Competitive strategies of Italian bottled water industry: evidence from a hedonic analysis

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Abstract

Bottled water has become a global business and Italy is one of the most important producer and consumer countries. However, the Italian bottled water market seems to have reached the maturity stage of its lifecycle. Because the competitive pressure is strongly increased, bottled water producers need to revise their marketing strategies. This study aims to analyze the emerging market trends and policy concerns. We built a hedonic price model to evaluate whether, and to what extent, the price of bottled water depends upon its extrinsic (brand, packaging, origin), and intrinsic characteristics (mineral composition). Data were collected via direct observation of the shelves in some modern retail stores. Results show that bottled water is highly differentiated and its retail price is mainly affected by extrinsic characteristics. Conversely, intrinsic characteristics affect the price of bottled water moderately. On the basis of these results, some insights are provided for both practitioners and policy makers.

Keywords
bottled water, mineral water, consumption, hedonic price, competitive advantage

Introduction

Bottled water has become a global business (Wilk, 2006), and Italy is one of the most important producer and consumer countries (IBWA, 2015). In Italy, consumption of bottled water began in the 1970s and, since then, per capita consumption has increased considerably from 47 litres in 1980 to a maximum of 192 litres in 2008 (Bevitalia, 2015). The strong increase of bottled water consumption has been mostly linked to the changes of food habits and, specifically, to the rising consumers' attention towards some attributes of drinking water such as palatability, safety, healthiness and convenience (Rani et al., 2012). However, in the last years (2005-2013) Italian bottled water consumption was stagnant considering that per capita consumption has been ranging between 187 and 190 litres. This is probably due to the persistent economic crisis that is reducing purchasing power of Italian households, but also to other factors. In particular, modern water purification devices are increasingly used in bar and restaurants as well as at home to treat tap water by removing

DOI: 10.13128/REA-18648
ISSN (print): 0035-6190
ISSN (online): 2281-1559

chlorine, bad taste and odours in order to provide safe and palatable drinking water in substitution of bottled water. In addition, there is a growing movement against the consumption of bottled water for its environmental impacts (Rani et al., 2012). Really, the bottled water production process uses vast amounts of energy for extraction, processing, bottling and transportation of water, not to mention the waste created by the empty bottles, most of which are not recycled (Legambiente, 2014). In other words, Italian bottled water market seems to have reached the maturity stage of its lifecycle (Rani et al., 2012) and, therefore, the competitive pressure is strongly increased. In this new context, bottled water producers need to revise their marketing strategies in order to build or reinforce their competitive advantages and defend their profits and market shares from competitors.
A review of the economics literature on the bottled water market reveals that most of studies have focused on the environmental impacts of bottled water consumption (Gironi and Piemonte, 2010; Niccolucci et al., 2011; Torretta, 2013), while, to our knowledge, only few studies provide insights supporting firms in their decision-making problems (He et al., 2008; Rani et al., 2012). This study starts from the observation that a variety of products with different features and prices is now available in the Italian bottled water market despite the simplicity of "water product", but it is unknown how retail price of bottled water is affected by its attributes. Our survey aims to fill this knowledge gap measuring whether, and to what extent, the price of bottled water depends upon its extrinsic (brand, packaging, origin), and intrinsic characteristics (mineral composition). Specifically, we used the hedonic price method to estimate the implicit prices associated with the main characteristics of bottled water. The hedonic approach has been successfully employed to analyze the market of several food products, including wine (Nerlove, 1995; Oczkowski, 1994; Schamel, 2006; Steiner, 2004; Boatto et al., 2011; Panzone, 2011), carbonated beverages (Martínez-Garmendia, 2010), apples (Carew et al., 2012), yogurt (Carlucci et al., 2013), coffee (Schollenberg, 2012), and olive oil (Cicia et al., 2013; Carlucci et al., 2014; Muñoz et al., 2015). Estimates of the implicit prices of bottled water attributes can provide useful insights for both practitioners and policy makers. First, firms involved in this market, being aware of their production costs, can use implicit prices to devise optimal mix of attributes and more profitable marketing strategies. Second, the hedonic approach allows to isolate the premium for some attributes affecting the environmental impact of bottled water consumption such as the use eco-friendly bottles and the distance between the water sources and the point of sale. Regarding these aspects, interesting policy implications can also be deduced.

An overview of the Italian bottled water market

In 2013, the Italian bottled water consumption was over 12 billion litres, the seventh highest in the world after China (39), the USA (38), Mexico (31), Indonesia (18), Brazil (18), and Thailand (15) (IBWA, 2015). In terms of annual per capita consumption, Italy (190 L) is the first European country and third in the world after Mexico (255L) and Thailand (225L) (IBWA, 2015). It is also important to note that most of the bottled water consumed in Italy is produced domestically and foreign trade is limited (Bevitalia, 2015).

Contrary to other countries in the world, like China and the USA, where purified water[1] is largely sold as bottled water (IBWA, 2015), in Italy, bottled water is essentially represented by the so-called "natural mineral water" (Bevitalia, 2015) as specified in the Legislative Decree n. 176/2011 implementing the European Directive 2009/54/EC. By law, natural mineral water is clearly distinguished from ordinary drinking water by its original purity (absence of chemical treatments) and its specific properties favourable to health.
According to the annual report of Bevitalia (2015), in 2013, the Italian bottled water industry included 143 companies of different sizes with overall annual gross sales of 2.4 billion Euros. The industry is highly concentrated considering that the four largest players (Nestlé Waters, San Benedetto, Norda and Fonti Vinadio) control more than the half of domestic market. Since many companies adopt a multi-branding strategy, about 270 brands are available in the Italian market of bottled water. However, most of these brands are regional or local brands, and only few (about a dozen) are national brands. There are also some store brands which have reached an important cumulative market share accounting for 9% of total sales in value.
The largest segment of Italian bottled water market is represented by still (non-sparkling) water which accounts for 65% of total sales in volume, while carbonated and naturally carbonated waters account for 19% and 16%, respectively. Bottled water with low mineral content (50-500 mg/L) is sold the most accounting for 59% of total sales in volume, while bottled water with very low mineral content (<50 mg/L) and medium-high mineral content (>500 mg/L) represent minor market segments (14% and 27%, respectively). Moreover, mineral water is largely packaged in plastic bottles (83% in volume), while glass bottles are used to a lesser extent (17% in volume).
Finally, retail sales mainly occur in modern retail stores (hypermarkets, supermarkets, minimarkets and discount stores) which convey 71% of total sales in volume, while the remaining part follows the Ho.Re.Ca. channel (18%) and traditional stores (11%).

Method

Hedonic price model

We built a hedonic price model to analyze the relationship between the price and the main attributes of bottled waters. This methodological approach is borrowed from Lancaster's (1966) theory of demand which states that consumers derive utility directly from the quality attributes embedded in a product rather than from the product itself. In other words, any differentiated product can be considered to be a bundle of several quality attributes that are independently valued by consumers at the time of purchase. Successively, Rosen (1974) developed a theoretical model demonstrating that the observed price of a product can be considered as the sum of the prices associated with each of its quality attributes. Although

[1] Purified water is produced by distillation, deionization, reverse osmosis, or other suitable processes to ensure that water meets specific public standards. The finished product is then placed in bottles under sanitary conditions and sold to the consumers.

these prices are not explicitly expressed by the market, they can be estimated by employing a regression equation, i.e. the hedonic price model, which expresses the price of a product (directly observable) as a function of its attributes (directly or indirectly observable).
According to the Rosen's (1974) formulation, a hedonic price model can be specified as follows:

$$P(Z) = P(z_1, z_2, \ldots, z_j, \ldots, z_n) \quad (1)$$

where P is the price of a product and Z = z_1, z_2, . . . , z_j, . . . , z_n is a vector of n objectively measured attributes that completely describe product quality.
After estimating the hedonic price equation, a partial derivative with respect to the attribute j, $\partial P(Z)/\partial z_j$, can be interpreted as the implicit or shadow price of the specific attribute j.
This theoretical model is based on the assumption that the market is in equilibrium and there is perfect competition. In this situation, consumers maximize utility by choosing available products under budget constraints, and firms maximize profits given the available technology and factor prices (Rosen, 1974). Consequently, being related to both supply and demand conditions, implicit prices cannot be considered merely as indicators of consumers' preferences (Costanigro and McCluskey, 2011; Oczkowski, 1994; Rosen, 1974; Schamel, 2006).

Data collection

Data on the prices and characteristics of bottled water were collected via direct observation of the shelves in some modern retail stores located in the Province of Bari, one of the most populous Provinces of Southern Italy. As already noted, modern retail stores are the most important distribution channels of bottled water in Italy. Specifically, we collected data in the first months of 2015 (January and February) from two hypermarkets (Auchan and Coop), two supermarkets (Famila and Sigma), two minimarkets (Despar and Simply) and two discount stores (Lidl and Eurospin) of the main retail chains operating in the Province of Bari. Obviously, this is only an explorative analysis and the reliability of results could be further improved by extending the survey to a larger area where some differences may arise in price levels and product variety. In each of the selected stores, we adopted a snapshot-type data collection: each store was visited just one time, when we directly and simultaneously recorded the retail prices and the characteristics of all drinking bottled waters placed on dedicated shelves. Because in some cases the same product was offered in different types of packaging or at different prices, each item was considered as a separate observation. We only excluded products sold at reduced prices (special offer) when the "normal" prices were not indicated in order to avoid possible bias of results due to the inclusion of prices only temporarily reduced. However, the number of products excluded in the process of data collection was very limited (one or two products for each of the selected stores). In particular, by observing the products and their labelling, the following information was recorded for each product: price, packaging characteristics (type of pack, bottle size, bottle material, type of cap), chemical composition (total salt content, Sodium content, presence/type of effervescence), brand and place of bottling.

Data set

Using the criteria described above, we collected a data set containing 374 observations. A preliminary analysis of the data set was carried out by calculating descriptive statistics regarding both the total sample and specific sub-samples grouped according to particular attributes (Table 1).

First, a wide variability of price was detected in the overall sample considering that the unit price of bottled water ranged from a minimum of 0.08 Euro/L to a maximum of 3.52 Euro/L, while the average was 0.50 Euro/L. This range seems to be primarily related to the different types of packaging. Mineral water is sold as single bottles or multipacks (including four or six bottles), and bottle size varies from a minimum of 0.25L to a maximum of 2L. In addition, bottles are made of plastic (polyethylene terephthalate PET), glass, or eco-friendly materials (biodegradable or partly recycled) and they are closed with standard or push-pull caps. It is worth noting that the average price of mineral water sold in the smaller bottles (1 L or less), in glass bottles, and in bottles with push-pull caps is much higher than the average price of mineral water sold, respectively, in larger bottles (1.5-2L), in plastic bottles, and in bottles with standard caps. Conversely, regarding intrinsic attributes of bottled water (total salt content, Sodium content, presence/type of effervescence), it is possible to observe only limited differences in the average prices, while distance (calculated between the place of bottling and the point of sale) affects the average price of mineral water notably. Finally, it should be noted large unit price differences among different store formats (in particular, for discount stores compared to the other formats) and different brands.

Table 1. Summary statistics of the sample

		Price/litre*			
	N. cases	**Min**	**Max**	**Mean**	**Std dev**
Total sample	374	0.08	3.52	0.50	0.45
Type of pack					
single bottle	315	0.08	3.52	0.48	0.44
multipack	59	0.12	3.49	0.59	0.51
Bottle size					
2.00 L	51	0.08	0.28	0.17	0.05
1.50 L	133	0.09	0.66	0.28	0.11
0.75-1.00 L	54	0.25	3.52	0.83	0.72
≤ 0.50 L	136	0.26	3.49	0.70	0.42
Bottle material					
plastic	332	0.08	1.67	0.45	0.32
glass	17	0.89	3.52	1.74	0.94
eco-friendly material	25	0.13	0.49	0.31	0.11
Type of cap					
standard	347	0.08	3.52	0.45	0.42
push-pull	27	0.64	1.67	1.15	0.40
Salt content					
medium mineral (500-1500 mg/L)	109	0.08	1.40	0.43	0.23
low mineral (50-500 mg/L)	234	0.09	3.52	0.53	0.54
very low mineral (<50 mg/L)	31	0.17	1.25	0.48	0.30

Table 1 (continues). Summary statistics of the sample

	N. cases	Price/litre*			
		Min	Max	Mean	Std dev
Effervescence					
still	215	0.08	3.52	0.52	0.45
naturally carbonated	92	0.16	1.40	0.45	0.23
carbonated	67	0.09	3.52	0.50	0.66
Sodium content					
low-sodium (<20 mg/L)	296	0.08	3.49	0.49	0.39
medium-sodium (>20mg/L)	78	0.09	3.52	0.52	0.63
Store format					
hypermarket	160	0.08	3.52	0.54	0.57
supermarket	117	0.12	1.67	0.51	0.34
minimarket	75	0.13	1.67	0.47	0.34
discount	22	0.09	0.54	0.20	0.10
Distance (source-store)					
<500 km	139	0.08	1.40	0.33	0.24
500-1,000 km	161	0.11	1.60	0.51	0.32
>1,000 km	74	0.16	3.52	0.78	0.76
Brand					
San Benedetto	40	0.22	1.60	0.63	0.45
Levissima	31	0.28	1.67	0.70	0.46
Rocchetta	25	0.33	0.86	0.49	0.15
Sant'Anna	23	0.25	0.90	0.41	0.17
Vera	18	0.16	0.60	0.30	0.14
Ferrarelle	17	0.26	1.40	0.52	0.28
Uliveto	14	0.35	0.74	0.55	0.14
Sangemini	12	0.53	1.00	0.74	0.20
store brands	9	0.11	0.38	0.24	0.10
other brands	185	0.08	3.52	0.45	0.54

**Prices are expressed in €*

Source: own elaboration

Empirical Model

We used a stepwise procedure to specify and estimate the following hedonic price equation:

$$\ln price = \alpha + \beta\, multipack + \gamma_i\, bottle_{size_i} + \delta_j\, bottle_{material_j} + \eta\, push\_pull + \theta_m\, salt\_content_m + \lambda_m\, effervescence_m + \rho\, low\_sodium + \varphi_n\, store_n + \chi \ln distance + \omega_z\, brand_z + \varepsilon \quad (2)$$

The variables included in the empirical model are listed and briefly described in Table 2. The unit price of bottled water is the dependent variable (price) which is a continuous variable. Just one explanatory variable, the distance between the place of bottling and the point of sale (distance), is also a continuous variable, while the other explanatory variables, being categorical, were transformed into one or more dummy variables. Regarding the functional form of the equation, we choose the double-log formulation for its better fit to the data.

Table 2. Variables of the empirical model

Variables	Type	Description
Dependent variable		
price	continuous variable	price per litre (€)
Regressors		
multipack	dummy	multipack (4 or 6 bottles) = 1; single bottle = 0
bottle size	dummy	small (≤0.50 L) = 1; otherwise = 0
	dummy	medium (0.75-1.00 L) = 1; otherwise = 0
	dummy	large (1.50 L) = 1; otherwise = 0
	dummy	extra-large (2.00 L) = 1; otherwise = 0 (baseline)
bottle material	dummy	glass = 1; otherwise = 0
	dummy	eco-friendly material = 1; otherwise = 0
	dummy	plastic = 1; otherwise = 0 (baseline)
push-pull	dummy	Push-pull = 1; standard = 0
salt content	dummy	medium mineral (>500 mg/L) = 1; otherwise = 0
	dummy	low mineral (50-500 mg/L) = 1; otherwise = 0 (baseline)
	dummy	very low mineral (<50 mg/L) = 1; otherwise = 0
effervescence	dummy	still = 1; otherwise = 0 (baseline)
	dummy	naturally carbonated = 1; otherwise = 0
	dummy	carbonated = 1; otherwise = 0
low sodium	dummy	low-sodium (<20 mg/L) = 1; medium- sodium (>20mg/L) = 0
store	dummy	hypermarket = 1; otherwise = 0 (baseline)
	dummy	supermarket = 1; otherwise = 0
	dummy	minimarket = 1; otherwise = 0
	dummy	discount = 1; otherwise = 0
distance	continuous variable	distance between the source and the store (km)
brand	dummy	San Benedetto = 1; otherwise = 0
	dummy	Levissima = 1; otherwise = 0
	dummy	Rocchetta = 1; otherwise = 0
	dummy	Sant'Anna = 1; otherwise = 0
	dummy	Vera = 1; otherwise = 0
	dummy	Ferrarelle = 1; otherwise = 0
	dummy	Uliveto = 1; otherwise = 0
	dummy	Sangemini = 1; otherwise = 0
	dummy	other brands = 1; otherwise = 0
	dummy	store brands = 1; otherwise = 0 (baseline)

Source: own elaboration

Results

We used the Ordinary Least Squares (OLS) method to estimate the hedonic price equation. Estimation results are summarized in Table 3, which also includes the most important performance indicators of the empirical model. This shows a good overall significance (F-statistic equal to 141, with a P-value much lower than 0.01) and high capability to explain the variability of the data set (adjusted R-squared equal to 0.90). Statistical tests were also performed for excluding possible problems of multi-collinearity, heteroskedasticity and non-normality of residuals.

Table 3. Estimation results for the hedonic price function

	Coefficient		*Standard Error*	*Marginal effect**
constant	-3.61	***	0.18	N/A
multipack	-0.01		0.04	N/A
bottle size				
large	0.27	***	0.05	31%
medium	0.69	***	0.07	100%
small	0.97	***	0.05	165%
bottle material				
glass	1.18	***	0.09	226%
eco-friendly material	0.03		0.05	N/A
push-pull	0.68	***	0.06	97%
salt content				
medium mineral	0.05		0.09	N/A
very low mineral	-0.13	***	0.05	-12%
effervescence				
naturally carbonated	0.11		0.08	N/A
carbonated	0.02		0.03	N/A
low-sodium	-0.21	***	0.05	-19%
store				
supermarket	0.09	***	0.03	9%
minimarket	0.09	***	0.03	9%
discount	-0.45	***	0.06	-36%
ln distance	0.28	***	0.03	28%
brand				
San Benedetto	0.28	***	0.06	32%
Levissima	0.44	***	0.06	55%
Rocchetta	0.66	***	0.06	94%
Sant'Anna	0.42	***	0.07	53%
Vera	0.16	**	0.07	18%
Ferrarelle	0.53	***	0.10	70%
Uliveto	0.30	***	0.09	35%
Sangemini	1.02	***	0.08	177%
other brands	0.38	***	0.07	46%

Dependent variable = ln price per litre
F-Statistic (25 / 348) = 141.53 P-value (F) <0.0001
R^2 = 0.91 Adjusted R^2 = 0.90
Log-likelihood = 48.10

*Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.*
Source: own elaboration

The type of pack (multipack) is not a significant variable, meaning that single bottles and multipacks are sold at the same unit price, all other characteristics being equal. This is an unexpected result because a discount on the unit price is usually given when a larger amount of product is purchased. The type of packaging, instead, has a strong effect on the unit price of bottled water. First, the size of bottle has a significant effect on price and, specifically, the dummies large, medium and small have positive and increasing coefficients equal to +0.27, +0.69 and +0.97, respectively. Considering the functional form of the equation, the coefficient of dichotomous explanatory variables can been transformed in the percentage change in price due to the presence of a given quality attribute (marginal effect) applying the following formula: *{exp(coefficient) - 1}*. It follows that, assuming the largest

bottles (2L) as the baseline, the unit price increases by +31%, +100% and +165%, respectively, when mineral water is sold in progressively smaller bottles (1.5L, 0.75-1.5L, ≤0.5L). This can be explained considering both the higher costs of packaging for smaller bottles and the higher consumers' willingness to pay for smaller bottles that are more easy to use outside the home. The same considerations can be made about the type of cap. In fact, bottled water with push-pull cap has a much higher unit price (+97%) than bottled water with standard cap. As regards the packaging, the kind of material used for bottle (codified by the dummies glass, plastic and eco-friendly) also has a significant effect on price. In particular, assuming plastic bottles as the baseline, mineral water in glass bottles gains a relevant premium price (+226%), while, unexpectedly, non-significant effect has been found for bottles of eco-friendly material. The premium for mineral water in glass bottles can be explained considering the higher cost of glass compared to plastic, but also the high willingness to pay of those consumers who prefer mineral water in glass rather than in plastic bottle. Conversely, the result about the bottles of eco-friendly material means that consumers are not willing to pay any premium for this attribute even considering its positive impact on the environment.

Intrinsic attributes of bottled water seem to have only a slight influence on price. Specifically, compared to low mineral water used as the baseline, very low mineral water had a significant but moderate discount price equal to -12%, while medium-high mineral water did not have any premium or discount price. The presence/type of effervescence did not have any effect on price as well, while mineral water with low Sodium content showed a discount price (-19%) compared to mineral water with medium Sodium content. These results show that consumers appear to be scarcely interested in mineral composition of bottled water even though they express a lesser preference for the water with very low content of minerals, including Sodium.

Other important factors affecting the price of bottled water are, instead, the type of store, the distance between the water source and the point of sale, and brand. About store format, bottled water sold in discount stores had a discount price of -36% compared to bottled water sold in hypermarkets used as the baseline, while bottled water sold in supermarkets and minimarkets showed a premium price equal to +9%. These price differences can be related to the costs of logistics and store management which are, obviously, much lower for discount stores and higher for supermarkets and minimarkets compared to hypermarkets. The distance between the water source and the point of sale is also a significant variable with a coefficient equal to +0.28. Taking into account the logarithmic form of the equation, the coefficient of a continuous variable can be directly interpreted in terms of elasticity. Therefore, the positive (but less than one) coefficient of the distance variable means that an increase in the distance leads to a less-than-proportional increase in the unit price of bottled water. Obviously, the positive impact of distance on the price of bottled water could be mainly related to the transportation costs. Finally, it should be noted that brand affects the unit price of bottled water considerably. Specifically, compared to the store brands used as the baseline, all major brands (San Benedetto, Levissima, Rocchetta, Sant'Anna, Vera, Ferrarelle, Uliveto, Sangemini) as well as the minor brands gain a significant premium price ranging from a minimum of +18% (Vera) to a maximum of +177% (Sangemini).

Conclusions

Results of this study show that bottled water is, surprisingly, highly differentiated but its retail price is mainly affected by extrinsic characteristics, in particular brand and packaging (bottle size, bottle material and type of cap). Other extrinsic factors, i.e. the type of store where retail sales occur and the distance between the water source and the point of sale, also have a relevant effect on price. Conversely, intrinsic characteristics affect the price of bottled water moderately.

The results of our study give a more comprehensive overview of the Italian market of bottled water. The two main marketing strategies adopted by firms are "lower cost" and "differentiation" (Porter, 1985), sometimes combined within the same firm through different brands.

In order to deepen the price competition strategy, firms should concentrate their efforts on the choice of packaging. In fact, it seems to be a key factor because packaging greatly affects the price of bottled water and, at the same time, relative production costs. In particular, firms should adopt less-expensive types of packaging represented by larger-sized plastic bottles with lower thickness, and standard caps. It's worth noting that Italian regulation prohibits the use of containers holding more than 2 litres for bottling natural mineral water, and this seems to be a counterproductive constraint. In fact, the possibility of using big size containers (e.g. 3L, 5L, 10L) would represent an effective tool for reducing both the cost of packaging and the environmental impact of bottled water consumption. Moreover, firms implementing a price competition strategy should prefer a growth based on the penetration of local markets surrounding water sources rather than expanding the market because this second option would increase transportation costs considerably. Finally, discount stores and hypermarkets seem to be the more suitable channels for the distribution of low-priced bottled water for their more efficient logistics.

On the other hand, the marketing strategy based on product differentiation can be strengthened through the brand. It plays a key role in differentiating bottled water, as confirmed by its strong effect on price. However, a product differentiation strategy merely based on the brand seems to be not sustainable in long-term and in mature markets. Our analysis shows that some leading brands such as "Vera" and "San Benedetto" are already adopting very aggressive pricing strategies. In a context characterized by strong competitive pressure and high level of product substitutability, the reinforcement of brand equity should be supported by a real differentiation of products based on both extrinsic and intrinsic attributes specifically addressed to meet consumers' needs and preferences. Therefore, firms adopting this strategy should diversify their products, firstly, in terms of packaging by offering the same product in bottles of different sizes and with different types of cap in order to meet consumers' need in terms of convenience. In addition, despite our results show that mineral composition has only a moderate effect on the price of bottled water, firms interested in differentiating this product should not neglect this aspect. Mineral composition of bottled water varies notably among different brands, but consumers do not seem to perceive these differences. One reason could be that, despite mineral composition of bottled water is indicated on the label, consumers have difficulty in interpreting and comparing this information. Therefore, firms should intensify communication activities emphasizing the

connection between the brand and the specific intrinsic attributes of water able to address specific consumers' needs and preferences. For example, some brands (Ferrarelle and Lete) emphasize the natural effervescence, while other stresses the high content in Calcium or Magnesium (Sangemini, Lilia). Generic claims about the health effects of bottled water (e.g. "helps digestion", "promotes diuresis"), inserted on almost all the labels of mineral water, seem to be absolutely useless without well explaining the specific characteristics that generate these health effects and whether these characteristics are common or not to other products. Moreover, firms that invest in expensive advertising campaigns through mass-media should expand their market and implement a diffuse distribution network. Since market development involves higher transportation costs, logistics plays a key role and should be optimized carefully. In this respect, the possibility of implementing a multi-sourcing strategy could be useful in reducing both transportation costs and environmental impacts.

Results of our analysis also have some interesting policy implications. Specifically, the market of bottled water does not seem to exhibit any effective signals of self-regulation towards a reduction of its environmental impacts. Our analysis shows that consumers are willing to pay higher prices for bottled water packaged in small-sized bottles and with special caps (push-pull) in order to satisfy their need of convenience despite these choices have a more negative impact on the environment. In addition, consumers are willing to pay higher prices for bottled water which is transported over long distances (often greater than 1000 kilometres) with high energy consumption and air pollution. Conversely, consumers are not willing to pay any premium for mineral water packaged in bottles of eco-friendly material (biodegradable or partially recycled). Therefore, taking into account that environmental impact of bottled water consumption is a public concern, policy makers should implement some measures to address consumers towards a more responsible behaviour in terms of environmental sustainability. Currently, taxation of mineral water abstraction is differentiated among Italian Regions, and it is mainly calculated as a constant tariff per unit volume (Legambiente, 2014). Such regulation, differentiated among Regions, promotes an increase of bottled water flows from the Regions where taxation is lower to the Regions where taxation is higher and, consequently, an increase of environmental impacts. Therefore, taking into account that Italy is one of the European countries where bottled water is sold at lowest price (Bevitalia, 2015), increasing and levelling the taxes among the Regions could support the purchase of cheaper bottled water coming from local springs. In addition, policy makers could introduce a taxation scheme based on the type of packaging in order to discourage an excessive use of small-sized bottles and sustain the use of eco-friendly bottles.

References

Bevitalia (2015). *Acque Minerali, Bibite e Succhi - Annuari del Bere*, Beverfood.com Edizioni.

Boatto V., Defrancesco E., Trestini S. (2011). The price premium for wine quality signals: does retailers information provision matter? *British Food Journal*, 4-5, 669-679.

Carew R., Florkowski W.J., Smith E.J. (2012). Hedonic analysis of apple attributes in metropolitan markets of Western Canada. *Agribusiness*, 3, 293–309.
Carlucci D., De Gennaro B., Roselli L., Seccia A. (2014). E-commerce retail of extra virgin olive oil: an hedonic analysis of Italian SMEs supply. *British Food Journal*, 10, 1600-1617.
Carlucci D., Stasi A., Nardone G., Seccia A. (2013). Explaining Price Variability in the Italian Yogurt Market: A Hedonic Analysis. *Agribusiness*, 2, 194–206.
Cicia G., Caracciolo F., Cavallo C., Del Giudice T., Sannino G., Verneau F. (2013). The Role of Sensory Profile in the Extra-Virgin Olive Oil Consumers Choice. In U. Rickert and G. Schiefer, eds., *Proceedings in System Dynamics and Innovation in Food Networks*. University of Bonn-ILB Press.
Costanigro M., McCluskey J. (2011). Hedonic price analysis in food markets, in J. Lusk, J. Roosen, J. Shogren, eds., *The Oxford Handbook of the Economics of Food Consumption and Policy*. Oxford University Press, Oxford.
Gironi F., Piemonte V. (2010). Life cycle assessment of polylactic acid and polyethylene terephthalate bottles for drinking water. *Environmental Progress & Sustainable Energy*, 30 (3), 459–468.
He S., Jordan J., Paudel K. (2008). Economic evaluation of bottled water consumption as an averting means: evidence from a hedonic price analysis. *Applied Economics Letters*, 15, 337–342.
International Bottled Water Association – IBWA (2015). (accessed in May 2015).
Lancaster K.J. (1966). A new approach to consumer theory. *Journal of Political Economy*, 2, 132–157.
Legambiente (2014). *Regioni imbottigliate. L'indagine sul business delle acque in bottiglia in Italia*. LEGAMBIENTE-Altreconomia.
Martínez –Garmendia J. (2010). Application of hedonic price modelling to consumer packaged goods using store scanner data. *Journal of Business Research*, 7, 690–696.
Muñoz R. R., Moya M. L., Gil J. M. (2015). Market values for olive oil attributes in Chile: a hedonic price function. *British Food Journal*, 117, (1), 358-370.
Nerlove M. (1995). Hedonic price functions and measurement of preferences: The case of Swedish wine consumers. *European Economic Review*, 9, 1697–1716.
Niccolucci V., Botto S., Rugani B., Bastianoni S., Gaggi C. (2011). The real water consumption behind drinking water: the case of Italy. *Journal of Environmental Management*, 92, 2611–2618.
Oczkowski E. (1994). A hedonic price function for Australian premium table wine. *Australian Journal of Agricultural Economics*, 1, 93–110.
Panzone L.A. (2011). The lost scent of Eastern European wines in Western Europe. A hedonic model applied to the UK market. *British Food Journal*, 8-9, 1060-1078.
Porter M. E. (1985). *Competitive advantage: creating and sustaining superior performance*. New York: The Free Press.
Rani B., Maheshwari R., Garg A., Prasad M. (2012). Bottled Water – A Global Market Overview. *Bulletin of Environment, Pharmacology and Life Sciences*, 1, 1-4.
Rosen S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition. *Journal of Political Economy*, 82, pp. 34–55.

Schamel G. (2006). Geography versus brands in a global wine market. *Agribusiness*, 3, 363–374.
Schollenberg L. (2012). Estimating the hedonic price for Fair Trade coffee in Sweden. *British Food Journal*, 2-3, 428-446.
Steiner B.E. (2004). Australian wines in the British wine market: A hedonic price analysis. *Agribusiness*, 3, 287–307.
Torretta V. (2013). Environmental and economic aspects of water kiosks: Case study of a medium-sized Italian town. *Waste Management*, 33, 1057–1063.
Wilk R. (2006). Bottled water: The pure commodity in the age of branding. *Journal of Consumer Culture*, 6(3), 303-325.