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# Competition between Private Labels and National Brands in a Multichannel Retailer

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## Abstract

This chapter analyzes private label and national brand competition across online and offline channels. We analyze competition using three measures: market share, a loyalty index, and what is called in the literature conquering power (a measure of the ability of a brand to capture nonloyal consumers). We first provide a brief theoretical introduction and literature research about the topic. We also do an empirical analysis using data of a multichannel grocery retailer that sells both its own private label and national brands, through physical stores and an online store. The data include the purchases made by a sample of multichannel consumers. We find that the private label increases, in general, its competitive position in the online channel, compared to the offline channel. However, this result does not hold for all the product categories. We discuss some drivers of this general improvement, as well as potential causes for the differences between categories. We conclude with some recommendations for multichannel retailers and manufacturers.

**Keywords:** private label, national brand, multichannel retailing

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## 1. Introduction

Private labels (also called store brands, as opposed to national brands, manufacturer brands or name brands) are becoming a dominant feature in the world markets. A private label is a “brand owned not by a manufacturer or producer but by a retailer or supplier who gets its goods made by a contract manufacturer under its own label” [1]. Since their origins in the 1960s and 1970s, private labels have evolved from offering cheaper, generic products, to become almost equivalent in quality and closer on pricing to national brands in the mind of consumers. In 2013, and according to Nielsen [2], private labels’ world average value share was 16.5%. This share is in general higher in developed countries (Europe, North America, and the Pacific), and lower in developing countries (Latin America, Asia, and Africa/Middle East).

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Europe is the region where private labels have the higher penetration, reaching shares above 40% in the United Kingdom, Spain, and Switzerland, and being in general higher than 20% for most European countries. On the contrary, in big markets like China, India, and Brazil, private labels' value share is 5% or less (see **Figure 1** for more details). Steenkamp and Geyskens [3] analyze the factors that explain the differences in private label share across countries are mainly market (for example, national brands and retailers concentration) and institutional factors (like culture or market size).

The reason for the success of private labels is that their advantages exceed their disadvantages for the three main agents involved: retailer, manufacturer, and consumer. For the retailer, all are advantages: increasing bargaining power over manufacturers, control of all marketing of the brand, more store loyalty (private labels are only sold at one retailer), and higher contribution margin, compared to national brands. For the manufacturer of a private label, the main advantage is that it sells a high volume of goods without the need of investing in marketing activities. There are disadvantages, though: high risk (since sales are concentrated on one or few clients—the retailer), lower bargaining power, lower contribution margin, and they may not invest on developing their own brand. For the consumer, all seem to be also advantages: she can get a good with the same quality than a national brand at a lower price, and she benefits, in general, from competition between national brands and private labels. Sethuraman and Gielens [4] explore several drivers of private label's share.

Competition between private labels and national brands on current markets is very high. An indicator of the strength of this competition is whether promoted national brands and private labels attract the same consumers. Ailawadi et al. [5] find two different market segments for private labels and promoted national brands, but they also find a significant (and increasing) share of consumers belonging to a third segment that purchase both private labels and promoted national brands, which indicates strong competition. On the other hand, private labels and national brands strategies are, up to some point, different. Private labels know that maintaining a price differential with national brands is very important, but also recognize that being perceived close to them in quality is essential for their success. National brands are responding to this strategy increasing innovativeness and creating a strong brand image.

There are several interrelated factors boosting private label growth in the last years. One is the increasing concentration in retailing, which enables retailer chains to manage with their own brands. A second factor has been the economic crisis. A report [6] shows that more than 50% of consumers from 55 countries revealed that they were switching from national brands to private labels because of the economic downturn. However, it seems that when economy recovers, and once consumers have learnt to consume private labels, they do not stop buying them. This is shown in a study that compares the evolution of the market share of private labels and national brands in the USA for 21 years [7]. A third factor is a more positive attitude of consumers toward private labels. Although price is still the main primary driver for consumers to buy private labels, quality, and value are also considered important reasons. For example, a recent survey [2] shows that more than 60% of consumers think that private labels are a good value for money, and the same percentage agrees that buying private labels makes them feel smarter (see **Figure 2**).

### Private Label Value Share by Country (top 25). Source: Nielsen (2014)

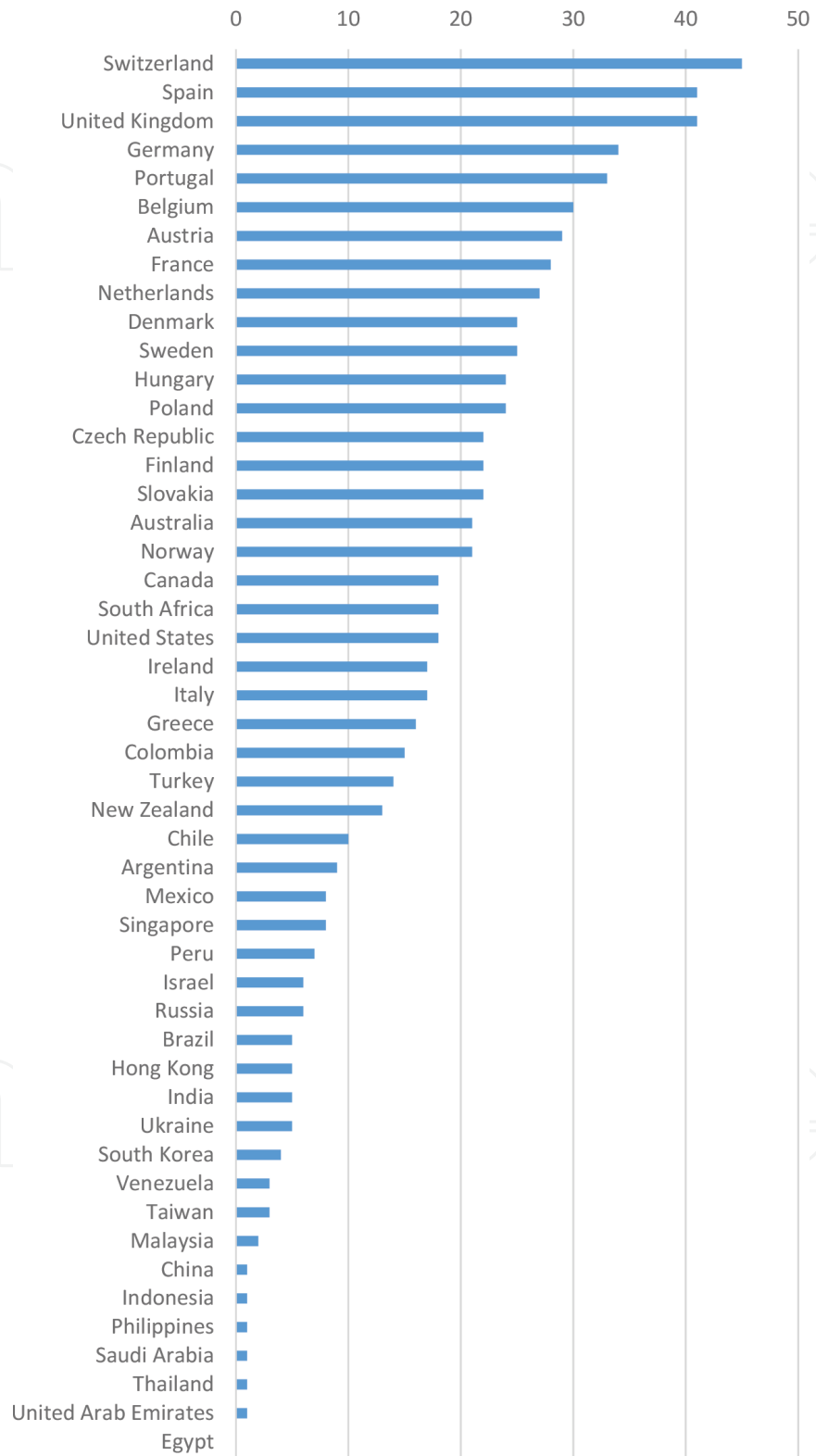


Figure 1. Private label penetration by country.

Percentage of respondents who somewhat or strongly agree. Source: Nielsen (2014)

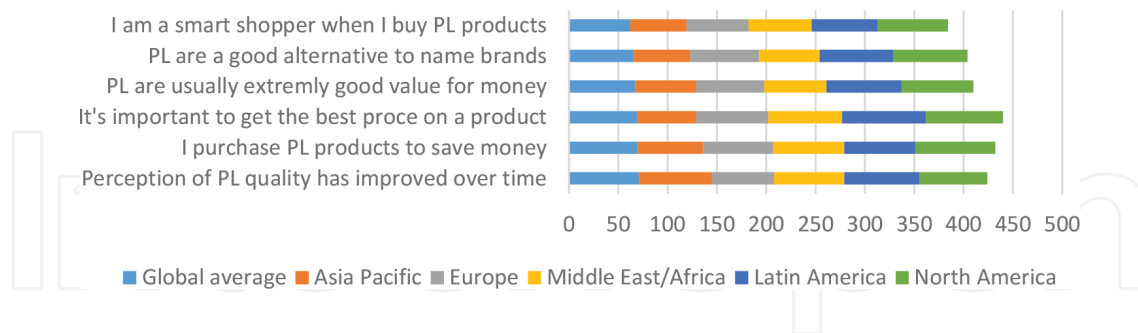


Figure 2. Perceptions about private label across world regions.

Another important factor that has not been enough investigated, and may affect the success of private labels, is the growth of electronic commerce. Although electronic commerce still represents a small fraction of traditional commerce in many product categories, all analysts believe it will grow in the future. A recent report [8] shows that 54% of consumers surveyed in 25 countries buy products online whether weekly or monthly. There are several academic articles showing that brands become more important in online than in offline channels. The reason seems to be that brands may help consumers to overcome the need for touch during the purchase process at online stores, serving as information providers and reducing the associated risk [9, 10].

In spite of the growing research both on private labels and on electronic commerce, the performance of private labels in online stores has been hardly studied. For example, Kopalle et al. [11] mention that the Internet is an interesting field for the battle of private labels and national brands, but do not go deeper. Amrouche and Yan [12] develop a game theory model to describe the decision of a retailer to introduce a private label at both channels, online and offline. Arce-Urriza and Cebollada [13] study competition between private labels and national brands across both the online and the offline channels of a grocery retailer. They find that both private labels and national brands have some gains at the online channel (for example, higher degree of loyalty), but that the private label improves more than the national brand.

This is the topic of our work. If private labels are increasing their presence in markets, and consumers are buying more online, will the private label maintain its success at the online channel? How private labels perform in online stores, compared to offline stores?

To assess these questions, we empirically analyze the performance of private labels and national brands in a multichannel grocery retailer in Spain. This retailer has its own private label in most of the categories, as well as one or more national brands. The retailer operates hundreds of offline stores and one online store. Since there can be more than one national brand in each category, we will compare the private label against, first, the national brand leader and, second, against a compound of all the national brands in the category, what we call the reference brand.

To evaluate the strength of private label, we examine three measures of competition at the brand level: market share, loyalty, and conquering power. We compute these three measures

for the brands in different categories, and for purchases made at each of the two channels, online and offline, and compare the results.

## 2. Empirical application

### 2.1. Data

We use data from a grocery retailer with more 600 offline stores and 1 online store in Spain. The online store centralizes all the online orders, independently of the location of the consumer. The order is later processed at one designated offline store close to the residence of the consumer, and home delivered. We analyze the purchases of a sample of more than 2500 consumers during 12 months in 2013 at both channels, online and offline. The retailer offers a wide variety of products, ranging from food to house care and personal care products, and, in general, everything that can be purchased in a typical supermarket. For most of the categories, the retailer offers its own private label, one or several national brands, and one or several second brands. Although only around 6% of the items sold are private label, its volume share is around 30%. We examine 30 categories (see **Table 2** for the list of the categories). These categories are the biggest in volume share among the categories meeting the following criteria: private label has a significant volume share, and the category has a significant sales volume at both channels. Among the different national brands in a category, we select all brands meeting the following criteria: have at least 100 purchases and have at least a 1% of market share at each channel. On average, a category has one private label and three or four national brands.

### 2.2. Private label, national brand leader, and reference brand: measures for competition analysis

We compare the private label against the national brand leader and the reference brand. The national brand leader is the national brand in the category with the highest volume share. The reference brand aggregates all the national brands in the category into a single brand. Therefore, at each category, and for the purpose of our analysis, there is one private label, one national brand leader, and one reference brand.

We use three variables to measure the competitive position of each of the brands in the study: market share, loyalty, and conquering power (see [14], and Appendix for more details). These variables definition is shown in **Table 1**.

	Market share	Intrinsic loyalty	Conquering power
Private label	# units of private label sold in the category/# total units sold in the category	Percentage of intrinsically loyal consumers ( $\alpha_i$ ) to the private label in the category	Percentage of non-loyal consumers in the market ( $\pi_i$ ) who purchase the private label
National brand leader	Id., national brand leader	Id., national brand leader	Id., national brand leader
Reference brand	Id., reference brand	Id., reference brand	Id., reference brand

**Table 1.** Measures for private label and national brand competition.

Note that market share can be explained in terms of brand intrinsic loyalty and conquering power (see Eqs. (4)–(6) in Appendix for more details).

At each product category, the reference brand market share, intrinsic loyalty, and conquering power are calculated as follows:

$$\text{Market Share} = \frac{\sum_i^I \text{Market Share (percent)}_i \cdot \text{Market Share}_i}{\sum_i^I \text{Market Share}_i} \quad (1)$$

$$\text{Intrinsic Loyalty} = \frac{\sum_i^I \text{Intrinsic Loyalty}_i \cdot \text{Market Share}_i}{\sum_i^I \text{Market Share}_i} \quad (2)$$

$$\text{Conquering Power} = \frac{\sum_i^I \text{Conquering Power}_i \cdot \text{Market Share}_i}{\sum_i^I \text{Market Share}_i} \quad (3)$$

where  $i$  represents each of the national brands in the category, and  $I$  is the total number of national brands in the category.

To assess the difference in performance of the private label and the national brand across online and offline channels, we, first, compute the measures of **Table 1** for each of the categories of study. Then, we compute ratios of the form

Online Private Label market share's growth = Online Private Label market share/Offline Private Label market share

Online Private Label conq. power's growth = Online Private Label conq. power estimate/Offline Private Label conq. power estimate

Online Private Label int. loyalty's growth = Online Private Label int. loyalty estimate/Offline Private Label Int. loyalty estimate

for the private label, the national brand leader and reference brand, at each of the categories. In **Table 2**, we can see the results of these computations.

In **Table 2**, we can see the ratios online/offline for the three measures of interest (market share, conquering power, and intrinsic loyalty), for the private label, national brand leader, and reference brand, and for each of the categories. Information in the table indicates there are differences across product categories in the growth (or decrease) of brand competition between online and offline channels for all measures under study. For instance, while market share for the brioche category online is 1.59 times its value offline, market share for the noncarbonated mineral water category online is 0.48 times its value offline.

The last line of the table shows the mean values of the ratios across all the product categories. Looking at the market share, results show that both the private label and the national brand (leader and reference) increase their market share, but more the first (1.09 vs. 1.01 and 1.01).

Product category	Market share			Conquesting power			Intrinsic loyalty		
	Private label ratio (on/off)	Reference brand ratio (on/off)	National brand leader ratio (on/off)	Private label ratio (on/off)	Reference brand ratio (on/off)	National brand leader ratio (on/off)	Private label ratio (on/off)	Reference brand ratio (on/off)	National brand leader ratio (on/off)
Aluminum foil	0.98	1.07	1.07	0.90	1.12	1.12	1.11	2.10	2.10
Biscuits	1.00	0.88	0.84	0.87	0.91	0.75	1.16	1.00	1.05
Bleach	1.03	0.95	0.95	1.04	0.96	0.96	1.15	1.30	1.30
Brioche	1.59	0.95	0.63	1.38	0.96	0.66	1.36	1.08	0.96
Canned chickpeas	0.97	1.16	1.10	0.96	1.22	1.19	1.26	1.34	1.29
Canned tuna	1.16	0.97	1.14	1.22	0.93	0.97	1.12	1.06	1.08
Chocolate	0.55	1.44	1.46	0.82	1.32	1.41	0.80	1.13	1.19
Dish-washer	0.97	1.01	1.01	0.93	1.05	1.12	1.22	1.19	1.21
Floor cleaner	1.11	0.95	0.99	1.11	0.91	0.93	1.33	1.14	1.16
Flour	1.23	0.82	0.81	1.39	0.84	0.84	1.15	1.04	1.03
Frozen pizza	1.02	0.88	0.88	1.40	0.89	0.87	1.20	1.49	1.39
Hair conditioner	1.37	0.99	1.06	1.29	0.85	0.82	1.65	1.29	1.23
Kitchen paper	1.13	0.91	0.90	1.07	0.98	0.98	1.37	1.51	1.50
Muffins	0.94	1.39	1.28	0.95	1.23	1.15	1.11	1.07	1.13
Nonfat milk	0.92	1.16	1.17	0.87	1.13	1.08	1.01	1.08	1.07
Olive oil	1.03	0.86	0.89	1.05	0.84	0.85	1.12	1.10	1.08
Olives	1.08	1.05	1.08	1.11	0.97	1.09	1.30	1.36	1.17
Orange juice	1.41	1.01	1.01	1.24	1.24	1.21	1.19	1.14	1.42
Paper napkins	1.06	1.01	0.94	1.22	1.05	0.98	1.17	3.11	6.36
Plain yogurt	1.16	0.93	0.94	1.27	0.74	0.74	1.17	1.01	1.01
Plastic bags	1.08	0.93	0.95	1.74	0.85	0.85	1.12	2.92	4.46
Powder detergent	1.18	0.89	0.93	1.58	0.87	0.94	1.05	1.12	1.04
Rice	1.19	1.21	1.11	1.28	1.03	0.97	1.62	1.19	1.14
Sandwich bread	1.15	0.95	0.95	1.34	0.72	0.72	1.10	1.02	1.02
Shower gel	1.57	1.18	1.13	1.64	1.07	1.01	1.36	1.29	1.26
Spaghetti	1.37	0.90	1.21	1.51	0.78	1.78	1.29	1.13	1.02
Toilet paper	1.00	1.01	1.02	0.90	1.05	1.06	1.16	1.52	1.32
Transparent foil	1.03	0.96	0.96	1.13	0.89	0.89	1.14	1.23	1.23
Uncarb. mineral water	0.48	1.00	1.01	0.58	1.01	0.97	0.59	0.92	0.94
WC cleaner	1.04	1.02	1.00	1.01	0.95	0.91	1.14	1.27	1.35
Mean	1.09	1.01	1.01	1.16	0.98	0.99	1.18	1.34	1.48

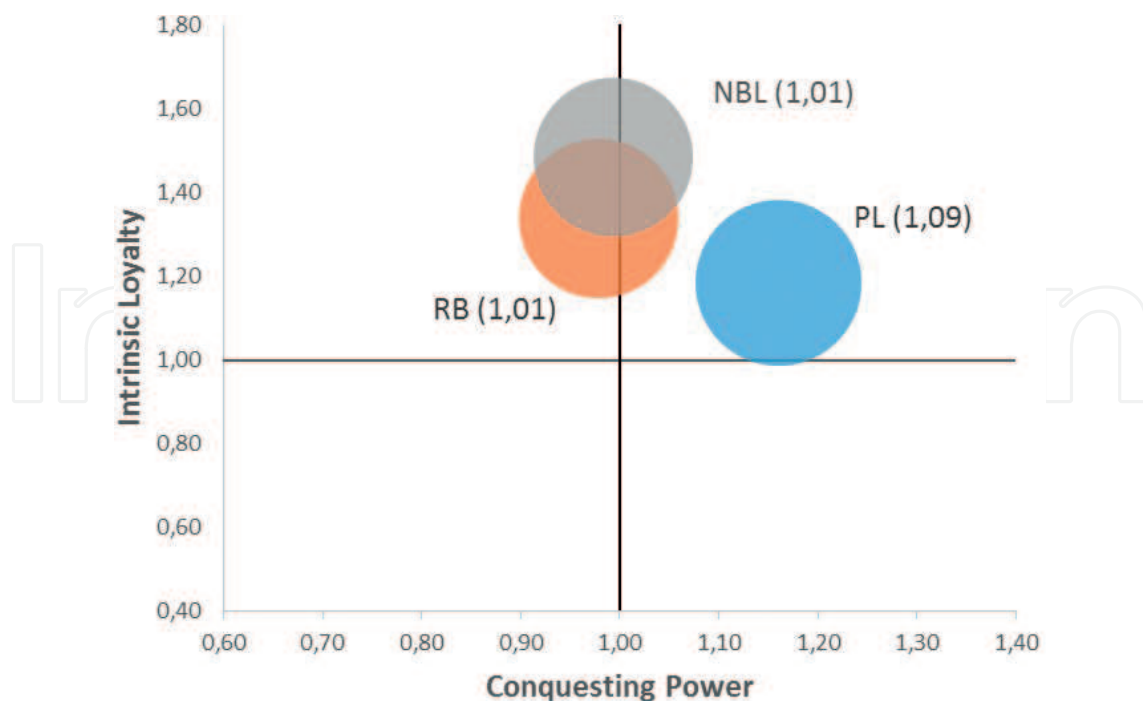
**Table 2.** Online/offline ratios by product category.



Note that the market share is the compound of the intrinsic loyalty and the conquering power. Therefore, it is interesting to see what happens with these two measures. Mean values show that whereas the intrinsic loyalty is 1.18 times greater online than offline for the private label, it is 1.34 times greater for the reference brand and 1.48 times greater for the national brand leader. These figures suggest that all the brands increase their intrinsic loyalty online, but the improvement is stronger for the national brand (both the leader and the reference) than for the private label. On the contrary, the average ratios online/offline for conquering power show that only the private label increases its conquering power online, whereas the national brand leader and the reference brand decrease it, although slightly (1.16 vs. 0.98 and 0.99). These results show that the higher increase in market share in the online channel of the private label, compared to the national brand, is a result of both an increase in intrinsic loyalty and in conquering power. And that the increase in market share on the online channel of the national brand is a result of an increase in intrinsic loyalty, but not in conquering power. We can see these results graphically in **Figure 3**.

### 2.3. Online/offline ratios by product categories

The online/offline channel effects that have been reported heretofore on average can be visually represented for categories by means of a map, which considers the three competition measures we analyze. This map uses data from **Table 2** as input and represents the effects of online channel shift on intrinsic loyalty, conquering power and market share across product categories. In concrete, the X-axis reflects the effect of online channel shift on a brand's conquering power, the Y-axis reflects the effect on its intrinsic loyalty, and the color and shape



**Figure 3.** Private label, national brand leader, and reference brand's intrinsic loyalty and conquering power online/offline ratios. Between parentheses market share online/offline ratios.

of the bean representing the brand reflect the effect on its market share (note that, at this map, the position of each category is represented by a bean). For the intrinsic loyalty and conquesting power dimensions, the frontier between a gain and a loss (due to the online channel shift) is delimited by a line, whereas the market share change is marked with beans with of different shape.

Figures 4–6 show this map for the private label, the reference brand, and the national brand leader, for all the analyzed product categories. These maps provide two insights. First, within each map, we can observe that the effect of the online channel shift is not homogeneous across product categories. For instance, when going online (see Figure 4), the private label gets worse in terms of intrinsic loyalty, conquesting power, and market share for the chocolate category, whereas better for the shower gel category. For the canned chickpeas category, however, the private label improves its position in terms of intrinsic loyalty but gets worse in terms of conquesting power and market share. Second, across the three maps (private label, reference brand, and national brand leader maps), we can compare the position of each category for the private label and national brands. In this comparison, the reader must take into consideration that the market shares and conquesting powers for all brands in a category add to 100, respectively.<sup>1</sup> Therefore, it is not striking that while the private label gets worse online for the

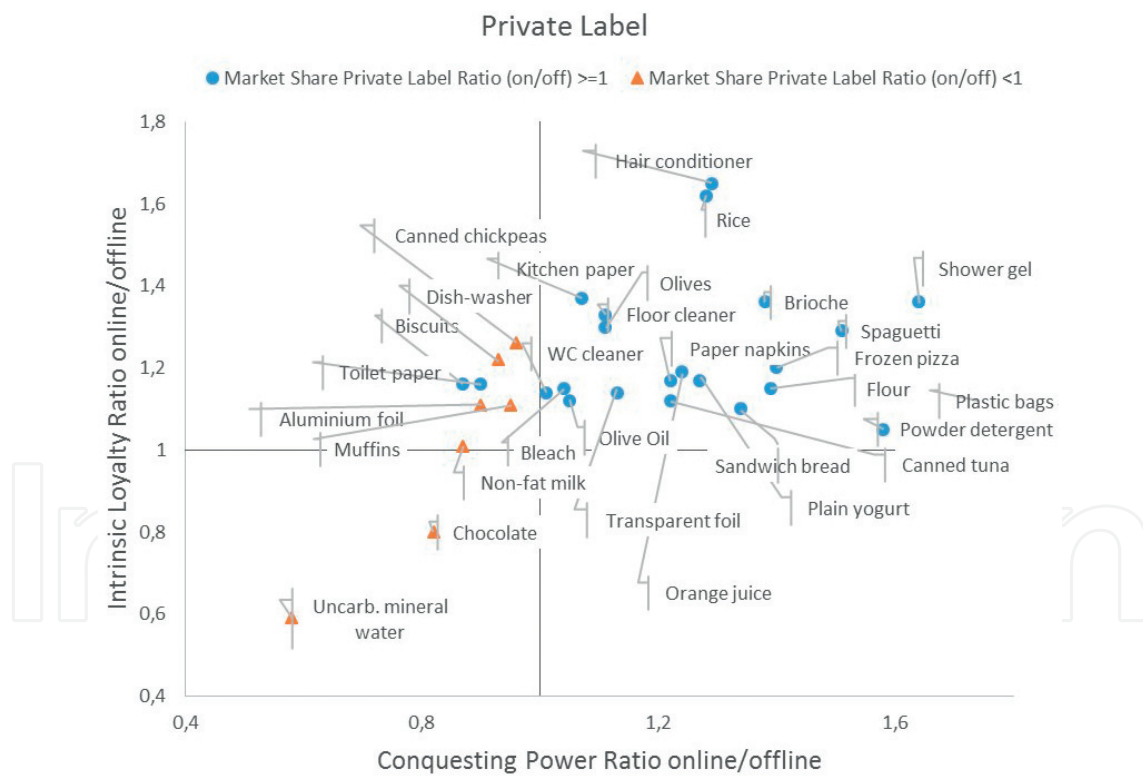


Figure 4. Private label channel shifts across product categories.

<sup>1</sup>In our analysis, market shares for some categories do not add 100 because not all the brands in the category have been included in the analysis, as explained before.

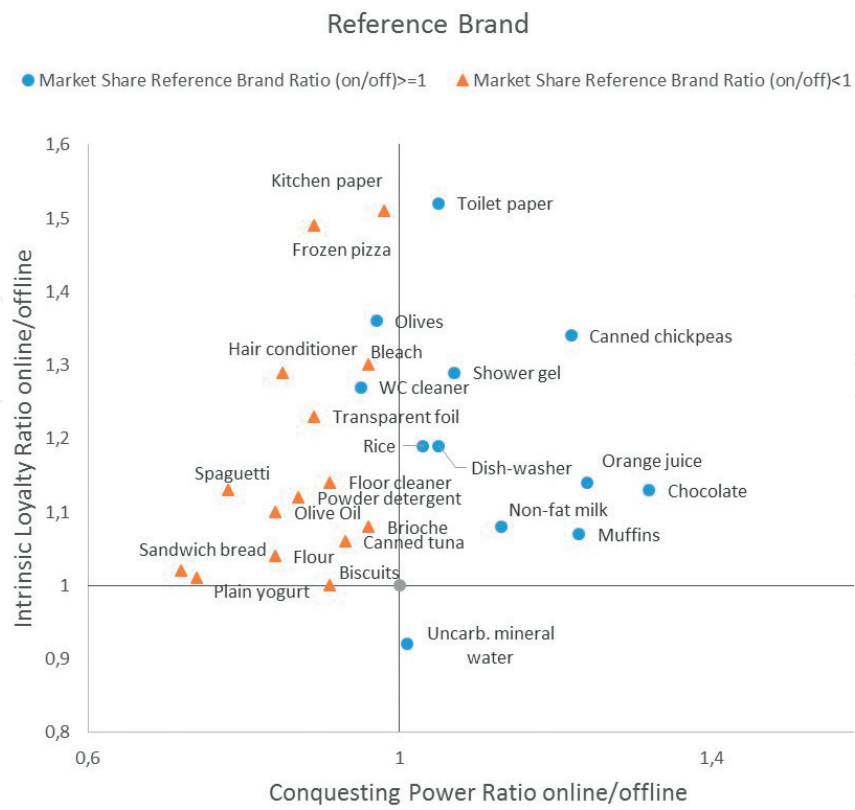


Figure 5. Reference brand channel shifts across product categories.

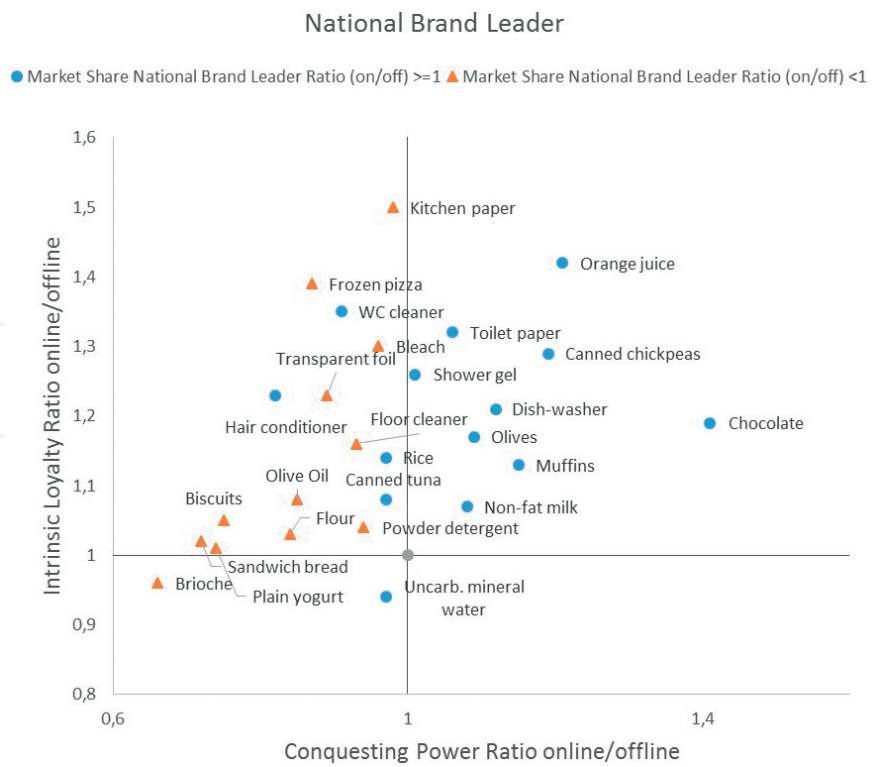


Figure 6. National brand leader channel shifts across product categories.

chocolate category, the reference brand, in particular the national brand leader improve their position online. However, for the intrinsic loyalty dimension, we can see categories for which the online channel shift affects all brand measures in the same direction. For instance, for the kitchen paper category, the private label, the reference brand, and the national brand leader have their intrinsic loyalty increased online. In general, private label's loyalty decreases at the online channel for foods and beverages, and increases for sensory products (products consumers evaluate with their senses, such as smell or touch). We can also see that private label's loyalty grows less in categories where the price difference between the private label and the national brand is higher. This finding favors the idea that an excessive price differential with national brands may hamper the success of the private label in the category. More results about the differences across categories are found in [13].

Global results indicate that whereas both the private label and the national brand increase their intrinsic loyalty online, it is the private label the brand which increases its conquering power online. In addition, it is the brand which increases more its market share online. These findings suggest that the private label is benefiting from its "empowered" conquering power online to gain market share at this channel. However, category-level results show that the online channel does not affect competition among private label and national brands homogeneously across categories. This finding reveals that management shall suit its online global marketing strategies to category-specific characteristics.

### **3. Conclusions and management implications**

We provide here some conclusions and implications for manufacturers and retailers in the management of their national brands and private labels. We focus on the online channel, and add some recommendations to the existing literature (see, for example, [15]). We have found that all the brands increase their loyalty online and more the national brands. This means that consumers tend to purchase the same brand more in the online channel than in the offline channel. One reason can be that consumers might be using shopping lists from previous purchase occasions when buying online. Another reason can be that consumers buy online for convenience, and this makes them to do less search and to be more inertial in their behavior. Higher loyalty reduces competition. If brands want to break this loyalty, they should make more and deeper price discounts than in the offline channel. Otherwise, consumers will keep buying the same brand. Launching a new product will also be more difficult in the online channel, since it will not be included in the shopping lists.

Only the private label increases its conquering power at the online channel. One reason can be that the retailer offers a tool to substitute all the brands in the cart by the private label, and there can be consumers using it. This shows that the retailer has a higher control on the shopping environment online, and that this control may be used in its favor. Another reason can be that, since consumers use the online channel for convenience, purchasing the private label simplifies the purchase, and therefore some consumers may behave in this way. The private label increases its market share online, and this is driven by its higher conquering power.

We have also seen that these general results vary across categories. Although we have not investigated here the reasons why this might be, it seems clear that the previous general results will be even deeper in some categories. For example, the market share of the private label is 157 and 137% higher online than offline for the shower gel and the spaghetti categories.

In general, we can conclude that the private label improves its competitive position at the online channel more than the national brand. This is bad news for manufacturers, and good news for retailers.

## Acknowledgements

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## Appendix

### The Colombo and Morrison Model

We use the model by Colombo and Morrison [14] to build the measures of intrinsic loyalty and conquering power.

The Colombo and Morrison [14] model is well established in the marketing literature (e.g., [16]). Its parameter estimates have clear managerial interpretations, it is robust, and the data requirements are few. The input to the model is a brand switching matrix whose elements  $(i, j)$  represent the proportion of consumers who purchased brand  $i$  on one purchase occasion and switched to brand  $j$  on the next occasion (see an illustration below). The elements  $(i, j)$  therefore give the conditional probability that brand  $j$  is purchased, given that  $i$  was bought the previous time. A simple brand-loyalty measure would look at the diagonal elements of the matrix, which give the repeat-purchase probabilities. However, this measure, as already noted, does not distinguish between (1) consumers who repurchase the brand because they are intrinsically loyal to the brand and (2) consumers who just pick any brand and happen to select the same one on two consecutive occasions.

The key underlying assumption of the Colombo and Morrison model is, therefore, that there are two kinds of consumers: consumers who are intrinsically loyal and stay with the same brand, and potential switchers who on every purchase occasion choose between all brands in the market.

All potential switchers are assumed to have the same probability to buy a specific brand, but this probability may differ across brands. The proportion of loyal consumers and the potential switchers' choice probabilities are linked to the elements of the observed brand switching matrix through:

$$p_{ii} = \alpha_i + (1 - \alpha_i)\pi_i, \quad i = 1, 2, \dots, I \quad (4)$$

$$p_{ij} = (1 - \alpha_i)\pi_j, \quad i \neq j, \quad i, j = 1, 2, \dots, I \quad (5)$$

where  $p_{ij}$  is an element of the switching matrix,  $\pi_i$  the proportion of potential switchers buying brand  $i$ , and  $\alpha_i$  the proportion of the current buyers of brand  $i$  who is intrinsically loyal. The first equation states that the (conditional) probability to repurchase brand  $i$  ( $p_{ii}$ ) depends on (1) the proportion of loyals ( $\alpha_i$ ) and (2) the proportion ( $\pi_i$ ) of the potential switchers ( $1 - \alpha_i$ ) who decided to repurchase brand  $i$  after all. The second equation shows how the conditional probability  $p_{ij}$  equals the proportion ( $\pi_j$ ) of the potential switchers ( $1 - \alpha_i$ ) who choose brand  $j$ . Clearly, every actual switcher is a potential switcher, but not every repeat purchase comes from a loyal consumer.

Parameters  $\alpha_i$  and  $\pi_i$  must be estimated for each brand included in the brand switching matrix. Note that although  $\alpha_i$  and  $\pi_i$  can both vary between 0 and 1, there is no simple relation between the two because they refer to a different base. The former refers to the proportion of the current buyers of a brand that is intrinsically loyal, while the latter refers to the proportion of the total number of switchers in the market that will buy that brand. In general,  $\alpha_i$  will be larger than  $\pi_i$ , but this has no intrinsic meaning as, already explained, they refer to different bases. Note also that  $\sum_{i=1}^I \pi_i = 1$ ; i.e., the sum of the proportion of potential switchers who decided to repurchase each brand in the market equals 1.

The market share of a brand can then be explained in terms of its intrinsic loyalty and its conquering power. At a purchase occasion  $t$ , the market share of brand  $i$  is the sum of its probability of being repurchased by consumers who previously purchased it, plus the probability of being purchased by consumers who previously purchased other brands in the market.

$$Market\ Share_i = P_{ii} + \sum_{j \neq i}^J P_{ji} = \alpha_i + (1 - \alpha_i)\pi_i + \sum_{j \neq i}^J (1 - \alpha_j)\pi_j = \alpha_i + \sum_j^J (1 - \alpha_j)\pi_j \quad (6)$$

In terms of our two dimensions of brand  $i$ 's power, it is clear that  $\alpha_i$  measures its intrinsic loyalty, while  $\pi_i$  is a measure of the brand's conquering power.

## Specification of our model

The Colombo and Morrison model is based on the construction of a brand switching matrix, which requires a minimum of two observations per consumer. Given that we observe the purchase behavior of our consumers during a whole year, we apply the Colombo and Morrison model to successive switching matrices, which results in the evaluation of  $\alpha_i$  and  $\pi_i$  at the purchase occasion level, instead of at the consumer level. This means that for every consumer in our database, we examine its repetitive or switching behavior across brands from one purchase occasion to the next.

Imagine there are three brands in the market, brand A, brand B, and brand C. Consider that consumer  $h$  purchases brand A at its first purchase occasion, brand A at its second purchase

occasion, and brand C at the third one. Consider that consumer  $k$  purchases brand B at its first purchase occasion, brand A at its second purchase occasion, brand C at its third purchase occasion, and brand C at its fourth one. From our approach, we do not limit our attention to two consecutive purchases of each consumer (let us say the first two purchase occasions), but to all purchase occasions of each consumer.

For consumer  $h$ , 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 consumer  $k$ , 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 Colombo and Morrison model 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

With our approach, we (1) take into consideration all purchases of every consumer in a product category, and therefore introduce the weight of each consumer's purchases on the total category purchases, i.e., we provide more weight to heavy than light buyers in the category. Consequently, we (2) can consider a larger number of observations at each category, which allow us to evaluate a wide range of categories in our investigation. Otherwise, the switching matrices for some categories would have presented too many zeros to enable the estimation of the parameters.

Besides, in this investigation, we intend to draw differences in brand power across online and offline channels. Given that the building of a switching matrix needs evaluating pairs of two consecutive purchases, we should determine how we define an “offline observation” and an “online observation.”

In our database, we can find four different combinations for a pair of purchases: (1) both purchases are done offline, (2) both purchases are done online, (3) the first purchase is done offline but the second is done online, and (4) the reverse, the first purchase is done online but the second is done offline. Limiting our attention to the first two cases, for which the differentiation between an offline observation and an online observation is clear, would have meant to discard many of the purchase registers of our database, since many consumers switch between channels from one occasion to the next. Hence, we establish the following criteria to distinguish between offline and online observations: A pair of two consecutive purchases is considered as an offline observation when the second purchase is done offline, whereas it is considered as an online observation when the second purchase is done online. This means it is the channel where the second purchase is done, the one which determines whether an observation is referred to as offline or online. In this way, we attach more importance to the channel where the consumer is currently purchasing than the channel where it previously purchased as a determinant of its current shopping behavior.

We build a switching matrix per category and channel, which means that for the estimation of intrinsic loyalty and conquering power parameters, we use 60 switching matrices (30 product categories  $\times$  2 channels).

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