the PL competes with four national brands: La Familia, El Pavo, Gallo and Barilla. For example: a simple examination of the online map (Fig. 6) indicates that the PL is doing well in terms of market share, conquesting power, where it takes first place; and intrinsic loyalty, where it takes second. However, it is worth examining the performance of the national brands in this last dimension, where we find that the leader in terms of intrinsic loyalty (Barilla) is placed second in terms of market share, whereas all the remaining brands in the market present lower values than the PL. So how is the PL actually positioned against national brands in terms of intrinsic loyalty in this market? This is not easy to answer, because there are several national brands, so it depends which one the PL is being compared with. This is precisely where the relative analysis plays its role. It can be seen in Table 5, "Appendix 3" that the RIL(PL, On) = IL(PL)/IL(RB) = 0.85/0.82 = 1.04, which means that, in global terms, the PL's intrinsic loyalty online is 4% higher than that of the average national brand in the market. We can conclude that, although the PL ranks second for intrinsic loyalty in absolute terms, it ranks first in relative terms. To illustrate this visually, Fig. 7 depicts the relative position of the PL in the spaghetti category both online and offline.



Note. Circle size proportional to market share within category and channel

Fig. 5 Offline brand position map for the spaghetti category



Note. Circle size proportional to market share within category and channel

Fig. 6 Online brand position map for the spaghetti category

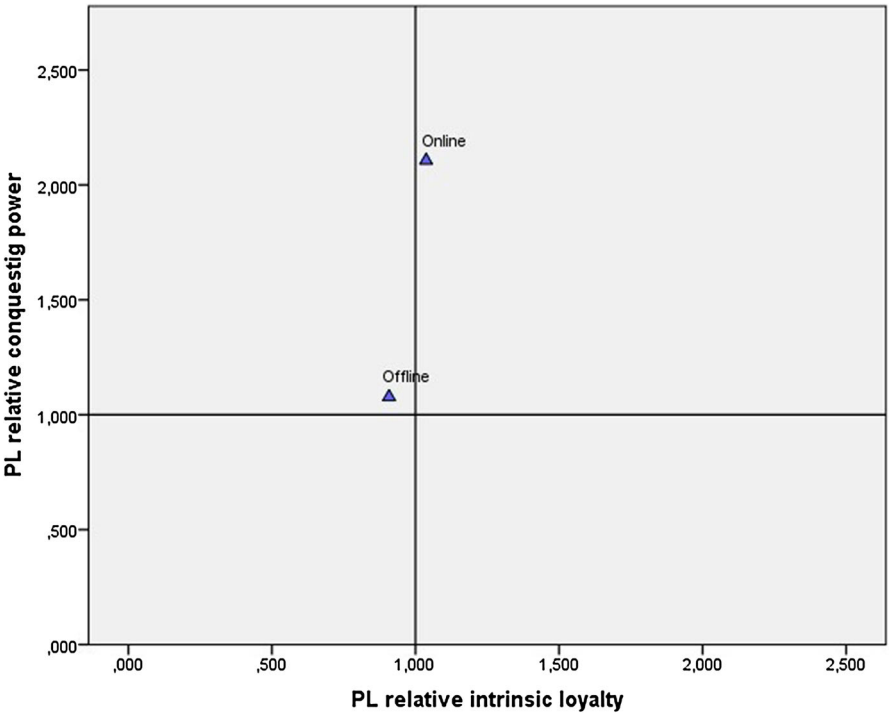


Fig. 7 Relative position of the PL in the spaghetti category

Appendix 3: Tables

See Tables 4 and 5.

Table 4 General descriptives

Product category	# Brands	PL market position (a)	# Alt.	Cat. interp. time (days)	Basket weight (%)	Market share information						Price information			
						Mk. concentration (b)		PL mk. share (%)		RB mk. share (%) (c)		Price unit	PL price	RB price (d)	PL versus RB price reduction (%)
						Offline	Online	Offline	Online	Offline	Online				
Aluminium foil	2	1	5	67.81	0.22	0.65	0.63	77.46	76.00	22.53	23.99	50 m	3.58	4.77	24.90
Biscuits	10	3	15	32.95	0.46	0.17	0.15	15.16	15.13	16.96	14.96	1 kg	1.81	2.92	37.87
Bleach	2	1	7	50.13	0.24	0.52	0.52	59.27	61.28	40.73	38.72	1 L	0.28	0.51	45.10
Brioche	3	3	4	28.56	0.43	0.40	0.37	13.47	21.41	43.79	41.38	1 kg	3.95	5.87	32.67
Camomile tea	3	2	5	68.25	0.05	0.33	0.34	32.64	34.95	33.86	33.79	25 teabags	1.00	1.45	30.94
Canned chickpeas	5	2	6	45.01	0.28	0.36	0.39	40.59	39.29	33.14	38.35	1 kg	1.07	1.43	25.44
Canned tuna	8	2	16	32.50	0.71	0.19	0.20	21.25	24.66	18.98	18.37	1 kg	5.61	7.65	26.63
Chocolate	6	5	7	33.85	0.29	0.23	0.34	8.10	4.48	24.46	35.10	1 kg	4.80	7.55	36.39
Dish-washer	3	2	13	56.06	0.38	0.34	0.34	31.86	30.78	35.13	35.55	1 L	2.04	2.81	27.37
Floor cleaner	6	3	21	42.11	0.62	0.23	0.23	24.58	27.39	22.45	21.21	1.5 L	1.49	2.16	31.01
Flour	3	1	3	74.27	0.17	0.42	0.46	46.50	57.35	37.73	30.92	1 kg	0.56	0.72	22.22
Fresh pizza	2	2	15	21.15	0.13	0.74	0.67	15.59	21.16	84.41	78.84	1 pizza	2.13	2.56	16.95
Frozen pizza	4	3	13	28.82	0.62	0.37	0.33	12.58	12.82	40.63	35.87	1 pizza	1.95	3.44	43.38
Hair conditioner	11	5	14	54.64	0.13	0.18	0.18	4.778	6.52	18.81	18.66	1 L	6.44	10.10	36.22
Kitchen paper	3	1	7	40.14	0.77	0.41	0.43	45.26	51.24	37.07	33.68	6 rolls	1.89	2.54	25.68
Muffins	6	2	13	28.25	0.47	0.27	0.34	27.85	26.29	26.16	36.23	1 kg	2.33	3.06	23.89

Table 4 continued

Product category	# Brands	PL market position (a)	# Alt.	Cat. interp. time (days)	Basket weight (%)	Market share information						Price information			
						Mk. concentration (b)		PL mk. share (%)		RB mk. share (%) (c)		Price unit	PL price	RB price (d)	PL versus RB price reduction (%)
						Offline	Online	Offline	Online	Offline	Online				
Non-alcoholic beer	3	3	3	38.25	0.09	0.44	0.47	7.16	8.17	46.43	50.99	25 cl × 6	1.63	1.89	13.98
Non-fat milk	7	1	9	27.64	0.37	0.23	0.24	34.127	31.53	17.39	20.11	1 L	0.58	0.67	13.21
Olive oil	7	2	8	31.93	0.73	0.32	0.30	37.06	38.18	29.32	25.14	1 L	2.41	2.52	4.45
Olives	4	1	9	34.49	0.69	0.34	0.37	42.09	45.31	28.29	29.83	150 g	1.12	1.17	4.28
Orange juice	5	1	9	25.87	0.30	0.28	0.42	41.58	58.79	18.31	18.51	1 L	0.90	0.93	2.59
Orange-flav. soft drink	3	2	6	38.68	0.12	0.79	0.87	5.74	5.34	83.48	91.39	1 L	0.55	0.93	41.50
Paper napkins	4	1	4	35.96	0.53	0.62	0.70	77.59	82.08	10.33	10.45	1 pack = 30 u	0.77	0.85	9.08
Plain yogurt	3	2	11	25.20	1.18	0.62	0.57	17.11	19.85	71.37	66.10	1 kg	1.28	2.31	44.51
Plastic bags	3	1	5	47.28	0.53	0.73	0.84	85.02	91.50	7.54	7.03	1 pack = 30 u	1.85	2.88	35.66
Powder detergent	8	1	18	43.64	0.48	0.17	0.17	22.43	26.48	15.85	14.08	1 kg	1.79	2.44	26.40
Rice	6	2	6	44.40	0.44	0.30	0.36	23.03	27.36	32.69	39.48	1 kg	0.86	0.97	11.52
Sliced bread	2	2	7	24.14	0.94	0.62	0.58	25.67	29.48	74.33	70.52	1 kg	1.65	3.34	50.54
Shower gel	19	4	30	46.29	0.51	0.12	0.14	7.05	11.05	12.07	14.26	1 L	1.95	3.29	40.80
Spaghetti	5	1	10	44.61	0.33	0.27	0.30	28.52	39.02	26.59	23.87	1 kg	1.11	1.74	36.06
Toasted bread	4	1	5	41.61	0.09	0.30	0.33	35.81	37.05	27.02	30.36	1 kg	3.60	4.47	19.44

Table 4 continued

Product category	# Brands	PL market position (a)	# Alt.	Cat. interp. time (days)	Basket weight (%)	Market share information						Price information			
						Mk. concentration (b)		PL mk. share (%)		RB mk. share (%) (c)		Price unit	PL price	RB price (d)	PL versus RB price reduction (%)
						Offline	Online	Offline	Online	Offline	Online				
Toilet paper	3	1	10	34.61	1.05	0.40	0.40	54.13	54.16	23.41	23.55	12 rolls	2.12	3.19	33.47
Plastic wrap/cling film	2	1	3	68.23	0.14	0.52	0.53	59.90	61.67	40.10	38.33	30 m	0.83	1.41	40.78
Still mineral water	10	9	21	18.12	1.78	0.18	0.18	4.36	2.08	18.68	18.64	1 L	0.26	0.61	56.77
Vinegar	3	1	3	67.94	0.07	0.57	0.44	72.14	58.04	17.01	25.54	1 L	0.61	0.77	21.29
WC cleaner	5	1	13	55.71	0.15	0.37	0.39	48.97	50.95	25.39	25.81	750 ml	1.37	1.90	28.13
Mean	5.08	2.11	9.83	41.64	0.46	0.39	0.40	33.51	35.80	32.29	32.77		1.89	2.72	28.36

(a) Position of PL in the ranking of brands with highest market share

(b) Herfindahl concentration index

(c) Weighted market share of all national brands

(d) Weighted mean price of all national brands. Market shares are used as weights

Table 5 Intrinsic Loyalty and Conquesting Power Values for PL and RB

Category	PL				RB				Relative values (PL/RB)			
	Offline		Online		Offline		Online		Offline		Online	
	CP	IL	CP	IL	CP	IL	CP	IL	CP (a)	IL (b)	CP (a)	IL (b)
Aluminium foil	0.55	0.81	0.49	0.90	0.45	0.33	0.51	0.69	1.22	2.45	0.98	1.30
Biscuits	0.16	0.57	0.14	0.66	0.16	0.54	0.14	0.54	0.98	1.05	0.94	1.22
Bleach	0.51	0.69	0.52	0.80	0.49	0.53	0.48	0.68	1.02	1.31	1.10	1.16
Brioche	0.26	0.48	0.36	0.65	0.36	0.71	0.35	0.77	0.73	0.67	1.05	0.85
Camomile tea	0.30	0.77	0.38	0.79	0.35	0.62	0.33	0.62	0.85	1.23	1.14	1.26
Canned chickpeas	0.36	0.59	0.34	0.75	0.28	0.53	0.34	0.72	1.27	1.11	1.01	1.04
Canned tuna	0.16	0.69	0.19	0.78	0.18	0.60	0.16	0.63	0.90	1.16	1.18	1.23
Chocolate	0.10	0.66	0.09	0.53	0.22	0.63	0.29	0.72	0.48	1.04	0.30	0.73
Dish-washer	0.34	0.63	0.32	0.77	0.33	0.65	0.35	0.77	1.03	0.97	0.91	1.00
Floor cleaner	0.22	0.48	0.24	0.63	0.21	0.48	0.19	0.55	1.04	0.99	1.28	1.14
Flour	0.33	0.72	0.46	0.82	0.42	0.49	0.35	0.51	0.80	1.46	1.31	1.62
Fresh pizza	0.45	0.15	0.54	0.49	0.55	0.83	0.46	0.87	0.81	0.18	1.18	0.57
Frozen pizza	0.10	0.62	0.14	0.75	0.39	0.33	0.35	0.49	0.26	1.88	0.40	1.51
Hair conditioner	0.06	0.42	0.08	0.69	0.17	0.54	0.14	0.69	0.35	0.78	0.53	1.00
Kitchen paper	0.40	0.54	0.43	0.74	0.38	0.39	0.37	0.58	1.05	1.39	1.14	1.26
Muffins	0.30	0.68	0.28	0.76	0.23	0.69	0.29	0.74	1.27	0.99	0.98	1.02
Non-alcoholic beer	0.09	0.74	0.10	0.94	0.46	0.72	0.48	0.78	0.19	1.03	0.21	1.21
Non-fat milk	0.20	0.87	0.17	0.88	0.18	0.74	0.21	0.80	1.08	1.17	0.83	1.10
Olive oil	0.29	0.76	0.31	0.85	0.26	0.69	0.22	0.76	1.13	1.09	1.42	1.11
Olives	0.36	0.56	0.40	0.72	0.29	0.46	0.28	0.62	1.25	1.22	1.42	1.17
Orange juice	0.31	0.71	0.38	0.84	0.21	0.59	0.26	0.67	1.48	1.20	1.48	1.25
Orange-flv. soft drink	0.25	0.52	0.49	0.44	0.44	0.89	0.40	0.95	0.56	0.58	1.21	0.47
Paper napkins	0.38	0.76	0.47	0.89	0.28	0.14	0.29	0.45	1.36	5.29	1.58	1.98
Plain yogurt	0.33	0.60	0.42	0.70	0.49	0.83	0.36	0.84	0.67	0.72	1.15	0.83
Plastic bags	0.35	0.86	0.61	0.96	0.33	0.24	0.28	0.70	1.08	3.63	2.22	1.38
Powder detergent	0.12	0.81	0.19	0.84	0.16	0.60	0.14	0.67	0.74	1.35	1.34	1.27
Rice	0.26	0.45	0.34	0.73	0.23	0.64	0.24	0.76	1.15	0.70	1.42	0.95
Sliced bread	0.45	0.67	0.60	0.73	0.55	0.88	0.40	0.90	0.81	0.76	1.52	0.82
Shower gel	0.07	0.40	0.11	0.54	0.10	0.42	0.11	0.54	0.64	0.95	0.99	1.00
Spaghetti	0.26	0.65	0.40	0.85	0.24	0.72	0.19	0.82	1.08	0.91	2.11	1.04
Toasted bread	0.38	0.71	0.43	0.81	0.25	0.81	0.25	0.84	1.53	0.87	1.68	0.96
Toilet paper	0.35	0.75	0.31	0.87	0.32	0.43	0.34	0.65	1.10	1.75	0.94	1.33
Plastic wrap/cling film	0.48	0.72	0.54	0.83	0.52	0.60	0.46	0.74	0.91	1.20	1.16	1.11
Still mineral water	0.06	0.50	0.04	0.29	0.16	0.53	0.16	0.49	0.40	0.94	0.23	0.60
Vinegar	0.45	0.79	0.40	0.87	0.35	0.20	0.36	0.64	1.30	3.94	1.12	1.36

Table 5 continued

Category	PL				RB				Relative values (PL/RB)			
	Offline		Online		Offline		Online		Offline		Online	
	CP	IL	CP	IL	CP	IL	CP	IL	CP (a)	IL (b)	CP (a)	IL (b)
WC cleaner	0.39	0.63	0.39	0.72	0.26	0.50	0.25	0.64	1.49	1.26	1.57	1.13
Mean	0.29	0.64	0.34	0.74	0.31	0.57	0.30	0.69	0.94	1.37	1.14	1.11

Paired-samples *t* test (offline–online)

(a) Result for the paired-samples *t* test: relative CP off versus relative CP on: Sig. (2-tailed) = 0.04

(b) Result for the paired-samples *t* test: relative IL off versus relative IL on: Sig. (2-tailed) = 0.13

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