USE OF SCANNER DATA TO ANALYZE THE TABLE WINE DEMAND IN THE ITALIAN MAJOR RETAILING TRADE (REFEREED)

Francesco Torrisi University of Florence, Italy
Chiara Seghieri University of Florence, Italy
seghieri@ds.unifi.it

Abstract

While utilization of scanner data for food demand analyses has become increasingly popular in the United States, few food demand studies, and in particular none on table wine, have been conducted using scanner data in Italy. This paper presents a first attempt to estimate the econometric Italian demand for selected brands of red table wine using scanner data in order to provide new and useful insights into the marketing of Italian wine. Price and expenditure elasticities of Italian red table wine demand using the estimated coefficients of a Linear Almost Ideal Demand System are estimated. Results suggest a partially fidelized market of table wine, with a certain tendency to substitution and with evident relations of competition among the leader analyzed brands.

Introduction

The availability of scanner data from retailers enhances analysts' ability to understand consumer demand, particularly for food products. For example, Cotterill (1994) summarized the usefulness of this data for examining such issues as oligopolistic pricing strategies and promotion effectiveness. Moreover, Cotterill has noted that scanner data allow significant advances in understanding food marketing because one can now estimate firm-, brand-, and commodity-level demand models.

Utilization of this kind of data is becoming more prevalent especially in United States where a growing literature on this field can be found. Some U.S. food demand studies using this type of data for example include: Brooker, Eastwood, and Gray (1994); Capps (1989); Chevalier (1993); Cotterill and Haller (1994); Duvall (1993); Langan and Cotterill (1994); McLaughlin and Lesser (1986); Peterson and Cotterill (1998); Vickner and Davies (1999).

On the other side, in Italy, only a small body of literature on application of scanner data to food demand analysis can be retrieved (Maietta, 2003; Marattin, 2002, Giulietti, 2004). In particular, no research on the wine consumption of Italians using scanner data has been conducted.

Per capita demand for wines in Italy and other major Mediterranean wine-producing countries of the European Community has steadily declined for the last few decades.

On the basis of the Institute for Services to Agricultural and Food Market (ISMEA) Observatory information, wine consumption by Italian families in 2003 fell by almost 1%. In the wake of -4% in 2002 for the wine segment, the ISMEA data for household purchases of wine and "spumante" indicates overall consumption in 2003 of 857 million litres, against 862 millions in 2002 (-0.6%). Although the economic changes mentioned above, probably due to shifts in tastes of most consumers to other drinks, packaged wine still represents an important feature of the Italian household consumptions. ISMEA data for the year 2002-2003 highlighted that packaged wine remained steady at levels for the previous year while bulk wine dropped by 5%. In the packaged category, Doc-Docg wines lost ground, with consumption down by 6%, compared with a recovery of 2.4% for packaged table wines[1]. The last accounting for 56% of total wine household consumptions.

The primary purpose of this study is to demonstrate the usefulness of scanner data to analyse the demand relationships of selected leading brands of Italian packaged table wine. From the estimates of the brand level demand model price and expenditures elasticities are then derived in order to understand better the competitive market behaviour of packaged table wine such as the nature and differences in price competition among the selected brands, how consumers substitute across products and so on.

The article is organized as follows. In the first section we introduce the most important findings in the literature of demand analysis based on scanner data. We give an overview of the Italian wine market in the second section. In the third section we briefly introduce the econometric demand models and in particular the Almost Ideal Demand System (AIDS), developed by Deaton and Muelbauer in 1980. Then, in the fourth section we describe the database and we present an attempt to explain the main feature of the demand of selected brands of Italian wine. Finally, section 5 presents a summary of the main findings and conclusions.

The application of scanner data in marketing research

Literature, which studies the effects of new information technology on business management and marketing, is practically endless.

Beginning in the Eighties with the first contributions of a Porterian imprint (Parsons, 1983; Porter and Millar, 1985; Benjamin, 1985), passing through the interpretations according to the “resource-based view” (Mata et al., 1995), it is now given for granted that new technologies bring value and competitive advantage to enterprises, thanks to the fact they make information available.

This resource has peculiar characteristics since value of information is, instead of being diminished, increased by sharing: we can gather that in the new economic context, less based on flux of goods and increasingly based on knowledge, the creation of value is easier if pluralized, that is resulting from a process including more partners, organised around structured fluxes of information.

The natural “container” of informative fluxes is the marketing channel: much before Internet, producers, wholesalers and retailers, exchanging not only goods, but also information, created the value for the client.

First the market revolution and then, more recently, the information revolution, have changed the setting of the channel relations, particularly in the sector of widely consumed goods on which we are focusing our attention. A modern distribution sector, relatively concentrated, able to perform independent marketing strategies, in direct contact with the final market and, because of this, possessing a growing amount of detailed information on consumers, represents an extraordinary challenge for industry and transforms vertical relations in an “unstable compound” of conflict and collaboration.

The transition from an economy based on the flux of goods to an economy based on flux of information and knowledge, is changing the boundaries of enterprises and many traditional paradigms that have been leading firms’ behaviour in the last decades.

During 1980 the registration of products through scanning of bar-codes began to spread in the major retailing trade to later become, through the adoption of a wider scale of price and sales volume registration systems, via scanner, a new revolutionary marketing tool able to ensure a marked competitive advantage to the holders of centralised and computerised market analysis systems.

The scanning of all outgoing products from each point of sale allows in fact obtaining a series of daily information (scanner data) ideal to adopt and weigh up adequate market strategies. Furthermore it puts the data holder in a position of advantage compared to his competitors.

As a consequence, agro-food businesses have been able to improve the distribution phase and, at the same time, to adopt more flexible marketing strategies rapidly adjusting to changes and needs of the market.

However, due to evident scale economies, the gathering and elaboration of this information cannot be managed directly by the single points of sale or by the single brands present in the major retailing trade points of sale. The task has been taken over by two world leader societies in market surveys, the A.C. Nielsen and I.R.I. InFoscan, that since 1987 take care of all products transiting the sample major retailing trade with which they have an arrangement. The main outputs are products, flexible according to the needs of customers, as software for data management, price detailed databases, sales volume, market shares and promotion activities, or reports able to outline main dynamics of the interest market, as well as specific trends of products and brands with long term perspective evaluations. All these analyses aim at interpreting the behaviour and the purchase choices carried out within the point of sale by the retailer push.

A second type of survey carried out by Nielsen and IRI concerned household panels, and intended to investigate consumptions of families and habit of consumer pulls, a typology of consumer which needs differentiated marketing strategies and a promotion activity focused on mass-media and post advertising.

In general, the use of these tools allows a more accurate investigation of the agro-food products market as well as estimating demand curves of single products or entire brands.

Experiences of this type have been conducted starting from 1989 through pioneer applications, as the survey on the consumption of different types of meet carried out by Capps and Nayaga in Huston, Texas (1989), that aimed at determining, through a historical series of observations, the relations among demand curves of various products. A similar work, based on weekly scanner data, was carried out by Brooker and Eastman (1994). Starting from a linear version of the Capps-Nagaya model, the Authors were able to assess not only price cross effects but also the own and cross elasticity of the effects of advertising of the examined products on TV and local papers.

Scanner data have also proved useful in analysing industrial organisation, first of all by Haller (1994) who analysed the relation between price and market share of certain brands of cheese and by Chevalier (1994) who proposed an innovative model of oligopoly, inclusive of the effects of financial investments.

The analysis of neoclassic demand, in fact, focuses only on well-defined commodities, while demand at a brand level inevitably involves industrial structure organisation.

The problem of estimating demand becomes particularly difficult in front of an oligopoly made by enterprises offering differentiated products. This is due to the interdependency of prices among the various brands which makes the definition of relations within the offer difficult.

In this perspective Baker and Breshnahan (1985) were the first to consider the benefits between the analysis of demand and the concepts of enterprises organisation, in order to analyse price policies in the different oligopolies. The idea was picked up again in 1994 by R.W.Cotterill who attempted to analyse demand and market power at the brand level, utilising scanner data supplied by IRI and resorting to the AIDS. The result consisted in a study which offered agro-food marketing a tool to understand purchase behaviour of consumers and therefore useful to orientate business strategy policies.

The Italian wine market

According to data from the 5th Agricultural General Census, referred to the agricultural year November 1999-October 2000, wine grapes cover 675.580 hectares of national territory, of these 233.522 hectares (35%) are dedicated to the production of Doc (Controlled Designation of Origin) and Docg (Guaranteed and Controlled Designation of Origin) and 442.057 hectares (the remaining 65%) to table wine and Igt (Typical Geographic Indication). The sector counts 770.206 enterprises, of which 90% produce table wine or Igt.

The comparison with the two previous censuses is particularly interesting. In the last twenty years both table wines and Igt have successively lost ground, up to the point that in the year 2000 the segment was reduced to half of what is was in 1982, concerning both number of firms and land invested. Designation of Origin instead, after a

slight contraction registered in 1990, has definitely expanded in the following decade, especially in terms of area dedicated to vineyards.

Analysing firms' size it is evident that the segment of table wines and Igt is strongly fragmented, in fact firms with less than 1 hectare contribute by 34% of the corresponding national territory, while those with more than 10 hectares represent only 13%. The widespread presence of wine producers' co-operatives explains the phenomenon, guaranteeing the survival of small farms.

Nearly half of the land dedicated to the production of black grapes for table wine is planted with Sangiovese, Montepulciano, Barbera, Merlot or Negro Amaro: representing the most widely cultivated vines.

Among white varieties, Catarratto Bianco Comune, Trebbiano Toscano, Trebbiano Romagnolo, Moscato bianco and Chardonnay, cover 42% of the total white area.

The total number of producer and marketing firms is around 1.200 units, with around 9.000 people employed. Table wine bottlers are concentrated in the North, especially in Emilia Romagna and in Veneto.

Analysing the market through the ISMEA data, relatively to the year 2002/2003, packaged table wine represents the main share of household consumptions (56%), to which we can add another 15% of wine from the cask.

Obviously table wine incidence on values is moderate compared to incidence on volumes. In fact, only 42% of total expenditure in wine and sparkling white wine is a prerogative of packaged table wines, while the share of wines from the cask represents 9% of the total.

During the same period, 64% of table wine consumed by Italian families was purchased in the main formats of modern distribution, that is in supermarkets and megastores. Under these terms modern distribution doesn't leave much space to traditional food shops, which account for only the 10%, of which 6% ascribable to wine houses, bearing witness to the ever higher qualification of supermarkets as purchasing centres especially for wines in the first price range.

Among larger size firms we find a strong presence of co-operatives, since the sector is characterised mainly by family-managed farms.

However only few large firms such as G.I.V., Gruppo Coltiva, Caviro, Cantine Riunite, Due Tigli and Zonin, are potentially able to operate in the national and international market; others, more limited in size, try to enlarge the ambit of their presence, with uncertain success.

In order to penetrate foreign markets, especially those of Northern Europe, the main enterprises have asked and obtained quality certifications, implying the reorganisation and rationalisation of firms' processes.

The most widespread business structure is represented by the wine producers' co-operatives where wine growers are the main members.

Co-operatives' policy in the last five years has focused on shifting the productive mix towards packaged wine, compared to wine from the cask, and towards high-quality wine compared to table wine. Small and medium firms tend to requalify their offer producing higher quality wines, though resulting penalised because of their scarce possibility of investment in promotion and differentiating policies due to their limited financial possibilities.

Product Policies

Present product policies promoted in the table wine sector are based mainly on a standardisation of the qualitative level of the product, obtained through technological investments in the production area. Special attention is dedicated to packaging, not only in terms of increased practicalness (multibrik packaging, easy open-close packaging, 250 ml brik), but also in terms of improving communication, through an improved aesthetical image of the product and information concerning quality, origins, and productive processes of the product.

During the last years producers have modified strategies relative to the range of products, which used to include a large number of references, with different brands and various sizes. The range of enterprises, which sell their products on domestic market and mainly through modern distribution, is decreased. In fact, modern distribution tends to limit the number of references in assortment for each brand, in order to maintain high bargaining power towards suppliers.

In particular, concerning brik packaging, modern distribution usually supplies the leader brand (red and white wine), a commercial or first price brand (generally red wine) and an average price product.

The supply of a wide and complete range of products represents an essential characteristic for enterprises operating in the foreign market (among these G.I.V., Zonin and Schenk) in order to increase their sales, offering to importers the advantage of a limited number of suppliers, therefore saving in logistics.

Choices operated by producers relatively to the product portfolio are referable to three main guiding lines:

- production of only one wine (in the three types white, red and light red) with a traditional taste and therefore potentially adapt to all consumers. This choice fails to satisfy consumers completely, not being able to choose, also in brik, among different typologies of product (for example sweet or dry wine);
- production of different wines of various regions, typically adapt to the main taste of each region. This is the principle followed by Zonin and the Gruppo Coltiva.
- Different wines of the same region, following the tradition of a consumption area. This is the case of S.Matteo and Cielo (who also has a wide range of broad wines).

Generally consumers tend to prefer wines of their own region, looking more at the type of wine, than at the brand. The supply of wines known at the national level and sought-after because of the renown of the brand is very limited.

Product innovation has been and continues to be a very important factor in determining business success, as long it is coherent with the image of the firm's brand and the pre-existing products' portfolio.

Price policies

The main element of strategy of great part of businesses in the sector is price that represents a main parameter for the positioning of a product. The transversal positioning of a same typology of product at different price ranges debases the market and confuses the consumer. It is often the case of table wines sold at a higher price than Doc wines.

The price variable together with the commitment in brand policy represent the main reasons for success of wines in coupled cardboard; in this case the careful positioning compared to all the parameters of the marketing mix has given place to the development of a segment with its own distinctive value. In this case consumer tends to rely on the advice of the personnel in the specialised sale points and to refer to the guarantee offered by the brand.

Some chains have operated a clear separation between the Doc wines and table wines, privileging the first type creating the typical wine house atmosphere. Others have divided wines according to the region of origin and the colour, attempting to avoid overcrowding and confusion on shelves.

Analysis of threats and opportunities

The sector in exam is now mature and the analysis of threats and opportunities reveals that the first prevail on the second.

The strongest threat for the whole table wine sector is the preference granted to quality wines at common wines' disadvantage, even if these represent the main share of the wine market.

Furthermore, at a productive level, we assisted to an acceleration in the recognition of various Doc wines that, together with the Igt, improved qualification of Italian wine reducing the production of simple table wine.

Other threats are represented by the weak barriers permitting the entrance in the market of scarcely qualified operators; the reduced number of occasions in which wine is consumed (fewer traditional meals at home); the growing bargaining power of modern distribution that determines a pressure on enterprises' margin; the development potential of competitive products favoured by the strong fragmentation of Italian market and by an optimal price/quality ratio (Chilean, Australian and Argentinean products); the strong competition in the modern distribution channels, with "first price" products, that on the whole worsen the overall image of the product.

Among the opportunities of the sector we can point out the general interest of Italian firms operating in the area in exam, towards Eastern countries and Asia, with high rates of development potential.

The growing number of Internet users representing a potentially new target of consumers may offer other opportunities. Presently on-line sales are mainly carried out by distributors (especially wine houses and virtual shopping centres), but it is believed that in future business-to-business sales will take place (from producer to distributor) as happening already in other sectors. These events may represent an income margin not only for wine growers but also for the territories where they operate.

Other opportunities mainly involve aesthetical aspects of the product (packaging). In fact, brik packaging will continue to expand as consumers will confer to it the same dignity as to glass bottles; as trade will pay growing attention to the handiness of transport and assortment arrangement phases and thanks to the lower price compared to the bottled product.

The Almost Ideal Demand System

Trying to estimate the statistical relationship between the quantity of good purchased (*i.e.* table wine) and the price, and the promotional activities and other determinant of the demand, requires the analyst to specify functional form for the market-level demand equations. Moreover, the study of cross-category demand interdependencies requires a functional specification for a conditional demand system from which the cross-price elasticity of demand can subsequently determined.

Among the econometric demand systems, one well-known model is the already mentioned Almost Ideal Demand System. This modelling has attracted a great deal of attention, and has been extensively applied to cross-section and time series data. Moreover, extensions of the standard AIDS has been developed to make this modelling as rich as possible.

Deaton and Muelbauer developed this flexible-functional-form demand system from a PIGLOG (Price Independent Generalized LOGarithmic) expenditure or cost function. It is almost ideal, in their opinion, because it provides an arbitrary first-order approximation of any demand system, it provides perfect aggregation over consumers without maintaining homothetic preferences, its functional form is consistent with known household-budget data, it satisfies the axioms of choice exactly, it allows statistical testing of homogeneity and symmetry, and its linear approximation is simple to estimate (Deaton and Muelbauer). Although this model has his own disadvantages (*i.e.* it requires the estimation of a large number of parameters, it needs strong restriction to guarantee the reliability of crosselasticities signs and so on) is still one of the most popular choice among the demand model specifications.

In the AIDS model, expenditure shares of each product are regressed on the logarithms of the prices of the different goods and the log of total expenditure (deflated by a price index).

Starting from the PIGLOG, the minimum expenditure necessary to attain specific level of utility *u* at given price vector $\overline{p}$ is:

$$\log c\left(\overline{p},u\right)=\left(1-u\right)\log a\left(\overline{p}\right)+u\log b\left(\overline{p}\right) \quad (1)$$

where $a\left(\overline{p}\right)$ and $b\left(\overline{p}\right)$ are linear homogeneous concave functions.

In (1) *u* lies between 0 (subsistence) and 1 (bliss) so that $a(\bar{p})$ can be considered as the cost of subsistence and $b(\bar{p})$ the cost of bliss.

The specific functional form for $\log a(\bar{p})$ and $\log b(\bar{p})$

$$\log a(\bar{p}) = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj} \log p_k \log p_j \quad (2)$$

$$\log b(\bar{p}) = \beta_0 \prod_k p_k^{\beta_k} \quad (3)$$

Substituting (2) and (3) in (1) we obtain the AIDS cost function:

$$\log c(\bar{p}, u) = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma_{kj} * \log p_k \log p_j + u\beta_0 \prod_k p_k^{\beta_k} \quad (4)$$

The demand function for each commodity can be derived from (4) by computing its price derivates which are quantities demanded (see Shephard, 1953):

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i u \beta_0 \prod_k p_k^{\beta_k} \quad (5)$$

where $\gamma_{ij} = \frac{1}{2}(\gamma_{ij} * + \gamma_{ji} *)$, w_i is the budget share of commodity *i* (*i*=1,…,*n*) and p_j is the price of the *j*th commodity (*j*=1,…,*n*).

For a utility maximising consumer, total expenditure *y* is equal to the cost function and by reversing (4) in this way and substituting it in (5) we obtain the AIDS demand function in prices and expenditures:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log\left\{ y / P \right\} \quad (6)$$

where *P* is price index defined as:

$$\log P = \alpha_0 + \sum_i \alpha_i \log p_i + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \log p_i \log p_j \quad (7)$$

The fact that the consumption shares must add up to unity implies the following parameter restriction:

$$\sum_i \alpha_i = 1, \quad \sum_i \gamma_{ij} = 0, \ \sum_j \gamma_{ij} = 0, \ \sum_i \beta_i = 1 \qquad i = 1,...,n$$

Then, the assumption of homogeneity (no money illusion) implies the following restrictions:

$$\sum_i \gamma_{ij} = 0, \ \ j = 1,...,n$$

A further restriction is the “rationality” of budget allocation among the commodities purchased by the households, thus if consumers are rational then the price parameters must be symmetric:

$\gamma_{ij} = \gamma_{ji}$ for all $i, j = 1,...,n$

The model is made non-linear by the form of *P* but can be linearised by substituting *P* with some proportional approximation. Deaton and Muellbauer (1980) suggest the Stone index which transform equation (6) into:

$$w_i = \alpha_i^* + \sum_j \gamma_{ij} \log p_j + \beta_i \log\left\{ m \big/ P^* \right\} \quad (8)$$

where $\log P^* = \sum_i w_i \log p_i$ is the Stone index and $\alpha_i^* = (\alpha_i) - \beta_i \log\left(P \big/ P^*\right)$.

Estimation of the demand functions is very useful as they provide us with income and price elasticities.

The own price elasticities, the cross-price elasticities and income elasticities indicate the percentage change in the quantity demanded of a particular good, for example wine brand, to a one per cent change in the price of that wine, in the prices of substitute wine brands, and in total expenditures, respectively. They indicate the extent to which consumers adjust their purchases, substituting across products, in response to changes in prices and incomes allowing policy makers to predict the impacts of various

types of policy interventions, such as a minimum price policy or a taxation policy, on consumption.

In this study, the own price elasticity, the cross-price elasticity, e^{cr}_{ij}, and expenditure elasticity, e^{y}_{i}, are calculated. In mathematical terms:

$$e_{ij}^{cr} = \% \frac{\Delta x_i}{\Delta p_i} = \% \frac{\partial x_i}{\partial p_i} \bullet \frac{p_j}{x_i}$$

where e_{ij}^{cr} is the cross price elasticity for $i \neq j$, p_i is the price on the *i*th good, and q_i is the quantity demanded for the *i*th good. Price elasticity greater than 1 is called price elastic, and price elasticity smaller than 1 is called price inelastic. A given percentage increase in the price of an elastic good will reduce the quantity demanded for the good by a higher percentage than for an inelastic good.

Income elasticity is defined as the percentage change in quantity demanded *x* with respect to a one percent change in income *y*:

$$e_{i}^{y} = \% \frac{\Delta x_i}{\Delta y} = \% \frac{\partial x_i}{\partial y} \bullet \frac{y}{x_i}$$

Data and Methods

The econometric analysis of the Italian wine demand relies on scanner data referring to the total monthly observed purchases of all brands supplying packaged table wine in Italian supermarkets over the period 2002-2004 from IRI InfoScan source. Information are given for big territorial aggregates, in this case, 51 Italian provinces from 16 regions. These aggregates represent the 76% and 90% of respectively the sales and cover weighted average of all Italian supermarkets.

In particular, for each product (or brand) analysed, the dataset consists of the monthly sale volume in the period 2002-2004, the price that prevail in the period and also the price and volume sold during promotional activity (e.g. the price and volume of items whose original prices have been reduced of 5% for a period of no more than 6 weeks).

From a first descriptive analysis, Italian wine market appears highly segmented since there are lots of brands and even products of the same brands can differ for a variety of packaging choice, prices and so on. Moreover, estimating demand for each

individual size or variation of each consumer product is generally not practical, and attempting to do so would often lead to imprecise parameter estimates, while we are interested in highlighting the principal strategic issues. Thus, to keep the analysis manageable we estimate our demand system using only 4 “leading brands”: Castellino, Tavernello, Ronco and Private Label. These latest are those brands with the highest percentage of sale volumes among all the brands of red table wine sold in 3 different kind of packaging (Bag in Box, Plastic and Brick). Rest of the fringe brands are aggregated as an All-Other brand.

Data related to some characteristics of Castellino, Tavernello, Ronco and Private Label are reported in table 1.

In the period 2002-2003, proportions of volume sold are almost similar across Castellino, Ronco and Private Label, with respectively 11%, 9% and 10%. Conversely, Tavernello seems to behave differently, its percentage of volume sold is significantly higher (39%) than the other counterparts. This difference is also true in the period 2003-2004, where, in addition, Tavernello and Private Label are the only two brands experiencing an in increase in the share of volume sold: respectively 41% and 12% against 9% of both Castellino and Ronco. The pattern among the 4 brands is somewhat clear since Tavernello can be considered the first and most popular brand of table wine in the market nonetheless it also has a good quality/price ratio. On the other hand, Ronco, although being the best taste brand, is at the same time the most expensive one (*e.g*. in both period, the mean price of Ronco is the highest among the other brands). These last features might be also the reasons why, during a period of price promotion, the pattern of volume sold is completely reversed: consumers might decide to purchase the best quality brand when its price is in promotion. Consequently, the proportions of volume sold of Tavernello might decrease (12% in 2002-2003 and 13% in 2003-2004), while, on the contrary, the sales of Ronco seem to be positively affected by the promotional activity (the percentages of volume sold become 31% in 2002-2003 and 26% in 2003-2004).

Table 1

Proportions of sales volume, promotional sales volume and mean prices by selected brands of red table wine and by two period time (2002/2003-2003/2004)

	2002/2003				2003/2004			
	Sales Volume	**A****	**B****	**Mean Prices**	**Sales Volume**	**A****	**B****	**Mean Prices**
Total red table wine*	38133284	100%	10%	1.040	38936247	100%	11%	1.105
Castellino	4047522	11%	22%	1.289	3315294	9%	21%	1.297
Private Label	3905456	10%	14%	0.962	4511907	12%	16%	0.979
Ronco	3248745	9%	31%	1.305	3350229	9%	26%	1.377
Tavernello	14867479	39%	12%	1.194	16118540	41%	13%	1.213

*Packaged as Bag in box, Brick and Plastic bottle

** A: % of sales volume, B: % of sales volume during promotional activities

In addition to the above mentioned data we identify two wine demand drivers we feel are important wine demand determinants:

1. monthly mean temperatures (Ufficio Centrale di Ecologia Agraria, UCEA).
2. % of volume sold during promotional activities.

These two variables are explicitly included in our demand model as demand shifters.

To specify the demand for the different brands of wine we use the linear form of the AIDS model.

Thus, in our application, model (8) becomes:

$$w_{ilt} = \alpha_{ilt} + \sum_{j=1}^{N} \gamma_{ij} \log(p_{mlt}) + \beta_i \log(y_{lt} / P_{lt}) + \varepsilon_{ilt} \quad (9)$$

where $p = (p_1, ..., p_N)'$ is a (Nx1) vector of prices for *x*, *y* denotes expenditures on the *N* goods, $w_{ilt} = p_{ilt} x_{ilt} / y_{ilt}$ is the budget share for the i^{th} commodity consumed in the l^{th} city

at time t^{th} and, P is the Stone's price index and ε_{ilt} is a vector of stochastic errors $N(0,\Omega)$ distributed.

Demand shifters are incorporated into the model by specifying (see Heien and Wessels, 1988):

$$\alpha_{ilt} = \alpha_{0i} + \sum_{k=1}^{K} \lambda_{ik} Z_{klt} \quad i = 1,...,N$$

where Z_{klt} is the k^{th} demand shifter in the l^{th} city at time t^{th}.

The model parameters are then estimated using the Seemingly Unrelated Regression Estimation (Zellner, 1962) imposing the symmetry and homogeneity restrictions. Moreover, due to adding up restrictions we drop one demand equation (that on with all the other brands[2]) from the system and estimate a system with N-1 demand equations[3].

All the variables used in the econometric analysis are displayed in table 2.

Results

Before fitting the above mentioned demand system we estimated the demand equation of each good as a random effects panel model in order to test the presence of heterogeneity at the both group (cities) and period (months) level. The estimates show the non-significance of the random effects demonstrating the fact that there doesn't appear to be a statistical significant heterogeneity both among cities and months[4].

Successively we carried out a SURE estimation of the AIDS linear model, imposing symmetry and homogeneity restrictions on parameters. Parameter estimates together with their standard errors are shown in table 3.

In all the equations temperature seems not having a significant impact on the wine demand: its parameters in each equation are not statistical significant at 5%.

Conversely, the other demand shifter, the volume sold during promotional activities, seems to significantly influence the consumption of each product. In general, the demand of any brands reacts positively whenever its own volume sold in promotion increases, on the other hand the demand decreases as the volume of any other brand sold in promotion increases.

In particular, the demand for Ronco wine shows a positive relation with the fidelity index (the estimated coefficient of the variable “PV_RONCO” is 0.045) probably due to the higher price of the wine that positions it in a range of more sophisticated consumers indifferent towards promotion policies of other competitors. In acknowledgement of this, there is the absence of relation to the variation of prices of the Private Labels, occupying the lower price range and addressing a different type of consumer. Furthermore the demand for Ronco wine appears to grow with the increase of price of its most direct competitors, Tavernello and Castellino. The relation between demand and overall expenditure, only in this case, is significative and, on top of this, positive, demonstrating how the purchase of Ronco is linked to higher expenditure availability.

On the contrary fidelity for Private Label is supported only by convenience reasons. It is evident in fact how demand decreases when more expensive brands carry out promotional activities, temporally collocating themselves in the same price range and becoming competitive with the Private Label.

This last case represents the only possibility for Tavernello, Ronco and Castellino to enter in competition with the Privates, while it is difficult for the Privates to gain loyal consumers from other brands since there is no relation between the increase of price of the most expensive competitors and the demand of the Private Labels.

Castellino and Tavernello, the two brands of the Cavino S.c.a.r.l. are in an intermediate position, representing two goods that are substituted one by the other according to price.

In particular, the demand of the first grows as the price of both Tavernello and Ronco rises, while there aren’t significant relations with the Private Labels. Furthermore the Castellino brand shows a certain degree of fidelization with consumers since there is no relation between the increase of promotional activities and its demand.

Tavarnello, leader brand in terms of volumes sold, is a different case, since it increases its commercial interest when its competitors raise their price, including Private Label, while its demand decreases when other brands are promoted. Fundamentally it is a less fidelized product whose success is linked to the ratio quality/price considered optimal by consumers.

Obtaining further details of the analysis is possible thanks to the interpretation of the data on elasticity of demand (Table 4) compared to total expenditure in wine and both direct and cross compensated elasticity.

Own price elasticities are negative as expected and range from –1.10 to –2.21, indicating that small changes in the price of table wine elicit quite large changes in quantities purchased. The most elastic brand seems to be Ronco with price elasticity corresponding to –2.21, while the less elastic is Tavernello with –1.69, these results seem to again confirm the information obtained with the descriptive analysis. The cross elasticity of prices indicates furthermore how certain brands are strongly substituted.

Tavernello is the only good that is substitute for all the other brands. More in detail, even with elasticity<1, an increase in price of Tavernello corresponds to greater increases in demand for competitors. This is particularly for Castellino, the other brand of Cavino, since if Tavernello's price grows by 1%, consumers will increase the purchase of Castellino by the same 0.97%. However Castellino is a stronger substitute for Tavernello than the other way round since we have an increase of 0.23% of sales of Tavernello following an increase in price of Castellino of 1%. This is explained by the fact that Tavernello occupies a much larger share of the market compared to Castellino. Anyhow this combined effect of price/demand variation allows Cavino S.c.a.r.l. to compensate loss in shares following policies of joint increase in prices and at the same time to maintain a dominant position on the market as unquestioned leader of the sector.

On the contrary, rises in price of Private Labels determine more limited variations in the demand, in the order of 0.12.

It is therefore possible to individuate some clear trends within demand of various brands of red table wine, and on the whole the analysis of own and cross elasticity suggests the idea of a partially fidelized market, with a certain tendency to substitution and with evident relations of competition among leader brands.

Table 2

Description of the variables used in the econometric analysis

P_OTHER	Natural log of Other wines
P_CAST	Natural log of Castellino
P_PL	Natural log of Private Labels
P_RONCO	Natural log of Ronco
P_TAV	Natural log of Tavernello
EXP	Natural log of the Italian red wine expenditures divided by the Stone's index
PV_OTHER	Percentage volume of Other wines sold in promotion
PV_CAST	Percentage volume of Castellino sold in promotion
PV_PL	Percentage volume of Private Labels sold in promotion
PV_RONCO	Percentage volume of Ronco sold in promotion
PV_TAV	Percentage volume of Tavernello sold in promotion
PV_TEMP	Monthly mean temperatures

Table 3

Parameter estimates and standard errors of the Linear AIDS

	CAST	**PL**	**RONCO**	**TAV**
P_OTHER	-0.03421	0.02495	-0.00284	0.04384
	(-0.01072)	(0.00903)	(0.01052)	(0.01400)
P_CAST	-0.10991	0.01087	0.02968	0.10356
	(-0.01528)	(0.00918)	(0.01034)	(0.01482)
P_PL	0.01087	-0.08543	-0.00665	0.05626
	(0.00918)	(0.01086)	(0.00840)	(0.01204)
P_RONCO	0.02968	-0.00665	-0.12364	0.10345
	(0.01034)	(0.00840)	(0.01381)	(0.01335)
P_TAV	0.10356	0.05626	0.10345	-0.30711
	(0.01482)	(0.01204)	(0.01335)	(0.02432)
EXP	-0.00772	0.00151	0.03176	0.00560
	(0.00498)	(0.00393)	(0.00537)	(0.00622)
PV_OTHER	-0.03795	-0.00055	-0.03135	-0.06292
	(0.00972)	(0.00769)	(0.01047)	(0.01217)
PV_CAST	0.06186	-0.00957	-0.00757	-0.01309
	(0.00602)	(0.00417)	(0.00532)	(0.00666)
PV_PL	0.00586	0.02403	0.00357	-0.01918
	(0.00579)	(0.00519)	(0.00604)	(0.00731)
PV_RONCO	-0.00093	-0.01687	0.04501	-0.01358
	(0.00513)	(0.00411)	(0.00626)	(0.00659)
PV_TAV	0.00168	-0.01708	-0.00856	0.08150
	(0.00763)	(0.00609)	(0.00802)	(0.01017)
PV_TEMP	0.00002	0.00001	-0.00005	0.00000
	(0.00002)	(0.00002)	(0.00002)	(0.00003)
standard erros in parenthesis				

Table 4

Own and cross-price brand elasticities of demand

	OTHER	CAST	PL	RONCO	TAV
OTHER	**-1.10**	-0.13	0.12	0.00	0.24
	(0.13)	(0.05)	(0.06)	(0.06)	(0.08)
CAST	-0.29	**-1.99**	0.11	0.28	0.97
	(0.10)	(0.20)	(0.10)	(0.10)	(0.15)
PL	0.24	0.10	**-1.82**	-0.07	0.53
	(0.13)	(0.11)	(0.15)	(0.10)	(0.13)
RONCO	-0.10	0.25	-0.10	**-2.21**	0.86
	(0.13)	(0.10)	(0.09)	(0.18)	(0.15)
TAV	0.10	0.23	0.12	0.23	**-1.69**
	(0.04)	(0.04)	(0.03)	(0.04)	(0.06)

Boostrap standard errors in parenthesis

Limitations and future research

Possible limits of this study are mainly due to the potential measurement problems with the scanner data.

A first problem concerns price survey that cannot include discount systems as coupons or loyalty cards or promotional campaigns of a few days that determine a non-generalised reduction in price and therefore not detectable in the supplied data. In these cases, sometimes the price is recorded as the most commonly occurring price (typically the price with a club card), in other times average revenue is recorded. In addition, Infoscan collects and reports data weekly while products' price variations in the major retailing trade may be more rapid, e.g. promotions at some retailers run Sunday to Saturday, while others run on a Thursday to Wednesday schedule. Thus, it is quite possible that the shelf price reported in a given week will only correspond to the actual shelf price for a portion of the reported week.

However we tried to overcome this problem and took into account the possible effect of a promotional activity on the consumer's price sensitivity introducing in the demand equations the percentage of volume sold during promotional activities.

Another common problem in using scanner data, supplied as temporal and geographic aggregates, is that they don't allow an estimate of consumer's individual demand.

Moreover, the estimated own and cross-price elasticities of aggregate demands such as weekly ones could readily be dominated by the consumer response to short term price promotions, in particular using data aggregated across time might overestimate elasticities because consumers often buy large quantities of items which are on sale and take them into household inventories. Although economics and marketing research find that promotional and inventory effects are important especially in the antitrust analysis, econometrics does not give explicit guidance as to how these effects should be empirically modeled. Thus, since the demand elasticities we estimate are not for the pourpose of untistrust analysis we prefer to concentrate our study on our real objectives.

Furthermore data concerning the single points of sale are never supplied, but they appear as more or less large aggregates (Municipality, Province or Region). Clearly if independent price decisions are made by stores within geographic areas the price and quantity observed in the data (reported as average values) will not correspond to the price charged by the individual store and consequently, the estimated aggregate demand curve will not correspond to the aggregate demand curve.

Another technical drawback of the research could concern the possible endogeneity of both price and expenditure in the demand estimation which could lead to biased parameter estimates.

The usual practice is to treat prices and expenditures as exogenous variables.

For example, often economists focusing on consumer behavior ignore the problem of price endogeneity treating the consumers as price-takers, i.e. as having no impact on prices. However, as already mentioned, households, by making purchase decisions based on for example promotional activities could affect prices.

Besides price endogeneity, the endogeneity of household expenditures can also be a problem. In particular, our demand analysis doesn't cover the total household expenditures, i.e. the expenditures of all the products and services a household purchases. Given this, expenditure endogeneity may arise whenever the household

expenditure allocation process across products is correlated with the demand of the product we are analysing. Once again, economists usually consider the expenditure as exogenous on the basis of the assumption of weak separability of preferences (Deaton, Muellbouer, 1980).

Nonetheless, Dhar et al. (2002) undertook, for the first time, the potential problem of endogeneity using brand level data. In particular their empirical analysis on retail scanner data suggested that both price and expenditure endogeneity significantly impacts the demand parameters estimates.

However, it's well known that if taking into account of endogeneity in the demand model would generate more efficient parameter estimates it also would lead to demand equations difficult to be estimated. Given this, looking at future research directions it would be useful to include in our work appropriate tests for both price and expenditure separability, nonetheless, given the complexities and time requirement of estimating such demand systems it remains important to understand the trade-off between demand specification and empirical tractability.

Discussion

This research demonstrates that an analysis of scanner data at the brand level can combine two sub-fields of economy, as the study of demand and the analysis of firm's organisation, in order to offer a newer and more relevant investigation tool of marketing of agro-food products.

In particular the analysis of the demand of Red Table Wine (in Brik, Bag in Box and Plastic), in the Italian major retailing trade, has highlighted a structured market, managed both by the two leader firms and by major retailing trade itself through Private Labels and with the degree of substitution suggesting the presence of a competition system, whose grade of perfection is difficult to define.

However, this study is still a work in progress and opened to possible future developments such as: the completion of the analysis of the supply through the individuation of the market power of single brands and of the role of price leaders and a more accurate model specification.

Footnotes

[1] The definition of the “table wines" category is given by the European Community legislation. Basically they include red, pink (or rose) and white non-sparkling wines, containing at least 8.5 and below 14-15 percent alcohol, with no flavour additives, and meeting minimum standards regarding grape varieties and acidity. The other and opposite main category is defined as quality wines produced in specific regions.

[2] The parameters from the deleted equation were possible to calculate because they are linear combinations of random variables. However, from now on, we decided not to show the results concerning the deleted equation in order to draw the attention to the other more important and meaningful brands.

[3] All the elaborations are made using LIMDEP software (www.limdep.com), version 3.0.14.

[4] Due to space limitations the results of the panel estimation are not shown here but can be requested to the authors.

References

Allenby, G., & Rossi, P.E. (1991). Quality perceptions and asymmetric switching between brands. Marketing Science, 14, 300-325.

Baker, J.B., & Bresnahan, T.F. (1985). The Gains From Merger or Collusion in Product-Differentiated Industries. *J.Indust.Econ*, 33, 427-43

Barten, A.P. (1977). The System of Consumer Demand Function Approach: A Review. *European Economic Review*, 1.

Blundell R. (1988). Consumer Behaviour: Theory and empirical evidence. *The Economic Journal*, 98, 16-65.

Brooker, J.R., Eastwood D.B., & Gray M.D. (1994). The Impact of Advertising on Consumer Demand for Beef: An Application of Scan Data. *J. of Food Products Marketing*, 2, 17-35.

Capps, O., Jr. (1989). Utilizing Scanner Data to Estimate Retail Demand Functions for Meat Products. *American Journal of Agricultural Economics*, 71, 750-760.

Chevalier, J.A. (1987). A globally Flexible, Almost Ideal Demand System. *Journal of Business and Economic Statistics*, 5, 233-42

Chevalier, J.A. (1993). *Capitol Structure and Product Market Competition: An Empirical Study of Supermarket Pricing*. Ph.D. thesis, Harvard University.

Cooper, L.G., & Nakanishi. (1988). *Market-Share Analysis*. Boston: Kluwer Academic Press.

Cotteril, R.W., & Haller, L.E. (1994). Market Strategies in Branded Dairy Product Markets. In R.W. Cotterill (Ed.), *Competitive Strategy Analysis for Agricultural Marketing Cooperatives* (99-144). Boulder: Westview Press.

Cotteril, R.W., Franklin, A.W., & Ma, L.Y. (1996). Measuring Market Power Effects in Differentiated Product Industries: An Application to the Soft Drink Industry. *Food Marketing Policy Center*, Working Paper No.32, University of Connecticut.

Cotterill, R.W. (1994). Scanner Data: New Opportunities for Demand and Competitive Strategy Analysis. *Agr. And Res.Econ.Rev*, 125-39

Cotterill, R.W., Putsis, W.P., & Dhar, R. (2000). Assessing the Competitive Interaction Between Private Labels and National Brands. *J. Business*, 73, 109-37.

Deaton, A. (1986). *Demand Analysis*. In Handbook of Econometrics (Z. Griliches & M.D. Intriligator Ed.). Elsevier Science Publishers.

Deaton, A., & Muellbauer, J. (1980). An Almost Ideal Demand System. *The American Economic Review*, 70.

Deaton, A., & Muellbauer, J. (1980). *Economics and Consumer Behaviour*. Cambridge University Press.

Deneckere, R., & Davidson, C. (1985). Incentives to Form Coalition with Bertrand Competition. *Rand Journal of Economics, 16(4), 473-86.*

Dhar, T., Chavas, J.P., & Gould, B.W. (2002) An empirical assessment of endogeneity issue in demand analysis for differentiated products. University of Connecticut, *Food Marketing Policy Center*, Research Report No. 66.

Duvall, J.S. (1993). *A Study of Horizontal and Vertical Competitive Influence on Retail Price in the U.S. Soft Drink Industry*. M.S. thesis, University of Connecticut.

Elrod, T. (1991). Internal analysis of market structure: Recent developments and future prospects. *Marketing Letters*, 2, 253–267.

Erdem, T. (1996). A dynamic analysis of market structure based on panel data. *Marketing Science*, 16, 359–378.

Erdem, T., & Keane, M.P. (1996). Decision-making under uncertainty: capturing dynamic brand choice processes in turbulent consumer goods markets. *Marketing Science*, 15 (1), 1–21.

Farrell, M. J. (1953). Some Aggregation Problems in demand Analysis. *Review of Economic Studies*, vol. 21.

Froeb, L.M., & Werden, G.J. (1991). Residual Demand Estimation for Market Delineation: Complications and Limitations. *Review of Industrial Organization*, 6(1), 33-48.

Giulietti, M. (2004). Buyer and seller power in grocery retailing: evidence from Italy. Retrieved from http://www.abs.aston.ac.uk/newweb/research/publications/docs/SS0405.pdf.

Green, R., & Alston, J.M. (1990). Elasticities in AIDS Models. *American Journal of Agricultural Economics*, 70(2), 442-445.

Hausman, J., Leonard G., & Zona, J.D. (1994). Competitive Analysis with Differentiated Productus. *Annales d'economie et de Statistiques*, 34, 159-80.

Heien, D.M., & Wessels, C.R. (1988). The Demand for Dairy Products: Structure, Prediction, and Decomposition. *American Journal of Agricultural Economics*, 70, 219-228.

Houthakker, H. S. (1965). New Evidence in Demand Elasticities. *Econometrica*, 33.

IRI-InFoscan, Dati vendite vino da tavola 2002-2004.

ISMEA- Indice dei Prezzi alla Produzione 2002-2004.

Langan, G., & Cotterill, R.W. (1994). *Estimating Brand Level Demand Elasticities and Measuring Market Power for Regular Carbonated Soft Drinks*. Paper presented at the American Agricultural Economics Association annual meeting, August 7-10, San Diego.

Lee, J.Y., Brown, M.G., & Seale, J.L. jr. (1994). Model Choice in Consumer Analysis: Taiwan 1970 . *American Journal of Agricultural Economics*.

Leoni, R. (1967). Un'analisi delle spese per consumi privati in Italia. *Rivista di Politica Economica*, Fascicolo III.

McLaughlin, E., & Lesser, W. (1989). Experimental Price Variability and Consumer Response: Tracking Potato Sales with Scanners. Cornell University, Agricultural Staff Paper 86-28.

Maietta, O.W. (2003). *The Hedonic Price of Fair-trade Coffee for the Italian Consumer*. Contributed paper presented at the International Conference Agricultural policy reform and the WTO: where are we heading? Capri (Italy), June 23-26.

Marattin, L. (2002). *An econometric analysis of aggregate demand in Italy from 1980 to 2000: the impact of advertising*. University of Warwick Department of Economics, MSc dissertation.

Messori, F. (1992). *Economia del mercato dei prodotti agro-alimentari*. Edagricole 1992.

Muellbauer, J. (1975). Aggregation, income distribution and consumer demand. *Review of Economic Studies*, 62, 525-543.

Muellbauer, J. (1976). Community Preferences and the Representative Consumer. *Econometrica*, 44, 979-99.

Peterson, E.B., & R.W. Cotterill (1998). Incorporating Flexible Demand Systems in Empirical Models of Market Power. University of Connecticut, *Food Marketing Policy Center*, Research Report No. 43.

Ramenzani, C.A., Rose, D., & Murphy, S. (1995). Aggregation, Flexible Forms and Estimation of Food Consumption Parameters. *American Journal of Agricultural Economics*, August 1995.

Scherer, F.M., & D. Ross. (1990). *Industrial Market Structure and Economic Performance*. Boston: Houghton Mifflin.

Stiglitz, J. E. (1987). The Causes and Consequences of the Dependence of Quality on Price. *Journal of Economic Literature*, 25.

Stone, J. R. N. (1954). Linear Expenditure Systems and Demand Analysis: an Application to the Pattern of British Demand. *Economic Journal*, 64.

Tellis, G.J. (1988). The Price Elasticity of Selective Demand: A Meta-Analysis of Econometric Models of Sales. *Journal of Marketing Research*, 331-41.

Uffio Centrale di Ecologia Agraria. Retrieved from http://www.ucea.it.

Vickner, S.S., & Davies, S.P. (1999). Estimating Market Power and Pricing Conduct in a Product-Differentiated Oligopoly: The Case of the Domestic Spaghetti Sauce Industry. *Journal of Agricultural and Applied Economics*, 31, 1-13.

Zellner, A. (1962). An Efficient Method of Estimating Seemingly Unrelated Regression and Tests for Aggregation Bias. *Journal of the American Statistical Association*, 57, 1962.