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The evolution of the relationships between product attributes in determining consumers' behavioural loyalty

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Abstract

This work presents a new statistical distribution, called *Qualitative Multinomial Distribution* (QMD), able to analyse the relationships between brands and product attributes in determining consumers' behavioural loyalty. In this study the QMD will be applied to the retail purchases of wine in Italy made in two three-year periods (2003-2005 and 2006-2008), and the relationships between three product attributes – formats, prices and quality designations – will be observed. The results show a general presence of interaction effects among these attributes. In particular, the outcomes evidence that in both interval times format drives loyalty more than quality designation and price. However, while in 2003-2005 price and format show the strongest interaction, format and quality designation take the lead in 2006-2008.

Keywords: behavioural loyalty, qualitative multinomial distribution, evolution over time, wine

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Introduction and Literature Review

The analysis of behavioural loyalty is a fascinating though complicated research topic. Despite the fact that its importance has been recognised by several scholars (Bennet et al., 2007; McMullan, 2005; Brown, 2004; Smith et al., 2004) the debate is still open on (a) how loyalty evolves over time and (b) how is it possible to measure the relationships – interaction and/or correlation – between brands and product attributes in determining overall behavioural loyalty.

Loyalty, in fact, is not stable, but it evolves dynamically (Olsen, 2002; Bloemer and Kasper, 1995). For example, Löfgren et al. (2008) observed that benefits and attributes have different roles in affecting customer satisfaction and loyalty, in respect to the different moments of the consumption cycle of three packaged goods: ground coffee, frozen lasagne and orange juice. In particular, Graham (2009) observed the purchases made by over 4,000 English households over eighteen product categories, 140 brands, and six years, and found that despite an apparent stationarity in people repurchase behaviours, there are some substantial changes. The number of repeat buyers, in fact, tends to decline by one third on average, but they are replaced by a similar number of new buyers. Despite this, however, brand defection seems investable and conforms to the double jeopardy norms, a result, which is also shared by Wright and Riebe (2010), who analysed it on four different product categories: banks, industrial contracts, TV viewing and packaged goods. These results are conceptually similar to those obtained by Rungie et al. (2002) and Corsi et al. (2009). The first analysed ten years of anti-depressant prescriptions of GP panel members through the use of the polarization index (φ), concluding that as the number of brand increases, loyalty tends to decrease. Similarly, Corsi et al. (2009) applied the φ over the purchases of wine in the Italian retail sector in two consecutive three-year periods (2003-2005 and 2006-2008), observing how loyalty to three product attributes – price, format and quality designation – evolved over time. Once again, their results showed that loyalty decreases at a category level, but some levels within each of them (geographic indications – GI – and foreign wines, as well as the popular premium - €3-€5 – price category) increase their loyalty values. However, none of these studies were able to measure what the relationships between brands and product attributes are in determining overall behavioural loyalty.

In relation to this, literature evidenced that interaction and correlation effects exist. The first occurs when the association between two variables varies according to the level of one or more covariates (Greenberg, 1985), hence showing the extent at which a factor impacts on the value of another. The second does not prove evidence of any causal relation between the variables, but it measures the strength of a linear or nonlinear relationship between them (Bharati and Chaudhury, 2004). Only two studies so far were able to measure these effects under a loyalty perspective. Rungie (2007) applied a new statistical distribution – called *Qualitative Multinomial Distribution* (QMD) – to observe the preferences for post doctoral employment of US doctoral students, finding that there is a strong interaction between the reputation of the university and that of the department. The same methodology was applied to the purchases of wine in a retail setting in the years 2003-2005, again finding that price, format and quality designations interact together (Corsi et al., 2010). However, these studies never tested whether the QMD is a valid methodology when utilised to measure these relationships over time.

Therefore, the purpose of this paper is to apply the QMD on the purchases of wine made in two three-year periods (2003-2005 and 2006-2008) by a representative sample of the Italian population in the retail sector as reported by the AC Nielsen consumer panel. More specifically, given that it has been widely demonstrated that in a fragmented market, as that of wine, product attributes influence loyalty more than brands (Jarvis and Goodman, 2005), the analysis will be focused on three product attributes: format, price and quality designation.

Methodology

The *Qualitative Multinomial Distribution* (QMD) is obtained by combining two well known statistical distribution: the *Multinomial Logit* (MNL) and the *Dirichlet Multinomial Distribution* (DMD) (Rungie, 2007). The former is able to accommodate variable choice sets and deconstruct choice into utilities and partworths. However, the MNL is not able to (a) separately measure between and within consumer variance, (b) analyse the impact of choice sets and attributes on loyalty, and (c) identify reliability. The latter, the DMD, is considered the multivariate extension of a *Beta Binomial Distribution* (BBD), which is applicable when consumers make repeated choices from the same binary choice set. The DMD conceptualizes each choice by each individual as a Bernoulli trial, and his/her repeated choice as a multinomial trial, based on a fixed latent conditional choice probability for the consumer. Over the population, these probabilities have a Dirichlet distribution. Hence, the DMD is a multinomial mixed by a Dirichlet. This feature is unique in choice modelling and the main outcome is that the properties of the repeated choice (DMD) and the latent conditional choice probabilities (Dirichlet) can be estimated from the data. This means that variances are known, thus the DMD allows identifying reliability, partitioning the variance and establishing behavioural loyalty levels. This distribution, however, presents two limitations. As implicit assumptions of the DMD (i) only brands (or any one attribute) can be evaluated, and (ii) there is no variation in the underlying loyalty toward the levels assumed by the brands (or the levels of the attribute). This explains the necessity to apply the BBD to each single item j, so as to analyse the loyalty expressed as a binary choice between it and all the other items in the choice set.

The QMD is able to combine the strengths of both distributions, while eliminating their respective constraints. The main assumptions are summarised here: (i) the functional form which links variable partworths to latent conditional choice probabilities via variable choice sets is logit, (ii) the sequence of choices for each consumer is independent and the partworths are stationary, (iii) the partworths have a Gaussian distribution, and (iv) the interaction partworths are independent (Rungie, 2007).

Data, Analysis & Results

Data have been gathered from the AC Nielsen Italian consumer panel. The purchases of wine were recorded for six years (2003-2008). The sample was originally split in two three-year periods – 2003-2005 and 2006-2008 – and three product attributes were taken into consideration: price, format and quality designations. The first sub-sample accounts for 5,299 households, while the second comprises 6,394 families. A further sub-sample was extracted from each of the two groups, in order to include only those households with somewhat regular purchase behaviour. The sub-samples include the families who (a) bought wine on more than one occasion in each of the two three-year periods and (b) bought more than ten units of wine in each of the two interval times.

The QMD could be applied in a multivariate way, but, given the innovativeness of the methodology, it was decided to consider only two levels per attribute. In particular, the two selected price ranges are '<€3' and '>€3' – as the basic tier (< €3) accounts alone for a 68.2% of the market (IRI Infoscan, 2007). Segmentation according to denominations classified wine based on the presence/absence of a quality designation. Thus, wines have been catalogued as 'GI-DOC-DOCG' vs. 'NOT GI-DOC-DOCG'. In relation to formats, wines in 'up to 0.75 litres bottles' were grouped together. The other group has been organised in order to account for the sales of 1litre carton wines and larger formats, including 3litre bag-in-box wines. This generated eight possible product alternatives.

First of all, the QMD estimates the nature of relationship between product attributes, by running four variants of the model. The 'base model' only shows the means and the variance of the attributes, but it does not include interaction or correlation effects. Conversely, the 'full model' takes into account both effects, hence it presents 7 parameters – means and variance of the two attributes, means and variance of the interaction effect and the parameter relative to the correlation effect.

Secondly, one has to observe the means (μ_1, μ_2, μ_3) – which represent the partworth utilities consumers show when moving from one level of the attribute to the other – and the standard deviations (σ_1, σ_2, σ_3) – which (a) express the extent at which consumers differ in the utility they attach to each attribute, and (b) tell us what attribute drives more loyalty (Rungie, 2007).

Thirdly, the means (μ_4, μ_5, μ_6) and the standard deviations (σ_4, σ_5, σ_6) of the interaction section and the correlation coefficient (ρ), explain if there is a positive or negative interaction/correlation effect when the attributes are combined together.

Finally, it is possible to look at the loyalty levels associated with the different product alternatives and observe how these values evolved over time.

The preliminary analysis of the results shows a general presence of interaction effects among attribute levels in determining the overall level of consumers' loyalty (table 1). The observation of the log likelihood tests for both three-year periods shows that the model able to explain at best what kind of relationship exists among attributes levels is the one which includes the presence of interaction effects, but excludes the presence of correlation. This means that the levels which determine an increase in consumers' utility (which also means an increase in customer loyalty) should be presented together in order to generate the highest loyalty levels.

Tab. 1: log-likelihood values of the four variants of the QMD

ATTRIBUTES	ALTERNATIVES	MODEL	# PARAMETERS	LOG LIKELIHOOD	
				03-05	06-08
PRICE x FORMAT	Base	No Correlations; No interaction	4	237005	343680
	Correlation	Main correlation, No interaction	5	235024	343061
	Interaction	No correlation; Interaction	6	195920	329771
	Full	Main correlation, Interaction	7	195916	329772
PRICE X DESIGNATION	Base	No Correlations; No interaction	4	259292	353958
	Correlation	Main correlation, No interaction	5	258067	353051
	Interaction	No correlation; Interaction	6	234672	333572

	Full	Main correlation, Interaction	7	234631	333558
DESIGNATION X FORMAT	Base	No Correlations; No interaction	4	275402	345171
	Correlation	Main correlation, No interaction	5	274406	343229
	Interaction	No correlation; Interaction	6	244204	298297
	Full	Main correlation, Interaction	7	244203	298293

If one now looks (table 2) at the means (μ_1, μ_2, μ_3), one observes that in both periods consumers show a positive utility by moving from a higher to a lower price (1.25 in 2003-2005 and 1.01 in 2006-2008), and from a table to a quality wine (0.46 and 0.65 respectively). Conversely, the choice of regular bottles over bigger formats does not seem to particularly influence consumers' choices, as the partworth values are in both cases very close to zero (-0.01 and 0.06). Similarly, the standard deviations (σ_1, σ_2, σ_3) for both periods show that format (1.66 in 2003-2005 and 1.19 in 2006-2008) drives loyalty more than quality designation (1.01 and 0.98 respectively), and price (0.89 and 0.87).

Conversely, the results relative to the strength of the interaction effects (μ_4, μ_5, μ_6 - σ_4, σ_5, σ_6) evidence that the relationships between product attributes in driving behavioural loyalty changed over time. In 2003-2005, in fact, price and format show the strongest interaction (μ=1.16 – σ=0.68), followed by price and quality designation (0.75 – 0.20), and format and quality designation (0.67 – 0.88). This scenario is opposite to that relative to the three-year period 2006-2008. In this last interval time, format and quality designation showed the highest levels of interaction (1.09 – 0.82), followed by price and quality designation (0.75 – 0.55), and by price and format (-0.03 – 0.70).

Tab. 2: utility and interaction parameters for 2003-2005 and 2006-2008

RESULTS		UTILITY						INTERACTION					
		PRICE		FORMAT		DESIGN.		PRICE		FORMAT		DESIGN.	
		μ1	σ1	μ2	σ2	μ3	σ3	μ4	σ4	μ5	σ5	μ6	σ6
2003-2005	**PRICE** HIGH to LOW			1.25	1.01	1.25	1.01			1.16	0.68	0.75	0.20
	FORMAT SMALL TO BIG	-0.01	1.66			-0.01	1.66	1.16	0.68			0.67	0.88
	DESIGNATION TABLE TO GI-DOC-DOCG	0.46	0.89	0.46	0.89			0.75	0.20	0.67	0.88		
2006-2008	**PRICE** HIGH to LOW			1.02	0.98	1.02	0.98			-0.03	0.70	0.75	0.55
	FORMAT SMALL TO BIG	-0.06	1.19			-0.06	1.19	-0.03	0.70			1.09	0.82
	DESIGNATION TABLE TO GI-DOC-DOCG	0.65	0.87	0.65	0.87			0.75	0.55	1.09	0.82		

Finally, we can look at the loyalty values that the eight product combinations are able to generate and see how they evolved over time. These values should be interpreted exactly as those of the polarization index (φ), when applied to single brand categories or product

attributes (Corsi et al., 2010). The strong interaction between price and format in 2003-2005, and in particular, of higher priced wines and regular bottles versus lower priced wines sold in bigger formats, generate the three highest loyalty values for this interval time (#8=0.53, #1=0.52 and #6=0.40). However, the change in the strength of the interactions between the two periods emerges when looking at the values relative to 2006-2008. Consistent with the growth of interaction between quality designation and format, one can see that alternatives #4 and #5 register the highest increase in terms of loyalty between the two time periods (160.0% and 33.3% respectively). Similarly, although alternatives #8 and #1 reduce their loyalty values, due to the weakening of the relationship between price and format, they are still able to be the loyalty leaders due to the strength between quality designation and format (#8=0.48 and #1=0.44). For analogous, but opposite reasons, alternatives #6 and #3, which could benefit of the interaction between price and format in 2003-2005, evidence the two highest losses in 2006-2008 (#3=-36.8% and #6=-22.5%).

Tab. 3: changes in loyalty from 2003-2005 to 2006-2008

Alternative	Description	Loyalty (ϕ)		Diff. (%)
		2003-2005	2006-2008	03-05/06-08
1	≥€3 - GI/DOC/DOCG - ≤0.75l	0.52	0.44	- 15.4
2	≥€3 - GI/DOC/DOCG - >0.75l	0.26	0.32	23.1
3	≥€3 - NOT GI/DOC/DOCG - ≤0.75l	0.19	0.12	- 36.8
4	≥€3 - NOT GI/DOC/DOCG - >0.75l	0.10	0.26	160.0
5	<€3 - GI/DOC/DOCG - ≤0.75l	0.33	0.44	33.3
6	<€3 - GI/DOC/DOCG - >0.75l	0.40	0.31	- 22.5
7	<€3 - NOT GI/DOC/DOCG - ≤0.75l	0.37	0.35	- 5.4
8	<€3 - NOT GI/DOC/DOCG - >0.75l	0.53	0.48	- 9.4

Conclusions

This work presented a new statistical distribution, called *Qualitative Multinomial Distribution* (QMD), which is able to analyse the relationships (none, interaction, correlation or a mix of the two) between product attributes in determining the loyalty levels the latter are able to stimulate over time.

The results showed that the model able to explain at best the relationships between the three attributes under analysis – price, format and quality designation – is the one which includes the presence of interaction, but excludes that of correlation. In particular, the outcomes evidenced that in both interval times format drives loyalty more than quality designation and price. However, while in 2003-2005 price and format show the strongest interaction, followed by price and quality designation, and format and quality designation, the ranking was inverted in 2006-2008, with format and quality designation then leading the ranking.

Future researches will extend this analysis to a multivariate level, in order to have a more sensible representation of reality. Secondly, the same data will be studied adopting a longitudinal approach, so as to consolidate the validity of the methodology. Finally, the QMD will be applied to different product categories, in order to verify whether the results obtained in this study are only specific to wine purchases or whether they can be extended further.

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